

**HYDROGEOLOGY INVESTIGATION
REPORT**

**UPPER WEST SIDE
COMMUNITY**

CITY OF HAMILTON

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Rev. 0	September 15, 2023	Issued DRAFT report for external coordination.
Rev. 1	November 2, 2023	Issued DRAFT report for coordination with updated results.
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1.0 Background

C.F. Crozier & Associates Inc. (Crozier) has been retained by the Upper West Side Landowners Group to prepare a comprehensive Hydrogeological Investigation Report to support the development of the Secondary Plan area for the proposed urban neighbourhood known as the Upper West Side Community. The subject lands (herein referred to as the Study Area) are located in the Twenty Road West Urban Expansion Area and portions of the Airport Employment Growth (AEGD) Secondary Plan Area according to the Urban Hamilton Official Plan.

The hydrogeological report has been prepared to support the establishment of a Secondary Plan for the Upper West Side Community area. The scope of this report was designed to meet the relevant City of Hamilton (City) and Niagara Peninsula Conservation Authority (NPCA) criteria. The scope of work for this report is outlined within the Terms of Reference prepared and submitted to the City for comment on July 2023. A copy of the Terms of Reference has been included as Appendix A.

1.1 Site Situation

The Study Area is located within the southwestern district of Glanbrook within the City of Hamilton and covers a total area of approximately 264.75 ha. The Study Area, known as the Upper West Side (UWS) Community lands is located between Twenty Road West to the north, Upper James Street to the east, Dickenson Road West to the south and Glancaster Road to the west (Figure 1). The Study Area is comprised of multiple land parcels—555 Glancaster Road, 9285, 9445, 9511, 9575 and 9751 Twenty Road West and 2060 Upper James Street.

The UWS Community lands currently consist of agricultural lands, natural features, single family homes and the former Glancaster Golf and Country Club. The Study Area is currently zoned as Agriculture (A1), Rural (A2), Open Space (P4) and Conservation/Hazard Land (P5) according to the City of Hamilton Official Plan.

Tributaries of Twenty Mile Creek flow across the Study Area northwards towards the Upper Twenty Mile Creek Wetland Complex and ultimately outlet at Lake Ontario, east of Lincoln (NPCA, 2006). Twenty Mile Creek flows parallel to the escarpment, approximately 360 m from the Site. Shallow ponds and wetlands are located within the Study Area. The entire lands surrounding Twenty Mile Creek have been designated as provincially significant wetland by the Ministry of Natural Resources. The locations of surface water features within and around the Study Area lands on Figures 1 and 2.

1.2 Proposed Development

According to the Upper West Side Secondary Plan, Land Use Plan prepared by (Corbett Land Strategies, October 2023), residential, mixed use, institutional development, parks, open space and stormwater management facilities are planned for the Study Area. Table 1 outlines the areas for each planned development type.

Table 1: Upper West Side Community Land Use Areas

Land Use Designation	Area (ha)
Low Density Residential 1	3.12
Low Density Residential 2	6.50
Medium Density Residential	84.64
High Density Residential	6.08
Community Parks	7.98
Neighbourhood Parks	2.39
Natural Open Space	103.44
Mixed Use	12.82
Institutional Use	6.11
Compensation Areas	2.98
Utility Use	6.46
Major Roads	42.00
Schools	4.51
Employment	105.71

For further information on the proposed land uses, please refer to the Planning Justification Report (under separate cover) prepared by Corbett.

1.3 Previous Studies

Several studies were conducted on the property to characterize existing conditions and to support previous planning applications conducted for the Study Area. Crozier has completed a detailed review of the background documents and a summary is provided in Table 2. The contents of each report have been considered while preparing this report.

Table 2: Summary of Background Reports for Upper West Side

Report Title & Author	Scope/Purpose	Major Findings Relating to Hydrogeology
Preliminary Hydrogeological Investigation (EXP, July 2018)	This report was prepared to examine the local hydrogeological settings, determine preliminary construction dewatering and existing groundwater quality.	<ul style="list-style-type: none"> -A total of 22 monitoring wells were installed on the property—five (5) nested pairs (6 meters below ground surface (mbgs) and 12 mbgs), four (4) intermediate wells (8 mbgs) and eight (8) shallow wells (6 mbgs). -The soils noted on the subject lands include topsoil, fill, silt to sand, and silty clay in stratigraphic order. -Hydraulic conductivity testing was conducted across the subject lands range from 1.4×10^{-5} m/s to 9.3×10^{-8} m/s. The geometric mean hydraulic conductivity for the coarser materials on the subject lands was determined to be 3.8×10^{-6} m/s and fine materials was determined to be 7.8×10^{-8} m/s. -Groundwater elevations within the shallow wells ranged from 221.36 masl to 234.96 masl and 221.26 masl to 237.15 masl within the intermediate/deep wells in June 2018. Artesian conditions were noted up to 2.8 mbgs at some monitoring locations. -Additional monitoring was recommended.
Preliminary Geotechnical Investigation (EXP, June 2018)	This investigation was undertaken to provide geotechnical recommendations pertinent to the former proposed Garth Industrial Subdivision, located in the centre of the Upper West Side Study Area.	<ul style="list-style-type: none"> -33 boreholes were advanced for geotechnical purposes across the site. -Depth to bedrock is estimated to be 30 mbgs in the area of the site. -The soils encountered during drilling was topsoil, silty clay fill, silt to sand and silty clay in stratigraphic order. -Shallow excavations not exceeding 3 mbgs are not expected to encounter significant groundwater. -A groundwater drainage system and a clay liner are recommended for stormwater management ponds proposed in the area of artesian conditions. To prevent uplift, the groundwater table should be lowered 0.5 m below the base of the pond level.

2.0 Existing Conditions

The following sections below outline the existing conditions of the Study Area based on literature review and field observations.

2.1 Physiography, Drainage & Topography

Regional topography is characterised as rolling with steep slopes at the flank of the Niagara Escarpment to gentle rolling and flat towards Lake Ontario (NPCA, 2006). As shown in Figure 3, topography of the Study Area ranges from approximately 242 masl in the west to 218 masl in the east at Twenty Mile Creek. The Study Area is located within the Twenty Mile Creek Watershed, in the Upper Twenty Mile Creek Subwatershed (NPCA, 2006). Surface water drainage appears to be from southwest-west to northeast-east across the Study Area, following topography.

Ontario Geological Survey (OGS) mapping indicates that the Study Area is located within the physiographic region known as the Haldimand Clay Plain (Figure 4). Located between the Niagara Escarpment and Lake Erie, the Haldimand Clay Plain is primarily comprised of clay-rich and poorly drained soils deposited in the deep-water stages of Glacial Lakes Whittlesey and Warren (Chapman and Putnam, 1984).

2.2 Regional Geology

The Study Area sits atop a bedrock basement of the Guelph Formation. The Guelph Formation is characterized by tan or buff coloured, massive bedded dolostone. Karstification is possible in areas of thin cover or exposed bedrock due to the carbonate origin of the bedrock. Based on Ministry of Natural Resources and Forestry (MNRF) mapping and local well records, the depth to bedrock is estimated to be approximately 30 mbgs or at an elevation of approximately 212 masl to 188 masl.

Regional surficial geology consists primarily of fine-textured glaciolacustrine deposits comprised of silt, clay, and minor sand and gravel. These soils are representative of the Beverly Silt Loam and Brantford Silt Loam soil groups. These soils are imperfectly drained, slowly permeable soils with a medium to high water-holding capacity and a rapid surface runoff. The area is interspersed with sandy sediments in the headwaters area and loamy sediments over clay soils (NPCA, 2006).

The bedrock and surficial geology of the Study Area are displayed in Figures 4 and 5, respectively.

2.3 Local Geology

Detailed subsurface investigation has been conducted within the Study Area throughout the project timeline. Previously, collaborative hydrogeological and geotechnical investigations were conducted for the Study Area to support a previous development application with the City of Hamilton. The scope of both investigations included the advancement of a number of boreholes across the subject lands and the installation of a number of monitoring wells to investigate the subsurface conditions.

A total of 22 monitoring wells were installed as part of the previous hydrogeological investigation and 33 boreholes were advanced as part of the geotechnical investigation in Spring 2018. In general, the following soils were encountered in stratigraphic order:

- 0 – 0.17 m: topsoil
- 0.17 – 0.60 m: brown, moist, silty clay fill

- 0.60 – 10.0 m: brown, moist to wet, silt to silty sand; grey encountered between 3 and 5 mbgs
- 0.60 – 11.0 m: brown to grey, moist to wet, silty clay, trace sand and gravel

Monitoring wells/boreholes installed within the southern portion of the Study Area (BH/MW29-S, BH/MW29-D, BH/MW30-S, BH/MW30-D, BH/MW11, BH/MW33-S and BH/MW33-D, BH/MW10, BH/MW31-S and BH/MW31-D) encountered silty clay material at a higher elevation than the remaining wells and the unit below the silty clay was observed to be sandy and under slight pressure (EXP, 2018). Detailed borehole logs prepared by EXP have been appended to this report in Appendix B.

To supplement the existing monitoring well network, an additional four (4) boreholes and twelve (12) monitoring wells were advanced across the Study Area as part of this Hydrogeological Investigation (see Appendix A). Similar strata to previous investigations were encountered during drilling and additional borehole logs have been provided in Appendix B2.

It should be noted that the Study Area is identified as an area of potential karst according to OGS mapping, based upon the bedrock type. Through field investigation, no bedrock outcrops were encountered. Over 33 boreholes were drilled with depths up to 12.7 mbgs of overburden material. Based upon the field investigation, karstic features are not presumed to be present across the Study Area. A karst letter was previously completed by EXP. in 2019. The karst letter is attached as Appendix C.

2.4 Surface Water Features

There are nine (9) identified tributaries within the Study Area according to environmental surveys conducted by NRSI and GeoMorphix staff as part of the EIS and from field observations by Crozier staff. The tributaries are interpreted to flow east towards the main branch of Twenty Mile Creek, located just outside the Study Area boundary. The Study Area is located approximately 8.2 km southwest of the Lake Ontario shoreline. Surface water features are shown on Figures 1 and 2.

2.5 Source Protection Information

According to the MECP Source Protection Information Atlas, the Study Area is located within the Niagara Peninsula Source Protection Area and is therefore governed by the policies outlined within the Approved Source Protection Plan for the Niagara Peninsula Source Protection Area.

The Study Area is located within a Significant Groundwater Recharge Area (SGRA) and atop a Highly Vulnerable Aquifer (HVA). Within an SGRA, the rate of annual recharge to the underlying water supply aquifer is greater than the surrounding area. Across the Study Area the vulnerability score ranges from 4 to 6 within the SGRA. The HVA below the Study Area is noted to have a vulnerability score of 6. No significant drinking water threats and source protection policies related to the HVA and SGRA are identified for the Study Area under the Clean Drinking Water Act 2006.

Despite no *significant* drinking water threats being identified for the Study Area, a number of low to moderate drinking water threats are identified for the future use of the property, including the following:

- 1) Use of stormwater management facilities
- 2) Application, handling and storage of road salt
- 3) Storage of snow
- 4) An activity that reduces the recharge of an aquifer.

Best management strategies should be employed such that the prescribed low to moderate drinking water threats above will not become significant drinking water threats in the future.

2.6 Hydrogeology

The following sections below detail the existing hydrogeological conditions of the Upper West Side Community area based on regional studies, local studies and relevant background information.

2.6.1 MECP Well Records

According to the MECP Well Records Database, there are 130 identified well records within 500 m of the Study Area boundary. A summary table of the well records has been appended to this report as Appendix D.

In general, the following can be concluded from the identified well records:

- In stratigraphic order, topsoil, clay, sand/silt and limestone was encountered in most wells.
- The majority of the records indicated that the wells were installed for domestic purposes, reportedly producing between 10 liters per minute (LPM) to 30 LPM.
- Two identified domestic supply aquifers were noted—the dolostone/limestone bedrock located approximately 30 mbgs and the overburden sandy silt to sand aquifer located approximately 20 mbgs.

Figure 6 shows the spatial distribution of all the identified well records within 500 m of the Study Area boundary.

2.6.2 Groundwater Properties

Regional shallow and deep groundwater flow direction is interpreted to follow surface and bedrock topography and flow northeast/east towards Lake Ontario. NPCA mapping indicates that along the tributaries within the Study Area boundary, groundwater discharge is observed. Local studies indicate that baseflow within the tributaries is low throughout the summer and visible water flow within the Study Area is minimal.

2.6.3 Aquifer Properties

According to the Niagara Peninsula Source Protection Area Assessment Report (NPCA, 2013), there are four (4) primary types of aquifers within the area: surficial overburden, the Guelph Formation, the Onondaga/Bois Blanc Formations and the contact zone aquifer. The hydrostratigraphy of the source protection area is summarized in Table 3 below.

Table 3: Hydrostratigraphy of the Hamilton Area

Age	Name	Function	Material	Supply
1 - Youngest	Recent Quaternary Sediments	Aquifer	Sand, silt	Local domestic
2	Beverly Silt Loam, Brantford Silt Loam	Aquitard	Silts, clays	
3	Contact Zone	Aquifer	Weathered dolostone, limestone	
4	Onondaga/Bois Blanc Formation	Aquifer	Limestone, dolostone	Local domestic
5	Salina Formation	Aquifer	Dolostone, shale	Local domestic
6	Guelph Formation	Aquifer	Dolostone	City of Hamilton
7	Cataract Group	Aquitard	Sandstone, shale	
8 - Oldest	Queenston Formation	Aquitard	shale	

Sands and gravels of recent glacial events form the overburden aquifer across the Hamilton Area. Thicker deposits are found near buried bedrock valleys such as the Dundas Valley, that stretches from northwest of Stratford to the Hamilton harbour (NPCA, 2009). Major bedrock groundwater resources for water supply are held within the dolostones and limestones of the Onondaga, Bois Blanc, Salina and Guelph Formations. Karst topography is common within the Salina Formation due to groundwater dissolution of the dolostones. Karstification causes significant groundwater recharge within stream beds above the escarpment.

Groundwater quality within the Hamilton Area has been reported in multiple studies undertaken by the City of Hamilton. According to the Hamilton Rural Well Water Quality Report from 2017, exceedances of the Ontario Drinking Water Quality Standards (ODWQS) for arsenic, barium, fluoride, lead, nitrates and sodium have been observed in the past. All exceeding parameters are noted to be naturally occurring in the area based on the chemical composition of the bedrock. Nitrates are common in groundwater in areas where septic systems are used and in agricultural areas. Local groundwater quality within the Study Area is discussed within Section 4.4.

3.0 Field Methodology

3.1 Site Reconnaissance

A preliminary site reconnaissance visit was conducted to investigate the location of and the status of the existing monitoring wells that were installed in 2018 under the supervision of a previous engineering consultant. Of the 22 monitoring wells installed, 21 were located and 1 was identified to be damaged (Figure 7)

During additional site visits conducted by Crozier in September 2023, five (5) additional monitoring wells were discovered on the 555 Glancaster Road property. No further details of these wells have been disclosed to the Crozier team.

3.2 Monitoring Well Installation

The 2023 drilling program was conducted from September 6 to September 15, 2023 with the installation of fourteen (14) boreholes across the Study Area, twelve (12) of which were converted to monitoring wells to supplement the existing monitoring well network (Figure 8). All wells were constructed with 2-inch Schedule 40 PVC pipe and completed with monument well casing. Screen depths and total depths of each of the wells were determined in the field based on soils encountered and target unit identified.

Table 4 below outlines the construction details of the 2023 monitoring wells and monitoring wells logs are provided in Appendix B2.

Table 4: 2023 Monitoring Well Construction Details

Monitoring Well ID	Depth (mbgs)	Estimated Ground Elevation (masl)	Stick up Height (m)	Screened Interval (mbgs)	Screened Material
MW23-1	7.01	239.90	1.08	3.96-7.01	silt
MW23-2	7.01	242.80	1.00	3.96-7.01	silt
MW23-3	7.62	250.10	1.12	4.57-7.62	silt
MW23-4	5.48	240.08	1.05	2.43-5.48	silt
MW23-5	8.23	233.13	1.03	5.18-8.23	silt
MW23-6	9.10	235.93	1.05	6.05-9.10	silt-silty sand
MW23-7	9.10	229.33	1.12	6.05-9.10	silt-silty sand
MW23-8	5.48	226.24	1.05	2.43-5.48	silt
MW23-9	5.18	225.00	1.12	2.13-5.18	silty clay
MW23-10	6.10	233.83	1.07	3.05-6.10	silt
MW23-11	6.71	237.03	1.08	3.66-6.71	sand
MW23-12	6.10	232.69	0.98	3.05-6.10	silt

Best efforts were made during monitoring well installation to isolate the target unit from any coarse material above the well screen through the placement of the sand pack. In general, the majority of monitoring wells were installed within a silt to silty sand unit. Further details are presented in Section 4.0.

3.3 Groundwater Monitoring

Manual groundwater measurements will continue for a minimum of one (1) year in order to capture the spring freshet and seasonal fluctuations. Manual measurements collected at the monitoring

wells will supplement the existing data collected by others in 2018 and by Crozier staff collected in late Summer 2023. Automatic level loggers have been placed in select monitoring and have been set to collect water levels on an hourly basis. Additional loggers were installed within the 2023 monitoring wells in Fall 2023. A hydrograph representing groundwater levels across the Study Area are attached as Appendix E.

3.4 Door-to-Door Survey

A door-to-door survey was conducted by Crozier Staff on September 8, 2023 to confirm the location of and details of nearby water supply wells and septic systems within and around the Study Area. A questionnaire was used to address the following information about the wells and septic systems on the adjacent properties:

- Property address
- Existence of a well, septic system and/or cistern on the property
- Well use, age, depth
- History of water quantity and quality

A copy of the questionnaire and obtained responses are included in Appendix F. Figure 9 presents the addresses visited during the door-to-door survey. Results are summarized in Section 4.2 below.

3.5 Groundwater Quality Sampling

Groundwater quality sampling was conducted in October 2023 within the Study Area. One (1) representative water quality sample was obtained from monitoring well MW23-1 using standard hand purging methods. Three (3) well volumes were removed prior to obtaining the sample and water was observed for general clarity and colour prior to bottling the sample. The sample was sent to a licensed third-party laboratory, ALS Canada Ltd. for analysis and resulting concentrations were compared to the City of Hamilton Sewer Use By-Law. Results and discussion of groundwater quality within the Study Area is presented in Section 4.0 and Appendix G.

3.6 Surface Water Monitors Installation

Shallow piezometers were installed across the Study Area to investigate the interaction between groundwater and surface water features within the properties. A total of fifteen (15) piezometers were driven by hand across the Study Area as shown in Figure 8. Installation details are presented in Appendix H1.

4.0 Results

The following sections outline the results of the investigation at the time of this report. Note that groundwater monitoring is ongoing and this report will be updated as additional results are obtained.

4.1 Groundwater Levels

Groundwater levels collected by EXP and Crozier to date are provided in Appendix H1. In general, groundwater levels have ranged from 0.27 mbgs to -2.82 meters above ground surface (mags) or 239.40 masl to 221.54 masl. Groundwater flow is interpreted to flow from BH/MW1 in the west to

BH/MW7 in the east. Artesian conditions have been noted at MW12, MW13, MW29-S, MW29-D, MW30-D, and MW31-D.

From the existing borehole logs and field observations collected thus far, it is interpreted that shallow groundwater is semi-confined through the Study Area. The water bearing unit is interpreted to be a shallow silty sand to sandy silt unit located at an elevation of approximately 228 – 227 masl to 219 masl in the west and from 220 masl to 213 masl. A layer varying in thickness of silty clay and silt is interpreted to partially confine the water bearing unit below, driving artesian conditions observed in the monitoring wells that intercept the sandy silt/silty sand unit.

Wells installed within the silty clay and silt unit have recorded water levels at the top of unit at approximately 231.50 masl. Water levels within this unit are interpreted to be unconfined within the Study Area and the unit is anticipated to respond to seasonal fluctuation.

4.2 Door-to-Door Survey Results

At the time of this report, twelve (12) responses have been received from the door-to-door survey. A detailed table of the survey is appended to this report in Appendix F.

In general, most properties have a private water supply wells near the Study Area, along Glancaster and Dickenson roads and some use their wells for drinking water. Some property owners rely on cistern to supply water to their homes or as additional water supply. Some homeowners or tenants have noted high levels of sulphur and iron in their water and quantity issues in the past. No noted bacteriological issues were reported by homeowners or tenants.

Each property is noted to be serviced by private onsite sewage systems. The majority of the onsite sewage systems are in the backyards or side yards and are older than 20 years.

4.3 Surface Water Levels

Surface water levels were collected at the time of piezometer install in October 2023 and are provided in Appendix H2. In general, shallow groundwater levels were measured to be lower than the surface water levels outside of the pipe, suggesting that the majority of surface water features are operating as a groundwater recharge area across the Study Area. Note that surface water monitoring is ongoing and this interpretation is preliminary.

4.4 Groundwater Quality

Details laboratory results are provided in Appendix G. Four (4) exceedances of the Hamilton Sewer Use By-Law were noted: total suspended solids, total aluminum, total iron and total manganese. The significant presence of total suspended solids within the groundwater sample is not uncommon for the method of sampling described in Section 3.5 above. Hand purging the well prior to sampling stirs sediments that may have been collected within the base of the monitoring well and pulls additional fines through the screen during sampling. The elevated concentration of metals such as aluminum, iron and manganese are interpreted to be naturally occurring due to the composition of the overburden glacial materials and the underlying bedrock.

Exceedances of the Hamilton Sewer Use By-Law indicate that any future groundwater discharge from the Study Area for dewatering purposes must be treated or filtered prior to discharging to the City sewer system. Note that dewatering treatment methods or discharge plans are beyond the scope of this report.

5.0 Design Considerations

Sections 5.1 and 5.2 below outline preliminary design considerations for the proposed development. Note that design parameters should be reevaluated following the spring freshet.

5.1 Groundwater Conditions

As described in Section 4.1, groundwater levels have ranged from from 0.27 mbgs to -2.82 meters above ground surface (mags) or 239.40 masl to 221.54 masl. Given that the shallow aquifer is interpreted to be semi-confined in nature, some response to seasonal change and to precipitation is expected to occur. It is anticipated that short-term dewatering during construction for the purposes of excavation and that long-term dewatering may be required for any structure permanently completed at an elevation below the measured groundwater table. It is recommended that detailed dewatering assessment be undertaken at the Site Plan stage of each development within the Study Area.

At the time of this report, it is understood that five (5) stormwater management facilities (SMF) will be constructed on site (see Servicing and Stormwater Management Report prepared by Urbantech, submitted under separate cover). If the proposed SMF are to intercept the measured groundwater table, groundwater control methods or design elements may be required to mitigate groundwater discharge into the facility. Seasonally high groundwater conditions will be provided following the Spring freshet for design purposes following Spring 2024.

5.2 Dewatering Considerations

If proposed building footings or SWF are to be extended below the reported seasonally high groundwater conditions, it can be expected that short-term and/or long-term groundwater dewatering will be required. If construction volumes are expected to fall between 50,000 L/day and 400,000 L/day registration with the MECP Environmental Activity Sector Register is required. If construction dewatering volumes are to exceed 400,000 L/day, a Permit to Take Water will be required. Similarly, if daily permanent dewatering volumes are to exceed 50,000 L/day post-construction, an additional Permit to Take Water will be required for the groundwater discharge. Local permitting will also likely be required prior to any groundwater discharge.

Groundwater dewatering volumes should be evaluated once final footings for the proposed buildings are determined.

6.0 Conclusions & Recommendations

At the time of this report, Crozier is prepared to make the following conclusions and recommendations:

- The soils of Study Area are primarily fill, silty clay to silt and silty sand to sandy silt in stratigraphic order. The Study Area sits atop a bedrock basement of dolostone and limestone, interpreted to be encountered at a depth of approximately 30 mbgs.
- Groundwater levels have been observed to be 0.27 mbgs to – 2.82 mags or at elevations of 236.90 to 221.54 masl. Groundwater is interpreted to flow from west to east across the Study Area. Groundwater monitoring is ongoing across the Study Area.

- Artesian conditions have been recorded on the properties within the monitoring wells screened within a confined water bearing, sandy silt to silty sand unit.
- The silty clay to silt unit above the water bearing unit is interpreted to be discontinuous across the Study Area.
- Exceedances of the City of Hamilton Sewer Use By-Law for total suspended solids, iron, aluminum and manganese were reported. Treatment and/or filtration will be required to meet the City of Hamilton standards if short-term or long-term groundwater discharge to the City sewer system is required.
- Due to the high groundwater levels recorded to date and artesian conditions, it is anticipated that active construction dewatering and long-term dewatering will be required if excavations are to extend below an elevation of 228-227 masl in the west area of the Study Area and 220 masl in the east. Dewatering volumes should be evaluated once final floor elevations are determined for the proposed developments planned.
- This report and its findings are advised to be preliminary and should not be used for final design purposes.

Respectfully submitted,

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APPENDIX A

Terms of Reference

JULY 19, 2023

PROJECT NO: 2521-6807

**SENT VIA: EMAIL
C/O CANDICE HOOD
CANDICE@CORBETTLANDSTRATEGIES.CA**

Development Engineering
City of Hamilton
71 Main Street W
Hamilton, Ontario
L8P 4Y5

**Attention: Tu Vu, P.Eng.
Project Manager – Development Engineering Approvals**

**RE: CITY OF HAMILTON FILE NO: FC – 23-049
TERMS OF REFERENCE – HYDROGEOLOGY REPORT
UPPER WEST SIDE COMMUNITY
555 GLANCASTER ROAD, 9285, 9445, 9511, 9625, 9751 9575 TWENTY ROAD W &
2060 UPPER JAMES STREET
GLANBROOK, ONTARIO**

Dear Tu,

C.F. Crozier & Associates Inc. (Crozier) has been retained to provide Hydrogeological Services to support the development applications for the proposed Upper West Side Community located at 555 Glancaster Road, 9285, 9445, 9511, 9625, 9575 and 9751 Twenty Road West and portions of 2060 Upper James Street in the Glanbrook district of Hamilton, Ontario. Crozier has prepared this Terms of Reference for the Hydrogeology Investigation and Report to support the applications with the City of Hamilton (City). The following Terms of Reference has been completed in reference to the Formal Consultation Document dated April 26, 2023 and the City of Hamilton's Guidelines for Hydrogeological Studies and Technical Standards for Private Services (Hamilton Water, February 2023).

The following sections below outline background information about the subject property (herein referred to as the Site) and our proposed workplan.

Background

The Site covers a total area of approximately 222.23 ha and is defined as the lands located between Twenty Road West to the north, Upper James Street to the east, Dickenson Road West to the south and Glancaster Road to the west. Known as the Upper West Side Community lands, the Site is comprised of multiple land parcels at 555 Glancaster Road, 9285, 9445, 9511, 9575 and 9751 Twenty Road West and 2060 Upper James Street in the Glanbrook district of Hamilton. The Site is located within the Twenty Road West Urban Expansion Area and portion of the Airport Employment Growth District Secondary Plan area.

The Upper West Side Community lands are currently comprised of agricultural lands, natural features, single family homes and the former Glancaster Golf and Country Club. The proposed

Upper West Side Community will include low, medium, and high density residential, parkland, commercial space, mixed use buildings, institutional buildings, Airport Prestige Business and Airport Light Business areas, stormwater infrastructure and designated natural heritage space according to the Secondary Plan Land Use Plan.

As part of previous development applications with the City, a comprehensive Hydrogeological Investigation was completed for the Upper West Side Community Lands by a previous consultant in July 2018. The previous investigation included the implementation of a large monitoring well network, conduction of groundwater monitoring, and analysis of groundwater regime. Only measurements in June 2018 were collected and no continuous groundwater monitoring methods appeared to be used. Comments were issued by the Niagara Peninsula Conservation Authority and the City on the previous investigation and are summarized below:

- A door-to-door well survey must be completed to locate and confirm the details of water supply wells in the area around the Site to assess the potential impact of dewatering on local groundwater users.
- Additional groundwater monitoring is required to characterize seasonally high groundwater conditions and determining groundwater dewatering requirements. Previous groundwater monitoring revealed potential artesian conditions in the south portion of the site. Further groundwater investigation should be conducted to further understand the artesian conditions.
- Further investigation into potential dewatering requirements should be completed.

In addition to developing a workplan to respond to the comments from the City and the NPCA, the existing monitoring network will need to be expanded to include two (2) additional land parcel located at the northeast corner of the study area and the other, representing a new participating landowner—that was not previously included in the Hydrogeological Investigation.

The following sections describe the proposed workplan to prepare a detailed and comprehensive Hydrogeological Investigation report to characterize the hydrogeological driven constraints on the development and assess the potential impacts of dewatering for construction and permanent dewatering. The report will also investigate that the proposed development will not have any adverse effects on the groundwater and/or surface water resources within the area around the Site.

Proposed Workplan

Task 1: Physical Setting Review

In order to characterize the local geological and hydrogeological regime, Crozier will:

- Review all existing background reports and studies completed for the Site and surrounding areas.
- Review local geological studies, watershed studies and environmental studies for the Site and surrounding area.

- Complete one (1) site reconnaissance to examine and confirm the existing site conditions and the condition of the existing monitoring wells on the Site. We have assumed that the 2018 monitoring wells are in good condition and can be used for future groundwater investigation. If wells are deemed to be unusable or damaged, wells will be repaired to their original condition or replaced with a monitoring well within the same area. During the site reconnaissance, additional monitoring well locations will be scoped to gather additional groundwater information within the areas of the proposed Stormwater Infrastructure, the additional landowner lands in the northeast and any additional areas where additional hydrogeological information would be vital to the analysis.

Task 2: Supplemental Monitoring Well Construction

To supplement the existing monitoring well network, Crozier is proposing the installation of an additional 8 -12 monitoring wells within the additional 10 ha of land in the northeast corner of the Upper West Side Community Lands and the additional lands. The additional wells will be added to extend the monitoring network across the new lands and to investigate any additional features that should be investigated such as the proposed Stormwater Infrastructure and around natural features.

Shallow piezometers will be installed within the natural watercourses and ponds on the Site to investigate the vertical groundwater gradient and characterize the shallow groundwater-surface water interaction. Note that locations and number of piezometers will be determined in Task 1 and preliminary locations are attached to these terms of reference. Locations are subject to change following revisions to the stormwater management ponds and design locations.

Task 3: Groundwater Monitoring, Sampling & Testing

Concurrently with Tasks 1 & Task 2, Crozier will install a number of automatic water level recording devices within selected existing and new monitoring wells on the property to continuously capture water levels. The automatic measurements captured will supplement the manual measurements collected at each well. Manual measurements will be collected on roughly a bi-monthly basis for a minimum of one (1) year in order to capture seasonally high groundwater conditions and automatic readings will occur on a hourly basis within selected wells.

In addition to the groundwater monitoring program, Crozier will collect additional shallow groundwater samples from select wells. Samples will be collected and submitted to an accredited analytical laboratory to establish baseline water quality and for comparison to previous groundwater sampling results. Results will also be compared and analyzed against the City's Sewer Use By-Law for groundwater discharge purposes.

During the field program, Crozier will complete a detailed door-to-door survey within the anticipated dewatering zone of influence. Crozier will survey home and business owners about their water supply well, water quality and quantity. Crozier will use best efforts to collect offsite water samples to compare to onsite water quality with the home/business owner's permission.

Task 4: Hydrogeological Investigation Report

Following the completion of the field program, Crozier will prepare a detailed, comprehensive Hydrogeological Investigation Report to support the proposed development applications. This report will characterize the hydrogeological regime and determine seasonally high groundwater elevations across the Site for design purposes. The report will discuss the findings of the field investigation and will discuss potential mitigation measures if required. Additionally, the report will include a site-wide water balance to support potential Low Impact Development Structure design, long-term and short-term dewatering volumes, dewatering permitting requirements and additional design constraints. The report will be complete with Geographical Information Systems (GIS) produced figures and all monitoring well construction logs and calculations.

We are looking forward to receiving your feedback on the proposed workplan. Should you have any questions or require any further information, please do not hesitate to contact the undersigned.

Sincerely,

C.F. CROZIER & ASSOCIATES INC.



Caitlyn MacPhee, EIT, GIT
Hydrogeology Intern

cm/dd

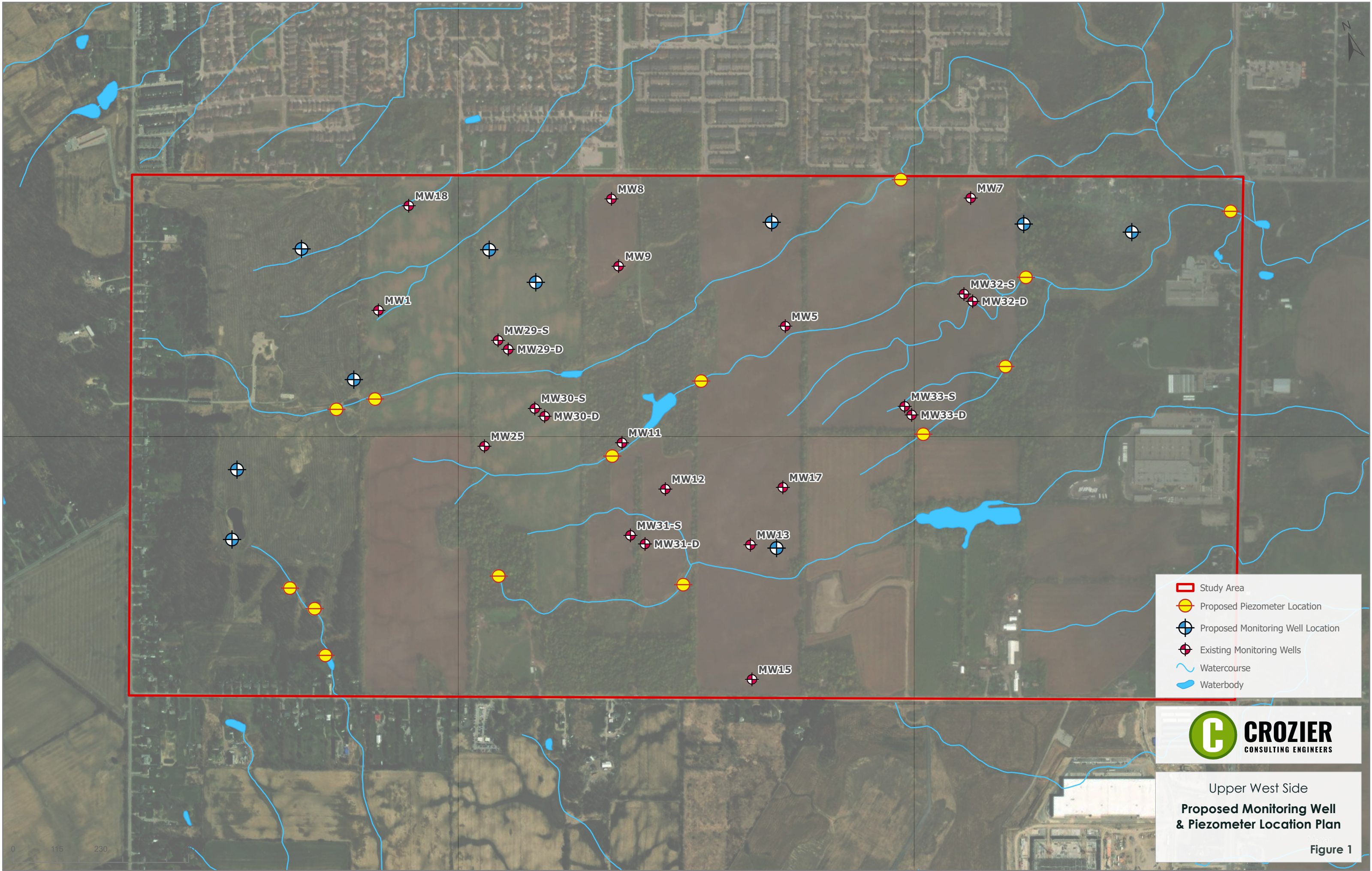
C.F. CROZIER & ASSOCIATES INC.



