REPORT

Geotechnical Foundation Investigation and Design Report (FIDR)

Installation of Three Trenchless Crossings and Sanitary Servicing for Proposed Development - Hwy 26, Meaford

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1.0 INTRODUCTION

Golder Associates Ltd., a Member of WSP, (Golder) has been retained by M1 Development Inc. (M1) to provide geotechnical and environmental engineering services in relation to the installation of three (3) utility / service crossings along Highway 26 using trenchless technologies in Meaford, Ontario. In addition, M1 has asked Golder for geotechnical and hydrogeological design services related to the proposed sanitary sewer installation for the development on the west side of Highway 26. The location of the site is shown on the Key Map, Figure 1 in Appendix B.

The purpose of this report is both to provide information on the subsurface soil and groundwater conditions at the site and to provide geotechnical engineering design parameters and recommendations for the proposed servicing in accordance with Ministry of Transportation Ontario (MTO) standards. Soil characterization for excess soil has also been included (Appendices G and H).

The factual data, interpretations and recommendations contained in this report pertain to a specific project as described in the report and are not applicable to any other project or site location. If the project is modified in concept, location or elevation, or if the project is not initiated within eighteen months of the date of the report, Golder should be given an opportunity to confirm that the recommendations are still valid.

This report should be read in conjunction with *"Important Information and Limitations of this Report"*, presented in Appendix A. The reader's attention is specifically drawn to this information, as it is essential for the proper use and interpretation of this report.

Additional pavement engineering recommendations are concurrently being evaluated by Golder to support widening of the existing Highway 26 platform and will be reported under separate cover.

2.0 PROJECT AND SITE DESCRIPTION

Nine (9) boreholes were advanced (three (3) per Highway under crossing) in April 2022 in support of the trenchless utility installations. The locations of the under crossings and boreholes advanced are shown on the Borehole Location Plan, Figure 1 in Appendix B. These locations have been determined using drawing *11471 SERV-1* received from Pinestone Engineering Limited (PEL) on February 23, 2022. Each crossing is described in greater detail below:

- 200-millimetre (mm) diameter watermain encased in a 350-mm diameter casing to be located 75 metres (m) east of the development main access road (Street A), approximately 330 m west of Ridge Road;
- Rogers and Bell utilities encased in a 100-mm diameter HDPE conduit crossing at the development emergency access road, approximately 180 m west of Ridge Road; and
- 250-mm diameter sanitary pipe encased in a 350-mm diameter casing located approximately 55 m east of Ridge Road.

In addition to the scope summarized above, Golder performed geotechnical investigations related to the installation of a sanitary sewer system for the proposed development to the west of Highway 26. Three (3) boreholes were advanced in support of the sanitary sewer installation. The locations of each borehole are shown on the attached Borehole Location Plan, Figure 1 in Appendix B. Borehole locations were determined using drawing *11471 PH-1 with borehole locations* sent by PEL on March 24, 2022.

This report addresses the geotechnical, geo-environmental and hydrogeological aspects of the following items:

- Foundation and geo-environmental recommendations for the installation of three (3) utilities under the existing Highway 26 road platform using trenchless methods; and
- Foundation and hydrogeological recommendations for the installation of a sanitary sewer system for the proposed development.

Appendices G and H of this report include soil characterization related to excess soil generated as part of the trenchless utility installation and widening of Highway 26. The related environmental sampling was performed concurrently with the geotechnical investigation described herein.

Throughout the project limits, Highway 26 is a two-lane MTO roadway, with a left turn lane onto Ridge Road near the east project limit. Underground natural gas, hydro and telecommunications (Bell and Rogers) are present on both sides of the highway with some undercrossing utilities present. Overhead electrical lines are present primarily on the west side of Highway 26, except near Ridge Road, and the Bayside Jeep dealership near the east and west project limits. A 150-mm diameter municipal watermain owned by the Municipality of Meaford is present throughout the project limits. The watermain runs on the east side of the highway until it crosses the highway near the proposed development emergency access road, running on the west side of Highway 26 towards Ridge Road. Municipally owned streetlights are also present east of Ridge Road with buried infrastructure in the eastbound shoulder. Underground telecommunications services (UTS) in the vicinity of the trenchless utility crossings should be contacted to determine the depths of the UTS throughout the alignment and to ensure that no conflicts exist with the proposed construction.

Several adjacent properties are located near the proposed trenchless utility crossings at variable distances from the existing roadway. In particular, the utility crossing located 55 m east of Ridge Road will be adjacent to residential properties on both sides of Highway 26 and the crossing located near the emergency access road will be adjacent to the Don Bumstead & Family Medical Center. Consideration should be given to ensure access is available for the tunnelling equipment at these locations. Roadside drainage ditches are also present on the east of Highway 26 and the west of Highway 26 near Ridge Road.

3.0 GEOLOGICAL SETTING

3.1 Topography and Drainage

Throughout the project site, Highway 26 ranges in elevation from about 199 metres above sea level (masl) at Boreholes 22-01 and 22-02 to 190 masl at Boreholes 22-07 to 22-09. Elevations in the off-road areas to the west of Highway 26 range from approximately 196 masl at Borehole 22-06 to 199 masl at Borehole 22-12. Highway 26 and the surrounding area gradually slope towards the north throughout the investigation area.

Drainage of the existing Highway 26 pavement structure is provided by the raised highway platform in fill areas and by roadside ditches within cut sections. Cross drainage of the highway platform is provided by centreline culverts and entrance culverts. Surface water and groundwater flow from the upland areas in the south towards the lowland areas in the north and eventually into Georgian Bay to the north.

3.2 Quaternary Geology

The area southwest of Meaford along Highway 26 lies near the geologic boundary between Elma Till (Huron-Georgian Bay lobe) deposits of sand, gravelly sand and gravel Glaciolacustrine deposits[1]. The Elma Till deposits consist of moderately stony, strongly calcareous sandy silt to silt matrixes with localized deposits of clayey silt. Based on laboratory data carried out under this field investigation and the subsequent pavement engineering field investigation to the west of this project site (completed under separate cover), the transition between Elma Till and sandy/gravelly Glaciolacustrine deposits likely occurs near the western project limits.

4.0 FIELD PROCEDURE

The field drilling program for the current investigation was carried out between April 8 and April 18, 2022, at which time twelve (12) boreholes (designated as Boreholes 22-01 to 22-12) were advanced to depths of about 6.2 to 9.8 m below ground surface (mbgs). The approximate borehole locations are shown on the Borehole Location Plan, Figure 1, in Appendix B. The boreholes were staked out by Golder and drilled using a track-mounted drill rig, supplied and operated by Walker Drilling Ltd. out of Utopia, Ontario. Standard Penetration Testing (SPT) and sampling were carried out at regular intervals of depth in the boreholes using conventional 38-mm internal diameter split spoon sampling equipment driven by an automatic hammer in accordance with the SPT procedures outlined in ASTM International Standard D1586: *"Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils".* The split-spoon samplers used in the investigation limit the maximum particle size that can be sampled and tested to about 38 mm. Therefore, particles or objects that may exist within the soils that are larger than this dimension will not be sampled or represented in the grain size distributions presented in Appendix D. The results of the in situ field tests (i.e., Standard Penetration Testing N-values - SPT "N"-values), as presented on the Record of Borehole sheets and in subsequent sections of this report, are the values measured directly in the field and are unfactored.

Groundwater conditions were noted in the open boreholes during drilling and 50-mm diameter monitoring wells were installed in nine (9) boreholes (Boreholes 22-01, 22-03, 22-04, 22-06, 22-07, 22-09, 22-10, 22-11 and 22-12) to permit further monitoring of the groundwater levels over time. Permeability testing (K testing) was performed at monitoring wells 22-10, 22-11 and 22-12 to support recommendations for excavation dewatering for the installation of the sanitary sewer at the development location. The remaining boreholes were backfilled upon completion in accordance with the requirements of the Revised Regulations of Ontario (R.R.O.) 1990, Ontario Regulation (O.Reg) 903 (as amended) of the Ontario Water Resources Act.

Prior to drilling, Golder staff laid out the borehole locations as shown on the Borehole Location Plan, Figure 1 in Appendix B. The field work for this investigation was monitored by a member of our geotechnical staff, who arranged for the clearance of underground utilities, observed the drilling, sampling and in situ testing operations, logged the boreholes, and examined and took custody of the recovered soil samples. The soil samples obtained during this investigation were identified in the field, placed in appropriate containers, labelled and transported to Golder's laboratory for further detailed visual examination by a geotechnical engineer, water content testing and selected geotechnical classification analyses.

In addition to the above, selected soil samples were collected and submitted to a specialist analytical laboratory for the evaluation of corrosion potential for buried steel elements and sulfate attack on concrete. The results of the corrosion potential and sulfate testing are presented in Appendix F. Soil samples were also collected and submitted

[1] Ministry of Northern Development and Mines, Map 2556 – Quaternary Geology of Ontario – Southern Sheet

to a specialist analytical laboratory for characterization analyses to support the management, re-use, and/or disposal of excess soils likely to be generated during construction of the proposed works; the results are presented in Appendices G and H.

Elevations and GPS coordinates at the borehole locations, as shown on the Record of Borehole sheets in Appendix C, were taken during investigations using a Trimble Geo 7X device.

5.0 SUBSURFACE CONDITIONS

The detailed subsurface soil and groundwater conditions encountered in the boreholes advanced at this site along with the results of geotechnical laboratory testing are shown on the Record of Borehole sheets in Appendix C. The detailed results of geotechnical laboratory testing on selected soil samples are presented in Appendix D. Method of Soil Classification, Abbreviations and Terms used on Records of Boreholes, and List of Symbols are also provided in Appendix C to assist in the interpretation of the Record of Borehole sheets.

The Record of Borehole sheets indicate the subsurface conditions at the borehole locations only. The stratigraphic boundaries shown on the borehole records are inferred from non-continuous sampling, observations of drilling progress as well as the results of Standard Penetration Tests and, therefore, typically represent transitions between soil types rather than exact planes of geological / stratigraphic change. Subsurface soil conditions will vary between and beyond the borehole locations. The subsurface conditions encountered within the boreholes in each area are described below:

5.1 Trenchless Utility Installation Investigation (BHs 22-01 to 22-09)

Boreholes 22-01 to 22-03

Boreholes (BHs) 22-01 and 22-02 were both advanced through the roadway platform, BH 22-01 was advanced through the eastbound shoulder and BH 22-02 was advanced through the eastbound driving lane. BH 22-03 was advanced at the westbound ditch. Typically, boreholes are advanced through the lane and at the inlet/outlet of the trenchless installation; however, limited space and the presence of buried utilities made drilling a borehole in the east ditch infeasible. As such, the borehole was relocated to the eastbound shoulder within 5.0 m of the existing ditch.

The subsurface conditions encountered in this area generally comprised cohesive clayey silt layers overlain by a layer of non-cohesive sandy silt glacial till material. Silty sand and sand layers were also encountered in all three (3) boreholes at varying depths A silty sand and gravel subbase fill layer was encountered in BHs 22-01 and 22-02 advanced through the highway platform. A silty clay fill layer was encountered in BH 22-02 below the road subbase layer. Asphalt was encountered at the ground surface in BH 22-02 advanced through the driving lanes.

BHs 22-01 and 22-02 were both dry upon completion of drilling, while the monitoring well installed in BH 22-03 indicated a static groundwater level of 1.6 m below ground surface (bgs) upon completion of drilling on April 13, 2022. The groundwater levels in the monitoring wells were measured on April 18, 2022; static groundwater levels of 1.5 mbgs and 0.4 mbgs were measured in BHs 22-01 and 22-03, respectively.

BHs 22-04 to 22-06

BHs 22-04 and 22-05 were both advanced through the roadway platform. BH 22-04 was advanced through the commercial entrance on the east side of Highway 26, BH 22-05 was advanced through the westbound driving lane, and BH 22-06 was advanced through the westbound ditch. Typically, boreholes are advanced through the lane and at the inlet/outlet of the trenchless installation; however, the location of the commercial entrance and the presence

of buried utilities made drilling a borehole in the east ditch infeasible. As such, the borehole was relocated to the commercial entrance within 5.0 m of the existing ditch.

The subsurface conditions encountered in this area generally comprised clayey sandy silt glacial till material. Cohesive fill material, consisting of sandy silty clay to silty clay with some sand, was encountered in BHs 22-05 and 22-06. A gravel and sand subbase fill layer was encountered in BHs 22-04 and 22-05 advanced through the roadway platform. Asphalt was also encountered at the ground surface in BHs 22-04 and 22-05.

BHs 22-05 and 22-06 were both dry upon completion of drilling, while the monitoring well installed in BH 22-04 indicated a static groundwater level of 2.1 mbgs upon completion of drilling. The groundwater levels in the monitoring wells were measured on April 18, 2022; static groundwater levels of 6.1 mbgs and 2.1 mbgs were measured in BHs 22-04 and 22-06, respectively.

BHs 22-07 to 22-09

All three (3) boreholes were advanced through the roadway platform, BH 22-07 was advanced through the eastbound shoulder, BH 22-08 was advanced through the eastbound driving lane, and BH 22-09 was advanced through the westbound shoulder. Typically, boreholes are advanced through the lane and at the inlet/outlet of the trenchless installation; however, limited space and the presence of buried utilities made drilling a borehole in the east and west ditches infeasible. As such, the boreholes were relocated to the east/west shoulders within 5.0 m of the existing ditches.

The subsurface conditions encountered in this area generally comprised non-cohesive sandy silt glacial till overlain by silty clay till. Silty clay fill materials and gravel and sand subbase fill were encountered in all three (3) boreholes. Asphalt was encountered in BH 22-08 advanced through the driving lanes.

All three (3) boreholes were dry upon completion of drilling. Groundwater levels were measured in the monitoring wells installed in BHs 22-07 and 22-09 on April 18, 2022; static groundwater levels of 2.1 mbgs and 2.3 mbgs were measured in BHs 22-07 and 22-09, respectively.

More detailed information on the subsurface soil and groundwater conditions encountered in the boreholes and installed monitoring wells is presented below.

5.1.1 Topsoil and Organic Material

Topsoil was encountered at the ground surface in the off-road boreholes (22-03 and 22-06). The topsoil extended to depths ranging from approximately 150 mm bgs to 250 mm bgs. Organic inclusions were also found in BHs 22-01, 22-02, 22-05, 22-07 and 22-08 in various native and fill materials below the topsoil. Materials designated as topsoil in this report were classified solely based on visual and textural evidence. Testing for organic content, pH, acidity, alkalinity and nutrients, was not carried out. Accordingly, materials classified as topsoil herein cannot necessarily be relied upon for the support and growth of landscaping vegetation without supplementary soil fertility testing.

5.1.2 Hot Mix Asphalt

Hot mix asphalt (HMA) was encountered in the boreholes advanced through the roadway platform of Highway 26 (driving lanes and fully paved shoulders). HMA was encountered in Bhs 22-02, 22-04, 22-05, 22-07 and 22-08. The HMA extended to depths ranging from about 100 mm bgs to 160 mm bgs.

5.1.3 Fill Material

Fill material was encountered in all boreholes advanced for the trenchless investigations. The fill material were comprised of cohesive sandy silty clay to silty clay with a trace to some sand and non-cohesive silty sand, silty sand and gravel, sand, and sand and gravel. The silty sand and gravel as well as the sand and gravel layers were classified as roadway subbase material. The fill material was encountered under the asphalt in boreholes advanced through the driving lanes/fully paved shoulders (Boreholes 22-02, 22-04, 22-05, 22-07 and 22-08), and at ground surface in boreholes advanced through granular shoulders (22-01 and 22-09). The cohesive and non-cohesive fill material extended to depths ranging from about 0.17 mbgs to 1.52 mbgs and from the surface to 0.88 m bgs, respectively.

SPT “N’-values measured within the non-cohesive fill ranged from 12 blows to 59 blows per 0.3 m of penetration indicating a compact to very dense state. The water content values measured on samples of the non-cohesive fill ranged from approximately 4 to 25 percent.

SPT “N’-value measured within the cohesive fill ranged from 8 blows to 28 blows per 0.3 m of penetration suggesting a firm to very stiff consistency. The water content measured on the cohesive fill samples ranged from approximately 9 percent to 24 percent.

The results of grain size distribution analyses carried out on samples of the fill material are presented on Figures D1 to D4 in Appendix D.

5.1.4 Silty Sand to Sand

Native silty sand to sand deposits were encountered in Bhs 22-01 and 22-02. The silty sand layer in BH 22-01 was encountered below the fill material and was underlain by clayey silt below approximately 0.7 mbgs to 1.82 mbgs. The sand layer was interlayered between a cohesive fill layer above and cohesive clayey silt layer below, from 1.34 mbgs to 1.70 mbgs.

The SPT “N”-values measured within the silty sand to sand deposits ranged from 8 blows to 12 blows per 0.3 m of penetration, indicating a loose to compact state. The natural water content values measured on samples of the silty sand to sand deposits ranged from approximately 24 to 30 percent.

5.1.5 Non-Cohesive Glacial Till

Deposits of non-cohesive sandy silt glacial till were encountered in Bhs 2 2-01, 22-02, 22-07, 22-08 and 22-09. The glacial till deposits were encountered at depths ranging from about 2.2 m bgs to 3.7 m bgs and ranged in thickness from about 3.0 m to greater than 4.5 m. All boreholes that encountered the glacial till material were terminated in the non-cohesive glacial till at a depth of about 6.7 mbgs.

The SPT “N”-values measured within the glacial till deposits ranged from 40 blows per 0.3 m of penetration to 97 blows per 0.25 m penetration, indicating a dense to very dense state. The natural water content values measured on samples of the non-cohesive glacial till generally ranged from approximately 8 to 17 percent.

Although not specifically indicated in the borehole logs, the presence of cobbles and boulders should be expected in glacially derived deposits in Southern Ontario.

The results of grain size distribution analyses carried out on samples of the non-cohesive glacial till are presented on Figure D5a in Appendix D. The results of Atterberg limits testing are presented on Figure D5b in Appendix D. The results of the Atterberg limits testing indicate that the till material is non-cohesive.

5.1.6 Cohesive Glacial Till

Cohesive sandy clayey silt glacial till deposits were encountered in BHs 22-04 to 22-06. The cohesive glacial till deposits were encountered at depths ranging from about 0.9 m bgs to 1.5 m bgs and ranged in thickness from greater than 5.2 m to greater than 5.8 m. All boreholes that encountered the glacial till material were terminated in the cohesive glacial till at depths of 6.2 mbgs to 6.7 mbgs.

The SPT “N”-values measured within the cohesive glacial till deposits ranged from 52 blows per 0.3 m of penetration to 92 blows per 0.28 m penetration, indicating a stiff to hard consistency. The natural water content values measured on samples of the cohesive glacial till generally ranged from approximately 7 to 14 percent.

The results of grain size distribution analyses on samples of the cohesive glacial till deposits are presented on Figure D6a in Appendix D. The results of Atterberg limits testing are presented on Figure D6b in Appendix D. The results of the Atterberg limits testing indicated a plastic limit between 13 and 14 percent, a liquid limit between 20 and 23 percent, and a plasticity index between 8 and 9 percent. Based on the Atterberg limits results, the cohesive glacial till would be classified as an inorganic clayey silt to silty clay of low plasticity.

5.1.7 Clayey Silt

Cohesive clayey silt deposits were encountered in BHs 22-01 to 22-03. The clayey silt deposits were encountered at depths ranging from about 1.5 mbgs to 1.8 mbgs and ranged in thickness from about 0.4 m to greater than 5.2 m. BHs 22-01, and 22-02 fully penetrated the clayey silt material and BH 22-03 was terminated within the clayey silt material at a depth of about 6.7 mbgs.

The SPT “N”-values measured within the clayey silt deposits ranged from 11 blows to 77 blows per 0.3 m of penetration, indicating a stiff to hard consistency. The natural water content values measured on samples of the clayey silt generally ranged from approximately 9 to 20 percent.

The results of Atterberg limits testing on the clayey silt deposits are presented on Figure D7 in Appendix D. The results of the Atterberg limits testing indicate a plastic limit between 13 and 16 percent, a liquid limit between 19 and 22 percent, and a plasticity index between 5 and 7 percent. The results of the Atterberg limits testing indicate that the cohesive material would be classified as an inorganic clayey silt of low plasticity.

5.1.8 Groundwater Conditions

The groundwater conditions encountered in each of the boreholes are shown in detail on the Record of Borehole sheets presented in Appendix C. Table 1, below, summarizes the water level measurements collected to date; no additional water level measurements have been taken beyond those listed in Table 1.

Table 1: Groundwater Details

Well/Borehole ID	On Completion of Drilling (mbgs [masl])*	April 18, 2022 (mbgs [masl])
22-01	**Dry**	**1.5** (197.56)
22-02	**Dry**	**N/A**
22-03	**1.5** (195.63)	**0.4** (196.73)
22-04	**2.1** (195.72)**	**6.1** (191.71)

Well/Borehole ID	On Completion of Drilling (mbgs [masl])*	April 18, 2022 (mbgs [masl])
22-05	**Dry**	**N/A**
22-06	**Dry**	**Dry**
22-07	**Dry**	**2.1** (189.55)
22-08	**Dry**	**N/A**
22-09	**Dry**	**2.3** (188.06)

* Measurements outside parentheses represent depth in meters below ground surface. Measurements within brackets represent elevation in meters above sea level. masl = metres above sea level.

** Fluctuation between groundwater level observed on completion of drilling and measured groundwater level on April 18 can likely be attributed to the addition of water during drilling operations.

The groundwater level measurements reflect the groundwater conditions in the monitoring wells at the time of the field work and are specific to the locations of the boreholes. Groundwater levels at the site are anticipated to vary between and beyond the borehole locations and to fluctuate with seasonal variations in precipitation and snowmelt.

5.2 Sanitary Sewer Installation (BHs 22-10 to 22-12)

5.2.1 Topsoil and Organic Material

Topsoil was encountered at the ground surface in all of the boreholes advanced for the sanitary sewer installations. The topsoil extended to depths ranging from approximately 100 mm bgs to 200 mm bgs. Organic inclusions were also found in the fill materials in BHs 22-01 and 22-11. Materials designated as topsoil in this report were classified solely based on visual and textural evidence. Testing for organic content, pH, acidity, alkalinity and nutrients, was not carried out. Accordingly, materials classified as topsoil herein cannot necessarily be relied upon for the support and growth of landscaping vegetation without supplementary soil fertility testing.

5.2.2 Fill Material

Fill material was encountered in BHs 22-11 and 22-12, advanced for sanitary sewer investigation. The fill material was comprised of cohesive silty clay with organic inclusions and silty sand with organic inclusions. The fill material was encountered under the topsoil in both boreholes at depths of about 0.1 mbgs and 0.2 mbgs. The cohesive and non-cohesive fill material extended to depths of about 0.79 mbgs to 0.9 mbgs

An SPT “N”-value of 8 blows per 0.3 m of penetration was measured within the non-cohesive fill, indicating a loose state. An SPT “N”-value of 13 blows per 0.3 m of penetration was measured within the cohesive fill, indicating a very stiff consistency. Water contents of about 19 and 20 percent value measured on the non-cohesive and cohesive fill materials, respectively.

5.2.3 Cohesive Glacial Till

A cohesive glacial till deposit was encountered in all three (3) boreholes advanced for the sanitary sewer installations. A silty clay till material was encountered in BH 22-10. The silty clay material was encountered at a depth of about 1.5 mbgs and the borehole was terminated in this material at a depth of about 9.75 mbgs. A sandy clayey silt till deposit was encountered in BHs 22-11 and 22-12. The sandy clayey silt material was encountered at

depths of about 0.7 mbgs to 0.8 mbgs and both boreholes were terminated in this material at depths of about 7.92 mbgs and 9.75 mbgs.

The SPT “N”-values measured within the cohesive glacial till deposits ranged from 27 blows per 0.3 m of penetration to 98 blows per 0.25 m of penetration, indicating a very stiff to hard consistency. The natural water content values measured on samples of the clayey silt generally ranged from approximately 8 to 16 percent.

The results of grain size distribution analyses carried out on samples of the cohesive glacial till deposits are presented on Figure D6a in Appendix D. The results of Atterberg limits testing are presented on Figure D6b in Appendix D. The results of the Atterberg limits testing indicated a plastic limit of 22 percent, a liquid limit of 31 percent, and a plasticity index of 9 percent.

5.2.4 Groundwater Conditions

The groundwater conditions encountered in each of the boreholes advanced for the sanitary sewer installations are shown in detail on the Record of Borehole sheets presented in Appendix C. Table 2, below, summarizes the water level measurements collected to date; no additional water level measurements have been taken beyond those listed in Table 1.

Table 2: Groundwater Details

Well/Borehole ID	On Completion of Drilling (m [masl])	April 18, 2022 (m [masl])
22-10	Dry	**8.0** (190.87)
22-11	Dry	**3.9** (192.8)
22-12	Dry	**3.5** (195.69)

* Measurements outside parentheses represent depth in meters below ground surface. Measurements within brackets represent elevation in meters above sea level (masl).

The groundwater level measurements reflect the groundwater conditions in the monitoring wells at the time of the field work and are specific to the locations of the boreholes. Groundwater levels at the site are anticipated to vary between and beyond the borehole locations and to fluctuate with seasonal variations in precipitation and snowmelt.

5.3 Single-Well Response Testing

Single-well response testing was conducted at monitoring wells 22-03, 22-10, 22-11, and 22-12. In each instance, the well was purged to dryness and the water level recovery recorded. The data was analyzed using the Bouwer-Rice (1976) method, using AQTESOLV for Windows version 4.50 Professional software. The single-well response testing AQTESOLV printouts are provided in Appendix I. The analysis indicated the hydraulic conductivity of overburden deposits ranged from about 7×10^{-9} m per second (m/s) to 1×10^{-7} m/s.

6.0 DISCUSSION

This section of the report provides engineering information and recommendations for the geotechnical and hydrogeological design aspects of the project based on our interpretation of the field information, the laboratory test data and on our understanding of the project requirements. The information in this portion of the report is provided for planning and design purposes for the guidance of the design engineers. Where comments are made related to construction, they are provided only to highlight aspects of construction which could affect the design of the project.

Contractors bidding on or undertaking any work at the site should examine the factual results of the investigation, satisfy themselves as to the adequacy of the information for construction and make their own independent interpretation of the factual data as it affects their proposed construction techniques, schedule, equipment capabilities, costs, sequencing and the like.

Golder will not assume any responsibility for construction-related decisions made by contractors on the basis of this report.

Trenchless work should be carried out in accordance with MTO's Special Provisions (SP) titled "*Pipe Installation by Trenchless Method*", as amended. These provisions were reviewed during preparation of the recommendations contained in this report. Construction work for this project should also be performed in accordance with the SP.

6.1 Trenchless Utility / Servicing Installations

6.1.1 Trenchless Methods

The various methods of trenchless utility installation are summarized in this section. A comparison of each method including the advantages, disadvantages, relative cost and risks for each tunnelling method is also included in Appendix E.

6.1.1.1 Pipe Ramming

Pipe ramming uses a large horizontal percussion hammer to drive a steel casing horizontally into the ground. In most instances, the ground within the casing is not removed until the full length of the casing is driven. However, partial removal of material from within the casing may be needed to reduce friction and increase driving efficiency. Entry and receiving pits of sufficient dimensions would also be required. Since pipe ramming is not steerable, a properly constructed entry pit with careful setting of line and grade at the outset is essential for this method.

Given the length of the installation, casing size and overburden cover for this project, pipe ramming is considered to be a feasible method of installation. The potential for ground loss at the face of the casing is generally less with pipe ramming than with other trenchless techniques, especially if the entire length of the installation can be driven first before removing the soils from inside the casing. In any case, it is recommended that the full soil plug remain inside the casing until the casing is fully installed to reduce the risk of running (dry) sand or squeezing (cohesive) soils entering the casing and the associated loss of pipe support and/or possible settlement that may result.

With the pipe ramming method, the installation should be carefully monitored as pipe ramming has the potential to cause heaving at the ground surface when the casing displaces the surrounding ground. In this case, pipe ramming may also cause settlement due to vibration-induced disturbance of liquefiable subsurface materials. Noise and vibrations associated with pipe ramming may also be disturbing to nearby residents and should be considered within an overall project management and scheduling plan.

Based on the anticipated subsurface conditions, pipe ramming is **not** recommended due to the possibility of large boulders being present in the subsurface glacial till material. The main disadvantage of pipe ramming is that there is no control over the line and grade of installation. If the end of the pipe encounters an obstruction, such as a hard boulder larger than the casing, it is likely that the casing will be deflected causing misalignment of the utility line. Additionally, the sanitary sewer crossing east of Ridge Road has buried Municipally owned lighting infrastructure in the eastbound shoulders. Other utilities (including Bell, Rogers, Gas and a Municipally owned watermain) are also present in the ditches/embankment toes near all three (3) tunnelling locations. Should pipe ramming be selected as the trenchless method, additional support should be provided to prevent adverse effects to the existing utilities.

6.1.1.2 Jack and Bore

The jack and bore method forms a near horizontal bore from a jacking/drive (i.e., entry) pit. Boring is undertaken with a rotating cutter head and a continuously welded casing is jacked through reaction against a thrust block located within the jacking pit. Spoils from the tunnel excavation are transported to the jacking pit along helical auger flights. The new sewer pipe is then installed either behind the casing pipe or within a permanent casing, depending on the proposed diameter. The casing may be lubricated with slurry to reduce the frictional or adhesive forces between the casing and the surrounding soil.

Soils that are classified as “running,” are generally not considered suitable for the jack and bore method because of the risk for uncontrolled inflows into the casing that would lead to increased settlement (and potentially the formation of sink holes) at the ground surface. The jack and bore method may be suitable in “ravelling” granular soils, provided a sufficient soil plug is maintained at all times and provided that the excavation is undertaken on a continuous and well-controlled basis.

The jack and bore method can lead to excessive ground losses, settlement and development of sinkholes extending to the surface when passing through saturated (flowing) or dry (running) sand, silt and/or gravel. The presence of boulders and cobbles can obstruct augering operations, damage the equipment and require manual interventions that slow progress. The removal of obstructions may also result in loss of ground at the face and ground settlement at the ground surface, depending on the soil conditions. Difficulties may also be encountered in maintaining alignment control of the tunnel as it advances due to the presence of stiffer or more dense soils ahead of the excavation, cobbles or boulders at the face or mixed face conditions. Because the steel casing is jacked from the rear, there is little opportunity to adjust the alignment if deviations begin to occur as a result of obstructions or variability in the ground conditions at the tunnel face.

The size of the jacking pit is controlled by the equipment size and the length of the casing sections which are being installed. Typically, a work area of about 10 m long by about 3 m to 5 m wide is required to accommodate the jacking/drive pit for jack and bore operations. The receiving pit is typically about 3 m square unless it will be used as the next jacking/drive pit.

Based on the anticipated subsurface conditions, jack and bore is **not** recommended due to the possibility of obstructions (boulders) in the subsurface soil and the high groundwater level found in the groundwater monitoring wells at the main access road crossing. Any obstructions encountered during the tunneling process can make it difficult to control the line and grade of the casing installation causing misalignment in the utility installation.

6.1.1.3 Horizontal Directional Drilling

For HDD installations, a small rotating and steerable drill bit is launched from the surface at a shallow angle (typically 15 to 30-degree entry and exit angles from horizontal) and is used to drill a pilot hole supported with drilling fluid. Once the desired invert depth is achieved, the borepath is maintained horizontal or at the design grade until it reaches the exit. Once the pilot bore is complete, the drill head is replaced with a backreamer or expander, if required, which enlarges the drill hole. When the desired size is reached, the pipe is attached to the reaming head and pulled through the bore. The annular gap around the pipe is filled with a high-viscosity mix of drilling fluids and cuttings that gels to form a semi-solid material to support the ground and pipe.

Consideration should be given to monitoring the viscosity of the drilling mud during installation, particularly during the drill hole enlargement (reaming) process. The drilling fluid must be sufficiently viscous to support the bore annulus and prevent collapse, since there is no rigid casing in place to maintain bore stability. Settlement/void creation can also result if the drilling mud viscosity drops low enough to cause scour/erosion of the tunnel walls.

The optimal mud density should be evaluated prior to commencing drilling and testing of the mud should be carried out prior to and during the reaming process. Provisions should also be made in the contract documents to ensure that this process is not undertaken directly before weekends or before any period where the contractor will be required to leave site for a prolonged period of time. If the bore must be left during the reaming stage, care should be taken to ensure the bore annulus is completely filled with drilling fluid.

The potential for hydraulic fracturing ("frac-out") to occur during a directional drill is influenced by several factors including the depth of cover below ground surface, the ground conditions (including fractured or high permeability materials), the hydrostatic head acting in the drill hole and the dynamic drilling fluid pressures that occur during the drilling process. Once initiated, hydraulic fractures occurring in soil will lead to fluid loss and may continue to spread vertically causing fluid movement towards the surface (frac-out). The required depth of cover beneath a roadway or other infrastructure to control the potential for frac-out will need to be reviewed by the designers by completing a hydraulic fracture analysis. Also, given the potential elevation difference between the ground surface at the entry and exit locations, this could also result in difficulties maintaining mud pressures. Soil cover above the borepath obvert will be a minimum of 5.4 m (or about 9 pipe diameters) which is adequate to address potential blowout under typical installation pressures. However, detailed analysis should be performed to ensure frac-out is not a concern.

It is also recommended that the contractor be required to have contingency/mitigation plans in place to control/reduce drill fluid pressures and to clean up any drill fluid in the event that drilling fluid migrates to the ground surface. For the duration of the HDD crossing, provision for full time visual and settlement monitoring should be included in the contract to ensure that, if drill fluid migration occurs, it could be identified immediately. It should be noted that the contingency plan should include the need to divert traffic flow around the affected area and pavement restoration, if required. Further, it is possible for a frac-out to go undetected under the structures or pavement into the granular fills and thus the contingency plan should include inspections and probing underneath the pavement to check for and fill any voids if sudden drops in pressure indicative of a frac-out are noted by the HDD contractor.

Based on the anticipated subsurface conditions, the use of HDD is considered feasible. Typically for HDD, the entry pits are near surface and the pipe enters the ground at angles ranging from about 15 to 30 degrees from the horizontal and thus at this site it would need to be set back some distance to achieve the proposed vertical profile. The property requirements at each trenchless crossing must be assessed prior to choosing the preferred tunnelling method.

Golder recommends that the client perform a cost/benefit analysis of the possible installation options. If HDD is selected, the contractor should carefully consider the presence of cobbles/boulders as they may result in delays due to drilling obstructions. Further, a satisfactory mud-management and contingency plan would need to be reviewed by the geotechnical engineer before this method could be approved.

6.1.1.4 Micro-Tunnel Boring Machine

A micro-tunnel boring machine (MTBM) typically uses pressurized bentonite slurry to counterbalance the earth and water pressures acting at the tunnel face and to transport the cuttings to the surface. A remotely controlled rotating cutterhead is used to excavate soil in a controlled manner at the face and, together with the pressurized slurry, acts to minimize loss of ground during tunnel advance. The slurry is circulated back through the tunnel to transport cuttings to a settling tank fitted with cyclone and screen separators. The MTBM can also be specified and equipped to cut and/or crush cobbles and boulders that are anticipated along the proposed tunnel alignment. Given the machine's ability to control soil and water pressures at the face, dewatering of non-cohesive soils along the tunnel alignment is seldom necessary with this tunnelling method; however, within the unsaturated sandy soils present along the borepath, a sufficiently viscous slurry will be required to prevent loss of drilling fluid into the formation.

The over-cut and MTBM diameter should be selected to minimize the difference in dimensions between the cut diameter and the diameter of the jacked casing pipe. Minimizing the differences between the cut diameter and outside diameter of the casing pipe will assist with limiting potential ground settlement caused by convergence of the ground around the pipe if the bentonite slurry is not adequately pressurized or the viscosity is not appropriately controlled. To maintain control of the granular soils and water within the tunnel alignment, minimize losses of slurry into the ground and provide suitable lubrication along the casing pipe during jacking, the bentonite viscosity should be maintained within a range of 40 to 50 seconds Marsh Funnel viscosity[2]. A seal will also be required for closing the annular space between the wall of the sending/receiving shafts and the shield/pipes to retain soil behind the temporary shoring and inhibit slurry backflow into the pits.

Obstructions can fully choke and obstruct the MTBM if sufficient quantities and sizes of cobbles and boulders are encountered. To mitigate this risk, the selected cutting tools and methods should be compatible with the anticipated soil conditions. The more successful systems include a combination of rock disc cutters and soft ground tools on the face to permit cutting of stones before they enter the machine, as well as excavation of the soils within which the cobbles and boulders are embedded. The rock disc cutters should be designed to cut igneous rocks common to the Canadian Shield formations, found to the north of Lake Ontario, that were transported by glaciation to the area of the project site. Traditional pick or hardened steel teeth are typically not sufficient to cut cobbles and boulders found in the region.

Micro-tunnelling, as described above, is typically considered to be the method that optimally reduces the risk of loss of ground and ground surface settlement. However, it is likely more expensive to mobilize this type of equipment and the availability of machines with a suitable diameter bore may constrain their use on this project. Some boring diameters are more common than others and the selected diameter may affect the availability and cost. MTBMs are typically relatively large diameter (minimum diameter of about 1.2 m is common). Given the small bore diameters of 100 mm and 350 mm, microtunnelling is likely infeasible.

6.1.2 Watermain at Development Main Access Road (Street A)

It is understood that a 200-mm diameter watermain encased in a 350-mm diameter carrier casing is to cross under Highway 26 at the main access road (Street A) for the proposed development to connect with the existing 15- mm diameter watermain on the east side of Highway 26. The minimum invert depth of the watermain will be approximately 2.0 mbgs (at the entry/exit pits outside of the Highway 26 roadway platform) and a maximum of approximately 3.8 m below the Highway 26 roadway platform.

The main access road crossing can feasibly be completed by trenchless installation using one of the methods listed below. Based on the observed groundwater levels (0.4 to 1.5 mbgs), it is likely that the chosen construction method would occur entirely within the saturated zone below the water table.

6.1.2.1 Trenchless Installation

The proposed trenchless undercrossing of Highway 26 will be approximately 20 m in length and will be performed at an approximate invert elevation of 196 masl. Based on the subsurface conditions encountered in BH 22-01 to 22-03 and the approximate invert depth of 3.8 m below the Highway 26 road surface, the soils within the borepath will consist primarily of very dense non cohesive sandy silt glacial till material. It is also likely that the borepath will intersect the cohesive clayey silt encountered from 1.7 mbgs to 3.7 mbgs in BH 22-02 and from 1.49 mbgs to 6.7

[2] American Society for Testing and Materials, Designation D6910/D6910M – 09, Standard Test Method for Marsh Funnel Viscosity of Clay Construction Slurries1

mbgs in BH 22-03. It is assumed that the sending/receiving (S/R) pits on the east and west sides of Highway 26 will extend to a depth of approximately 1.8 mbgs. Throughout the area, the minimum measured depth to groundwater was greater than 0.4 mbgs and, consequently, the borepath and sending/receiving pits are likely to be partly below the groundwater level. Proactive dewatering of the sandy silt till and clayey silt material will be required to maintain the entry and exit pit excavations. The soil has been classified according to the Tunnelman's Ground Classification System developed by Terzaghi, as reported in Heuer (1974)[3]. This system is commonly used to describe the expected behaviour of an unsupported tunnel face during excavation and uses qualitative "stand-up time" criteria to classify the ground at and above the tunnel face into the following principal categories: firm, slow ravelling, fast ravelling, squeezing, cohesive-running, running and flowing. The sandy silt till material can be classified as "ravelling" and the clayey silt material can be classified as "firm".

The tunnelling contractor will be responsible for selecting the method and equipment for the tunnel construction unless specific methods are otherwise prohibited. Successful completion of any trenchless technology or tunnelling project largely depends on the skills and experience of the contractor. Ground behaviour will be, in part, dependent on the installation method adopted and this report provides guidance for the influence of ground behaviour on the suitable trenchless methodologies. It should not be construed that the contractor is restricted to the specific method(s) provided herein, and in the event the contractor choses alternative means and methods, the contractor must independently interpret anticipated ground behaviour based on the factual information presented in Section 5.1.

All trenchless works should be carried out by an experienced specialist contractor employing only qualified workers skilled in their trade under the direction of an experienced supervisor. Prior to construction, the contractor should be required to submit their proposed construction method and monitoring program (identifying the risks and methods of control for possible problems that could cause interference with the roadway or existing infrastructure, such as heave/settlement/changes of alignment) for review and approval by the MTO. It is recommended that the geotechnical aspects of the contractor's work plan for the installation be reviewed by Golder prior to construction.

Performance of the completed works will largely be dependent upon the contractor's construction procedures and techniques. Ground movements (heave or settlement) associated with the work should be monitored as discussed in Section 6.2, if necessary, the construction method should be modified to control ground movements and address potential disturbance to the existing properties and infrastructure. Where adequate provisions are not included to ensure stability of the bore and associated excavations, detrimental surface settlement could occur, adversely affecting the roadway and/or other underground services and infrastructure in the vicinity of the bore which would then require remedial measures to be undertaken. The contractor's work plan should include a provision for compensation grouting or other remedial measures, should the need arise.

Given the assumed size of the pipe (about 350 mm) and length of the bore (approximately 40 m), horizontal directional drilling is considered to be a feasible technique for the installation of the watermain beneath Highway 26 near the development main access road. Other methods (such as auger jack and bore, pipe ramming or microtunnelling) were considered but are not recommended as the preferred tunneling method.

3 Heuer, Ronald E., 1974 "Important Ground Parameters in Soft Ground Tunneling", Proceedings Specialty Conference on Subsurface Explorations for Underground Excavations and Heavy Construction, ASCE, NY.

6.1.3 Utility Crossing at Development Emergency Access Road

It is understood that a Rogers cable and Hydro One cable are proposed to cross under Highway 26 in separate crossings approximately 180 m west of Ridge Road. Each cable will be encased in a 100-mm diameter HDPE conduit requiring a 100-mm diameter tunnel undercrossing Highway 26. We understand that the minimum invert depth to the HDPE conduit will be approximately 1.5 m. Drawings sent by PEL on May 17, 2022 were used in determining the conduit size and invert depths.