Chris Gerrits, M.Sc., P.Eng.
Senior Project Manager (Hydrogeology)

J:\2500\2521 - Upper West Side Land Owners Group Inc. co Corbett Land Strategies\6807 - Upper West Side Community - Hydrogeology\Letters\23.07.18_(2521-6807)_Terms of Reference Hydrogeology (UWS).docx

Attachment: Proposed Monitoring Well and Piezometer Locations



Upper West Side
**Proposed Monitoring Well
& Piezometer Location Plan**

Figure 1

APPENDIX B1

Borehole Logs (EXP 2018)

Log of Borehole BH-01

Project No. HAM-00801363-A0

Drawing No. 3

Project: Proposed Glenbrook Industrial Subdivision

Sheet No. 1 of 1

Location: Twenty Road West, Hamilton, ON

Date Drilled: March 27, 2018

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

Natural Moisture

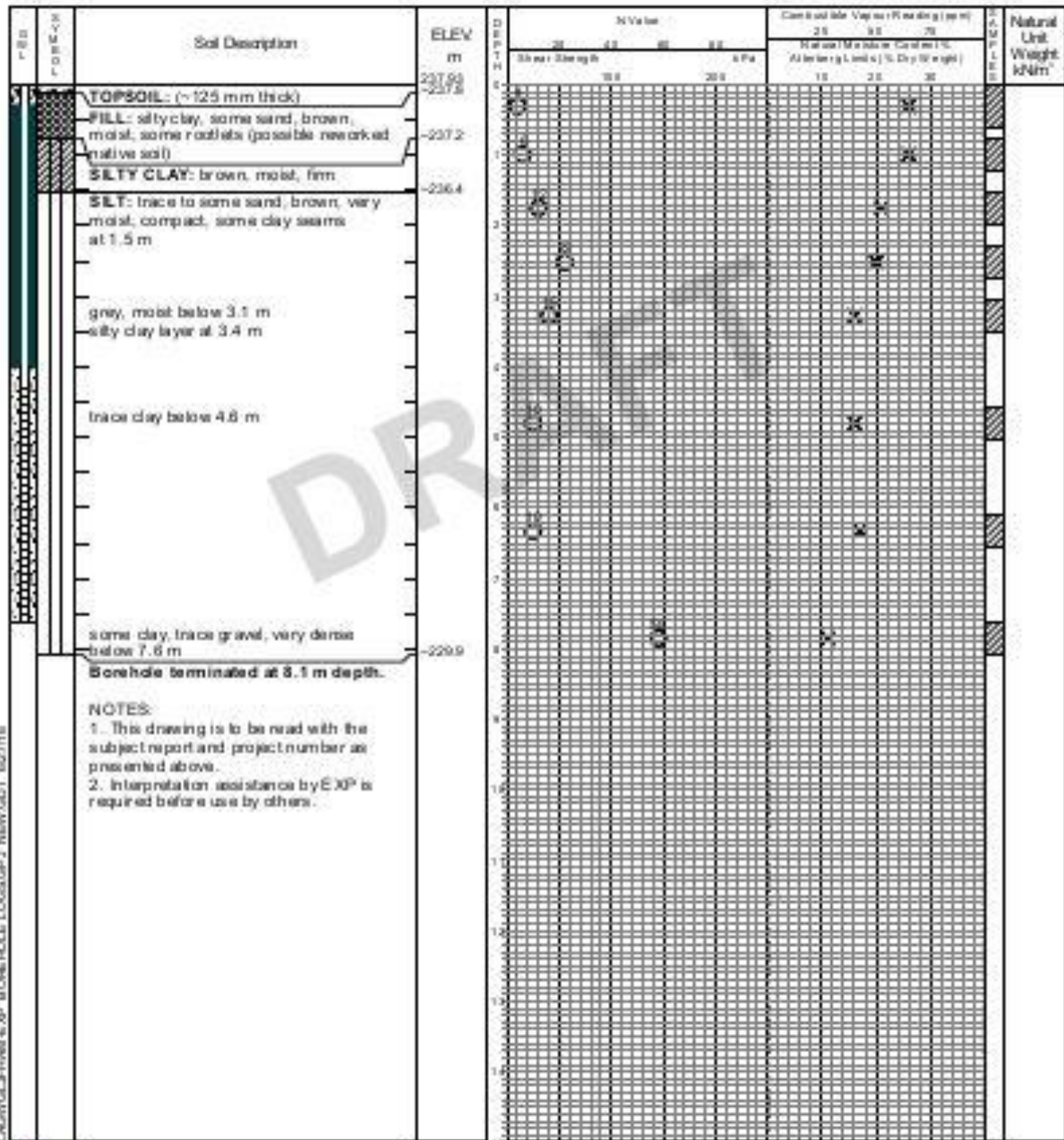
Plastic and Liquid Limit

Undrained Triaxial at

% Strain at Failure

Penetrometer

Datum: Geodetic



EOP Services Inc.
Hamilton, Ontario
Telephone: 905.573.4000
Facsimile: 905.573.9693

Time	Water Level (m)	Depth to Cave (m)
on completion June 5, 2018	5.22 bgs 0.78 bgs	no cave —

bgs (above ground surface)
bgs (below ground surface)

Log of Borehole BH-02

Project No.: HAM-00801363-A0

Drawing No. 4

Project: Proposed Glanbrook Industrial Subdivision

Sheet No. 1 of 1

Location: Twenty Road West, Hamilton, ON

Date Drilled: March 27, 2018

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

Natural Moisture

Plastic and Liquid Limit

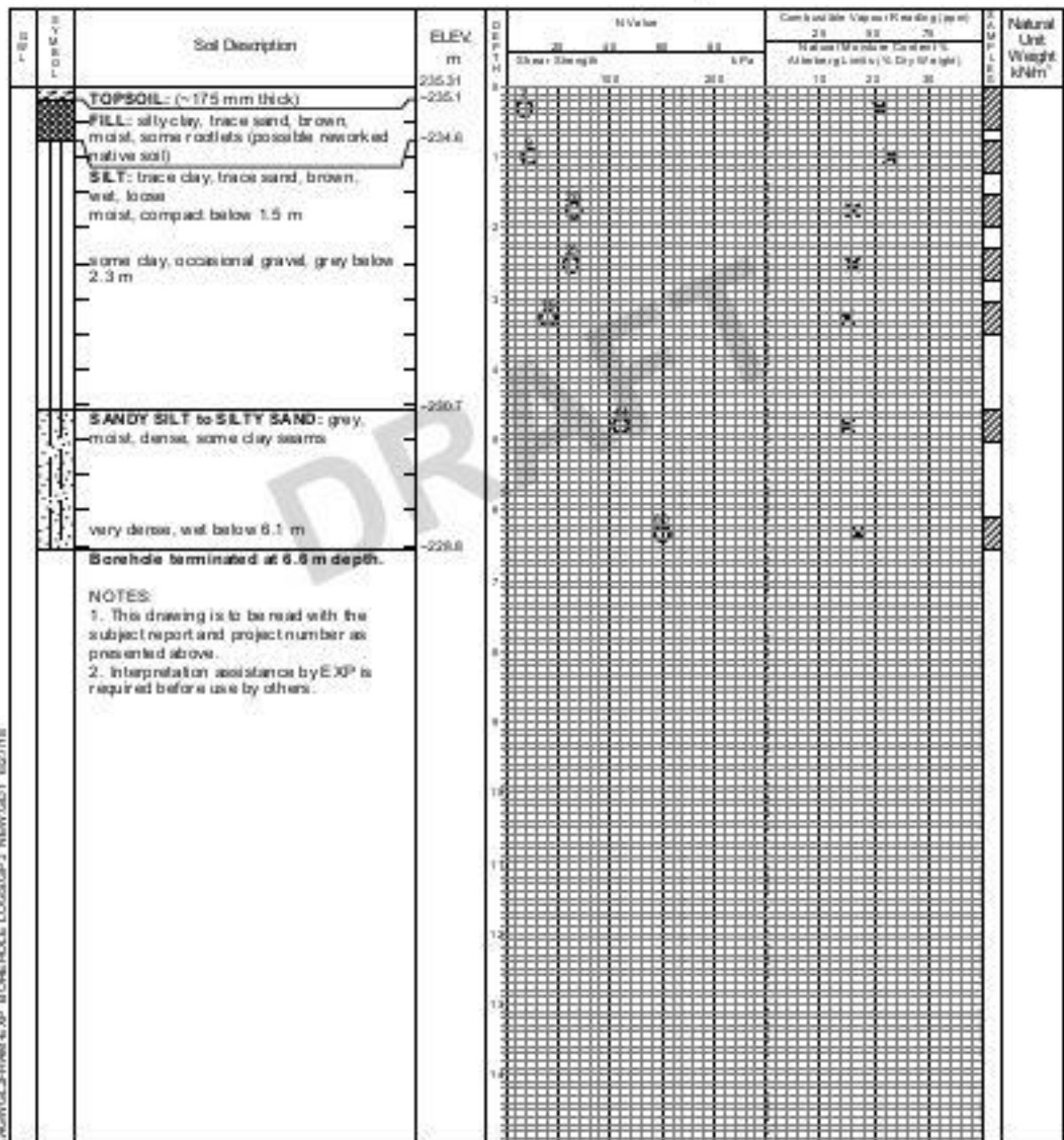
Undrained Triaxial at

% Strain at Failure

Penetration

Drill Type: D-50 Track Mount. Solid Stem.

Datum: Geodetic



EXP Services Inc.
Hamilton, Ontario
Telephone: 905.573.4000
Facsimile: 905.573.9893

Time	Water Level (m)	Depth to Cave (m)
on completion	5.83 bgs	no cave

ags (above ground surface)
bgs (below ground surface)

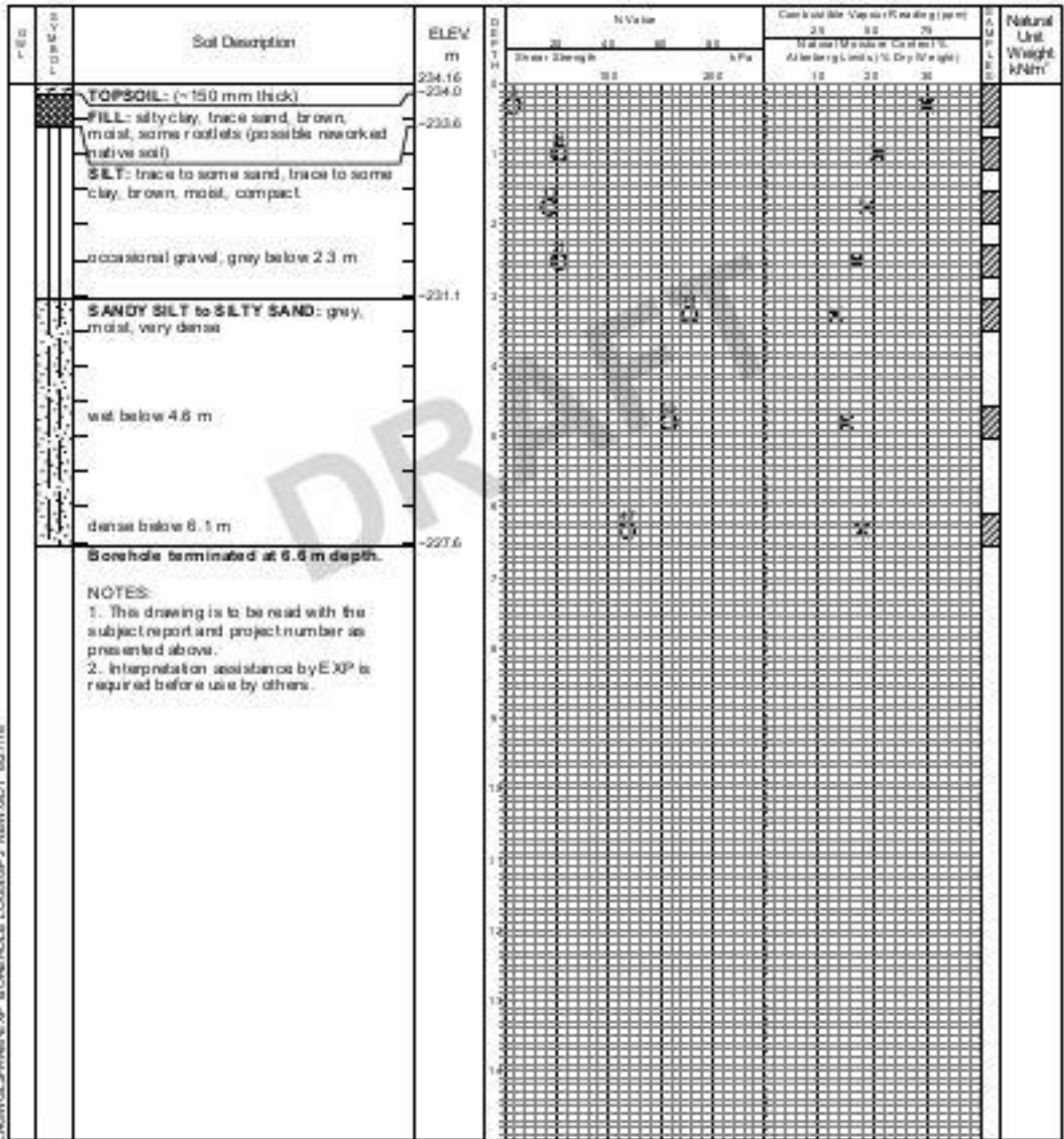
Log of Borehole BH-03

Project No. HAM-00801363-A0 Drawing No. 5
 Project: Proposed Glanbrook Industrial Subdivision Sheet No. 1 of 1
 Location: Twenty Road West, Hamilton, ON

Date Drilled: March 28, 2018
 Drill Type: D-50 Track Mount. Solid Stem.
 Datum: Geodetic

Auger Sample
 SPT (N) Value
 Dynamic Cone Test
 Shelby Tube
 Field Vane Test

Combustible Vapour Reading
 Natural Moisture
 Plastic and Liquid Limit
 Undrained Triaxial at
 % Strain at Failure
 Penetration



EXP Services Inc.
 Hamilton, Ontario
 Telephone: 905.573.4000
 Facsimile: 905.573.9893

Time	Water Level (m)	Depth to Cave (m)
on completion	6.05 bgs	no cave

bgs (above ground surface)
 bgs (below ground surface)

Log of Borehole BH-04

Project No. HAM-00801363-A0

Drawing No. 6

Project: Proposed Glanbrook Industrial Subdivision

Sheet No. 1 of 1

Location: Twenty Road West, Hamilton, ON

Date Drilled: April 3, 2018

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

Natural Moisture

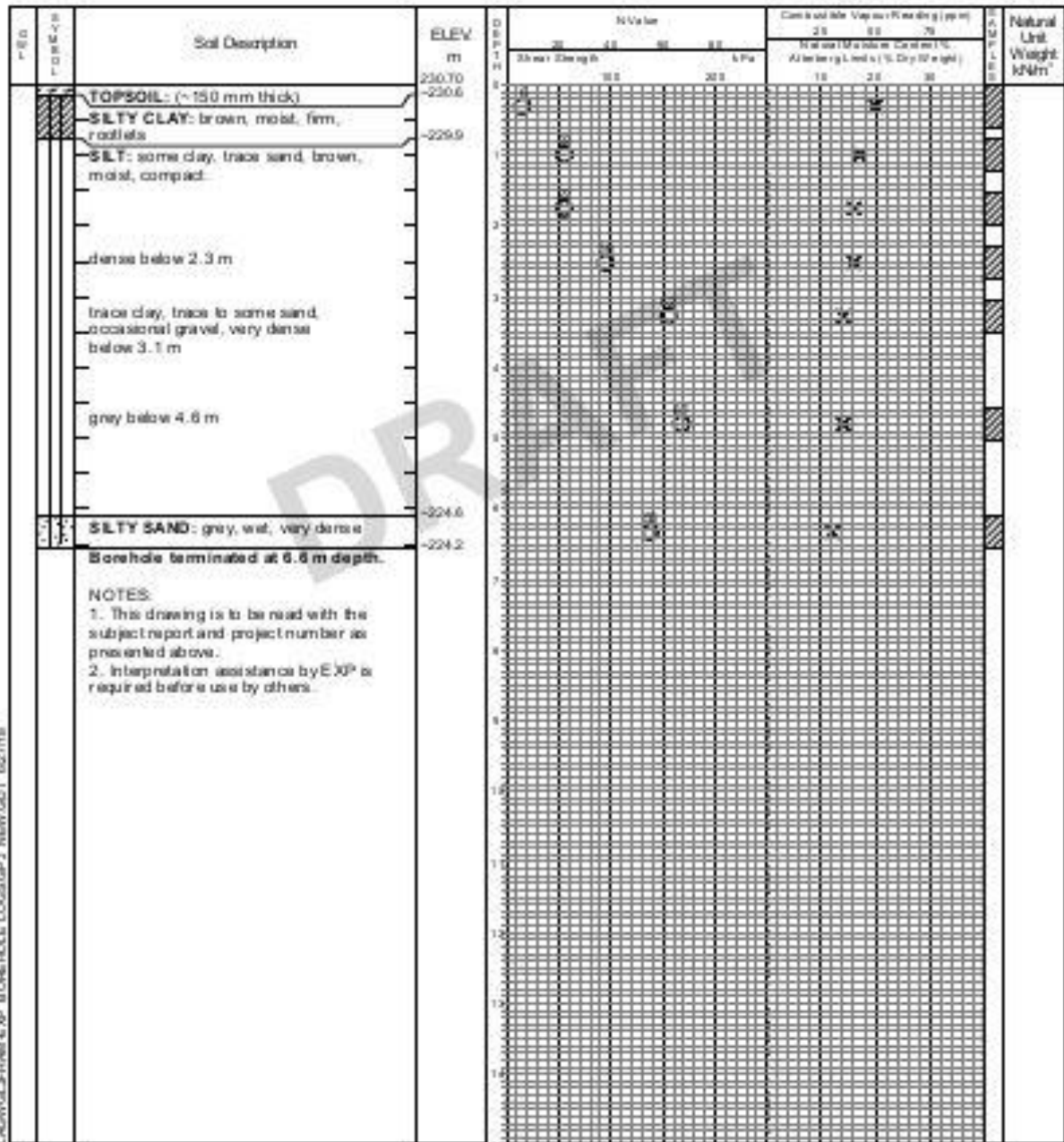
Plastic and Liquid Limit

Undrained Triaxial at

% Strain at Failure

Penetration

Datum: Geodetic



LACAVLJTHM EXP BOREHOLE LOGS.GPJ NEW.GDT 6/27/18



EXP Services Inc.
Hamilton, Ontario
Telephone: 905.573.4000
Facsimile: 905.573.9893

Time	Water Level (m)	Depth to Cave (m)
on completion	5.72 bgs	no cave

bgs (above ground surface)
bgs (below ground surface)

Log of Borehole BH-05

Project No. HAM-00801363-A0

Drawing No. 7

Project: Proposed Glanbrook Industrial Subdivision

Sheet No. 1 of 1

Location: Twenty Road West, Hamilton, ON

Date Drilled: April 18, 2018

Auger Sample

Combustible Vapour Reading

Drill Type: D-50 Track Mount. Solid Stem.

SPT (N) Value

Natural Moisture

Datum: Geodetic

Dynamic Cone Test

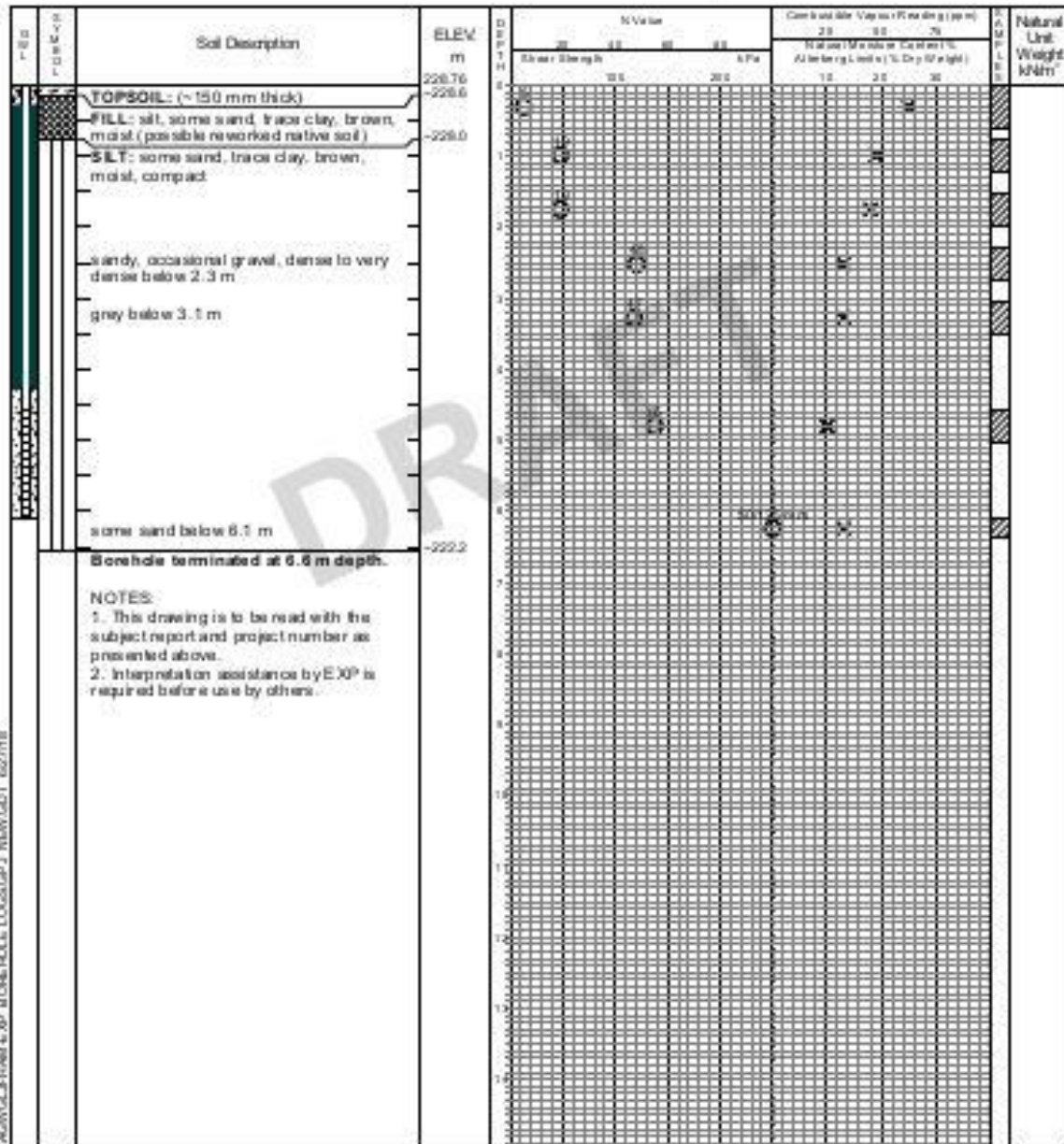
Plastic and Liquid Limit

Shelby Tube

Undrained Triaxial at % Strain at Failure

Field Vane Test

Penetrometer



EXP Services Inc.
Hamilton, Ontario
Telephone: 905.573.4000
Facsimile: 905.573.9893

Time	Water Level (m)	Depth to Cave (m)
on completion June 5, 2018	4.91 bgs 0.73 bgs	no cave —

bgs (above ground surface)
bgs (below ground surface)

Log of Borehole BH-06

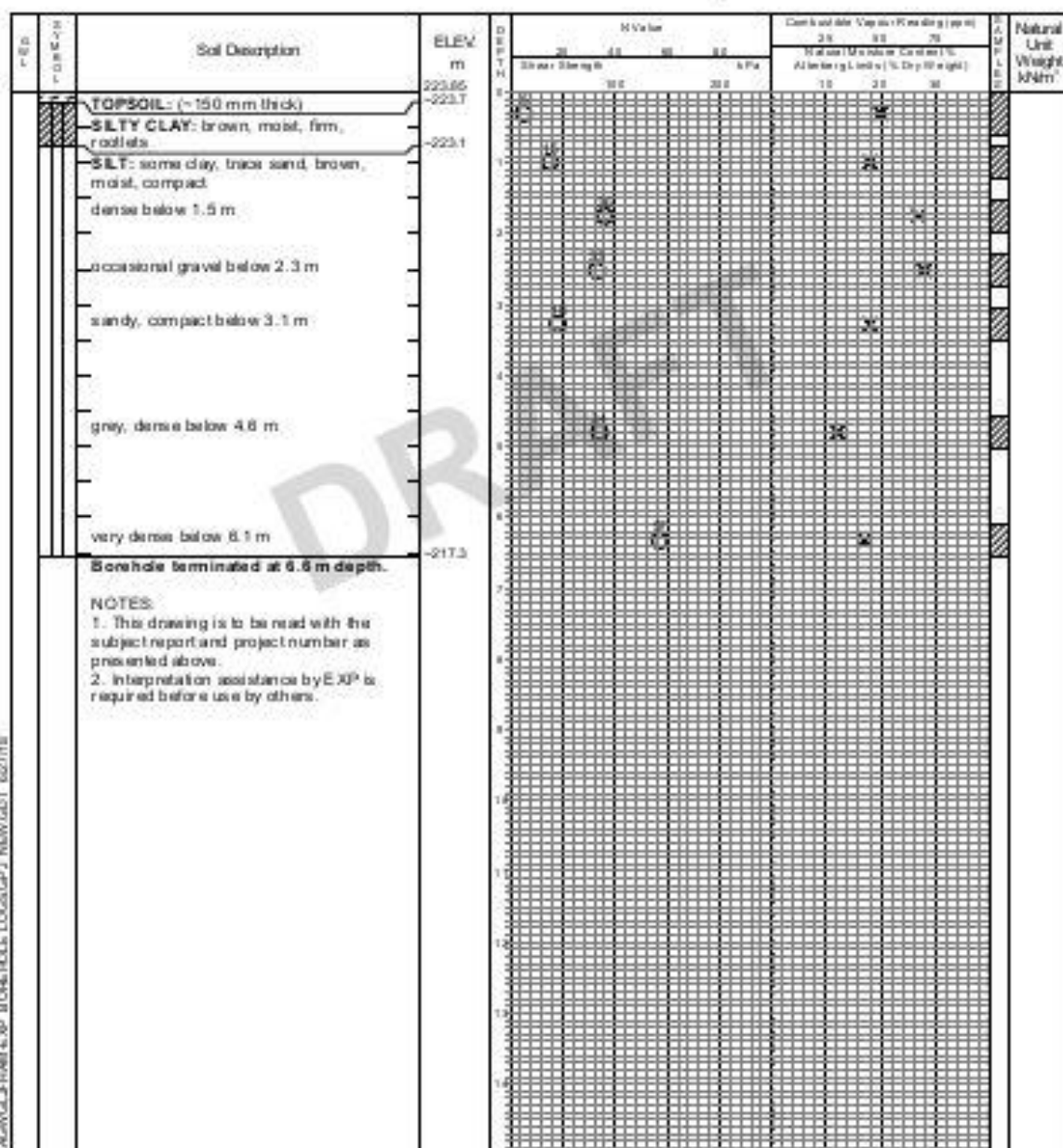
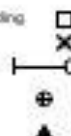
Project No. HAM-00801363-A0 Drawing No. 8
 Project: Proposed Glanbrook Industrial Subdivision Sheet No. 1 of 1
 Location: Twenty Road West, Hamilton, ON

Date Drilled: April 3, 2018
 Drill Type: D-50 Track Mount Solid Stem
 Datum: Geodetic

Auger Sample
 SPT (N) Value
 Dynamic Cone Test
 Shelby Tube
 Field Vane Test



Combustible Vapour Reading
 Natural Moisture
 Plastic and Liquid Limit
 Undrained Triaxial at
 % Strain at Failure
 Penetration



EXP Services Inc.
 Hamilton, Ontario
 Telephone: 905.573.4000
 Facsimile: 905.573.9693

Time	Water Level (m)	Depth to Cave (m)
on completion	5.84 tps	no cave

tps (above ground surface)
 tps (below ground surface)

Log of Borehole BH-07

Project No. HAM-00801363-A0

Drawing No. 9

Project: Proposed Glanbrook Industrial Subdivision

Sheet No. 1 of 1

Location: Twenty Road West, Hamilton, ON

Date Drilled: May 9, 2018

Auger Sample

Combustible Vapour Reading

Drill Type: CME-55 Track Mount. Hollow Stem.

SPT (N) Value

Natural Moisture

Datum: Geodetic

Dynamic Cone Test

Plastic and Liquid Limit

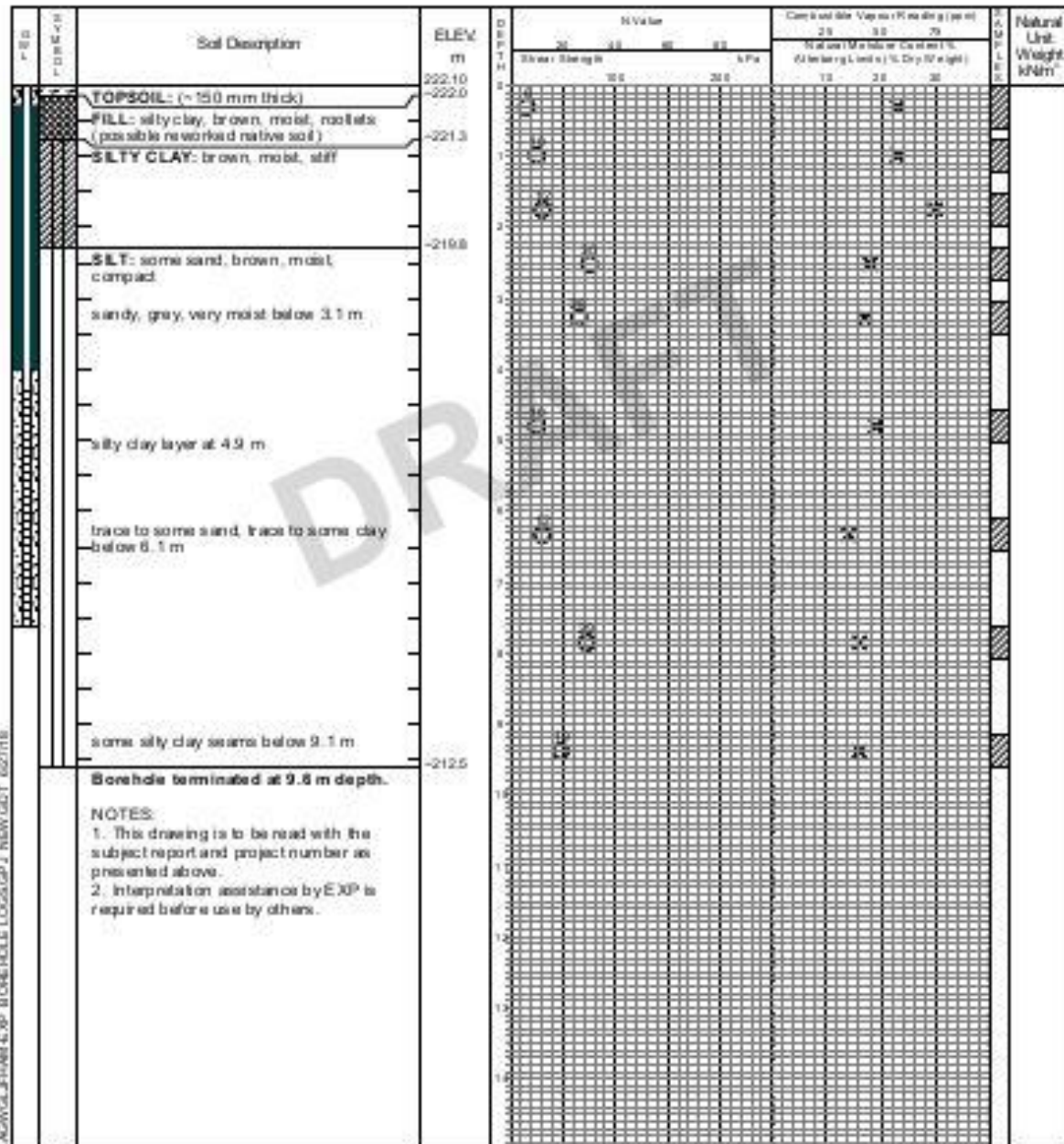
Shelby Tube

Undrained Triaxial

Field Vane Test

% Strain at Failure

Penetration



EXP Services Inc.
Hamilton, Ontario
Telephone: 905.573.4000
Facsimile: 905.573.9893

Time	Water Level (m)	Depth to Cave (m)
on completion June 4, 2018	9.21 bgs 0.27 bgs	no cave —

bgs (above ground surface)
bgs (below ground surface)

Log of Borehole BH-08

Project No. HAM-00801363-A0

Drawing No. 10

Project: Proposed Glanbrook Industrial Subdivision

Sheet No. 1 of 1

Location: Twenty Road West, Hamilton, ON

Data Dated: May 11, 2018

Auger Sample

SPT (N) Value

Drill Type: CME-55 Track Mount. Hollow Stem

Dynamic Core Test

Datum: Geodetic

Field Vane Test

Combustible Vapor Reading

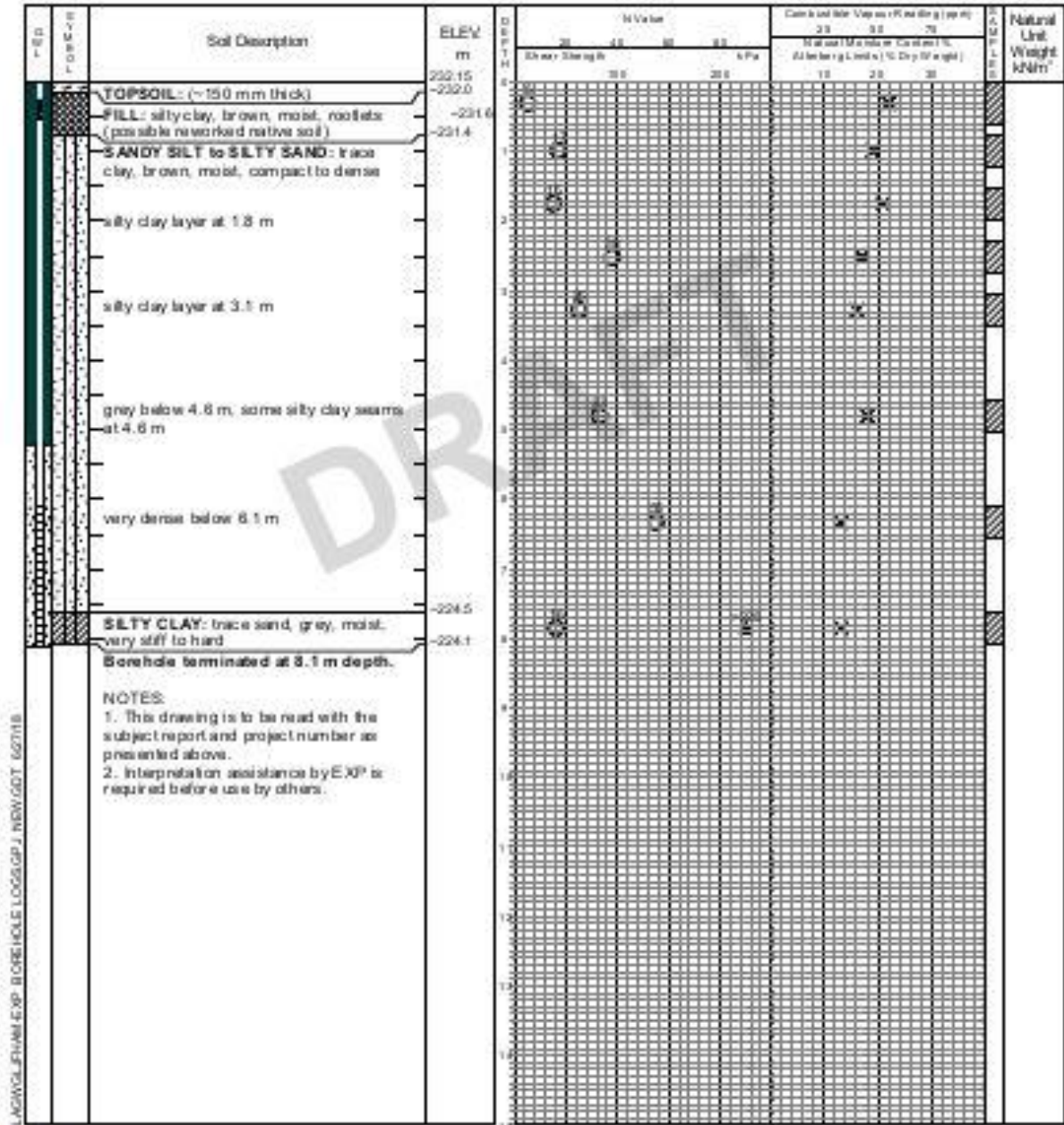
Featured molecule

Plastic and Liquid Limit

Undrained Triaxial at

% Strain at Failure

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EXP Services Inc.
Hamilton, Ontario
Telephone: 905.573.4000
Facsimile: 905.573.9893

Time	Water Level (m)	Depth to Cave (m)
on completion on June 4, 2018	7.61 bgs 0.53 bgs	no cave —

ags (above ground surface)
bgs (below ground surface)

Log of Borehole BH-09

Project No. HAM-00801363-A0

Drawing No. 11

Project: Proposed Glanbrook Industrial Subdivision

Sheet No. 1 of 1

Location: Twenty Road West, Hamilton, ON

Date Drilled: April 18, 2018

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

Natural Moisture

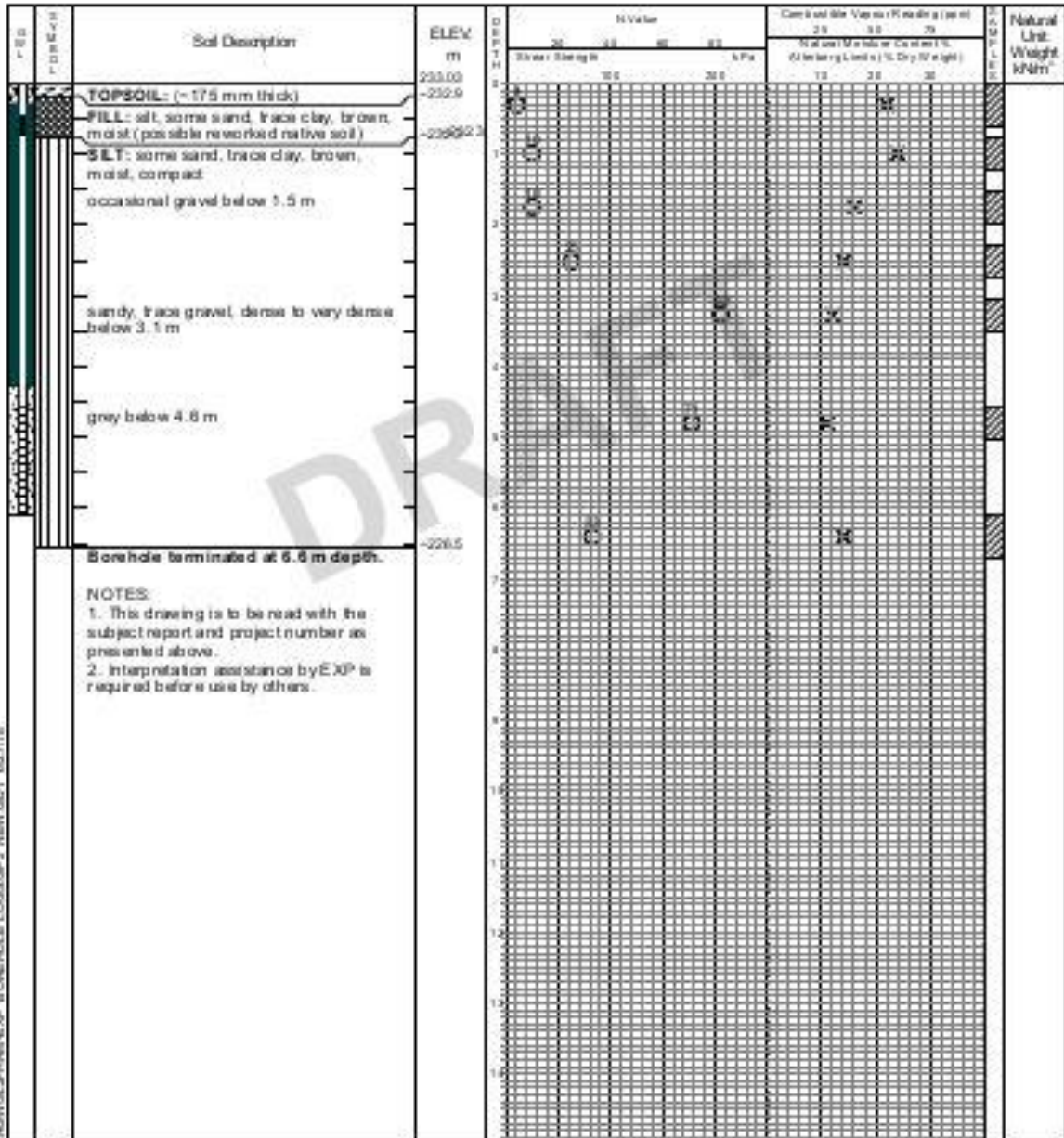
Plastic and Liquid Limit

Undrained Triaxial at

% Strain at Failure

Penetration

Datum: Geodetic



Log of Borehole BH-10

Project No. HAM-00801363-A0

Drawing No. 12

Project: Proposed Glanbrook Industrial Subdivision

Sheet No. 1 of 1

Location: Twenty Road West, Hamilton, ON

Date Drilled: March 29, 2018

Auger Sample

Combustible Vapour Reading

Drill Type: D-50 Track Mount Solid Stem

SPT (N) Value

Natural Moisture

Datum: Geodetic

Dynamic Cone Test

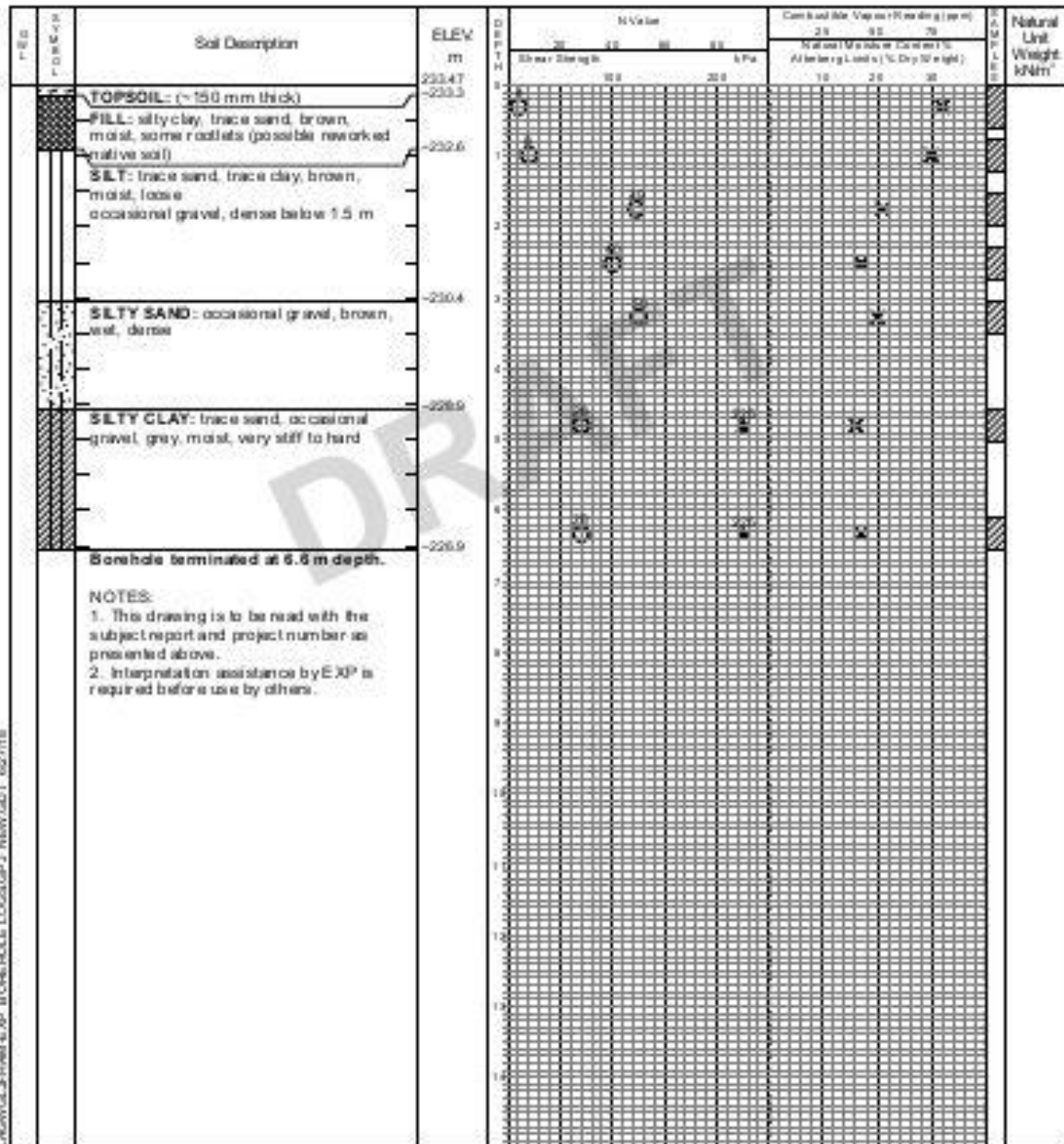
Plastic and Liquid Limit

Shelby Tube

Undrained Triaxial at % Strain at Failure

Field Vane Test

Penetrometer



EXP Services Inc.
Hamilton, Ontario
Telephone: 905.573.4000
Facsimile: 905.573.9893

Time	Water Level (m)	Depth to Cave (m)
on completion	dry	no cave

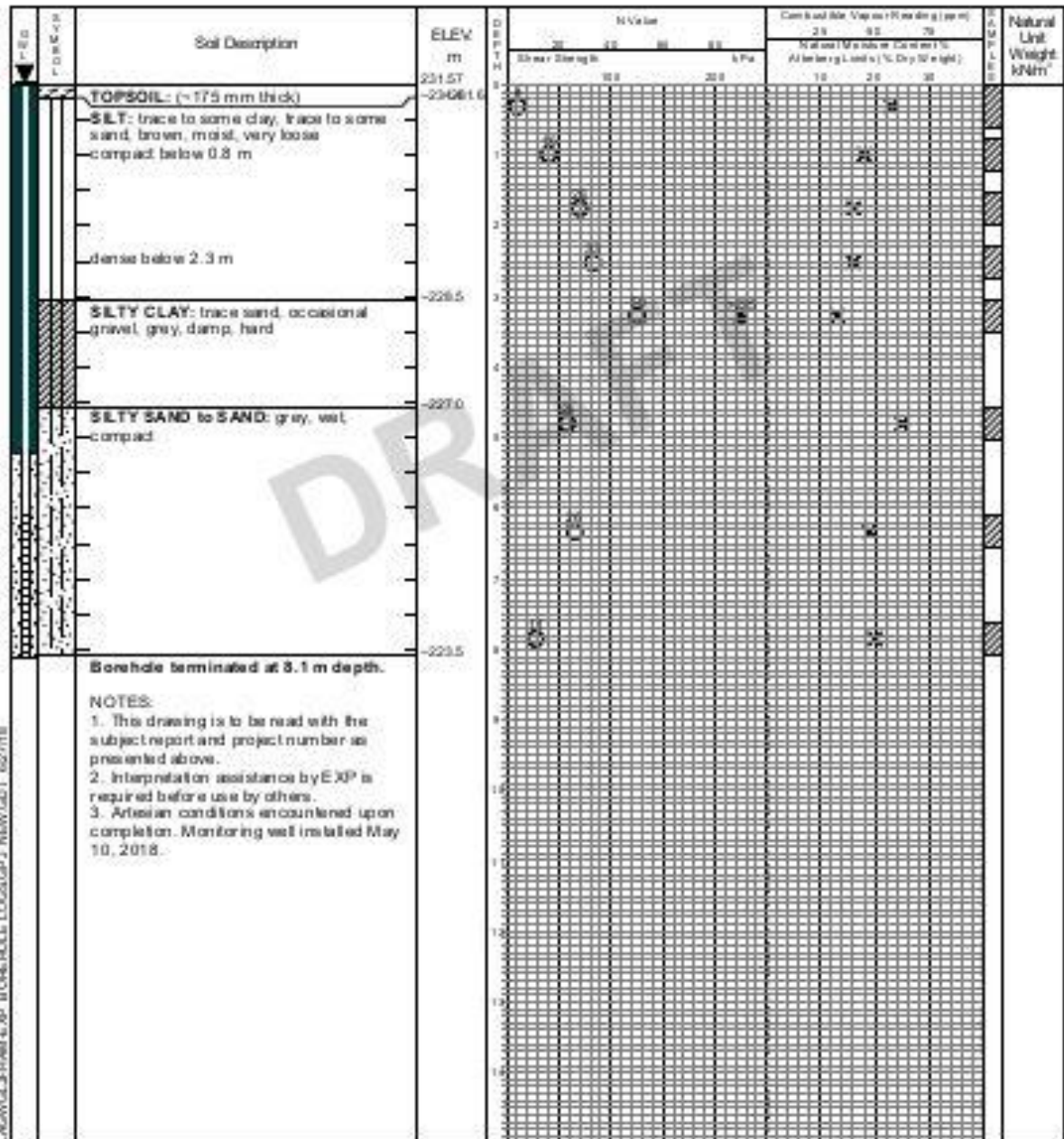
ags (above ground surface)
bgs (below ground surface)

Log of Borehole BH-11

Project No. HAM-00801363-A0 Drawing No. 13
 Project: Proposed Glanbrook Industrial Subdivision Sheet No. 1 of 1
 Location: Twenty Road West, Hamilton, ON

Date Drilled: March 29, 2018 Auger Sample
 Drill Type: D-50 Track Mount, Solid Stem. SPT (N) Value
 Datum: Geodetic Dynamic Cone Test
 Shelby Tube
 Field Vane Test

Combustible Vapour Reading
 Natural Moisture
 Plastic and Liquid Limit
 Undrained Triaxial
 % Strain at Failure
 Penetration

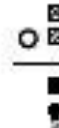


Log of Borehole BH-12

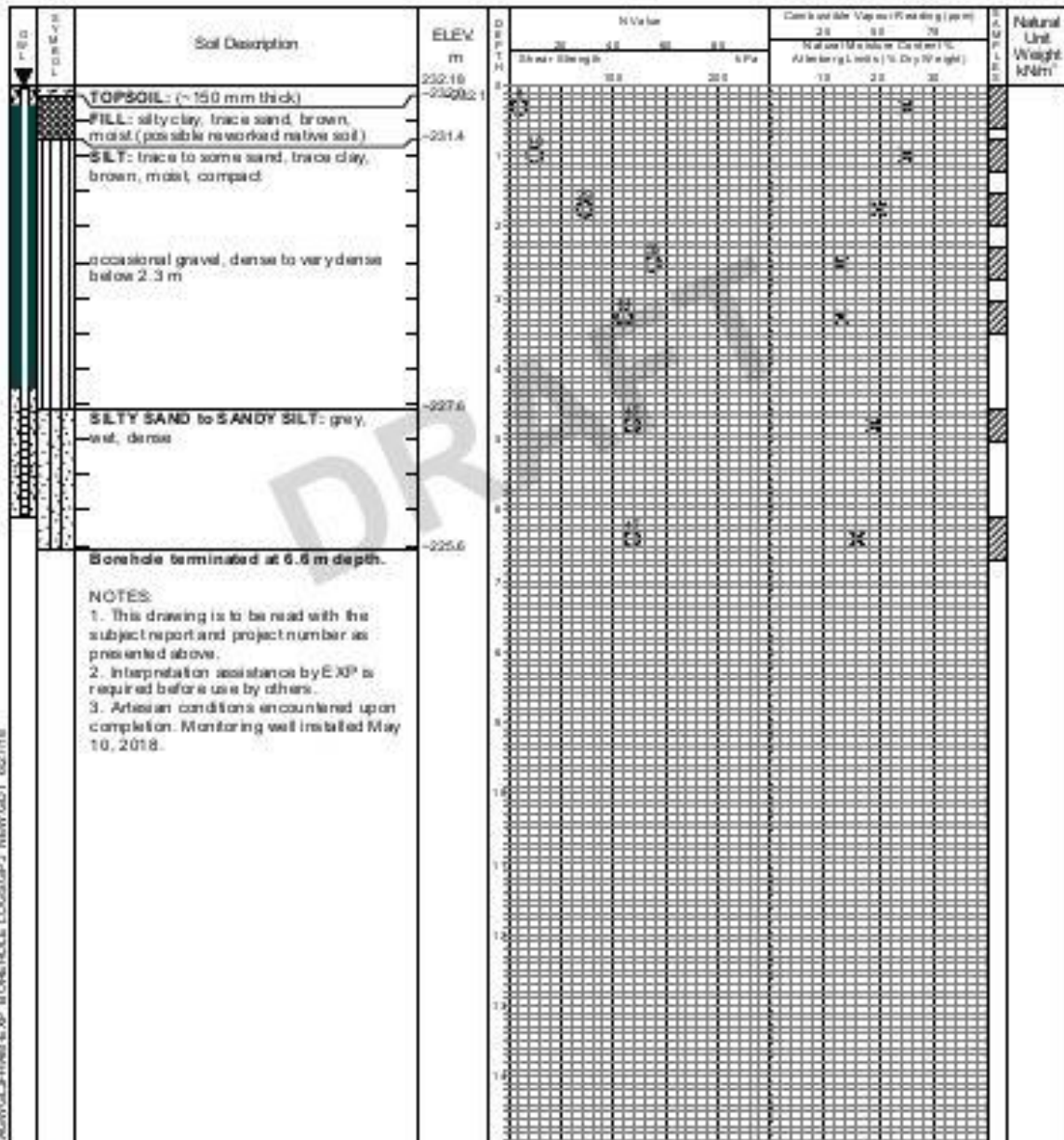
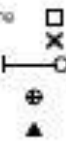
Project No. HAM-00801363-A0 Drawing No. 14
 Project: Proposed Glanbrook Industrial Subdivision Sheet No. 1 of 1
 Location: Twenty Road West, Hamilton, ON

Date Drilled: April 17, 2018
 Drill Type: D-50 Track Mount. Solid Stem.
 Datum: Geodetic

Auger Sample
 SPT (N) Value
 Dynamic Cone Test
 Shelby Tube
 Field Vane Test



Combustible Vapour Reading
 Natural Moisture
 Plastic and Liquid Limit
 Undrained Triaxial at
 % Strain at Failure
 Penetration



EXP Services Inc.
 Hamilton, Ontario
 Telephone: 905.573.4000
 Facsimile: 905.573.9893

Time	Water Level (m)	Depth to Cave (m)
on completion	agg	3.70
May 10, 2018	agg	—
June 5, 2018	0.04 bps	—

agg (above ground surface)
 bps (below ground surface)

Log of Borehole BH-13

Project No. HAM-00801363-A0

Drawing No. 15

Project: Proposed Glenbrook Industrial Subdivision

Sheet No. 1 of 1

Location: Twenty Road West, Hamilton, ON

Date Drilled: April 17, 2018

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

Natural Moisture

Plastic and Liquid Limit

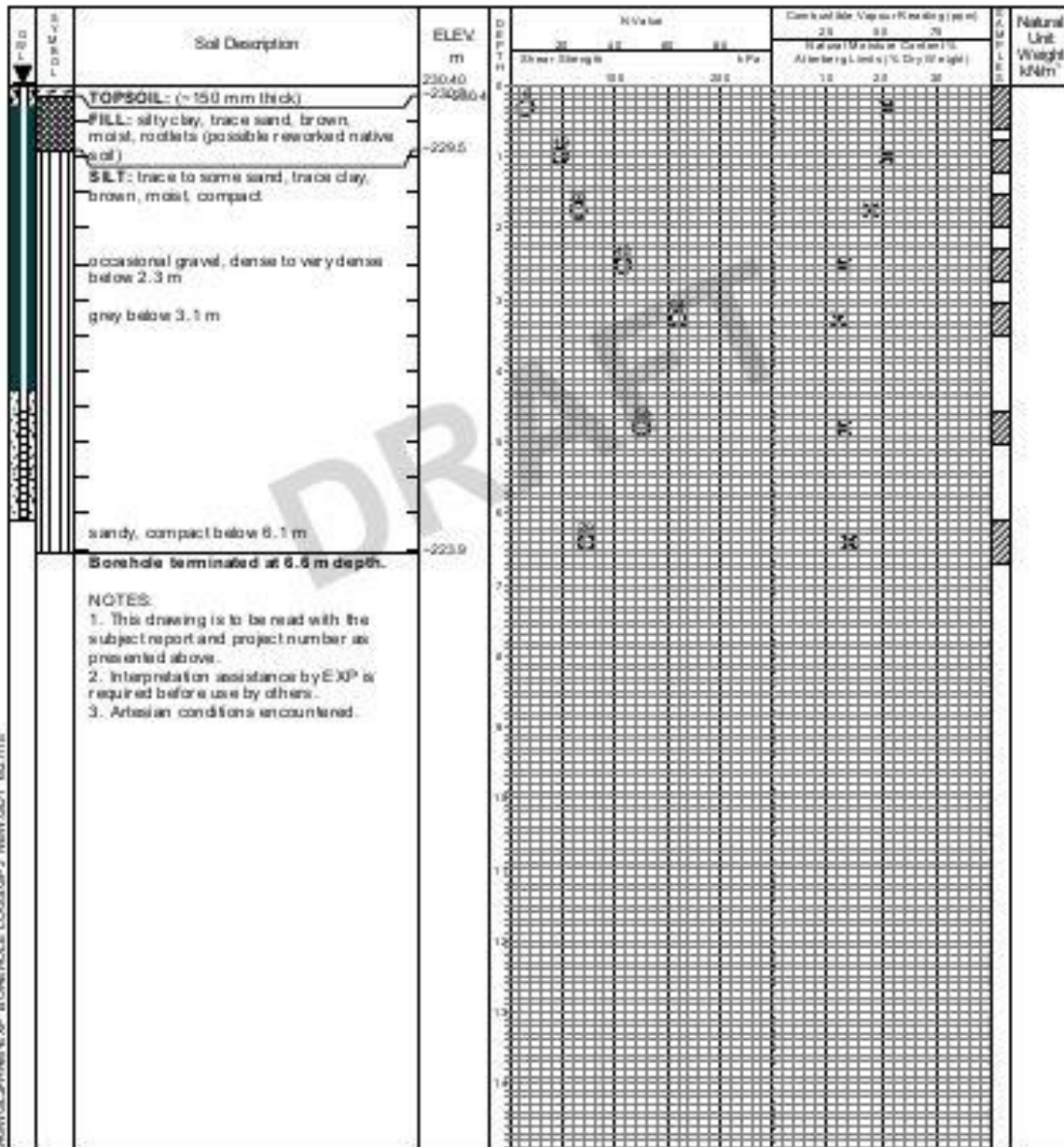
Undrained Triaxial at

% Strain at Failure

Penetrometer

Drill Type: D-50 Track Mount Solid Stem

Datum: Geodetic



EXP Services Inc.
Hamilton, Ontario
Telephone: 905.573.4000
Facsimile: 905.573.9893

Time	Water Level (m)	Depth to Cave (m)
on completion June 5, 2018	dry 0.19 ags	no cave

ags (above ground surface)
bgs (below ground surface)

Log of Borehole BH-14

Project No.: HAM-00801363-A0

Drawing No. 16

Project: Proposed Glanbrook Industrial Subdivision

Sheet No. 1 of 1

Location: Twenty Road West, Hamilton, ON

Date Drilled: April 17, 2018

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

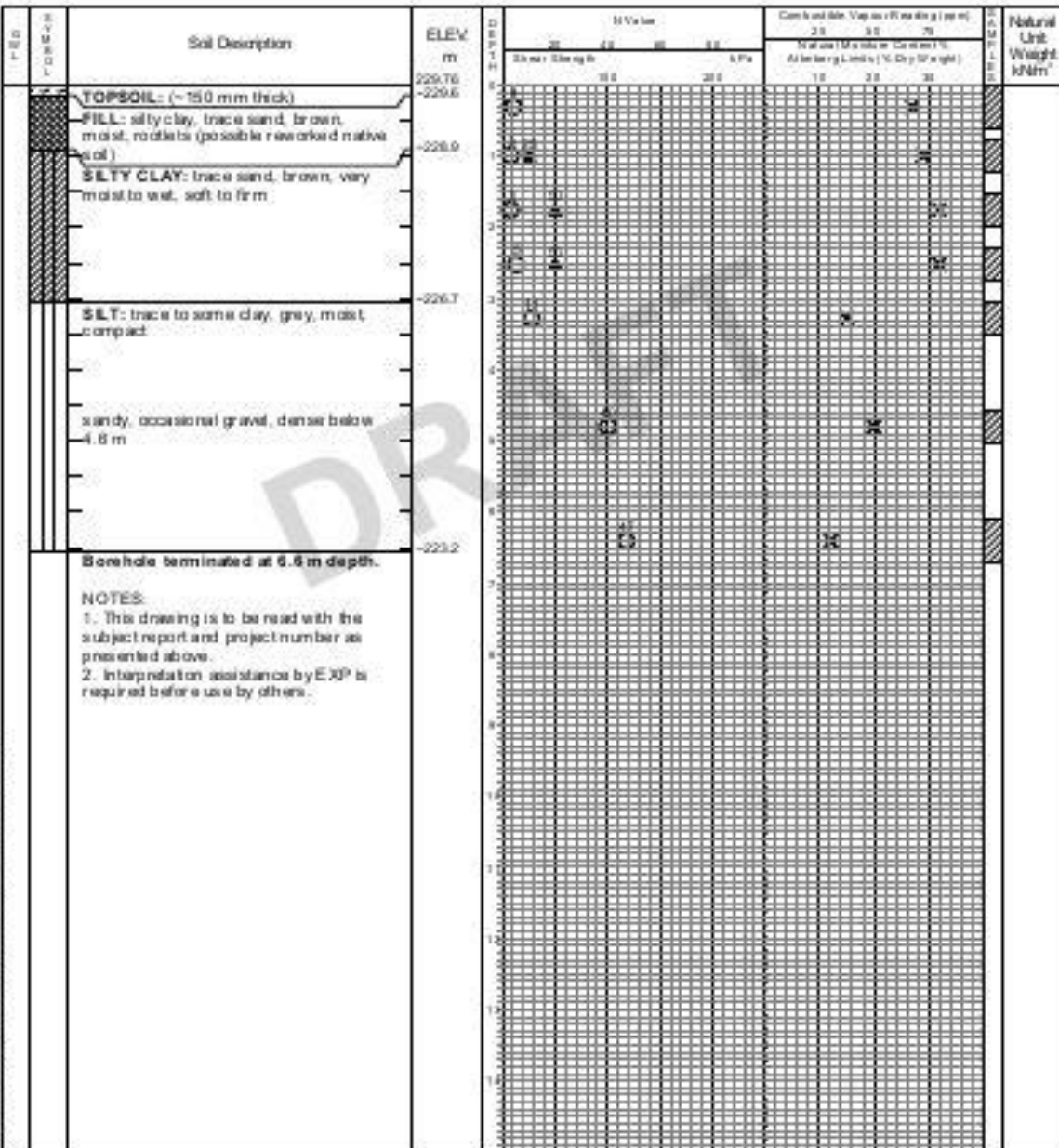
Natural Moisture

Plastic and Liquid Limit

Undrained Triaxial at

% Strain at Failure

Penetrometer



EXP Services Inc.
Hamilton, Ontario
Telephone: 905.573.4000
Facsimile: 905.573.9893

Time	Water Level (m)	Depth to Cave (m)
on completion	N/A	0.9 (bridged)

age (above ground surface)
tgs (below ground surface)

Log of Borehole BH-15

Project No. HAM-00801363-A0

Drawing No. 17

Project: Proposed Glanbrook Industrial Subdivision

Sheet No. 1 of 1

Location: Twenty Road West, Hamilton, ON

Date Drilled: March 28, 2018

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

Natural Moisture

Plastic and Liquid Limit

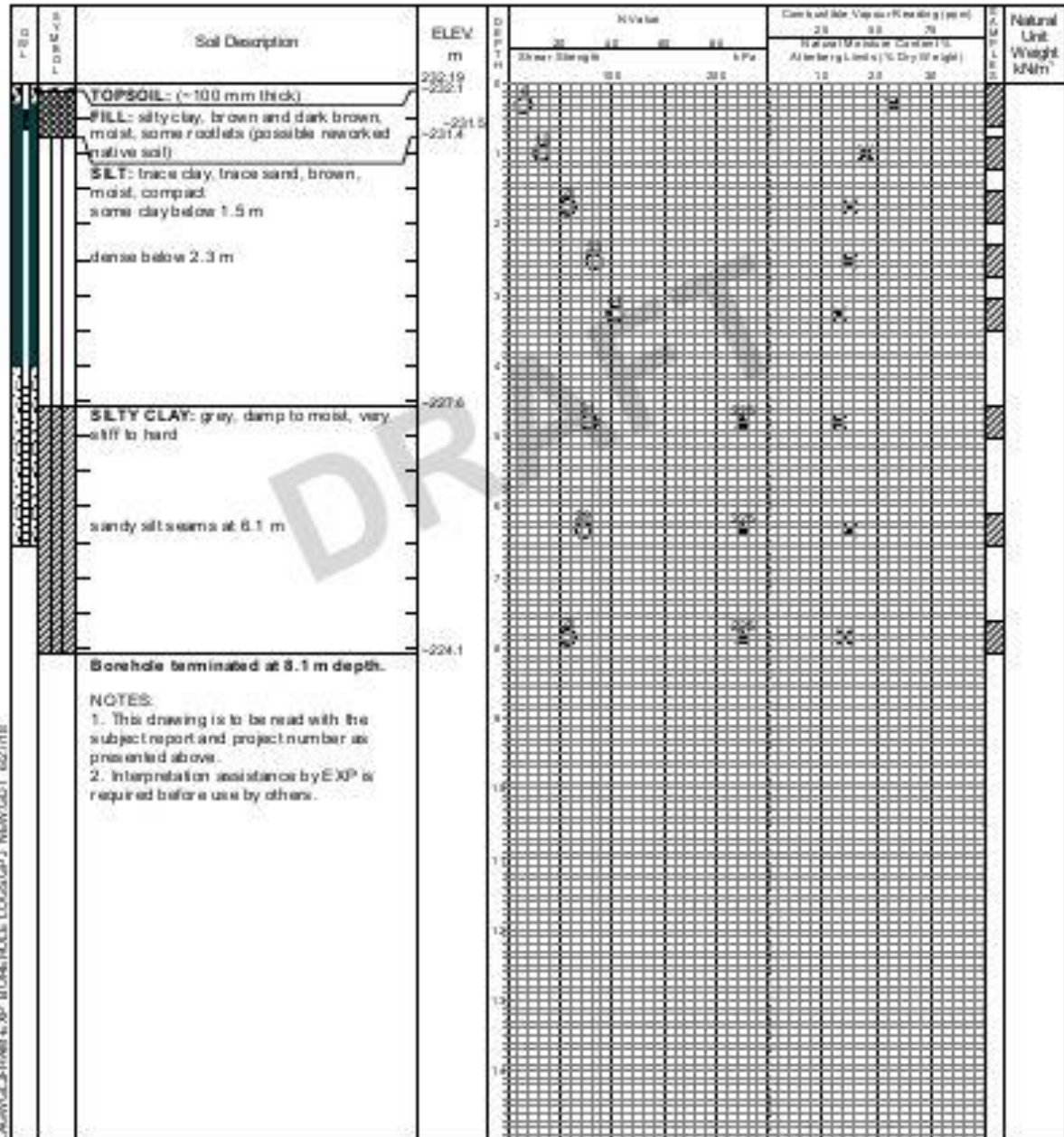
Undrained Triaxial at

% Strain at Failure

Penetration

Drill Type: D-50 Track Mount, Solid Stem.

Datum: Geodetic



EXP Services Inc.
Hamilton, Ontario
Telephone: 905.573.4000
Facsimile: 905.573.9893

Time	Water Level (m)	Depth to Cave (m)
on completion	dry	no cave
Mar. 27	1.59 bgs	—
June 4, 2018	0.65 bgs	—

bgs (above ground surface)
bgs (below ground surface)

Log of Borehole BH-16

Project No. HAM-00801363-A0

Drawing No. 18

Project: Proposed Glanbrook Industrial Subdivision

Sheet No. 1 of 1

Location: Twenty Road West, Hamilton, ON

Date Drilled: April 17, 2018

Auger Sample

Combustible Vapour Reading

Drill Type: D-50 Track Mount, Solid Stem.

SPT (N) Value

Natural Moisture

Datum: Geodetic

Dynamic Cone Test

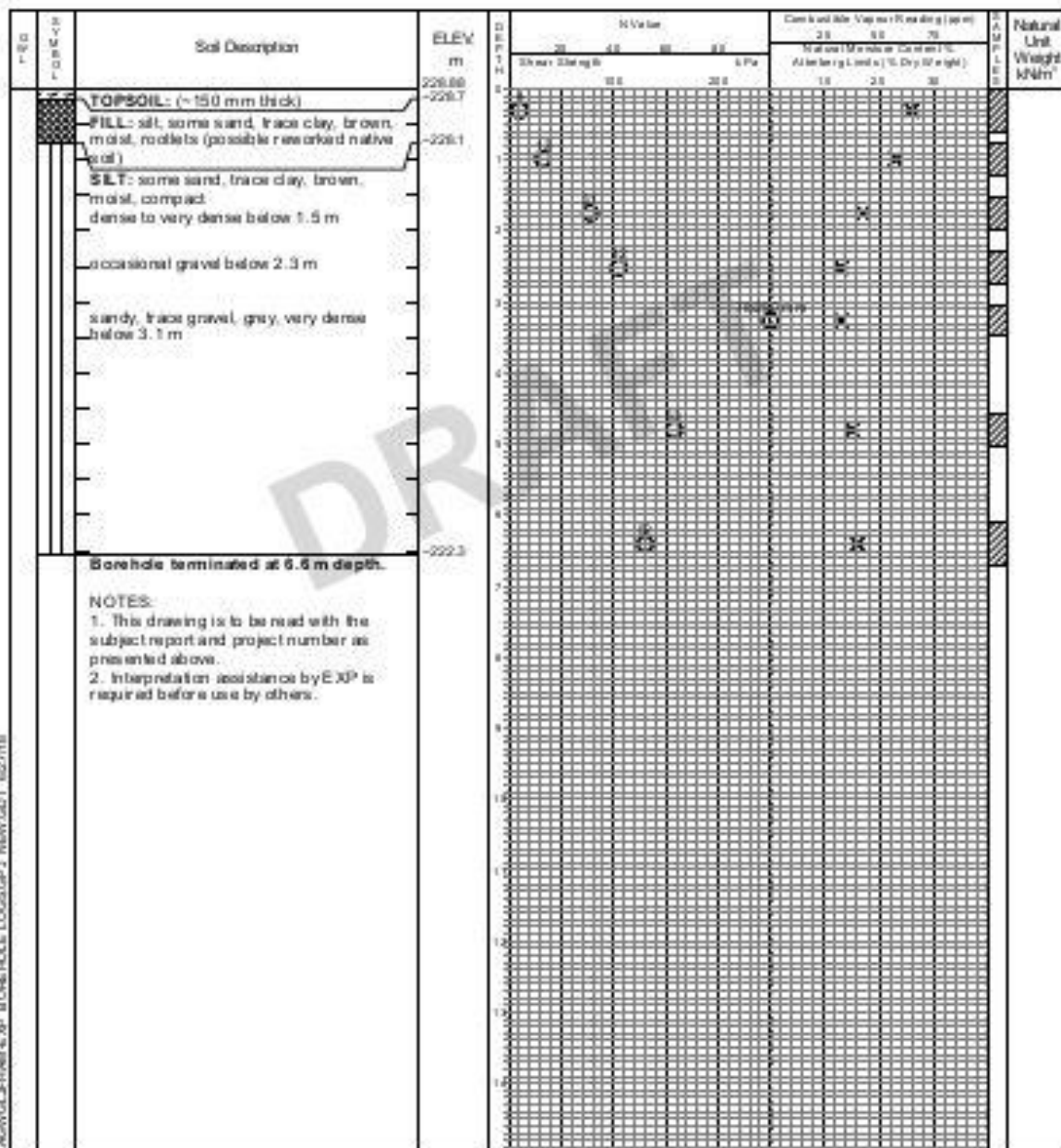
Plastic and Liquid Limit

Shelby Tube

Undrained Triaxial at % Strain at Failure

Field Vane Test

Penetration



LACWOLRHAM-EXP-BOREHOLE LOGS.GPJ INDWGDT 6/27/18



EXP Services Inc.
Hamilton, Ontario
Telephone: 905.573.4000
Facsimile: 905.573.9893

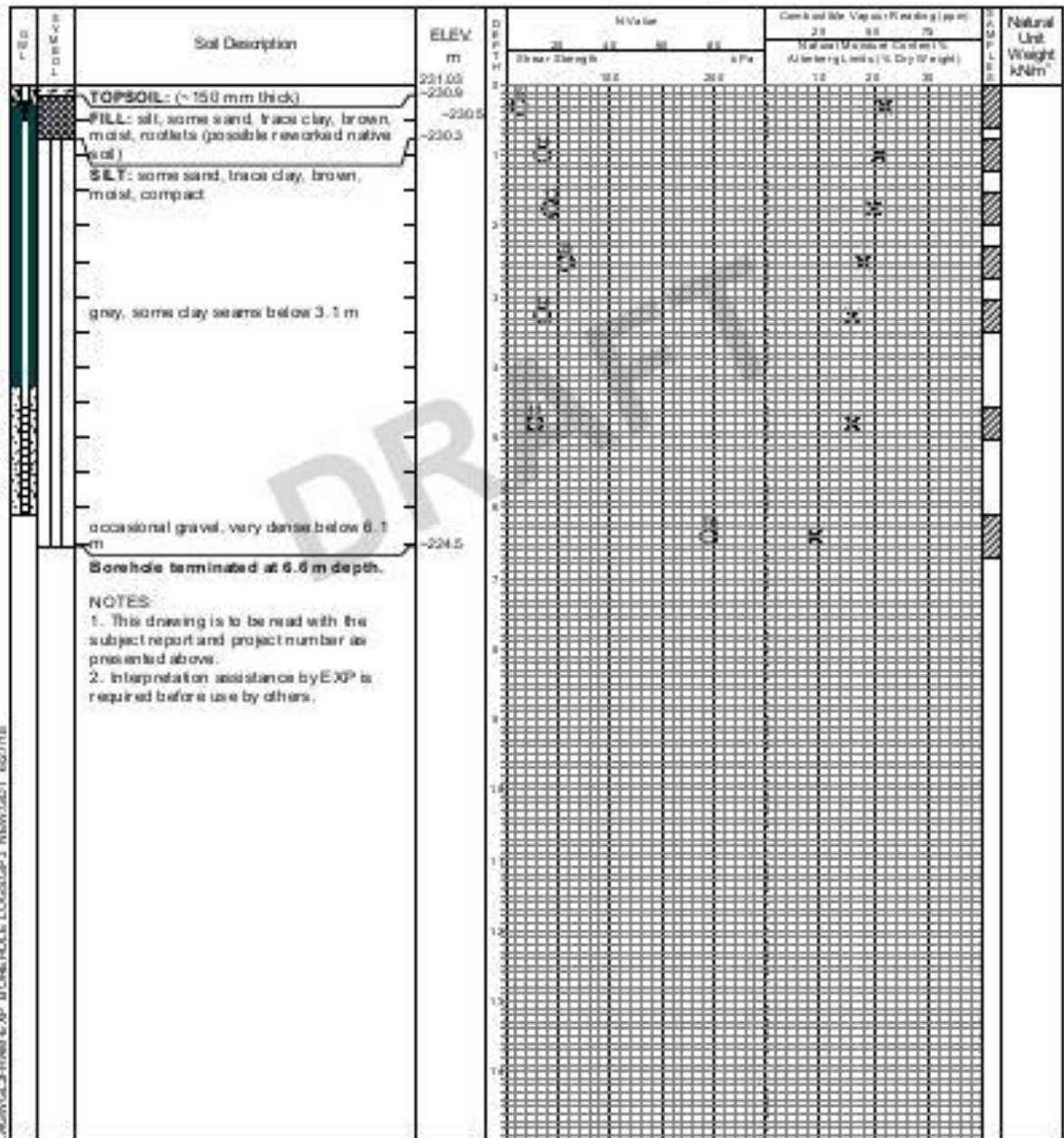
Time	Water Level (m)	Depth to Cave (m)
on completion	5.80 lgs	no cave

lgs (above ground surface)
lgs (below ground surface)