The Highway 26 crossing can feasibly be completed by trenchless installation using one of the methods listed below. Based on the observed groundwater levels (2.1 mbgs), it is likely that the chosen construction method would occur entirely within the unsaturated zone above the water table.

6.1.3.1 Trenchless Installation

As the Hydro One and Rogers utility crossings are to be in close proximity to each other, the subsurface data collected at BHs 22-04 to 22-07 was used in developing recommendations for both crossings. In addition, the trenchless methods discussed will apply to both utility crossings. The proposed trenchless undercrossing of Highway 26 was assumed to be approximately 20 m in length and will be performed at an approximate invert elevation of 195.5 mas (assumed based on an approximate invert depth of 1.5 m below the Highway 26 centreline). Based on the subsurface conditions encountered in Boreholes 21-7 to 21-8 and the approximate invert depth of 1.5 m below the Highway 26 centreline, the soils within the borepath will consist of stiff to hard cohesive clayey sandy silt glacial till material. It is assumed that the sending/receiving (S/R) pit on both sides of Highway 26 will extend to a depth of approximately 1.5 m. Throughout the area, the minimum measured depth to groundwater was 2.1 mbgs and, consequently, the borepath and sending/receiving pits are likely to be entirely above the groundwater level. The soil has been classified according to the Tunnelman's Ground Classification System developed by Terzaghi, as reported in Heuer (1974). This system is commonly used to describe the expected behaviour of an unsupported tunnel face during excavation and uses qualitative "stand-up time" criteria to classify the ground at and above the tunnel face into the following principal categories: firm, slow ravelling, fast ravelling, squeezing, cohesive-running, running and flowing. The clayey sandy silt till material can be classified as "ravelling".

The tunnelling contractor will be responsible for selecting the method and equipment for the tunnel construction unless specific methods are otherwise prohibited. Successful completion of any trenchless technology or tunnelling project largely depends on the skills and experience of the contractor. Ground behaviour will be, in part, dependent on the installation method adopted and this report provides guidance for the influence of ground behaviour on the suitable trenchless methodologies. It should not be construed that the contractor is restricted to the specific method(s) provided herein, and in the event the contractor choses alternative means and methods, the contractor must independently interpret anticipated ground behaviour based on the factual information presented in Section 5.1.

All trenchless works should be carried out by an experienced specialist contractor employing only qualified workers skilled in their trade under the direction of an experienced supervisor. Prior to construction, the contractor should be required to submit their proposed construction method and monitoring program (identifying the risks and methods of control for possible problems that could cause interference with the roadway or existing infrastructure, such as heave/settlement/changes of alignment) for review and approval by the MTO. It is recommended that the geotechnical aspects of the contractor's work plan for the installation be reviewed by Golder prior to construction.

Performance of the completed works will largely be dependent upon the contractor's construction procedures and techniques. Ground movements (heave or settlement) associated with the work should be monitored as discussed in Section 6.2, if necessary, the construction method should be modified to control ground movements and address

potential disturbance to the existing properties and infrastructure. Where adequate provisions are not included to ensure stability of the bore and associated excavations, detrimental surface settlement could occur, adversely affecting the roadway and/or other underground services and infrastructure in the vicinity of the bore which would then require remedial measures to be undertaken. The contractor's work plan should include a provision for compensation grouting or other remedial measures, should the need arise.

Given the assumed size of the pipe (a diameter of about 100 mm) and length of the bore (approximately 20 m), horizontal directional drilling is considered to be a feasible technique for the installation of the utility crossings. Other methods (such as auger jack and bore, pipe ramming or microtunnelling) were considered but are not recommended as the preferred tunnelling method.

6.1.4 Sanitary Service Crossing East of Ridge Road

It is understood that a sanitary sewer alignment is proposed to cross under Highway 26 to connect with the existing sanitary sewer approximately 55 m east of Ridge Road in the vicinity of BHs 22-07 to 22-09. The proposed sewer will have a diameter of 250 mm and will be encased in a 350-mm diameter carrier casing. The maximum invert depth of the sewer pipe will be approximately 1.8 m below the Highway 26 roadway platform.

The road undercrossing can feasibly be completed by trenchless installation using one of the methods listed below. Based on the observed groundwater levels (2.1 mbgs to 2.3 mbgs), it is likely that the chosen construction method would occur entirely within the unsaturated zone above the water table.

6.1.4.1 Trenchless Installation

The proposed trenchless undercrossing of Highway 26 will be approximately 30 m in length and will be performed at an approximate invert elevation of 189.5 masl. Based on the subsurface conditions encountered in Boreholes 22-07 to 22-08 and the approximate invert depth of 1.8 m, the soils within the borepath will consist of non-cohesive sandy silt till and cohesive silty clay till material. It is assumed that the sending/receiving (S/R) pit on the west side of Highway 26 will extend to a depth of approximately 1.8 mbgs within the proposed engineered fill at the eastern site margin. The S/R pit to the east of Highway 26 will extend to a depth of approximately 1.5 mbgs. Throughout the area, the minimum measured depth to groundwater was approximately 2.1 m bgs and, consequently, the borepath and sending/receiving pits are likely to be entirely above the groundwater level. The soil has been classified according to the Tunnelman's Ground Classification System developed by Terzaghi, as reported in Heuer (1974). This system is commonly used to describe the expected behaviour of an unsupported tunnel face during excavation and uses qualitative "stand-up time" criteria to classify the ground at and above the tunnel face into the following principal categories: firm, slow ravelling, fast ravelling, squeezing, cohesive-running, running and flowing. The sandy silt till material can be classified as "ravelling" and the silty clay till material can be classified as "firm".

The tunnelling contractor will be responsible for selecting the method and equipment for the tunnel construction unless specific methods are otherwise prohibited. Successful completion of any trenchless technology or tunnelling project largely depends on the skills and experience of the contractor. Ground behaviour will be, in part, dependent on the installation method adopted and this report provides guidance for the influence of ground behaviour on the suitable trenchless methodologies. It should not be construed that the contractor is restricted to the specific method(s) provided herein, and in the event the contractor choses alternative means and methods, the contractor must independently interpret anticipated ground behaviour based on the factual information presented in Section 5.1.

All trenchless works should be carried out by an experienced specialist contractor employing only qualified workers skilled in their trade under the direction of an experienced supervisor. Prior to construction, the contractor should

be required to submit their proposed construction method and monitoring program (identifying the risks and methods of control for possible problems that could cause interference with the roadway or existing infrastructure, such as heave/settlement/changes of alignment) for review and approval by the MTO. It is recommended that the geotechnical aspects of the contractor's work plan for the installation be reviewed by Golder prior to construction.

Performance of the completed works will largely be dependent upon the contractor's construction procedures and techniques. Ground movements (heave or settlement) associated with the work should be monitored as discussed in Section 6.2, if necessary, the construction method should be modified to control ground movements and address potential disturbance to the existing properties and infrastructure. Where adequate provisions are not included to ensure stability of the bore and associated excavations, detrimental surface settlement could occur, adversely affecting the roadway and/or other underground services and infrastructure in the vicinity of the bore which would then require remedial measures to be undertaken. The contractor's work plan should include a provision for compensation grouting or other remedial measures, should the need arise.

Consideration should be given to property requirements prior to choosing a tunneling method. The eastbound ditch is located near a residential property and additional space outside the MTO right of way would likely be required to accommodate the tunnelling process.

Given the assumed size of the pipe (a diameter of about 350 mm) and length of the bore (approximately 30 m), horizontal directional drilling is considered to be a feasible technique for the installation of the sanitary sewer beneath Highway 26 east of Ridge Road. Other methods (such as auger jack and bore, pipe ramming or microtunnelling) were considered but are not recommended as the preferred tunnelling method.

6.2 Settlement and Monitoring

This project work will involve trenchless installations crossing Highway 26 at three (3) locations as described in the previous sections. Installation by trenchless methods can cause both long- and short-term settlements that may cause damage to the overlying structures (pavement, culverts, etc.). Settlements associated with trenchless installation methods are typically of two types:

- Large settlements: These settlements are the result of loss of ground due to over-excavation caused by the inability to control adverse ground conditions or due to the tunnelling contractor's errors. Large settlements can lead to the creation of voids and/or sinkholes above the installed pipe.
- Systematic settlements: These settlements are primarily caused by the collapse of the annular space between the pipe and the bore annulus or by deformation of the soils ahead of the advanced bore.

The magnitude of such settlement is highly dependent on the construction procedures utilized (i.e., bore size, over-cut selected, depth of installation, drilling fluid, fluid pressure control, etc.), Provisions for settlement monitoring should be made in the contract documents for monitoring the response of the pavement structure prior to, during, and after the trenchless installation to assess the potential impacts to the Highway 26 structure. The monitoring program will be combined with daily visual assessments by the Contract Administrator (CA) and contractor supervisor to identify any evidence of movement (cracks, bulges, depressions, ponding, etc.).

6.2.1 Monitoring Program

A monitoring program is required for approval of the installation and should consist of an array of surface and in-ground settlement monitors. The surface settlement monitors should consist of corrosion resistant, hardened steel markers with a minimum 12-mm diameter head (PK surveyor nails or equivalent); the markers should be rigidly secured to the existing asphalt and be recessed to allow for safe passage of vehicles and snow removal equipment

without damaging the markers. The in-ground settlement monitors should consist of a 12 to 18-mm diameter reinforcing steel bar encased in a 50- to 70-mm diameter SCH40 PVC pipe and set to a depth of 1.5 mbgs (frost penetration depth); the monitors should be placed in a drill hole, backfilled with uniform sand and provided with protective covers suitable for high traffic areas.

A monitoring program utilizing an array of surface settlement/heave monitors is recommended for all installation methods. The surface settlement monitors would consist of survey nails installed at the road edge and centreline of Highway 26. A row of seven (7) surface settlement monitors is recommended along each utility alignment. The monitors should be installed through the road surface approximately 0.3 m from the edge of pavement in the eastbound and westbound driving lanes as well as through the centreline of Highway 26. In addition, a monitor should be installed in the eastbound and westbound shoulders and at the existing embankment toe (or ditches where applicable) and should be founded to a depth of 1.5 mbgs (frost penetration depth).

A condition survey for the pavement shall be carried out prior to tunneling. The condition survey shall document visible flaws such as cracks, distortions and deviations, heaves and depressions. Two surveys should be completed, once during installation of the monitors and again once the tunnel has been completed.

The settlement monitoring installations could be carried out by Golder, upon request, and the subsequent survey monitoring should be carried out by the CA with the results being promptly reviewed by Golder on an ongoing basis. The monitors must be installed a minimum of 2 weeks prior to construction. During construction, Golder should be on site for part time monitoring of the trenchless installation. The results must be provided to the MTO on a daily basis in the form of a written memorandum (memo). The MTO must also be provided with alarm notices within the memo whenever the subsurface monitoring points are measured to have settled 66% of the critical monitoring threshold (CMT) and 100% of the CMT.

At 66% CMT, a “Review” alarm will be immediately issued to notify the CA of the observed settlement; a discussion will then occur between the contractor and the CA about possible mitigation strategies. The contractor must submit a plan of action to the CA which would include steps to prevent settlements from reaching the 100% CMT level. At 100% CMT, an “Alert” alarm will immediately be issued to the CA; construction work will then be discontinued until the following criteria are met:

- The cause of the settlement is identified;
- The contractor submits a corrective/preventative plan;
- Any necessary corrective/preventative measures are implemented; and
- The CA deems it is safe to proceed.

The MTO’s SP for tunneling indicate a review alarm at 10 mm of settlement (66% CMT) and an alert alarm at 15 mm of settlement (100% CMT); the Client should confirm that this CMT value is acceptable for the type of work being performed prior to implementing a monitoring plan.

A baseline survey should be carried out prior to construction, with the points referenced to at least two independent benchmarks. The baseline survey must include three consecutive measurements at least 1 week prior to the start of construction. Surveying during construction should be carried out a minimum of three (3) times per day, provided that the settlements are within the anticipated limits. Surveying should also be carried out weekly for one month following the construction or until all parties agree that further settlement has stopped. The above-indicated surveying schedule is mandated by the MTO as part of their tunneling guidelines and SP; however, it would be

prudent for the Client to consider additional surveying for liability protection purposes. Provided no significant movement is measured following the trenchless installation, Golder recommends additional surveying daily for a period two weeks and once per month for up to three months after construction to serve as evidence that the installation did not result in any settlement related damage to the roadway. Surveying should be carried out using equipment and crews capable of achieving a precision of ±2 mm.

The construction monitoring program should be overseen by a Tunnelling Specialist certified in the MTO's Registry, Appraisal and Qualification System (RAQS).

According to MTO's SP for tunnelling, on low complexity projects with an excavation diameter of 300 mm or less, exemption from the monitoring requirements can be submitted to MTO provided that the risk and likelihood of adversely impacting the MTO roadway is low. However, based on the moderate traffic volumes and varying depths of cover, it is recommended that the monitoring programs described in this section be followed.

6.3 Dewatering Assessment

This section of the report provides hydrogeological recommendations for the proposed trenchless installations, based on our interpretation of the geological and hydrogeological data obtained from the field investigation along the proposed alignments, and the current design plans. In the event the design plans, or choice of construction and installation methods change, the results of this investigation should be reviewed by the project hydrogeologist, and the assumptions re assessed to evaluate their suitability.

It is recommended that a licensed, specialist dewatering subcontractor supervise the installation, operation and decommissioning of any active dewatering systems required for this project, in accordance with applicable legislation. For the purpose of evaluating dewatering rates and the dewatering zone of influence ("ZOI"), Golder has assumed the following:

- Based on the assumptions and recommendations provided above, it has been assumed that the areas requiring dewatering for the trenchless installations would be limited to the locations of the shafts/pits;
- The shaft/pit dimensions would be approximately 5 m by 5 m, and the maximum depth of each shaft will be 1 m below the proposed pipe invert at each location. Two shafts will be required at each crossing location;
- The method of construction dewatering is to be solely determined by the Contractor based on their own independent assessment of the Site-specific conditions, and likely by their specialist dewatering contractor;
- The hydraulic conductivity of the overburden deposits was assumed to be 1×10^{-7} m/s, which was the highest value measured at the tested wells;
- Surface water runoff will be directed away from any open excavations; and
- Groundwater should be pumped in a manner to prevent the migration of soil particles and associated loss of ground.

As noted above, there are three proposed crossings of Highway 26. The following table summarizes the estimated drawdown requirements at each location, based on the invert depths and measured groundwater levels. As groundwater levels were measured in April, it has been assumed the reported levels are generally representative of the period of seasonal high levels.

Table 3: Drawdown Estimates

Crossing	Invert Depth	Estimated Excavation Depth	Depth to Groundwater[1]	Estimated Drawdown Required
Watermain	1.8	2.8	0.4	2.4
Utilities	1.5	2.5	2.1	0.4
Sanitary	1.5	2.5	2.1	0.4

Note: all values in metres

[1] shallowest measured depth

6.3.1 Dewatering Zone of Influence

Applying the Theis analytical solution, the lateral extent of groundwater level drawdown from a single excavation in the unconfined sandy silt till can be estimated as follows:

$$s(r,t) = \frac{Q}{4\pi T} W\left(\frac{r^2 S}{4Tt}\right)$$

Where $s(r,t)$ = drawdown at distance (r) and time (t) after the start of pumping;
Q = pumping rate required to achieve the drawdown at the source;
T = aquifer transmissivity;
S = aquifer storativity (–.1 - assumed specific capacity for surficial overburden); and
W = Theis well function.

As natural systems are expected to be able to tolerate at least a 0.5-m lowering in groundwater levels without an adverse effect, a drawdown of 0.5 m is referred to herein as the “effective” zone of influence. Based on the above approach, and assuming seven days for the dewatering system to reach steady-state, it is estimated that the effective ZOI for a shaft excavation completed in the shallow overburden will be about 3 m for a drawdown of 2.4 m. The effective ZOI for drawdown of 0.4 m would be less than 1 m.

6.3.2 Dewatering Rates

The modified Jacob’s equation was applied using the aquifer parameters and conditions estimated during this investigation. The dewatering rate (“Q”) was estimated by the following equation for confined aquifer conditions:

$$Q = \left[\frac{xK(H^2 - {h_w}^2)}{2L}\right]$$

where:

Q = Dewatering rate (m^3/s)
H = initial groundwater level
x = total excavation perimeter length
K = hydraulic conductivity (1×10^{-7} m/s)
h = final groundwater level
L = zone of influence, ZOI * to 0.5 m drawdown

Based on the above calculation, the estimated maximum dewatering rate for each shaft associated with the watermain crossing would be 0.3 m^3/day, per shaft, for a total of 0.6 m^3/day for the water main crossing. Due to the

lower expected drawdown at the utility and sanitary sewer crossings, 0.4 m compared to 2.4 m, the expected dewatering rate at these crossings would be negligible.

6.4 Installation of Underground Sanitary Services

Golder has been retained to provide engineering services related to a proposed sanitary sewer service to be installed throughout the development area. After reviewing drawings sent by PEL on May 3, 2022, we understand that a 200-mm diameter PVC sanitary sewer pipe is to be installed at depths ranging from approximately 3.0 m to 7.0 m below the proposed ground surface. Three (3) boreholes were advanced at the sanitary manhole locations provided in drawing "*11471 PH-1 with Borehole Locations*" sent by PEL on March 24, 2022 with the subsurface conditions summarized in Section 5.2. The following subsections provide recommendations to support the sanitary sewer installation based on the results of the field investigation.

6.4.1 Soil Bearing Capacity

The sanitary manhole locations investigated vary in depth to a maximum of 7.0 m below the proposed ground surface and the diameter of each manhole is assumed to be approximately 1,800 mm. At this depth and diameter, the foundations will be bearing directly on the native, undisturbed hard silty clay to sandy silty clay glacial till materials. At this depth, a factored geotechnical resistance at Ultimate Limit States (ULS) of 150 kilopascals (kPa) and a net geotechnical reaction at Serviceability Limit States (SLS) of 100 kPa may be used.

The native soils are susceptible to disturbance by construction activities especially during wet or freezing weather. Care should be taken to preserve the integrity of the bearing strata. The founding soils at the excavation base must be inspected and approved by Golder to confirm that the founding soils are competent to carry the design foundation loads and that the bearing surfaces are properly prepared and free of ponded water, loosened soils and any deleterious materials prior to placing the concrete. Remedial work should be carried out on any softened, disturbed, wet or poorly performing zones as directed by the geotechnical engineer. Any low areas may then be brought up to the underside of the floor slab, as required, using Ontario Provincial Standard Specification (OPSS) Granular B, Type I material or other approved material, placed in maximum 200-mm loose lifts and uniformly compacted to at least 98 percent of the material's standard Proctor maximum dry density (SPMDD). Any filling operations must be inspected and tested by Golder on a full-time basis. If the concrete for the footings on native soil cannot be placed immediately (i.e., within 24 hours) after excavation and inspection, it is recommended that a working mat of lean concrete be placed in the excavation to protect the integrity of the bearing stratum. In addition, the bearing soil and fresh concrete should be protected from freezing during cold weather construction.

Our foundation recommendations are subject to a key assumption that no former excavation, former or existing underground utility or structure is within, or intercepts, the zone of influence of the proposed footings. The zone of influence of the proposed foundation can be defined as any line drawn from the underside edge of the slab / raft down and away at an inclination of 1 horizontal to 1 vertical (or 45 degrees) to the horizontal. Complete removal of any existing or remaining foundations from either previous structures or underground utilities or lowering of the founding elevation (if appropriate) may be required, subject to the inspection by Golder at the time of construction.

The founding materials are susceptible to disturbance by construction activity, especially during wet weather, and care should be taken to preserve the integrity of the materials as bearing strata. Due to the presence of fill in some portions of the site and the variability in native soil consistency/compactness, it will be **essential** that all founding soils be inspected by the geotechnical engineer prior to placing concrete for the footings. If the concrete for the footings on native material cannot be placed immediately after excavation and inspection (i.e., within 24 hours of excavation and inspection), it is recommended that a working mat of lean concrete be placed in the excavation to

protect the integrity of the bearing strata. The bearing soil and fresh concrete must be protected from freezing during cold weather construction. All exterior footings and footings in unheated areas should be provided with at least 1.5 m of cover after final grading or a thermally equivalent thickness of insulation, to address the potential for damage due to frost action (frost penetration depth determined from Ontario Provincial Standard Drawing (OPSD) 3090.101).

6.4.2 Pipe Bedding and Cover

The bedding for the buried pipes should be compatible with the type and class of pipe, the surrounding subsoil and anticipated loading conditions and should be designed in accordance with local regional and municipal standards. Granular bedding should consist of 150 mm of OPSS.PROV 1010 (Aggregates) Granular 'A'. Additional bedding (i.e., 300 mm or more) may be required if wet or loose materials are encountered at the base of the trenches. The requirements for additional bedding thicknesses exceeding 150 mm should be determined during construction by the geotechnical engineer.

From the springline to 300 mm above the obvert of the pipe, sand cover may be used such as OPSS.PROV 1002 (Aggregates – Concrete) Fine Aggregate. All bedding and cover materials should be placed in maximum 200-mm loose lifts and should be uniformly compacted to at least 98 percent of SPMDD in accordance with OPSS.PROV 501 (Compacting).

The cover should also be placed concurrently on both sides of the pipe, ensuring that the backfill depth on one side does not exceed the other side by more than 200 mm as per OPSS.PROV 401 (Trenching, Backfilling, and Compacting).

"Clear Stone" aggregate should not be used in any case for pipe bedding or to stabilize the base since fine particles from the native deposits could potentially migrate into the voids in the clear stone and cause loss of lateral pipe support and pipe settlement.

6.4.3 Trench Backfill

It should be generally acceptable to re-use the excavated overburden soils as trench backfill, provided they are free of significant amounts of organics or other deleterious material and are at a suitable water content for compaction. The excavated materials from the site will consist predominantly of sandy clayey silt glacial till material. Subsoils below the groundwater table may require drying prior to reuse. Materials intended for re-use should be inspected by a geotechnical engineer in the field prior to placement and compaction.

It should be noted that due to the presence of fine-grained material in the native till, its workability is sensitive to moisture conditions and some difficulty would be expected in achieving adequate compaction during periods of wet or cold weather.

Based on the measured natural water contents, the materials encountered at the site are generally estimated to be below their estimated water content for compaction and some wetting may be required. The optimum water content will be determined during construction by standard proctor analysis conforming to MTO standard LS-706 "*Method of Test for Moisture-Density Relationship of Soils Using 2.5 kg Rammer and 305 mm Drop"*. The contractor should have contingency plans for wetting backfill soils as needed to achieve the required compaction. Alternatively, if placement water contents at the time of construction are too high, or if there is a shortage of suitable in situ material, then an approved imported sandy material which meets the requirements for OPSS Select Subgrade Material (SSM) could be used.

Soils that contain significant quantities of organics or deleterious material are not suitable for use as trench backfill within settlement sensitive areas. In addition, any boulders or cobbles greater than 150 mm in size should be removed prior to placement of trench backfill material. Backfilling operations during cold weather should avoid inclusions of frozen lumps of material, snow and ice.

All trench backfill, from the top of the cover material to 1.5 m below subgrade elevation, should be placed in maximum 300-mm loose lifts and uniformly compacted to at least 95 percent of SPMDD in accordance with OPSS.PROV 501 (Compacting). From 1.5 m below finished ground elevation to the subgrade level, the materials should be placed in maximum 150-mm loose lifts and uniformly compacted to at least 98 percent of the SPMDD in accordance with OPSS.PROV 501 (Compacting) where a trench is to be constructed beneath a sidewalk or pavement structure (below development streets/roads). In these areas where the trench will be covered with hard surfaced materials (concrete or asphalt), the type of material placed within the frost zone (between finished grade and about 1.5 m depth) should match the soil exposed on the trench walls for frost heave compatibility.

6.4.4 Engineered Fill

In areas where a grade raise is required, loose soil or fill material must be replaced or where there is not enough existing material to be used as backfill, engineered fill may be used to transfer structural loads to the competent underlying native soils.

Prior to placing engineered fill at the site, all topsoil, existing fill and disturbed or deleterious materials within the limits of the engineered fill must first be removed. The limits of any engineered fill should extend beyond the structure's footprint in all directions by at least the depth of the engineered fill plus one meter. The area should be proofrolled in conjunction with an inspection by the geotechnical engineer to confirm that the exposed soils are native, undisturbed and competent. The area must also be confirmed to have been adequately cleaned of ponded water and all disturbed, loosened, softened, organic or otherwise deleterious material. Some localized loose/soft soils may also need to be removed prior to placement as directed by the geotechnical engineer prior to proofrolling.

Materials intended for use as engineered fill must be inspected and approved by the geotechnical engineer prior to placement. In this regard, the existing site soils that which are near their optimum water contents and do not contain any topsoil, organics or any other deleterious material and meet the requirements of OPSS SSM.

Imported materials to be used for engineered fill must be approved by the geotechnical engineer at the source(s) prior to hauling to site. In this regard, imported sandy materials which meet the requirements of OPSS SSM would be suitable for use as engineered fill. The approved materials must be placed in maximum 300-mm thick loose lifts and uniformly compacted to at least 98 percent of SPMDD throughout. The placement of engineered fill must be monitored by the geotechnical engineer on a full-time basis.

The final surface of the engineered fill should be protected as necessary from both construction traffic and freezing and should be sloped to provide positive drainage for surface water during and following the construction period. During periods of freezing weather, additional soil cover or insulation should be placed above the final subgrade to provide frost protection.

Cobbles and boulders exceeding 150 mm in diameter should be removed prior from the engineered fill prior to compaction. It is recommended that the contractor consider the possible presence of cobbles and boulders or other obstructions when developing their excavation and engineered fill construction plans.

6.4.5 Temporary Excavations

All excavations should be carried out in accordance with the Occupational Health and Safety Act (OHSA) and Regulations for Construction Projects (O.Reg. 213/91). Excavations at this site will likely extend into the hard silty clay to sandy clayey silt till material. According to the OHSA, the soils at the site can generally be classified as Type 3 and Type 4 soils as summarized in the following table:

OHSA Soil Classification for Excavations			
Soil Description	**Above/Below Groundwater Table**	**OHSA Soil Type**	**Maximum Excavation Side Slopes**
Existing Silty Sand Fill (Loose)	Above	Type 3	1H:1V
Sandy CLAYEY SILT TILL (Very Stiff to Hard)	Above	Type 2	1H:1V
	Below	Type 4	3H:1V

All excavations should be inspected by the geotechnical engineer for correct soil classification under OHSA. Depending upon the construction procedures adopted by the Contractor, actual groundwater seepage conditions, the success of the contractor's groundwater control methods and weather conditions at the time of construction, some flattening and/or blanketing of slopes may be required to enhance stability. Care should be taken to direct surface water runoff away from open cut excavations. Where deeper excavations are required (i.e., where 1H:1V sloping is not practical), shoring or temporary support systems will need to be implemented at the site. Design of temporary works is the responsibility of the contractor and the requirements of OPSS.MUNI 539 should be followed.

To maintain temporary excavation stability, excavated materials should be placed away from the edge of the excavation a distance equal to the depth of excavation or greater. Failure to comply with this may result in trenched wall failures. Where sufficient space is not available to stockpile the excavated material at the site, off-site disposal of the excavated material would need to be arranged. In addition, all excavations should be left open for as short a duration as possible and completely backfilled at the end of each day.

6.4.6 Frost Susceptibility

The glacial till soils encountered at the site are frost susceptible and should not be used as backfill against exterior or unheated foundation elements. To reduce the effects of frost heave on such structures, preventive measures should be included in the design as appropriate. Such measures may include positive subgrade grading, provision of subdrains, removal and replacement of native soils with non-frost susceptible (sandy) materials, provision of frost tapers and thermal insulation.

A sufficient degree of laboratory testing during construction will be required to determine if the excavated soils intended for re-use meet the requirements for non-frost susceptible material. To avoid problems with frost adhesion and heaving, the foundation elements should be backfilled with non-frost susceptible sand or sand and gravel conforming to the requirements of OPSS.MUNI 1010 Granular 'B' Type I material.

In any areas where pavement or other hard surfacing may abut structures, differential frost heaving could occur between the granular fill immediately adjacent to a structure and the more frost susceptible native subgrade materials which exist beyond the backfill envelope. To reduce the severity of this differential heaving, the backfill adjacent to the wall should be placed to form a frost taper. The frost taper should be brought up to pavement subgrade level

from 1.5 m below finished exterior grade at a slope of 3 horizontal to 1 vertical, or flatter, away from the wall. The granular fill should be placed in maximum 300-mm thick loose lifts and should be uniformly compacted to at least 95 per cent of the material's SPMDD using suitable vibratory compaction equipment. The upper 0.3 metres of wall backfill should consist of clayey material to provide a relatively impermeable cap and the exterior grade should also be shaped to slope away from the structure.

6.4.7 Dewatering Assessment

This section of the report provides hydrogeological recommendations for the proposed open cut sanitary sewer installation, based on interpretation of the geological and hydrogeological data obtained from the field investigation along the proposed alignment, and the current design plans. In the event the design plans, or choice of construction and installation methods change, the results of this investigation should be reviewed by the project hydrogeologist, and the assumptions re assessed to evaluate their suitability.

It is recommended that a licensed, specialist dewatering subcontractor supervise the installation, operation and decommissioning of any active dewatering systems required for this project, in accordance with applicable legislation. For the purpose of evaluating dewatering rates and the dewatering ZOI, Golder has assumed the following:

- For the open cut sanitary sewer installation, the maximum length of open trench at any time would be 25 m. The width of the trench would be 5 m;
- The maximum invert depth (i.e., maximum excavation depth) would be approximately 7 m, with dewatering to a level approximately 0.5 m below the bottom of the excavation;
- The shallowest measured depth to groundwater in the proposed area of open cut excavations was 3.5 m. Based on the above assumptions, the maximum required drawdown is expected to be 4 m;
- Groundwater ingress into the trench will be managed via in trench sumps and pumps; however, the method of construction dewatering is to be solely determined by the Contractor based on their own independent assessment of the Site-specific conditions, and likely by their specialist dewatering contractor;
- The hydraulic conductivity of the overburden deposits was assumed to be 1 x 10^{-7} m/s, which was the highest value measured at the tested wells;
- Surface water runoff will be directed away from any open excavations; and
- Groundwater should be pumped in a manner to prevent the migration of soil particles and associated loss of ground.

As groundwater levels were measured in April, it has been assumed the reported levels were generally representative of the period of seasonal high levels.

6.4.7.1 Dewatering Zone of Influence

Applying the Theis analytical solution, the lateral extent of groundwater level drawdown from a length of open trench in the unconfined overburden can be estimated as follows:

$$s(r,t) = \frac{Q}{4\pi T} W\left(\frac{r^2 S}{4Tt}\right)$$

Where $s(r,t)$ = drawdown at distance (r) and time (t) after the start of pumping;
Q = pumping rate required to achieve the drawdown at the source;
T = aquifer transmissivity;
S = aquifer storativity (0.1 - assumed specific capacity for unconfined overburden); and
W = Theis well function.

As natural systems are expected to be able to tolerate at least a 0.5-m lowering in groundwater levels without an adverse effect, a drawdown of 0.5 m is referred to herein as the "effective" ZOI. Based on the above approach, and assuming seven days for the dewatering system to reach steady-state, it is estimated that the effective ZOI for a trench excavation completed in the shallow overburden will be about 5 m for a drawdown of 4 m.

6.4.7.2 Dewatering Rates

The modified Jacob's equation was applied using the aquifer parameters and conditions estimated during this investigation. The dewatering rate ("Q") was estimated by the following equation for confined aquifer conditions:

$$Q = \left[\frac{xK(H^2 - {h_w}^2)}{2L}\right]$$

where:

Q = Dewatering rate (m^3/s)
K = hydraulic conductivity (1×10^{-7} m/s)
H = initial groundwater level
h = final groundwater level
x = total excavation perimeter length
L = zone of influence, ZOI * to 0.5 m drawdown

Based on the above calculation, the estimated maximum dewatering rate for each stretch of open trench would be approximately 1 m^3/day. In an effort to account for potential heterogeneities in the overburden, a safety factor of two was applied to the above estimate, for a total estimated maximum steady-state discharge rate of 2 m^3/day.

Additional inflow will occur as a result of the drainage of pore water from the saturated overburden material within the footprint of the excavation, which is estimated to be a soil volume of about 500 m^3, and within the zone of influence drawdown cone (about 83 m^3). Assuming a specific yield of 10% for the overburden equates to a pore water volume of 58 m^3. Assuming that the removal of aquifer storage for the area to be excavated is achieved within a 14-day period, the result would be an additional 4 m^3/day of pumping over that period.

6.5 Construction Dewatering Summary

Water takings in excess of 50 m^3/day are regulated by the Ministry of the Environment, Conservation, and Parks (MECP). Groundwater takings for temporary construction dewatering purposes with a combined total volume of less than 400 m^3/day qualify for registration on the MECP's Environmental Activity and Sector Registry (EASR). A Category 3 Permit to Take Water (PTTW) is required where the proposed water taking is greater than 400 m^3/day. The total requirements at any one time will depend on the construction sequence and timing for the various areas

of the Site; however, even assuming all crossing work and open cut excavations are conducted simultaneously, accounting for each of the described sources, an estimated total maximum groundwater taking rate of about 8 m^3/day would be required for construction dewatering purposes. As such, it is expected that construction operations could proceed without the need for a formal dewatering permit.

Recent revisions to O.Reg. 63/16 have stipulate that stormwater (i.e., incidental rainfall) is no longer required to be accounted for in the dewatering permitting process; however, any incidental rainfall which does not infiltrate will have to be removed and disposed of as part of the construction activities. Based on the excavation footprint, and assuming a 30-mm rainfall event, the total volume of incidental rainfall would be 4 m^3.

7.0 CORROSIVITY AND SULPHATE ATTACK TEST RESULTS

The results of corrosivity and sulphate attack testing are presented in Appendix F.

The corrosivity results were compared to the American Water Works Association (AWWA) C-105 (2005) Standard, “Polyethylene Encasement for Ductile-Iron Pipe Systems” as follows:

- Based on the analytical results:
  - The corrosivity potential is considered to low at all locations tested (BHs 22-3, 22-5, 22-8 and 22-11); buried steel elements installed at these locations will therefore likely not require protection from corrosion:

The sulphate attack results were compared to the Canadian Standards Association (CSA) A23.1 Standard, “Concrete materials and methods of concrete construction” as follows:

- Based on the analytical results at the tested locations, the potential for sulphate attack is negligible and concrete made with Type GU Portland cement should be acceptable for below grade concrete elements.

These recommendations are provided as guidance only; the structural designer should take the results of the laboratory testing, the potential for corrosion and the ultimate selection of materials into consideration.

8.0 EXCESS SOIL CHARACTERZATION

Appendices G and H of this report include soil characterization related to excess soil generated as part of the trenchless utility installation and widening of Highway 26. The results are discussed in the Soil Characterization Report (SCR) presented in Appendix G. A separate Assessment of Past Uses (APU) describing the results of the preliminary qualitative assessment of the environmental condition of the project area is included in a separate addendum to this report.

9.0 COMMUNICATION, MONITORING AND INSPECTION

It is recommended that geotechnical input continue throughout the design and construction of the trenchless installation. A program of geotechnical inspections and monitoring during construction of the service is recommended to ensure that the intent of the provided design recommendations is being met and that the various project criteria are being consistently achieved.

It should be noted that decommissioning of the monitoring wells and piezometers is required prior to the expiry of the MTO’s ROW encroachment permit (i.e., must be performed as part of the construction work). Golder would be pleased to provide assistance with well decommissioning upon request from the client.

It is recommended that the contractor's trenchless installation work plans be reviewed by this office prior to the start of construction. Written confirmation of review of the design package and work plans by the Geotechnical Service Provider must be provided to MTO.

Communications between the project team and the MTO should consist of preliminary/final design meetings, pre-construction meetings following project approval, and on-going meetings during construction. Regular (daily) updates on construction progress must be made to the MTO along with notification of any issues or incidents which occur during the installation (including settlement alarms).

10.0 CLOSURE

We trust that this report provides sufficient information at this time. If you have any questions regarding the contents of this report or require additional information, please do not hesitate to contact this office.

Signature Page

Golder Associates Ltd.

Ty Sawyers, E.I.T.
Pavements Analyst

Mark A. Swallow, P.E., P.Eng.
Geotechnical Engineer VIII, Fellow

TJS/MAS/TJS;rl

https://golderassociates.sharepoint.com/sites/156435/project files/6 deliverables/geotechnical design report/final report/21505824 rep final rev0 2022'06'02 hwy 26 meaford - geotechnical design report.docx

APPENDIX A

Important Information and Limitations of this Report

IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT

Standard of Care: Golder Associates Ltd. (Golder) has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practising under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report. No other warranty, expressed or implied is made.

Basis and Use of the Report: This report has been prepared for the specific site, design objective, development and purpose described to Golder by the Client. The factual data, interpretations and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location. Any change of site conditions, purpose, development plans or if the project is not initiated within eighteen months of the date of the report may alter the validity of the report. Golder cannot be responsible for use of this report, or portions thereof, unless Golder is requested to review and, if necessary, revise the report.

The information, recommendations and opinions expressed in this report are for the sole benefit of the Client. No other party may use or rely on this report or any portion thereof without Golder's express written consent. If the report was prepared to be included for a specific permit application process, then upon the reasonable request of the client, Golder may authorize in writing the use of this report by the regulatory agency as an Approved User for the specific and identified purpose of the applicable permit review process. Any other use of this report by others is prohibited and is without responsibility to Golder. The report, all plans, data, drawings and other documents as well as all electronic media prepared by Golder are considered its professional work product and shall remain the copyright property of Golder, who authorizes only the Client and Approved Users to make copies of the report, but only in such quantities as are reasonably necessary for the use of the report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make available the report or any portion thereof to any other party without the express written permission of Golder. The Client acknowledges that electronic media is susceptible to unauthorized modification, deterioration and incompatibility and therefore the Client can not rely upon the electronic media versions of Golder's report or other work products.

The report is of a summary nature and is not intended to stand alone without reference to the instructions given to Golder by the Client, communications between Golder and the Client, and to any other reports prepared by Golder for the Client relative to the specific site described in the report. In order to properly understand the suggestions, recommendations and opinions expressed in this report, reference must be made to the whole of the report. Golder can not be responsible for use of portions of the report without reference to the entire report.

Unless otherwise stated, the suggestions, recommendations and opinions given in this report are intended only for the guidance of the Client in the design of the specific project. The extent and detail of investigations, including the number of test holes, necessary to determine all of the relevant conditions which may affect construction costs would normally be greater than has been carried out for design purposes. Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual data presented in the report, as to how subsurface conditions may affect their work, including but not limited to proposed construction techniques, schedule, safety and equipment capabilities.

Soil, Rock and Ground Water Conditions: Classification and identification of soils, rocks, and geologic units have been based on commonly accepted methods employed in the practice of geotechnical engineering and related disciplines. Classification and identification of the type and condition of these materials or units involves judgment, and boundaries between different soil, rock or geologic types or units may be transitional rather than abrupt. Accordingly, Golder does not warrant or guarantee the exactness of the descriptions.

Special risks occur whenever engineering or related disciplines are applied to identify subsurface conditions and even a comprehensive investigation, sampling and testing program may fail to detect all or certain subsurface conditions. The environmental, geologic, geotechnical, geochemical and hydrogeologic conditions that Golder interprets to exist between and beyond sampling points may differ from those that actually exist. In addition to soil variability, fill of variable physical and chemical composition can be present over portions of the site or on adjacent properties. The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise specifically stated and identified in the report. The presence or implication(s) of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this project and have not been investigated or addressed.

Soil and groundwater conditions shown in the factual data and described in the report are the observed conditions at the time of their determination or measurement. Unless otherwise noted, those conditions form the basis of the recommendations in the report. Groundwater conditions may vary between and beyond reported locations and can be affected by annual, seasonal and meteorological conditions. The condition of the soil, rock and groundwater may be significantly altered by construction activities (traffic, excavation, groundwater level lowering, pile driving, blasting, etc.) on the site or on adjacent sites. Excavation may expose the soils to changes due to wetting, drying or frost. Unless otherwise indicated the soil must be protected from these changes during construction.

Sample Disposal: Golder will dispose of all uncontaminated soil and/or rock samples 90 days following issue of this report or, upon written request of the Client, will store uncontaminated samples and materials at the Client's expense. In the event that actual contaminated soils, fills or groundwater are encountered or are inferred to be present, all contaminated samples shall remain the property and responsibility of the Client for proper disposal.

Follow-Up and Construction Services: All details of the design were not known at the time of submission of Golder's report. Golder should be retained to review the final design, project plans and documents prior to construction, to confirm that they are consistent with the intent of Golder's report.