Log of Borehole BH-17

Project No. HAM-00801363-A0 Drawing No. 19
 Project: Proposed Glanbrook Industrial Subdivision Sheet No. 1 of 1
 Location: Twenty Road West, Hamilton, ON

Date Drilled: April 17, 2018 Auger Sample
 Drill Type: D-50 Track Mount, Solid Stem. SPT (N) Value
 Datum: Geodetic Dynamic Cone Test
 Shelby Tube
 Field Vane Test
 Combustible Vapour Reading
 Natural Moisture
 Plastic and Liquid Limit
 Undrained Triaxial at
 % Strain at Failure
 Penetration



EXP Services Inc.
 Hamilton, Ontario
 Telephone: 905.573.4000
 Facsimile: 905.573.9893

Time	Water Level (m)	Depth to Cave (m)
on completion June 5, 2018	dry 0.50 bgs	no cave -

bgs (above ground surface)
 bgs (below ground surface)

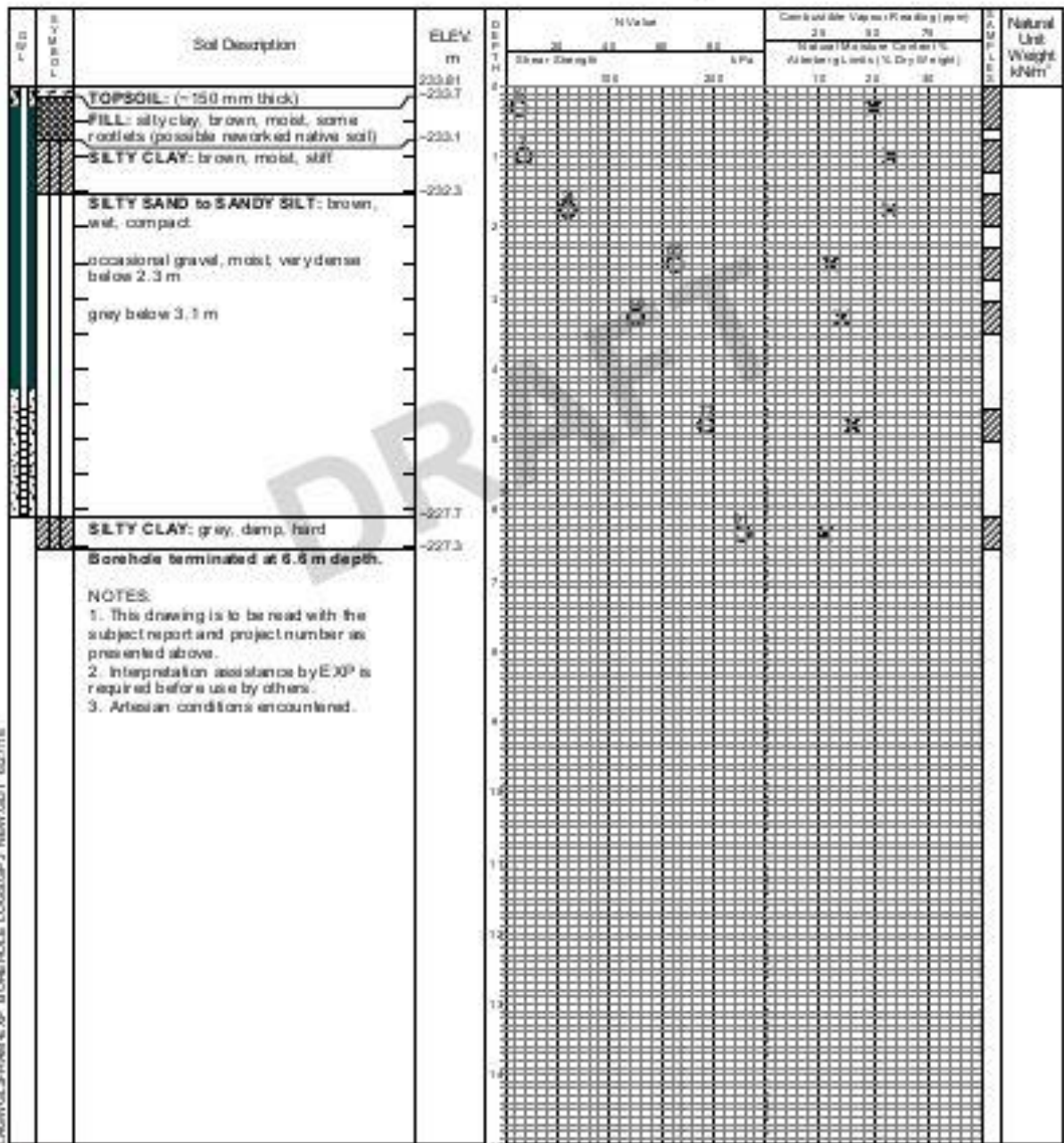
Log of Borehole BH-18

Project No: HAM-00801363-A0 Drawing No: 20
 Project: Proposed Glanbrook Industrial Subdivision Sheet No: 1 of 1
 Location: Twenty Road West, Hamilton, ON

Date Drilled: March 28, 2018
 Drill Type: D-50 Track Mount. Solid Stem.
 Datum: Geodetic

Auger Sample
 SPT (N) Value
 Dynamic Cone Test
 Shelby Tube
 Field Vane Test

Contributable Vapour Reading
 Natural Moisture
 Plastic and Liquid Limit
 Undrained Triaxial at % Strain at Failure
 Penetration test



EXP Services Inc.
 Hamilton, Ontario
 Telephone: 905.573.4000
 Facsimile: 905.573.9893

Time	Water Level (m)	Depth to Cave (m)
on completion June 4, 2018	5.3 bgs 0.85 ags	no cave —

ags (above ground surface)
 bgs (below ground surface)

Log of Borehole BH-19

Project No. HAM-00801363-A0

Drawing No. 21

Project: Proposed Glanbrook Industrial Subdivision

Sheet No. 1 of 1

Location: Twenty Road West, Hamilton, ON

Date Drilled: March 28, 2018

A Upper Sample of

SPT (N) Value

Dynamic Core Test

Shelby Tube

Field Vane Test

Combustible Vapor Reading

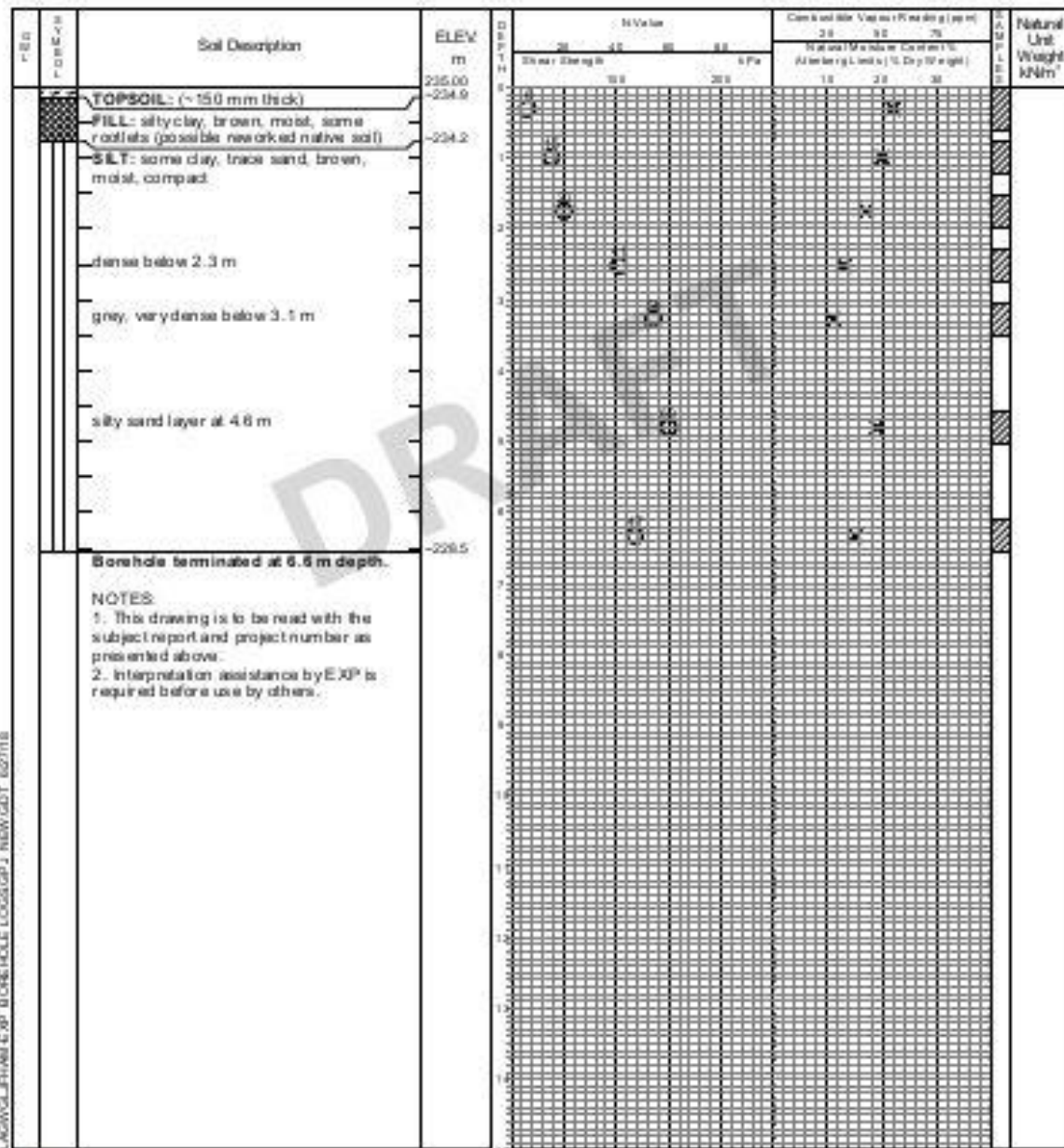
Natural history

Plastic and Liquid Limit

Undesired Triazole at

% Strain at Failure

Perceptions of...



EXP Services Inc.
Hamilton, Ontario
Telephone: 905.573.4000
Facsimile: 905.573.9693

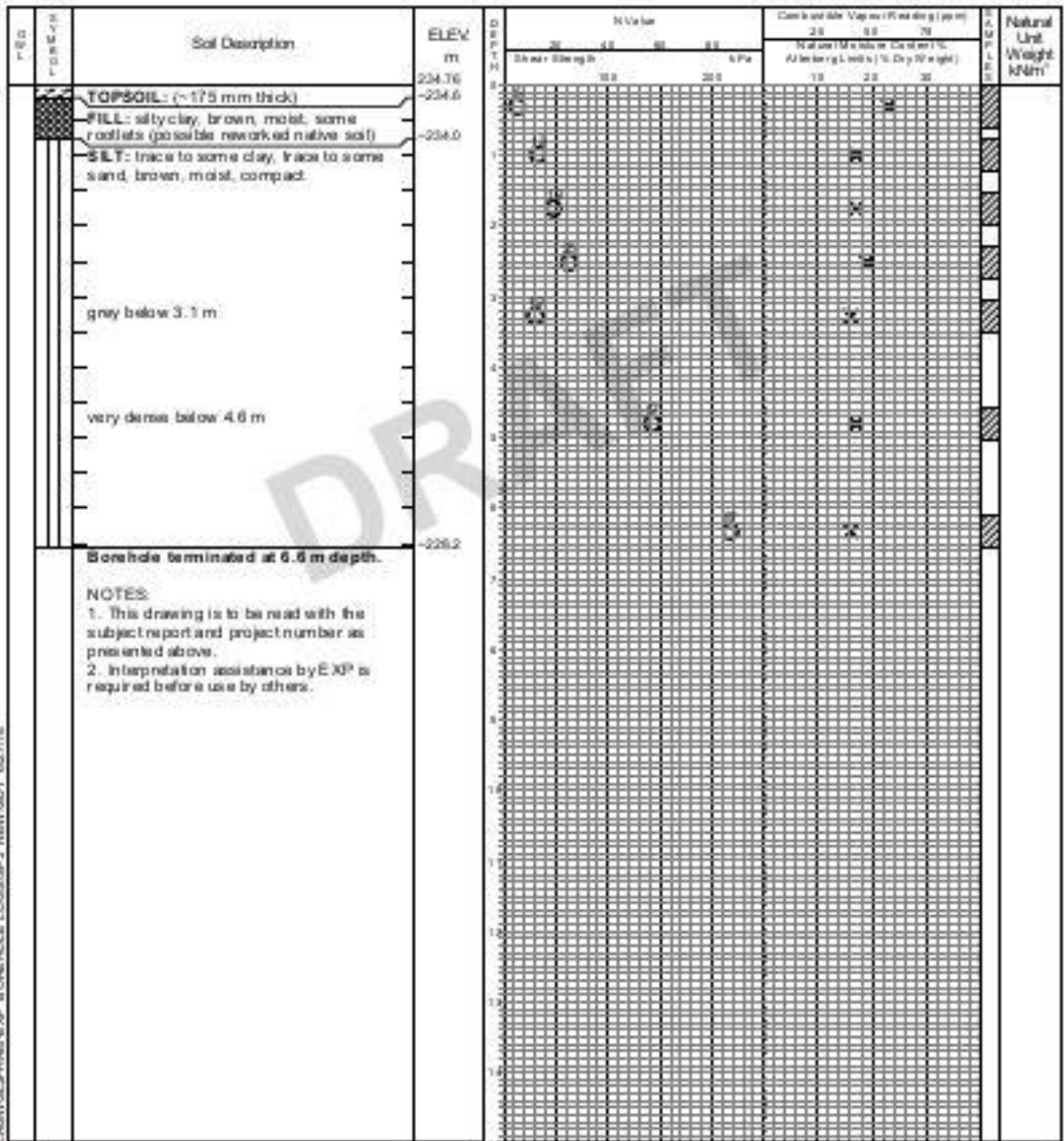
Time	Water Level (m)	Depth to Cave (m)
on completion	dry	no cave

ags. (above ground surface)
bgs. (below ground surface)

Log of Borehole BH-20

Project No. HAM-00801363-A0 Drawing No. 22
 Project: Proposed Glanbrook Industrial Subdivision Sheet No. 1 of 1
 Location: Twenty Road West, Hamilton, ON

Date Drilled: March 28, 2018 Auger Sample
 Drill Type: D-50 Track Mount, Solid Stem SPT (N) Value
 Datum: Geodetic Dynamic Cone Test
 Shelby Tube
 Field Vane Test
 Combustible Vapour Reading
 Natural Moisture
 Plastic and Liquid Limit
 Undrained Tensile at
 % Strain at Failure
 Penetration



EXP Services Inc.
 Hamilton, Ontario
 Telephone: 905.573.4000
 Facsimile: 905.573.9693

Time	Water Level (m)	Depth to Cave (m)
on completion	dry	no cave

agl (above ground surface)
 bgs (below ground surface)

Log of Borehole BH-21

Project No. HAM-00801363-A0

Drawing No. 23

Project: Proposed Glandbrook Industrial Subdivision

Sheet No. 1 of 1

Location: Twenty Road West, Hamilton, ON

Date Drilled: April 3, 2018

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

Natural Moisture

Plastic and Liquid Limit

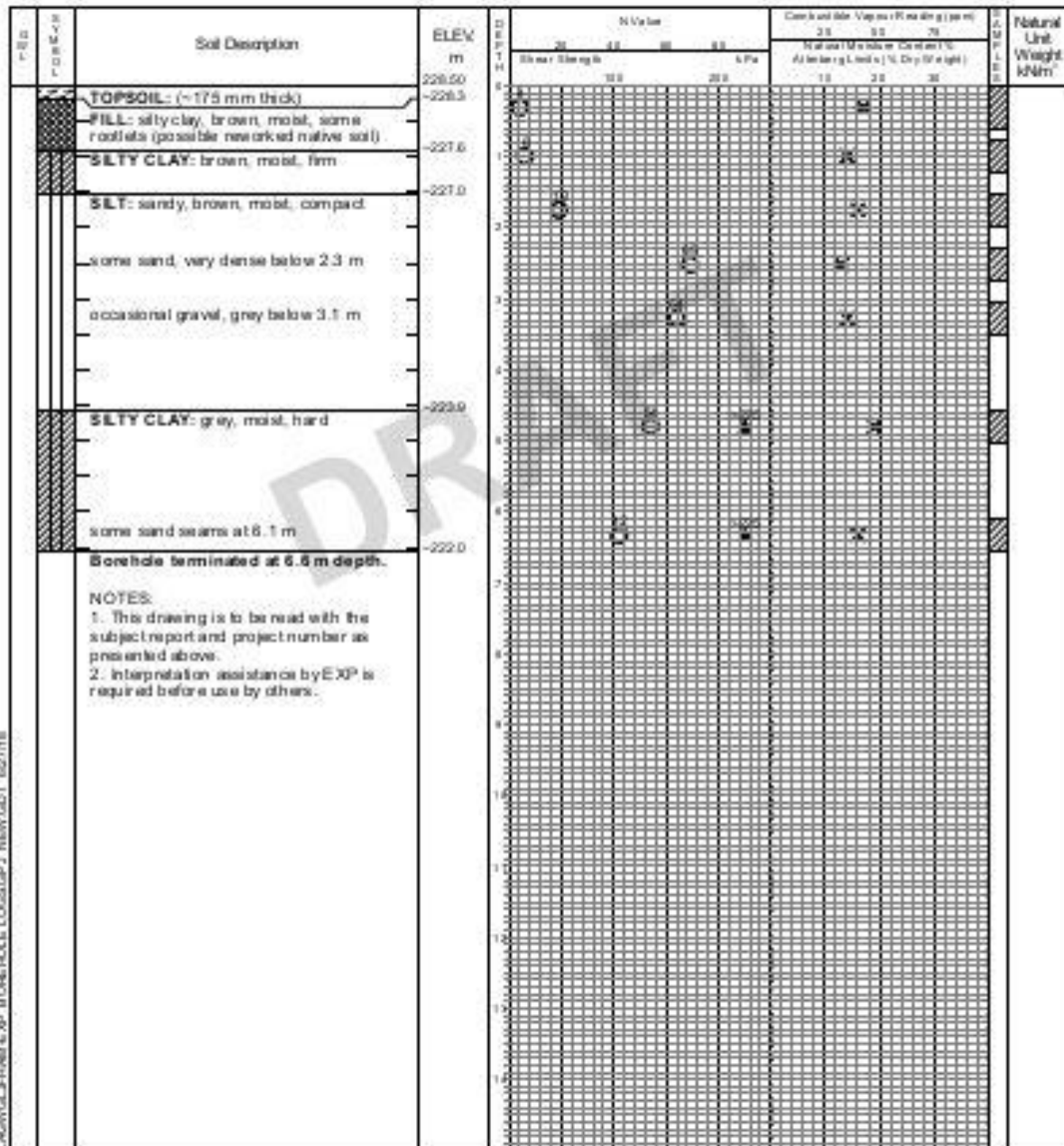
Undrained Triaxial at

% Strain at Failure

Penetration

Drill Type: D-50 Track Mount Solid Stem

Datum: Geodetic



EXP Services Inc.
Hamilton, Ontario
Telephone: 905.573.4000
Facsimile: 905.573.9893

Time	Water Level (m)	Depth to Cave (m)
on completion	5.51 bgs	no cave

ags (above ground surface)
bgs (below ground surface)

Log of Borehole BH-22

Project No. HAM-00801363-A0

Drawing No. 24

Project: Proposed Glenbrook Industrial Subdivision

Sheet No. 1 of 1

Location: Twenty Road West, Hamilton, ON

Date Drilled: April 3, 2018

Auger Sample

Combustible Vapour Reading

Drill Type: D-50 Track Mount Solid Stem.

SPT (N) Value

Natural Moisture

Datum: Geodetic

Dynamic Cone Test

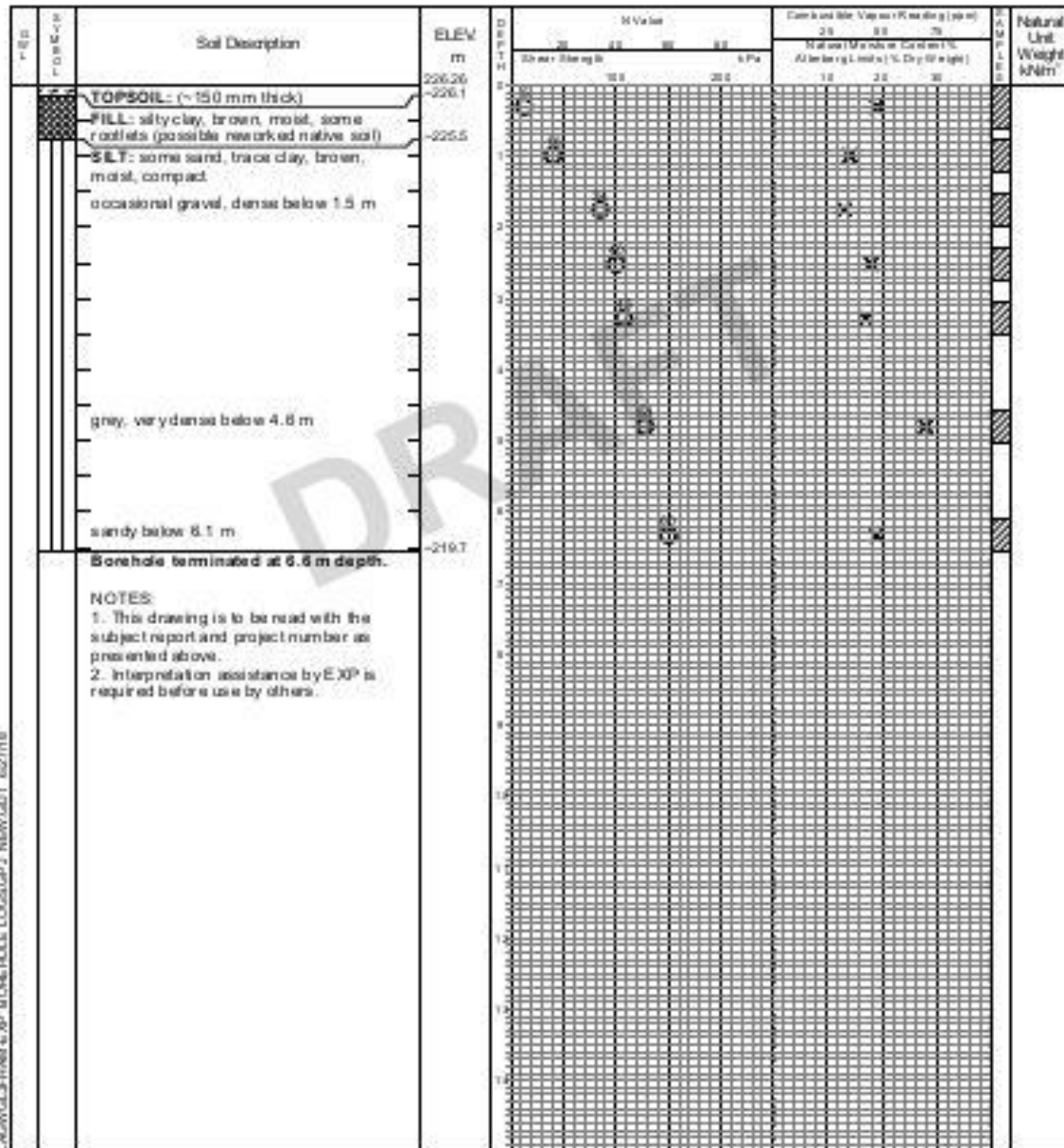
Plastic and Liquid Limit

Shelby Tube

Undrained Triaxial at % Strain at Failure

Field Vane Test

Penetration Test



LAGANVILLE EXP BOREHOLE LOGS GP J NEW.GDT 6/27/18



EXP Services Inc.
Hamilton, Ontario
Telephone: 905.573.4000
Facsimile: 905.573.9893

Time	Water Level (m)	Depth to Cave (m)
on completion	5.90 bgs	no cave

bgs (below ground surface)

Log of Borehole BH-23

Project No. HAM-00801363-A0

Drawing No. 25

Project: Proposed Glenbrook Industrial Subdivision

Sheet No. 1 of 1

Location: Twenty Road West, Hamilton, ON

Date Drilled: April 18, 2018

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

Natural Moisture

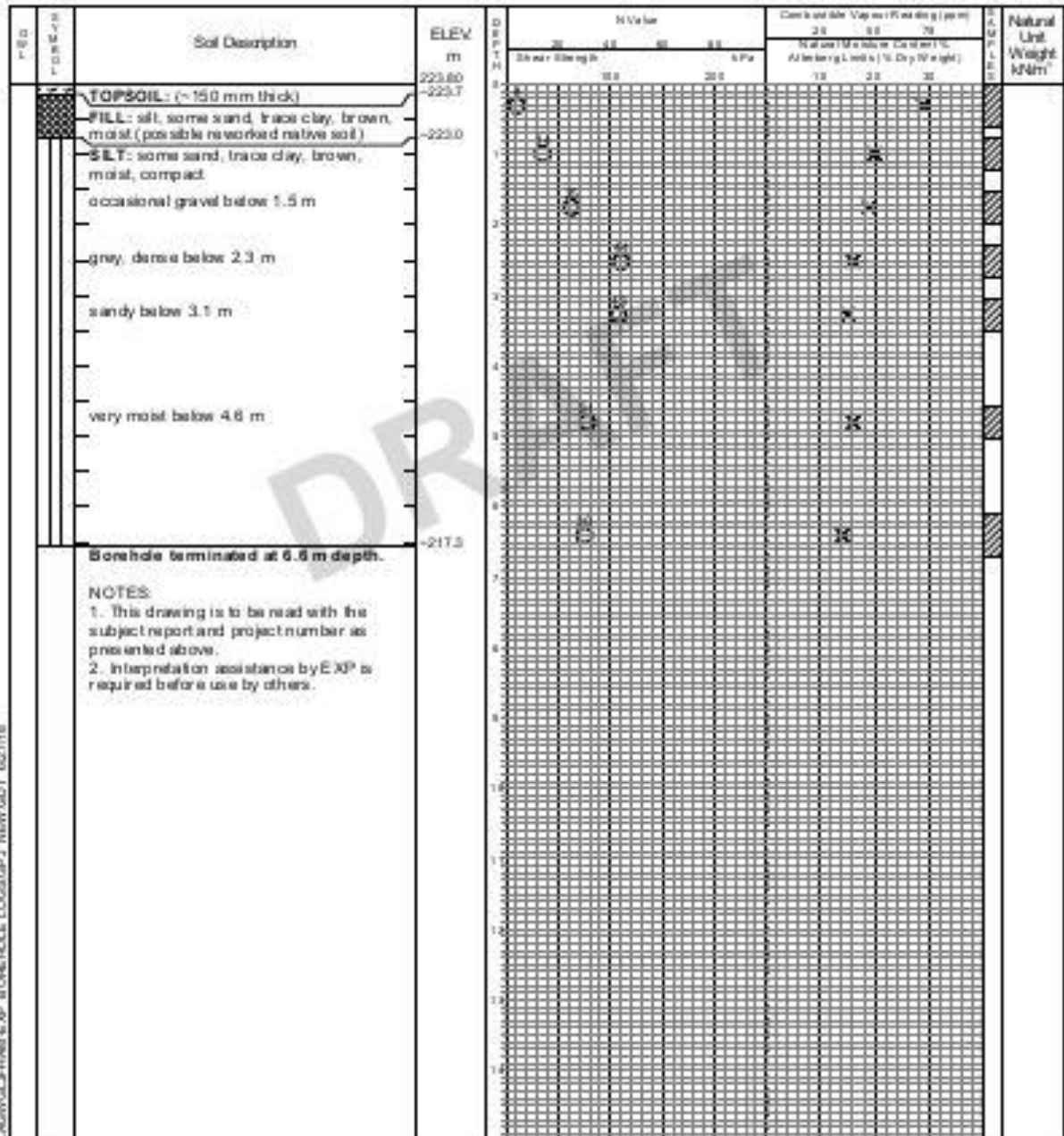
Plastic and Liquid Limit

Undrained Triaxial at

% Strain at Failure

Penetration

Datum: Geodetic



EXP Services Inc.
Hamilton, Ontario
Telephone: 905.573.4000
Facsimile: 905.573.9893

Time	Water Level (m)	Depth to Cave (m)
on completion	5.21 bgs	no cave

bgs (above ground surface)
bgs (below ground surface)

Log of Borehole BH-24

Project No. HAM-00801363-A0

Drawing No. 26

Project: Proposed Glanbrook Industrial Subdivision

Sheet No. 1 of 1

Location: Twenty Road West, Hamilton, ON

Date Drilled: March 26, 2018

Auger Sample

Combustible Vapour Reading

Drill Type: D-50 Track Mount. Solid Stem.

SPT (N) Value

Natural Moisture

Datum: Geodetic

Dynamic Cone Test

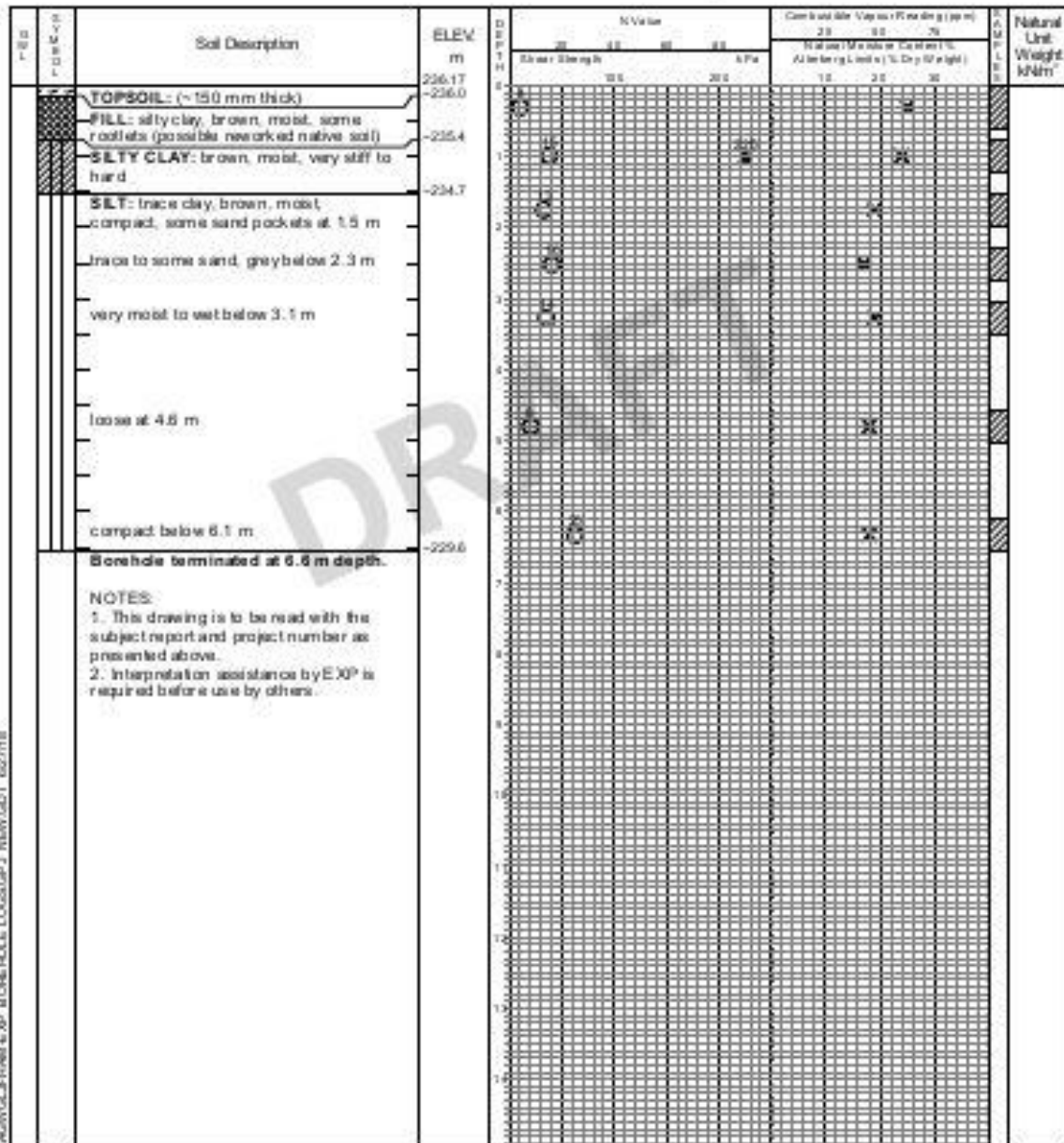
Plastic and Liquid Limit

Shelby Tube

Undrained Triaxial at % Strain at Failure

Field Vane Test

Penetration Test



LAGWOLJHAM-EXP-BOREHOLE LOGS.GPJ NEW/CDT 6/27/18



EXP Services Inc.
Hamilton, Ontario
Telephone: 905.573.4000
Facsimile: 905.573.9893

Time	Water Level (m)	Depth to Cave (m)
on completion	5.52 bgs	no cave

bgs (above ground surface)
bgs (below ground surface)

Log of Borehole BH-25

Project No. HAM-00801363-A0

Drawing No. 27

Project: Proposed Glanbrook Industrial Subdivision

Sheet No. 1 of 1

Location: Twenty Road West, Hamilton, ON

Date Drilled: March 27, 2018

Auger Sample



Combustible Vapour Reading



Natural Moisture



Plastic and Liquid Limit



Undrained Triaxial at



% Strain at Failure

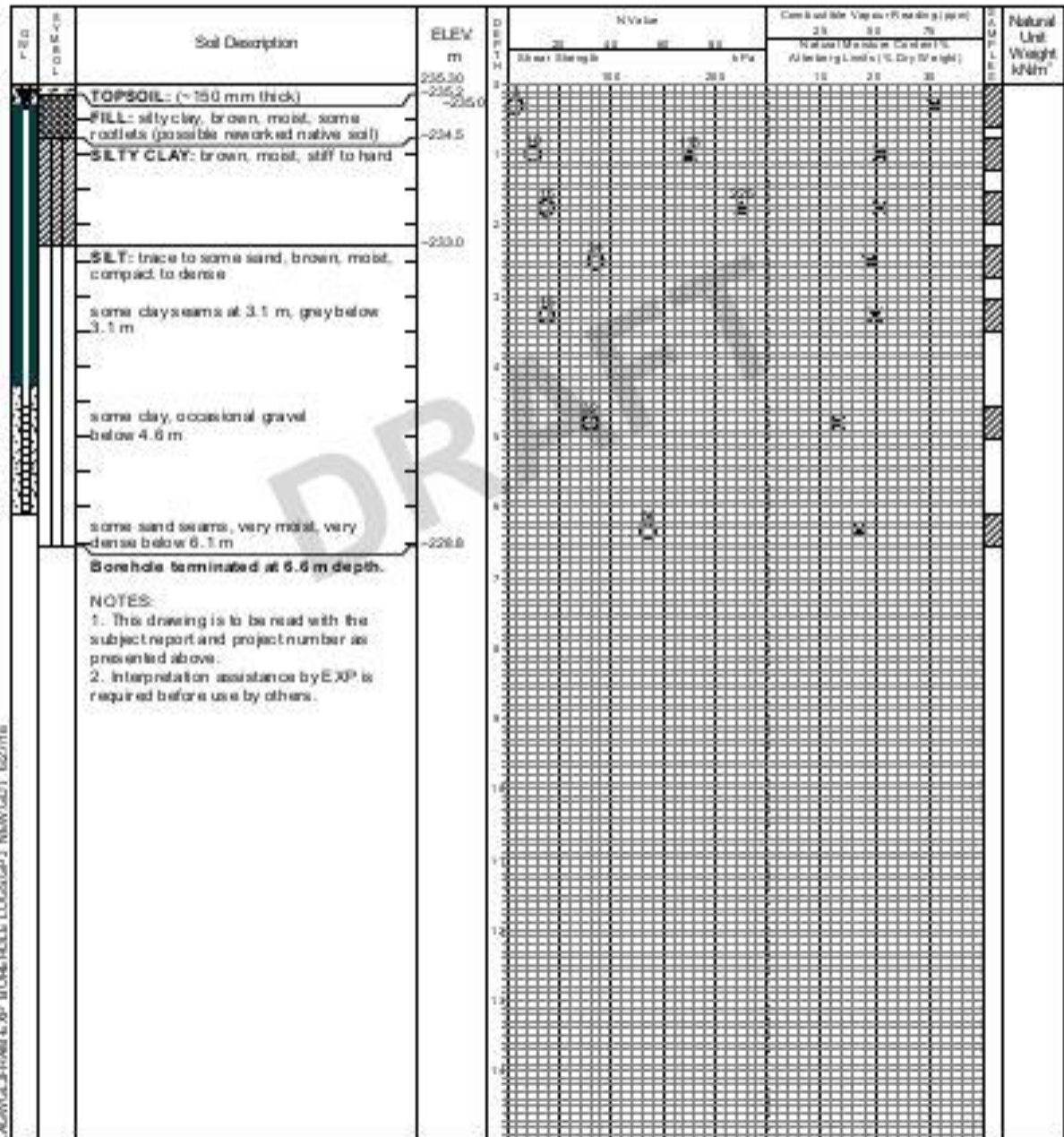


Penetrometer



Drill Type: D-50 Track Mount, Solid Stem.

Datum: Geodetic



EXP Services Inc.
Hamilton, Ontario
Telephone: 905.573.4000
Facsimile: 905.573.9893

Time	Water Level (m)	Depth to Cave (m)
on completion June 5, 2018	5.81 bgs 0.34 bgs	no cave -

bgs (above ground surface)
bgs (below ground surface)

Log of Borehole BH-26

Project No. HAM-00801363-A0

Drawing No. 28

Project: Proposed Glenbrook Industrial Subdivision

Sheet No. 1 of 1

Location: Twenty Road West, Hamilton, ON

Date Drilled: March 26, 2018

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

Natural Moisture

Plastic and Liquid Limit

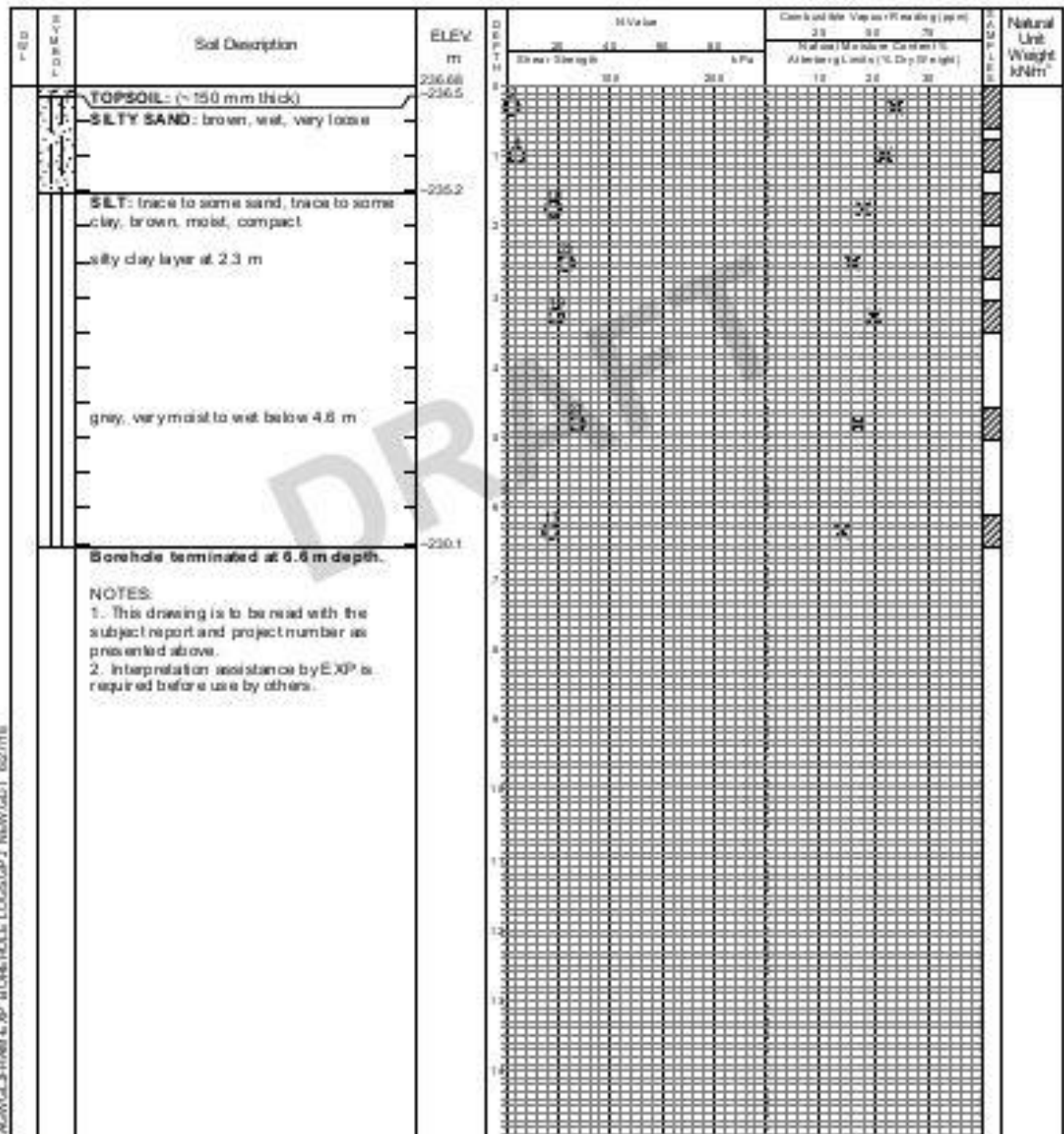
Undrained Triaxial

% Strain at Failure

Penetration

Drill Type: D-50 Track Mount, Solid Stem

Datum: Geodetic



EXP Services Inc.
Hamilton, Ontario
Telephone: 905.573.4000
Facsimile: 905.573.9893

Time	Water Level (m)	Depth to Cave (m)
on completion	4.32 tps	no cave

tps: above ground surface
tps: below ground surface

Log of Borehole BH-27

Project No. HAM-00801363-A0

Drawing No. 29

Project: Proposed Glanbrook Industrial Subdivision

Sheet No. 1 of 1

Location: Twenty Road West, Hamilton, ON

Date Drilled: April 18, 2018

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

Natural Moisture

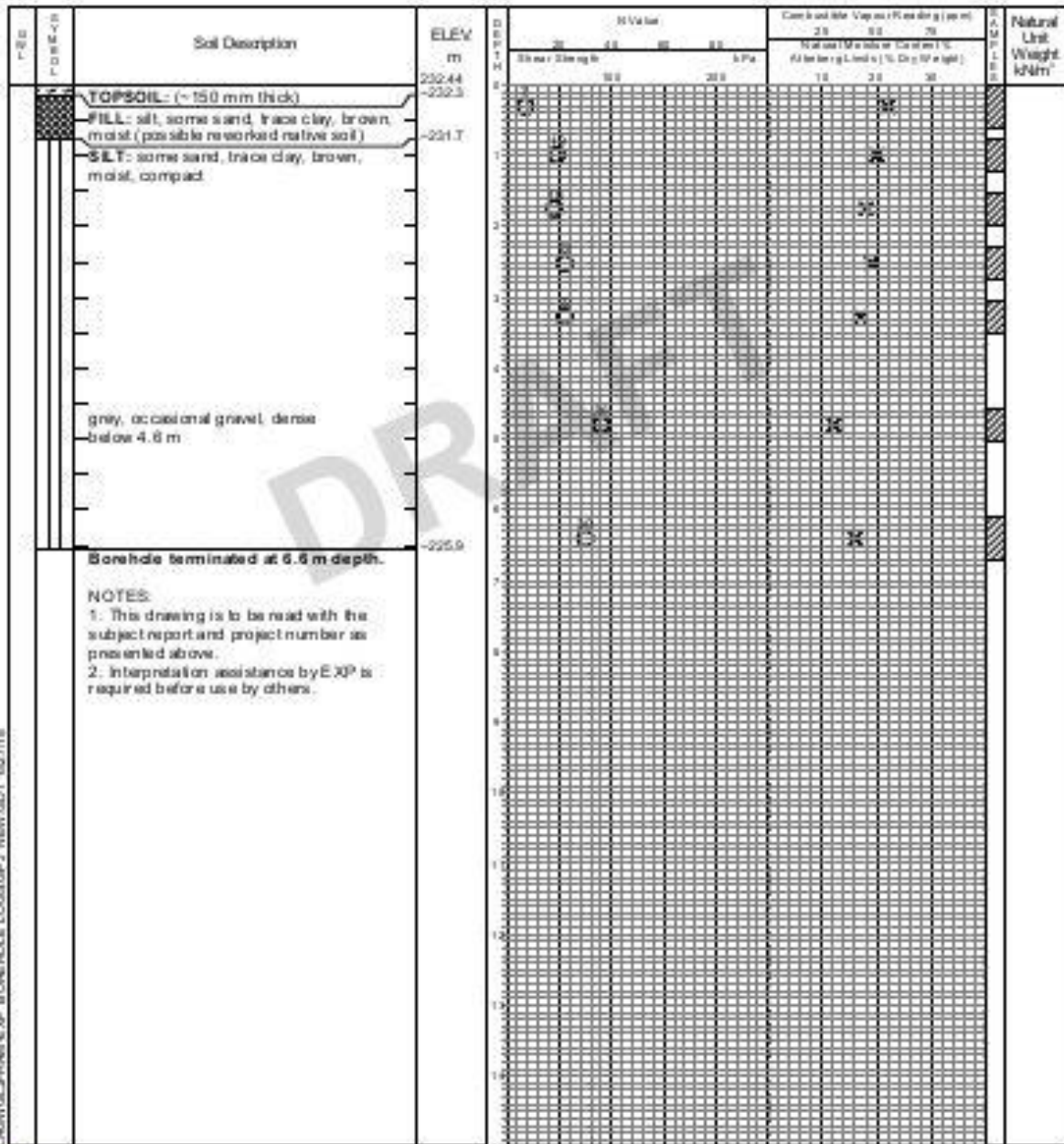
Plastic and Liquid Limit

Undrained Triaxial

% Strain at Failure

Pneumometer

Datum: Geodetic



LACWGLFHAM-EXP-BOREHOLE LOGS.GPJ NEW.GDT 6/27/18



EXP Services Inc.
Hamilton, Ontario
Telephone: 905.573.4000
Facsimile: 905.573.9693

Time	Water Level (m)	Depth to Cave (m)
on completion	5.83 tps	no cave

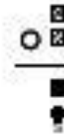
tps (above ground surface)
tps (below ground surface)

Log of Borehole BH-28

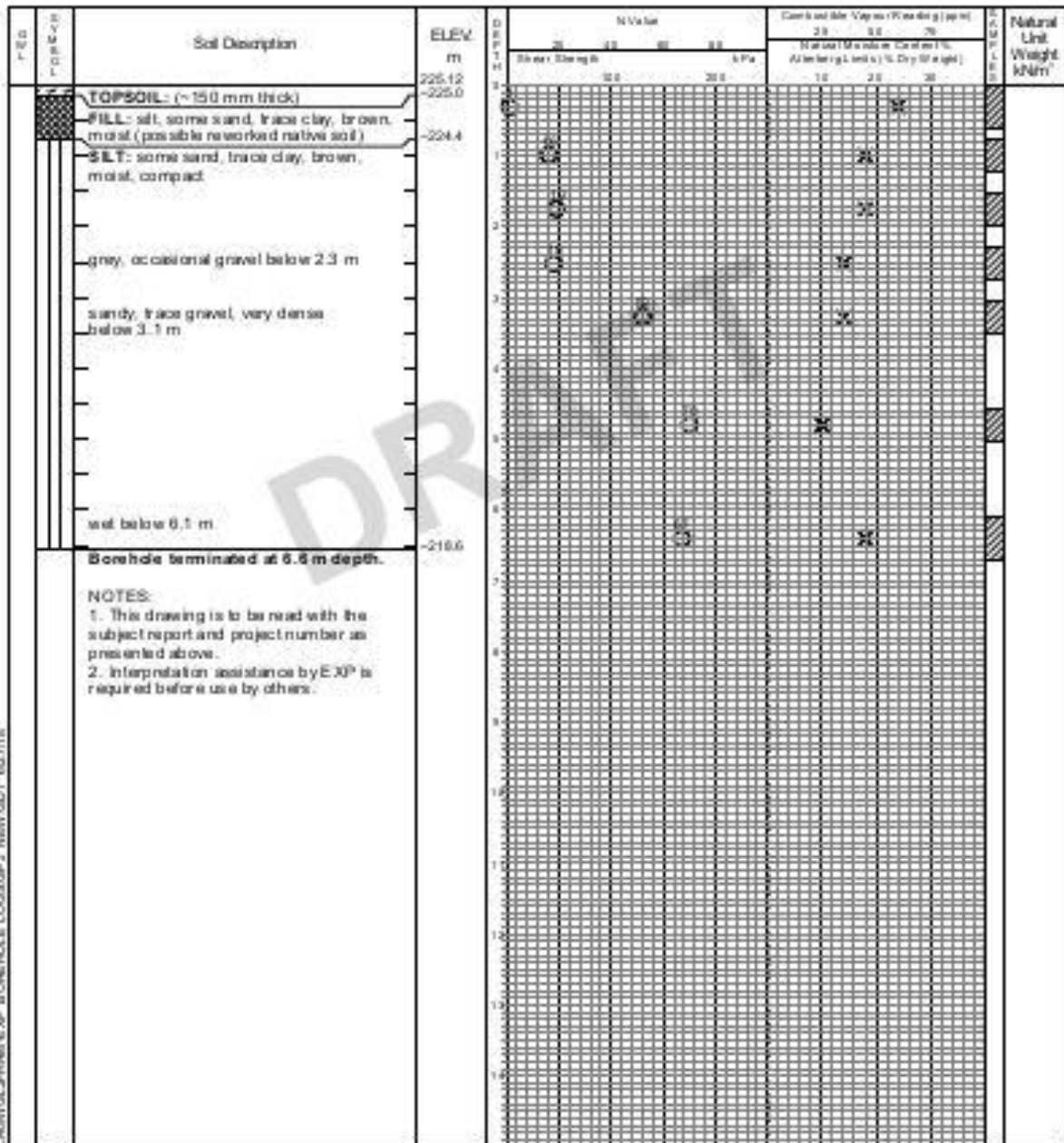
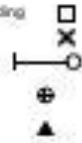
Project No. HAM-00801363-A0 Drawing No. 30
 Project: Proposed Glanbrook Industrial Subdivision Sheet No. 1 of 1
 Location: Twenty Road West, Hamilton, ON

Date Drilled: April 18, 2018
 Drill Type: D-50 Track Mount, Solid Stem.
 Datum: Geodetic

Auger Sample
 SPT (N) Value
 Dynamic Cone Test
 Shelby Tube
 Field Vane Test



Combustible Vapour Reading
 Natural Moisture
 Plastic and Liquid Limit
 Undrained Triaxial at
 % Strain at Failure
 Penetration



EXP Services Inc.
 Hamilton, Ontario
 Telephone: 905.573.4000
 Facsimile: 905.573.9693

Time	Water Level (m)	Depth to Cave (m)
on completion	5.94 bgs	no cave

bgs (above ground surface)
 bgs (below ground surface)

Log of Borehole BH-29

Project No: HAM-00801363-A0 Drawing No: 31
 Project: Proposed Glanbrook Industrial Subdivision Sheet No: 1 of 1
 Location: Twenty Road West, Hamilton, ON

Date Drilled: March 28, 2018
 Drill Type: CME-55 Track Mount. Hollow Stem
 Datum: Geodetic

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

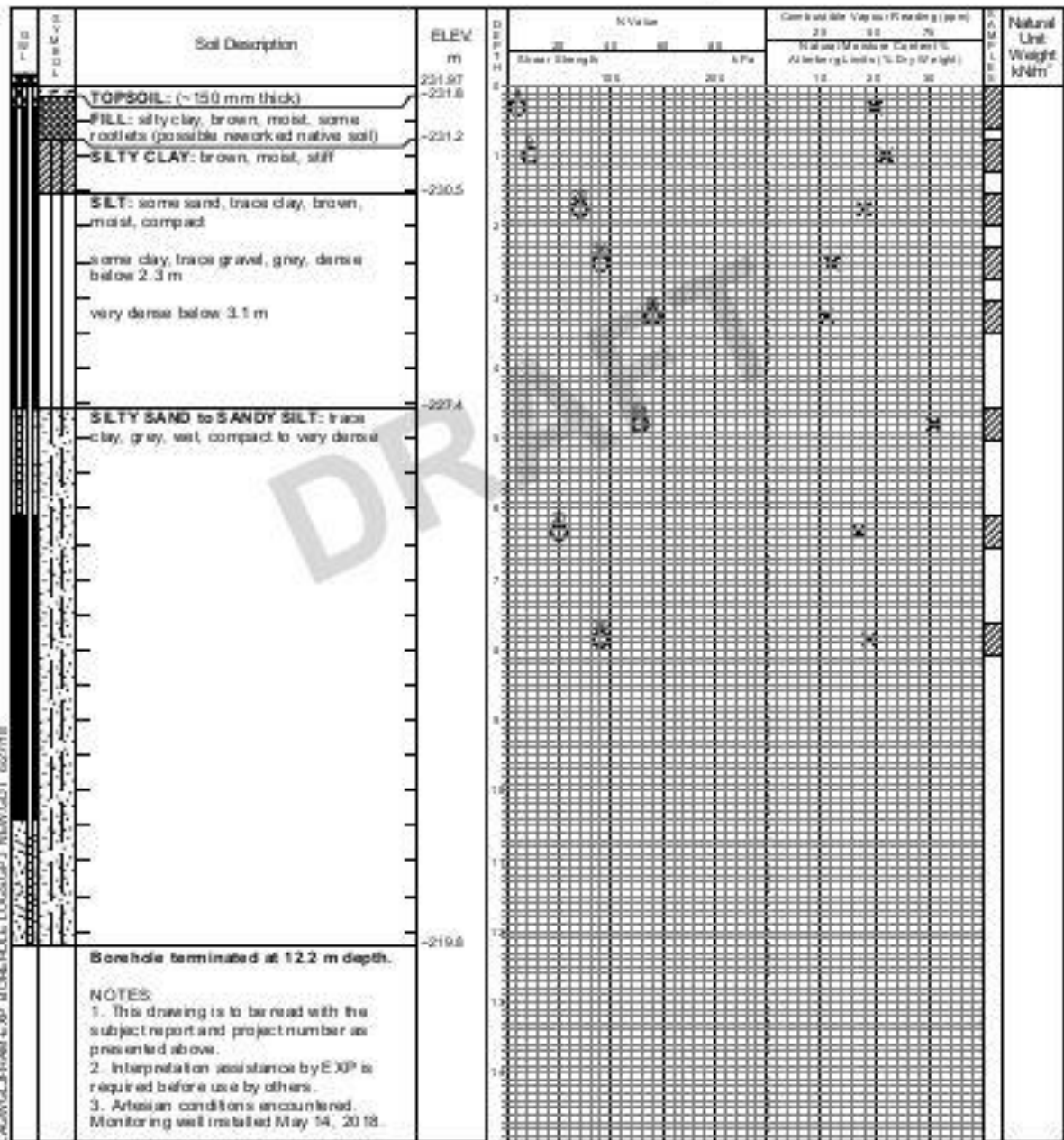
Natural Moisture

Plastic and Liquid Limit

Undrained Triaxial at

% Strain at Failure

Penetration Test



EXP Services Inc.
 Hamilton, Ontario
 Telephone: 905.573.4000
 Facsimile: 905.573.9893

Time	Water Level (m)	Depth to Cave (m)
on completion	0.84 bgs	6.1
Mar. 29 (shallow)	ags	—
Mar. 29 (deep)	ags	—
Jun. 5 (shallow)	2.90 ags	—
Jun. 5 (deep)	1.37 ags	—

ags (above ground surface)
 bgs (below ground surface)

Log of Borehole BH-30

Project No. HAM-00801363-A0

Drawing No. 32

Project: Proposed Glanbrook Industrial Subdivision

Sheet No. 1 of 1

Location: Twenty Road West, Hamilton, ON

Date Drilled: May 10, 2018

Auger Sample

Combustible Vapour Reading

Drill Type: CME-55 Track Mount, Hollow Stem

SPT (N) Value

Natural Moisture

Datum: Geodetic

Dynamic Cone Test

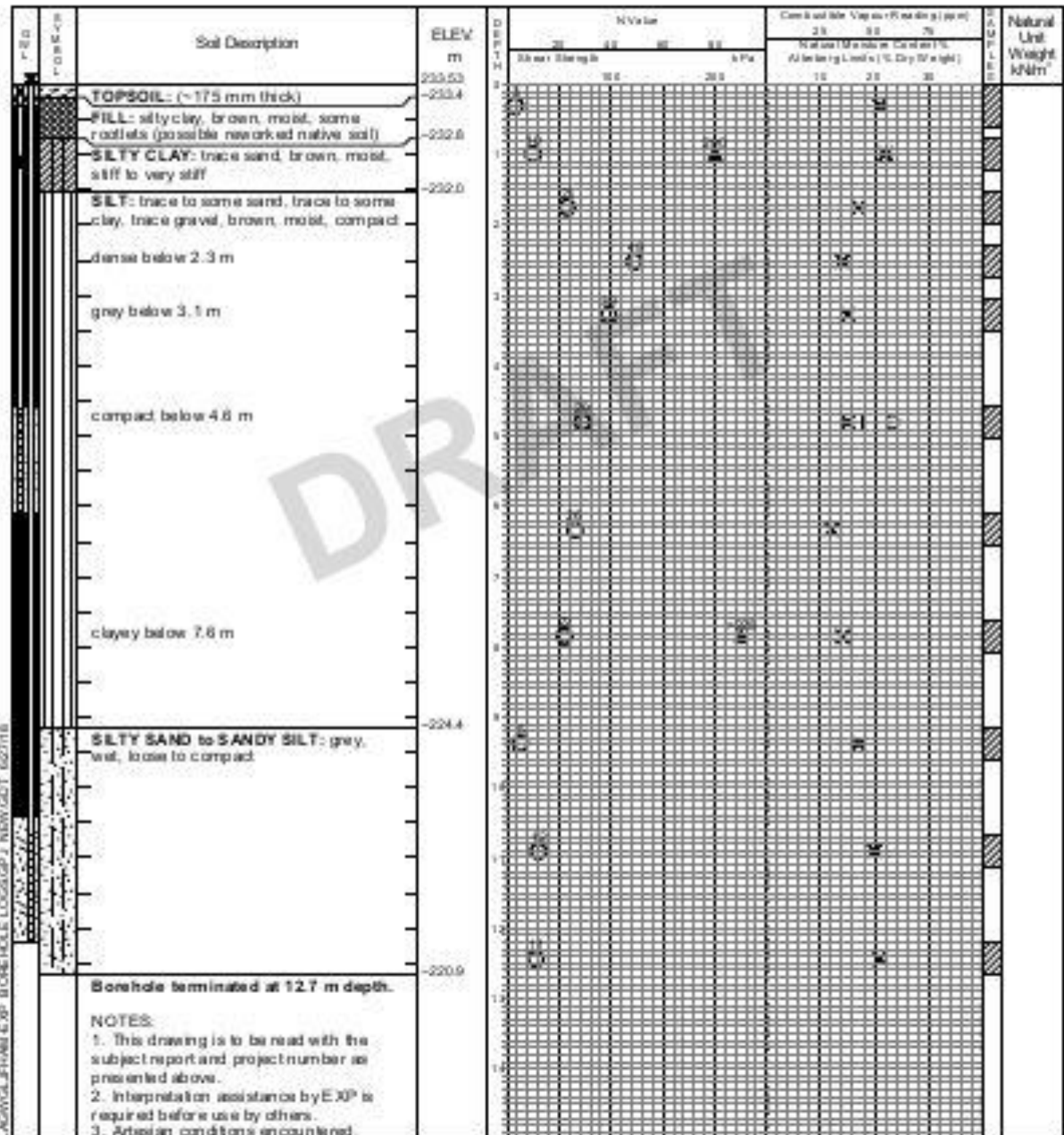
Plastic and Liquid Limit

Shelby Tube

Undrained Triaxial at % Strain at Failure

Field Vane Test

Penetration Test



EXP Services Inc.
Hamilton, Ontario
Telephone: 905.573.4000
Facsimile: 905.573.9893

Time	Water Level (m)	Depth to Cave (m)
on completion	ags	9.3
Jun. 5 (shallow)	1.18 bgs	-
Jun. 5 (deep)	0.70 ags	-

ags (above ground surface)
bgs (below ground surface)

Log of Borehole BH-31

Project No.: HAM-00801363-A0

Drawing No. 33

Project: Proposed Glanbrook Industrial Subdivision

Sheet No. 1 of 1

Location: Twenty Road West, Hamilton, ON

Date Drilled: March 26, 2018

Auger Sample

Combustible Vapour Reading

Drill Type: D-50 Track Mount. Solid Stem.

SPT (N) Value

Natural Moisture

Datum: Geodetic

Dynamic Cone Test

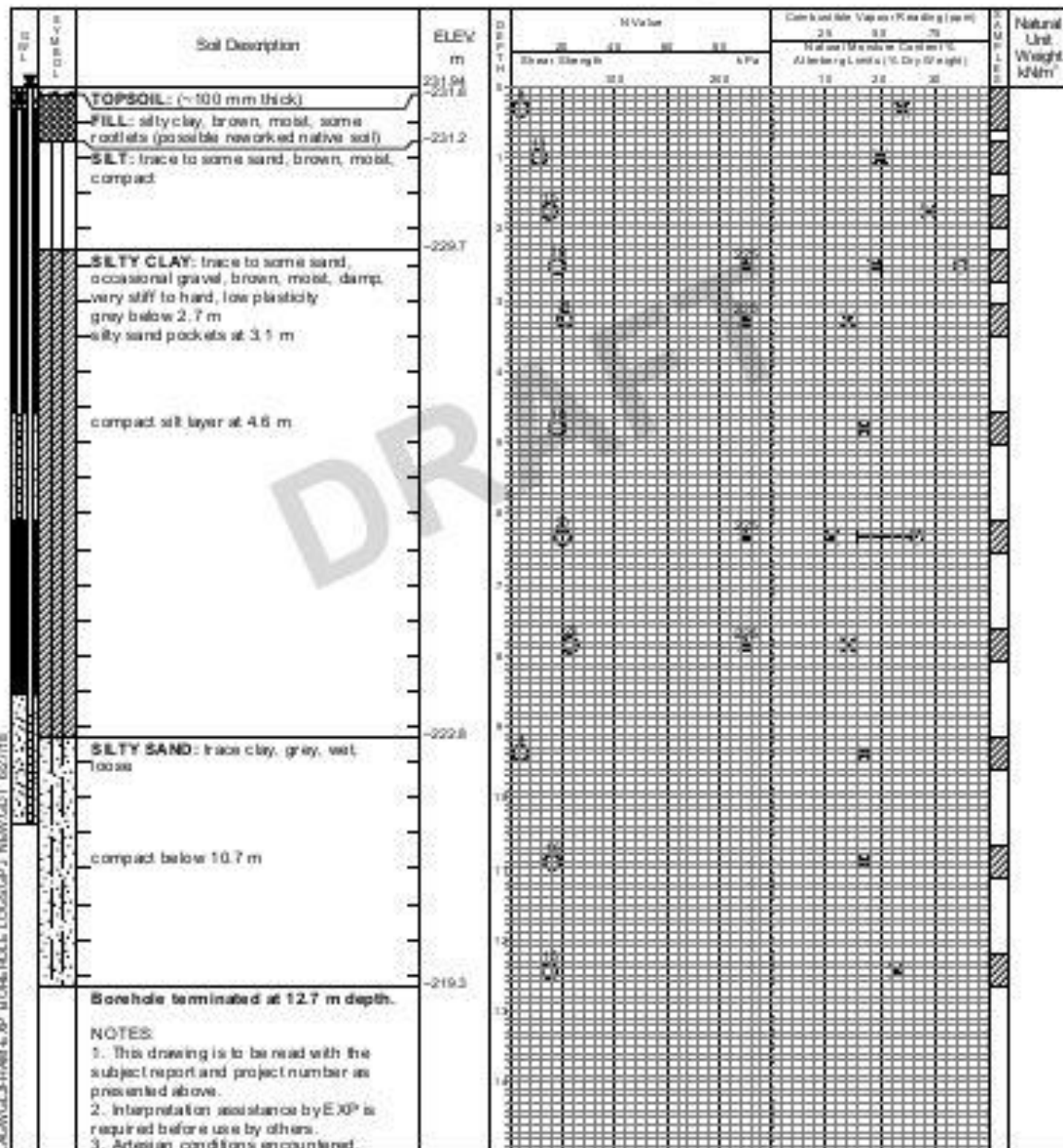
Plastic and Liquid Limit

Shelby Tube

Undrained Triaxial at % Strain at Failure

Field Vane Test

Penetrometer



EXP Services Inc.
Hamilton, Ontario
Telephone: 905.573.4000
Facsimile: 905.573.9893

Time	Water Level (m)	Depth to Cave (m)
on completion	3.10 bgs	10.41
Mar. 27 (shallow)	0.51 bgs	—
Mar. 27 (deep)	0.50 bgs	—
Jun. 5 (shallow)	0.20 bgs	—
Jun. 5 (deep)	1.12 bgs	—

bgs (above ground surface)
bgs (below ground surface)

Log of Borehole BH-32

Project No. HAM-00801363-A0

Drawing No. 34

Project: Proposed Glanbrook Industrial Subdivision

Sheet No. 1 of 1

Location: Twenty Road West, Hamilton, ON

Date Drilled: May 9, 2018

Auger Sample

Combustible Vapour Reading

Drill Type: CME-55 Track Mount. Solid Stem.

SPT (N) Value

Natural Moisture

Datum: Geodetic

Dynamic Cone Test

Plastic and Liquid Limit

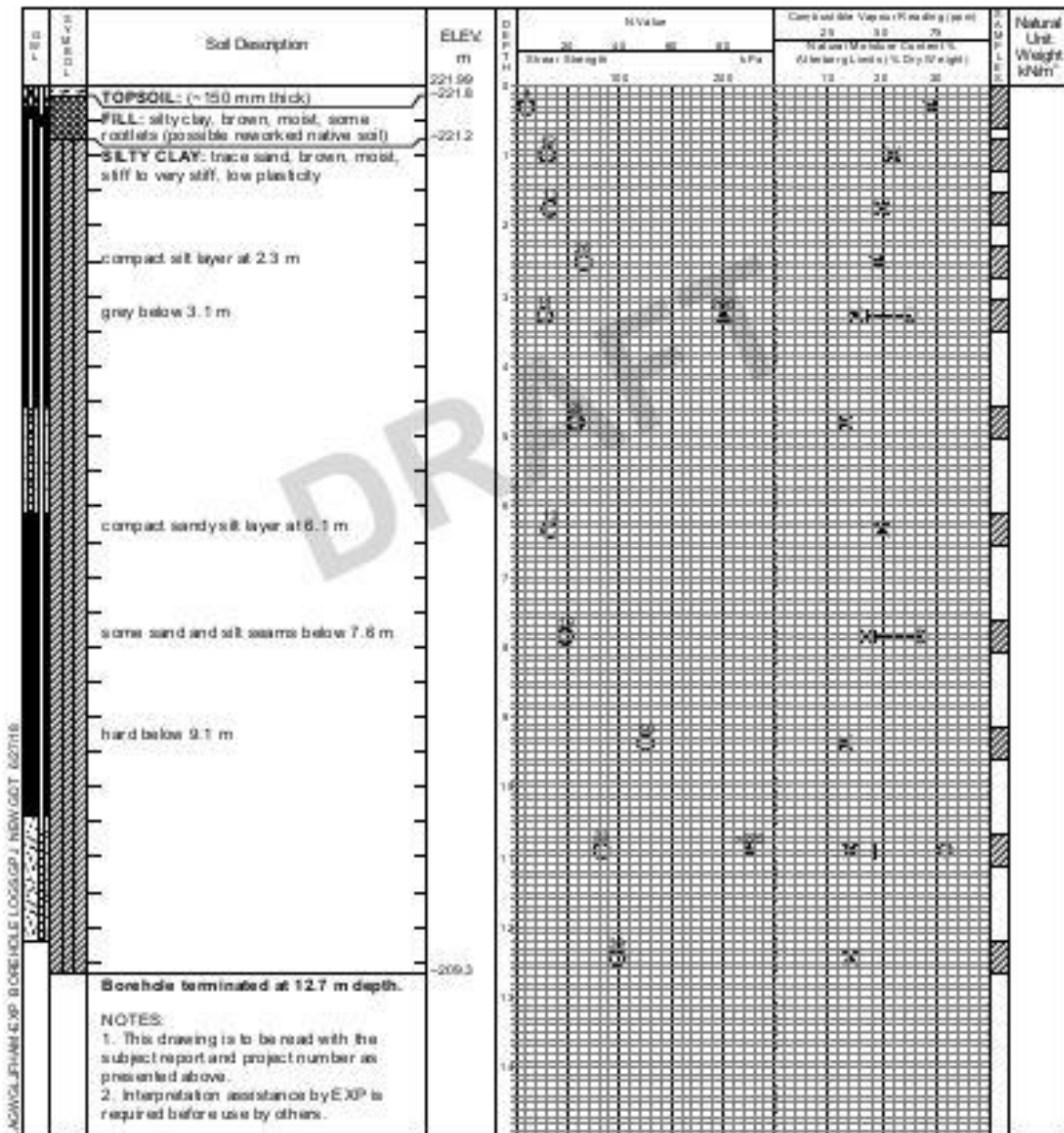
Shelby Tube

Undrained Triaxial at

Field Vane Test

% Strain at Failure

Penetration



EXP Services Inc.
Hamilton, Ontario
Telephone: 905.573.4000
Facsimile: 905.573.9893

Time	Water Level (m)	Depth to Cave (m)
on completion	dry	no cave
Jun. 5 (shallow)	0.46 bgs	—
Jun. 5 (deep)	0.56 bgs	—

bgs (above ground surface)
bgs (below ground surface)

Log of Borehole BH-33

Project No. HAM-00801363-A0

Drawing No. 35

Project: Proposed Glenbrook Industrial Subdivision

Sheet No. 1 of 1

Location: Twenty Road West, Hamilton, ON

Date Drilled: May 9, 2018

Auger Sample

Combustible Vapour Reading

Drill Type: CME-55 Track Mount. Solid Stem.