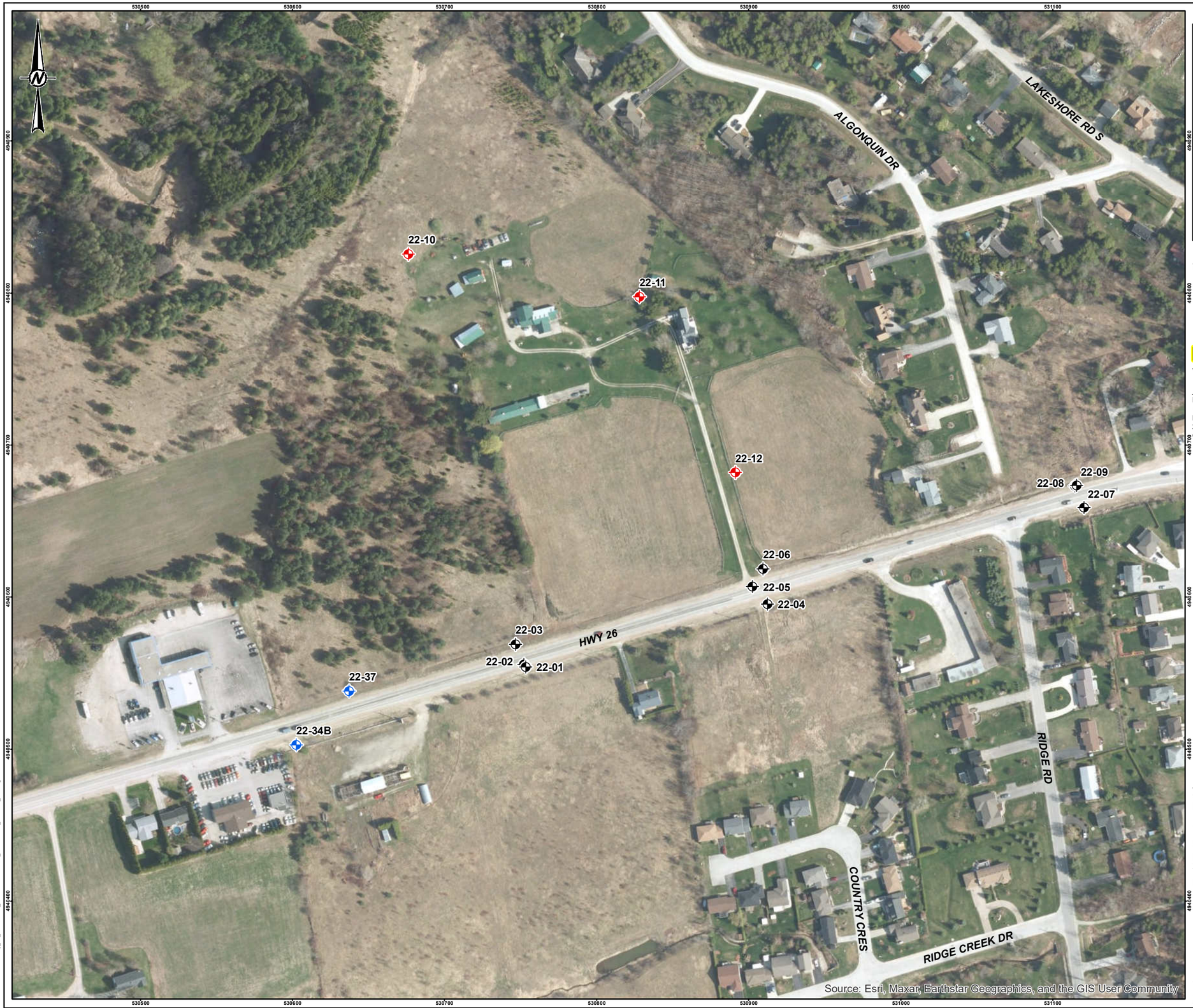
During construction, Golder should be retained to perform sufficient and timely observations of encountered conditions to confirm and document that the subsurface conditions do not materially differ from those interpreted conditions considered in the preparation of Golder's report and to confirm and document that construction activities do not adversely affect the suggestions, recommendations and opinions contained in Golder's report. Adequate field review, observation and testing during construction are necessary for Golder to be able to provide letters of assurance, in accordance with the requirements of many regulatory authorities. In cases where this recommendation is not followed, Golder's responsibility is limited to interpreting accurately the information encountered at the borehole locations, at the time of their initial determination or measurement during the preparation of the Report.

Changed Conditions and Drainage: Where conditions encountered at the site differ significantly from those anticipated in this report, either due to natural variability of subsurface conditions or construction activities, it is a condition of this report that Golder be notified of any changes and be provided with an opportunity to review or revise the recommendations within this report. Recognition of changed soil and rock conditions requires experience and it is recommended that Golder be employed to visit the site with sufficient frequency to detect if conditions have changed significantly.

Drainage of subsurface water is commonly required either for temporary or permanent installations for the project. Improper design or construction of drainage or dewatering can have serious consequences. Golder takes no responsibility for the effects of drainage unless specifically involved in the detailed design and construction monitoring of the system.

APPENDIX B

Figure 1 - Borehole Location Plan



KEY MAP

SCALE 1:25,000

LEGEND

- APPROXIMATE BOREHOLE LOCATION (EXCESS SOIL MANAGEMENT)
- APPROXIMATE BOREHOLE LOCATION (TRENCHLESS INVESTIGATION)
- APPROXIMATE BOREHOLE LOCATION (SANITARY SEWER INVESTIGATION)
- STUDY AREA

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. LAND INFORMATION ONTARIO (LIO) DATA PRODUCED BY GOLDER ASSOCIATES LTD. UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2020
2. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83, COORDINATE SYSTEM: UTM ZONE 17, VERTICAL DATUM: CGG2013

DRAFT

0 25 50 100
1:2,500 METRES

CLIENT
M1 DEVELOPMENT INC.

PROJECT
GEOTECHNICAL INVESTIGATIONS FOR PROPOSED DEVELOPMENT - MEAFORD, ON

TITLE
BOREHOLE LOCATION PLAN

CONSULTANT
WSP GOLDER

YYYY-MM-DD	2022-05-09
DESIGNED	---
PREPARED	JEM
REVIEWED	TJS
APPROVED	---

PROJECT No.	CONTROL	REV.	FIGURE
21505824	0001	A	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 25mm 0

Path: S:\Clients\MTO\Hwy_26_Meaford\99_PROJ\21505824\0_PROD\0002_Geotech_Investigation\21505824-0001-BID-0002.mxd

APPENDIX C

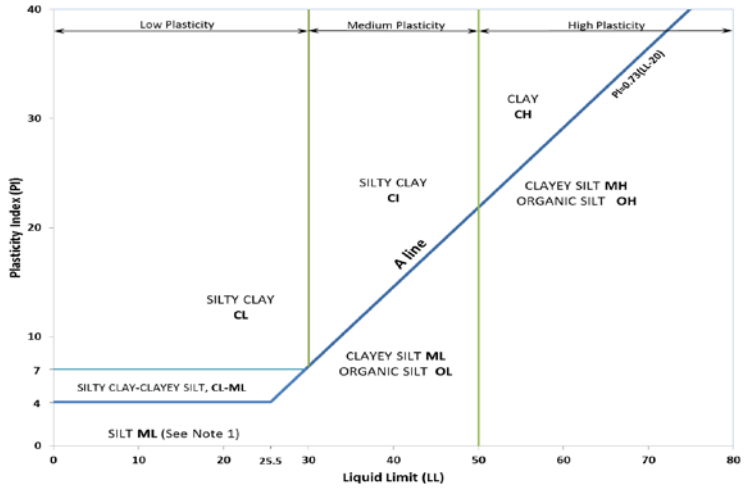
Methods of Soil Classifcation Abbreviations and Terms used on Record of Boreholes List of Symbols Record of Boreholes Sheets 22-01 to 22-12

METHOD OF SOIL CLASSIFICATION

The Golder Associates Ltd. Soil Classification System is based on the Unified Soil Classification System (USCS)

Organic or Inorganic	Soil Group	Type of Soil		Gradation or Plasticity	$Cu = \frac{D_{60}}{D_{10}}$	$Cc = \frac{(D_{30})^2}{D_{10} x D_{60}}$	Organic Content	USCS Group Symbol	Group Name
INORGANIC (Organic Content ≤30% by mass)	COARSE-GRAINED SOILS (>50% by mass is larger than 0.075 mm)	GRAVELS (>50% by mass of coarse fraction is larger than 4.75 mm)	Gravels with ≤12% fines (by mass)	Poorly Graded	<4	≤1 or ≥3	≤30%	GP	GRAVEL
				Well Graded	≥4	1 to 3		GW	GRAVEL
			Gravels with >12% fines (by mass)	Below A Line	n/a			GM	SILTY GRAVEL
				Above A Line	n/a			GC	CLAYEY GRAVEL
		SANDS (≥50% by mass of coarse fraction is smaller than 4.75 mm)	Sands with ≤12% fines (by mass)	Poorly Graded	<6	≤1 or ≥3		SP	SAND
				Well Graded	≥6	1 to 3		SW	SAND
			Sands with >12% fines (by mass)	Below A Line	n/a			SM	SILTY SAND
				Above A Line	n/a			SC	CLAYEY SAND

Organic or Inorganic	Soil Group	Type of Soil	Laboratory Tests	Field Indicators					Organic Content	USCS Group Symbol	Primary Name
				Dilatancy	Dry Strength	Shine Test	Thread Diameter	Toughness (of 3 mm thread)			
INORGANIC (Organic Content ≤30% by mass)	FINE-GRAINED SOILS (≥50% by mass is smaller than 0.075 mm)	SILTS (Non-Plastic or PI and LL plot below A-Line on Plasticity Chart below)	Liquid Limit <50	Rapid	None	None	>6 mm	N/A (can't roll 3 mm thread)	<5%	ML	SILT
				Slow	None to Low	Dull	3mm to 6 mm	None to low	<5%	ML	CLAYEY SILT
				Slow to very slow	Low to medium	Dull to slight	3mm to 6 mm	Low	5% to 30%	OL	ORGANIC SILT
			Liquid Limit ≥50	Slow to very slow	Low to medium	Slight	3mm to 6 mm	Low to medium	<5%	MH	CLAYEY SILT
				None	Medium to high	Dull to slight	1 mm to 3 mm	Medium to high	5% to 30%	OH	ORGANIC SILT
		CLAYS (PI and LL plot above A-Line on Plasticity Chart below)	Liquid Limit <30	None	Low to medium	Slight to shiny	~ 3 mm	Low to medium	0% to 30% **(see Note 2)**	CL	SILTY CLAY
			Liquid Limit 30 to 50	None	Medium to high	Slight to shiny	1 mm to 3 mm	Medium		CI	SILTY CLAY
			Liquid Limit ≥50	None	High	Shiny	<1 mm	High		CH	CLAY
HIGHLY ORGANIC SOILS (Organic Content >30% by mass)		Peat and mineral soil mixtures							30% to 75%	PT	SILTY PEAT, SANDY PEAT
		Predominantly peat, may contain some mineral soil, fibrous or amorphous peat							75% to 100%		PEAT



Note 1 – Fine grained materials with PI and LL that plot in this area are named (ML) SILT with slight plasticity. Fine-grained materials which are non-plastic (i.e. a PL cannot be measured) are named SILT.
Note 2 – For soils with <5% organic content, include the descriptor "trace organics" for soils with between 5% and 30% organic content include the prefix "organic" before the Primary name.

Dual Symbol — A dual symbol is two symbols separated by a hyphen, for example, GP-GM, SW-SC and CL-ML.
For non-cohesive soils, the dual symbols must be used when the soil has between 5% and 12% fines (i.e. to identify transitional material between "clean" and "dirty" sand or gravel.
For cohesive soils, the dual symbol must be used when the liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart (see Plasticity Chart at left).

Borderline Symbol — A borderline symbol is two symbols separated by a slash, for example, CL/CI, GM/SM, CL/ML.
A borderline symbol should be used to indicate that the soil has been identified as having properties that are on the transition between similar materials. In addition, a borderline symbol may be used to indicate a range of similar soil types within a stratum.

ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES AND TEST PITS

PARTICLE SIZES OF CONSTITUENTS

Soil Constituent	Particle Size Description	Millimetres	Inches (US Std. Sieve Size)
BOULDERS	Not Applicable	>300	>12
COBBLES	Not Applicable	75 to 300	3 to 12
GRAVEL	Coarse Fine	19 to 75 4.75 to 19	0.75 to 3 (4) to 0.75
SAND	Coarse Medium Fine	2.00 to 4.75 0.425 to 2.00 0.075 to 0.425	(10) to (4) (40) to (10) (200) to (40)
SILT/CLAY	Classified by plasticity	<0.075	< (200)

MODIFIERS FOR SECONDARY AND MINOR CONSTITUENTS

Percentage by Mass	Modifier
>35	Use 'and' to combine major constituents (*i.e.,* SAND and GRAVEL)
> 12 to 35	Primary soil name prefixed with "gravelly, sandy, SILTY, CLAYEY" as applicable
> 5 to 12	some
≤ 5	trace

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.) split-spoon sampler for a distance of 300 mm (12 in.). Values reported are as recorded in the field and are uncorrected.

Cone Penetration Test (CPT)

An electronic cone penetrometer with a 60° conical tip and a project end area of 10 cm^2 pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (q_t), porewater pressure (u) and sleeve frictions are recorded electronically at 25 mm penetration intervals.

Dynamic Cone Penetration Resistance (DCPT); 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.).

PH: Sampler advanced by hydraulic pressure
PM: Sampler advanced by manual pressure
WH: Sampler advanced by static weight of hammer
WR: Sampler advanced by weight of sampler and rod

SAMPLES

AS	Auger sample
BS	Block sample
CS	Chunk sample
DD	Diamond Drilling
DO or DP	Seamless open ended, driven or pushed tube sampler – note size
DS	Denison type sample
GS	Grab Sample
MC	Modified California Samples
MS	Modified Shelby (for frozen soil)
RC	Rock core
SC	Soil core
SS	Split spoon sampler – note size
ST	Slotted tube
TO	Thin-walled, open – note size (Shelby tube)
TP	Thin-walled, piston – note size (Shelby tube)
WS	Wash sample

SOIL TESTS

w	water content
PL , w_p	plastic limit
LL , w_L	liquid limit
C	consolidation (oedometer) test
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test[1]
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement[1]
D_R	relative density (specific gravity, Gs)
DS	direct shear test
GS	specific gravity
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
SO_4	concentration of water-soluble sulphates
UC	unconfined compression test
UU	unconsolidated undrained triaxial test
V (FV)	field vane (LV-laboratory vane test)
γ	unit weight

1. Tests anisotropically consolidated prior to shear are shown as CAD, CAU.

NON-COHESIVE (COHESIONLESS) SOILS

Compactness[2]

Term	SPT 'N' (blows/0.3m)[1]
Very Loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	>50

1. SPT 'N' in accordance with ASTM D1586, uncorrected for the effects of overburden pressure.
2. Definition of compactness terms are based on SPT 'N' ranges as provided in Terzaghi, Peck and Mesri (1996). Many factors affect the recorded SPT 'N' value, including hammer efficiency (which may be greater than 60% in automatic trip hammers), overburden pressure, groundwater conditions, and grainsize. As such, the recorded SPT 'N' value(s) should be considered only an approximate guide to the soil compactness. These factors need to be considered when evaluating the results, and the stated compactness terms should not be relied upon for design or construction.

Field Moisture Condition

Term	Description
Dry	Soil flows freely through fingers.
Moist	Soils are darker than in the dry condition and may feel cool.
Wet	As moist, but with free water forming on hands when handled.

COHESIVE SOILS

Consistency

Term	Undrained Shear Strength (kPa)	SPT 'N'[1,2] (blows/0.3m)
Very Soft	<12	0 to 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	>200	>30

1. SPT 'N' in accordance with ASTM D1586, uncorrected for overburden pressure effects; approximate only.
2. SPT 'N' values should be considered ONLY an approximate guide to consistency; for sensitive clays (e.g., Champlain Sea clays), the N-value approximation for consistency terms does NOT apply. Rely on direct measurement of undrained shear strength or other manual observations.

Water Content

Term	Description
w < PL	Material is estimated to be drier than the Plastic Limit.
w ~ PL	Material is estimated to be close to the Plastic Limit.
w > PL	Material is estimated to be wetter than the Plastic Limit.

LIST OF SYMBOLS

Unless otherwise stated, the symbols employed in the report are as follows:

I. GENERAL

π	3.1416
ln x	natural logarithm of x
$\log_{10}$	x or log x, logarithm of x to base 10
g	acceleration due to gravity
t	time

II. STRESS AND STRAIN

γ	shear strain
Δ	change in, e.g. in stress: $\Delta\sigma$
ε	linear strain
ε_v	volumetric strain
η	coefficient of viscosity
υ	Poisson's ratio
σ	total stress
σ'	effective stress ($\sigma' = \sigma - u$)
σ'_{vo}	initial effective overburden stress
$\sigma_1, \sigma_2, \sigma_3$	principal stress (major, intermediate, minor)
σ_{oct}	mean stress or octahedral stress $= (\sigma_1 + \sigma_2 + \sigma_3)/3$
τ	shear stress
u	porewater pressure
E	modulus of deformation
G	shear modulus of deformation
K	bulk modulus of compressibility

III. SOIL PROPERTIES

(a) Index Properties

$\rho(\gamma)$	bulk density (bulk unit weight)*
$\rho_d(\gamma_d)$	dry density (dry unit weight)
$\rho_w(\gamma_w)$	density (unit weight) of water
$\rho_s(\gamma_s)$	density (unit weight) of solid particles
γ'	unit weight of submerged soil ($\gamma' = \gamma - \gamma_w$)
D_R	relative density (specific gravity) of solid particles ($D_R = \rho_s / \rho_w$) (formerly G_s)
e	void ratio
n	porosity
S	degree of saturation

* Density symbol is ρ. Unit weight symbol is γ where $\gamma = \rho g$ (i.e. mass density multiplied by acceleration due to gravity)

(a) Index Properties (continued)

w	water content
w_l or LL	liquid limit
w_p or PL	plastic limit
I_p or PI	plasticity index = $(w_l - w_p)$
NP	non-plastic
w_s	shrinkage limit
I_L	liquidity index = $(w - w_p) / I_p$
I_C	consistency index = $(w_l - w) / I_p$
e_{max}	void ratio in loosest state
e_{min}	void ratio in densest state
I_D	density index = $(e_{max} - e) / (e_{max} - e_{min})$ (formerly relative density)

(b) Hydraulic Properties

h	hydraulic head or potential
q	rate of flow
v	velocity of flow
i	hydraulic gradient
k	hydraulic conductivity (coefficient of permeability)
j	seepage force per unit volume

(c) Consolidation (one-dimensional)

C_c	compression index (normally consolidated range)
C_r	recompression index (over-consolidated range)
C_s	swelling index
C_α	secondary compression index
m_v	coefficient of volume change
c_v	coefficient of consolidation (vertical direction)
c_h	coefficient of consolidation (horizontal direction)
T_v	time factor (vertical direction)
U	degree of consolidation
σ'_p	pre-consolidation stress
OCR	over-consolidation ratio = σ'_p / σ'_{vo}

(d) Shear Strength

τ_p, τ_r	peak and residual shear strength
ϕ'	effective angle of internal friction
δ	angle of interface friction
μ	coefficient of friction = tan δ
c'	effective cohesion
c_u, s_u	undrained shear strength ($\phi = 0$ analysis)
p	mean total stress $(\sigma_1 + \sigma_3)/2$
p′	mean effective stress $(\sigma'_1 + \sigma'_3)/2$
q	$(\sigma_1 - \sigma_3)/2$ or $(\sigma'_1 - \sigma'_3)/2$
q_u	compressive strength $(\sigma_1 - \sigma_3)$
S_t	sensitivity

Notes: 1 $\tau = c' + \sigma' \tan \phi'$

2 shear strength = (compressive strength)/2

PROJECT: 21505824 (MEAFORD - HWY 26)

LOCATION: Refer to Figure 2

RECORD OF BOREHOLE: 22-01

BORING DATE: APRIL 11, 2022

SHEET 1 OF 1

DATUM: Geodetic

SPT/DCPT HAMMER: MASS, 140kg; DROP, 30mm

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W WI) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		199.06							
0	POWER AUGER 150 mm DIAMETER SOLID STEM AUGER	FILL (SP) silty SAND and GRAVEL, trace plastic fines; brown; non-cohesive, moist, compact		0.00	1	SS	22			MH	FLUSH MOUNT 50 mm DIAMETER MONITORING WELL
				198.36							
1		(SM) SILTY SAND, trace gravel organic inclusions; brown; non-cohesive, wet, loose to compact		0.70	2	SS	8				CUTTINGS AND BENTONITE CHIPS
					3a	SS	11				
				197.24							
2		(CL-ML) clayey SILT; brown; w<PL, stiff		1.82	3b	SS	11				BENTONITE PLUG
				196.84							
		(ML) sandy SILT, some plastic fines, trace gravel; brown; non-cohesive, very dense		2.22	4	SS	52				
3											TYPE 2 SAND
					5	SS	50			MH	
4											
											PVC SCREEN
5					6	SS	50				
6											
					7	SS	57				
				192.36							
		END OF BOREHOLE		6.70							
7		NOTES:									
		1. Groundwater level in monitoring well dry when measured upon completion drilling and at 1.5 mbgs on April 18, 2022.									
8											
9											
10											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: TJS

CHECKED: TJS

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PROJECT: 21505824 (MEAFORD - HWY 26)

LOCATION: Refer to Figure 2

RECORD OF BOREHOLE: 22-02

BORING DATE: APRIL 11, 2022

SHEET 1 OF 1

DATUM: Geodetic

SPT/DCPT HAMMER: MASS, 140kg; DROP, 30mm

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		199.17							
0	POWER AUGER 150 mm DIAMETER SOLID STEM AUGER	ASPHALT (89 mm)		0.00							
		FILL - (SP) silty SAND and GRAVEL, trace plastic fines; brown; moist compact		0.09	1a	SS	27				
		FILL - (CL) SILTY CLAY; brown, organic inclusions; w<PL, very stiff		0.17	1b	SS	29				
1					2	SS	8				
		(SP) SAND, trace non-plastic fines; brown; non-cohesive, wet, compact		197.83 1.34							
		(CL-ML) clayey SILT; brown; w<PL, hard		197.47 1.70	3a	SS	12				
2					3b	SS	12				
					4	SS	38				
3					5	SS	54				
		(ML) sandy SILT, some plastic fines, trace gravel; brown (TILL); non-cohesive, dense to very dense		195.43 3.74							
4					6	SS	52				
5					7	SS	48				
6					8	SS	40				
		END OF BOREHOLE		192.47 6.70							
7		NOTES:									
		1. Borehole dry upon completion of drilling.									
8											
9											
10											

DEPTH SCALE

1 : 50

LOGGED: TJS

CHECKED: TJS

GOLDER

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PROJECT: 21505824 (MEAFORD - HWY 26)

LOCATION: Refer to Figure 2

RECORD OF BOREHOLE: 22-03

BORING DATE: APRIL 13, 2022

SHEET 1 OF 1

DATUM: Geodetic

SPT/DCPT HAMMER: MASS, 140kg; DROP, 30mm

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	HEADSPACE COMBUSTIBLE VAPOUR CONCENTRATIONS [PPM] ND = Not Detected; LEL	HYDRAULIC CONDUCTIVITY, k, cm/s; WATER CONTENT PERCENT Wp W Wl	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		197.13							
0	POWER AUGER 150 mm DIAMETER SOLID STEM AUGER	FILL - TOPSOIL		0.00 / 196.88							STICK-UP CASING 50 mm DIAMETER MONITORING WELL
		FILL - (SP) SAND, trace gravel, trace non-plastic fines; brown; non-cohesive, moist, compact		0.25 / 0.33	1	SS	12	ND			
1		(CL) SILTY CLAY, trace sand; brown; compact, w<PL, very stiff			2	SS	20				CUTTINGS AND BENTONITE CHIPS
				195.64							
2		(CL-ML) clayey SILT, some sand; brown (TILL); w<PL, hard		1.49	3	SS	77	ND			BENTONITE PLUG
					4	SS	45	ND			
3					5	SS	49	ND			TYPE 2 SAND
4					6	SS	34	ND			
											PVC SCREEN
5					7	SS	50	ND			
6					8	SS	54	ND			
				190.43							
		END OF BOREHOLE		6.70							
7		NOTES:									
		1. Groundwater level in monitoring well measured at 1.6 mbgs upon completion of drilling and at 0.4 mgbs on April 18, 2022.									
8											
9											
10											

DEPTH SCALE

1 : 50

LOGGED: TJS

CHECKED: TJS

GOLDER

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PROJECT: 21505824 (MEAFORD - HWY 26)

LOCATION: Refer to Figure 2

RECORD OF BOREHOLE: 22-04

BORING DATE: APRIL 12, 2022

SHEET 1 OF 1

DATUM: Geodetic

SPT/DCPT HAMMER: MASS, 140kg; DROP, 30mm

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	HEADSPACE COMBUSTIBLE VAPOUR CONCENTRATIONS [PPM] ND = Not Detected; LEL	HYDRAULIC CONDUCTIVITY, k, cm/s; WATER CONTENT PERCENT Wp W WI	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		197.82							
0	POWER AUGER 150 mm DIAMETER SOLID STEM AUGER	ASPHALT		0.00							
		FILL - (GP) GRAVEL and SAND, some non-plastic fines, trace plastic fines; brown; non-cohesive, moist, dense		0.10	1	SS	36	ND			FLUSH MOUNT 50 mm DIAMETER MONITORING WELL
				196.94							CUTTINGS AND BENTONITE CHIPS
1		(CL) clayey SANDY SILT, some gravel; brown (TILL); w<PL, stiff to hard		0.88	2	SS	15	ND			
					3	SS	25	ND		MH	
2											BENTONITE PLUG
					4	SS	62	ND			
3											TYPE 2 SAND
					5	SS	27	ND			
4					6	SS	38	ND			
											PVC SCREEN
5					7	SS	53	ND			
6					8	SS	92/11"	ND			
				191.12							
		END OF BOREHOLE		6.70							
7		NOTES:									
		1. Groundwater level in monitoring well measured at 2.1 mbgs upon completion of drilling and at 6.1 mgbs on April 18, 2022.									
8											
9											
10											

DEPTH SCALE

1 : 50

LOGGED: TJS

CHECKED: TJS

GOLDER

GTA-BHS 001 \\GOLDER.GDS\COMPLEXDATA\OFFICE\ONTARIO\SIM\CLIENTS\LC_DEVELOPMENT_GROUP\MEAFORD_206105_HIGHWAY_26\02_DATA\GINT\21505824.GPJ GAL-MIS.GDT 5/16/22 DP

PROJECT: 21505824 (MEAFORD - HWY 26)

LOCATION: Refer to Figure 2

RECORD OF BOREHOLE: 22-05

BORING DATE: APRIL 11, 2022

SHEET 1 OF 1

DATUM: Geodetic

SPT/DCPT HAMMER: MASS, 140kg; DROP, 30mm

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		197.12							
0	POWER AUGER 150 mm DIAMETER SOLID STEM AUGER	ASPHALT		0.00							
		FILL - (GP) GRAVEL and SAND, some non-plastic fines, trace plastic fines; brown; non-cohesive, moist, very dense		0.15	1	SS	59		○	M	
				196.32							
1		FILL - (CL) sandy SILTY CLAY, some gravel; brown, organic inclusions; w<PL, very stiff,		0.80	2	SS	28		○		
				195.60							
2		(CL) clayey SANDY SILT, some sand; brown (TILL); w<PL, very stiff to hard		1.52	3	SS	49		○		
					4	SS	45		○		
3					5	SS	40		○		
4					6	SS	47		○		
5					7	SS	44		○		
6					8	SS	64		○		
				190.42							
7		END OF BOREHOLE		6.70							
		NOTES:									
		1. Borehole dry upon completion of drilling.									
8											
9											
10											

DEPTH SCALE

1 : 50

LOGGED: TJS

CHECKED: TJS

GOLDER

GTA-BHS 001 \\GOLDER.GDS\COMPLEXDATA\OFFICE\ONTARIO\SIM\CLIENTS\LC_DEVELOPMENT_GROUP\MEAFORD_206105_HIGHWAY_26\02_DATA\GINT\21505824.GPJ GAL-MIS.GDT 5/16/22 DP

PROJECT: 21505824 (MEAFORD - HWY 26)

LOCATION: Refer to Figure 2

RECORD OF BOREHOLE: 22-06

BORING DATE: APRIL 14, 2022

SHEET 1 OF 1

DATUM: Geodetic

SPT/DCPT HAMMER: MASS, 140kg; DROP, 30mm

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W WI) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		195.70							
0	POWER AUGER, 150 mm DIAMETER SOLID STEM AUGER	FILL - TOPSOIL		0.00							
		FILL - (CL) SILTY CLAY, some sand, some gravel; brown with grey clods; w>PL to w<PL, firm to very stiff		0.12	1	SS	10				FLUSH MOUNT 50 mm DIAMETER MONITORING WELL
1					2	SS	26				CUTTINGS AND BENTONITE CHIPS
				194.21							
		(CL) clayey SANDY SILT, some gravel; brown (TILL); w~PL, firm to hard		1.49	3	SS	37				BENTONITE PLUG
2		-- Auger grinding on interred boulder at 3.96 m									
					4	SS	56			MH	
3											TYPE 2 SAND
					5	SS	85/ 10"				
4				191.56							
		(CL) clayey SANDY SILT, some gravel; grey (TILL); w<PL, firm to hard		4.14							
5					6	SS	50/ 5"				PVC SCREEN
6				189.49	7	SS	50/ 4"				
		END OF BOREHOLE		6.21							
7		NOTES: 1. Groundwater level in monitoring well dry upon completion of drilling and at 2.1 mgbs on April 18, 2022.									
8											
9											
10											

DEPTH SCALE

1 : 50

LOGGED: TJS

CHECKED: TJS

GOLDER

PROJECT: 21505824 (MEAFORD - HWY 26)

LOCATION: Refer to Figure 2

RECORD OF BOREHOLE: 22-07

BORING DATE: APRIL 12, 2022

SHEET 1 OF 1

DATUM: Geodetic

SPT/DCPT HAMMER: MASS, 140kg; DROP, 30mm

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W WI) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		GROUND SURFACE		191.65							
	POWER AUGER 150 mm DIAMETER SOLID STEM AUGER	ASPHALT		0.00							
		FILL - (GW) GRAVEL and SAND, some non-plastic fines; brown; non-cohesive, moist, dense		0.12	1	SS	33				FLUSH MOUNT 50 mm DIAMETER MONITORING WELL
1		FILL - (CL) SILTY CLAY, some sand; brown; organic inclusions, w>PL, stiff		190.77 0.88	2a	SS	13				CUTTINGS AND BENTONITE CHIPS
		(CL) SILTY CLAY, some sand, trace gravel; brown (TILL); w<PL, stiff to hard		1.03	2b	SS	13				
2					3	SS	65/ 11"				BENTONITE PLUG
					4	SS	84/ 11"				
3				188.68							TYPE 2 SAND
		(ML) sandy SILT; some plastic fines; grey (TILL) ; non-cohesive, moist, very dense		2.97	5	SS	59/ 10"				
4					6	SS	97/ 10"				PVC SCREEN
					7	SS	60			MH	
5											
6					8	SS	85/ 10"				
				184.95							
7		END OF BOREHOLE		6.70							
		NOTES:									
8		1. Groundwater level in monitoring well dry when measured upon completion of drilling and at 2.1 mgbs on April 18, 2022.									
9											
10											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: TJS

CHECKED: TJS

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PROJECT: 21505824 (MEAFORD - HWY 26)

LOCATION: Refer to Figure 2

RECORD OF BOREHOLE: 22-08

BORING DATE: APRIL 12, 2022

SHEET 1 OF 1

DATUM: Geodetic

SPT/DCPT HAMMER: MASS, 140kg; DROP, 30mm

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		190.72							
0	POWER AUGER 150 mm DIAMETER SOLID STEM AUGER	ASPHALT		0.00							
		FILL - (GW) GRAVEL and SAND, some non-plastic fines; brown; non-cohesive, moist, compact		0.16	1a	SS	25				
				0.33	1b	SS	25				
		FILL - (CL) SILTY CLAY, trace sand, trace gravel; brown, organic inclusions; w<PL, very stiff		189.84							
1		FILL - (CL) SILTY CLAY; brown; w>PL, stiff		0.88	2	SS	10				
				189.23							
		(CL) SILTY CLAY, some sand, trace gravel; brown (TILL); w<PL, hard		1.49	3	SS	68/ 12"				
2					4	SS	95/ 12"				
				187.71							
3		(ML) sandy SILT, some plastic fines, trace gravel; grey (TILL); non-cohesive, moist, dense to very dense		3.01	5	SS	96/ 9"			MH	
4											
					6	SS	45				
5											
6					7	SS	11"				
				184.02							
		END OF BOREHOLE		6.70							
7		NOTES:									
		1. Borehole dry upon completion of drilling.									
8											
9											
10											

DEPTH SCALE

1 : 50

LOGGED: TJS

CHECKED: TJS

GOLDER

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PROJECT: 21505824 (MEAFORD - HWY 26)

LOCATION: Refer to Figure 2

RECORD OF BOREHOLE: 22-09

BORING DATE: APRIL 12, 2022

SHEET 1 OF 1

DATUM: Geodetic

SPT/DCPT HAMMER: MASS, 140kg; DROP, 30mm

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	HEADSPACE COMBUSTIBLE VAPOUR CONCENTRATIONS [PPM] ND = Not Detected; LEL	HYDRAULIC CONDUCTIVITY, k, cm/s; WATER CONTENT PERCENT Wp W WI	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		190.36							
0	POWER AUGER 150 mm DIAMETER SOLID STEM AUGER	FILL - (GW) GRAVEL and SAND, some non-plastic fines; brown; non-cohesive, moist, compact		0.00 / 189.72	1	SS	25	ND		M	FLUSH MOUNT 50 mm DIAMETER MONITORING WELL
1		FILL - (CL) SILTY CLAY, some sand, trace gravel; brown; w>PL, firm		0.64 / 188.87	2	SS	9	ND			CUTTINGS AND BENTONITE CHIPS
		(CL) SILTY CLAY; brown; w>PL, hard		1.49 / 188.23	3	SS	61/12"	ND			BENTONITE PLUG
2		(ML) sandy SILT, some plastic fines, trace gravel; brown (TILL); non-cohesive, moist, very dense		2.13 / 187.35	4	SS	85/10"	ND			TYPE 2 SAND
3		(ML) sandy SILT, some plastic fines, trace gravel; grey (TILL); non-cohesive, moist, compact to very dense		3.01 / 183.66	5	SS	88/10"	ND			PVC SCREEN
4					6	SS	28	ND			
5					7	SS	60	ND			
6					8	SS	76	ND			
7		END OF BOREHOLE		6.70							
8		NOTES: 1. Groundwater level in monitoring well dry upon completion of drilling and at 2.3 mgbs on April 18, 2022.									
9											
10											

DEPTH SCALE

1 : 50

LOGGED: TJS

CHECKED: TJS

PROJECT: 21505824 (MEAFORD - HWY 26)

LOCATION: Refer to Figure 2

RECORD OF BOREHOLE: 22-10

BORING DATE: APRIL 13, 2022

SHEET 1 OF 2

DATUM: Geodetic

SPT/DCPT HAMMER: MASS, 140kg; DROP, 30mm

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W WI) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		GROUND SURFACE		197.87							
	POWER AUGER	FILL - TOPSOIL		0.00							
	150 mm DIAMETER SOLID STEM AUGER	FILL - (CL) SILTY CLAY, trace gravel, trace sand; brown, organic inclusions; w~PL, firm		0.10	1	SS	13				FLUSH MOUNT 50 mm DIAMETER MONITORING WELL
1				196.99							CUTTINGS AND BENTONITE CHIPS
		(CL) sandy SILTY CLAY, trace gravel; brown; w<PL, firm		0.88	2	SS	16				
				196.38							
2		(CL) SILTY CLAY, some sand, some to trace gravel; brown (TILL); w<PL, stiff to hard		1.49	3	SS	27				
					4	SS	38				
3					5	SS	64/ 12"				BENTONITE PLUG
				193.91							
4		(CL) SILTY CLAY, some sand, some to trace gravel; grey (TILL); cohesive, w<PL, hard		3.96	6	SS	77/				
5											
					7	SS	5"				TYPE 2 SAND
6											
7											
					8	SS	90/ 10"				PVC SCREEN
8											
9					9	SS	91/ 11"				
				188.12							
		END OF BOREHOLE		9.75							
10		*CONTINUED NEXT PAGE*									

DEPTH SCALE

1 : 50

LOGGED: TJS

CHECKED: TJS

GOLDER

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PROJECT: 21505824 (MEAFORD - HWY 26)

LOCATION: Refer to Figure 2

RECORD OF BOREHOLE: 22-10

BORING DATE: APRIL 13, 2022

DATUM: Geodetic

SPT/DCPT HAMMER: MASS, 140kg; DROP, 30mm

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	SOIL PROFILE: STRATA PLOT	SOIL PROFILE: ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp — W — Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
10		*--- CONTINUED FROM PREVIOUS PAGE ---*									
		NOTES: 1. Groundwater level in monitoring well dry upon completion of drilling and at 8.0 mgbs on April 18, 2022.									
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: TJS

CHECKED: TJS

PROJECT: 21505824 (MEAFORD - HWY 26)

LOCATION: Refer to Figure 2

RECORD OF BOREHOLE: 22-11

BORING DATE: APRIL 13, 2022

SHEET 1 OF 1

DATUM: Geodetic

SPT/DCPT HAMMER: MASS, 140kg; DROP, 30mm

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W WI) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		196.70							
0	POWER AUGER 150 mm DIAMETER SOLID STEM AUGER	TOPSOIL		0.00 / 196.50							
		FILL - (SM) SILTY SAND, some gravel, trace plastic fines; brown, organic inclusions; non-cohesive, moist, loose		0.20 / 195.91	1	SS	8			MH	FLUSH MOUNT 50 mm DIAMETER MONITORING WELL
1		(CL) sandy CLAYEY SILT, trace gravel; brown; w<PL, stiff		0.79 / 195.21	2	SS	27				CUTTINGS AND BENTONITE CHIPS
2		(CL) sandy CLAYEY SILT, some gravel; grey; w>PL, hard		1.49 / 193.69	3	SS	87/ 12"			MH	
					4	SS	50/ 5"				
3		(CL) sandy CLAYEY SILT, some gravel; grey (TILL); w<PL, hard		3.01	5	SS	91/ 11"				BENTONITE PLUG
4											
5					6	SS	74				type 2 SAND
6											
					7	SS	50/ 5"				PVC SCREEN
7											
					8	SS	50/ 4"				
8				188.78							
		END OF BOREHOLE		7.92							
9		NOTES:									
		1. Groundwater level in monitoring well dry upon completion of drilling and at 3.9 mgbs on April 18, 2022.									
10											

DEPTH SCALE

1 : 50

LOGGED: TJS

CHECKED: TJS

GOLDER

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PROJECT: 21505824 (MEAFORD - HWY 26)

LOCATION: Refer to Figure 2

RECORD OF BOREHOLE: 22-12

BORING DATE: APRIL 14, 2022

SHEET 1 OF 2

DATUM: Geodetic

SPT/DCPT HAMMER: MASS, 140kg; DROP, 30mm

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80)	SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕; Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3})	WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	POWER AUGER 150 mm DIAMETER SOLID STEM AUGER	GROUND SURFACE		199.29									
		FILL - TOPSOIL		0.00									
		(CL) sandy CLAYEY SILT, trace gravel; brown; w>PL, very stiff		0.10	1	SS	28						FLUSH MOUNT 50 mm DIAMETER MONITORING WELL
				198.59									
1		(CL) sandy CLAYEY SILT, trace to some gravel; brown (TILL); w<PL, very stiff to hard		0.70	2	SS	47						CUTTINGS AND BENTONITE CHIPS
					3	SS	94/ 11"						
2													BENTONITE PLUG
					4	SS	75/ 10"						
3													FILTER PACK
					5	SS	77/ 8"						
4				195.15									
		(CL) sandy CLAYEY SILT, trace to some gravel; grey (TILL); w<PL, hard		4.14									PVC SCREEN WITH FILTER SAND
					6	SS	98/ 10"					MH	
5													
6													
					7	SS	50/ 5"						
7													
					8	SS	89/ 11"						
8													
					9	SS	70						
9				189.54									
		END OF BOREHOLE		9.75									
10		*CONTINUED NEXT PAGE*											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: TJS

CHECKED: TJS

GTA-BHS 001 \\GOLDER.GDS\COMPLEXDATA\OFFICE\ONTARIO\SIM\CLIENTS\LC_DEVELOPMENT_GROUP\MEAFORD_206105_HIGHWAY_26\02_DATA\GINT\21505824.GPJ GAL-MIS.GDT 5/16/22 DP

PROJECT: 21505824 (MEAFORD - HWY 26)

LOCATION: Refer to Figure 2

RECORD OF BOREHOLE: 22-12

BORING DATE: APRIL 14, 2022

DATUM: Geodetic

SPT/DCPT HAMMER: MASS, 140kg; DROP, 30mm

HAMMER TYPE: AUTOMATIC

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	SOIL PROFILE: STRATA PLOT	SOIL PROFILE: ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
10		*--- CONTINUED FROM PREVIOUS PAGE ---*									
		NOTES: 1. Groundwater level in monitoring well dry upon completion of drilling and at 3.5 mgbs on April 18, 2022.									
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											