SPT (h) Value

Natural Moisture

Datum: Geodetic

Dynamic Cone Test

Plastic and Liquid Limit

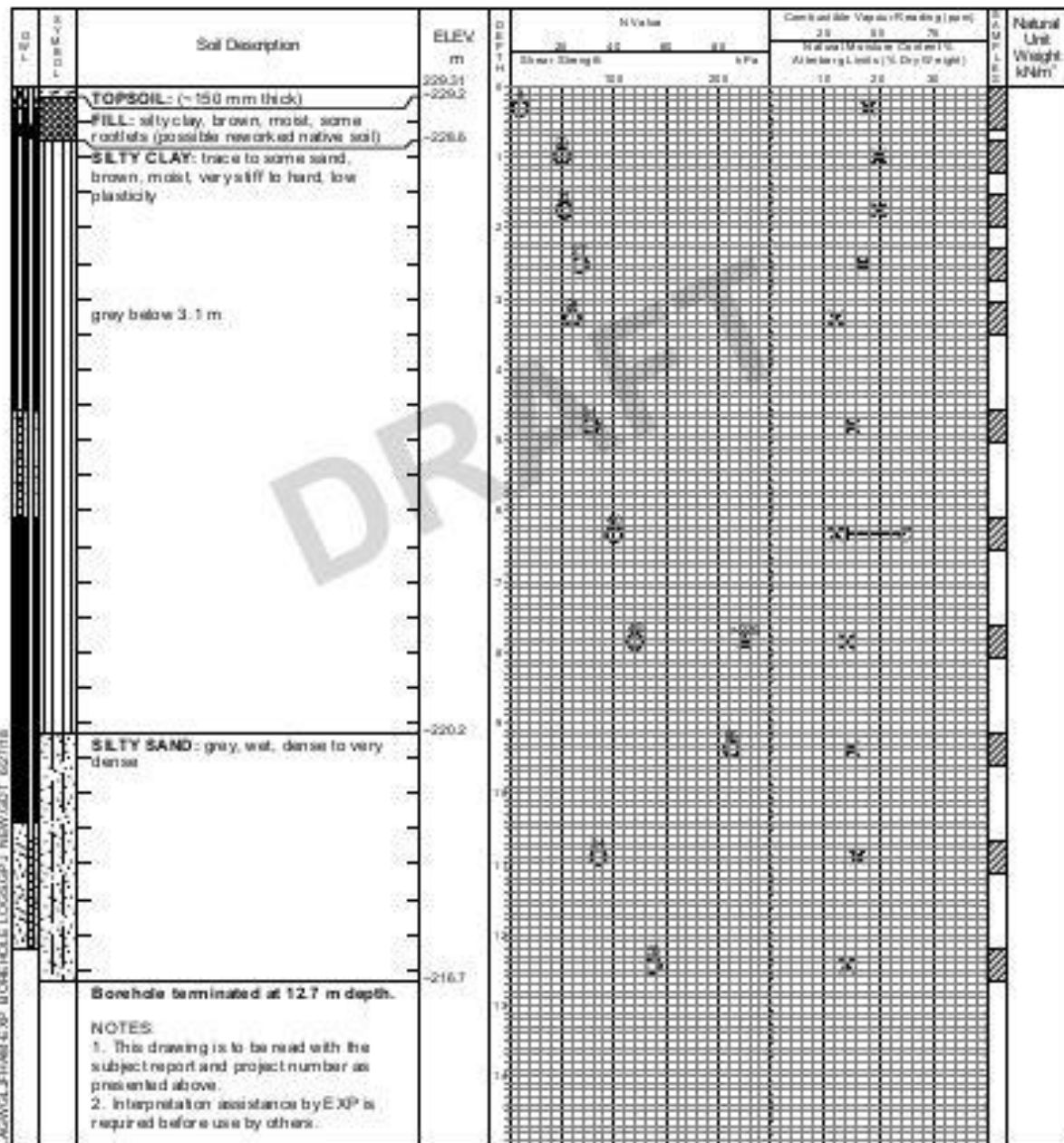
Shelby Tube

Undrained Triaxial at

Field Vane Test

% Strain at Failure

Penetration test



EXP Services Inc.
Hamilton, Ontario
Telephone: 905.573.4000
Facsimile: 905.573.9893

Time	Water Level (m)	Depth to Cave (m)
on completion	11.62 bgs	no cave
Jun. 4 (shallow)	0.66 bgs	—
Jun. 4 (deep)	0.71 bgs	—

bgs (above ground surface)
bgs (below ground surface)

APPENDIX B2


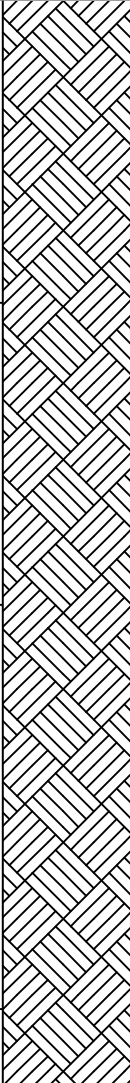
Borehole Logs (Crozier 2023)

BOREHOLE BH23-1

PROJECT NUMBER 2521-6807	DRILLING COMPANY Elements GEO Corp	COORDINATES 43.19804, -79.9298
PROJECT NAME Upper West Side	DRILLER	COORD SYS UTM
CLIENT UWS Landowner Group	DRILL RIG	SURFACE ELEVATION 242.03
ADDRESS Multiple Addresses	DRILLING METHOD Solid Stem	WELL TOC
DRILLING DATE 2023/09/06 - 2023/09/15	TOTAL DEPTH 8.23	LOGGED BY LT
LICENCE NO. 7687	DIAMETER 0.152 m	CHECKED BY CM

COMPLETION 2023/09/08	CASING PVC	SCREEN PVC
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COMMENTS


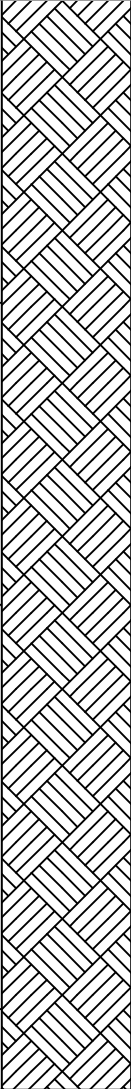




Depth (m)	Elevation (m)	Samples	Sample Type	Graphic Log	Material Description	Well Installation	Moisture	Water	Blow Counts			
0.5	242	SS1	SS		SILT: Brown, moist, soft to medium stiff, silt		M		2/3/4/8			
	241.5											
1	241	SS2									5/8/12/15	
	240.5											
1.5	240.5	SS3									8/11/17/22	
	240											
2	240											
	239.5	SS3							CLAYEY SILT: Grey, moist, very stiff, silt		12/15/28/37	
3	239											
	238.5											
4	238	SS4									8/11/12/14	
	237.5									SILT: Grey, moist, stiff, silty with trace clay		
5	237											
	236.5	SS5									3/5/8/11	
6	236											
	235.5	SS6				9/15/21/26						
6.5	235.5											
	235											
7	235											
	234.5											
7.5	234.5											
	234	SS7			SILT: Grey, moist, hard, silt			21/40/50 for 6"				
8	234											
8.5	233.5				Termination Depth at 8.23 m							
9	233											
9.5	232.5											

BOREHOLE BH23-2

PROJECT NUMBER 2521-6807	DRILLING COMPANY Elements GEO Corp	COORDINATES 43.19507, -79.9299
PROJECT NAME Upper West Side	DRILLER	COORD SYS UTM
CLIENT UWS Landowner Group	DRILL RIG	SURFACE ELEVATION 243.08
ADDRESS Multiple Addresses	DRILLING METHOD Solid Stem	WELL TOC
DRILLING DATE 2023/09/06 - 2023/09/15	TOTAL DEPTH 8.23	LOGGED BY LT
LICENCE NO. 7687	DIAMETER 0.152 m	CHECKED BY CM

COMPLETION 2023/09/08	CASING PVC	SCREEN PVC
------------------------------	-------------------	-------------------

COMMENTS


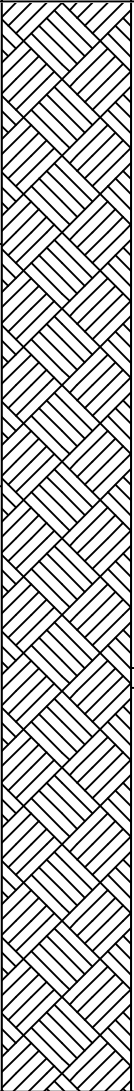

Depth (m)	Elevation (m)	Samples	Sample Type	Graphic Log	Material Description	Well Installation	Moisture	Water	Blow Counts			
0.5	243	SS1	SS		SILT: Brown, dry to moist, soft to medium stiff, silt		D - M		2/3/3/3			
	242.5											
1		SS2										2/6/7/13
	242											
1.5		SS3										8/11/13/23
	241.5											
2	241											
2.5		SS3					CLAYEY SILT: Grey, moist, stiff, silt trace sand		M	6/10/15/14		
	240.5											
3												
3.5	240											
4		SS4						12/14/15/20				
	239.5											
4	239											
4.5				SILT: Grey, moist, stiff, silty with sand seams								
	238.5											
5	238											
5.5		SS5							16/23/28/40			
	237.5											
6	237	SS6							8/14/11/13			
6.5												
	236.5											
7	236											
7.5		SS7					SILTY SAND: Grey, wet to moist, silty sand	W - M		18/25/41/50		
	235.5											
8	235											
8.5	234.5			Termination Depth at 8.23 m								
9	234											
9.5	233.5											

MONITORING WELL BH23-3

PROJECT NUMBER 2521-6807	DRILLING COMPANY Elements GEO Corp	COORDINATES 43.19337 -79.9316
PROJECT NAME Upper West Side	DRILLER	COORD SYS UTM
CLIENT UWS Landowner Group	DRILL RIG	SURFACE ELEVATION 243.93
ADDRESS Multiple Addresses	DRILLING METHOD Solid Stem	WELL TOC
DRILLING DATE 2023/09/06 - 2023/09/15	TOTAL DEPTH 8.23	LOGGED BY LT
LICENCE NO. 7687	DIAMETER 0.152	CHECKED BY CM

COMPLETION 2023/09/12	CASING PVC	SCREEN PVC
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COMMENTS

Depth (m)	Elevation (m)	Samples	Sample Type	Graphic Log	Material Description	Well Installation	Moisture	Water	Blow Counts
0.5	243.5	SS1	SS		SILT: Brown, medium stiff, moist, silt trace sand		M		2/3/3/5
1	243	SS2							4/2/4/8
1.5	242.5	SS3							9/14/16/19
2	242								SILTY CLAY: Grey, moist, very stiff, silty clay
2.5	241.5	SS4			4/5/4/5				
3	241	SS5							
3.5	240.5				SS6				
4	240	238							22/26/21/21
4.5	239.5				237.5				
5	239	236							235.5
5.5	238.5				SS7				
6	238	237			234.5				
6.5	237.5				SS8				234
7	237	236.5							233.5
7.5	236.5				236				233
8	236	235.5							232.5
8.5	235.5		235	232					
9	235	234.5		231.5					
9.5	234.5		234	231					
	234	233.5		230.5					
	233.5		233	230					
	233	232.5		229.5					
	232.5		232	229					
	232	231.5		228.5					
	231.5		231	228					
	231	230.5		227.5					
	230.5		230	227					
	230	229.5		226.5					
	229.5		229	226					
	229	228.5		225.5					
	228.5		228	225					
	228	227.5		224.5					
	227.5		227	224					
	227	226.5		223.5					
	226.5		226	223					
	226	225.5		222.5					
	225.5		225	222					
	225	224.5		221.5					
	224.5		224	221					
	224	223.5		220.5					
	223.5		223	220					
	223	222.5		219.5					
	222.5		222	219					
	222	221.5		218.5					
	221.5		221	218					
	221	220.5		217.5					
	220.5		220	217					
	220	219.5		216.5					
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	218.5		218	215					
	218	217.5		214.5					
	217.5		217	214					
	217	216.5		213.5					
	216.5		216	213					
	216	215.5		212.5					
	215.5		215	212					
	215	214.5		211.5					
	214.5		214	211					
	214	213.5		210.5					
	213.5		213	210					
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MONITORING WELL BH23-4


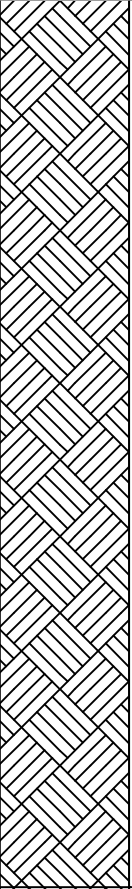
PROJECT NUMBER 2521-6807	DRILLING COMPANY Elements GEO Corp	COORDINATES 43.19018, -79.9295
PROJECT NAME Upper West Side	DRILLER	COORD SYS UTM
CLIENT UWS Landowner Group	DRILL RIG	SURFACE ELEVATION Est. 240
ADDRESS Multiple Addresses	DRILLING METHOD Solid Stem	WELL TOC
DRILLING DATE 2023/09/06 - 2023/09/15	TOTAL DEPTH 6.7	LOGGED BY LT
LICENCE NO. 7687	DIAMETER 0.152	CHECKED BY CM

COMPLETION 2023/09/12

CASING PVC

SCREEN PVC

COMMENTS

Depth (m)	Elevation (m)	Samples	Sample Type	Graphic Log	Material Description	Well Installation	Moisture	Water	Blow Counts
0.5	239.5	SS1	SS		SILT: Brown, medium stiff, moist, silt		M		1/2/3/4
1	239	SS2							6/7/9/12
1.5	238.5	SS3							8/12/15/5
2	238								
2.5	237.5	SS4			SILT: Grey, moist, very stiff, silt trace clay				8/12/15/16
3	237	SS5							8/13/18/21
3.5	236.5								
4	236	SS6							15/19/24/23
4.5	235.5								
5	235								
5.5	234.5	SS7							8/14/11/13
6	234								
6.5	233.5								
7	233			Termination Depth at:6.7 m					
7.5	232.5								
8	232								
8.5	231.5								
9	231								
9.5	230.5								

MONITORING WELL MW23-1

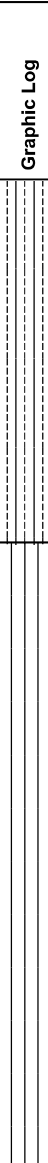
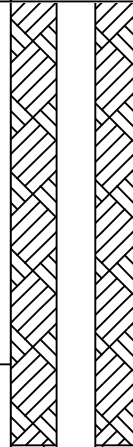

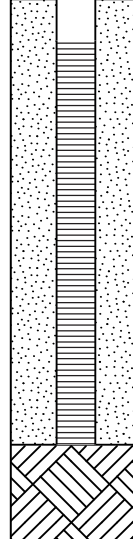
PROJECT NUMBER 2521-6807	DRILLING COMPANY Elements GEO Corp	COORDINATES 43.19753 -79.9272
PROJECT NAME Upper West Side	DRILLER	COORD SYS UTM
CLIENT UWS Landowner Group	DRILL RIG	SURFACE ELEVATION 239.90
ADDRESS Multiple Addresses	DRILLING METHOD Solid Stem	WELL TOC
DRILLING DATE 2023/09/06 - 2023/09/15	TOTAL DEPTH 6.1	LOGGED BY LT
LICENCE NO. 7687	DIAMETER 0.152 m	CHECKED BY CM

COMPLETION 2023/09/13

CASING PVC

SCREEN PVC

COMMENTS

Depth (m)	Elevation (m)	Samples	Sample Type	Graphic Log	Material Description	Well Installation	Moisture	Water	Blow Counts
0.5	239.5	SS1	SS		SILTY CLAY: Brown, dry, stiff, silty clay trace sand		D		1/2/3/4
1	239	SS2							1/3/8/11
1.5	238.5	SS3							4/5/12/15
2	238								
2.5	237.5	SS4			7/12/22/26				
3	237	SILT: Brown, moist, stiff, silt, grey at 2.74				M-W	7/18/28/31		
3.5	236.5								
4	236								
4.5	235.5								
5	235						SS6		10/26/39/43
5.5	234.5								
6	234								
6.5	233.5						SS7		20/32/50 for 5"
7	233						SS8		28/40/50 for 4"
7.5	232.5							Termination Depth at 7.46 m	
8	232								
8.5	231.5								
9	231								
9.5	230.5								
	230								

MONITORING WELL MW23-2

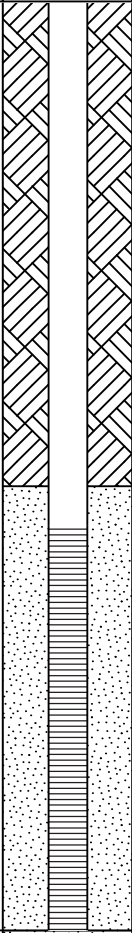
PROJECT NUMBER 2521-6807	DRILLING COMPANY Elements GEO Corp	COORDINATES 43.19268 -79.9277
PROJECT NAME Upper West Side	DRILLER	COORD SYS UTM
CLIENT UWS Landowner Group	DRILL RIG	SURFACE ELEVATION 242.8
ADDRESS Multiple Addresses	DRILLING METHOD Solid Stem	WELL TOC
DRILLING DATE 2023/09/06 - 2023/09/15	TOTAL DEPTH 7.01	LOGGED BY LT
LICENCE NO. 7687	DIAMETER 0.152 m	CHECKED BY CM

COMPLETION 2023/09/13

CASING PVC

SCREEN PVC

COMMENTS

Depth (m)	Elevation (m)	Samples	Sample Type	Graphic Log	Material Description	Well Installation	Moisture	Water	Blow Counts
0.5	242.5	SS1	SS		SILT: Brown to grey at 3.05, moist, stiff to very stiff, silt trace clay, trace sand		M		5/5/6/5
1	242	SS2							5/8/12/15
1.5	241.5								
2	241	SS3							8/14/19/23
2.5	240.5	SS4							7/9/15/16
3	240								
3.5	239.5	SS5							4/7/7/8
4	239								
4.5	238.5				Termination Depth at 7.01 m				
5	238	SS6							-/13/16/17
5.5	237.5								
6	237								
6.5	236.5	SS7							10/19/21/26
7	236								
7.5	235.5	SS8							10/22/24/27
8	235								
8.5	234.5								
9	234								
9.5	233.5								
	233								

MONITORING WELL MW23-3

PROJECT NUMBER 2521-6807	DRILLING COMPANY Elements GEO Corp	COORDINATES 43.19171, -79.9323
PROJECT NAME Upper West Side	DRILLER	COORD SYS UTM
CLIENT UWS Landowner Group	DRILL RIG	SURFACE ELEVATION 250.01
ADDRESS Multiple Addresses	DRILLING METHOD Solid Stem	WELL TOC 1.08 m
DRILLING DATE 2023/09/06 - 2023/09/15	TOTAL DEPTH 7.62	LOGGED BY LT
LICENCE NO. 7687	DIAMETER 0.152 m	CHECKED BY CM

COMPLETION 2023/09/06	CASING PVC	SCREEN PVC
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COMMENTS Former Golf Course

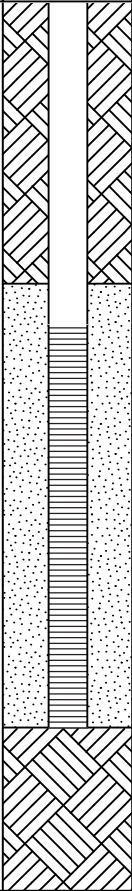
Depth (m)	Elevation (m)	Samples	Sample Type	Graphic Log	Material Description	Well Installation	Moisture	Water	Blow Counts
0.5	250	SS1	SS		TOPSOIL				3/3/4/5
	249.5				SILT: Brown, dry, soft, silt		D		
1	249	SS2			SILT: Brown, moist, medium stiff to stiff, silt, trace clay		M - D		3/3/4/5
1.5	248.5	SS3							9/14/15/17
2	248								
2.5	247.5	SS3			SILT: Grey, moist to dry, very stiff to hard, silt				13/14/14/20
3	247								
3.5	246.5								
4	246	SS4							10/14/21/32
4.5	245.5								
5	245								
5.5	244.5	SS5							19/15/21/24
6	244				SILT: Grey, wet at 5.79 m, hard, silt		W		
6.5	243.5								
7	243	SS6					M - D		9/13/42/50 for 4"
7.5	242.5								
8	242				Termination Depth at 7.62 m				
8.5	241.5								
9	241								
9.5	240.5								

MONITORING WELL MW23-4

PROJECT NUMBER 2521-6807	DRILLING COMPANY Elements GEO Corp	COORDINATES 43.19035 -79.933
PROJECT NAME Upper West Side	DRILLER	COORD SYS UTM
CLIENT UWS Landowner Group	DRILL RIG	SURFACE ELEVATION 240.08
ADDRESS Multiple Addresses	DRILLING METHOD Solid Stem	WELL TOC
DRILLING DATE 2023/09/06 - 2023/09/15	TOTAL DEPTH 5.48	LOGGED BY LT
LICENCE NO. 7687	DIAMETER 0.152 m	CHECKED BY CM

COMPLETION 2023/09/06	CASING PVC	SCREEN PVC
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COMMENTS

Depth (m)	Elevation (m)	Samples	Sample Type	Graphic Log	Material Description	Well Installation	Moisture	Water	Blow Counts
0.5	240	SS1	SS		SILT: Brown to grey at 3.81, moist to wet, stiff to very stiff, silt trace clay, trace sand		M		3/3/6/10
	239.5								
1	239	SS2							6/13/14/14
	238.5								
1.5	238.5	SS3							6/12/13/12
	238								
2	237.5	SS4							8/9/16/14
	237						W		
3	237	SS5							4/6/8/11
	236.5			▽			M	▽ 1	
4	236								4/6/9/14
	235.5	SS6							
5	235								4/9/14/19
	234.5			▽				▽ 2	
5.5	234	SS7					W		
6	234								7/23/28/41
6.5	233.5								
7	233				Termination Depth at 6.71 m				
7.5	232.5								
8	232								
8.5	231.5								
9	231								
9.5	230.5								

MONITORING WELL MW23-5

PROJECT NUMBER 2521-6807	DRILLING COMPANY Elements GEO Corp	COORDINATES 43.19388 -79.9122
PROJECT NAME Upper West Side	DRILLER	COORD SYS UTM
CLIENT UWS Landowner Group	DRILL RIG	SURFACE ELEVATION 233.13
ADDRESS Multiple Addresses	DRILLING METHOD Solid Stem	WELL TOC
DRILLING DATE 2023/09/06 - 2023/09/15	TOTAL DEPTH 8.23	LOGGED BY LT
LICENCE NO. 7687	DIAMETER 0.152 m	CHECKED BY CM

COMPLETION 2023/09/11

CASING PVC

SCREEN PVC

COMMENTS

Depth (m)	Elevation (m)	Samples	Sample Type	Graphic Log	Material Description	Well Installation	Moisture	Water	Blow Counts
0.5	233	SS1	SS		SILT: Brown, moist, soft, silt trace sand, trace clay		D - M		4/4/3/5
1	232.5	SS2							4/6/7/13
1.5	232				SILTY CLAY: Brown, moist, silty clay				6/7/8/7
2	231.5	SS3							9/10/13/11
2.5	231	SS4			SILT: Brown, stiff, dry to moist, silt, trace sand, grey at 6.1				5/5/11/13
3	230.5								
3.5	230	SS5							
4	229.5								
4.5	229								
5	228.5	SS6							12/15/24/27
5.5	228								
6	227.5								
6.5	227	SS7							12/27/27/28
7	226.5								
7.5	226								
8	225.5	SS8			∇ SILTY SAND: Grey, wet, stiff, silty sand		W - M	∇	20/31/31/37
8.5	225								
9	224.5				Termination Depth at 8.23 m				
9.5	224								
	223.5								

MONITORING WELL MW23-6

PROJECT NUMBER 2521-6807	DRILLING COMPANY Elements GEO Corp	COORDINATES 43.19484 -79.9227
PROJECT NAME Upper West Side	DRILLER	COORD SYS UTM
CLIENT UWS Landowner Group	DRILL RIG	SURFACE ELEVATION 235.93
ADDRESS Multiple Addresses	DRILLING METHOD Solid Stem	WELL TOC
DRILLING DATE 2023/09/06 - 2023/09/15	TOTAL DEPTH 7.01	LOGGED BY LT
LICENCE NO. 7687	DIAMETER 0.152 m	CHECKED BY CM

COMPLETION 2023/09/09

CASING PVC

SCREEN PVC

COMMENTS

Depth (m)	Elevation (m)	Samples	Sample Type	Graphic Log	Material Description	Well Installation	Moisture	Water	Blow Counts
0.5	235.5	SS1	SS		SILTY CLAY: Brown, moist, soft to medium stiff, silty clay		M		2/3/3/9
1	235	SS2							2/2/2/3
1.5	234.5	SS3							3/6/10/14
2	234								
2.5	233.5	SS4							6/12/10/18
3	233	SS5			SILT: Grey, moist, very stiff, silt				8/15/25/43
3.5	232.5								
4	232								
4.5	231.5	SS6							27/36/40/46
5	231								
5.5	230.5								
6	230	SS7							25/50 for 6"
6.5	229.5								
7	229								
7.5	228.5	SS8			SILTY SAND: Grey, dry, stiff, silty sand		D		26/30/34/50 for 6"
8	228				SILT: Grey, moist to wet, hard, silt		M-W		
8.5	227.5								
9	227	SS9							14/24/30/50 for 6"
9.5	226.5								
	226				Termination Depth at 9.75 m				

MONITORING WELL MW23-7

PROJECT NUMBER 2521-6807	DRILLING COMPANY Elements GEO Corp	COORDINATES 43.1947 -79.9151
PROJECT NAME Upper West Side	DRILLER	COORD SYS UTM
CLIENT UWS Landowner Group	DRILL RIG	SURFACE ELEVATION 229.33
ADDRESS Multiple Addresses	DRILLING METHOD Solid Stem	WELL TOC
DRILLING DATE 2023/09/06 - 2023/09/15	TOTAL DEPTH 9.1	LOGGED BY LT
LICENCE NO. 7687	DIAMETER 0.152 m	CHECKED BY CM

COMPLETION 2023/09/10

CASING PVC

SCREEN PVC

COMMENTS

Depth (m)	Elevation (m)	Samples	Sample Type	Graphic Log	Material Description	Well Installation	Moisture	Water	Blow Counts
0.5	229	SS1	SS		SILTY CLAY: Brown, moist, soft to medium stiff, silty clay, silt seams		D		4/5/5/6
1	228.5	SS2							2/2/7/12
1.5	228								
2	227.5	SS3			SILT: Brown, moist, very stiff, silt, grey at 4.57m		M		6/9/16/20
2.5	227	SS4							6/15/19/28
3	226.5								
3.5	226	SS5							11/19/30/50 for 6"
4	225.5								
4.5	225								
5	224.5	SS6							8/23/31/50 for 6"
5.5	224								
6	223.5								
6.5	223	SS7							16/22/35/50 for 6"
7	222.5								
7.5	222								
8	221.5	SS8			SILTY SAND: Grey, wet, stiff, silty sand		W		25/42/50 for 6"
8.5	221				SILT: Grey, moist to wet, hard, silt		D-M		
9	220.5								
9.5	220	SS9							15/25/31/41
	219.5				Termination Depth at 9.75 m				

MONITORING WELL MW23-8

PROJECT NUMBER 2521-6807	DRILLING COMPANY Elements GEO Corp	COORDINATES 43.19186 -79.9057
PROJECT NAME Upper West Side	DRILLER	COORD SYS UTM
CLIENT UWS Landowner Group	DRILL RIG	SURFACE ELEVATION 226.34
ADDRESS Multiple Addresses	DRILLING METHOD Solid Stem	WELL TOC
DRILLING DATE 2023/09/06 - 2023/09/15	TOTAL DEPTH 5.49	LOGGED BY LT
LICENCE NO. 7687	DIAMETER 0.152 m	CHECKED BY CM

COMPLETION 2023/09/11

CASING PVC

SCREEN PVC

COMMENTS

Depth (m)	Elevation (m)	Samples	Sample Type	Graphic Log	Material Description	Well Installation	Moisture	Water	Blow Counts
0.5	226	SS1	SS		SILTY CLAY: Brown, moist, silty clay trace sand		D - M		2/3/2/3
1	225.5	SS2							3/5/7/9
1.5	225								
2	224.5	SS3							4/6/8/11
2.5	224	SS4							8/9/7/7
3	223.5								
3.5	223	SS5			SILT: Brown, stiff, moist to wet, silt, trace sand, grey at 3.66				20/17/14/14
4	222.5						W - M		
4.5	222								
5	221.5	SS6							7/13/13/13
5.5	221								
6	220.5				Termination Depth at 5.49 m				
6.5	220								
7	219.5								
7.5	219								
8	218.5								
8.5	218								
9	217.5								
9.5	217								
	216.5								

MONITORING WELL MW23-9

PROJECT NUMBER 2521-6807	DRILLING COMPANY Elements GEO Corp	COORDINATES 43.1907 -79.9031
PROJECT NAME Upper West Side	DRILLER	COORD SYS UTM
CLIENT UWS Landowner Group	DRILL RIG	SURFACE ELEVATION 225.00
ADDRESS Multiple Addresses	DRILLING METHOD Solid Stem	WELL TOC
DRILLING DATE 2023/09/06 - 2023/09/15	TOTAL DEPTH 5.18	LOGGED BY LT
LICENCE NO. 7687	DIAMETER 0.152 m	CHECKED BY CM

COMPLETION 2023/09/11	CASING PVC	SCREEN PVC
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COMMENTS

Depth (m)	Elevation (m)	Samples	Sample Type	Graphic Log	Material Description	Well Installation	Moisture	Water	Blow Counts
0.5	224.5	SS1	SS		SILTY CLAY: Brown, moist, silty clay		M		3/3/5/6
1	224	SS2							3/3/3/5
1.5	223.5	SS3			SILT: Brown, stiff, moist to wet, silt, trace sand, grey at 3.05				3/9/15/18
2	223								
2.5	222.5	SS4							4/8/2/9
3	222	SS5					W		6/8/11/17
3.5	221.5								
4	221								
4.5	220.5	SS6			SILTY CLAY: Grey, wet, stiff, silty clay				2/2/3/4
5	220								
5.5	219.5				Termination Depth at 5.18 m				
6	219								
6.5	218.5								
7	218								
7.5	217.5								
8	217								
8.5	216.5								
9	216								
9.5	215.5								

MONITORING WELL MW23-10

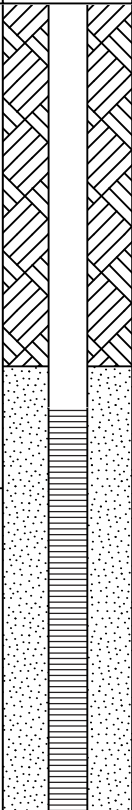
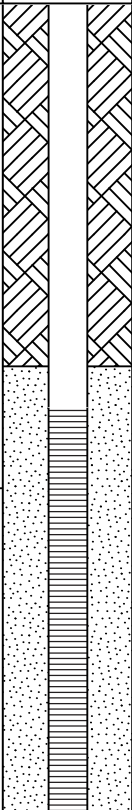
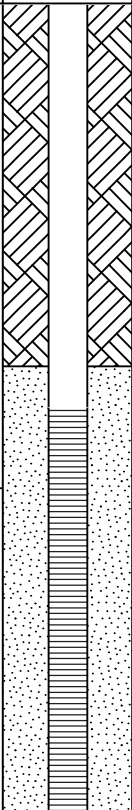
PROJECT NUMBER 2521-6807	DRILLING COMPANY Elements GEO Corp	COORDINATES 43.19572 -79.9199
PROJECT NAME Upper West Side	DRILLER	COORD SYS UTM
CLIENT UWS Landowner Group	DRILL RIG	SURFACE ELEVATION 233.83
ADDRESS Multiple Addresses	DRILLING METHOD Solid Stem	WELL TOC
DRILLING DATE 2023/09/06 - 2023/09/15	TOTAL DEPTH 6.1	LOGGED BY LT
LICENCE NO. 7687	DIAMETER 0.152 m	CHECKED BY CM

COMPLETION 2023/09/13

CASING PVC

SCREEN PVC

COMMENTS

Depth (m)	Elevation (m)	Samples	Sample Type	Graphic Log	Material Description	Well Installation	Moisture	Water	Blow Counts
0.5	233	SS1	SS		SILTY CLAY: Brown, moist, soft to stiff, silty clay, grey at 3.05		W		2/2/2/3
1	232.5	SS2							2/3/2/3
1.5	232								
2	231.5	SS3							3/3/6/6
2.5	231	SS4							5/6/10/13
3	230.5				SILT: Grey, moist, stiff, silt		W		3/5/8/9
3.5	230	SS5							
4	229.5								
4.5	229								
5	228.5	SS6							14/25/32/41
5.5	228				Termination Depth at 6.1 m		W		
6	227.5								
6.5	227	SS7							10/14/24/24
7	226.5								
7.5	226								
8	225.5								
8.5	225								
9	224.5								
9.5	224								
	223.5								

MONITORING WELL MW23-11

PROJECT NUMBER 2521-6807	DRILLING COMPANY Elements GEO Corp	COORDINATES
PROJECT NAME Upper West Side	DRILLER	COORD SYS UTM
CLIENT UWS Landowner Group	DRILL RIG	SURFACE ELEVATION
ADDRESS Multiple Addresses	DRILLING METHOD Solid Stem	WELL TOC
DRILLING DATE 2023/09/06 - 2023/09/15	TOTAL DEPTH	LOGGED BY LT
LICENCE NO. 7687	DIAMETER 0.152	CHECKED BY CM

COMPLETION 2023/09/12

CASING PVC

SCREEN PVC

COMMENTS

Depth (m)	Elevation (m)	Samples	Sample Type	Graphic Log	Material Description	Well Installation	Moisture	Water	Blow Counts
0.5	237	SS1	SS		SILT: Brown, medium stiff, moist, silt		M		3/3/4/5
1	236.5								
1.5	236	SS2							3/3/4/5
2	235.5								
2.5	235	SS3			SILT: Grey, moist, very stiff, silt				9/14/15/17
3	234.5								
3.5	234								
4	233.5	SS4							13/14/14/20
4.5	233								
5	232.5	SS5							10/14/21/32
5.5	232								
6	231.5	SS6							19/15/21/24
6.5	231								
7	230.5								
7.5	230	SS7							9/13/42/50 for 4"
7.5	229.5								
8	229				Termination Depth at: 7.62 m				
8.5	228.5								
9	228								
9.5	227.5								

MONITORING WELL MW23-12

PROJECT NUMBER 2521-6807	DRILLING COMPANY Elements GEO Corp	COORDINATES 43.18512 -79.9194
PROJECT NAME Upper West Side	DRILLER	COORD SYS UTM
CLIENT UWS Landowner Group	DRILL RIG	SURFACE ELEVATION 232.69
ADDRESS Multiple Addresses	DRILLING METHOD Solid Stem	WELL TOC
DRILLING DATE 2023/09/06 - 2023/09/15	TOTAL DEPTH 6.1	LOGGED BY LT
LICENCE NO. 7687	DIAMETER 0.152 m	CHECKED BY CM

COMPLETION 2023/09/13

CASING PVC

SCREEN PVC

COMMENTS

Depth (m)	Elevation (m)	Samples	Sample Type	Graphic Log	Material Description	Well Installation	Moisture	Water	Blow Counts
0.5	232.5	SS1	SS		SILT: Brown, dry, silt trace clay		D		5/6/7/7
1	232	SS2			SILTY CLAY: Brown, dry, stiff, silty clay				5/5/7/8
1.5	231.5	SS3							4/5/7/8
2	231	SS4							
2.5	230.5	SS4			SILT: Brown, wet, stiff, silt, grey at 3.05		W - M		4/8/8/9
3	230	SS5							
3.5	229.5	SS5							3/5/8/10
4	229								
4.5	228.5								
5	228	SS6							7/9/11/10
5.5	227.5								
6	227								
6.5	226.5	SS7			SILTY CLAY: Grey, wet to moist, silty clay trace sand		M-W		4/4/5/5
7	226				SILT: Grey, moist to wet, silt				
7.5	225.5								
8	225	SS8							9/9/14/16
8.5	224.5				Termination Depth at 8.23 m				
9	224								
9.5	223.5								
	223								

APPENDIX C

Karst Letter (EXP 2019)



September 5, 2019

Mr. Nick Wood, MES(PI)
Manager, Development Planning
Corbett Land Strategies Inc.
483 Dundas Street West, Suite 212
Oakville, ON L6M 1L9

Re: HAM-00801363-B0 Proposed Subdivision
Twenty Road West, Hamilton, ON

Dear Mr. Wood:

EXP Services Inc. (EXP) was retained by Corbett Land Strategies Inc. to carry out a geotechnical investigation at the above noted site with the results presented in EXP's Report No. HAM-00801363-A0 Rev. 1 dated March 4, 2019. A karst assessment was subsequently requested by the City of Hamilton's Planning and Economic Development Department.

The Ontario Geological Survey map *Karst Study for Southern Ontario* (2008) identifies the site as being in an area of potential karst based on the rock type which is susceptible to karst processes. No bedrock outcrops were observed at the site and bedrock was not encountered in any of the thirty-three (33) boreholes advanced throughout the property. The boreholes were drilled to a maximum depth of 12.7 m below grade. As such, given the relative overburden thickness, an assessment of karst features is not considered to be applicable at the site.

We trust that this information is sufficient for your present requirements. Should you have any further questions concerning the above, please do not hesitate to contact the undersigned directly.

Sincerely,

EXP Services Inc.

A handwritten signature in black ink that reads "Dilsher Bhargal".

Dilsher Bhargal, M.Eng.
Designer, Hamilton Geotechnical Services

A handwritten signature in black ink that reads "Jeff Golder".

Jeffrey Golder, P.Eng.
Manager, Hamilton Geotechnical Services

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APPENDIX D

MECP Well Summary Table

MECP WATER WELL RECORDS

Project Number: 2521 - 6807

Location: Upper West Side Community Lands

Prepared by: BL/LS

Date completed: September 13, 2023

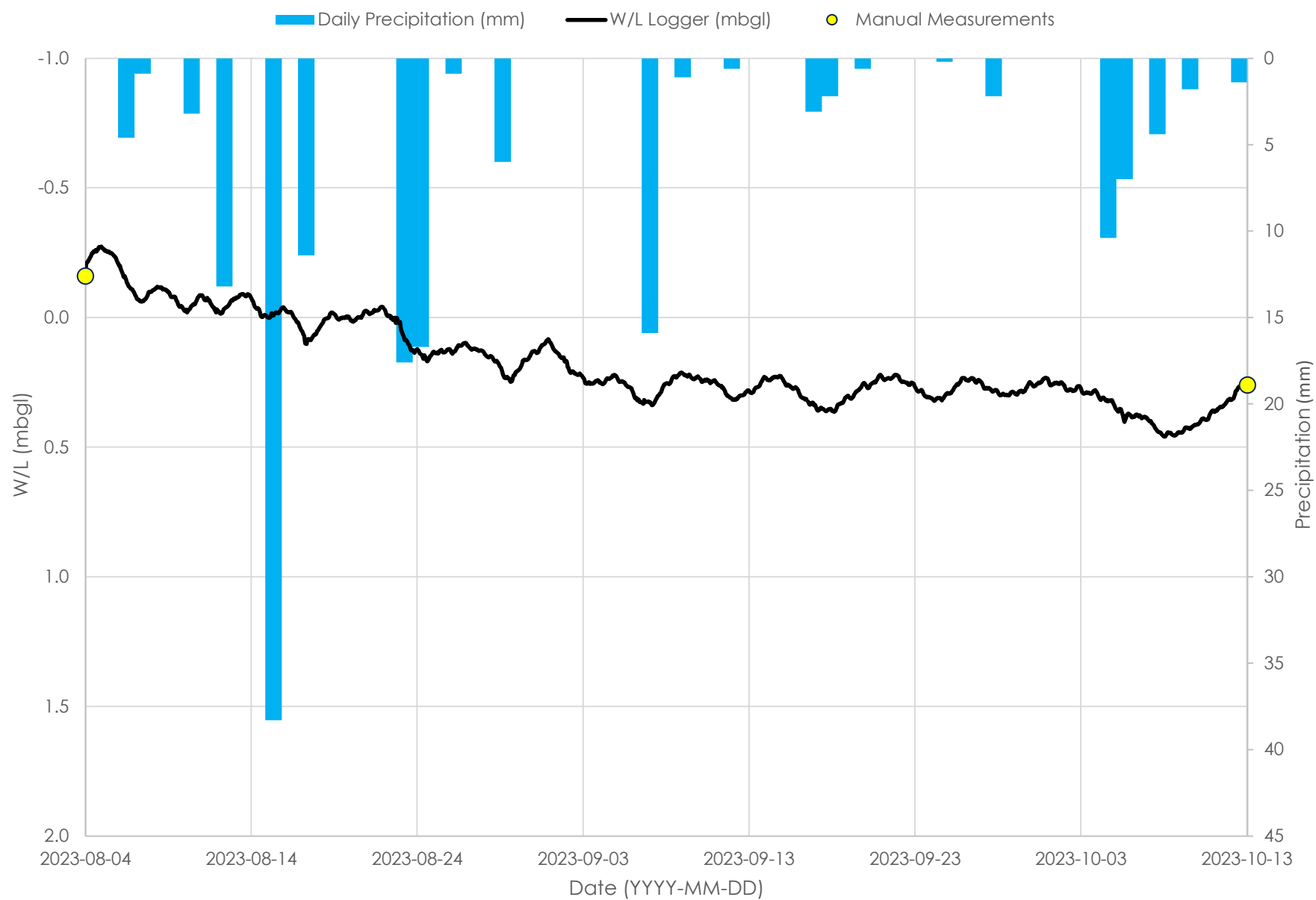
Well ID	Diameter (cm)	Depth (m)	Static Level (m)	Quantity (Lpm)	Quality	Materials	Aquifer ¹	Use	Date Completed
6803137	15.2	28.7	2.44	7.6	clear	blue clay, limestone	BR	Domestic	01/09/1956
6803144	15.2	31.4	7.92	7.6	clear	clay, limestone	BR	Domestic	09/25/1957
6803146	15.2	28.0	9.14	15.1	clear	clay, limestone	BR	Domestic	11/12/1957
6803149	15.2	35.1	27.43	3.8	clear	limestone	BR	Domestic	09/19/1960
6803150	91.4	11.6	1.22	18.9	clear	brown clay, blue hard pan, blue clay and silt, gravel	OB	Domestic	09/25/1965
6803151	91.4	11.9	1.22	18.9	clear	brown sandy loam, blue hard clay, coarse grey sand	OB	Domestic	05/04/1966
6803153	15.2	25.9	6.10	12.5	clear	yellow clay, grey limestone	BR	Domestic	09/13/1952
6803154	15.2	31.7	3.05	12.6	clear	yellow clay, grey limestone	BR	Domestic	09/15/1953
6803155	15.2	27.1	2.13	15.1	clear	clay, limestone	BR	Domestic	09/21/1953
6803156	15.2	33.2	15.24	1.1	clear	loam, blue clay, limestone	BR	Domestic	11/30/1957
6803157	17.8	35.4	9.14	0.9	clear	brown clay, blue clay, limestone	BR	Domestic	07/31/1959
6803158	15.2	25.6	9.14	15.1	clear	brown clay, limestone	BR	Domestic	02/23/1955
6803159	15.2	31.4	12.19	7.6	clear	brown clay, limestone	BR	Domestic	05/11/1955
6803160	15.2	32.6	3.05	3.8	clear	clay, limestone	BR	Domestic	05/01/1956
6803162	15.2	37.8	7.62	7.6	clear	clay, fine sand, gray rock	BR	Livestock	01/26/1957
6803170	15.2	30.5	5.79	18.9	clear	brown clay, limestone	BR	Domestic	02/02/1954
6803173	15.2	28.0	4.57	3.8	clear	sandy loam, brown clay, grey clay, limestone	BR	Domestic	07/27/1964
6803217	15.2	32.9	6.10	18.9	clear	clay, rock	BR	Domestic	03/26/1955
6803224	15.2	32.9	13.72	18.9	clear	brown clay, sandy loam, blue clay, limestone	BR	Domestic	10/07/1955
6803241	15.2	18.9	9.14	7.6	clear	loam, blue clay, limestone	BR	Domestic	09/16/1957
6803243	15.2	23.8	7.62	18.9	clear	brown clay, blue clay, limestone	BR	Domestic	03/05/1958
6803253	15.2	20.7	7.01	7.6	clear	topsoil, limestone	BR	Domestic	08/12/1953
6803254	15.2	18.3	6.10	3.8	clear	blue clay, sand, limestone	BR	Domestic	09/09/1953
6803255	15.2	24.7	3.66	113.6	clear	topsoil, yellow clay, limestone	BR	Domestic	11/12/1953
6803262	15.2	22.3	7.01	113.6	clear	clay, limestone	BR	Domestic	08/18/1954
6803265	15.2	20.7	6.10	18.9	clear	soft brown clay, sand, gravel	OB	Domestic	11/12/1954
6803266	15.2	20.7	9.14	11.4	clear	clay, clay and gravel, limestone	BR	Domestic	11/16/1954
6803267	15.2	21.3	3.66	18.9	clear	brown clay, silt, blue clay, limestone	BR	Domestic	11/20/1954
6803270	15.2	22.3	9.14	22.0	clear	clay, limestone	BR	Domestic	11/29/1954
6803272	15.2	26.5	13.72	49.2	clear	clay, limestone	BR	Domestic	12/22/1954
6803274	15.2	21.3	9.14	60.6	clear	clay, rock	BR	Domestic	01/10/1955
6803277	15.2	14.3	6.10	22.7	clear	brown clay, sand, rock	BR	Domestic	03/09/1955
6803278	15.2	21.6	17.07	2.6	clear	loam, blue clay, limestone	BR	Domestic	03/16/1955
6803280	15.2	23.8	12.80	15.1	clear	loam, blue clay, limestone	BR	Domestic	04/26/1955
6803285	15.2	21.9	10.67	7.6	clear	clay, sand, limestone	BR	Domestic	06/27/1955
6803286	15.2	22.3	12.19	8.7	clear	loam, blue clay, limestone	BR	Domestic	06/30/1955
6803317	15.2	23.2	3.66	11.4	clear	blue clay, limestone	BR	Domestic	01/19/1956
6803320	15.2	23.5	11.58	3.8	clear	loam, blue clay, limestone	BR	Domestic	02/03/1956
6803349	15.2	24.7	10.67	35.2	sulphur	loam, blue clay, limestone	BR	Domestic	07/12/1956
6803357	15.2	24.4	9.14	50.3	clear	loam, blue clay, limestone	BR	Commercial	09/04/1956
6803360	15.2	24.1	7.62	1.2	clear	loam, blue clay, limestone	BR	Domestic	09/08/1956
6803361	15.2	18.3	9.14	13.2	clear	loam, blue clay, limestone	BR	Domestic	09/28/1956
6803363	15.2	21.0	12.19	8.3	clear	loam, blue clay, limestone	BR	Domestic	10/08/1956
6803395	15.2	23.8	11.58	16.3	clear	loam, blue clay, limestone	BR	Domestic	09/21/1957
6803396	15.2	21.9	10.67	12.5	clear	loam, blue clay, limestone	BR	Domestic	09/23/1957
6803411	15.2	21.3	10.67	1.9	clear	loam, blue clay, limestone	BR	Domestic	04/04/1958
6803429	15.2	23.2	9.45	2.6	clear	loam, blue clay, limestone	BR	Domestic	09/10/1958
6803431	15.2	21.6	9.14	1.1	clear	blue clay, limestone	BR	Domestic	10/15/1958
6803438	15.2	20.7	9.14	9.5	clear	blue clay, limestone	BR	Domestic	05/08/1959
6803439	15.2	19.5	10.36	5.7	clear	blue clay, limestone	BR	Domestic	05/20/1959
6803443	15.2	19.5	9.75	30.3	clear	blue clay, limestone	BR	Domestic	07/08/1959
6803444	15.2	20.4	9.14	1.9	clear	blue clay, limestone	BR	Domestic	07/10/1959
6803445	15.2	19.8	9.14	26.5	clear	blue clay, limestone	BR	Domestic	10/15/1959
6803448	15.2	20.7	9.14	18.9	clear	clay, limestone	BR	Domestic	02/06/1960
6803450	15.2	20.4	9.14	3.8	clear	brown clay, sandy clay, limestone	BR	Domestic	06/08/1960
6803456	15.2	14.3	3.66	18.9	clear	clay, limestone	BR	Domestic	10/20/1961
6803603	15.2	35.4	4.57	18.9	clear	brown clay, blue clay, limestone	BR	Domestic	11/10/1954
6803618	15.2	17.4	3.05	7.6	clear	clay, limestone	BR	Domestic	03/26/1957
6803621	15.2	21.6	7.62	18.9	clear	brown clay, blue clay, limestone	BR	Domestic	01/25/1958
6803623	15.2	21.6	0.00	0.0		clay, sandy clay	OB	Abandoned	05/20/1958
6803624	15.2	17.1	7.62	18.9	clear	brown clay, blue clay, limestone	BR	Domestic	05/23/1958
6803625	15.2	18.3	3.66	18.9	clear	clay, limestone	BR	Domestic	07/10/1958
6803630	15.2	23.5	3.66	18.9	clear	clay, limestone	BR	Domestic	08/20/1958
6803632	15.2	23.2	6.10	0.0	dark	clay, limestone	BR	Domestic	03/02/1959
6803633	15.2	21.3	4.57	15.1	clear	clay, sand, limestone	BR	Domestic	03/09/1959
6803636	15.2	21.3	9.14	1.1	clear	brown clay, sandy clay, limestone	BR	Domestic	03/15/1961
6803820	76.2	33.8	4.27	7.6	clear	topsoil, brown clay, brown sand, blue hard clay, blue sand and clay, brown clay	OB	Domestic	12/10/1957
6803821	91.4	39.3	2.13	18.9	clear	brown sandy clay, sand, gray hard pan, fine sand, coarse sand	OB	Domestic	06/10/1959
6803825	91.4	14.0	1.22	18.9	clear	black loam, brown sand and clay, grey hard pan, sand, hard clay, red/grey sand and gravel	OB	Domestic	04/02/1964
6803827	15.2	11.9	10.67	18.9	clear	brown clay, grey sand, blue clay, limestone	BR	Domestic	05/12/1965
6803829	91.4	11.6	9.14	15.1	clear	topsoil, clay, running sand, limestone	BR	Domestic	01/12/1965
6803863	15.2	25.9	10.67	18.9	clear	brown clay, grey sand, blue clay, limestone	BR	Domestic	09/06/1956
6803865	15.2	24.4	9.14	0.9	Fresh	Top Soil, clay, running sand, liestone	BR	Domestic	10/14/1959
6803866	15.2	24.4	9.14	0.9	Fresh	Top Soil, clay, running sand, liestone	BR	Domestic	11/23/1959
6803867	15.2	29.0	6.10	11.4	Fresh	topsoil, brown clay, blue clay, limestone	BR	Domestic	12/18/1959
6803868	15.2	29.3	6.10	11.4	Fresh	brown clay, grey clay, limestone	BR	Domestic	01/08/1960
6803869	15.2	27.7	9.14	0.9	Fresh	loam, blue clay, limestone	BR	Domestic	04/19/1960
6803870	15.2	28.3	12.19	11.4	Fresh	topsoil, brown clay, blue clay, limestone	BR	Domestic	07/23/1962
6803873	15.2	27.4	15.24	7.6	Fresh	topsoil, brown clay, grey clay, limestone	BR	Domestic	12/27/1962
6803874	15.2	29.0	10.06	1.9	Fresh	Blue clay, shale rock, grey limestone	BR	Domestic	08/03/1963
6803875	15.2	22.6	6.10	1.9	Fresh	blue clay, shale, limestone	BR	Domestic	03/04/1965
6803876	15.2	28.0	12.19	1.9	Fresh	brown clay, blue clay, limestone	BR	Domestic	08/17/1965
6803877	15.2	26.8	9.75	18.9	Fresh	brown clay, blue clay, quick sand, fine sand, limestone	BR	Domestic	05/26/1967
6807034	91.4	13.4	1.22	18.9	Fresh	brown clay, blue hard clay, hard pan, blue clay, reddish brown sand	OB	Domestic	02/24/1969
6807337	15.2	27.7	5.79	5.7	Fresh	limestone	BR	Domestic	10/09/1969
6807351	76.2	17.7	1.22	7.6	-	Grey clay, blue clay	OB	Domestic	08/20/1969
6807354	76.2	16.8	11.58	11.4	Fresh	Grey silt, blue clay, bottom on bedrock	BR	Domestic	09/06/1969
6807419	76.2	14.6	2.13	18.9	Fresh	grey clay, blue clay	OB	Domestic	10/08/1969
6807830	91.4	12.2	3.96	11.4	Fresh	Brown sandy, grey silt small stones, grey sand	OB	Domestic	08/17/1971
6808129	91.4	15.2	7.01	18.9	Fresh	Brown sandy, grey sandy silt, grey sand	OB	Domestic	06/23/1972

6808463	91.4	16.8	3.05	30.3	Fresh	Brown sandy clay, grey sandy silt stones, grey silty clay black stones	BR	Domestic	05/30/1973
6808826	91.4	15.2	6.10	30.3	Fresh	brown topsoil, brown sandy soil, grey sandy silt, grey sand	BR	Domestic	06/13/1974
6808901	91.4	15.2	0.00	22.7	Fresh	brown topsoil, brown sandy clay, grey sandy silt, grey silty clay	OB	Domestic	07/23/1974
6808902	91.4	15.2	5.18	11.4	Fresh	brown sandy clay, blue clay, brown sand, grey silt, grey sand	OB	Domestic	07/24/1974
6808904	91.4	9.1	0.00	0.0	Fresh	Brown Sandy Clay, grey sandy clay	OB	Domestic	07/18/1974
6808990	91.4	16.2	13.11	22.7	Fresh	Brown Clay, grey sand, blue clay, gravel, blue clay	OB	Domestic	10/15/1974
6809067	91.4	15.2	2.44	22.7	Fresh	brown sandy clay, Blue Clay, grey silt, grey sand	OB	Domestic	01/03/1975
6809218	91.4	13.1	0.00	30.3	Fresh	Brown sandy clay, grey sandy clay, grey sand	OB	Domestic	07/30/1975
6809219	91.4	10.7	0.00	11.4	Fresh	Brown Sand, grey silt & clay	OB	Domestic	07/30/1975
6810128	91.4	13.1	1.52	15.1		brown sand, clay, grey sand	OB	Domestic	06/12/1980
6810174	91.4	18.3	3.05	22.7	fresh	brown sandy clay, blue clay, grey silt, grey sand, blue clay	OB	Domestic	08/07/1980
6811091	91.4	13.1	0.91	11.4	fresh	Brown sandy clay, grey silt, grey sand	OB	Domestic	11/20/1986
6811639	91.4	10.7	2.44	3.8	fresh	Brown sandy clay, brown sand, brown sandy clay, grey silty clay, red sand	OB	Domestic	03/08/1989
6811747	15.9	30.5	5.49	9.5	fresh	Blue Clay, Grey shale	BR	Domestic	07/27/1989
6812138	91.4	15.2	3.05	11.4	fresh	Brown Sandy clay, grey silt, blue clay	OB	Domestic	10/21/1991
6814216	5.0	5.0	0.00	0.0	fresh	Brown Sandy silt, grey clay silt	OB	not used	03/24/2005
7104587	5.1	6.0	0.00	0.0	fresh	Brown silty sand	OB	not used	11/28/2007
7204011	-	-	-	-	-	-	-	Empty Record	04/24/2013
7206136	-	-	-	-	-	-	-	Empty Record	01/08/2013
7218337	-	-	-	-	-	-	-	Abandoned	07/02/2013
7221436	3.8	4.5	-	-	-	Silt, Clay	OB	Monitoring	05/26/2014
7221437	3.8	4.5	-	-	-	Silt, Clay	OB	Monitoring	05/26/2014
7221735	4.6	6.1	-	-	-	Clay	OB	Monitoring	05/20/2014
7299389	5.1	6.1	-	-	-	Brown Sand, Grey Silt	OB	Monitoring	09/15/2017
7299390	5.1	6.1	-	-	-	Brown Sand, grey silt, clay	OB	Monitoring	09/25/2017
7307480	-	4.6	-	-	-	Silt fill	OB	Monitoring	03/13/2018
7307481	-	-	-	-	-	-	-	Empty Record	02/02/2018
7307482	-	-	-	-	-	-	-	Empty Record	02/15/2018
7313568	5.1	6.1	0.00	0.0		Brown Clay silt, grey clay, silt	OB	Monitoring	04/18/2018
7319591	-	-	-	-	-	-	-	Monitoring	04/15/2018
7339881	-	9.1	-	-	-	Brown Clay silt, grey clay, silt	OB	Monitoring	07/05/2019
7340837	5.1	12.2	-	-	-	brown clay, silt, grey clay, silt	OB	Monitoring	06/17/2019
7352629	-	N/A	-	-	-	-	-	Empty Record	11/12/2019
7354409	5.1	12.2	-	-	-	Brown silt, clay, grey silt, fine sand, grey fine sand, silt	OB	Monitoring	11/20/2019
7359727	-	6.1	-	-	-	-	-	Empty Record	05/05/2020
7373663	5.1	4.6	-	-	-	grey clay	OB	Monitoring	07/06/2020
7375592	-	N/A	-	-	-	-	-	Empty Record	09/19/2020
7375593	-	N/A	-	-	-	-	-	Empty Record	09/19/2020
7375594	-	N/A	-	-	-	-	-	Empty Record	09/19/2020
7375595	-	N/A	-	-	-	-	-	Empty Record	09/19/2020
7393607	5.1	7.6	-	-	-	Brown Sand, silt, brown clay, silt	OB	Monitoring	03/29/2021

APPENDIX E

Hydrograph

MW12, Upper West Side



APPENDIX F

Door-to-Door Survey Results

SEPTEMBER 7, 2023

PROJECT NO: 2521 - 6807

SENT VIA: HAND DELIVERED

Attention: **Property Owner/Tenant**

RE: **DOOR TO DOOR WELL AND SEPTIC SURVEY
CITY OF HAMILTON**

To whom it may concern,

C.F. Crozier & Associates Inc. (Crozier) has been retained to complete a detailed study of the nearby area to assess groundwater conditions and potential impacts occurring to the shallow groundwater system. Hence, Crozier is conducting a door-to-door survey to determine the location of any water supply wells, cisterns and private sewage systems in your area. We would appreciate participation in this survey to assist us in our study.

Attached is a questionnaire concerning your property and private well, cistern and/or septic system (if applicable). Please review and provide your responses using the forms located in the QR code below or via email to cmacphee@cfcrozier.ca. Alternatively, please feel free to call our office to provide us with your questionnaire responses. Please provide your response by September 30, 2023 if possible. Rest assured, we will not share your contact information with any third parties and the information provided in this questionnaire will only be used for the purposes of this study.

The City of Hamilton provides great resources on maintaining private wells and good water quality on your property and can be accessed at the following site:

<https://www.hamilton.ca/home-neighbourhood/house-home/private-wells-cisterns>

Should you have any questions or require any further information, please do not hesitate to contact the undersigned.

Scan QR Code below to
Access the form

Sincerely,

CROZIER CONSULTING ENGINEERS



Caitlyn MacPhee, EIT/GIT
Hydrogeology
SS/CM/cj



Enclosure

Door to Door Well & Septic Survey Questionnaire

1. What is your address?

The following questions 2 – 8 pertain to private water supply wells. If you do not have a well on your property, you may skip to question 9.

2. Do you have a private well on your property?
3. Does your well supply your drinking water?
4. What is the age of your well?
5. Is it a dug or drilled well?
6. How deep is your well?
7. Have you had any quantity or quality issues with your well? Briefly describe any issues.
8. Would you be willing to allow us to collect a sample of your water for laboratory analysis at no cost to you? All results will be provided to you for your records.


The following questions 9 - 10 pertain to cisterns. If you do not have a cistern on your property, you may skip to question 11.

9. Do you have a cistern on your property?
10. Does the cistern supply your drinking water?

11. What size is your cistern? Is it external or internal?
12. Do you have a surface water intake on your property?
13. Do you have any water treatment systems (e.g., water softener, chlorinator etc.)?
14. Do you have a septic system on your property?
15. Where is your sewage system located (i.e., front of your home, side yard etc.)?
16. What type of sewage system is it (i.e., septic tank with a leaching bed or holding tank)?
17. What is the age of your septic system?

If you are willing, please provide your contact information for any follow up questions we may have. If you answered yes to question 8, please provide your preferred method of contact so we may coordinate sampling:

Reminder: Your contact information will not be shared with any third parties.

	DOOR TO DOOR SURVEY QUESTIONNAIRE RESPONSES					
	Project Name: Upper West Side Community			Date: 2023-11-03		
	Project Number: 2521-6807			Filled By: BL		
	Checked By: CM					
1. What is your address?	2. Do you have a private well on your property?	3. Does your well supply your drinking water	4. What is the age of your well (yrs)?	5. How deep is your well?	6. Is it a dug or drilled well?	7. Have you had any quantity or quality issues with your well?
9717 Dickenson Road W	Yes	Yes	33	137 ft	Drilled	Yes, only getting 0.18gpm. Supposed to get 1gpm.
1261 Glancaster Rd	N/A	N/A	N/A	N/A	NA	N/A
559 Glancaster Rd	N/A	N/A	N/A	N/A	NA	N/A
9810 Dickerson Rd	No	N/A	N/A	N/A	NA	N/A
9798 Dickenson Rd W	Yes	Yes	53	25 ft	Dug	In early 2000 we had very little rain and the well was dry. Had a local water truck fill the well and never a problem since.
9856 Dickenson Rd. W	Yes	Yes	Not sure	25 ft	Drilled	No
9807 Dickenson Rd W	Yes	No	22	120 ft	Drilled	Not quantity but quality. Sometimes high levels of sulphur and iron.
9813 Dickenson Rd W	Yes	Yes	40-50	60 ft	Drilled	No
9883 Dickenson Rd W	Yes	Yes	40 years	not sure	Dug	Odouress water
9671 Dickenson Rd W	Yes	Yes	10 years	119 ft	Drilled	E.Coli
9778 Dickenson Rd W	N/A	N/A	N/A	N/A	N/A	N/A
9188 Dickenson Rd W	No	No	N/A	N/A	N/A	N/A

DOOR TO DOOR SURVEY QUESTIONNAIRE RESPONSES					
Project Name: Upper West Side Community Project Number: 2521-6807			Date: 2023-11-03 Filled By: BL Checked By: CM		
What is your address?	8. Would you be willing to allow us to collect a water sample for laboratory analysis at no cost to you? All results will be provided to you for your records.	9. Do you have a cistern on your property?	10. Does your cistern supply drinking water?	11. What size is your cistern? Is it an internal or external tank?	12. Do you have a surface water intake at your property?
9717 Dickenson Road W	Yes	Yes	Yes	Internal - 300 gallons	Yes
1261 Glancaster Rd	N/A	N/A	N/A	N/A	No
559 Glancaster Rd	N/A	N/A	N/A	N/A	N/A
9810 Dickerson Rd	N/A	Yes	Yes	External - 2000 gallons	No
9798 Dickenson Rd W	Yes	N/A	N/A	N/A	No
9856 Dickenson Rd. W	Yes	No	N/A	N/A	No
9807 Dickenson Rd W	Yes	No	N/A	NA	No
9813 Dickenson Rd W	Yes	No	N/A	N/A	No
9883 Dickenson Rd W	Yes	No	N/A	N/A	No
9671 Dickenson Rd W	Yes	Yes	Yes	External - 3000 gallons	No
9778 Dickenson Rd W	Yes	Yes	Yes	3000 gallons	No
9188 Dickenson Rd W	N/A	No	N/A	N/A	No

DOOR TO DOOR SURVEY QUESTIONNAIRE RESPONSES					
Project Name: Upper West Side Community Project Number: 2521-6807			Date: 2023-11-03 Filled By: BL Checked By: CM		
What is your address?	13. Do you have any water treatement systmes?	14. Do you have a septic system on your property?	15. Where is your system located?	16. What type of sewage system do you have?	17. What is the age of your septic system?
9717 Dickenson Road W	Yes, oxygenator, water software, UV light.	Yes	Backyard	Septic Tank with Leaching Bed or Drain Field	unknown
1261 Glancaster Rd	No	Yes	Backyard	Septic Tank with Leaching Bed or Drain Field	approx. 58 years old
559 Glancaster Rd	N/A	Yes	Backyard	Septic Tank with Leaching Bed or Drain Field	unknown
9810 Dickerson Rd	No	Yes	Backyard	Septic Tank with Leaching Bed or Drain Field	60 years
9798 Dickenson Rd W	No	Yes	Main tanks at East side of the house with tile bed in front of the home.	Septic Tank with Leaching Bed or Drain Field	20 - 25 years
9856 Dickenson Rd. W	No	Yes	Backyard	Septic Tank with Leaching Bed or Drain Field	Not sure
9807 Dickenson Rd W	No	Yes	Backyard	Septic Tank with Leaching Bed or Drain Field	22 years Waterloo bio filter system
9813 Dickenson Rd W	Yes	Yes	Backyard	Septic Tank with Leaching Bed or Drain Field	40 years
9883 Dickenson Rd W	No	Yes	Backyard	Septic Tank with Leaching Bed or Drain Field	40 years
9671 Dickenson Rd W	Yes	Yes	Backyard	Septic Tank with Leaching Bed or Drain Field	10 years
9778 Dickenson Rd W	UV Light	Yes	Backyard	Septic Tank with Leaching Bed or Drain Field	30+ years
9188 Dickenson Rd W	N/A	Yes	Side Yard	Unsure	More than 20 years

APPENDIX G

Groundwater Quality Results

CERTIFICATE OF ANALYSIS (GUIDELINE EVALUATION)

Work Order	: WT2333338	Page	: 1 of 12
Client	: CF Crozier & Associates	Laboratory	: ALS Environmental - Waterloo
Contact	: Caitlyn MacPhee	Account Manager	: Andrew Martin
Address	: 2800 High Point Drive Milton ON Canada L9T 6P4	Address	: 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	: ----	Telephone	: +1 519 886 6910
Project	: UWS-2521-10807	Date Samples Received	: 16-Oct-2023 17:45
PO	: ----	Date Analysis Commenced	: 17-Oct-2023
C-O-C number	: 20-1083366	Issue Date	: 25-Oct-2023 18:44
Sampler	: CLIENT		
Site	: ----		
Quote number	: 2023 Standing Offer		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Guideline Comparison

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

Signatories

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

Signatories	Position	Laboratory Department
Amaninder Dhillon	Team Lead - Semi-Volatile Instrumentation	Organics, Waterloo, Ontario
John Tang	Lab Analyst	Inorganics, Waterloo, Ontario
Jon Fisher	Production Manager, Environmental	Inorganics, Waterloo, Ontario
Jon Fisher	Production Manager, Environmental	Metals, Waterloo, Ontario
Rachel Cameron	Supervisor - Semi-Volatile Extractions	Organics, Waterloo, Ontario
Sarah Birch	VOC Section Supervisor	VOC, Waterloo, Ontario
Walt Kippenhuck	Supervisor - Inorganic	Inorganics, Waterloo, Ontario
Zeba Patel		Microbiology, Waterloo, Ontario



Summary of Guideline Breaches by Sample

SampleID/Client ID	Matrix	Analyte	Analyte Summary	Guideline	Category	Result	Limit
MW23-1	Water	Solids, total suspended [TSS]		HALSUB	SAN	13500 mg/L	350 mg/L
	Water	Aluminum, total		HALSUB	SAN	163 mg/L	50 mg/L
	Water	Iron, total		HALSUB	SAN	394 mg/L	50 mg/L
	Water	Manganese, total		HALSUB	SAN	19.7 mg/L	5 mg/L

General Comments

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

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

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to fitness for a particular purpose, or non-infringement. ALS assumes no responsibility for errors or omissions in the information. Guidelines are not adjusted for the hardness, pH or temperature of the sample (the most conservative values are used). Measurement uncertainty is not applied to test results prior to comparison with specified criteria values.

Key : LOR: Limit of Reporting (detection limit).

Unit	Description
µg/L	micrograms per litre
CFU/100mL	colony forming units per hundred millilitres
mg/L	milligrams per litre
pH units	pH units

>: greater than.

<: less than.

Red shading is applied where the result or the LOR is greater than the Guideline Upper Limit (or lower than the Guideline Lower Limit, if applicable).

For drinking water samples, Red shading is applied where the result for E.coli, fecal or total coliforms is greater than or equal to the Guideline Upper Limit.



Workorder Comments

RRR: DCM LOR increased due to the potential of laboratory contamination.

<1 or Not Detected with LOR of 1 equals Zero (0).

Not Detected = Absent; Detected = Present.

Sample Comments

Sample	Client Id	Comment
WT2333338-001	MW23-1	RRR/RRQC: Recovery of 3,3-Dichlorobenzidine in the Laboratory Control Sample is outside of ALS control limits. Associated non-detect sample results have not been affected. RRR; Surrogate result is outside of ALS control limits; associated Reporting Limits have been adjusted as required and non-detect results are reliable.

Qualifiers

Qualifier	Description
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).
DLM	Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).
HSED	High sediment content in submitted water sample. Analysis could only proceed using aqueous fraction after decanting. Results may be biased low and may be inappropriate for regulatory or compliance purposes.
OWP	Organic water sample contained visible sediment (must be included as part of analysis). Measured concentrations of organic substances in water can be biased high due to presence of sediment.
RRR	Refer to report comments for issues regarding this analysis.
SHMI	Surrogate recovery was outside ALS DQO (High) due to Matrix Interference
SP	Sample was preserved at the laboratory.



Analytical Results Evaluation

Matrix: Groundwater				Client sample ID	MW23-1	----	----	----	----	----	----
				Sampling date/time	13-Oct-2023 11:00	----	----	----	----	----	----
				Sub-Matrix	Groundwater	----	----	----	----	----	----
Analyte	CAS Number	Method/Lab	Unit	WT2333338-001	-----	-----	-----	-----	-----	-----	-----
Physical Tests											
pH	----	E108/WT	pH units	7.97	----	----	----	----	----	----	----
Solids, total suspended [TSS]	----	E160/WT	mg/L	13500 ^{DLHC}	----	----	----	----	----	----	----
Anions and Nutrients											
Chloride	16887-00-6	E235.CI/WT	mg/L	16.6	----	----	----	----	----	----	----
Fluoride	16984-48-8	E235.F/WT	mg/L	0.381	----	----	----	----	----	----	----
Kjeldahl nitrogen, total [TKN]	----	E318/WT	mg/L	1.92 ^{DLM}	----	----	----	----	----	----	----
Phosphorus, total	7723-14-0	E372-U/WT	mg/L	1.70 ^{DLM}	----	----	----	----	----	----	----
Sulfate (as SO4)	14808-79-8	E235.SO4/WT	mg/L	44.2	----	----	----	----	----	----	----
Cyanides											
Cyanide, strong acid dissociable (Total)	----	E333/WT	mg/L	<0.0020	----	----	----	----	----	----	----
Microbiological Tests											
Coliforms, Escherichia coli [E. coli]	----	E012A.EC/WT	CFU/100 mL	Not Detected ^{DLM}	----	----	----	----	----	----	----
Total Metals											
Aluminum, total	7429-90-5	E420/WT	mg/L	163 ^{DLHC}	----	----	----	----	----	----	----
Antimony, total	7440-36-0	E420/WT	mg/L	<0.00100 ^{DLHC}	----	----	----	----	----	----	----
Arsenic, total	7440-38-2	E420/WT	mg/L	0.113 ^{DLHC}	----	----	----	----	----	----	----
Bismuth, total	7440-69-9	E420/WT	mg/L	0.00298 ^{DLHC}	----	----	----	----	----	----	----
Cadmium, total	7440-43-9	E420/WT	mg/L	0.00223 ^{DLHC}	----	----	----	----	----	----	----
Chromium, total	7440-47-3	E420/WT	mg/L	0.920 ^{DLHC}	----	----	----	----	----	----	----
Cobalt, total	7440-48-4	E420/WT	mg/L	0.168 ^{DLHC}	----	----	----	----	----	----	----
Copper, total	7440-50-8	E420/WT	mg/L	0.648 ^{DLHC}	----	----	----	----	----	----	----
Iron, total	7439-89-6	E420/WT	mg/L	394 ^{DLHC}	----	----	----	----	----	----	----
Lead, total	7439-92-1	E420/WT	mg/L	0.228 ^{DLHC}	----	----	----	----	----	----	----
Manganese, total	7439-96-5	E420/WT	mg/L	19.7 ^{DLHC}	----	----	----	----	----	----	----
Mercury, total	7439-97-6	E508/WT	mg/L	0.0000208	----	----	----	----	----	----	----
Molybdenum, total	7439-98-7	E420/WT	mg/L	0.00980 ^{DLHC}	----	----	----	----	----	----	----



Analytical Results Evaluation

Matrix: Groundwater				Client sample ID	MW23-1	----	----	----	----	----	----
				Sampling date/time	13-Oct-2023 11:00	----	----	----	----	----	----
				Sub-Matrix	Groundwater	----	----	----	----	----	----
Analyte	CAS Number	Method/Lab	Unit	WT2333338-001	-----	-----	-----	-----	-----	-----	-----
Total Metals											
Nickel, total	7440-02-0	E420/WT	mg/L	0.648	DLHC	----	----	----	----	----	----
Selenium, total	7782-49-2	E420/WT	mg/L	0.00142	DLHC	----	----	----	----	----	----
Silver, total	7440-22-4	E420/WT	mg/L	0.000846	DLHC	----	----	----	----	----	----
Tin, total	7440-31-5	E420/WT	mg/L	0.0211	DLHC	----	----	----	----	----	----
Titanium, total	7440-32-6	E420/WT	mg/L	0.833	DLHC	----	----	----	----	----	----
Vanadium, total	7440-62-2	E420/WT	mg/L	0.264	DLHC	----	----	----	----	----	----
Zinc, total	7440-66-6	E420/WT	mg/L	0.958	DLHC	----	----	----	----	----	----
Aggregate Organics											
Carbonaceous biochemical oxygen demand [CBOD]	----	E555/WT	mg/L	7.6		----	----	----	----	----	----
Oil & grease (gravimetric)	----	E567/WT	mg/L	<5.0		----	----	----	----	----	----
Oil & grease, animal/vegetable (gravimetric)	----	EC567A.SG/WT	mg/L	<5.0		----	----	----	----	----	----
Oil & grease, mineral (gravimetric)	----	E567SG/WT	mg/L	<5.0		----	----	----	----	----	----
Phenols, total (4AAP)	----	E562/WT	mg/L	0.0013	SP	----	----	----	----	----	----
Volatile Organic Compounds											
Benzene	71-43-2	E611D/WT	µg/L	<0.50	OWP	----	----	----	----	----	----
Chloroform	67-66-3	E611D/WT	µg/L	<0.50	OWP	----	----	----	----	----	----
Dichlorobenzene, 1,2-	95-50-1	E611D/WT	µg/L	<0.50	OWP	----	----	----	----	----	----
Dichlorobenzene, 1,4-	106-46-7	E611D/WT	µg/L	<0.50	OWP	----	----	----	----	----	----
Dichloroethylene, cis-1,2-	156-59-2	E611D/WT	µg/L	<0.50	OWP	----	----	----	----	----	----
Dichloromethane	75-09-2	E611D/WT	µg/L	<29.0	OWP, RRR	----	----	----	----	----	----
Dichloropropylene, trans-1,3-	10061-02-6	E611D/WT	µg/L	<0.30	OWP	----	----	----	----	----	----
Ethylbenzene	100-41-4	E611D/WT	µg/L	<0.50	OWP	----	----	----	----	----	----
Tetrachloroethane, 1,1,2,2-	79-34-5	E611D/WT	µg/L	<0.50	OWP	----	----	----	----	----	----
Tetrachloroethylene	127-18-4	E611D/WT	µg/L	<0.50	OWP	----	----	----	----	----	----
Toluene	108-88-3	E611D/WT	µg/L	<0.50	OWP	----	----	----	----	----	----
Trichloroethylene	79-01-6	E611D/WT	µg/L	<0.50	OWP	----	----	----	----	----	----
Xylene, m+p-	179601-23-1	E611D/WT	µg/L	<0.40	OWP	----	----	----	----	----	----
Xylene, o-	95-47-6	E611D/WT	µg/L	<0.30	OWP	----	----	----	----	----	----