DEPTH SCALE

1 : 50

GOLDER

LOGGED: TJS

CHECKED: TJS

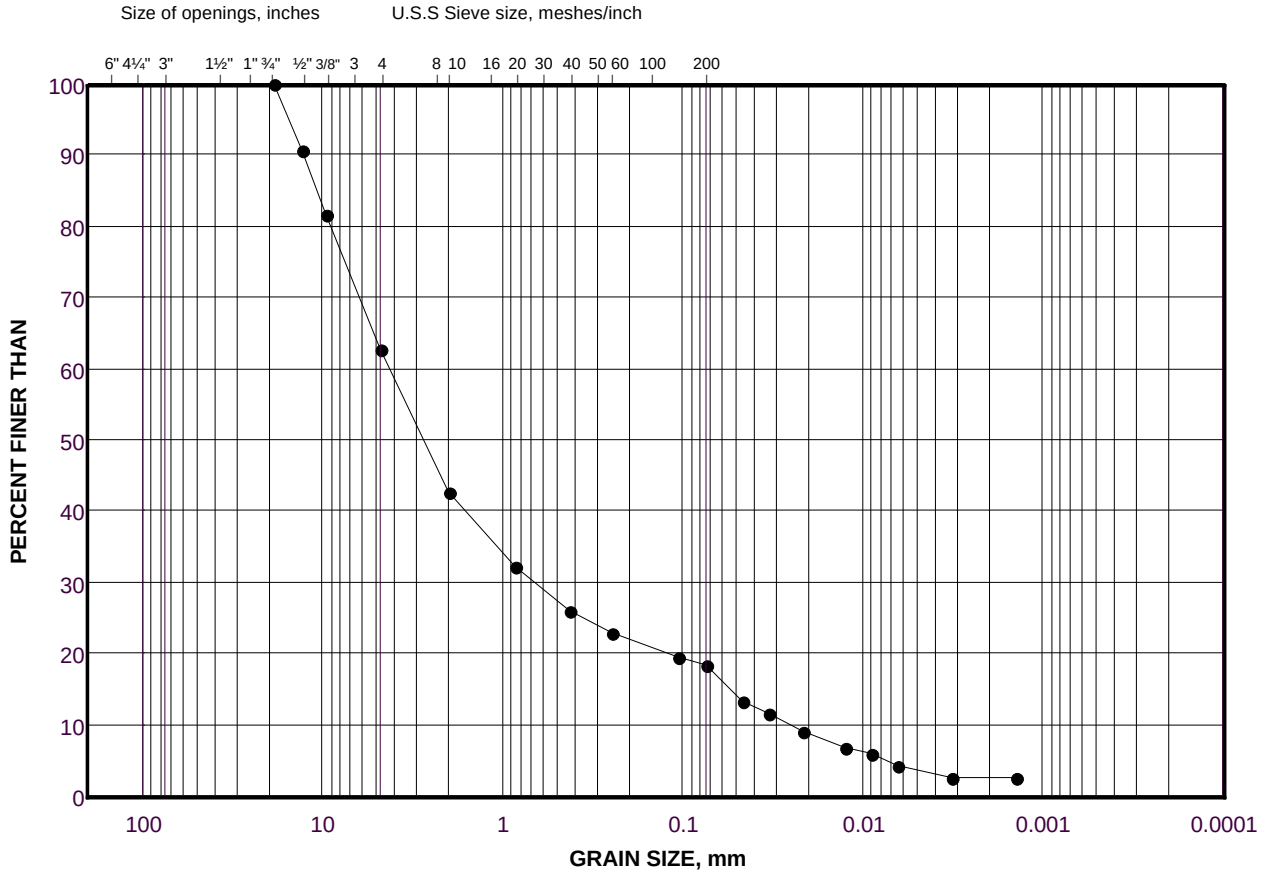
APPENDIX D

Laboratory Testing Figures D1 to D7

GRAIN SIZE DISTRIBUTION

FILL (SP) silty SAND and GRAVEL

FIGURE D1



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	22-1	1	0.0 - 0.61

Project Number: 21505824

Checked By: TS

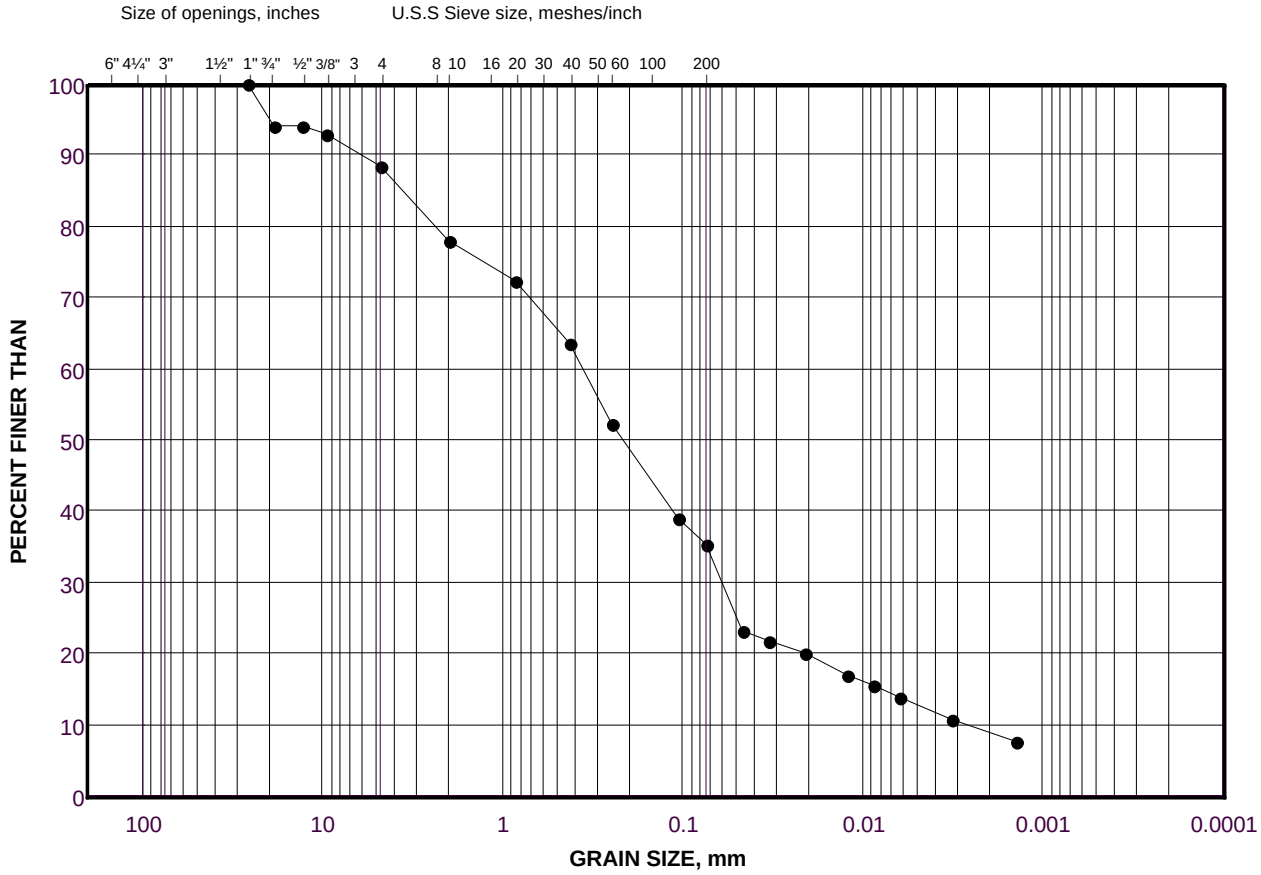
Golder Associates

Date: 13-May-22

GRAIN SIZE DISTRIBUTION

FILL (SM) silty SAND some gravel

FIGURE D2



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	22-11	1	0.20 - 0.61

Project Number: 21505824

Checked By: TS

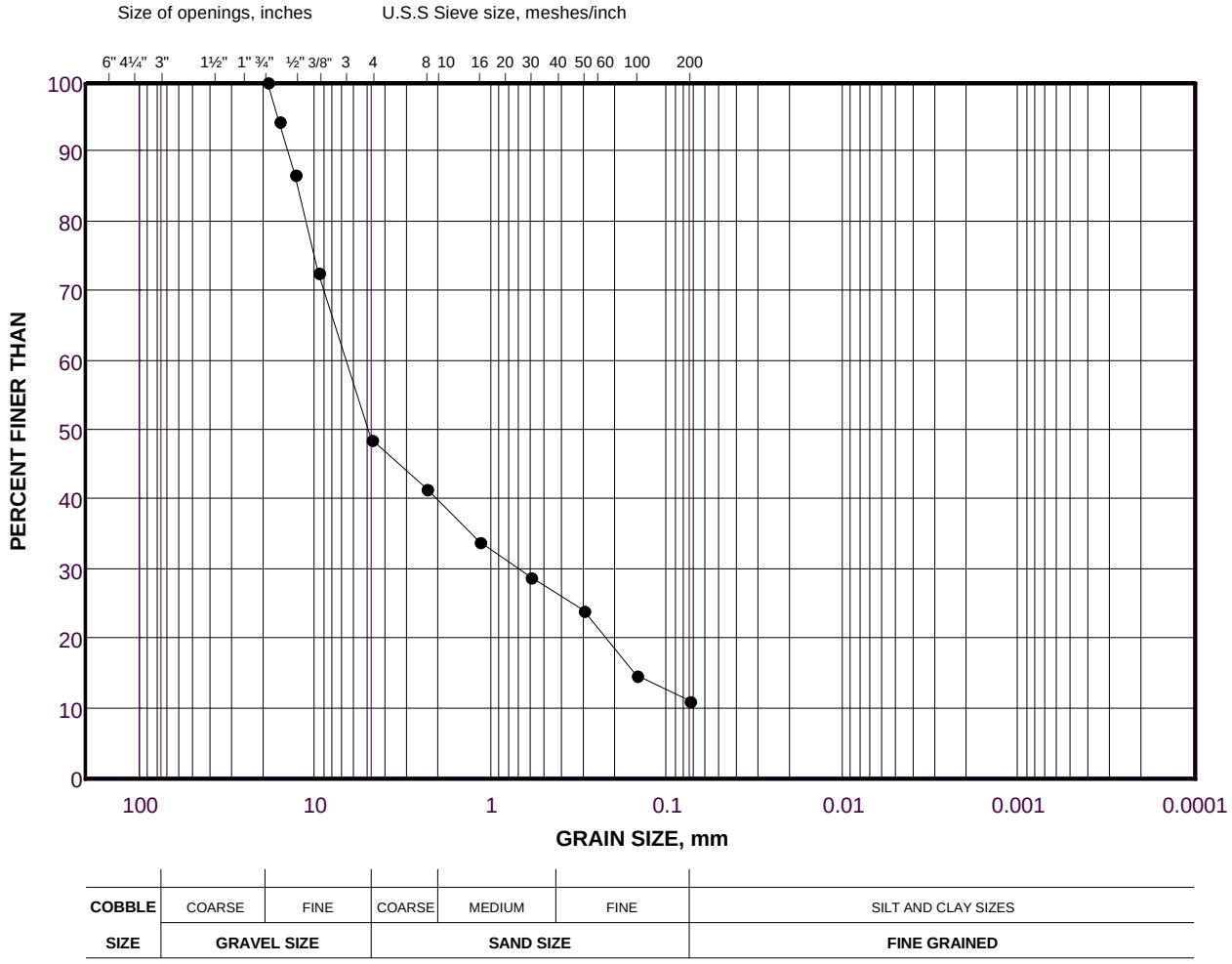
Golder Associates

Date: 13-May-22

GRAIN SIZE DISTRIBUTION

FILL - (GP) GRAVEL and SAND

FIGURE D3



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	22-5	1	0.15 - 0.61

Project Number: 21505824

Checked By: TS

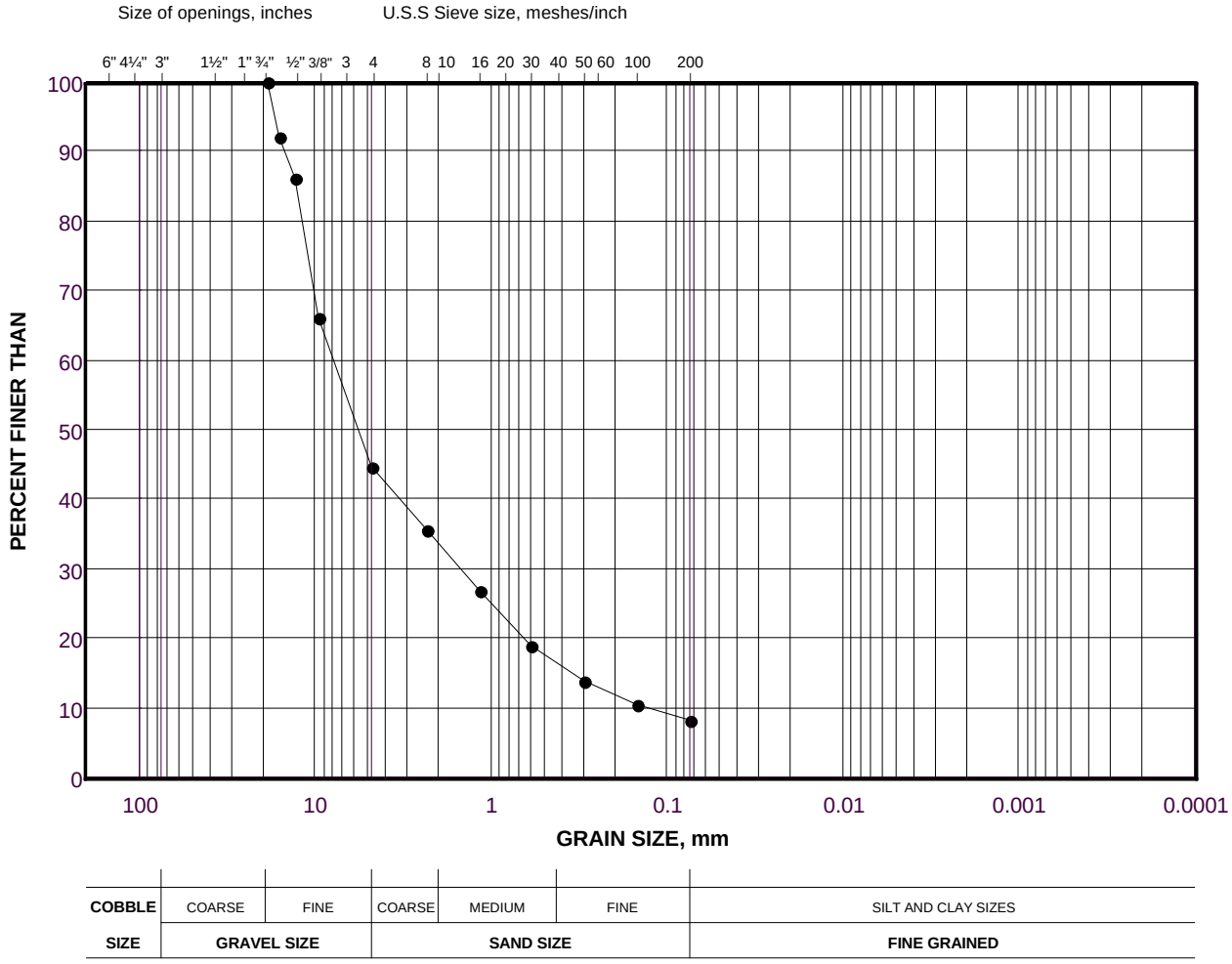
Golder Associates

Date: 13-May-22

GRAIN SIZE DISTRIBUTION

FILL (GW) GRAVEL and SAND

FIGURE D4



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	22-9	1	0.0 - 0.61

Project Number: 21505824

Checked By: TS

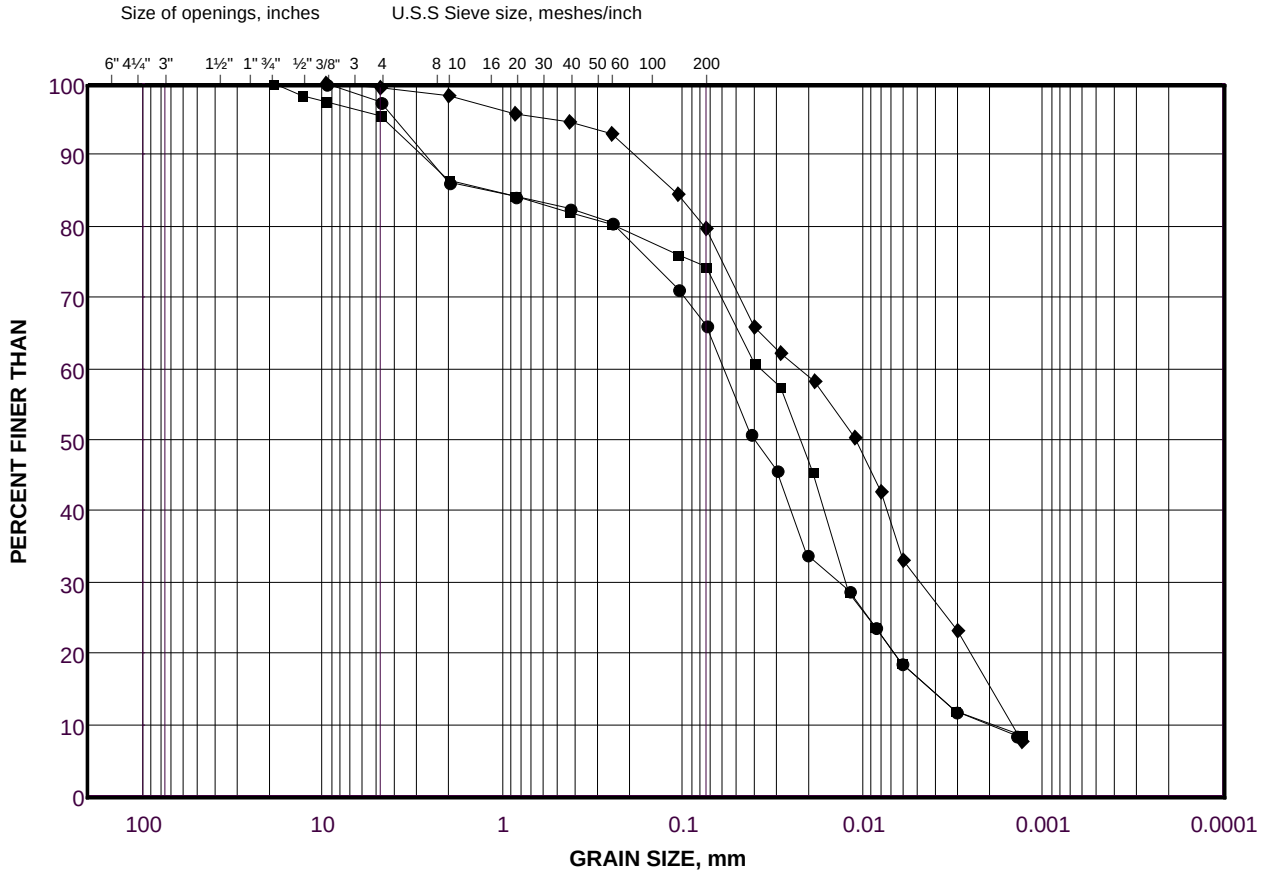
Golder Associates

Date: 13-May-22

GRAIN SIZE DISTRIBUTION

(ML) sandy SILT (TILL)

FIGURE D5a



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	22-8	5	3.05 - 3.66
■	22-1	5	3.05 - 3.66
◆	22-7	7	4.67 - 5.19

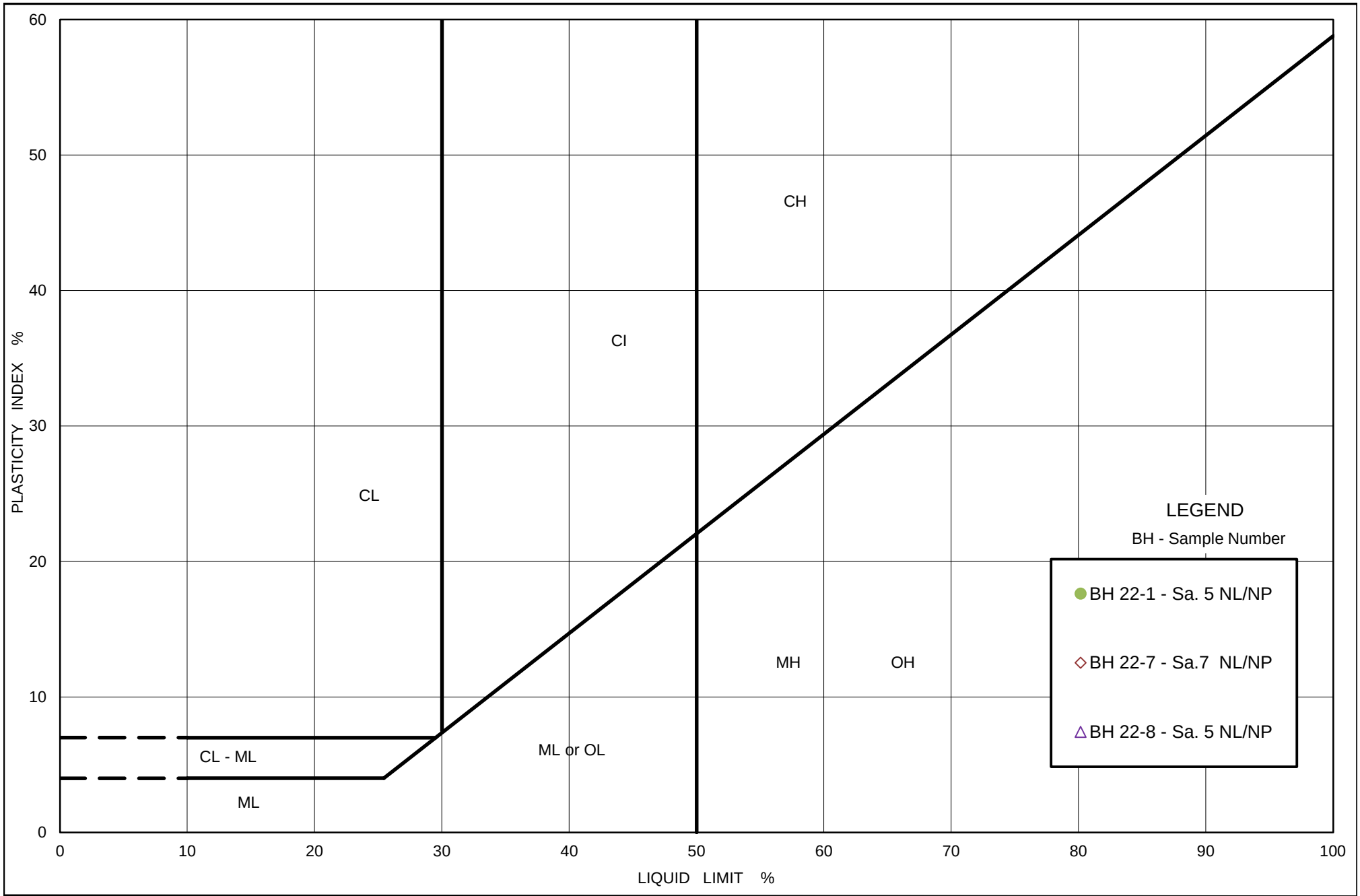
Project Number: 21505824

Checked By: TS

Golder Associates

Date: 13-May-22

LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY INDEX OF SOILS (ASTM D4318)



GOLDER

PLASTICITY CHART

(ML) sandy SILT (TILL)

Figure No.: D5b

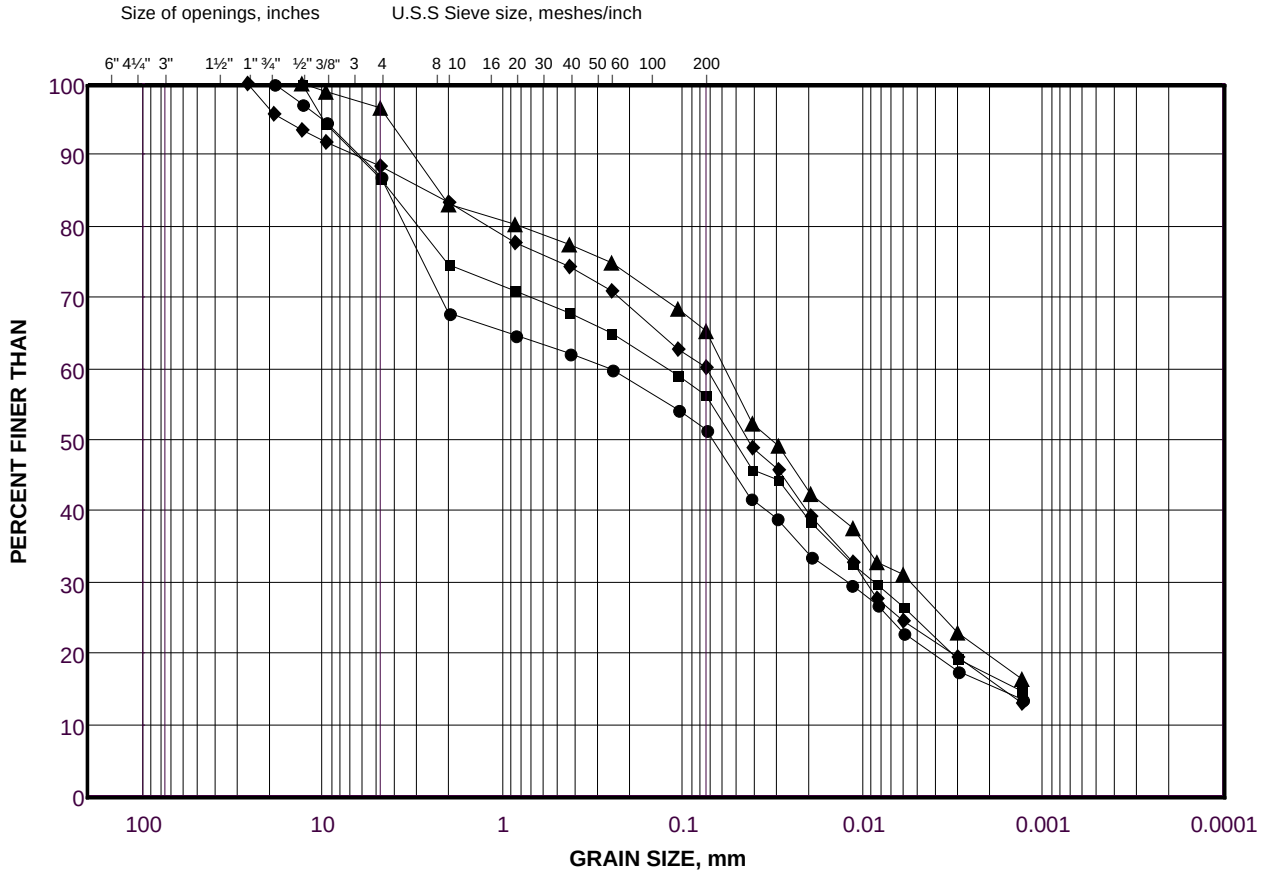
Project No.: 21505824

Checked By: TS

GRAIN SIZE DISTRIBUTION

(CL) clayey SANDY to sandy CLAYEY SILT (TILL)

FIGURE D6a



LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH(m)
●	22-11	3	1.62 - 2.13
■	22-4	3	1.52 - 2.13
◆	22-6	4	2.29 - 2.90
▲	22-12	6	4.57 - 5.18

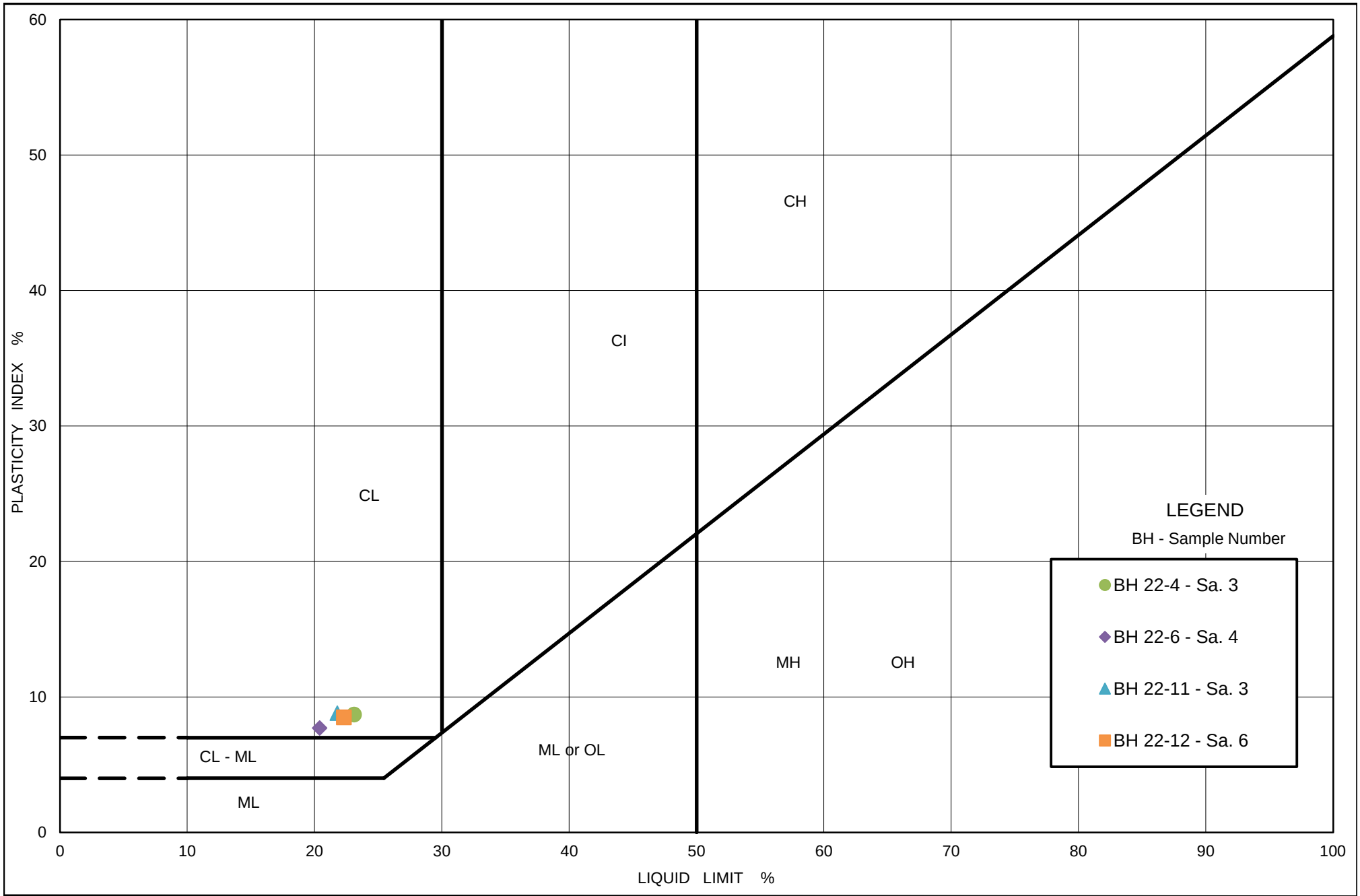
Project Number: 21505824

Checked By: TS

Golder Associates

Date: 13-May-22

LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY INDEX OF SOILS (ASTM D4318)



GOLDER

PLASTICITY CHART

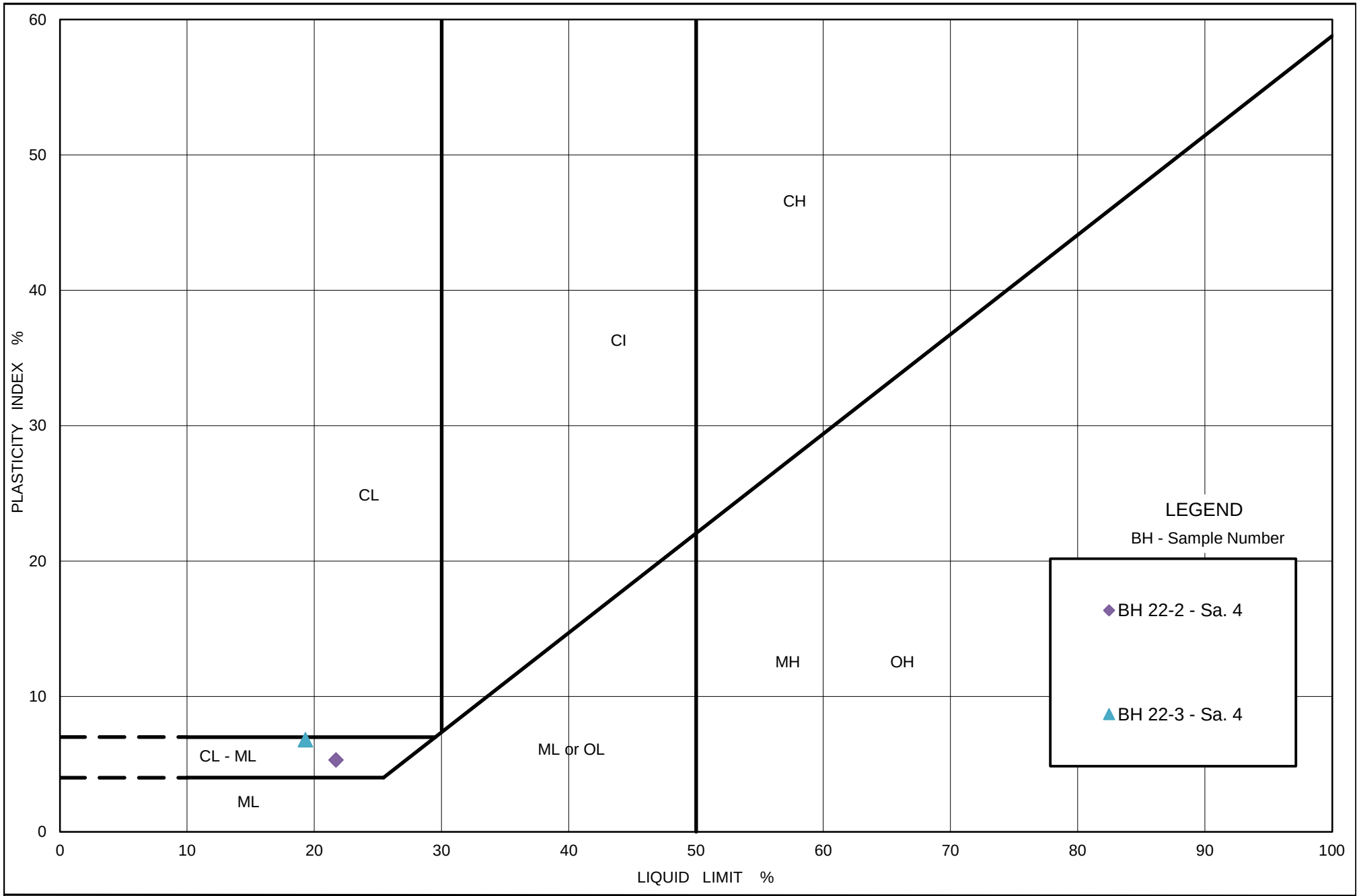
(CL) clayey SANDY to SANDY CLAYEY SILT (TILL)

Figure No.: D6b

Project No.: 21505824

Checked By: TS

LIQUID LIMIT, PLASTIC LIMIT, AND PLASTICITY INDEX OF SOILS (ASTM D4318)



GOLDER

PLASTICITY CHART

(CL-ML) clayey SILT (TILL)

Figure No.: D7

Project No.: 21505824

Checked By: TS

APPENDIX E

Comparison of Trenchless Methods

Comparison of Trenchless Installation Methods

Installation Method	Advantages	Disadvantages	Relative Costs	Risk / Consequences
Horizontal Directional Drilling (HDD) * Recommended Method	• Deep entry and exit pits are generally not required. • Existing pipe diameter is within installation method's capabilities. • Site soils are generally suitable for HDD. • Able to support earth forces using circulating drilling fluid. Dewatering will not be required between pit/shaft locations. • Reduced requirements for utility diversions	• Drilling is challenging in bouldery ground like the glacial till encountered through the site (similar challenge to jack and bore and pipe ramming). • Large laydown area required for carrier pipe; additional property requirements must be assessed particularly at the crossing east of Ridge Road. • Susceptible to hydraulic fracture ("frac-out") especially in low cover conditions.	• Similar cost to pipe ramming and jack and bore. Less expensive than MTBM.	• Less risk of ground loss when compared to the jack and bore method. • Risk of fluid losses to the surface; the potential of fluid losses to the surface depends on slurry composition, viscosity, pressure and the existence of available pathways (old boreholes or wells, utility bedding, etc.). • Obstructions can result in deflection of the casing/pipe resulting in misalignment of the sewer. • Careful consideration must be given to monitoring the density of the drilling fluid, especially during hole enlargement process. If drilling fluid is not able to withstand soil overburden possible ground loss can result
Traditional Jack and Bore	• Tunnel is fully lined as excavation progresses (i.e., culvert/casing pipe is installed behind the boring head during forward advancement). • Existing service size of 0.10 m to 0.35 m diameter is within the installation diameters by jack and bore. • Reduced requirements for utility diversions.	• Traditional jack and bore is not considered suitable for granular material below water levels or in granular soils above water levels if a plug of soil cannot be maintained in lead end of casing. • Dewatering would be required along tunnel alignment at main development access road to be used successfully. • Not suitable for "flowing" soils such as the sandy silt till material encountered at this site. • Relying on the density of the drilling fluids to withstand soil overburden during hole enlargement. • Difficult to control line and grade using jack and bore, potentially requiring installation of a larger culvert/casing pipe than that specified to accommodate variation during installation. • Soft cohesive soils may settle at surface during excavation due to low internal strength.	• Similar cost to HDD and pipe ramming. Less expensive than MTBM. • Cost of dewatering for shafts as well as along the tunnel alignment. • Less costly than MTBM.	• Significant potential for loss of ground into casing/pipe regardless of dewatering, especially in wet/flowing conditions and even with plug of soil ahead of augers. • Obstructions can cause deflection of the casing/pipe resulting in misalignment of the sewer. Cutter head can be specified to have capability for cutting through boulders.

Comparison of Trenchless Installation Methods

Installation Method	Advantages	Disadvantages	Relative Costs	Risk / Consequences
Pipe Ramming	• Less risk of subsidence above utility/sewer alignment when compared to jack and bore installation methods. • Better suited to site soils below the groundwater level when compared to jack and bore methods. • Potentially smaller footprint for entry/exit shafts than that required for HDD, jack and bore, and MTBM. • Existing service size of 0.10 m to 0.35 m diameter is considered within the installation diameters by pipe ramming.	• Difficult to control line and grade using pipe ramming. • Small size of pipes to be installed increases the likelihood of encountered boulders that are larger than the pipe size. This can cause misalignment of the installations and increase the chance of soil disturbance. • Ramming process can be more difficult in hard clays and hard to dense till materials, such as the materials found on site. • Potential for heaving at ground surface (where cover is thin) as long as the plug of soil is maintained inside pipe – may require periodic removal of soil plug which is not recommended in saturated ground. • Ramming vibration could affect adjacent service lines (which are present near each crossing location) or lead to liquefaction in the subsurface soils. • Noise can be a public nuisance, especially in the residential area near Ridge Road.	• Similar cost to jack and bore and HDD. Less expensive than MTBM.	• Less risk of ground loss during tunnelling when compared to the jack and bore method. • Obstructions can result in deflection of the casing/pipe resulting in misalignment of the sewer. • Vibration from pipe ramming may impact adjacent buried service lines or underlying soils. • No frac-out risk.
Microtunnelling with Slurry Micro Tunnel-Boring Machine (MTBM)	• Slurry-type MTBM is able to counterbalance earth and groundwater pressures in a controlled manner, providing continuous face support and eliminating need for dewatering at the tunnel face along the alignment. • Can be steered continuously, providing good control over line and grade. • Tunnel is fully lined as excavation progresses (i.e., culvert/casing pipe is installed behind the MTBM during forward advancement). • Potential effects on structures and underground utilities next to the tunnel alignment can be better controlled than most other methods. • Machines can include rock-cutting face tools and internal crushers. • Considered suitable for site subsurface conditions.	• Susceptible to hydraulic fracture (“frac-out”) especially in low cover conditions. • Slurry processing systems/separation plants required along with additional working area at shaft locations for some systems. • Relatively expensive for installation length. • Existing pipe size of 0.10 m to 0.35 m generally smaller than method capabilities.	• Relatively expensive when compared to traditional tunneling methods	• Relatively low risk of ground loss during tunnelling when a counterbalancing pressure and appropriately viscous slurry are used. • Risk of fluid losses to the surface; the potential of fluid losses to the surface depends on slurry composition, viscosity, pressure and the existence of available pathways (old boreholes or wells, utility bedding, etc.).

Comparison of Trenchless Installation Methods

Installation Method	Advantages	Disadvantages	Relative Costs	Risk / Consequences
Microtunnelling with Earth Pressure Balance (EPB) MTBM	• EPB TBM is able to counterbalance earth and groundwater pressures in a controlled manner, providing continuous face support and eliminating need for dewatering at the tunnel face along the alignment. • Can be steered continuously, providing good control over line and grade. • Tunnel is fully lined as excavation progresses (i.e., culvert/casing pipe is installed behind the MTBM during forward advancement). • Potential effects on structures and underground utilities next to the tunnel alignment can be better controlled than most other methods. • Machines can include rock-cutting face tools and older systems that use load or pressure-controlled gates for spoil discharge from forward chamber can pass some larger potential obstructions depending on face opening and relieving gate sizes. • Considered suitable for site subsurface conditions.	• Susceptible to ground losses depending on operator control of face pressures, relieving gate or screw conveyor operations • Addition of appropriate conditioning agents (e.g., bentonite) may be required to modify spoil for appropriate consistency and face pressure control • Relatively expensive for installation length. • Existing pipe size of 0.10 m to 0.35 m generally smaller than method capabilities.	• Relatively expensive when compared to traditional tunneling methods.	• Relatively low risk of ground loss during tunnelling when a counterbalancing face pressure is used; conditioning agents may be required.

APPENDIX F

Corrosivity and Sulphate Attack Testing Results

CADUCEON™ ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: ---

REPORT No. B22-11409

Report To:

Golder Associates Ltd.
121 Commerce Park Drive, Unit L,
Barrie ON. L4N 8X1 Canada
Attention: Ty Sawyers

Caduceon Environmental Laboratories
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 22-Apr-22
DATE REPORTED: 03-May-22
SAMPLE MATRIX: Soil

JOB/PROJECT NO.:
P.O. NUMBER: 21505824
WATERWORKS NO.

			Client I.D.		22-3 SA C	22-5 SA C	22-8 SA C	22-11 SA C
			Sample I.D.		B22-11409-1	B22-11409-2	B22-11409-3	B22-11409-4
			Date Collected		13-Apr-22	11-Apr-22	12-Apr-22	14-Apr-22
Parameter	**Units**	**R.L.**	**Reference Method**	**Date/Site Analyzed**				
pH @25°C	pH Units		MOEE3530	28-Apr-22/R	8.19	8.02	7.93	8.07
Resistivity	ohms·cm		SM 2510B	27-Apr-22/O	5050	3310	2620	4450
REDOX potential	mV		In-House	27-Apr-22/R	187	192	190	184
Chloride	µg/g	5	SM4110C	28-Apr-22/O	27	86	158	17
Sulphate	µg/g	10	SM4110C	28-Apr-22/O	110	170	190	170
Sulfide	µg/g	0.3	In-House	29-Apr-22	< 0.3 1	< 0.3 1	< 0.3 1	< 0.3 1

1 . Subcontracted to Testmark Labs

Christine Burke
Lab Manager

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

APPENDIX G

Soil Characterization Technical Memorandum

TECHNICAL MEMORANDUM

DATE June 2, 2022 **Project No.** 21505824

TO Angus Knowles
M1 Development Inc.

FROM Denise Lacchin, P.Eng., QPESA **EMAIL dlacchin@golder.com**

SOIL CHARACTERIZATION MEMORANDUM
HIGHWAY 26 WIDENING AND TRENCHLESS SERVICE INSTALLATION
MEAFORD, ONTARIO

Golder Associates Ltd. (Golder) was retained by M1 Development Inc. (M1) to provide environmental services for excess soil management in support of geotechnical and pavement investigations related to the widening of Highway 26 and installation of three trenchless crossings in Meaford, Ontario. The geotechnical and pavement work has been undertaken to support a residential development on the north side of Highway 26, west of Ridge Road. The investigation activities described herein were performed within the linear area located along Highway 26, from approximately 100 metres (m) east of Ridge Road to approximately 600 m west of Ridge Road (the "Project Area" or "Site"). The general location of the Project Area is shown on Figure 1 provided in Appendix B of the Geotechnical Foundation Investigation and Design Report (FIDR) within which this technical memorandum is contained.

This Technical Memorandum was prepared to generally meet the excess Soil Characterization Report (SCR) requirements of Ontario Regulation (O. Reg) 406/19, "*On-Site and Excess Soil Management"*, released by the Ontario Ministry of Environment, Conservation and Parks (MECP) on December 4, 2019 and amended December 21, 2020 and April 21, 2022, as well as the MECP document "*Rules for Soil Management and Excess Soil Quality Standards*", April 12, 2022 (the Rules Document). The assessment performed herein represents a limited SCR. Should the reuse site request Planning Documents that meet the prescribed requirements of O. Reg. 416/19, additional work may be required.

An Assessment of Past Uses (APU) was undertaken concurrently by Golder for the Project Area ("*Assessment of Past Uses, Hwy 26 Widening and Trenchless Service Installation, Meaford, Ontario*", currently pending).

Based on the findings of the APU, the following Potentially Contaminating Activities (PCAs) were noted for the Project Area:

- #30 Importation of Fill Material of Unknown Quality – The Project Area consists of a roadway with road base fill material of unknown quality.
- N/A – Road salting activities along Highway 26 within the Project Area.

Based on the findings of the APU, the following PCAs were noted for the APU Study Area:

- #55 Transformer Manufacturing, Processing and Use – Pole-mounted transformers were observed along Highway 26 outside the Project Area, within the APU Study Area. One off-site transformer was observed to have red staining.
- #10 Commercial Autobody Shops – Two former vehicle maintenance/service garages were reported in the central portion of the Project Area located at 206105 Highway 26 in a previous 2020 Phase I ESA conducted by Golder.
- #10 Commercial Autobody Shops – Bayside Chrysler Jeep Dodge Ram sales and service is currently located at 206065 Highway 26, adjacent to the north of the Project Area.
- #27 Garages and Maintenance and Repair of Railcars, Marine Vehicles and Aviation Vehicles – Grey County Auto Marine was reported at 206065 Highway 26, adjacent to the north of the Project Area. The years of operation are unknown.
- #28 Gasoline and Associated Products Storage in Fixed Tanks and #10 Commercial Autobody Shops – Bumstead Motors Ltd. was listed in the Private and Retail Fuel Storage Tanks database for the property located at 206065 Highway 26, adjacent to the north of the Project Area. The years of operation are unknown.
- #28 Gasoline and Associated Products Storage in Fixed Tanks and #10 Commercial Autobody Shops – Townline Automotive Inc. (206066 Highway 26) was listed as a fuel service facility with fuel service piping. The years of operation are not known. The property is currently Noble's Used Cars. This property is located adjacent to the south of the Project Area.
- #28 Gasoline and Associated Products Storage in Fixed Tanks – Meaford Gas Bar (206034 Highway 26) was listed with two 22,700-litre, single walled underground storage tanks (USTs) used for gasoline and one 13,650-litre, single walled UST used for diesel. The gas station is no longer operational. The current status of the tanks is unknown.
- #40 Pesticides (including Herbicides, Fungicides and Anti-Fouling Agents) Manufacturing, Processing, Bulk Storage and Large-Scale Applications – Land use adjacent to and surrounding Highway 26 has included agricultural fields since prior to 1954.
- #40 Pesticides (including Herbicides, Fungicides and Anti-Fouling Agents) Manufacturing, Processing, Bulk Storage and Large-Scale Applications – A pest control business registered in the Pesticide Register database was reported to be present at 113 Algonquin Drive, approximately 150 m north of the Project Area.
- #30: Importation of Fill Material of Unknown Quality – Small soil stockpiles (possibly fill) were observed just west of 206065 Highway 26, approximately 30 m north of the Project Area.

The following Areas of Potential Environmental Concern (APECs) were noted for the Project Area:

- APEC 1A/B – Fill material of unknown quality, road salting activities.
- APEC 2A/B/C – The current and historical presence of vehicle sales and service businesses at 206065 Highway 26 (adjacent to the north of the Project Area). This includes the potential presence of fuel tanks.

- APEC 3A/B – The current and historical presence of vehicle sales and service businesses at 206066 Highway 26 (adjacent to the south of the Project Area). This includes the potential presence of fuel tanks.
- APEC 4 – The historical presence of Meaford Gas Bar, located at 206034 Highway 26. This property was listed with three single walled USTs used for gasoline or diesel. The current status of the tanks is unknown.

Based on the information obtained and reviewed as part of this APU and the PCAs and APECs identified above, the implementation of a Sampling and Analysis Plan (SAP) and subsequent preparation of a Soil Characterization Report (SCR) was required.

The scope of this SCR was based on the APECs identified in the APU. A Sampling and Analysis Plan (SAP) was also created for the Project Area under separate cover.

Background and Soil Sampling Summary

The estimated volume of excess soil to be generated from the Project Area is approximately 1,000 cubic metres (m^3) based on the assumption of trenchless crossings. The objective of the soil sampling program was to assess the chemical quality of soil within the future excavation areas to determine whether the soil is of a quality that can be received off Site at a beneficial reuse site.

A summary of the sampling completed to date is provided in Table I below. No known previous sampling was completed by others in the Project Area.

Table I: Soil Sampling Summary

Location	Estimated Volume of Excess Soil (m^3)	Method of Sample Collection	Approximate Size of Excavation	Sampling Date	Bulk Environmental Samples Analyzed (in situ)	mSPLP Leachate Samples Analyzed
North and South of Highway 26	1,000	Boreholes	Unknown	April 8, 2022 to April 13, 2022	5 plus 1 duplicate	4

Scope of Work

As part of the limited SCR scope of work, the following tasks were completed:

- The advancement of five boreholes along the Project Area to depths ranging from 1.5 metres below ground surface (mbgs) to 6 mbgs. The 1.5-mbgs boreholes were associated with the proposed widening of Highway 26, while the 6-mbgs boreholes were associated with the proposed installation of trenchless crossings.
- The collection of continuous soil samples over the entire depth of the boreholes. The environmental sampling was performed concurrently with geotechnical and pavement investigations.
- The submission of five bulk soil samples and one duplicate sample for laboratory analysis of the following Contaminants of Potential Concern (COPC): metals and inorganics, petroleum hydrocarbon fractions F1 to F4 (PHC F1-F4), benzene, toluene, ethylbenzene and xylenes (BTEX), and/or volatile organic compounds (VOC).

- The submission of four leachate samples collected at discrete locations throughout the Project Area for analysis of metals and VOC using the modified Synthetic Precipitation Leaching Procedure (mSPLP).
- Preparation of a technical memorandum summarizing the work conducted within the Project Area and the findings of the investigation.

Methodology

The soil sampling program was conducted in general accordance with O.Reg. 406/19 and the Rules Document, as well as the MECP "*Protocol for Analytical Methods Used in the Assessment of Properties and Excess Soil Quality under Part XV.1 of the Environmental Protection Act*" (MECP Protocol), dated March 9, 2004 and revised July 2011 and November 2020. The sampling was also performed in general accordance with the SAP for the Project Area ("*Sampling and Analysis Plan – Excess Soil Sampling, Highway 26 Widening and Trenchless Service Installation, Meaford, Ontario*", dated March 29, 2022). The environmental sampling was performed concurrently with geotechnical and pavement investigations.

Golder retained Walker Drilling to drill five boreholes within the Project Area. Borehole locations are provided on Figure 1, within Appendix B of the Geotechnical FIDR, and borehole logs can be found on the Record of Borehole sheets in Appendix C of the Geotechnical FIDR. A summary of the boreholes is included in Table II below.

Table II: Borehole Summary

Geotechnical Work	Station ID	Borehole ID	Depth (mbgs)
Installation of three trenchless crossings	19+330 (Lt ditch)	BH22-03	6
Installation of three trenchless crossings	19+490 (Rt ditch)	BH22-04	6
Installation of three trenchless crossings	19+720 (Lt ditch)	BH22-09	6
Widening of Highway 26	19+200 (Lt ditch)	19+200 (later named BH22-37)	1.5
Widening of Highway 26	19+150 (Rt ditch)	19+150 (later named BH22-34B)	1.5

Soil samples were collected continuously over the entire depth of each borehole. At each borehole location, soil samples were logged for stratigraphy and field screened for visual and olfactory evidence of environmental impacts including staining and odours. Total organic vapour concentrations and combustible vapour concentrations were measured for each sample using a pre-calibrated RKI Eagle 2™ portable vapour meter, with methane response switched off. Soil samples were collected from undisturbed locations and placed into laboratory-prepared containers with minimal headspace and stored in a cooler for potential laboratory analysis.

One soil sample per borehole, representing "worst-case" conditions, was submitted for laboratory analysis to Bureau Veritas Laboratories. The samples selected for laboratory analysis were chosen based on encountered depth, field

headspace screening measurements, visual observations (e.g., staining, discoloration and/or free product, if any), and olfactory observations (if any). Soil samples were submitted to the analytical laboratory under chain-of-custody procedures. Additional samples were submitted per location on hold if additional analysis was deemed necessary once the primary sample results were received.

Geologic descriptions, visual and olfactory observations, and results of field headspace measurements are presented on the Record of Borehole sheets in Appendix C of the Geotechnical FIDR. Note that 19+150 and 19+200 were later named BH22-34B and BH22-37, respectively. These locations have been identified on Figure 1 and the Record of Borehole sheets as BH22-34B and BH22-37.

Regulatory Criteria

To assess the suitability of soil to be disposed of off Site at a beneficial reuse site, the soil analytical results were compared to the residential/parkland/institutional (RPI) and industrial/commercial/community (ICC) criteria listed in the:

- O.Reg. 153/04 Site Condition Standards (SCS): found in the supporting MECP document *"Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act"*, April 2011 (see Tables 1 and 2).
- O.Reg. 406/19 Excess Soil Quality Standards (ESQS): provided in Appendix 1 of the Soil Rules dated December 8, 2020 (see Tables 3 and 4).
- O.Reg. 406/19 Leachate Screening Levels (LSLs): requires the analysis of soil for leachate potential for the protection of groundwater at the reuse site(s) using the mSPLP. The mSPLP leachate results were compared to several of the LSLs provided in Appendix 2 of the Soil Rules dated December 8, 2020 (see Table 5).

Environmental Results

Stratigraphy within the Project Area generally consisted of a surficial layer of gravelly sand fill or topsoil, underlain by sandy, silty clay to sandy silt. Headspace readings obtained as part of the sampling program ranged from non-detect (ND) to 25 parts per million (ppm) for total combustible gases and from ND to 1 ppm for total organic vapours. No obvious visual or olfactory evidence of environmental impact was noted. Samples submitted for laboratory analysis included native soil samples.

The analytical results for bulk soil samples are provided in Tables 1 through 4 (attached). Sample depths are also included in Tables 1 through 4. The analytical results for mSPLP samples are provided in Table 5 (attached). The Laboratory Certificate of Analysis are included in Appendix H of the Geotechnical FIDR. Exceedances of the applicable standards are summarized in Table III below. No exceedances of the LSL for the mSPLP leachate samples were observed.

Table III: Soil Exceedances Compared to Environmental Standards

Relevant Standards/ESQS	# Samples Exhibiting Exceedances	Sample ID	Parameters Exceeding
Table 1 SCS/ESQS (residential/ parkland/institutional [RPI] and	5	19+150(1)	EC, SAR
		19+200(2)*	SAR, PHC F2, PCE
		BH22-03(2)	SAR, PHC F2

Relevant Standards/ESQS	# Samples Exhibiting Exceedances	Sample ID	Parameters Exceeding
industrial/ commercial/community [ICC])		BH22-04(3)	EC, SAR
		BH22-09(5)	SAR, PHC F2
Table 2 SCS (RPI)	3	19+150(1)	SAR
		BH22-03(2)	SAR
		BH22-04(3)	EC, SAR
Table 2 SCS (ICC)	2	19+150(1)	SAR
		BH22-04(3)	SAR
Table 3 SCS (RPI)	3	19+150(1)	SAR
		BH22-03(2)	SAR
		BH22-04(3)	EC, SAR
Table 3 SCS (ICC)	2	19+150(1)	SAR
		BH22-04(3)	SAR
Table 2.1 ESQS (RPI)	5	19+150(1)	SAR
		19+200(2)*	PHC F2, PCE
		BH22-03(2)	SAR, PHC F2
		BH22-04(3)	EC, SAR
		BH22-09(5)	PHC F2
Table 2.1 ESQS (ICC)	3	19+150(1)	SAR
		19+200(2)*	PCE
		BH22-04(3)	SAR
Table 3.1 ESQS (RPI)	5	19+150(1)	SAR
		19+200(2)*	PHC F2, PCE
		BH22-03(2)	SAR, PHC F2
		BH22-04(3)	EC, SAR
		BH22-09(5)	PHC F2
Table 3.1 ESQS (ICC)	3	19+150(1)	SAR
		19+200(2)*	PCE
		BH22-04(3)	SAR

Notes:
EC = electrical conductivity; SAR = sodium adsorption ratio; PHC F2 = petroleum hydrocarbons fraction F2; PCE = tetrachloroethylene
19+150 was later named BH22-34B and 19+200 was later named BH22-37.
* Duplicate sample for 19+200(2) did not exhibit any exceedances of the applicable criteria.

As shown in Table III, exceedances of the various parameters included electrical conductivity (EC) and/or sodium adsorption ratio (SAR) at all locations, PHC F2 at three locations, and tetrachloroethylene (PCE) at one location. Note that while primary sample 19+200(2) indicated exceedances of SAR, PHC F2 and PCE, the corresponding duplicate sample indicated no exceedances of the applicable SCS and ESQS.

Quality Assurance/Quality Control Program

Golder's quality assurance/quality control (QA/QC) program for environmental investigations was implemented to ensure that analytical data obtained by the investigation were valid and representative. The quality assurance program included the following measures:

- Standard operating procedures were used for all field investigation activities.
- Initial calibration of field equipment was performed at the start of each field day, with a daily check of calibration using a standard of known concentration.
- Soil samples were handled and stored in accordance with the sample collection and preservation requirements of the MECP Protocol. Samples were collected directly into pre-cleaned laboratory-supplied sample containers with the appropriate preservative for the analyte group. Upon collection, samples were placed in insulated coolers with ice for storage and transport to the analytical laboratory.
- Clean, disposable Nitrile™ gloves were used at each sampling location to prevent cross-contamination. All non-dedicated sampling equipment (e.g., shovel, etc.) was decontaminated between sampling locations. Sampling equipment in contact with soil was: cleaned by mechanical means; washed with a laboratory-grade detergent (e.g., phosphate-free LiquiNox or AlcoNox) and, if necessary, an appropriate desorbing wash solution; and thoroughly rinsed with analyte-free water.
- Detailed field records documenting the methods and circumstances of collection for each field sample were prepared at the time of sample collection. Each sample was assigned a unique sample identification number recorded in the field notes, along with the date/time of sample collection, the sample matrix, and the requested analyses.
- QA/QC samples, including field duplicate samples, were collected throughout the field investigation (results provided in Tables 1 through 4).
- Samples were submitted to the analytical laboratory in accordance with standard chain of custody procedures.
- Laboratory analyses were completed by an analytical laboratory accredited in accordance with the International Standard ISO/IEC 17025 *General Requirement for the Competence of Testing and Calibration Laboratories*, dated May 5, 2005 (as amended), and the applicable standards for proficiency testing developed by the Standards Council of Canada or the Canadian Association for Laboratory Accreditation.

Conclusions

Based on the results of this investigation, soil can remain on Site as the analysed soil samples met the MECP Table 3 RPI and ICC SCS assuming the soil is handled in accordance with the information below relating to EC and SAR.

If the reuse of all the Project Area soil is not possible within the Project Area, then soil exhibiting concentrations outside those acceptable at each Reuse Site will be segregated and will not be transported to the identified Reuse Site.

Based on the mSPLP results, no exceedances of the Table 1 LSL were detected.

In accordance with O.Reg. 406/19, prior to any off-site soil disposition, written approval from the identified Reuse Site is required for the receipt of the Excess Soil that meets the Reuse Site specific quality standards.

The elevated EC and SAR values are not considered exceedances if the following criteria are met:

i) The excess soil is finally placed at one of the following locations:

a) where it is reasonable to expect that the soil will be affected by the same chemicals as a result of continued application of a substance for the safety of vehicular or pedestrian traffic under conditions of snow or ice;

b) at an industrial or commercial property use and to which non-potable standards would be applicable; or,

c) at least 1.5 metres below the surface of the soil.

ii) The excess soil is not finally placed at any of the following locations:

d) within 30 metres of a waterbody;

e) within 100 metres of a potable water well or area with an intended property use that may require a potable water well; or,

f) a location that will be used for growing crops or pasturing livestock unless the excess soil is placed 1.5 metres or greater below the soil surface.

iii) The project leader or operator of the project area has informed the reuse site owner or operator that the excess soil is from a location that may be expected to contain the chemical and, if sampling and analysis has been conducted in accordance with the regulation, the project leader or operator of the project area has provided relevant sampling results to the reuse site owner or operator, including the soil characterization report if prepared, and identified and communicated any potential risks to surface water and ground water to the reuse site owner or operator.

As such, excess soil can be reused within the Project Area if these conditions are met.

The assessment performed herein represents a limited SCR. Should the reuse site request Planning Documents that meet the prescribed requirements of O. Reg. 416/19, additional work may be required.

Limitations

This Soil Characterization Technical Memorandum was prepared for the exclusive use of M1 Development Inc. (M1). No third parties may rely upon this memorandum. Any use which a third party makes of this memorandum, or any reliance on or decisions to be made based on it, is the sole responsibility of such third party. This memorandum is based on data and information collected during this environmental investigation conducted by Golder Associates Ltd. in accordance with our proposal and is based solely on site conditions encountered at the time of the field investigation. In preparing this assessment, Golder evaluated only conditions on the Site and did not evaluate the operations on adjacent properties. Only limited chemical analyses of soil samples were carried out. Regulatory criteria are used for comparison purposes only and are not necessarily enforceable on the site owner. It should be noted that the results of an investigation of this nature should, in no way, be construed as a warranty that the site is free from any and all contamination from past or current practices.

The activities described and conclusions drawn within this report address only the geo-environmental (chemical) aspects of the subsurface conditions at the subject property. The geotechnical (physical) aspects, including, without limitation, the engineering recommendations for the design and construction of building foundations, pavements,

underground servicing and the like are outside the terms of reference for this report and have not been investigated or addressed herein.

In evaluating the property, Golder Associates Ltd. has relied in good faith on information provided by others. We accept no responsibility for any deficiency, misstatements or inaccuracies contained in this report as a result of omission, errors, misinterpretations or fraudulent acts of the persons interviewed. Golder Associates Ltd. accepts no responsibility for any reduction in property value, either real or perceived, or for decisions made as a result of the reporting of factual information herein.

If additional information is obtained during future work at the Site, including excavations, borings, or other studies, and/or if conditions exposed during construction are different from those encountered in this assessment, Golder should be requested to re-evaluate the conclusions presented in this report and provide amendments as required.

Closing

The Qualified Person confirms that the SAP and investigation for this scoped area and the SCR was conducted and/or supervised by the Qualified Person and that all findings and conclusions of the SCR are included in this Preliminary SCR Memorandum.

Noting that this SAP/SCR was undertaken by the Project Leader prior to January 1, 2023 and is "deemed to satisfy the requirements of a soil characterization report" as set out in O.Reg. 406/19 (as amended). In accordance with O.Reg. 406/19 and the Soil Rules, the Qualified Person declares:

1. That the project leader or operator of the project area have provided the qualified person or an individual supervised by the qualified person with all necessary information and access to the project area and authorized the qualified person or an individual supervised by the qualified person to make any inquiries of the project leader and operator's employees and agents, for the purpose of assisting the qualified person in preparing or overseeing the preparation of the documents.

2. That the qualified person has prepared or overseen the preparation of the documents.

3. That the documents are complete and accurate and meet the requirements of the regulation and these Soil Rules to the best of the qualified person's knowledge.

We trust that the information presented in this report meets your current requirements. Should you have any questions or concerns, please do not hesitate to contact the undersigned.

Golder Associates Ltd.

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Environmental Scientist

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Attachments: Tables 1 to 5

Table 1
Soil Analytical Results
O.Reg.153/04 Standards
Metals and Inorganics
Highway 26, Meaford, Ontario

Sample I.D.								19+150(1)	19+200(2)	19+200(2) DUP 2	BH22-03(2)	BH22-04(3)	BH22-09(5)
Borehole (BH) Number								BH22-34B	BH22-37		BH22-03	BH22-04	BH22-09
Sample Depth (mbgs)								0.1 - 0.6	0.8 - 1.4		0.8 - 1.4	1.5 - 2.1	3.0 - 3.7
Combustible Gas Meter Reading (ppm)								0	0		25	5	10
Photoionization Detector Reading (ppm)								0	0		1	0	0
Sampling Date								08-Apr-22	08-Apr-22		13-Apr-22	12-Apr-22	12-Apr-22
Parameter	**Units**	**RDL**	**MECP Table 1 Standard**	**MECP Table 2 RPI Standard**	**MECP Table 2 ICC Standard**	**MECP Table 3 RPI Standard**	**MECP Table 3 ICC Standard**			**Field Duplicate of 19+200(2)**			
Metals													
Acid Extractable Antimony (Sb)	ug/g	0.20	1.3	7.5	40	7.5	40	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Acid Extractable Arsenic (As)	ug/g	1.0	18	18	18	18	18	3.3	2.3	2.4	4.7	4.0	3.1
Acid Extractable Barium (Ba)	ug/g	0.50	220	390	670	390	670	24	9.8	9.7	22	27	22
Acid Extractable Beryllium (Be)	ug/g	0.20	2.5	4	8	4	8	0.38	<0.20	<0.20	0.35	0.42	0.28
Acid Extractable Boron (B)	ug/g	5.0	36	120	120	120	120	12	<5.0	<5.0	11	16	8.3
Acid Extractable Cadmium (Cd)	ug/g	0.10	1.2	1.2	1.9	1.2	1.9	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Acid Extractable Chromium (Cr)	ug/g	1.0	70	160	160	160	160	13	7.8	8.3	13	16	13
Acid Extractable Cobalt (Co)	ug/g	0.10	21	22	80	22	80	7.3	2.6	2.7	7.8	9.0	6.3
Acid Extractable Copper (Cu)	ug/g	0.50	92	140	230	140	230	23	9.9	10	18	25	19
Acid Extractable Lead (Pb)	ug/g	1.0	120	120	120	120	120	4.7	5.8	5.3	4.7	5.0	3.9
Acid Extractable Molybdenum (Mo)	ug/g	0.50	2	6.9	40	6.9	40	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Acid Extractable Nickel (Ni)	ug/g	0.50	82	100	270	100	270	16	5.5	5.6	16	17	13
Acid Extractable Selenium (Se)	ug/g	0.50	1.5	2.4	5.5	2.4	5.5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Acid Extractable Silver (Ag)	ug/g	0.20	0.5	20	40	20	40	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Acid Extractable Thallium (Tl)	ug/g	0.050	1	1	3.3	1	3.3	0.088	<0.050	<0.050	0.072	0.098	0.063
Acid Extractable Uranium (U)	ug/g	0.050	2.5	23	33	23	33	0.43	0.30	0.31	0.52	0.51	0.43
Acid Extractable Vanadium (V)	ug/g	5.0	86	86	86	86	86	18	15	16	17	18	15
Acid Extractable Zinc (Zn)	ug/g	5.0	290	340	340	340	340	29	11	11	31	32	25
Inorganics													
WAD Cyanide (Free)	ug/g	0.01	0.051	0.051	0.051	0.051	0.051	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Conductivity	mS/cm	0.002	0.57	0.7	1.4	0.7	1.4	**0.63**	0.42	0.42	0.52	***1.2***	0.48
Sodium Adsorption Ratio	N/A	na	2.4	5	12	5	12	***13***	**2.5**	2.3	***5.8***	***13***	**2.9**
Available (CaCl2) pH	pH	na	5-9/5-11	5-9/5-11	5-9/5-11	5-9/5-11	5-9/5-11	7.74	7.38	7.55	7.75	7.89	7.93

Notes:

1. Organic Vapour Meter Reading - measured in ppm (parts per million by volume), calibrated to hexane
2. Photoionization Detector Reading - measured in ppm (parts per million by volume), calibrated to isobutylene
3. mbgs = metres below ground surface
4. µg/g = Microgram per Gram
5. mS/cm = MilliSiemens per Centimeter
6. na/N/A = Not applicable
7. RDL = Laboratory Reportable Detection Limit
8. - = not analysed
9. NV = no value
10. nr = not recorded
11. Table 1 Standard = Ministry of Environment, Conservation and Parks (MECP) "Soil, Groundwater, and Sediment Standards, Part XV.1 Environment Protection Act, April 15, 2011 " full depth generic background site condition standards for industrial/commercial/community or residential/parkland/institutional land use, coarse textured soil
12. Table 2 RPI Standard = MECP "Soil, Groundwater, and Sediment Standards, Part XV.1 Environment Protection Act, April 15, 2011 " full depth generic site condition standards in a potable groundwater condition for residential/parkland/institutional land use, coarse textured soil
13. Table 2 ICC Standard = MECP "Soil, Groundwater, and Sediment Standards, Part XV.1 Environment Protection Act, April 15, 2011 " full depth generic site condition standards in a potable groundwater condition for industrial/commercial/community land use, coarse textured soil
14. Table 3 RPI Standard = MECP "Soil, Groundwater, and Sediment Standards, Part XV.1 Environment Protection Act, April 15, 2011 " full depth generic site condition standards in a non-potable groundwater condition for residential/parkland/institutional land use, coarse textured soil
15. Table 3 ICC Standard = MECP "Soil, Groundwater, and Sediment Standards, Part XV.1 Environment Protection Act, April 15, 2011 " full depth generic site condition standards in a non-potable groundwater condition for industrial/commercial/community land use, coarse textured soil
16. Bold type indicates an exceedance of the MECP Table 1 site condition standard
17. Italicized text indicates an exceedance of the MECP Table 2 RPI site condition standard
18. Orange shading indicates an exceedance of the MECP Table 2 ICC site condition standard
19. Underlined text indicates an exceedance of the MECP Table 3 RPI site condition standard
20. Red text indicates an exceedance of the MECP Table 3 ICC site condition standard

Table 2
Soil Analytical Results
O.Reg.153/04 Standards
VOC and PHC
Highway 26, Meaford, Ontario

Sample I.D.								19+150(1)	19+150(1) Lab-Dup	19+200(2)	19+200(2) DUP 1	19+200(2) DUP 3	BH22-03(2)	BH22-04(3)	BH22-09(5)
Borehole (BH) Number								BH22-34B		BH22-37			BH22-03	BH22-04	BH22-09
Sample Depth (mbgs)								0.1 - 0.6		0.8 - 1.4			0.8 - 1.4	1.5 - 2.1	3.0 - 3.7
Organic Vapour Meter Reading (ppm)								0		0			25	5	10
Photoionization Detector Reading (ppm								0		0			1	0	0
Sampling Date								08-Apr-22		08-Apr-22			13-Apr-22	12-Apr-22	12-Apr-22
Parameter	**Units**	**RDL**	**MECP Table 1 Standard**	**MECP Table 2 RPI Standard**	**MECP Table 2 ICC Standard**	**MECP Table 3 RPI Standard**	**MECP Table 3 ICC Standard**		**Laboratory Duplicate of 19+150(1)**		**Field Duplicate of 19+200(2)**	**Field Duplicate of 19+200(2)**			
Volatile Organic Compounds															
Acetone (2-Propanone)	ug/g	0.49	0.5	16	16	16	16	<0.49	-	<0.49	-	<0.49	<0.49	-	-
Benzene	ug/g	0.0060	0.02	0.21	0.32	0.21	0.32	<0.0060	-	<0.0060	-	<0.0060	<0.0060	<0.020	<0.020
Bromodichloromethane	ug/g	0.040	0.05	1.5	1.5	13	18	<0.040	-	<0.040	-	<0.040	<0.040	-	-
Bromoform	ug/g	0.040	0.05	0.27	0.61	0.27	0.61	<0.040	-	<0.040	-	<0.040	<0.040	-	-
Bromomethane	ug/g	0.040	0.05	0.05	0.05	0.05	0.05	<0.040	-	<0.040	-	<0.040	<0.040	-	-
Carbon Tetrachloride	ug/g	0.040	0.05	0.05	0.21	0.05	0.21	<0.040	-	<0.040	-	<0.040	<0.040	-	-
Chlorobenzene	ug/g	0.040	0.05	2.4	2.4	2.4	2.4	<0.040	-	<0.040	-	<0.040	<0.040	-	-
Chloroform	ug/g	0.040	0.05	0.05	0.47	0.05	0.47	<0.040	-	<0.040	-	<0.040	<0.040	-	-
Dibromochloromethane	ug/g	0.040	0.05	2.3	2.3	9.4	13	<0.040	-	<0.040	-	<0.040	<0.040	-	-
1,2-Dichlorobenzene	ug/g	0.040	0.05	1.2	1.2	3.4	6.8	<0.040	-	<0.040	-	<0.040	<0.040	-	-
1,3-Dichlorobenzene	ug/g	0.040	0.05	4.8	9.6	4.8	9.6	<0.040	-	<0.040	-	<0.040	<0.040	-	-
1,4-Dichlorobenzene	ug/g	0.040	0.05	0.083	0.2	0.083	0.2	<0.040	-	<0.040	-	<0.040	<0.040	-	-
1,1-Dichloroethane	ug/g	0.040	0.05	0.47	0.47	3.5	17	<0.040	-	<0.040	-	<0.040	<0.040	-	-
Dichlorodifluoromethane (FREON 12)	ug/g	0.040	0.05	16	16	16	16	<0.040	-	<0.040	-	<0.040	<0.040	-	-
1,2-Dichloroethane	ug/g	0.049	0.05	0.05	0.05	0.05	0.05	<0.049	-	<0.049	-	<0.049	<0.049	-	-
1,1-Dichloroethylene	ug/g	0.040	0.05	0.05	0.064	0.05	0.064	<0.040	-	<0.040	-	<0.040	<0.040	-	-
cis-1,2-Dichloroethylene	ug/g	0.040	0.05	1.9	1.9	3.4	55	<0.040	-	<0.040	-	<0.040	<0.040	-	-
trans-1,2-Dichloroethylene	ug/g	0.040	0.05	0.084	1.3	0.084	1.3	<0.040	-	<0.040	-	<0.040	<0.040	-	-
1,2-Dichloropropane	ug/g	0.040	0.05	0.05	0.16	0.05	0.16	<0.040	-	<0.040	-	<0.040	<0.040	-	-
CIS-1,3-Dichloropropene	ug/g	0.030	0.05	NV	0.059	NV	NV	<0.030	-	<0.030	-	<0.030	<0.030	-	-
TRANS-1,3-Dichloropropene	ug/g	0.040	0.05	NV	0.059	NV	NV	<0.040	-	<0.040	-	<0.040	<0.040	-	-
1,3-Dichloropropene	ug/g	0.050	0.05	0.05	0.059	0.05	0.18	<0.050	-	<0.050	-	<0.050	<0.050	-	-
Ethylbenzene	ug/g	0.010	0.05	1.1	1.1	2	9.5	<0.010	-	<0.010	-	<0.010	<0.010	<0.020	<0.020
Ethylene Dibromide	ug/g	0.040	0.05	0.05	0.05	0.05	0.05	<0.040	-	<0.040	-	<0.040	<0.040	-	-
Hexane	ug/g	0.040	0.05	2.8	46	2.8	46	<0.040	-	<0.040	-	<0.040	<0.040	-	-
Methylene Chloride(Dichloromethane)	ug/g	0.049	0.05	0.1	1.6	0.1	1.6	<0.049	-	<0.049	-	<0.049	<0.049	-	-
Methyl Ethyl Ketone (2-Butanone)	ug/g	0.40	0.5	16	70	16	70	<0.40	-	<0.40	-	<0.40	<0.40	-	-
Methyl Isobutyl Ketone	ug/g	0.40	0.5	1.7	31	1.7	31	<0.40	-	<0.40	-	<0.40	<0.40	-	-
Methyl t-butyl ether (MTBE)	ug/g	0.040	0.05	0.75	1.6	0.75	11	<0.040	-	<0.040	-	<0.040	<0.040	-	-
Styrene	ug/g	0.040	0.05	0.7	34	0.7	34	<0.040	-	<0.040	-	<0.040	<0.040	-	-
Toluene	ug/g	0.020	0.2	2.3	6.4	2.3	68	<0.020	-	<0.020	-	<0.020	<0.020	<0.020	<0.020
1,1,1,2-Tetrachloroethane	ug/g	0.040	0.05	0.058	0.087	0.058	0.087	<0.040	-	<0.040	-	<0.040	<0.040	-	-
1,1,2,2-Tetrachloroethane	ug/g	0.040	0.05	0.05	0.05	0.05	0.05	<0.040	-	<0.040	-	<0.040	<0.040	-	-
Tetrachloroethylene	ug/g	0.040	0.05	0.28	1.9	0.28	4.5	<0.040	-	**0.051**	-	<0.040	<0.040	-	-
1,1,1-Trichloroethane	ug/g	0.040	0.05	0.38	6.1	0.38	6.1	<0.040	-	<0.040	-	<0.040	<0.040	-	-
1,1,2-Trichloroethane	ug/g	0.040	0.05	0.05	0.05	0.05	0.05	<0.040	-	<0.040	-	<0.040	<0.040	-	-
Trichloroethylene	ug/g	0.010	0.05	0.061	0.55	0.061	0.91	<0.010	-	<0.010	-	<0.010	<0.010	-	-
Trichlorofluoromethane (FREON 11)	ug/g	0.040	0.25	4	4	4	4	<0.040	-	<0.040	-	<0.040	<0.040	-	-
Vinyl Chloride	ug/g	0.019	0.02	0.02	0.032	0.02	0.032	<0.019	-	<0.019	-	<0.019	<0.019	-	-
p+m-Xylene	ug/g	0.020	NV	NV	NV	NV	NV	<0.020	-	<0.020	-	<0.020	<0.020	<0.040	<0.040
o-Xylene	ug/g	0.020	NV	NV	NV	NV	NV	<0.020	-	<0.020	-	<0.020	<0.020	<0.020	<0.020
Total Xylenes	ug/g	0.020	0.05	3.1	26	3.1	26	<0.020	-	<0.020	-	<0.020	<0.020	<0.040	<0.040
Petroleum Hydrocarbons															
F1 (C6-C10) - BTEX	ug/g	10	25	55	55	55	55	<10	-	<10	-	<10	<10	<10	<10
F2 (C10-C16 Hydrocarbons)	ug/g	10	10	98	230	98	230	<10	<10	**11**	<10	-	**11**	<10	**13**
F3 (C16-C34 Hydrocarbons)	ug/g	50	240	300	1700	300	1700	<50	<50	<50	<50	-	<50	<50	<50
F4 (C34-C50 Hydrocarbons)	ug/g	50	120	2800	3300	2800	3300	<50	<50	<50	<50	-	<50	<50	<50
Reached Baseline at C50	ug/g	NA	NA	NA	NA	NA	NA	Yes	Yes	Yes	Yes	-	Yes	Yes	Yes

Notes:

1. Organic Vapour Meter Reading - measured in ppm (parts per million by volume), calibrated to hexane
2. Photoionization Detector Reading - measured in ppm (parts per million by volume), calibrated to isobutylene
3. mbgs = metres below ground surface
4. µg/g = Microgram per Gram
5. RDL = Laboratory Reportable Detection Limit
6. - = not analysed
7. NV = no value
8. nr = not recorded
9. Table 1 Standard = Ministry of Environment, Conservation and Parks (MECP) "Soil, Groundwater, and Sediment Standards, Part XV.1 Environment Protection Act, April 15, 2011 " full depth generic background site condition standards for industrial/commercial/community or residential/parkland/institutional land use, coarse textured soil
10. Table 2 RPI Standard = MECP "Soil, Groundwater, and Sediment Standards, Part XV.1 Environment Protection Act, April 15, 2011 " full depth generic site condition standards in a potable groundwater condition for residential/parkland/institutional land use, coarse textured soil
11. Table 2 ICC Standard = MECP "Soil, Groundwater, and Sediment Standards, Part XV.1 Environment Protection Act, April 15, 2011 " full depth generic site condition standards in a potable groundwater condition for industrial/commercial/community land use, coarse textured soil
12. Table 3 RPI Standard = MECP "Soil, Groundwater, and Sediment Standards, Part XV.1 Environment Protection Act, April 15, 2011 " full depth generic site condition standards in a non-potable groundwater condition for residential/parkland/institutional land use, coarse textured soil
13. Table 3 ICC Standard = MECP "Soil, Groundwater, and Sediment Standards, Part XV.1 Environment Protection Act, April 15, 2011 " full depth generic site condition standards in a non-potable groundwater condition for industrial/commercial/community land use, coarse textured soil
14. Bold type indicates an exceedance of the MECP Table 1 site condition standard
15. Italicized text indicates an exceedance of the MECP Table 2 RPI site condition standard
16. Orange shading indicates an exceedance of the MECP Table 2 ICC site condition standard
17. Underlined text indicates an exceedance of the MECP Table 3 RPI site condition standard
18. Red text indicates an exceedance of the MECP Table 3 ICC site condition standard

Table 3
Soil Analytical Results
O.Reg.406/19 ESQS
Metals and Inorganics
Highway 26, Meaford, Ontario

Sample I.D.								19+150(1)	19+200(2)	19+200(2) DUP 2	BH22-03(2)	BH22-04(3)	BH22-09(5)
Borehole (BH) Number								BH22-34B	BH22-37		BH22-03	BH22-04	BH22-09
Sample Depth (mbgs)								0.1 - 0.6	0.8 - 1.4		0.8 - 1.4	1.5 - 2.1	3.0 - 3.7
Combustible Gas Meter Reading (ppm)								0	0		25	5	10
Photoionization Detector Reading (ppm)								0	0		1	0	0
Sampling Date								08-Apr-22	08-Apr-22		13-Apr-22	12-Apr-22	12-Apr-22
Parameter	**Units**	**RDL**	**MECP Table 1 Standard**	**MECP Table 2.1 RPI ESQS**	**MECP Table 2.1 ICC ESQS**	**MECP Table 3.1 RPI ESQS**	**MECP Table 3.1 ICC ESQS**			**Field Duplicate of 19+200(2)**			
Metals													
Acid Extractable Antimony (Sb)	ug/g	0.20	1.3	7.5	40	7.5	40	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Acid Extractable Arsenic (As)	ug/g	1.0	18	18	18	18	18	3.3	2.3	2.4	4.7	4.0	3.1
Acid Extractable Barium (Ba)	ug/g	0.50	220	390	670	390	670	24	9.8	9.7	22	27	22
Acid Extractable Beryllium (Be)	ug/g	0.20	2.5	4	8	4	8	0.38	<0.20	<0.20	0.35	0.42	0.28
Acid Extractable Boron (B)	ug/g	5.0	36	120	120	120	120	12	<5.0	<5.0	11	16	8.3
Acid Extractable Cadmium (Cd)	ug/g	0.10	1.2	1.2	1.9	1.2	1.9	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Acid Extractable Chromium (Cr)	ug/g	1.0	70	160	160	160	160	13	7.8	8.3	13	16	13
Acid Extractable Cobalt (Co)	ug/g	0.10	21	22	80	22	80	7.3	2.6	2.7	7.8	9.0	6.3
Acid Extractable Copper (Cu)	ug/g	0.50	92	140	230	140	230	23	9.9	10	18	25	19
Acid Extractable Lead (Pb)	ug/g	1.0	120	120	120	120	120	4.7	5.8	5.3	4.7	5.0	3.9
Acid Extractable Molybdenum (Mo)	ug/g	0.50	2	6.9	40	6.9	40	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Acid Extractable Nickel (Ni)	ug/g	0.50	82	100	270	100	270	16	5.5	5.6	16	17	13
Acid Extractable Selenium (Se)	ug/g	0.50	1.5	2.4	5.5	2.4	5.5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Acid Extractable Silver (Ag)	ug/g	0.20	0.5	20	40	20	40	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Acid Extractable Thallium (Tl)	ug/g	0.050	1	1	3.3	1	3.3	0.088	<0.050	<0.050	0.072	0.098	0.063
Acid Extractable Uranium (U)	ug/g	0.050	2.5	23	33	23	33	0.43	0.30	0.31	0.52	0.51	0.43
Acid Extractable Vanadium (V)	ug/g	5.0	86	86	86	86	86	18	15	16	17	18	15
Acid Extractable Zinc (Zn)	ug/g	5.0	290	340	340	340	340	29	11	11	31	32	25
Inorganics													
Conductivity	mS/cm	0.002	0.57	0.7	1.4	0.7	1.4	**0.63**	0.42	0.42	0.52	***1.2***	0.48
Sodium Adsorption Ratio	N/A	na	2.4	5	12	5	12	***13***	**2.5**	2.3	***5.8***	***13***	**2.9**
Available (CaCl2) pH	pH	na	5-9/5-11	5-9/5-11	5-9/5-11	5-9/5-11	5-9/5-11	7.74	7.38	7.55	7.75	7.89	7.93

Notes:

1. Organic Vapour Meter Reading - measured in ppm (parts per million by volume), calibrated to hexane
2. Photoionization Detector Reading - measured in ppm (parts per million by volume), calibrated to isobutylene
3. mbgs = metres below ground surface
4. µg/g = Microgram per Gram
5. mS/cm = MilliSiemens per Centimeter
6. na/N/A = Not applicable
7. RDL = Laboratory Reportable Detection Limit
8. - = not analysed
9. NV = no value
10. nr = not recorded
11. Table 1 Standard = Ministry of Environment, Conservation and Parks (MECP) "Soil, Groundwater, and Sediment Standards, Part XV.1 Environment Protection Act, April 15, 2011 " full depth generic background site condition standards for industrial/commercial/community or residential/parkland/institutional land use, coarse textured soil
12. Table 2.1 RPI ESQS = MECP "Rules for Soil Management and Excess Soil Quality Standards, 2020 " full depth excess soil quality standards in a potable ground water condition, volume independent for residential/parkland/institutional land use
13. Table 2.1 ICC ESQS = MECP "Rules for Soil Management and Excess Soil Quality Standards, 2020 " full depth excess soil quality standards in a potable ground water condition, volume independent for industrial/commercial/community land use
14. Table 3.1 RPI ESQS = MECP "Rules for Soil Management and Excess Soil Quality Standards, 2020 " full depth excess soil quality standards in a non-potable ground water condition, volume independent for residential/parkland/institutional land use
15. Table 3.1 ICC ESQS = MECP "Rules for Soil Management and Excess Soil Quality Standards, 2020 " full depth excess soil quality standards in a non-potable ground water condition, volume independent for industrial/commercial/community land use
16. Bold type indicates an exceedance of the MECP Table 1 site condition standard
17. Italicized indicates an exceedance of the MECP Table 2.1 RPI ESQS
18. Outlined indicates an exceedance of the MECP Table 2.1 ICC ESQS
19. Underlined indicates an exceedance of the MECP Table 3.1 RPI ESQS
20. Shaded indicates an exceedance of the MECP Table 3.1 ICC ESQS

Table 4
Soil Analytical Results
O.Reg.406/19 ESQS
VOC and PHC
Highway 26, Meaford, Ontario

Sample I.D.								19+150(1)	19+150(1) Lab-Dup	19+200(2)	19+200(2) DUP 1	19+200(2) DUP 3	BH22-03(2)	BH22-04(3)	BH22-09(5)
Borehole (BH) Number								BH22-34B		BH22-37			BH22-03	BH22-04	BH22-09
Sample Depth (mbgs)								0.1 - 0.6		0.8 - 1.4			0.8 - 1.4	1.5 - 2.1	3.0 - 3.7
Organic Vapour Meter Reading (ppm)								0		0			25	5	10
Photoionization Detector Reading (ppm)								0		0			1	0	0
Sampling Date								08-Apr-22		08-Apr-22			13-Apr-22	12-Apr-22	12-Apr-22
Parameter	Units	RDL	MECP Table 1 Standard	MECP Table 2.1 RPI ESQS	MECP Table 2.1 ICC ESQS	MECP Table 3.1 RPI ESQS	MECP Table 3.1 ICC ESQS		Laboratory Duplicate of 19+150(1)		Field Duplicate of 19+200(2)	Field Duplicate of 19+200(2)			
Volatile Organic Compounds															
Acetone (2-Propanone)	ug/g	-	0.5	0.5	0.5	1.8	1.8	<0.49	-	<0.49	-	<0.49	<0.49	-	-
Benzene	ug/g	-	0.02	0.02	0.02	0.02	0.034	<0.0060	-	<0.0060	-	<0.0060	<0.0060	<0.020	<0.020
Bromodichloromethane	ug/g	-	0.05	0.05	0.05	5.8	5.8	<0.040	-	<0.040	-	<0.040	<0.040	-	-
Bromoform	ug/g	-	0.05	0.05	0.05	2.5	2.5	<0.040	-	<0.040	-	<0.040	<0.040	-	-
Bromomethane	ug/g	-	0.05	0.05	0.05	0.05	0.05	<0.040	-	<0.040	-	<0.040	<0.040	-	-
Carbon Tetrachloride	ug/g	-	0.05	0.05	0.05	0.05	0.05	<0.040	-	<0.040	-	<0.040	<0.040	-	-
Chlorobenzene	ug/g	-	0.05	0.083	0.083	0.28	0.28	<0.040	-	<0.040	-	<0.040	<0.040	-	-
Chloroform	ug/g	-	0.05	0.05	0.05	0.08	0.26	<0.040	-	<0.040	-	<0.040	<0.040	-	-
Dibromochloromethane	ug/g	-	0.05	0.05	0.05	5.5	5.5	<0.040	-	<0.040	-	<0.040	<0.040	-	-
1,2-Dichlorobenzene	ug/g	-	0.05	3.4	6.8	3.4	6.8	<0.040	-	<0.040	-	<0.040	<0.040	-	-
1,3-Dichlorobenzene	ug/g	-	0.05	0.26	0.26	4.8	6.8	<0.040	-	<0.040	-	<0.040	<0.040	-	-
1,4-Dichlorobenzene	ug/g	-	0.05	0.05	0.05	0.05	0.05	<0.040	-	<0.040	-	<0.040	<0.040	-	-
1,1-Dichloroethane	ug/g	-	0.05	0.05	0.05	0.14	0.57	<0.040	-	<0.040	-	<0.040	<0.040	-	-
Dichlorodifluoromethane (FREON 12)	ug/g	-	0.05	1.5	1.5	1.8	1.8	<0.040	-	<0.040	-	<0.040	<0.040	-	-
1,2-Dichloroethane	ug/g	-	0.05	0.05	0.05	0.05	0.05	<0.049	-	<0.049	-	<0.049	<0.049	-	-
1,1-Dichloroethylene	ug/g	-	0.05	0.05	0.05	0.05	0.05	<0.040	-	<0.040	-	<0.040	<0.040	-	-
cis-1,2-Dichloroethylene	ug/g	-	0.05	0.05	0.05	0.05	0.05	<0.040	-	<0.040	-	<0.040	<0.040	-	-
trans-1,2-Dichloroethylene	ug/g	-	0.05	0.05	0.05	0.05	0.05	<0.040	-	<0.040	-	<0.040	<0.040	-	-
1,2-Dichloropropane	ug/g	-	0.05	0.05	0.05	0.05	0.05	<0.040	-	<0.040	-	<0.040	<0.040	-	-
CIS-1,3-Dichloropropene	ug/g	-	0.05	NV	NV	NV	NV	<0.030	-	<0.030	-	<0.030	<0.030	-	-
TRANS-1,3-Dichloropropene	ug/g	-	0.05	NV	NV	NV	NV	<0.040	-	<0.040	-	<0.040	<0.040	-	-
1,3-Dichloropropene	ug/g	-	0.05	0.05	0.05	0.05	0.05	<0.050	-	<0.050	-	<0.050	<0.050	-	-
Ethylbenzene	ug/g	-	0.05	0.05	0.05	1.9	1.9	<0.010	-	<0.010	-	<0.010	<0.010	<0.020	<0.020
Ethylene Dibromide	ug/g	-	0.05	0.05	0.05	0.05	0.05	<0.040	-	<0.040	-	<0.040	<0.040	-	-
Hexane	ug/g	-	0.05	2.5	2.5	2.5	2.5	<0.040	-	<0.040	-	<0.040	<0.040	-	-
Methylene Chloride(Dichloromethane	ug/g	-	0.05	0.05	0.05	0.06	0.2	<0.049	-	<0.049	-	<0.049	<0.049	-	-
Methyl Ethyl Ketone (2-Butanone	ug/g	-	0.5	0.5	0.5	14	26	<0.40	-	<0.40	-	<0.40	<0.40	-	-
Methyl Isobutyl Ketone	ug/g	-	0.5	0.5	0.5	0.89	17	<0.40	-	<0.40	-	<0.40	<0.40	-	-
Methyl t-butyl ether (MTBE)	ug/g	-	0.05	0.05	0.05	0.05	0.05	<0.040	-	<0.040	-	<0.040	<0.040	-	-
Styrene	ug/g	-	0.05	0.05	0.05	0.5	6.8	<0.040	-	<0.040	-	<0.040	<0.040	-	-
Toluene	ug/g	-	0.2	0.2	0.2	0.99	7.8	<0.020	-	<0.020	-	<0.020	<0.020	<0.020	<0.020
1,1,1,2-Tetrachloroethane	ug/g	-	0.05	0.05	0.05	0.05	0.05	<0.040	-	<0.040	-	<0.040	<0.040	-	-
1,1,2,2-Tetrachloroethane	ug/g	-	0.05	0.05	0.05	0.05	0.05	<0.040	-	<0.040	-	<0.040	<0.040	-	-
Tetrachloroethylene	ug/g	-	0.05	0.05	0.05	0.05	0.05	<0.040	-	***0.051***	-	<0.040	<0.040	-	-
1,1,1-Trichloroethane	ug/g	-	0.05	0.11	0.12	0.11	0.4	<0.040	-	<0.040	-	<0.040	<0.040	-	-
1,1,2-Trichloroethane	ug/g	-	0.05	0.05	0.05	0.05	0.05	<0.040	-	<0.040	-	<0.040	<0.040	-	-
Trichloroethylene	ug/g	-	0.05	0.05	0.05	0.05	0.05	<0.010	-	<0.010	-	<0.010	<0.010	-	-
Trichlorofluoromethane (FREON 11)	ug/g	-	0.25	0.25	0.25	0.46	0.46	<0.040	-	<0.040	-	<0.040	<0.040	-	-
Vinyl Chloride	ug/g	-	0.02	0.02	0.02	0.02	0.02	<0.019	-	<0.019	-	<0.019	<0.019	-	-
p+m-Xylene	ug/g	-	NV	NV	NV	NV	NV	<0.020	-	<0.020	-	<0.020	<0.020	<0.040	<0.040
o-Xylene	ug/g	-	NV	NV	NV	NV	NV	<0.020	-	<0.020	-	<0.020	<0.020	<0.020	<0.020
Total Xylenes	ug/g	-	0.05	0.091	0.091	0.9	3	<0.020	-	<0.020	-	<0.020	<0.020	<0.040	<0.040
Petroleum Hydrocarbons															
F1 (C6-C10) - BTEX	ug/g	-	25	25	25	25	25	<10	-	<10	-	<10	<10	<10	<10
F2 (C10-C16 Hydrocarbons)	ug/g	-	10	10	26	10	26	<10	<10	***11***	<10	-	***11***	<10	***13***
F3 (C16-C34 Hydrocarbons)	ug/g	-	240	240	240	300	1700	<50	<50	<50	<50	-	<50	<50	<50
F4 (C34-C50 Hydrocarbons)	ug/g	-	120	2800	3300	2800	3300	<50	<50	<50	<50	-	<50	<50	<50
Reached Baseline at C50	ug/g	NA	NA	NA	NA	NA	NA	Yes	Yes	Yes	Yes	-	Yes	Yes	Yes

Notes:

1. Organic Vapour Meter Reading - measured in ppm (parts per million by volume), calibrated to hexane
2. Photoionization Detector Reading - measured in ppm (parts per million by volume), calibrated to isobutylene
3. mbgs = metres below ground surface
4. µg/g = Microgram per Gram
5. RDL = Laboratory Reportable Detection Limit
6. - = not analysed
7. NV = no value
8. nr = not recorded
9. Table 1 Standard = Ministry of Environment, Conservation and Parks (MECP) "Soil, Groundwater, and Sediment Standards, Part XV.1 Environment Protection Act, April 15, 2011 " full depth generic background site condition standards for industrial/commercial/community or residential/parkland/institutional land use, coarse textured soil
10. Table 2.1 RPI ESQS = MECP "Rules for Soil Management and Excess Soil Quality Standards, 2020 " full depth excess soil quality standards in a potable ground water condition, volume independent for residential/parkland/institutional land use
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12. Table 3.1 RPI ESQS = MECP "Rules for Soil Management and Excess Soil Quality Standards, 2020 " full depth excess soil quality standards in a non-potable ground water condition, volume independent for residential/parkland/institutional land use
13. Table 3.1 ICC ESQS = MECP "Rules for Soil Management and Excess Soil Quality Standards, 2020 " full depth excess soil quality standards in a non-potable ground water condition, volume independent for industrial/commercial/community land use
14. Bold type indicates an exceedance of the MECP Table 1 site condition standard
15. Italicized indicates an exceedance of the MECP Table 2.1 RPI ESQS
16. Outlined indicates an exceedance of the MECP Table 2.1 ICC ESQS
17. Underlined indicates an exceedance of the MECP Table 3.1 RPI ESQS
18. Shaded indicates an exceedance of the MECP Table 3.1 ICC ESQS

Table 5
Soil Leachate Analytical Results
O.Reg.406/19 LSL
Metals and VOCs
Highway 26, Meaford, Ontario

Sample I.D.								19+150(1)	19+200(2)	19+200(2) Lab-Dup	BH22-03(2)	BH22-04(3)
Borehole (BH) Number								BH22-34B	BH22-37		BH22-03	BH22-04
Sample Depth (mbgs)								0.1 - 0.6	0.8 - 1.4		0.8 - 1.4	1.5 - 2.1
Combustible Gas Meter Reading (ppm)								0	0		25	5
Photoionization Detector Reading (ppm								0	0		1	0
Sampling Date								08-Apr-22	08-Apr-22		13-Apr-22	12-Apr-22
Parameter	**Units**	**RDL**	**MECP Table 1 LSL**	**MECP Table 2.1 RPI LSL**	**MECP Table 2.1 ICC LSL**	**MECP Table 3.1 RPI LSL**	**MECP Table 3.1 ICC LSL**			**Laboratory Duplicate of 19+200(2)**		
Metals												
Leachable (SPLP) Antimony (Sb)	ug/L	0.5	NV	6	6	NV	NV	<0.5	<0.5	-	<0.5	<0.5
Leachable (SPLP) Arsenic (As)	ug/L	1	NV	NV	NV	NV	NV	<1	<1	-	<1	<1
Leachable (SPLP) Barium (Ba)	ug/L	5	NV	1000	1000	4600	4600	<5	<5	-	7	<5
Leachable (SPLP) Beryllium (Be)	ug/L	0.5	NV	4	4	11	11	<0.5	<0.5	-	<0.5	<0.5
Leachable (SPLP) Boron (B)	ug/L	10	NV	5000	5000	NV	NV	<10	<10	-	<10	<10
Leachable (SPLP) Cadmium (Cd)	ug/L	0.1	NV	NV	0.5	NV	0.5	<0.1	<0.1	-	<0.1	<0.1
Leachable (SPLP) Chromium (Cr)	ug/L	5	NV	50	50	130	130	<5	<5	-	<5	<5
Leachable (SPLP) Cobalt (Co)	ug/L	0.5	NV	3.8	3.8	10	10	<0.5	<0.5	-	<0.5	<0.5
Leachable (SPLP) Copper (Cu)	ug/L	1	NV	14	14	14	14	1	2	-	<1	<1
Leachable (SPLP) Lead (Pb)	ug/L	0.5	NV	NV	NV	NV	NV	<0.5	0.6	-	<0.5	<0.5
Leachable (SPLP) Molybdenum (Mo)	ug/L	1	23	23	23	NV	1500	<1	<1	-	<1	1
Leachable (SPLP) Nickel (Ni)	ug/L	1	NV	78	78	78	78	<1	<1	-	<1	<1
Leachable (SPLP) Selenium (Se)	ug/L	2	NV	10	10	10	10	<2	<2	-	<2	<2
Leachable (SPLP) Silver (Ag)	ug/L	0.1	0.3	0.3	0.3	0.3	0.3	<0.1	<0.1	-	<0.1	<0.1
Leachable (SPLP) Thallium (Tl)	ug/L	0.05	2	2	2	NV	80	<0.05	<0.05	-	<0.05	<0.05
Leachable (SPLP) Uranium (U)	ug/L	0.1	NV	20	20	66	66	0.1	<0.1	-	0.5	0.2
Leachable (SPLP) Vanadium (V)	ug/L	1	NV	NV	NV	NV	NV	<1	2	-	<1	<1
Leachable (SPLP) Zinc (Zn)	ug/L	5	NV	180	180	180	180	<5	<5	-	<5	<5
VOCs												
Leachable (SPLP) Bromomethane	ug/L	0.40	0.5	0.5	0.5	0.5	0.5	<0.40	<0.40	<0.40	<0.40	-
Leachable (SPLP) Carbon Tetrachloride	ug/L	0.19	0.2	0.2	0.2	0.2	0.2	<0.19	<0.19	<0.19	<0.19	-
Leachable (SPLP) Chloroform	ug/L	0.90	1	NV	NV	NV	NV	<0.90	<0.90	<0.90	<0.90	-
Leachable (SPLP) 1,2-Dichlorobenzene	ug/L	0.40	0.55	0.55	0.55	NV	NV	<0.40	<0.40	<0.40	<0.40	-
Leachable (SPLP) 1,4-Dichlorobenzene	ug/L	0.40	0.5	0.5	0.5	NV	NV	<0.40	<0.40	<0.40	<0.40	-
Leachable (SPLP) 1,1-Dichloroethane	ug/L	0.40	0.5	NV	NV	NV	NV	<0.40	<0.40	<0.40	<0.40	-
Leachable (SPLP) 1,2-Dichloroethane	ug/L	0.40	0.5	0.5	0.5	NV	NV	<0.40	<0.40	<0.40	<0.40	-
Leachable (SPLP) 1,1-Dichloroethylene	ug/L	0.40	0.5	0.5	0.5	0.5	0.5	<0.40	<0.40	<0.40	<0.40	-
Leachable (SPLP) cis-1,2-Dichloroethylene	ug/L	0.40	0.5	0.5	0.5	NV	NV	<0.40	<0.40	<0.40	<0.40	-
Leachable (SPLP) trans-1,2-Dichloroethylen	ug/L	0.40	0.5	0.5	0.5	0.5	0.5	<0.40	<0.40	<0.40	<0.40	-
Leachable (SPLP) 1,2-Dichloropropane	ug/L	0.40	0.5	0.5	0.5	NV	NV	<0.40	<0.40	<0.40	<0.40	-
Leachable (SPLP) cis-1,3-Dichloropropene	ug/L	0.30	NV	NV	NV	NV	NV	<0.30	<0.30	<0.30	<0.30	-
Leachable (SPLP) trans-1,3-Dichloropropen	ug/L	0.30	NV	NV	NV	NV	NV	<0.30	<0.30	<0.30	<0.30	-
Leachable (ZHE) 1,3-Dichloropropene (cis+t	ug/L	0.42	0.5	NV	NV	NV	NV	<0.42	<0.42	-	<0.42	-
Leachable (SPLP) Ethylene Dibromide	ug/L	0.19	0.2	0.2	0.2	0.2	0.2	<0.19	<0.19	<0.19	<0.19	-
Leachable (SPLP) 1,1,1,2-Tetrachloroethane	ug/L	0.40	0.5	NV	NV	NV	NV	<0.40	<0.40	<0.40	<0.40	-
Leachable (SPLP) 1,1,2,2-Tetrachloroethane	ug/L	0.40	0.5	0.5	0.5	NV	NV	<0.40	<0.40	<0.40	<0.40	-
Leachable (SPLP) Tetrachloroethylene	ug/L	0.40	0.5	0.5	0.5	0.5	0.5	<0.40	<0.40	<0.40	<0.40	-
Leachable (SPLP) 1,1,2-Trichloroethane	ug/L	0.40	0.5	NV	NV	NV	NV	<0.40	<0.40	<0.40	<0.40	-
Leachable (SPLP) Trichloroethylene	ug/L	0.40	0.5	0.5	0.5	0.5	0.5	<0.40	<0.40	<0.40	<0.40	-

Notes:

1. Organic Vapour Meter Reading - measured in ppm (parts per million by volume), calibrated to hexane
2. Photoionization Detector Reading - measured in ppm (parts per million by volume), calibrated to isobutylene
3. mbgs = metres below ground surface
4. µg/l = Microgram per Litre
5. RDL = Laboratory Reportable Detection Limit
6. - = not analysed
7. NV = no value
8. Table 1 LSL = MECP "Rules for Soil Management and Excess Soil Quality Standards, 2020 " leachate screening levels for excess soil reuse for residential/parkland/institutional and industrial/commercial/community land use
9. Table 2.1 RPI LSL= MECP "Rules for Soil Management and Excess Soil Quality Standards, 2020 " leachate screening levels for full depth excess soil in a potable ground water condition for residential/parkland/institutional land use
10. Table 2.1 ICC LSL = MECP "Rules for Soil Management and Excess Soil Quality Standards, 2020 " leachate screening levels for full depth excess soil in a potable ground water condition for industrial/commercial/community land use
11. Table 3.1 RPI ESQS = MECP "Rules for Soil Management and Excess Soil Quality Standards, 2020 " leachate screening levels for full depth excess soil in a non-potable ground water condition for residential/parkland/institutional land use
12. Table 3.1 ICC ESQS = MECP "Rules for Soil Management and Excess Soil Quality Standards, 2020 " leachate screening levels for full depth excess soil in a non-potable ground water condition for industrial/commercial/community land use

APPENDIX H

Analytical Laboraty Testing Results

Your Project #: 21505824(2000)
Site Location: HIGHWAY 26, MEAFORD, ON
Your C.O.C. #: n/a

Attention: Kate Critchley

Golder Associates Ltd
121 Commerce Park Drive
Unit L
Barrie, ON
CANADA L4N 8X1

Report Date: 2022/04/22
Report #: R7096360
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C2A1464
Received: 2022/04/18, 12:46

Sample Matrix: Soil
Samples Received: 8

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Hot Water Extractable Boron	6	2022/04/21	2022/04/21	CAM SOP-00408	R153 Ana. Prot. 2011
1,3-Dichloropropene Sum	3	N/A	2022/04/22		EPA 8260D m
1,3-Dichloropropene Sum	4	N/A	2022/04/21		EPA 8260C m
Free (WAD) Cyanide	1	2022/04/20	2022/04/20	CAM SOP-00457	OMOE E3015 m
Free (WAD) Cyanide	5	2022/04/21	2022/04/21	CAM SOP-00457	OMOE E3015 m
Conductivity	6	2022/04/21	2022/04/21	CAM SOP-00414	OMOE E3530 v1 m
Hexavalent Chromium in Soil by IC (1)	5	2022/04/21	2022/04/21	CAM SOP-00436	EPA 3060/7199 m
Hexavalent Chromium in Soil by IC (1)	1	2022/04/21	2022/04/22	CAM SOP-00436	EPA 3060/7199 m
Petroleum Hydro. CCME F1 & BTEX in Soil (2)	1	N/A	2022/04/20	CAM SOP-00315	CCME PHC-CWS m
Petroleum Hydro. CCME F1 & BTEX in Soil (2)	1	N/A	2022/04/21	CAM SOP-00315	CCME PHC-CWS m
Petroleum Hydrocarbons F2-F4 in Soil (3)	6	2022/04/20	2022/04/21	CAM SOP-00316	CCME CWS m
Acid Extractable Metals by ICPMS	6	2022/04/21	2022/04/21	CAM SOP-00447	EPA 6020B m
Total Metals in SPLP Leachate by ICPMS	4	2022/04/22	2022/04/22	CAM SOP-00447	EPA 6020B m
Moisture	6	N/A	2022/04/19	CAM SOP-00445	Carter 2nd ed 51.2 m
Moisture	1	N/A	2022/04/20	CAM SOP-00445	Carter 2nd ed 51.2 m
Modified SPLP extraction - pH	4	N/A	2022/04/21	CAM SOP-00941	OMOECP LaSB E9003 R3
Modified SPLP extraction - Weight	4	N/A	2022/04/21	CAM SOP-00941	OMOECP LaSB E9003 R3
pH CaCl2 EXTRACT	3	2022/04/20	2022/04/20	CAM SOP-00413	EPA 9045 D m
pH CaCl2 EXTRACT	3	2022/04/21	2022/04/21	CAM SOP-00413	EPA 9045 D m
Sodium Adsorption Ratio (SAR)	6	N/A	2022/04/22	CAM SOP-00102	EPA 6010C
SPLP Zero Headspace Extraction	3	2022/04/20	2022/04/21	CAM SOP-00430	EPA 1312 m
Volatile Organic Compounds and F1 PHCs	4	N/A	2022/04/20	CAM SOP-00230	EPA 8260C m
Volatile organics in SPLP leachates	3	N/A	2022/04/21	CAM SOP-00228	EPA 8260D m

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are

Your Project #: 21505824(2000)
Site Location: HIGHWAY 26, MEAFORD, ON
Your C.O.C. #: n/a

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CANADA L4N 8X1

Report Date: 2022/04/22
Report #: R7096360
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C2A1464
Received: 2022/04/18, 12:46

reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Soils are reported on a dry weight basis unless otherwise specified.
(2) No lab extraction date is given for F1BTEX & VOC samples that are field preserved with methanol. Extraction date is the date sampled unless otherwise stated.
(3) All CCME PHC results met required criteria unless otherwise stated in the report. The CWS PHC methods employed by Bureau Veritas conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following "Alberta Environment's Interpretation of the Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil Validation of Performance-Based Alternative Methods September 2003". Documentation is available upon request. Modifications from Reference Method for the Canada-wide Standard for Petroleum Hydrocarbons in Soil-Tier 1 Method: F2/F3/F4 data reported using validated cold solvent extraction instead of Soxhlet extraction.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Ankita Bhalla, Project Manager
Email: Ankita.Bhalla@bureauveritas.com
Phone# (905) 817-5700
==========
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For Service Group specific validation please refer to the Validation Signature Page.

O.REG 406 EXCESS SOIL SPLP METALS (SOIL)

Bureau Veritas ID		SJP980	SJP983	SJQ089	SJQ229		
Sampling Date		2022/04/08 02:30	2022/04/08 04:00	2022/04/12 04:45	2022/04/13 10:40		
COC Number		n/a	n/a	n/a	n/a		
	UNITS	19+150(1)	19+200(2)	BH22-04(3)	BH22-03(2)	RDL	QC Batch
Metals							
Leachable (SPLP) Antimony (Sb)	ug/L	<0.5	<0.5	<0.5	<0.5	0.5	7953575
Leachable (SPLP) Arsenic (As)	ug/L	<1	<1	<1	<1	1	7953575
Leachable (SPLP) Barium (Ba)	ug/L	<5	<5	<5	7	5	7953575
Leachable (SPLP) Beryllium (Be)	ug/L	<0.5	<0.5	<0.5	<0.5	0.5	7953575
Leachable (SPLP) Boron (B)	ug/L	<10	<10	<10	<10	10	7953575
Leachable (SPLP) Cadmium (Cd)	ug/L	<0.1	<0.1	<0.1	<0.1	0.1	7953575
Leachable (SPLP) Chromium (Cr)	ug/L	<5	<5	<5	<5	5	7953575
Leachable (SPLP) Cobalt (Co)	ug/L	<0.5	<0.5	<0.5	<0.5	0.5	7953575
Leachable (SPLP) Copper (Cu)	ug/L	1	2	<1	<1	1	7953575
Leachable (SPLP) Lead (Pb)	ug/L	<0.5	0.6	<0.5	<0.5	0.5	7953575
Leachable (SPLP) Molybdenum (Mo)	ug/L	<1	<1	1	<1	1	7953575
Leachable (SPLP) Nickel (Ni)	ug/L	<1	<1	<1	<1	1	7953575
Leachable (SPLP) Selenium (Se)	ug/L	<2	<2	<2	<2	2	7953575
Leachable (SPLP) Silver (Ag)	ug/L	<0.1	<0.1	<0.1	<0.1	0.1	7953575
Leachable (SPLP) Thallium (Tl)	ug/L	<0.05	<0.05	<0.05	<0.05	0.05	7953575
Leachable (SPLP) Uranium (U)	ug/L	0.1	<0.1	0.2	0.5	0.1	7953575
Leachable (SPLP) Vanadium (V)	ug/L	<1	2	<1	<1	1	7953575
Leachable (SPLP) Zinc (Zn)	ug/L	<5	<5	<5	<5	5	7953575

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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O.REG 406 EXCESS SOIL SPLP PREP (SOIL)

Bureau Veritas ID		SJP980	SJP983	SJQ089	SJQ229	
Sampling Date		2022/04/08 02:30	2022/04/08 04:00	2022/04/12 04:45	2022/04/13 10:40	
COC Number		n/a	n/a	n/a	n/a	
	UNITS	19+150(1)	19+200(2)	BH22-04(3)	BH22-03(2)	QC Batch
Inorganics						
Dry Weight	g	100	100	100	100	7949242
Final pH	pH	9.08	8.79	9.45	8.74	7949250

QC Batch = Quality Control Batch

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O.REG 406 EXCESS SOIL SPLP VOCS (SOIL)

Bureau Veritas ID		SJP980	SJP983			SJP983		
Sampling Date		2022/04/08 02:30	2022/04/08 04:00			2022/04/08 04:00		
COC Number		n/a	n/a			n/a		
	UNITS	19+150(1)	19+200(2)	RDL	QC Batch	19+200(2) Lab-Dup	RDL	QC Batch
Charge/Prep Analysis								
Amount Extracted (Wet Weight) (g)	N/A	25	25	N/A	7949415	25	N/A	7949415
Calculated Parameters								
Leachable (ZHE) 1,3-Dichloropropene (cis+trans)	ug/L	<0.42	<0.42	0.42	7946622			
Volatile Organics								
Leachable (SPLP) Bromomethane	ug/L	<0.40	<0.40	0.40	7951645	<0.40	0.40	7951645
Leachable (SPLP) Carbon Tetrachloride	ug/L	<0.19	<0.19	0.19	7951645	<0.19	0.19	7951645
Leachable (SPLP) Chloroform	ug/L	<0.90	<0.90	0.90	7951645	<0.90	0.90	7951645
Leachable (SPLP) 1,2-Dichlorobenzene	ug/L	<0.40	<0.40	0.40	7951645	<0.40	0.40	7951645
Leachable (SPLP) 1,4-Dichlorobenzene	ug/L	<0.40	<0.40	0.40	7951645	<0.40	0.40	7951645
Leachable (SPLP) 1,1-Dichloroethane	ug/L	<0.40	<0.40	0.40	7951645	<0.40	0.40	7951645
Leachable (SPLP) 1,2-Dichloroethane	ug/L	<0.40	<0.40	0.40	7951645	<0.40	0.40	7951645
Leachable (SPLP) 1,1-Dichloroethylene	ug/L	<0.40	<0.40	0.40	7951645	<0.40	0.40	7951645
Leachable (SPLP) cis-1,2-Dichloroethylene	ug/L	<0.40	<0.40	0.40	7951645	<0.40	0.40	7951645
Leachable (SPLP) trans-1,2-Dichloroethylene	ug/L	<0.40	<0.40	0.40	7951645	<0.40	0.40	7951645
Leachable (SPLP) 1,2-Dichloropropane	ug/L	<0.40	<0.40	0.40	7951645	<0.40	0.40	7951645
Leachable (SPLP) cis-1,3-Dichloropropene	ug/L	<0.30	<0.30	0.30	7951645	<0.30	0.30	7951645
Leachable (SPLP) trans-1,3-Dichloropropene	ug/L	<0.30	<0.30	0.30	7951645	<0.30	0.30	7951645
Leachable (SPLP) Ethylene Dibromide	ug/L	<0.19	<0.19	0.19	7951645	<0.19	0.19	7951645
Leachable (SPLP) 1,1,1,2-Tetrachloroethane	ug/L	<0.40	<0.40	0.40	7951645	<0.40	0.40	7951645
Leachable (SPLP) 1,1,2,2-Tetrachloroethane	ug/L	<0.40	<0.40	0.40	7951645	<0.40	0.40	7951645
Leachable (SPLP) Tetrachloroethylene	ug/L	<0.40	<0.40	0.40	7951645	<0.40	0.40	7951645
Leachable (SPLP) 1,1,2-Trichloroethane	ug/L	<0.40	<0.40	0.40	7951645	<0.40	0.40	7951645
Leachable (SPLP) Trichloroethylene	ug/L	<0.40	<0.40	0.40	7951645	<0.40	0.40	7951645
Surrogate Recovery (%)								
Leachable (SPLP) 4-Bromofluorobenzene	%	91	92		7951645	91		7951645
Leachable (SPLP) D4-1,2-Dichloroethane	%	120	119		7951645	121		7951645
Leachable (SPLP) D8-Toluene	%	93	93		7951645	92		7951645

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable

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O.REG 406 EXCESS SOIL SPLP VOCS (SOIL)

Bureau Veritas ID		SJQ229		
Sampling Date		2022/04/13 10:40		
COC Number		n/a		
	UNITS	BH22-03(2)	RDL	QC Batch
Charge/Prep Analysis				
Amount Extracted (Wet Weight) (g)	N/A	25	N/A	7949415
Calculated Parameters				
Leachable (ZHE) 1,3-Dichloropropene (cis+trans)	ug/L	<0.42	0.42	7946622
Volatile Organics				
Leachable (SPLP) Bromomethane	ug/L	<0.40	0.40	7951645
Leachable (SPLP) Carbon Tetrachloride	ug/L	<0.19	0.19	7951645
Leachable (SPLP) Chloroform	ug/L	<0.90	0.90	7951645
Leachable (SPLP) 1,2-Dichlorobenzene	ug/L	<0.40	0.40	7951645
Leachable (SPLP) 1,4-Dichlorobenzene	ug/L	<0.40	0.40	7951645
Leachable (SPLP) 1,1-Dichloroethane	ug/L	<0.40	0.40	7951645
Leachable (SPLP) 1,2-Dichloroethane	ug/L	<0.40	0.40	7951645
Leachable (SPLP) 1,1-Dichloroethylene	ug/L	<0.40	0.40	7951645
Leachable (SPLP) cis-1,2-Dichloroethylene	ug/L	<0.40	0.40	7951645
Leachable (SPLP) trans-1,2-Dichloroethylene	ug/L	<0.40	0.40	7951645
Leachable (SPLP) 1,2-Dichloropropane	ug/L	<0.40	0.40	7951645
Leachable (SPLP) cis-1,3-Dichloropropene	ug/L	<0.30	0.30	7951645
Leachable (SPLP) trans-1,3-Dichloropropene	ug/L	<0.30	0.30	7951645
Leachable (SPLP) Ethylene Dibromide	ug/L	<0.19	0.19	7951645
Leachable (SPLP) 1,1,1,2-Tetrachloroethane	ug/L	<0.40	0.40	7951645
Leachable (SPLP) 1,1,2,2-Tetrachloroethane	ug/L	<0.40	0.40	7951645
Leachable (SPLP) Tetrachloroethylene	ug/L	<0.40	0.40	7951645
Leachable (SPLP) 1,1,2-Trichloroethane	ug/L	<0.40	0.40	7951645
Leachable (SPLP) Trichloroethylene	ug/L	<0.40	0.40	7951645
Surrogate Recovery (%)				
Leachable (SPLP) 4-Bromofluorobenzene	%	90		7951645
Leachable (SPLP) D4-1,2-Dichloroethane	%	122		7951645
Leachable (SPLP) D8-Toluene	%	91		7951645

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

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O.REG 153 METALS & INORGANICS PKG (SOIL)

Bureau Veritas ID		SJP980		SJP983		SJP988		SJQ089		
Sampling Date		2022/04/08 02:30		2022/04/08 04:00		2022/04/12 02:40		2022/04/12 04:45		
COC Number		n/a		n/a		n/a		n/a		
	UNITS	19+150(1)	QC Batch	19+200(2)	QC Batch	BH22-09(5)	QC Batch	BH22-04(3)	RDL	QC Batch
Calculated Parameters										
Sodium Adsorption Ratio	N/A	13	7946623	2.5	7946623	2.9	7946623	13		7946623
Inorganics										
Conductivity	mS/cm	0.63	7951207	0.42	7951207	0.48	7951207	1.2	0.002	7951207
Available (CaCl2) pH	pH	7.74	7949293	7.38	7951249	7.93	7949293	7.89		7949293
WAD Cyanide (Free)	ug/g	<0.01	7951005	<0.01	7951005	<0.01	7951005	<0.01	0.01	7949229
Chromium (VI)	ug/g	<0.18	7951120	0.24	7951095	<0.18	7951120	<0.18	0.18	7951120
Metals										
Hot Water Ext. Boron (B)	ug/g	0.12	7951001	0.11	7951001	0.41	7951001	0.29	0.050	7951001
Acid Extractable Antimony (Sb)	ug/g	<0.20	7950989	<0.20	7950989	<0.20	7950989	<0.20	0.20	7950989
Acid Extractable Arsenic (As)	ug/g	3.3	7950989	2.3	7950989	3.1	7950989	4.0	1.0	7950989
Acid Extractable Barium (Ba)	ug/g	24	7950989	9.8	7950989	22	7950989	27	0.50	7950989
Acid Extractable Beryllium (Be)	ug/g	0.38	7950989	<0.20	7950989	0.28	7950989	0.42	0.20	7950989
Acid Extractable Boron (B)	ug/g	12	7950989	<5.0	7950989	8.3	7950989	16	5.0	7950989
Acid Extractable Cadmium (Cd)	ug/g	<0.10	7950989	<0.10	7950989	<0.10	7950989	<0.10	0.10	7950989
Acid Extractable Chromium (Cr)	ug/g	13	7950989	7.8	7950989	13	7950989	16	1.0	7950989
Acid Extractable Cobalt (Co)	ug/g	7.3	7950989	2.6	7950989	6.3	7950989	9.0	0.10	7950989
Acid Extractable Copper (Cu)	ug/g	23	7950989	9.9	7950989	19	7950989	25	0.50	7950989
Acid Extractable Lead (Pb)	ug/g	4.7	7950989	5.8	7950989	3.9	7950989	5.0	1.0	7950989
Acid Extractable Molybdenum (Mo)	ug/g	<0.50	7950989	<0.50	7950989	<0.50	7950989	<0.50	0.50	7950989
Acid Extractable Nickel (Ni)	ug/g	16	7950989	5.5	7950989	13	7950989	17	0.50	7950989
Acid Extractable Selenium (Se)	ug/g	<0.50	7950989	<0.50	7950989	<0.50	7950989	<0.50	0.50	7950989
Acid Extractable Silver (Ag)	ug/g	<0.20	7950989	<0.20	7950989	<0.20	7950989	<0.20	0.20	7950989
Acid Extractable Thallium (Tl)	ug/g	0.088	7950989	<0.050	7950989	0.063	7950989	0.098	0.050	7950989
Acid Extractable Uranium (U)	ug/g	0.43	7950989	0.30	7950989	0.43	7950989	0.51	0.050	7950989
Acid Extractable Vanadium (V)	ug/g	18	7950989	15	7950989	15	7950989	18	5.0	7950989
Acid Extractable Zinc (Zn)	ug/g	29	7950989	11	7950989	25	7950989	32	5.0	7950989
Acid Extractable Mercury (Hg)	ug/g	<0.050	7950989	<0.050	7950989	<0.050	7950989	<0.050	0.050	7950989

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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O.REG 153 METALS & INORGANICS PKG (SOIL)

Bureau Veritas ID		SJQ089			SJQ229			SJQ321		
Sampling Date		2022/04/12 04:45			2022/04/13 10:40			2022/04/08 04:00		
COC Number		n/a			n/a			n/a		
	UNITS	BH22-04(3) Lab-Dup	RDL	QC Batch	BH22-03(2)	RDL	QC Batch	19+200(2) DUP 2	RDL	QC Batch
Calculated Parameters										
Sodium Adsorption Ratio	N/A				5.8		7946623	2.3		7946623
Inorganics										
Conductivity	mS/cm				0.52	0.002	7951207	0.42	0.002	7951207
Moisture	%							19	1.0	7947871
Available (CaCl2) pH	pH				7.75		7951249	7.55		7951242
WAD Cyanide (Free)	ug/g	<0.01	0.01	7949229	<0.01	0.01	7951008	<0.01	0.01	7951005
Chromium (VI)	ug/g				<0.18	0.18	7951095	0.18	0.18	7951120
Metals										
Hot Water Ext. Boron (B)	ug/g				0.26	0.050	7951001	0.10	0.050	7951001
Acid Extractable Antimony (Sb)	ug/g				<0.20	0.20	7950989	<0.20	0.20	7950989
Acid Extractable Arsenic (As)	ug/g				4.7	1.0	7950989	2.4	1.0	7950989
Acid Extractable Barium (Ba)	ug/g				22	0.50	7950989	9.7	0.50	7950989
Acid Extractable Beryllium (Be)	ug/g				0.35	0.20	7950989	<0.20	0.20	7950989
Acid Extractable Boron (B)	ug/g				11	5.0	7950989	<5.0	5.0	7950989
Acid Extractable Cadmium (Cd)	ug/g				<0.10	0.10	7950989	<0.10	0.10	7950989
Acid Extractable Chromium (Cr)	ug/g				13	1.0	7950989	8.3	1.0	7950989
Acid Extractable Cobalt (Co)	ug/g				7.8	0.10	7950989	2.7	0.10	7950989
Acid Extractable Copper (Cu)	ug/g				18	0.50	7950989	10	0.50	7950989
Acid Extractable Lead (Pb)	ug/g				4.7	1.0	7950989	5.3	1.0	7950989
Acid Extractable Molybdenum (Mo)	ug/g				<0.50	0.50	7950989	<0.50	0.50	7950989
Acid Extractable Nickel (Ni)	ug/g				16	0.50	7950989	5.6	0.50	7950989
Acid Extractable Selenium (Se)	ug/g				<0.50	0.50	7950989	<0.50	0.50	7950989
Acid Extractable Silver (Ag)	ug/g				<0.20	0.20	7950989	<0.20	0.20	7950989
Acid Extractable Thallium (Tl)	ug/g				0.072	0.050	7950989	<0.050	0.050	7950989
Acid Extractable Uranium (U)	ug/g				0.52	0.050	7950989	0.31	0.050	7950989
Acid Extractable Vanadium (V)	ug/g				17	5.0	7950989	16	5.0	7950989
Acid Extractable Zinc (Zn)	ug/g				31	5.0	7950989	11	5.0	7950989
Acid Extractable Mercury (Hg)	ug/g				<0.050	0.050	7950989	<0.050	0.050	7950989

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

O.REG 153 PHCS, BTEX/F1-F4 (SOIL)

Bureau Veritas ID		SJP988	SJQ089			SJQ089		
Sampling Date		2022/04/12 02:40	2022/04/12 04:45			2022/04/12 04:45		
COC Number		n/a	n/a			n/a		
	UNITS	BH22-09(5)	BH22-04(3)	RDL	QC Batch	BH22-04(3) Lab-Dup	RDL	QC Batch
Inorganics								
Moisture	%	9.3	9.1	1.0	7947871	8.7	1.0	7947871
BTEX & F1 Hydrocarbons								
Benzene	ug/g	<0.020	<0.020	0.020	7949365			
Toluene	ug/g	<0.020	<0.020	0.020	7949365			
Ethylbenzene	ug/g	<0.020	<0.020	0.020	7949365			
o-Xylene	ug/g	<0.020	<0.020	0.020	7949365			
p+m-Xylene	ug/g	<0.040	<0.040	0.040	7949365			
Total Xylenes	ug/g	<0.040	<0.040	0.040	7949365			
F1 (C6-C10)	ug/g	<10	<10	10	7949365			
F1 (C6-C10) - BTEX	ug/g	<10	<10	10	7949365			
F2-F4 Hydrocarbons								
F2 (C10-C16 Hydrocarbons)	ug/g	13	<10	10	7950628			
F3 (C16-C34 Hydrocarbons)	ug/g	<50	<50	50	7950628			
F4 (C34-C50 Hydrocarbons)	ug/g	<50	<50	50	7950628			
Reached Baseline at C50	ug/g	Yes	Yes		7950628			
Surrogate Recovery (%)								
1,4-Difluorobenzene	%	96	100		7949365			
4-Bromofluorobenzene	%	94	96		7949365			
D10-o-Xylene	%	121	109		7949365			
D4-1,2-Dichloroethane	%	93	99		7949365			
o-Terphenyl	%	109	102		7950628			

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

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O.REG 153 VOCS BY HS & F1-F4 (SOIL)

Bureau Veritas ID		SJP980			SJP980			SJP983		
Sampling Date		2022/04/08 02:30			2022/04/08 02:30			2022/04/08 04:00		
COC Number		n/a			n/a			n/a		
	UNITS	19+150(1)	RDL	QC Batch	19+150(1) Lab-Dup	RDL	QC Batch	19+200(2)	RDL	QC Batch
Inorganics										
Moisture	%	12	1.0	7947871				32	1.0	7947871
Calculated Parameters										
1,3-Dichloropropene (cis+trans)	ug/g	<0.050	0.050	7946313				<0.050	0.050	7946313
Volatile Organics										
Acetone (2-Propanone)	ug/g	<0.49	0.49	7947934				<0.49	0.49	7947934
Benzene	ug/g	<0.0060	0.0060	7947934				<0.0060	0.0060	7947934
Bromodichloromethane	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
Bromoform	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
Bromomethane	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
Carbon Tetrachloride	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
Chlorobenzene	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
Chloroform	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
Dibromochloromethane	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
1,2-Dichlorobenzene	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
1,3-Dichlorobenzene	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
1,4-Dichlorobenzene	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
Dichlorodifluoromethane (FREON 12)	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
1,1-Dichloroethane	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
1,2-Dichloroethane	ug/g	<0.049	0.049	7947934				<0.049	0.049	7947934
1,1-Dichloroethylene	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
cis-1,2-Dichloroethylene	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
trans-1,2-Dichloroethylene	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
1,2-Dichloropropane	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
cis-1,3-Dichloropropene	ug/g	<0.030	0.030	7947934				<0.030	0.030	7947934
trans-1,3-Dichloropropene	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
Ethylbenzene	ug/g	<0.010	0.010	7947934				<0.010	0.010	7947934
Ethylene Dibromide	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
Hexane	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
Methylene Chloride(Dichloromethane)	ug/g	<0.049	0.049	7947934				<0.049	0.049	7947934

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

O.REG 153 VOCS BY HS & F1-F4 (SOIL)

Bureau Veritas ID		SJP980			SJP980			SJP983		
Sampling Date		2022/04/08 02:30			2022/04/08 02:30			2022/04/08 04:00		
COC Number		n/a			n/a			n/a		
	UNITS	19+150(1)	RDL	QC Batch	19+150(1) Lab-Dup	RDL	QC Batch	19+200(2)	RDL	QC Batch
Methyl Ethyl Ketone (2-Butanone)	ug/g	<0.40	0.40	7947934				<0.40	0.40	7947934
Methyl Isobutyl Ketone	ug/g	<0.40	0.40	7947934				<0.40	0.40	7947934
Methyl t-butyl ether (MTBE)	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
Styrene	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
1,1,1,2-Tetrachloroethane	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
1,1,2,2-Tetrachloroethane	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
Tetrachloroethylene	ug/g	<0.040	0.040	7947934				0.051	0.040	7947934
Toluene	ug/g	<0.020	0.020	7947934				<0.020	0.020	7947934
1,1,1-Trichloroethane	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
1,1,2-Trichloroethane	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
Trichloroethylene	ug/g	<0.010	0.010	7947934				<0.010	0.010	7947934
Trichlorofluoromethane (FREON 11)	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
Vinyl Chloride	ug/g	<0.019	0.019	7947934				<0.019	0.019	7947934
p+m-Xylene	ug/g	<0.020	0.020	7947934				<0.020	0.020	7947934
o-Xylene	ug/g	<0.020	0.020	7947934				<0.020	0.020	7947934
Total Xylenes	ug/g	<0.020	0.020	7947934				<0.020	0.020	7947934
F1 (C6-C10)	ug/g	<10	10	7947934				<10	10	7947934
F1 (C6-C10) - BTEX	ug/g	<10	10	7947934				<10	10	7947934
F2-F4 Hydrocarbons										
F2 (C10-C16 Hydrocarbons)	ug/g	<10	10	7950628	<10	10	7950628	11	10	7950628
F3 (C16-C34 Hydrocarbons)	ug/g	<50	50	7950628	<50	50	7950628	<50	50	7950628
F4 (C34-C50 Hydrocarbons)	ug/g	<50	50	7950628	<50	50	7950628	<50	50	7950628
Reached Baseline at C50	ug/g	Yes		7950628	Yes		7950628	Yes		7950628
Surrogate Recovery (%)										
o-Terphenyl	%	96		7950628	88		7950628	106		7950628
4-Bromofluorobenzene	%	88		7947934				88		7947934
D10-o-Xylene	%	83		7947934				96		7947934
D4-1,2-Dichloroethane	%	115		7947934				119		7947934
D8-Toluene	%	91		7947934				94		7947934

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

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O.REG 153 VOCS BY HS & F1-F4 (SOIL)

Bureau Veritas ID		SJQ229			SJQ229			SJQ322		
Sampling Date		2022/04/13 10:40			2022/04/13 10:40			2022/04/08 04:00		
COC Number		n/a			n/a			n/a		
	UNITS	BH22-03(2)	RDL	QC Batch	BH22-03(2) Lab-Dup	RDL	QC Batch	19+200(2) DUP 3	RDL	QC Batch
Inorganics										
Moisture	%	14	1.0	7949684	15	1.0	7949684			
Calculated Parameters										
1,3-Dichloropropene (cis+trans)	ug/g	<0.050	0.050	7946313				<0.050	0.050	7946313
Volatile Organics										
Acetone (2-Propanone)	ug/g	<0.49	0.49	7947934				<0.49	0.49	7947934
Benzene	ug/g	<0.0060	0.0060	7947934				<0.0060	0.0060	7947934
Bromodichloromethane	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
Bromoform	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
Bromomethane	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
Carbon Tetrachloride	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
Chlorobenzene	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
Chloroform	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
Dibromochloromethane	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
1,2-Dichlorobenzene	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
1,3-Dichlorobenzene	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
1,4-Dichlorobenzene	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
Dichlorodifluoromethane (FREON 12)	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
1,1-Dichloroethane	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
1,2-Dichloroethane	ug/g	<0.049	0.049	7947934				<0.049	0.049	7947934
1,1-Dichloroethylene	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
cis-1,2-Dichloroethylene	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
trans-1,2-Dichloroethylene	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
1,2-Dichloropropane	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
cis-1,3-Dichloropropene	ug/g	<0.030	0.030	7947934				<0.030	0.030	7947934
trans-1,3-Dichloropropene	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
Ethylbenzene	ug/g	<0.010	0.010	7947934				<0.010	0.010	7947934
Ethylene Dibromide	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
Hexane	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
Methylene Chloride(Dichloromethane)	ug/g	<0.049	0.049	7947934				<0.049	0.049	7947934

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

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O.REG 153 VOCS BY HS & F1-F4 (SOIL)

Bureau Veritas ID		SJQ229			SJQ229			SJQ322		
Sampling Date		2022/04/13 10:40			2022/04/13 10:40			2022/04/08 04:00		
COC Number		n/a			n/a			n/a		
	UNITS	BH22-03(2)	RDL	QC Batch	BH22-03(2) Lab-Dup	RDL	QC Batch	19+200(2) DUP 3	RDL	QC Batch
Methyl Ethyl Ketone (2-Butanone)	ug/g	<0.40	0.40	7947934				<0.40	0.40	7947934
Methyl Isobutyl Ketone	ug/g	<0.40	0.40	7947934				<0.40	0.40	7947934
Methyl t-butyl ether (MTBE)	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
Styrene	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
1,1,1,2-Tetrachloroethane	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
1,1,2,2-Tetrachloroethane	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
Tetrachloroethylene	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
Toluene	ug/g	<0.020	0.020	7947934				<0.020	0.020	7947934
1,1,1-Trichloroethane	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
1,1,2-Trichloroethane	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
Trichloroethylene	ug/g	<0.010	0.010	7947934				<0.010	0.010	7947934
Trichlorofluoromethane (FREON 11)	ug/g	<0.040	0.040	7947934				<0.040	0.040	7947934
Vinyl Chloride	ug/g	<0.019	0.019	7947934				<0.019	0.019	7947934
p+m-Xylene	ug/g	<0.020	0.020	7947934				<0.020	0.020	7947934
o-Xylene	ug/g	<0.020	0.020	7947934				<0.020	0.020	7947934
Total Xylenes	ug/g	<0.020	0.020	7947934				<0.020	0.020	7947934
F1 (C6-C10)	ug/g	<10	10	7947934				<10	10	7947934
F1 (C6-C10) - BTEX	ug/g	<10	10	7947934				<10	10	7947934
F2-F4 Hydrocarbons										
F2 (C10-C16 Hydrocarbons)	ug/g	11	10	7950628						
F3 (C16-C34 Hydrocarbons)	ug/g	<50	50	7950628						
F4 (C34-C50 Hydrocarbons)	ug/g	<50	50	7950628						
Reached Baseline at C50	ug/g	Yes		7950628						
Surrogate Recovery (%)										
o-Terphenyl	%	106		7950628						
4-Bromofluorobenzene	%	90		7947934				88		7947934
D10-o-Xylene	%	91		7947934				82		7947934
D4-1,2-Dichloroethane	%	116		7947934				120		7947934
D8-Toluene	%	91		7947934				90		7947934

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

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Bureau Veritas Job #: C2A1464
Report Date: 2022/04/22

Golder Associates Ltd
Client Project #: 21505824(2000)
Site Location: HIGHWAY 26, MEAFORD, ON
Sampler Initials: TS

RESULTS OF ANALYSES OF SOIL

Bureau Veritas ID		SJQ320		
Sampling Date		2022/04/08 04:00		
COC Number		n/a		
	UNITS	**19+200(2) DUP 1**	**RDL**	**QC Batch**
Inorganics				
Moisture	%	26	1.0	7947871

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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PETROLEUM HYDROCARBONS (CCME)

Bureau Veritas ID		SJQ320		
Sampling Date		2022/04/08 04:00		
COC Number		n/a		
	UNITS	**19+200(2) DUP 1**	**RDL**	**QC Batch**
F2-F4 Hydrocarbons				
F2 (C10-C16 Hydrocarbons)	ug/g	<10	10	7950628
F3 (C16-C34 Hydrocarbons)	ug/g	<50	50	7950628
F4 (C34-C50 Hydrocarbons)	ug/g	<50	50	7950628
Reached Baseline at C50	ug/g	Yes		7950628
Surrogate Recovery (%)				
o-Terphenyl	%	106		7950628

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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TEST SUMMARY

Bureau Veritas ID: SJP980
Sample ID: 19+150(1)
Matrix: Soil

Collected: 2022/04/08
Shipped:
Received: 2022/04/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Hot Water Extractable Boron	ICP	7951001	2022/04/21	2022/04/21	Jolly John
1,3-Dichloropropene Sum	CALC	7946622	N/A	2022/04/22	Automated Statchk
1,3-Dichloropropene Sum	CALC	7946313	N/A	2022/04/21	Automated Statchk
Free (WAD) Cyanide	TECH	7951005	2022/04/21	2022/04/21	Aditiben Patel
Conductivity	AT	7951207	2022/04/21	2022/04/21	Kien Tran
Hexavalent Chromium in Soil by IC	IC/SPEC	7951120	2022/04/21	2022/04/22	Violeta Porcila
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	7950628	2022/04/20	2022/04/21	Dennis Ngondu
Acid Extractable Metals by ICPMS	ICP/MS	7950989	2022/04/21	2022/04/21	Viviana Canzonieri
Total Metals in SPLP Leachate by ICPMS	ICP/MS	7953575	2022/04/22	2022/04/22	Azita Fazaeli
Moisture	BAL	7947871	N/A	2022/04/19	Kruti Jitesh Patel
Modified SPLP extraction - pH	PH	7949250	N/A	2022/04/21	Jian (Ken) Wang
Modified SPLP extraction - Weight		7949242	N/A	2022/04/21	Jian (Ken) Wang
pH CaCl2 EXTRACT	AT	7949293	2022/04/20	2022/04/20	Taslima Aktar
Sodium Adsorption Ratio (SAR)	CALC/MET	7946623	N/A	2022/04/22	Automated Statchk
SPLP Zero Headspace Extraction		7949415	2022/04/20	2022/04/21	Mohammed Abdul Nafay Shoeb
Volatile Organic Compounds and F1 PHCs	GC/MSFD	7947934	N/A	2022/04/20	Xueming Jiang
Volatile organics in SPLP leachates	HS/MS	7951645	N/A	2022/04/21	Manpreet Sarao

Bureau Veritas ID: SJP980 Dup
Sample ID: 19+150(1)
Matrix: Soil

Collected: 2022/04/08
Shipped:
Received: 2022/04/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	7950628	2022/04/20	2022/04/21	Dennis Ngondu

Bureau Veritas ID: SJP983
Sample ID: 19+200(2)
Matrix: Soil

Collected: 2022/04/08
Shipped:
Received: 2022/04/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Hot Water Extractable Boron	ICP	7951001	2022/04/21	2022/04/21	Jolly John
1,3-Dichloropropene Sum	CALC	7946622	N/A	2022/04/22	Automated Statchk
1,3-Dichloropropene Sum	CALC	7946313	N/A	2022/04/21	Automated Statchk
Free (WAD) Cyanide	TECH	7951005	2022/04/21	2022/04/21	Aditiben Patel
Conductivity	AT	7951207	2022/04/21	2022/04/21	Kien Tran
Hexavalent Chromium in Soil by IC	IC/SPEC	7951095	2022/04/21	2022/04/21	Violeta Porcila
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	7950628	2022/04/20	2022/04/21	Dennis Ngondu
Acid Extractable Metals by ICPMS	ICP/MS	7950989	2022/04/21	2022/04/21	Viviana Canzonieri
Total Metals in SPLP Leachate by ICPMS	ICP/MS	7953575	2022/04/22	2022/04/22	Azita Fazaeli
Moisture	BAL	7947871	N/A	2022/04/19	Kruti Jitesh Patel
Modified SPLP extraction - pH	PH	7949250	N/A	2022/04/21	Jian (Ken) Wang
Modified SPLP extraction - Weight		7949242	N/A	2022/04/21	Jian (Ken) Wang
pH CaCl2 EXTRACT	AT	7951249	2022/04/21	2022/04/21	Taslima Aktar
Sodium Adsorption Ratio (SAR)	CALC/MET	7946623	N/A	2022/04/22	Automated Statchk

TEST SUMMARY

Bureau Veritas ID: SJP983
Sample ID: 19+200(2)
Matrix: Soil

Collected: 2022/04/08
Shipped:
Received: 2022/04/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
SPLP Zero Headspace Extraction		7949415	2022/04/20	2022/04/21	Mohammed Abdul Nafay Shoeb
Volatile Organic Compounds and F1 PHCs	GC/MSFD	7947934	N/A	2022/04/20	Xueming Jiang
Volatile organics in SPLP leachates	HS/MS	7951645	N/A	2022/04/21	Manpreet Sarao

Bureau Veritas ID: SJP983 Dup
Sample ID: 19+200(2)
Matrix: Soil

Collected: 2022/04/08
Shipped:
Received: 2022/04/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
SPLP Zero Headspace Extraction		7949415	2022/04/20	2022/04/21	Mohammed Abdul Nafay Shoeb
Volatile organics in SPLP leachates	HS/MS	7951645	N/A	2022/04/21	Manpreet Sarao

Bureau Veritas ID: SJP988
Sample ID: BH22-09(5)
Matrix: Soil

Collected: 2022/04/12
Shipped:
Received: 2022/04/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Hot Water Extractable Boron	ICP	7951001	2022/04/21	2022/04/21	Jolly John
Free (WAD) Cyanide	TECH	7951005	2022/04/21	2022/04/21	Aditiben Patel
Conductivity	AT	7951207	2022/04/21	2022/04/21	Kien Tran
Hexavalent Chromium in Soil by IC	IC/SPEC	7951120	2022/04/21	2022/04/21	Violeta Porcila
Petroleum Hydro. CCME F1 & BTEX in Soil	HSGC/MSFD	7949365	N/A	2022/04/20	Anca Ganea
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	7950628	2022/04/20	2022/04/21	Dennis Ngondu
Acid Extractable Metals by ICPMS	ICP/MS	7950989	2022/04/21	2022/04/21	Viviana Canzonieri
Moisture	BAL	7947871	N/A	2022/04/19	Kruti Jitesh Patel
pH CaCl2 EXTRACT	AT	7949293	2022/04/20	2022/04/20	Taslima Aktar
Sodium Adsorption Ratio (SAR)	CALC/MET	7946623	N/A	2022/04/22	Automated Statchk

Bureau Veritas ID: SJQ089
Sample ID: BH22-04(3)
Matrix: Soil

Collected: 2022/04/12
Shipped:
Received: 2022/04/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Hot Water Extractable Boron	ICP	7951001	2022/04/21	2022/04/21	Jolly John
Free (WAD) Cyanide	TECH	7949229	2022/04/20	2022/04/20	Aditiben Patel
Conductivity	AT	7951207	2022/04/21	2022/04/21	Kien Tran
Hexavalent Chromium in Soil by IC	IC/SPEC	7951120	2022/04/21	2022/04/21	Violeta Porcila
Petroleum Hydro. CCME F1 & BTEX in Soil	HSGC/MSFD	7949365	N/A	2022/04/21	Anca Ganea
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	7950628	2022/04/20	2022/04/21	Dennis Ngondu
Acid Extractable Metals by ICPMS	ICP/MS	7950989	2022/04/21	2022/04/21	Viviana Canzonieri
Total Metals in SPLP Leachate by ICPMS	ICP/MS	7953575	2022/04/22	2022/04/22	Azita Fazaeli
Moisture	BAL	7947871	N/A	2022/04/19	Kruti Jitesh Patel
Modified SPLP extraction - pH	PH	7949250	N/A	2022/04/21	Jian (Ken) Wang
Modified SPLP extraction - Weight		7949242	N/A	2022/04/21	Jian (Ken) Wang

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Bureau Veritas Job #: C2A1464
Report Date: 2022/04/22

Golder Associates Ltd
Client Project #: 21505824(2000)
Site Location: HIGHWAY 26, MEAFORD, ON
Sampler Initials: TS

TEST SUMMARY

Bureau Veritas ID: SJQ089
Sample ID: BH22-04(3)
Matrix: Soil

Collected: 2022/04/12
Shipped:
Received: 2022/04/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
pH CaCl2 EXTRACT	AT	7949293	2022/04/20	2022/04/20	Taslima Aktar
Sodium Adsorption Ratio (SAR)	CALC/MET	7946623	N/A	2022/04/22	Automated Statchk

Bureau Veritas ID: SJQ089 Dup
Sample ID: BH22-04(3)
Matrix: Soil

Collected: 2022/04/12
Shipped:
Received: 2022/04/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Free (WAD) Cyanide	TECH	7949229	2022/04/20	2022/04/20	Aditiben Patel
Moisture	BAL	7947871	N/A	2022/04/19	Kruti Jitesh Patel

Bureau Veritas ID: SJQ229
Sample ID: BH22-03(2)
Matrix: Soil

Collected: 2022/04/13
Shipped:
Received: 2022/04/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Hot Water Extractable Boron	ICP	7951001	2022/04/21	2022/04/21	Jolly John
1,3-Dichloropropene Sum	CALC	7946622	N/A	2022/04/22	Automated Statchk
1,3-Dichloropropene Sum	CALC	7946313	N/A	2022/04/21	Automated Statchk
Free (WAD) Cyanide	TECH	7951008	2022/04/21	2022/04/21	Aditiben Patel
Conductivity	AT	7951207	2022/04/21	2022/04/21	Kien Tran
Hexavalent Chromium in Soil by IC	IC/SPEC	7951095	2022/04/21	2022/04/21	Violeta Porcila
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	7950628	2022/04/20	2022/04/21	Dennis Ngondu
Acid Extractable Metals by ICPMS	ICP/MS	7950989	2022/04/21	2022/04/21	Viviana Canzonieri
Total Metals in SPLP Leachate by ICPMS	ICP/MS	7953575	2022/04/22	2022/04/22	Azita Fazaeli
Moisture	BAL	7949684	N/A	2022/04/20	Mathew Bowles
Modified SPLP extraction - pH	PH	7949250	N/A	2022/04/21	Jian (Ken) Wang
Modified SPLP extraction - Weight		7949242	N/A	2022/04/21	Jian (Ken) Wang
pH CaCl2 EXTRACT	AT	7951249	2022/04/21	2022/04/21	Taslima Aktar
Sodium Adsorption Ratio (SAR)	CALC/MET	7946623	N/A	2022/04/22	Automated Statchk
SPLP Zero Headspace Extraction		7949415	2022/04/20	2022/04/21	Mohammed Abdul Nafay Shoeb
Volatile Organic Compounds and F1 PHCs	GC/MSFD	7947934	N/A	2022/04/20	Xueming Jiang
Volatile organics in SPLP leachates	HS/MS	7951645	N/A	2022/04/21	Manpreet Sarao

Bureau Veritas ID: SJQ229 Dup
Sample ID: BH22-03(2)
Matrix: Soil

Collected: 2022/04/13
Shipped:
Received: 2022/04/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture	BAL	7949684	N/A	2022/04/20	Mathew Bowles

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Bureau Veritas Job #: C2A1464
Report Date: 2022/04/22

Golder Associates Ltd
Client Project #: 21505824(2000)
Site Location: HIGHWAY 26, MEAFORD, ON
Sampler Initials: TS

TEST SUMMARY

Bureau Veritas ID: SJQ320
Sample ID: 19+200(2) DUP 1
Matrix: Soil

Collected: 2022/04/08
Shipped:
Received: 2022/04/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	7950628	2022/04/20	2022/04/21	Dennis Ngondu
Moisture	BAL	7947871	N/A	2022/04/19	Kruti Jitesh Patel

Bureau Veritas ID: SJQ321
Sample ID: 19+200(2) DUP 2
Matrix: Soil

Collected: 2022/04/08
Shipped:
Received: 2022/04/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Hot Water Extractable Boron	ICP	7951001	2022/04/21	2022/04/21	Jolly John
Free (WAD) Cyanide	TECH	7951005	2022/04/21	2022/04/21	Aditiben Patel
Conductivity	AT	7951207	2022/04/21	2022/04/21	Kien Tran
Hexavalent Chromium in Soil by IC	IC/SPEC	7951120	2022/04/21	2022/04/21	Violeta Porcila
Acid Extractable Metals by ICPMS	ICP/MS	7950989	2022/04/21	2022/04/21	Viviana Canzonieri
Moisture	BAL	7947871	N/A	2022/04/19	Kruti Jitesh Patel
pH CaCl2 EXTRACT	AT	7951242	2022/04/21	2022/04/21	Taslima Aktar
Sodium Adsorption Ratio (SAR)	CALC/MET	7946623	N/A	2022/04/22	Automated Statchk

Bureau Veritas ID: SJQ322
Sample ID: 19+200(2) DUP 3
Matrix: Soil

Collected: 2022/04/08
Shipped:
Received: 2022/04/18

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
1,3-Dichloropropene Sum	CALC	7946313	N/A	2022/04/21	Automated Statchk
Volatile Organic Compounds and F1 PHCs	GC/MSFD	7947934	N/A	2022/04/20	Xueming Jiang

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GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	7.3°C
Package 2	6.3°C

Results relate only to the items tested.

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QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
7947871	SB3	RPD [SJQ089-02]	Moisture	2022/04/19	4.5		%	20
7947934	XJI	Matrix Spike	4-Bromofluorobenzene	2022/04/20		100	%	60 - 140
			D10-o-Xylene	2022/04/20		91	%	60 - 130
			D4-1,2-Dichloroethane	2022/04/20		107	%	60 - 140
			D8-Toluene	2022/04/20		106	%	60 - 140
			Acetone (2-Propanone)	2022/04/20		100	%	60 - 140
			Benzene	2022/04/20		91	%	60 - 140
			Bromodichloromethane	2022/04/20		99	%	60 - 140
			Bromoform	2022/04/20		100	%	60 - 140
			Bromomethane	2022/04/20		108	%	60 - 140
			Carbon Tetrachloride	2022/04/20		100	%	60 - 140
			Chlorobenzene	2022/04/20		93	%	60 - 140
			Chloroform	2022/04/20		98	%	60 - 140
			Dibromochloromethane	2022/04/20		96	%	60 - 140
			1,2-Dichlorobenzene	2022/04/20		92	%	60 - 140
			1,3-Dichlorobenzene	2022/04/20		89	%	60 - 140
			1,4-Dichlorobenzene	2022/04/20		104	%	60 - 140
			Dichlorodifluoromethane (FREON 12)	2022/04/20		104	%	60 - 140
			1,1-Dichloroethane	2022/04/20		95	%	60 - 140
			1,2-Dichloroethane	2022/04/20		95	%	60 - 140
			1,1-Dichloroethylene	2022/04/20		96	%	60 - 140
			cis-1,2-Dichloroethylene	2022/04/20		101	%	60 - 140
			trans-1,2-Dichloroethylene	2022/04/20		99	%	60 - 140
			1,2-Dichloropropane	2022/04/20		96	%	60 - 140
			cis-1,3-Dichloropropene	2022/04/20		89	%	60 - 140
			trans-1,3-Dichloropropene	2022/04/20		101	%	60 - 140
			Ethylbenzene	2022/04/20		80	%	60 - 140
			Ethylene Dibromide	2022/04/20		94	%	60 - 140
			Hexane	2022/04/20		96	%	60 - 140
			Methylene Chloride(Dichloromethane)	2022/04/20		99	%	60 - 140
			Methyl Ethyl Ketone (2-Butanone)	2022/04/20		99	%	60 - 140
			Methyl Isobutyl Ketone	2022/04/20		95	%	60 - 140
			Methyl t-butyl ether (MTBE)	2022/04/20		84	%	60 - 140
			Styrene	2022/04/20		96	%	60 - 140
			1,1,1,2-Tetrachloroethane	2022/04/20		99	%	60 - 140
			1,1,2,2-Tetrachloroethane	2022/04/20		95	%	60 - 140
			Tetrachloroethylene	2022/04/20		92	%	60 - 140
			Toluene	2022/04/20		88	%	60 - 140
			1,1,1-Trichloroethane	2022/04/20		100	%	60 - 140
			1,1,2-Trichloroethane	2022/04/20		100	%	60 - 140
			Trichloroethylene	2022/04/20		100	%	60 - 140
			Trichlorofluoromethane (FREON 11)	2022/04/20		103	%	60 - 140
			Vinyl Chloride	2022/04/20		108	%	60 - 140
			p+m-Xylene	2022/04/20		86	%	60 - 140
			o-Xylene	2022/04/20		85	%	60 - 140
			F1 (C6-C10)	2022/04/20		71	%	60 - 140
7947934	XJI	Spiked Blank	4-Bromofluorobenzene	2022/04/20		100	%	60 - 140
			D10-o-Xylene	2022/04/20		94	%	60 - 130
			D4-1,2-Dichloroethane	2022/04/20		106	%	60 - 140
			D8-Toluene	2022/04/20		107	%	60 - 140
			Acetone (2-Propanone)	2022/04/20		104	%	60 - 140

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Benzene	2022/04/20		94	%	60 - 130
			Bromodichloromethane	2022/04/20		103	%	60 - 130
			Bromoform	2022/04/20		102	%	60 - 130
			Bromomethane	2022/04/20		112	%	60 - 140
			Carbon Tetrachloride	2022/04/20		104	%	60 - 130
			Chlorobenzene	2022/04/20		97	%	60 - 130
			Chloroform	2022/04/20		102	%	60 - 130
			Dibromochloromethane	2022/04/20		99	%	60 - 130
			1,2-Dichlorobenzene	2022/04/20		94	%	60 - 130
			1,3-Dichlorobenzene	2022/04/20		91	%	60 - 130
			1,4-Dichlorobenzene	2022/04/20		107	%	60 - 130
			Dichlorodifluoromethane (FREON 12)	2022/04/20		107	%	60 - 140
			1,1-Dichloroethane	2022/04/20		99	%	60 - 130
			1,2-Dichloroethane	2022/04/20		98	%	60 - 130
			1,1-Dichloroethylene	2022/04/20		99	%	60 - 130
			cis-1,2-Dichloroethylene	2022/04/20		105	%	60 - 130
			trans-1,2-Dichloroethylene	2022/04/20		102	%	60 - 130
			1,2-Dichloropropane	2022/04/20		100	%	60 - 130
			cis-1,3-Dichloropropene	2022/04/20		91	%	60 - 130
			trans-1,3-Dichloropropene	2022/04/20		103	%	60 - 130
			Ethylbenzene	2022/04/20		83	%	60 - 130
			Ethylene Dibromide	2022/04/20		96	%	60 - 130
			Hexane	2022/04/20		101	%	60 - 130
			Methylene Chloride(Dichloromethane)	2022/04/20		102	%	60 - 130
			Methyl Ethyl Ketone (2-Butanone)	2022/04/20		102	%	60 - 140
			Methyl Isobutyl Ketone	2022/04/20		97	%	60 - 130
			Methyl t-butyl ether (MTBE)	2022/04/20		86	%	60 - 130
			Styrene	2022/04/20		100	%	60 - 130
			1,1,1,2-Tetrachloroethane	2022/04/20		103	%	60 - 130
			1,1,2,2-Tetrachloroethane	2022/04/20		98	%	60 - 130
			Tetrachloroethylene	2022/04/20		97	%	60 - 130
			Toluene	2022/04/20		92	%	60 - 130
			1,1,1-Trichloroethane	2022/04/20		104	%	60 - 130
			1,1,2-Trichloroethane	2022/04/20		105	%	60 - 130
			Trichloroethylene	2022/04/20		104	%	60 - 130
			Trichlorofluoromethane (FREON 11)	2022/04/20		107	%	60 - 130
			Vinyl Chloride	2022/04/20		111	%	60 - 130
			p+m-Xylene	2022/04/20		88	%	60 - 130
			o-Xylene	2022/04/20		88	%	60 - 130
			F1 (C6-C10)	2022/04/20		98	%	80 - 120
7947934	XJI	Method Blank	4-Bromofluorobenzene	2022/04/20		88	%	60 - 140
			D10-o-Xylene	2022/04/20		81	%	60 - 130
			D4-1,2-Dichloroethane	2022/04/20		113	%	60 - 140
			D8-Toluene	2022/04/20		91	%	60 - 140
			Acetone (2-Propanone)	2022/04/20	<0.49		ug/g	
			Benzene	2022/04/20	<0.0060		ug/g	
			Bromodichloromethane	2022/04/20	<0.040		ug/g	
			Bromoform	2022/04/20	<0.040		ug/g	
			Bromomethane	2022/04/20	<0.040		ug/g	
			Carbon Tetrachloride	2022/04/20	<0.040		ug/g	
			Chlorobenzene	2022/04/20	<0.040		ug/g	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Chloroform	2022/04/20	<0.040		ug/g	
			Dibromochloromethane	2022/04/20	<0.040		ug/g	
			1,2-Dichlorobenzene	2022/04/20	<0.040		ug/g	
			1,3-Dichlorobenzene	2022/04/20	<0.040		ug/g	
			1,4-Dichlorobenzene	2022/04/20	<0.040		ug/g	
			Dichlorodifluoromethane (FREON 12)	2022/04/20	<0.040		ug/g	
			1,1-Dichloroethane	2022/04/20	<0.040		ug/g	
			1,2-Dichloroethane	2022/04/20	<0.049		ug/g	
			1,1-Dichloroethylene	2022/04/20	<0.040		ug/g	
			cis-1,2-Dichloroethylene	2022/04/20	<0.040		ug/g	
			trans-1,2-Dichloroethylene	2022/04/20	<0.040		ug/g	
			1,2-Dichloropropane	2022/04/20	<0.040		ug/g	
			cis-1,3-Dichloropropene	2022/04/20	<0.030		ug/g	
			trans-1,3-Dichloropropene	2022/04/20	<0.040		ug/g	
			Ethylbenzene	2022/04/20	<0.010		ug/g	
			Ethylene Dibromide	2022/04/20	<0.040		ug/g	
			Hexane	2022/04/20	<0.040		ug/g	
			Methylene Chloride(Dichloromethane)	2022/04/20	<0.049		ug/g	
			Methyl Ethyl Ketone (2-Butanone)	2022/04/20	<0.40		ug/g	
			Methyl Isobutyl Ketone	2022/04/20	<0.40		ug/g	
			Methyl t-butyl ether (MTBE)	2022/04/20	<0.040		ug/g	
			Styrene	2022/04/20	<0.040		ug/g	
			1,1,1,2-Tetrachloroethane	2022/04/20	<0.040		ug/g	
			1,1,2,2-Tetrachloroethane	2022/04/20	<0.040		ug/g	
			Tetrachloroethylene	2022/04/20	<0.040		ug/g	
			Toluene	2022/04/20	<0.020		ug/g	
			1,1,1-Trichloroethane	2022/04/20	<0.040		ug/g	
			1,1,2-Trichloroethane	2022/04/20	<0.040		ug/g	
			Trichloroethylene	2022/04/20	<0.010		ug/g	
			Trichlorofluoromethane (FREON 11)	2022/04/20	<0.040		ug/g	
			Vinyl Chloride	2022/04/20	<0.019		ug/g	
			p+m-Xylene	2022/04/20	<0.020		ug/g	
			o-Xylene	2022/04/20	<0.020		ug/g	
			Total Xylenes	2022/04/20	<0.020		ug/g	
			F1 (C6-C10)	2022/04/20	<10		ug/g	
			F1 (C6-C10) - BTEX	2022/04/20	<10		ug/g	
7947934	XJI	RPD	Acetone (2-Propanone)	2022/04/20	NC		%	50
			Benzene	2022/04/20	NC		%	50
			Bromodichloromethane	2022/04/20	NC		%	50
			Bromoform	2022/04/20	NC		%	50
			Bromomethane	2022/04/20	NC		%	50
			Carbon Tetrachloride	2022/04/20	NC		%	50
			Chlorobenzene	2022/04/20	NC		%	50
			Chloroform	2022/04/20	NC		%	50
			Dibromochloromethane	2022/04/20	NC		%	50
			1,2-Dichlorobenzene	2022/04/20	NC		%	50
			1,3-Dichlorobenzene	2022/04/20	NC		%	50
			1,4-Dichlorobenzene	2022/04/20	NC		%	50
			Dichlorodifluoromethane (FREON 12)	2022/04/20	NC		%	50
			1,1-Dichloroethane	2022/04/20	NC		%	50
			1,2-Dichloroethane	2022/04/20	NC		%	50

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			1,1-Dichloroethylene	2022/04/20	NC		%	50
			cis-1,2-Dichloroethylene	2022/04/20	NC		%	50
			trans-1,2-Dichloroethylene	2022/04/20	NC		%	50
			1,2-Dichloropropane	2022/04/20	NC		%	50
			cis-1,3-Dichloropropene	2022/04/20	NC		%	50
			trans-1,3-Dichloropropene	2022/04/20	NC		%	50
			Ethylbenzene	2022/04/20	NC		%	50
			Ethylene Dibromide	2022/04/20	NC		%	50
			Hexane	2022/04/20	NC		%	50
			Methylene Chloride(Dichloromethane)	2022/04/20	NC		%	50
			Methyl Ethyl Ketone (2-Butanone)	2022/04/20	NC		%	50
			Methyl Isobutyl Ketone	2022/04/20	NC		%	50
			Methyl t-butyl ether (MTBE)	2022/04/20	NC		%	50
			Styrene	2022/04/20	NC		%	50
			1,1,1,2-Tetrachloroethane	2022/04/20	NC		%	50
			1,1,2,2-Tetrachloroethane	2022/04/20	NC		%	50
			Tetrachloroethylene	2022/04/20	NC		%	50
			Toluene	2022/04/20	NC		%	50
			1,1,1-Trichloroethane	2022/04/20	NC		%	50
			1,1,2-Trichloroethane	2022/04/20	NC		%	50
			Trichloroethylene	2022/04/20	NC		%	50
			Trichlorofluoromethane (FREON 11)	2022/04/20	NC		%	50
			Vinyl Chloride	2022/04/20	NC		%	50
			p+m-Xylene	2022/04/20	NC		%	50
			o-Xylene	2022/04/20	NC		%	50
			Total Xylenes	2022/04/20	NC		%	50
			F1 (C6-C10)	2022/04/20	NC		%	30
			F1 (C6-C10) - BTEX	2022/04/20	NC		%	30
7949229	ABP	Matrix Spike [SJQ089-02]	WAD Cyanide (Free)	2022/04/20		101	%	75 - 125
7949229	ABP	Spiked Blank	WAD Cyanide (Free)	2022/04/20		95	%	80 - 120
7949229	ABP	Method Blank	WAD Cyanide (Free)	2022/04/20	<0.01		ug/g	
7949229	ABP	RPD [SJQ089-02]	WAD Cyanide (Free)	2022/04/20	NC		%	35
7949293	TAK	Spiked Blank	Available (CaCl2) pH	2022/04/20		100	%	97 - 103
7949293	TAK	RPD	Available (CaCl2) pH	2022/04/20	0.33		%	N/A
7949365	AGA	Matrix Spike	1,4-Difluorobenzene	2022/04/20		101	%	60 - 140
			4-Bromofluorobenzene	2022/04/20		98	%	60 - 140
			D10-o-Xylene	2022/04/20		96	%	60 - 140
			D4-1,2-Dichloroethane	2022/04/20		102	%	60 - 140
			Benzene	2022/04/20		94	%	50 - 140
			Toluene	2022/04/20		97	%	50 - 140
			Ethylbenzene	2022/04/20		103	%	50 - 140
			o-Xylene	2022/04/20		103	%	50 - 140
			p+m-Xylene	2022/04/20		101	%	50 - 140
			F1 (C6-C10)	2022/04/20		92	%	60 - 140
7949365	AGA	Spiked Blank	1,4-Difluorobenzene	2022/04/20		100	%	60 - 140
			4-Bromofluorobenzene	2022/04/20		99	%	60 - 140
			D10-o-Xylene	2022/04/20		90	%	60 - 140
			D4-1,2-Dichloroethane	2022/04/20		102	%	60 - 140
			Benzene	2022/04/20		90	%	50 - 140
			Toluene	2022/04/20		91	%	50 - 140
			Ethylbenzene	2022/04/20		98	%	50 - 140

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			o-Xylene	2022/04/20		97	%	50 - 140
			p+m-Xylene	2022/04/20		95	%	50 - 140
			F1 (C6-C10)	2022/04/20		97	%	80 - 120
7949365	AGA	Method Blank	1,4-Difluorobenzene	2022/04/20		103	%	60 - 140
			4-Bromofluorobenzene	2022/04/20		97	%	60 - 140
			D10-o-Xylene	2022/04/20		94	%	60 - 140
			D4-1,2-Dichloroethane	2022/04/20		102	%	60 - 140
			Benzene	2022/04/20	<0.020		ug/g	
			Toluene	2022/04/20	<0.020		ug/g	
			Ethylbenzene	2022/04/20	<0.020		ug/g	
			o-Xylene	2022/04/20	<0.020		ug/g	
			p+m-Xylene	2022/04/20	<0.040		ug/g	
			Total Xylenes	2022/04/20	<0.040		ug/g	
			F1 (C6-C10)	2022/04/20	<10		ug/g	
			F1 (C6-C10) - BTEX	2022/04/20	<10		ug/g	
7949365	AGA	RPD	Benzene	2022/04/20	NC		%	50
			Toluene	2022/04/20	NC		%	50
			Ethylbenzene	2022/04/20	NC		%	50
			o-Xylene	2022/04/20	NC		%	50
			p+m-Xylene	2022/04/20	NC		%	50
			Total Xylenes	2022/04/20	NC		%	50
			F1 (C6-C10)	2022/04/20	NC		%	30
			F1 (C6-C10) - BTEX	2022/04/20	NC		%	30
7949684	MYG	RPD [SJQ229-02]	Moisture	2022/04/20	4.7		%	20
7950628	DN0	Matrix Spike [SJP980-03]	o-Terphenyl	2022/04/21		94	%	60 - 130
			F2 (C10-C16 Hydrocarbons)	2022/04/21		99	%	60 - 130
			F3 (C16-C34 Hydrocarbons)	2022/04/21		105	%	60 - 130
			F4 (C34-C50 Hydrocarbons)	2022/04/21		113	%	60 - 130
7950628	DN0	Spiked Blank	o-Terphenyl	2022/04/21		95	%	60 - 130
			F2 (C10-C16 Hydrocarbons)	2022/04/21		103	%	80 - 120
			F3 (C16-C34 Hydrocarbons)	2022/04/21		108	%	80 - 120
			F4 (C34-C50 Hydrocarbons)	2022/04/21		116	%	80 - 120
7950628	DN0	Method Blank	o-Terphenyl	2022/04/21		100	%	60 - 130
			F2 (C10-C16 Hydrocarbons)	2022/04/21	<10		ug/g	
			F3 (C16-C34 Hydrocarbons)	2022/04/21	<50		ug/g	
			F4 (C34-C50 Hydrocarbons)	2022/04/21	<50		ug/g	
7950628	DN0	RPD [SJP980-03]	F2 (C10-C16 Hydrocarbons)	2022/04/21	NC		%	30
			F3 (C16-C34 Hydrocarbons)	2022/04/21	NC		%	30
			F4 (C34-C50 Hydrocarbons)	2022/04/21	NC		%	30
7950989	VIV	Matrix Spike	Acid Extractable Antimony (Sb)	2022/04/21		96	%	75 - 125
			Acid Extractable Arsenic (As)	2022/04/21		100	%	75 - 125
			Acid Extractable Barium (Ba)	2022/04/21		NC	%	75 - 125
			Acid Extractable Beryllium (Be)	2022/04/21		102	%	75 - 125
			Acid Extractable Boron (B)	2022/04/21		92	%	75 - 125
			Acid Extractable Cadmium (Cd)	2022/04/21		106	%	75 - 125
			Acid Extractable Chromium (Cr)	2022/04/21		102	%	75 - 125
			Acid Extractable Cobalt (Co)	2022/04/21		105	%	75 - 125
			Acid Extractable Copper (Cu)	2022/04/21		NC	%	75 - 125
			Acid Extractable Lead (Pb)	2022/04/21		104	%	75 - 125
			Acid Extractable Molybdenum (Mo)	2022/04/21		106	%	75 - 125
			Acid Extractable Nickel (Ni)	2022/04/21		108	%	75 - 125

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Acid Extractable Selenium (Se)	2022/04/21		99	%	75 - 125
			Acid Extractable Silver (Ag)	2022/04/21		106	%	75 - 125
			Acid Extractable Thallium (Tl)	2022/04/21		105	%	75 - 125
			Acid Extractable Uranium (U)	2022/04/21		107	%	75 - 125
			Acid Extractable Vanadium (V)	2022/04/21		NC	%	75 - 125
			Acid Extractable Zinc (Zn)	2022/04/21		NC	%	75 - 125
			Acid Extractable Mercury (Hg)	2022/04/21		91	%	75 - 125
7950989	VIV	Spiked Blank	Acid Extractable Antimony (Sb)	2022/04/21		108	%	80 - 120
			Acid Extractable Arsenic (As)	2022/04/21		104	%	80 - 120
			Acid Extractable Barium (Ba)	2022/04/21		105	%	80 - 120
			Acid Extractable Beryllium (Be)	2022/04/21		101	%	80 - 120
			Acid Extractable Boron (B)	2022/04/21		98	%	80 - 120
			Acid Extractable Cadmium (Cd)	2022/04/21		105	%	80 - 120
			Acid Extractable Chromium (Cr)	2022/04/21		105	%	80 - 120
			Acid Extractable Cobalt (Co)	2022/04/21		106	%	80 - 120
			Acid Extractable Copper (Cu)	2022/04/21		104	%	80 - 120
			Acid Extractable Lead (Pb)	2022/04/21		105	%	80 - 120
			Acid Extractable Molybdenum (Mo)	2022/04/21		108	%	80 - 120
			Acid Extractable Nickel (Ni)	2022/04/21		104	%	80 - 120
			Acid Extractable Selenium (Se)	2022/04/21		101	%	80 - 120
			Acid Extractable Silver (Ag)	2022/04/21		107	%	80 - 120
			Acid Extractable Thallium (Tl)	2022/04/21		106	%	80 - 120
			Acid Extractable Uranium (U)	2022/04/21		105	%	80 - 120
			Acid Extractable Vanadium (V)	2022/04/21		105	%	80 - 120
			Acid Extractable Zinc (Zn)	2022/04/21		102	%	80 - 120
			Acid Extractable Mercury (Hg)	2022/04/21		86	%	80 - 120
7950989	VIV	Method Blank	Acid Extractable Antimony (Sb)	2022/04/21	<0.20		ug/g	
			Acid Extractable Arsenic (As)	2022/04/21	<1.0		ug/g	
			Acid Extractable Barium (Ba)	2022/04/21	<0.50		ug/g	
			Acid Extractable Beryllium (Be)	2022/04/21	<0.20		ug/g	
			Acid Extractable Boron (B)	2022/04/21	<5.0		ug/g	
			Acid Extractable Cadmium (Cd)	2022/04/21	<0.10		ug/g	
			Acid Extractable Chromium (Cr)	2022/04/21	<1.0		ug/g	
			Acid Extractable Cobalt (Co)	2022/04/21	<0.10		ug/g	
			Acid Extractable Copper (Cu)	2022/04/21	<0.50		ug/g	
			Acid Extractable Lead (Pb)	2022/04/21	<1.0		ug/g	
			Acid Extractable Molybdenum (Mo)	2022/04/21	<0.50		ug/g	
			Acid Extractable Nickel (Ni)	2022/04/21	<0.50		ug/g	
			Acid Extractable Selenium (Se)	2022/04/21	<0.50		ug/g	
			Acid Extractable Silver (Ag)	2022/04/21	<0.20		ug/g	
			Acid Extractable Thallium (Tl)	2022/04/21	<0.050		ug/g	
			Acid Extractable Uranium (U)	2022/04/21	<0.050		ug/g	
			Acid Extractable Vanadium (V)	2022/04/21	<5.0		ug/g	
			Acid Extractable Zinc (Zn)	2022/04/21	<5.0		ug/g	
			Acid Extractable Mercury (Hg)	2022/04/21	<0.050		ug/g	
7950989	VIV	RPD	Acid Extractable Antimony (Sb)	2022/04/21	NC		%	30
			Acid Extractable Arsenic (As)	2022/04/21	9.1		%	30
			Acid Extractable Barium (Ba)	2022/04/21	4.0		%	30
			Acid Extractable Beryllium (Be)	2022/04/21	0.89		%	30
			Acid Extractable Boron (B)	2022/04/21	3.7		%	30
			Acid Extractable Cadmium (Cd)	2022/04/21	2.2		%	30

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Acid Extractable Chromium (Cr)	2022/04/21	2.0		%	30
			Acid Extractable Cobalt (Co)	2022/04/21	4.5		%	30
			Acid Extractable Copper (Cu)	2022/04/21	1.8		%	30
			Acid Extractable Lead (Pb)	2022/04/21	4.6		%	30
			Acid Extractable Molybdenum (Mo)	2022/04/21	NC		%	30
			Acid Extractable Nickel (Ni)	2022/04/21	2.5		%	30
			Acid Extractable Selenium (Se)	2022/04/21	NC		%	30
			Acid Extractable Silver (Ag)	2022/04/21	NC		%	30
			Acid Extractable Thallium (Tl)	2022/04/21	9.7		%	30
			Acid Extractable Uranium (U)	2022/04/21	6.1		%	30
			Acid Extractable Vanadium (V)	2022/04/21	3.6		%	30
			Acid Extractable Zinc (Zn)	2022/04/21	2.2		%	30
7951001	JOH	Matrix Spike	Hot Water Ext. Boron (B)	2022/04/21		106	%	75 - 125
7951001	JOH	Spiked Blank	Hot Water Ext. Boron (B)	2022/04/21		107	%	75 - 125
7951001	JOH	Method Blank	Hot Water Ext. Boron (B)	2022/04/21	<0.050		ug/g	
7951001	JOH	RPD	Hot Water Ext. Boron (B)	2022/04/21	6.7		%	40
7951005	ABP	Matrix Spike	WAD Cyanide (Free)	2022/04/21		90	%	75 - 125
7951005	ABP	Spiked Blank	WAD Cyanide (Free)	2022/04/21		91	%	80 - 120
7951005	ABP	Method Blank	WAD Cyanide (Free)	2022/04/21	<0.01		ug/g	
7951005	ABP	RPD	WAD Cyanide (Free)	2022/04/21	NC		%	35
7951008	ABP	Matrix Spike	WAD Cyanide (Free)	2022/04/21		94	%	75 - 125
7951008	ABP	Spiked Blank	WAD Cyanide (Free)	2022/04/21		96	%	80 - 120
7951008	ABP	Method Blank	WAD Cyanide (Free)	2022/04/21	<0.01		ug/g	
7951008	ABP	RPD	WAD Cyanide (Free)	2022/04/21	NC		%	35
7951095	VP2	Matrix Spike	Chromium (VI)	2022/04/21		84	%	70 - 130
7951095	VP2	Spiked Blank	Chromium (VI)	2022/04/21		92	%	80 - 120
7951095	VP2	Method Blank	Chromium (VI)	2022/04/21	<0.18		ug/g	
7951095	VP2	RPD	Chromium (VI)	2022/04/21	27		%	35
7951120	VP2	Matrix Spike	Chromium (VI)	2022/04/21		98	%	70 - 130
7951120	VP2	Spiked Blank	Chromium (VI)	2022/04/21		95	%	80 - 120
7951120	VP2	Method Blank	Chromium (VI)	2022/04/21	<0.18		ug/g	
7951120	VP2	RPD	Chromium (VI)	2022/04/21	6.4		%	35
7951207	KIT	Spiked Blank	Conductivity	2022/04/21		99	%	90 - 110
7951207	KIT	Method Blank	Conductivity	2022/04/21	<0.002		mS/cm	
7951207	KIT	RPD	Conductivity	2022/04/21	0		%	10
7951242	TAK	Spiked Blank	Available (CaCl2) pH	2022/04/21		100	%	97 - 103
7951242	TAK	RPD	Available (CaCl2) pH	2022/04/21	0.69		%	N/A
7951249	TAK	Spiked Blank	Available (CaCl2) pH	2022/04/21		100	%	97 - 103
7951249	TAK	RPD	Available (CaCl2) pH	2022/04/21	0.063		%	N/A
7951645	MS4	Matrix Spike [SJP983-04]	Leachable (SPLP) 4-Bromofluorobenzene	2022/04/21		102	%	70 - 130
			Leachable (SPLP) D4-1,2-Dichloroethane	2022/04/21		110	%	70 - 130
			Leachable (SPLP) D8-Toluene	2022/04/21		103	%	70 - 130
			Leachable (SPLP) Bromomethane	2022/04/21		107	%	60 - 140
			Leachable (SPLP) Carbon Tetrachloride	2022/04/21		98	%	70 - 130
			Leachable (SPLP) Chloroform	2022/04/21		101	%	70 - 130
			Leachable (SPLP) 1,2-Dichlorobenzene	2022/04/21		98	%	70 - 130
			Leachable (SPLP) 1,4-Dichlorobenzene	2022/04/21		112	%	70 - 130
			Leachable (SPLP) 1,1-Dichloroethane	2022/04/21		96	%	70 - 130
			Leachable (SPLP) 1,2-Dichloroethane	2022/04/21		105	%	70 - 130
			Leachable (SPLP) 1,1-Dichloroethylene	2022/04/21		96	%	70 - 130
			Leachable (SPLP) cis-1,2-Dichloroethylene	2022/04/21		103	%	70 - 130

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Leachable (SPLP) trans-1,2-Dichloroethylene	2022/04/21		99	%	70 - 130
			Leachable (SPLP) 1,2-Dichloropropane	2022/04/21		99	%	70 - 130
			Leachable (SPLP) cis-1,3-Dichloropropene	2022/04/21		105	%	70 - 130
			Leachable (SPLP) trans-1,3-Dichloropropene	2022/04/21		115	%	70 - 130
			Leachable (SPLP) Ethylene Dibromide	2022/04/21		103	%	70 - 130
			Leachable (SPLP) 1,1,1,2-Tetrachloroethane	2022/04/21		101	%	70 - 130
			Leachable (SPLP) 1,1,2,2-Tetrachloroethane	2022/04/21		105	%	70 - 130
			Leachable (SPLP) Tetrachloroethylene	2022/04/21		91	%	70 - 130
			Leachable (SPLP) 1,1,2-Trichloroethane	2022/04/21		109	%	70 - 130
			Leachable (SPLP) Trichloroethylene	2022/04/21		100	%	70 - 130
7951645	MS4	Spiked Blank	Leachable (SPLP) 4-Bromofluorobenzene	2022/04/21		102	%	70 - 130
			Leachable (SPLP) D4-1,2-Dichloroethane	2022/04/21		108	%	70 - 130
			Leachable (SPLP) D8-Toluene	2022/04/21		102	%	70 - 130
			Leachable (SPLP) Bromomethane	2022/04/21		108	%	60 - 140
			Leachable (SPLP) Carbon Tetrachloride	2022/04/21		104	%	70 - 130
			Leachable (SPLP) Chloroform	2022/04/21		105	%	70 - 130
			Leachable (SPLP) 1,2-Dichlorobenzene	2022/04/21		101	%	70 - 130
			Leachable (SPLP) 1,4-Dichlorobenzene	2022/04/21		115	%	70 - 130
			Leachable (SPLP) 1,1-Dichloroethane	2022/04/21		100	%	70 - 130
			Leachable (SPLP) 1,2-Dichloroethane	2022/04/21		107	%	70 - 130
			Leachable (SPLP) 1,1-Dichloroethylene	2022/04/21		100	%	70 - 130
			Leachable (SPLP) cis-1,2-Dichloroethylene	2022/04/21		107	%	70 - 130
			Leachable (SPLP) trans-1,2-Dichloroethylene	2022/04/21		103	%	70 - 130
			Leachable (SPLP) 1,2-Dichloropropane	2022/04/21		102	%	70 - 130
			Leachable (SPLP) cis-1,3-Dichloropropene	2022/04/21		105	%	70 - 130
			Leachable (SPLP) trans-1,3-Dichloropropene	2022/04/21		110	%	70 - 130
			Leachable (SPLP) Ethylene Dibromide	2022/04/21		103	%	70 - 130
			Leachable (SPLP) 1,1,1,2-Tetrachloroethane	2022/04/21		103	%	70 - 130
			Leachable (SPLP) 1,1,2,2-Tetrachloroethane	2022/04/21		104	%	70 - 130
			Leachable (SPLP) Tetrachloroethylene	2022/04/21		94	%	70 - 130
			Leachable (SPLP) 1,1,2-Trichloroethane	2022/04/21		109	%	70 - 130
			Leachable (SPLP) Trichloroethylene	2022/04/21		105	%	70 - 130
7951645	MS4	Method Blank	Leachable (SPLP) 4-Bromofluorobenzene	2022/04/21		92	%	70 - 130
			Leachable (SPLP) D4-1,2-Dichloroethane	2022/04/21		118	%	70 - 130
			Leachable (SPLP) D8-Toluene	2022/04/21		93	%	70 - 130
			Leachable (SPLP) Bromomethane	2022/04/21	<0.40		ug/L	
			Leachable (SPLP) Carbon Tetrachloride	2022/04/21	<0.19		ug/L	
			Leachable (SPLP) Chloroform	2022/04/21	<0.90		ug/L	
			Leachable (SPLP) 1,2-Dichlorobenzene	2022/04/21	<0.40		ug/L	
			Leachable (SPLP) 1,4-Dichlorobenzene	2022/04/21	<0.40		ug/L	
			Leachable (SPLP) 1,1-Dichloroethane	2022/04/21	<0.40		ug/L	
			Leachable (SPLP) 1,2-Dichloroethane	2022/04/21	<0.40		ug/L	
			Leachable (SPLP) 1,1-Dichloroethylene	2022/04/21	<0.40		ug/L	
			Leachable (SPLP) cis-1,2-Dichloroethylene	2022/04/21	<0.40		ug/L	
			Leachable (SPLP) trans-1,2-Dichloroethylene	2022/04/21	<0.40		ug/L	
			Leachable (SPLP) 1,2-Dichloropropane	2022/04/21	<0.40		ug/L	
			Leachable (SPLP) cis-1,3-Dichloropropene	2022/04/21	<0.30		ug/L	
			Leachable (SPLP) trans-1,3-Dichloropropene	2022/04/21	<0.30		ug/L	
			Leachable (SPLP) Ethylene Dibromide	2022/04/21	<0.19		ug/L	
			Leachable (SPLP) 1,1,1,2-Tetrachloroethane	2022/04/21	<0.40		ug/L	
			Leachable (SPLP) 1,1,2,2-Tetrachloroethane	2022/04/21	<0.40		ug/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Leachable (SPLP) Tetrachloroethylene	2022/04/21	<0.40		ug/L	
			Leachable (SPLP) 1,1,2-Trichloroethane	2022/04/21	<0.40		ug/L	
			Leachable (SPLP) Trichloroethylene	2022/04/21	<0.40		ug/L	
7951645	MS4	RPD [SJP983-04]	Leachable (SPLP) Bromomethane	2022/04/21	NC		%	30
			Leachable (SPLP) Carbon Tetrachloride	2022/04/21	NC		%	30
			Leachable (SPLP) Chloroform	2022/04/21	NC		%	30
			Leachable (SPLP) 1,2-Dichlorobenzene	2022/04/21	NC		%	30
			Leachable (SPLP) 1,4-Dichlorobenzene	2022/04/21	NC		%	30
			Leachable (SPLP) 1,1-Dichloroethane	2022/04/21	NC		%	30
			Leachable (SPLP) 1,2-Dichloroethane	2022/04/21	NC		%	30
			Leachable (SPLP) 1,1-Dichloroethylene	2022/04/21	NC		%	30
			Leachable (SPLP) cis-1,2-Dichloroethylene	2022/04/21	NC		%	30
			Leachable (SPLP) trans-1,2-Dichloroethylene	2022/04/21	NC		%	30
			Leachable (SPLP) 1,2-Dichloropropane	2022/04/21	NC		%	30
			Leachable (SPLP) cis-1,3-Dichloropropene	2022/04/21	NC		%	30
			Leachable (SPLP) trans-1,3-Dichloropropene	2022/04/21	NC		%	30
			Leachable (SPLP) Ethylene Dibromide	2022/04/21	NC		%	30
			Leachable (SPLP) 1,1,1,2-Tetrachloroethane	2022/04/21	NC		%	30
			Leachable (SPLP) 1,1,2,2-Tetrachloroethane	2022/04/21	NC		%	30
			Leachable (SPLP) Tetrachloroethylene	2022/04/21	NC		%	30
			Leachable (SPLP) 1,1,2-Trichloroethane	2022/04/21	NC		%	30
			Leachable (SPLP) Trichloroethylene	2022/04/21	NC		%	30
7953575	AFZ	Matrix Spike	Leachable (SPLP) Antimony (Sb)	2022/04/22		105	%	80 - 120
			Leachable (SPLP) Arsenic (As)	2022/04/22		104	%	80 - 120
			Leachable (SPLP) Barium (Ba)	2022/04/22		98	%	80 - 120
			Leachable (SPLP) Beryllium (Be)	2022/04/22		111	%	80 - 120
			Leachable (SPLP) Boron (B)	2022/04/22		101	%	80 - 120
			Leachable (SPLP) Cadmium (Cd)	2022/04/22		103	%	80 - 120
			Leachable (SPLP) Chromium (Cr)	2022/04/22		99	%	80 - 120
			Leachable (SPLP) Cobalt (Co)	2022/04/22		100	%	80 - 120
			Leachable (SPLP) Copper (Cu)	2022/04/22		102	%	80 - 120
			Leachable (SPLP) Lead (Pb)	2022/04/22		97	%	80 - 120
			Leachable (SPLP) Molybdenum (Mo)	2022/04/22		101	%	80 - 120
			Leachable (SPLP) Nickel (Ni)	2022/04/22		101	%	80 - 120
			Leachable (SPLP) Selenium (Se)	2022/04/22		104	%	80 - 120
			Leachable (SPLP) Silver (Ag)	2022/04/22		99	%	80 - 120
			Leachable (SPLP) Thallium (Tl)	2022/04/22		98	%	80 - 120
			Leachable (SPLP) Uranium (U)	2022/04/22		105	%	80 - 120
			Leachable (SPLP) Vanadium (V)	2022/04/22		100	%	80 - 120
			Leachable (SPLP) Zinc (Zn)	2022/04/22		108	%	80 - 120
7953575	AFZ	Leachate Blank	Leachable (SPLP) Antimony (Sb)	2022/04/22	<0.5		ug/L	
			Leachable (SPLP) Arsenic (As)	2022/04/22	<1		ug/L	
			Leachable (SPLP) Barium (Ba)	2022/04/22	<5		ug/L	
			Leachable (SPLP) Beryllium (Be)	2022/04/22	<0.5		ug/L	
			Leachable (SPLP) Boron (B)	2022/04/22	<10		ug/L	
			Leachable (SPLP) Cadmium (Cd)	2022/04/22	<0.1		ug/L	
			Leachable (SPLP) Chromium (Cr)	2022/04/22	<5		ug/L	
			Leachable (SPLP) Cobalt (Co)	2022/04/22	<0.5		ug/L	
			Leachable (SPLP) Copper (Cu)	2022/04/22	<1		ug/L	
			Leachable (SPLP) Lead (Pb)	2022/04/22	<0.5		ug/L	
			Leachable (SPLP) Molybdenum (Mo)	2022/04/22	<1		ug/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Leachable (SPLP) Nickel (Ni)	2022/04/22	<1		ug/L	
			Leachable (SPLP) Selenium (Se)	2022/04/22	<2		ug/L	
			Leachable (SPLP) Silver (Ag)	2022/04/22	<0.1		ug/L	
			Leachable (SPLP) Thallium (Tl)	2022/04/22	<0.05		ug/L	
			Leachable (SPLP) Uranium (U)	2022/04/22	<0.1		ug/L	
			Leachable (SPLP) Vanadium (V)	2022/04/22	<1		ug/L	
			Leachable (SPLP) Zinc (Zn)	2022/04/22	<5		ug/L	
7953575	AFZ	Spiked Blank	Leachable (SPLP) Antimony (Sb)	2022/04/22		107	%	80 - 120
			Leachable (SPLP) Arsenic (As)	2022/04/22		104	%	80 - 120
			Leachable (SPLP) Barium (Ba)	2022/04/22		102	%	80 - 120
			Leachable (SPLP) Beryllium (Be)	2022/04/22		108	%	80 - 120
			Leachable (SPLP) Boron (B)	2022/04/22		102	%	80 - 120
			Leachable (SPLP) Cadmium (Cd)	2022/04/22		106	%	80 - 120
			Leachable (SPLP) Chromium (Cr)	2022/04/22		101	%	80 - 120
			Leachable (SPLP) Cobalt (Co)	2022/04/22		101	%	80 - 120
			Leachable (SPLP) Copper (Cu)	2022/04/22		103	%	80 - 120
			Leachable (SPLP) Lead (Pb)	2022/04/22		97	%	80 - 120
			Leachable (SPLP) Molybdenum (Mo)	2022/04/22		103	%	80 - 120
			Leachable (SPLP) Nickel (Ni)	2022/04/22		102	%	80 - 120
			Leachable (SPLP) Selenium (Se)	2022/04/22		108	%	80 - 120
			Leachable (SPLP) Silver (Ag)	2022/04/22		103	%	80 - 120
			Leachable (SPLP) Thallium (Tl)	2022/04/22		99	%	80 - 120
			Leachable (SPLP) Uranium (U)	2022/04/22		106	%	80 - 120
			Leachable (SPLP) Vanadium (V)	2022/04/22		102	%	80 - 120
			Leachable (SPLP) Zinc (Zn)	2022/04/22		111	%	80 - 120
7953575	AFZ	Method Blank	Leachable (SPLP) Antimony (Sb)	2022/04/22	<0.5		ug/L	
			Leachable (SPLP) Arsenic (As)	2022/04/22	<1		ug/L	
			Leachable (SPLP) Barium (Ba)	2022/04/22	<5		ug/L	
			Leachable (SPLP) Beryllium (Be)	2022/04/22	<0.5		ug/L	
			Leachable (SPLP) Boron (B)	2022/04/22	<10		ug/L	
			Leachable (SPLP) Cadmium (Cd)	2022/04/22	<0.1		ug/L	
			Leachable (SPLP) Chromium (Cr)	2022/04/22	<5		ug/L	
			Leachable (SPLP) Cobalt (Co)	2022/04/22	<0.5		ug/L	
			Leachable (SPLP) Copper (Cu)	2022/04/22	<1		ug/L	
			Leachable (SPLP) Lead (Pb)	2022/04/22	<0.5		ug/L	
			Leachable (SPLP) Molybdenum (Mo)	2022/04/22	<1		ug/L	
			Leachable (SPLP) Nickel (Ni)	2022/04/22	<1		ug/L	
			Leachable (SPLP) Selenium (Se)	2022/04/22	<2		ug/L	
			Leachable (SPLP) Silver (Ag)	2022/04/22	<0.1		ug/L	
			Leachable (SPLP) Thallium (Tl)	2022/04/22	<0.05		ug/L	
			Leachable (SPLP) Uranium (U)	2022/04/22	<0.1		ug/L	
			Leachable (SPLP) Vanadium (V)	2022/04/22	<1		ug/L	
			Leachable (SPLP) Zinc (Zn)	2022/04/22	<5		ug/L	
7953575	AFZ	RPD	Leachable (SPLP) Antimony (Sb)	2022/04/22	NC		%	35
			Leachable (SPLP) Arsenic (As)	2022/04/22	6.8		%	35
			Leachable (SPLP) Barium (Ba)	2022/04/22	NC		%	35
			Leachable (SPLP) Beryllium (Be)	2022/04/22	NC		%	35
			Leachable (SPLP) Boron (B)	2022/04/22	3.8		%	35
			Leachable (SPLP) Cadmium (Cd)	2022/04/22	NC		%	35
			Leachable (SPLP) Chromium (Cr)	2022/04/22	NC		%	35
			Leachable (SPLP) Cobalt (Co)	2022/04/22	NC		%	35

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
			Leachable (SPLP) Copper (Cu)	2022/04/22	NC		%	35
			Leachable (SPLP) Lead (Pb)	2022/04/22	NC		%	35
			Leachable (SPLP) Molybdenum (Mo)	2022/04/22	6.1		%	35
			Leachable (SPLP) Nickel (Ni)	2022/04/22	NC		%	35
			Leachable (SPLP) Selenium (Se)	2022/04/22	NC		%	35
			Leachable (SPLP) Silver (Ag)	2022/04/22	NC		%	35
			Leachable (SPLP) Thallium (Tl)	2022/04/22	NC		%	35
			Leachable (SPLP) Uranium (U)	2022/04/22	NC		%	35
			Leachable (SPLP) Vanadium (V)	2022/04/22	0.41		%	35
			Leachable (SPLP) Zinc (Zn)	2022/04/22	NC		%	35

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Leachate Blank: A blank matrix containing all reagents used in the leaching procedure. Used to determine any process contamination.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

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Bureau Veritas Job #: C2A1464
Report Date: 2022/04/22

Golder Associates Ltd
Client Project #: 21505824(2000)
Site Location: HIGHWAY 26, MEAFORD, ON
Sampler Initials: TS

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Cristina Carriere

Cristina Carriere, Senior Scientific Specialist

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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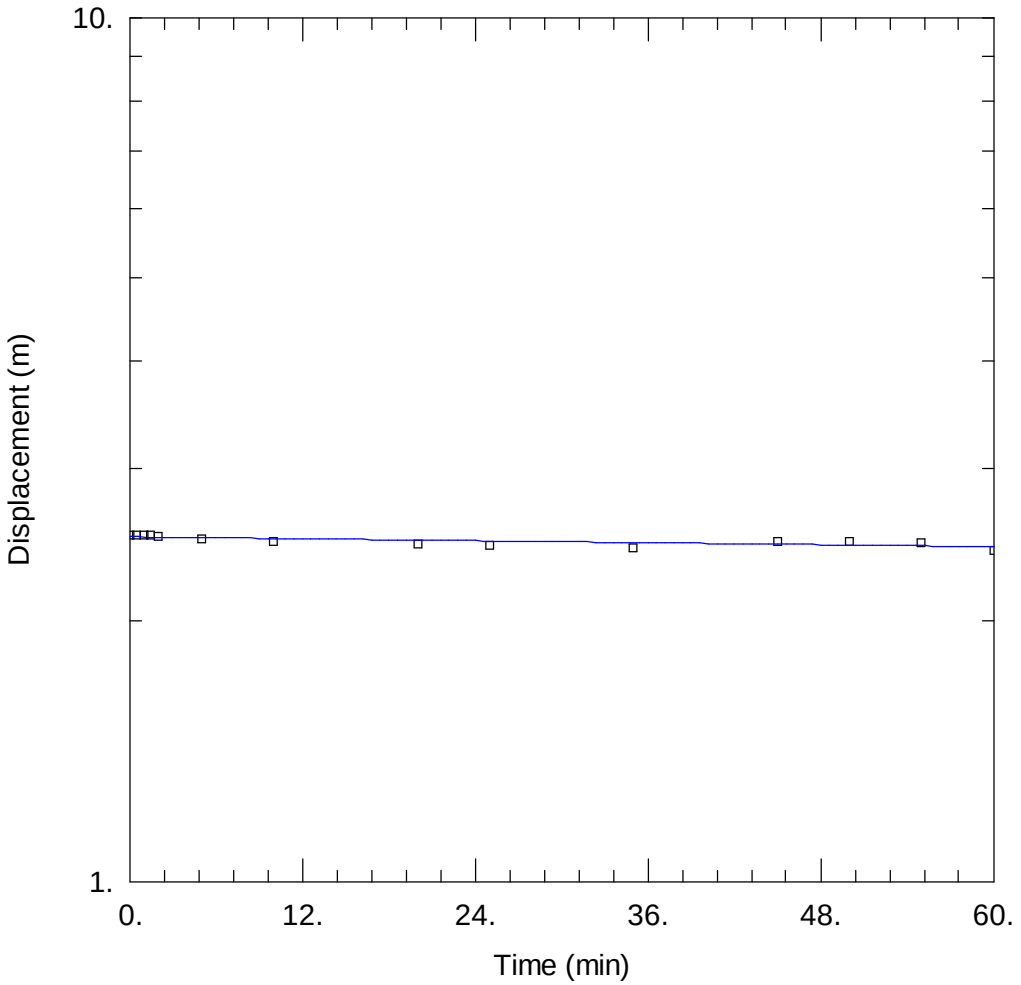
APPENDIX I

Well Test Data



WELL TEST ANALYSIS

Data Set: C:\Users\DDillon\Downloads\Meaford 22-03.aqt
Date: 05/24/22 Time: 11:57:06

PROJECT INFORMATION

Company: Golder Associates
Location: Hwy 26 Meaford
Test Well: BH22-1
Test Date: 19-Apr-22

AQUIFER DATA

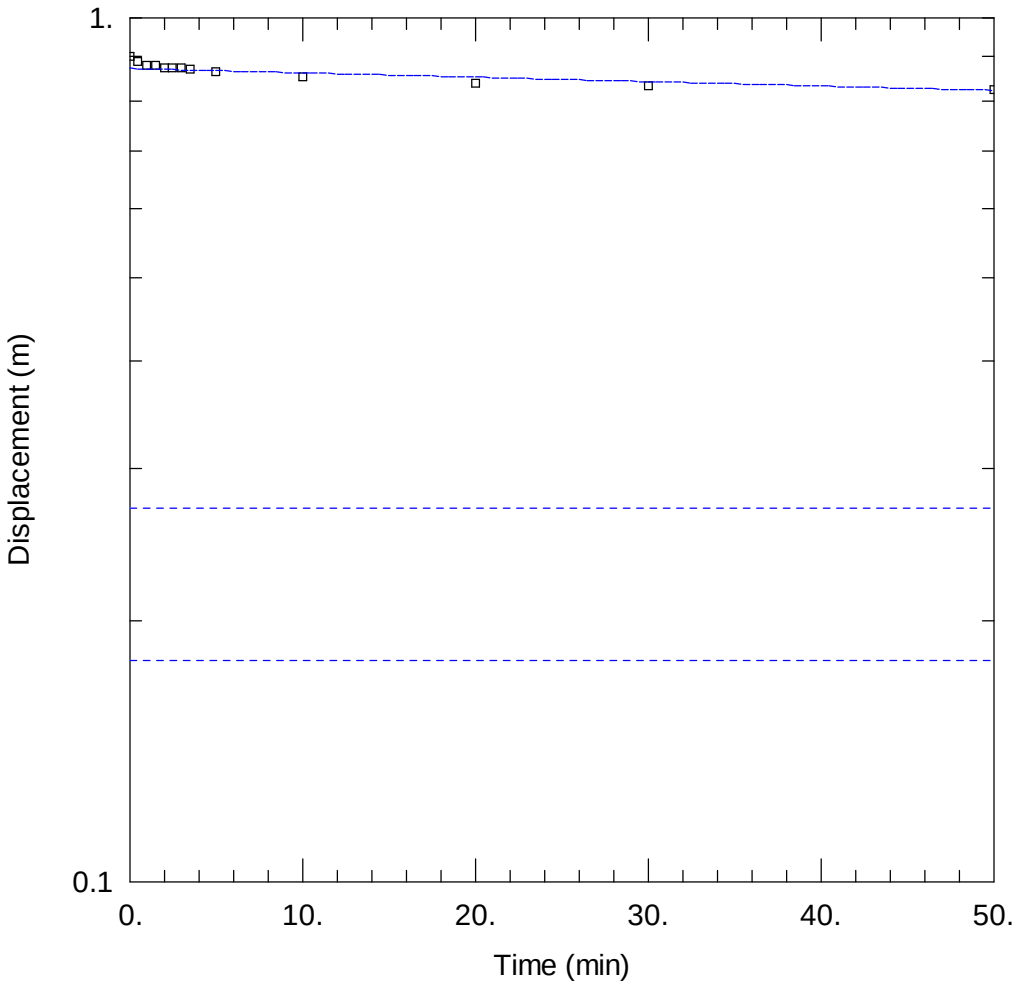
Saturated Thickness: 10. m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (22-03)

Initial Displacement: 2.52 m
Total Well Penetration Depth: 5.68 m
Casing Radius: 0.025 m
Static Water Column Height: 5.68 m
Screen Length: 3. m
Well Radius: 0.075 m
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 6.997E-9 m/sec
y0 = 2.504 m



WELL TEST ANALYSIS

Data Set: C:\Users\DDillon\Downloads\Meaford 22-10.aqt
Date: 05/24/22 Time: 11:57:27

PROJECT INFORMATION

Company: Golder Associates
Location: Hwy 26 Meaford
Test Well: BH22-1
Test Date: 19-Apr-22

AQUIFER DATA

Saturated Thickness: 10. m Anisotropy Ratio (Kz/Kr): 1.

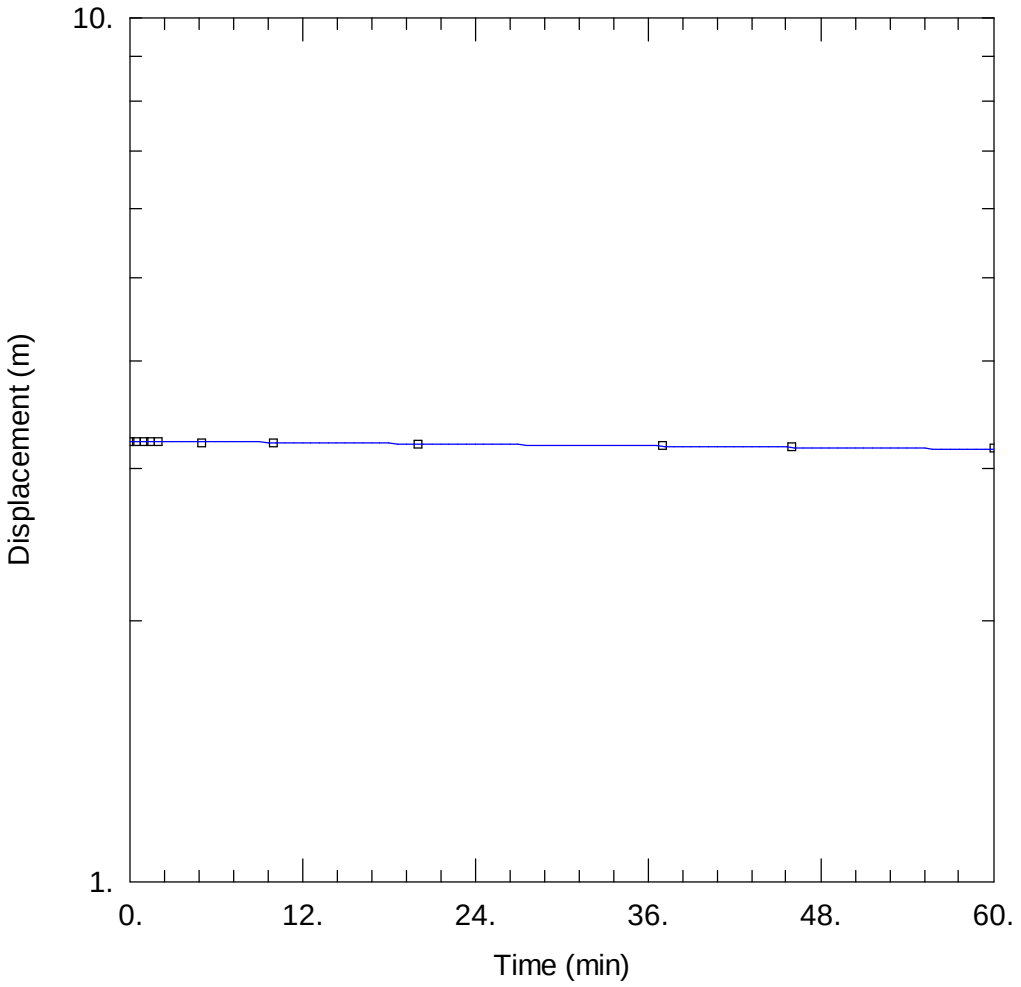
WELL DATA (22-01)

Initial Displacement: 0.9 m
Total Well Penetration Depth: 1. m
Casing Radius: 0.025 m
Static Water Column Height: 1.055 m
Screen Length: 1. m
Well Radius: 0.075 m
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 3.054E-8 m/sec y0 = 0.8725 m



WELL TEST ANALYSIS

Data Set: C:\Users\DDillon\Downloads\Meaford 22-11.aqt
Date: 05/24/22 Time: 11:58:17

PROJECT INFORMATION

Company: Golder Associates
Location: Hwy 26 Meaford
Test Well: BH22-11
Test Date: 19-Apr-22

AQUIFER DATA

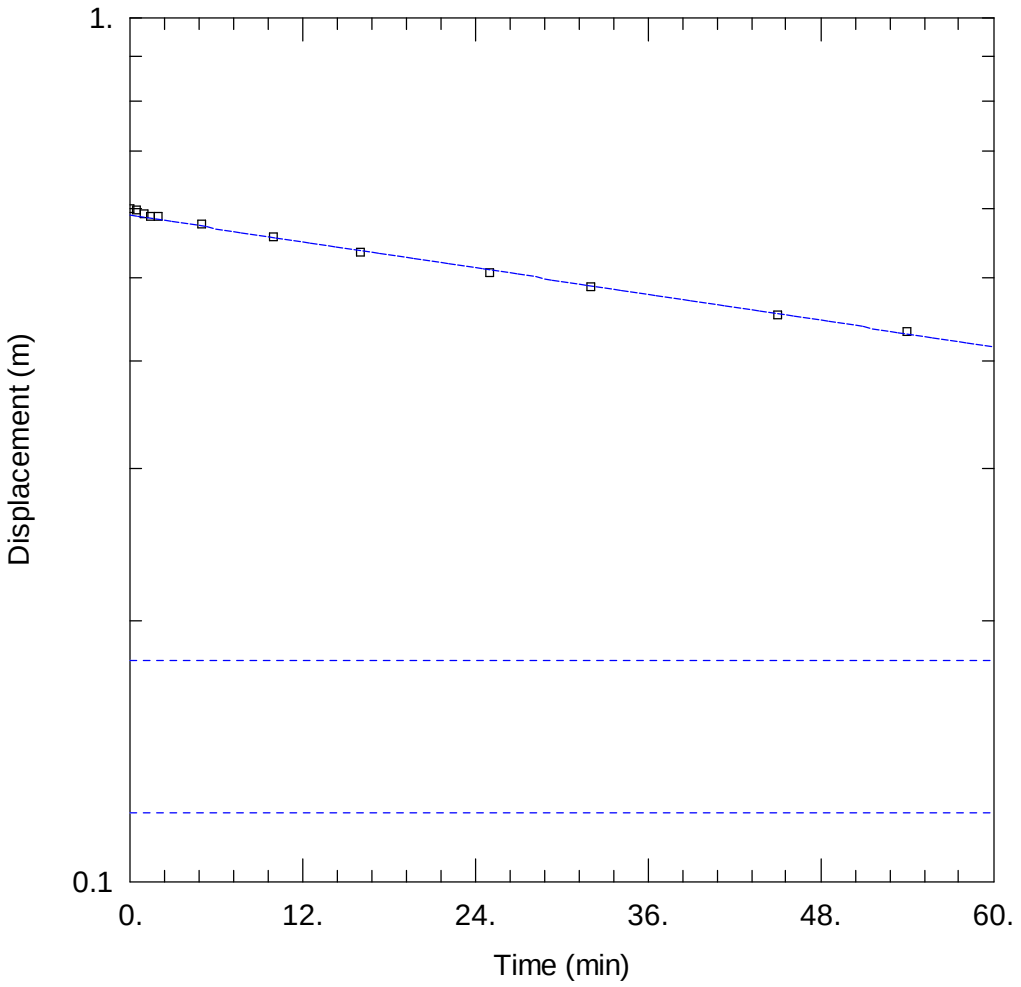
Saturated Thickness: 10. m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (22-11)

Initial Displacement: 3.23 m
Total Well Penetration Depth: 13.4 m
Casing Radius: 0.025 m
Static Water Column Height: 4.04 m
Screen Length: 3. m
Well Radius: 0.075 m
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 8.082E-9 m/sec
y0 = 3.233 m



WELL TEST ANALYSIS

Data Set: C:\Users\DDillon\Downloads\Meaford 22-12.aqt
Date: 05/24/22 Time: 11:54:10

PROJECT INFORMATION

Company: Golder Associates
Location: Hwy 26 Meaford
Test Well: BH22-12
Test Date: 19-Apr-22

AQUIFER DATA

Saturated Thickness: 15. m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (22-12)

Initial Displacement: 0.6 m
Total Well Penetration Depth: 1.79 m
Casing Radius: 0.025 m
Static Water Column Height: 1.79 m
Screen Length: 1.79 m
Well Radius: 0.075 m
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 1.11E-7 m/sec y0 = 0.5898 m

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