Analytical Results Evaluation

Matrix: Groundwater				Client sample ID	MW23-1	----	----	----	----	----	----
				Sampling date/time	13-Oct-2023 11:00	----	----	----	----	----	----
				Sub-Matrix	Groundwater	----	----	----	----	----	----
Analyte	CAS Number	Method/Lab	Unit	WT2333338-001	-----	-----	-----	-----	-----	-----	-----
Volatile Organic Compounds											
Xylenes, total	1330-20-7	E611D/WT	µg/L	<0.50	----	----	----	----	----	----	----
Volatile Organic Compounds Surrogates											
Bromofluorobenzene, 4-	460-00-4	E611D/WT	%	93.7	----	----	----	----	----	----	----
Diffuorobenzene, 1,4-	540-36-3	E611D/WT	%	96.2	----	----	----	----	----	----	----
Polycyclic Aromatic Hydrocarbons											
Anthracene	120-12-7	E641A-L/WT	mg/L	<0.000028 ^{DLM}	----	----	----	----	----	----	----
Benz(a)anthracene	56-55-3	E641A-L/WT	mg/L	<0.000010	----	----	----	----	----	----	----
Benzo(a)pyrene	50-32-8	E641A-L/WT	mg/L	<0.0000060 ^{DLM}	----	----	----	----	----	----	----
Benzo(b+j)fluoranthene	n/a	E641A-L/WT	mg/L	<0.000016 ^{DLM}	----	----	----	----	----	----	----
Benzo(e)pyrene	192-97-2	E641A-L/WT	mg/L	0.000018	----	----	----	----	----	----	----
Benzo(g,h,i)perylene	191-24-2	E641A-L/WT	mg/L	0.000010	----	----	----	----	----	----	----
Benzo(k)fluoranthene	207-08-9	E641A-L/WT	mg/L	0.000015	----	----	----	----	----	----	----
Chrysene	218-01-9	E641A-L/WT	mg/L	<0.000054 ^{DLM}	----	----	----	----	----	----	----
Dibenz(a,h)acridine	226-36-8	E642D/WT	mg/L	<0.000050	----	----	----	----	----	----	----
Dibenz(a,h)anthracene	53-70-3	E641A-L/WT	mg/L	<0.0000050	----	----	----	----	----	----	----
Dibenz(a,j)acridine	224-42-0	E642D/WT	mg/L	<0.000050	----	----	----	----	----	----	----
Dibenzo(a,i)pyrene	189-55-9	E642D/WT	mg/L	<0.000050	----	----	----	----	----	----	----
Dibenzo(c,g)carbazole, 7H-	194-59-2	E642D/WT	mg/L	<0.000050	----	----	----	----	----	----	----
Dinitropyrene, 1,3-	75321-20-9	E642D/WT	mg/L	<0.0010	----	----	----	----	----	----	----
Dinitropyrene, 1,6-	42397-64-8	E642D/WT	mg/L	<0.0010	----	----	----	----	----	----	----
Dinitropyrene, 1,8-	42397-65-9	E642D/WT	mg/L	<0.0010	----	----	----	----	----	----	----
Fluoranthene	206-44-0	E641A-L/WT	mg/L	<0.000052 ^{DLM}	----	----	----	----	----	----	----
Indeno(1,2,3-c,d)pyrene	193-39-5	E641A-L/WT	mg/L	<0.000010	----	----	----	----	----	----	----
Methylcholanthrene, 3-	56-49-5	E642D/WT	mg/L	<0.000050	----	----	----	----	----	----	----
Perylene	198-55-0	E641A-L/WT	mg/L	0.000012	----	----	----	----	----	----	----
Phenanthrene	85-01-8	E641A-L/WT	mg/L	0.000095	----	----	----	----	----	----	----
Pyrene	129-00-0	E641A-L/WT	mg/L	0.000069	----	----	----	----	----	----	----
PAHs, total (ON Sewer Use)	n/a	EC640A/WT	mg/L	<0.00175	----	----	----	----	----	----	----



Analytical Results Evaluation

Matrix: Groundwater				Client sample ID	MW23-1	----	----	----	----	----	----
				Sampling date/time	13-Oct-2023 11:00	----	----	----	----	----	----
				Sub-Matrix	Groundwater	----	----	----	----	----	----
Analyte	CAS Number	Method/Lab	Unit	WT2333338-001	-----	-----	-----	-----	-----	-----	-----
Polycyclic Aromatic Hydrocarbons Surrogates											
Chrysene-d12	1719-03-5	E641A-L/WT	%	131		----	----	----	----	----	----
Naphthalene-d8	1146-65-2	E641A-L/WT	%	223	SHMI	----	----	----	----	----	----
Phenanthrene-d10	1517-22-2	E641A-L/WT	%	107		----	----	----	----	----	----
Terphenyl-d14, p-	1718-51-0	E642D/WT	%	41.6		----	----	----	----	----	----
Phthalate Esters											
bis(2-Ethylhexyl) phthalate [DEHP]	117-81-7	E655F/WT	µg/L	<11.6	HSED, RRR	----	----	----	----	----	----
Di-n-butyl phthalate	84-74-2	E655F/WT	µg/L	<1.0	HSED	----	----	----	----	----	----
Semi-Volatile Organics											
Dichlorobenzidine, 3,3'-	91-94-1	E655F/WT	µg/L	<0.40	HSED, RRR	----	----	----	----	----	----
Semi-Volatile Organics Surrogates											
Fluorobiphenyl, 2-	321-60-8	E655F/WT	%	79.1		----	----	----	----	----	----
Terphenyl-d14, p-	1718-51-0	E655F/WT	%	43.0	RRR	----	----	----	----	----	----
Chlorinated Phenolics											
Pentachlorophenol [PCP]	87-86-5	E655F/WT	µg/L	<0.50	HSED	----	----	----	----	----	----
Phenolics Surrogates											
Tribromophenol, 2,4,6-	118-79-6	E655F/WT	%	113		----	----	----	----	----	----
Polychlorinated Biphenyls											
Aroclor 1016	12674-11-2	E687/WT	µg/L	<0.020		----	----	----	----	----	----
Aroclor 1221	11104-28-2	E687/WT	µg/L	<0.020		----	----	----	----	----	----
Aroclor 1232	11141-16-5	E687/WT	µg/L	<0.020		----	----	----	----	----	----
Aroclor 1242	53469-21-9	E687/WT	µg/L	<0.020		----	----	----	----	----	----
Aroclor 1248	12672-29-6	E687/WT	µg/L	<0.020		----	----	----	----	----	----
Aroclor 1254	11097-69-1	E687/WT	µg/L	<0.020		----	----	----	----	----	----
Aroclor 1260	11096-82-5	E687/WT	µg/L	<0.020		----	----	----	----	----	----
Aroclor 1262	37324-23-5	E687/WT	µg/L	<0.020		----	----	----	----	----	----
Aroclor 1268	11100-14-4	E687/WT	µg/L	<0.020		----	----	----	----	----	----
Polychlorinated biphenyls [PCBs], total	----	E687/WT	µg/L	<0.060		----	----	----	----	----	----



Analytical Results Evaluation

Matrix: Groundwater				Client sample ID	MW23-1	----	----	----	----	----	----
				Sampling date/time	13-Oct-2023 11:00	----	----	----	----	----	----
				Sub-Matrix	Groundwater	----	----	----	----	----	----
Analyte	CAS Number	Method/Lab	Unit	WT2333338-001	-----	-----	-----	-----	-----	-----	-----
Polychlorinated Biphenyls Surrogates											
Decachlorobiphenyl	2051-24-3	E687/WT	%	86.0	----	----	----	----	----	----	----
Tetrachloro-m-xylene	877-09-8	E687/WT	%	72.6	----	----	----	----	----	----	----
Organochlorine Pesticides											
Aldrin	309-00-2	E660F/WT	µg/L	<0.0080	----	----	----	----	----	----	----
Chlordane, cis- (alpha)	5103-71-9	E660F/WT	µg/L	<0.0080	----	----	----	----	----	----	----
Chlordane, total	57-74-9	E660F/WT	µg/L	<0.011	----	----	----	----	----	----	----
Chlordane, trans- (gamma)	5103-74-2	E660F/WT	µg/L	<0.0080	----	----	----	----	----	----	----
DDT, 2,4'-	789-02-6	E660F/WT	µg/L	<0.0040	----	----	----	----	----	----	----
DDT, 4,4'-	50-29-3	E660F/WT	µg/L	<0.0040	----	----	----	----	----	----	----
DDT, total	----	E660F/WT	µg/L	<0.0060	----	----	----	----	----	----	----
Dieldrin	60-57-1	E660F/WT	µg/L	<0.0080	----	----	----	----	----	----	----
Hexachlorobenzene	118-74-1	E660F/WT	µg/L	<0.0080	----	----	----	----	----	----	----
Hexachlorocyclohexane, gamma-	58-89-9	E660F/WT	µg/L	<0.0080	----	----	----	----	----	----	----
Mirex	2385-85-5	E660F/WT	µg/L	<0.0080	----	----	----	----	----	----	----
Aldrin + Dieldrin	----	E660F/WT	µg/L	<0.011	----	----	----	----	----	----	----
Organochlorine Pesticides Surrogates											
Decachlorobiphenyl	2051-24-3	E660F/WT	%	76.9	----	----	----	----	----	----	----
Tetrachloro-m-xylene	877-09-8	E660F/WT	%	68.1	----	----	----	----	----	----	----

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

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



Summary of Guideline Limits

Analyte	CAS Number	Unit	HALSUB SAN	HALSUB STM					
Physical Tests									
pH	----	pH units	6 - 10 pH units	6.5 - 8.5 pH units					
Solids, total suspended [TSS]	----	mg/L	350 mg/L	--					
Anions and Nutrients									
Chloride	16887-00-6	mg/L	1500 mg/L	--					
Fluoride	16984-48-8	mg/L	10 mg/L	--					
Kjeldahl nitrogen, total [TKN]	----	mg/L	100 mg/L	--					
Phosphorus, total	7723-14-0	mg/L	10 mg/L	--					
Sulfate (as SO4)	14808-79-8	mg/L	1500 mg/L	--					
Cyanides									
Cyanide, strong acid dissociable (Total)	----	mg/L	2 mg/L	--					
Microbiological Tests									
Coliforms, Escherichia coli [E. coli]	----	CFU/100mL	--	200 CFU/100mL					
Total Metals									
Aluminum, total	7429-90-5	mg/L	50 mg/L	--					
Antimony, total	7440-36-0	mg/L	5 mg/L	--					
Arsenic, total	7440-38-2	mg/L	1 mg/L	--					
Bismuth, total	7440-69-9	mg/L	5 mg/L	--					
Cadmium, total	7440-43-9	mg/L	1 mg/L	--					
Chromium, total	7440-47-3	mg/L	3 mg/L	--					
Cobalt, total	7440-48-4	mg/L	5 mg/L	--					
Copper, total	7440-50-8	mg/L	3 mg/L	--					
Iron, total	7439-89-6	mg/L	50 mg/L	--					
Lead, total	7439-92-1	mg/L	3 mg/L	--					
Manganese, total	7439-96-5	mg/L	5 mg/L	--					
Mercury, total	7439-97-6	mg/L	0.05 mg/L	--					
Molybdenum, total	7439-98-7	mg/L	5 mg/L	--					
Nickel, total	7440-02-0	mg/L	3 mg/L	--					
Selenium, total	7782-49-2	mg/L	5 mg/L	--					
Silver, total	7440-22-4	mg/L	5 mg/L	--					
Tin, total	7440-31-5	mg/L	5 mg/L	--					
Titanium, total	7440-32-6	mg/L	5 mg/L	--					
Vanadium, total	7440-62-2	mg/L	5 mg/L	--					
Zinc, total	7440-66-6	mg/L	3 mg/L	--					
Aggregate Organics									
Carbonaceous biochemical oxygen demand [CBOD]	----	mg/L	300 mg/L	--					



Analyte	CAS Number	Unit	HALSUB SAN	HALSUB STM					
Aggregate Organics - Continued									
Oil & grease (gravimetric)	----	mg/L	--	--					
Oil & grease, animal/vegetable (gravimetric)	----	mg/L	150 mg/L	--					
Oil & grease, mineral (gravimetric)	----	mg/L	15 mg/L	--					
Phenols, total (4AAP)	----	mg/L	1 mg/L	--					
Volatile Organic Compounds									
Benzene	71-43-2	µg/L	10 µg/L	--					
Chloroform	67-66-3	µg/L	40 µg/L	--					
Dichlorobenzene, 1,2-	95-50-1	µg/L	--	--					
Dichlorobenzene, 1,4-	106-46-7	µg/L	80 µg/L	--					
Dichloroethylene, cis-1,2-	156-59-2	µg/L	--	--					
Dichloromethane	75-09-2	µg/L	2000 µg/L	--					
Dichloropropylene, trans-1,3-	10061-02-6	µg/L	--	--					
Ethylbenzene	100-41-4	µg/L	160 µg/L	--					
Tetrachloroethane, 1,1,2,2-	79-34-5	µg/L	1400 µg/L	--					
Tetrachloroethylene	127-18-4	µg/L	1000 µg/L	--					
Toluene	108-88-3	µg/L	16 µg/L	--					
Trichloroethylene	79-01-6	µg/L	400 µg/L	--					
Xylene, m+p-	179601-23-1	µg/L	--	--					
Xylene, o-	95-47-6	µg/L	--	--					
Xylenes, total	1330-20-7	µg/L	--	--					
Volatile Organic Compounds Surrogates									
Bromofluorobenzene, 4-	460-00-4	%							
Difluorobenzene, 1,4-	540-36-3	%							
Polycyclic Aromatic Hydrocarbons									
Anthracene	120-12-7	mg/L	--	--					
Benz(a)anthracene	56-55-3	mg/L	--	--					
Benzo(a)pyrene	50-32-8	mg/L	--	--					
Benzo(b+j)fluoranthene	n/a	mg/L	--	--					
Benzo(e)pyrene	192-97-2	mg/L	--	--					
Benzo(g,h,i)perylene	191-24-2	mg/L	--	--					
Benzo(k)fluoranthene	207-08-9	mg/L	--	--					
Chrysene	218-01-9	mg/L	--	--					
Dibenz(a,h)acridine	226-36-8	mg/L	--	--					
Dibenz(a,h)anthracene	53-70-3	mg/L	--	--					
Dibenz(a,j)acridine	224-42-0	mg/L	--	--					
Dibenzo(a,i)pyrene	189-55-9	mg/L	--	--					
Dibenzo(c,g)carbazole, 7H-	194-59-2	mg/L	--	--					
Dinitropyrene, 1,3-	75321-20-9	mg/L	--	--					
Dinitropyrene, 1,6-	42397-64-8	mg/L	--	--					



Analyte	CAS Number	Unit	HALSUB SAN	HALSUB STM					
Polycyclic Aromatic Hydrocarbons - Continued									
Dinitropyrene, 1,8-	42397-65-9	mg/L	--	--					
Fluoranthene	206-44-0	mg/L	--	--					
Indeno(1,2,3-c,d)pyrene	193-39-5	mg/L	--	--					
Methylcholanthrene, 3-	56-49-5	mg/L	--	--					
PAHs, total (ON Sewer Use)	n/a	mg/L	--	--					
Perylene	198-55-0	mg/L	--	--					
Phenanthrene	85-01-8	mg/L	--	--					
Pyrene	129-00-0	mg/L	--	--					
Chrysene-d12	1719-03-5	%							
Naphthalene-d8	1146-65-2	%							
Phenanthrene-d10	1517-22-2	%							
Terphenyl-d14, p-	1718-51-0	%							
Phthalate Esters									
bis(2-Ethylhexyl) phthalate [DEHP]	117-81-7	µg/L	12 µg/L	--					
Di-n-butyl phthalate	84-74-2	µg/L	80 µg/L	--					
Semi-Volatile Organics									
Dichlorobenzidine, 3,3'-	91-94-1	µg/L	2 µg/L	--					
Semi-Volatile Organics Surrogates									
Fluorobiphenyl, 2-	321-60-8	%							
Terphenyl-d14, p-	1718-51-0	%							
Chlorinated Phenolics									
Pentachlorophenol [PCP]	87-86-5	µg/L	5 µg/L	--					
Tribromophenol, 2,4,6-	118-79-6	%							
Polychlorinated Biphenyls									
Aroclor 1016	12674-11-2	µg/L	--	--					
Aroclor 1221	11104-28-2	µg/L	--	--					
Aroclor 1232	11141-16-5	µg/L	--	--					
Aroclor 1242	53469-21-9	µg/L	--	--					
Aroclor 1248	12672-29-6	µg/L	--	--					
Aroclor 1254	11097-69-1	µg/L	--	--					
Aroclor 1260	11096-82-5	µg/L	--	--					
Aroclor 1262	37324-23-5	µg/L	--	--					
Aroclor 1268	11100-14-4	µg/L	--	--					
Polychlorinated biphenyls [PCBs], total	----	µg/L	1 µg/L	--					
Decachlorobiphenyl	2051-24-3	%							
Tetrachloro-m-xylene	877-09-8	%							
Organochlorine Pesticides									
Aldrin + Dieldrin	----	µg/L	0.2 µg/L	--					
Aldrin	309-00-2	µg/L	--	--					



Analyte	CAS Number	Unit	HALSUB SAN	HALSUB STM					
Organochlorine Pesticides - Continued									
Chlordane, cis- (alpha)	5103-71-9	µg/L	--	--					
Chlordane, total	57-74-9	µg/L	100 µg/L	--					
Chlordane, trans- (gamma)	5103-74-2	µg/L	--	--					
DDT, 2,4'-	789-02-6	µg/L	--	--					
DDT, 4,4'-	50-29-3	µg/L	--	--					
DDT, total	----	µg/L	--	--					
Dieldrin	60-57-1	µg/L	--	--					
Hexachlorobenzene	118-74-1	µg/L	0.1 µg/L	--					
Hexachlorocyclohexane, gamma-	58-89-9	µg/L	100 µg/L	--					
Mirex	2385-85-5	µg/L	100 µg/L	--					
Decachlorobiphenyl	2051-24-3	%							
Tetrachloro-m-xylene	877-09-8	%							

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

Key:

HALSUB	Ontario Halton Sanitary Sewer By-Law No. 02-03 (Mar, 2003)
SAN	Halton Sanitary By-Law (02-03, March 2003)
STM	Halton Storm Sewer By-Law 02-03 (Mar, 2003)

QUALITY CONTROL REPORT

Work Order	: WT2333338	Page	: 1 of 14
Client	: CF Crozier & Associates	Laboratory	: ALS Environmental - Waterloo
Contact	: Caitlyn MacPhee	Account Manager	: Andrew Martin
Address	: 2800 High Point Drive Milton ON Canada L9T 6P4	Address	: 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	:	Telephone	: +1 519 886 6910
Project	: UWS-2521-10807	Date Samples Received	: 16-Oct-2023 17:45
PO	: ----	Date Analysis Commenced	: 17-Oct-2023
C-O-C number	: 20-1083366	Issue Date	: 25-Oct-2023 18:39
Sampler	: CLIENT ----		
Site	: ----		
Quote number	: 2023 Standing Offer		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Matrix Spike (MS) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

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

Signatories	Position	Laboratory Department
Amaninder Dhillon	Team Lead - Semi-Volatile Instrumentation	Waterloo Organics, Waterloo, Ontario
John Tang	Lab Analyst	Waterloo Inorganics, Waterloo, Ontario
Jon Fisher	Production Manager, Environmental	Waterloo Inorganics, Waterloo, Ontario
Jon Fisher	Production Manager, Environmental	Waterloo Metals, Waterloo, Ontario
Rachel Cameron	Supervisor - Semi-Volatile Extractions	Waterloo Organics, Waterloo, Ontario
Sarah Birch	VOC Section Supervisor	Waterloo VOC, Waterloo, Ontario
Walt Kippenhuck	Supervisor - Inorganic	Waterloo Inorganics, Waterloo, Ontario
Zeba Patel		Waterloo Microbiology, Waterloo, Ontario



General Comments

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

Key :

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

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

DQO = Data Quality Objective.

LOR = Limit of Reporting (detection limit).

RPD = Relative Percent Difference

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

Workorder Comments

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



Laboratory Duplicate (DUP) Report

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

Sub-Matrix: Water					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Physical Tests (QC Lot: 1189031)											
WT2333137-001	Anonymous	Solids, total suspended [TSS]	----	E160	3.0	mg/L	49.1	57.3	15.4%	20%	----
Physical Tests (QC Lot: 1197217)											
WT2333892-001	Anonymous	pH	----	E108	0.10	pH units	8.24	8.14	1.22%	4%	----
Anions and Nutrients (QC Lot: 1196134)											
WT2333338-001	MW23-1	Kjeldahl nitrogen, total [TKN]	----	E318	0.500	mg/L	1.92	2.09	0.171	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 1196135)											
WT2333525-001	Anonymous	Phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.422	0.426	1.05%	20%	----
Anions and Nutrients (QC Lot: 1197211)											
WT2333628-001	Anonymous	Sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	39.3	39.2	0.125%	20%	----
Anions and Nutrients (QC Lot: 1197212)											
WT2333628-001	Anonymous	Chloride	16887-00-6	E235.Cl	0.50	mg/L	112	112	0.162%	20%	----
Anions and Nutrients (QC Lot: 1197213)											
WT2333628-001	Anonymous	Fluoride	16984-48-8	E235.F	0.020	mg/L	0.062	0.060	0.003	Diff <2x LOR	----
Cyanides (QC Lot: 1202167)											
WT2333338-001	MW23-1	Cyanide, strong acid dissociable (Total)	----	E333	0.0020	mg/L	<0.0020	<0.0020	0	Diff <2x LOR	----
Microbiological Tests (QC Lot: 1188922)											
WT2333370-001	Anonymous	Coliforms, Escherichia coli [E. coli]	----	E012A.EC	1	CFU/100mL	<1	<1	0	Diff <2x LOR	----
Total Metals (QC Lot: 1188403)											
BF2300316-001	Anonymous	Aluminum, total	7429-90-5	E420	0.0030	mg/L	0.0205	0.0252	0.0047	Diff <2x LOR	----
		Antimony, total	7440-36-0	E420	0.00010	mg/L	0.00014	0.00014	0.000002	Diff <2x LOR	----
		Arsenic, total	7440-38-2	E420	0.00010	mg/L	0.00022	0.00022	0.000001	Diff <2x LOR	----
		Bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		Cadmium, total	7440-43-9	E420	0.0000050	mg/L	<0.0000050	0.0000056	0.0000006	Diff <2x LOR	----
		Chromium, total	7440-47-3	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		Cobalt, total	7440-48-4	E420	0.00010	mg/L	0.00026	0.00027	0.0000003	Diff <2x LOR	----
		Copper, total	7440-50-8	E420	0.00050	mg/L	0.00153	0.00153	0.000002	Diff <2x LOR	----
		Iron, total	7439-89-6	E420	0.010	mg/L	0.038	0.045	0.007	Diff <2x LOR	----
		Lead, total	7439-92-1	E420	0.000050	mg/L	0.000077	0.000094	0.000017	Diff <2x LOR	----
		Manganese, total	7439-96-5	E420	0.00010	mg/L	0.0652	0.0656	0.596%	20%	----



Sub-Matrix: Water					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Total Metals (QC Lot: 1188403) - continued											
BF2300316-001	Anonymous	Molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.00500	0.00499	0.392%	20%	----
		Nickel, total	7440-02-0	E420	0.00050	mg/L	0.00093	0.00092	0.00001	Diff <2x LOR	----
		Selenium, total	7782-49-2	E420	0.000050	mg/L	0.000090	0.000094	0.000003	Diff <2x LOR	----
		Silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		Tin, total	7440-31-5	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		Titanium, total	7440-32-6	E420	0.00030	mg/L	0.00044	0.00092	0.00048	Diff <2x LOR	----
		Vanadium, total	7440-62-2	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		Zinc, total	7440-66-6	E420	0.0030	mg/L	0.0133	0.0132	0.00006	Diff <2x LOR	----
Total Metals (QC Lot: 1193575)											
TY2310508-006	Anonymous	Mercury, total	7439-97-6	E508	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----
Aggregate Organics (QC Lot: 1189120)											
WT2333355-001	Anonymous	Carbonaceous biochemical oxygen demand [CBOD]	----	E555	2.0	mg/L	2.6	3.4	26.9%	30%	----
Aggregate Organics (QC Lot: 1196136)											
WT2333533-001	Anonymous	Phenols, total (4AAP)	----	E562	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
Volatile Organic Compounds (QC Lot: 1195468)											
WT2333993-001	Anonymous	Benzene	71-43-2	E611D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		Chloroform	67-66-3	E611D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		Dichlorobenzene, 1,2-	95-50-1	E611D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		Dichlorobenzene, 1,4-	106-46-7	E611D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		Dichloroethylene, cis-1,2-	156-59-2	E611D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		Dichloromethane	75-09-2	E611D	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		Dichloropropylene, trans-1,3-	10061-02-6	E611D	0.30	µg/L	<0.30	<0.30	0	Diff <2x LOR	----
		Ethylbenzene	100-41-4	E611D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		Tetrachloroethane, 1,1,2,2-	79-34-5	E611D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		Tetrachloroethylene	127-18-4	E611D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		Toluene	108-88-3	E611D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		Trichloroethylene	79-01-6	E611D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		Xylene, m+p-	179601-23-1	E611D	0.40	µg/L	<0.40	<0.40	0	Diff <2x LOR	----
		Xylene, o-	95-47-6	E611D	0.30	µg/L	<0.30	<0.30	0	Diff <2x LOR	----



Method Blank (MB) Report

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

Sub-Matrix: Water

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 1189031)						
Solids, total suspended [TSS]	----	E160	3	mg/L	<3.0	----
Anions and Nutrients (QCLot: 1196134)						
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	<0.050	----
Anions and Nutrients (QCLot: 1196135)						
Phosphorus, total	7723-14-0	E372-U	0.002	mg/L	<0.0020	----
Anions and Nutrients (QCLot: 1197211)						
Sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	<0.30	----
Anions and Nutrients (QCLot: 1197212)						
Chloride	16887-00-6	E235.Cl	0.5	mg/L	<0.50	----
Anions and Nutrients (QCLot: 1197213)						
Fluoride	16984-48-8	E235.F	0.02	mg/L	<0.020	----
Cyanides (QCLot: 1202167)						
Cyanide, strong acid dissociable (Total)	----	E333	0.002	mg/L	<0.0020	----
Microbiological Tests (QCLot: 1188922)						
Coliforms, Escherichia coli [E. coli]	----	E012A.EC	1	CFU/100mL	<1	----
Total Metals (QCLot: 1188403)						
Aluminum, total	7429-90-5	E420	0.003	mg/L	<0.0030	----
Antimony, total	7440-36-0	E420	0.0001	mg/L	<0.00010	----
Arsenic, total	7440-38-2	E420	0.0001	mg/L	<0.00010	----
Bismuth, total	7440-69-9	E420	0.00005	mg/L	<0.000050	----
Cadmium, total	7440-43-9	E420	0.000005	mg/L	<0.0000050	----
Chromium, total	7440-47-3	E420	0.0005	mg/L	<0.00050	----
Cobalt, total	7440-48-4	E420	0.0001	mg/L	<0.00010	----
Copper, total	7440-50-8	E420	0.0005	mg/L	<0.00050	----
Iron, total	7439-89-6	E420	0.01	mg/L	<0.010	----
Lead, total	7439-92-1	E420	0.00005	mg/L	<0.000050	----
Manganese, total	7439-96-5	E420	0.0001	mg/L	<0.00010	----
Molybdenum, total	7439-98-7	E420	0.00005	mg/L	<0.000050	----
Nickel, total	7440-02-0	E420	0.0005	mg/L	<0.00050	----
Selenium, total	7782-49-2	E420	0.00005	mg/L	<0.000050	----
Silver, total	7440-22-4	E420	0.00001	mg/L	<0.000010	----
Tin, total	7440-31-5	E420	0.0001	mg/L	<0.00010	----



Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Total Metals (QCLot: 1188403) - continued						
Titanium, total	7440-32-6	E420	0.0003	mg/L	<0.00030	----
Vanadium, total	7440-62-2	E420	0.0005	mg/L	<0.00050	----
Zinc, total	7440-66-6	E420	0.003	mg/L	<0.0030	----
Total Metals (QCLot: 1193575)						
Mercury, total	7439-97-6	E508	0.000005	mg/L	<0.0000050	----
Aggregate Organics (QCLot: 1188319)						
Oil & grease (gravimetric)	----	E567	5	mg/L	<5.0	----
Aggregate Organics (QCLot: 1188320)						
Oil & grease, mineral (gravimetric)	----	E567SG	5	mg/L	<5.0	----
Aggregate Organics (QCLot: 1189120)						
Carbonaceous biochemical oxygen demand [CBOD]	----	E555	2	mg/L	<2.0	----
Aggregate Organics (QCLot: 1196136)						
Phenols, total (4AAP)	----	E562	0.001	mg/L	<0.0010	----
Volatile Organic Compounds (QCLot: 1195468)						
Benzene	71-43-2	E611D	0.5	µg/L	<0.50	----
Chloroform	67-66-3	E611D	0.5	µg/L	<0.50	----
Dichlorobenzene, 1,2-	95-50-1	E611D	0.5	µg/L	<0.50	----
Dichlorobenzene, 1,4-	106-46-7	E611D	0.5	µg/L	<0.50	----
Dichloroethylene, cis-1,2-	156-59-2	E611D	0.5	µg/L	<0.50	----
Dichloromethane	75-09-2	E611D	1	µg/L	<1.0	----
Dichloropropylene, trans-1,3-	10061-02-6	E611D	0.3	µg/L	<0.30	----
Ethylbenzene	100-41-4	E611D	0.5	µg/L	<0.50	----
Tetrachloroethane, 1,1,2,2-	79-34-5	E611D	0.5	µg/L	<0.50	----
Tetrachloroethylene	127-18-4	E611D	0.5	µg/L	<0.50	----
Toluene	108-88-3	E611D	0.5	µg/L	<0.50	----
Trichloroethylene	79-01-6	E611D	0.5	µg/L	<0.50	----
Xylene, m+p-	179601-23-1	E611D	0.4	µg/L	<0.40	----
Xylene, o-	95-47-6	E611D	0.3	µg/L	<0.30	----
Polycyclic Aromatic Hydrocarbons (QCLot: 1195722)						
Dibenz(a,h)acridine	226-36-8	E642D	0.05	µg/L	<0.050	----
Dibenz(a,j)acridine	224-42-0	E642D	0.05	µg/L	<0.050	----
Dibenzo(a,i)pyrene	189-55-9	E642D	0.05	µg/L	<0.050	----
Dibenzo(c,g)carbazole, 7H-	194-59-2	E642D	0.05	µg/L	<0.050	----
Dinitropyrene, 1,3-	75321-20-9	E642D	1	µg/L	<1.0	----
Dinitropyrene, 1,6-	42397-64-8	E642D	1	µg/L	<1.0	----



Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Polycyclic Aromatic Hydrocarbons (QCLot: 1195722) - continued						
Dinitropyrene, 1,8-	42397-65-9	E642D	1	µg/L	<1.0	----
Methylcholanthrene, 3-	56-49-5	E642D	0.05	µg/L	<0.050	----
Polycyclic Aromatic Hydrocarbons (QCLot: 1195774)						
Anthracene	120-12-7	E641A-L	0.01	µg/L	<0.010	----
Benz(a)anthracene	56-55-3	E641A-L	0.01	µg/L	<0.010	----
Benzo(a)pyrene	50-32-8	E641A-L	0.005	µg/L	<0.0050	----
Benzo(b+j)fluoranthene	n/a	E641A-L	0.01	µg/L	<0.010	----
Benzo(e)pyrene	192-97-2	E641A-L	0.01	µg/L	<0.010	----
Benzo(g,h,i)perylene	191-24-2	E641A-L	0.01	µg/L	<0.010	----
Benzo(k)fluoranthene	207-08-9	E641A-L	0.01	µg/L	<0.010	----
Chrysene	218-01-9	E641A-L	0.01	µg/L	<0.010	----
Dibenz(a,h)anthracene	53-70-3	E641A-L	0.005	µg/L	<0.0050	----
Fluoranthene	206-44-0	E641A-L	0.01	µg/L	<0.010	----
Indeno(1,2,3-c,d)pyrene	193-39-5	E641A-L	0.01	µg/L	<0.010	----
Perylene	198-55-0	E641A-L	0.01	µg/L	<0.010	----
Phenanthrene	85-01-8	E641A-L	0.01	µg/L	<0.010	----
Pyrene	129-00-0	E641A-L	0.01	µg/L	<0.010	----
Phthalate Esters (QCLot: 1195717)						
bis(2-Ethylhexyl) phthalate [DEHP]	117-81-7	E655F	2	µg/L	<2.0	----
Di-n-butyl phthalate	84-74-2	E655F	1	µg/L	<1.0	----
Semi-Volatile Organics (QCLot: 1195717)						
Dichlorobenzidine, 3,3'-	91-94-1	E655F	0.4	µg/L	<0.40	----
Chlorinated Phenolics (QCLot: 1195717)						
Pentachlorophenol [PCP]	87-86-5	E655F	0.5	µg/L	<0.50	----
Polychlorinated Biphenyls (QCLot: 1194420)						
Aroclor 1016	12674-11-2	E687	0.02	µg/L	<0.020	----
Aroclor 1221	11104-28-2	E687	0.02	µg/L	<0.020	----
Aroclor 1232	11141-16-5	E687	0.02	µg/L	<0.020	----
Aroclor 1242	53469-21-9	E687	0.02	µg/L	<0.020	----
Aroclor 1248	12672-29-6	E687	0.02	µg/L	<0.020	----
Aroclor 1254	11097-69-1	E687	0.02	µg/L	<0.020	----
Aroclor 1260	11096-82-5	E687	0.02	µg/L	<0.020	----
Aroclor 1262	37324-23-5	E687	0.02	µg/L	<0.020	----
Aroclor 1268	11100-14-4	E687	0.02	µg/L	<0.020	----
Organochlorine Pesticides (QCLot: 1194419)						



Sub-Matrix: Water

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Organochlorine Pesticides (QCLot: 1194419) - continued						
Aldrin	309-00-2	E660F	0.008	µg/L	<0.0080	----
Chlordane, cis- (alpha)	5103-71-9	E660F	0.008	µg/L	<0.0080	----
Chlordane, trans- (gamma)	5103-74-2	E660F	0.008	µg/L	<0.0080	----
DDT, 2,4'-	789-02-6	E660F	0.004	µg/L	<0.0040	----
DDT, 4,4'-	50-29-3	E660F	0.004	µg/L	<0.0040	----
Dieldrin	60-57-1	E660F	0.008	µg/L	<0.0080	----
Hexachlorobenzene	118-74-1	E660F	0.008	µg/L	<0.0080	----
Hexachlorocyclohexane, gamma-	58-89-9	E660F	0.008	µg/L	<0.0080	----
Mirex	2385-85-5	E660F	0.008	µg/L	<0.0080	----



Laboratory Control Sample (LCS) Report

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

Sub-Matrix: Water					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		Qualifier
					Concentration	LCS	Low	High	
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 1189031)									
Solids, total suspended [TSS]	----	E160	3	mg/L	150 mg/L	93.8	85.0	115	----
Physical Tests (QCLot: 1197217)									
pH	----	E108	----	pH units	7 pH units	100	98.0	102	----
Anions and Nutrients (QCLot: 1196134)									
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	4 mg/L	105	75.0	125	----
Anions and Nutrients (QCLot: 1196135)									
Phosphorus, total	7723-14-0	E372-U	0.002	mg/L	0.393 mg/L	95.6	80.0	120	----
Anions and Nutrients (QCLot: 1197211)									
Sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	100 mg/L	99.9	90.0	110	----
Anions and Nutrients (QCLot: 1197212)									
Chloride	16887-00-6	E235.Cl	0.5	mg/L	100 mg/L	99.3	90.0	110	----
Anions and Nutrients (QCLot: 1197213)									
Fluoride	16984-48-8	E235.F	0.02	mg/L	1 mg/L	101	90.0	110	----
Cyanides (QCLot: 1202167)									
Cyanide, strong acid dissociable (Total)	----	E333	0.002	mg/L	0.25 mg/L	97.2	80.0	120	----
Total Metals (QCLot: 1188403)									
Aluminum, total	7429-90-5	E420	0.003	mg/L	0.1 mg/L	97.1	80.0	120	----
Antimony, total	7440-36-0	E420	0.0001	mg/L	0.05 mg/L	102	80.0	120	----
Arsenic, total	7440-38-2	E420	0.0001	mg/L	0.05 mg/L	105	80.0	120	----
Bismuth, total	7440-69-9	E420	0.00005	mg/L	0.05 mg/L	99.1	80.0	120	----
Cadmium, total	7440-43-9	E420	0.000005	mg/L	0.005 mg/L	104	80.0	120	----
Chromium, total	7440-47-3	E420	0.0005	mg/L	0.0125 mg/L	99.6	80.0	120	----
Cobalt, total	7440-48-4	E420	0.0001	mg/L	0.0125 mg/L	95.0	80.0	120	----
Copper, total	7440-50-8	E420	0.0005	mg/L	0.0125 mg/L	97.2	80.0	120	----
Iron, total	7439-89-6	E420	0.01	mg/L	0.05 mg/L	96.1	80.0	120	----
Lead, total	7439-92-1	E420	0.00005	mg/L	0.025 mg/L	103	80.0	120	----
Manganese, total	7439-96-5	E420	0.0001	mg/L	0.0125 mg/L	102	80.0	120	----
Molybdenum, total	7439-98-7	E420	0.00005	mg/L	0.0125 mg/L	98.0	80.0	120	----
Nickel, total	7440-02-0	E420	0.0005	mg/L	0.025 mg/L	97.6	80.0	120	----
Selenium, total	7782-49-2	E420	0.00005	mg/L	0.05 mg/L	99.2	80.0	120	----



Sub-Matrix: Water					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		Qualifier
					Concentration	LCS	Low	High	
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Total Metals (QCLot: 1188403) - continued									
Silver, total	7440-22-4	E420	0.00001	mg/L	0.005 mg/L	94.8	80.0	120	----
Tin, total	7440-31-5	E420	0.0001	mg/L	0.025 mg/L	100	80.0	120	----
Titanium, total	7440-32-6	E420	0.0003	mg/L	0.0125 mg/L	97.1	80.0	120	----
Vanadium, total	7440-62-2	E420	0.0005	mg/L	0.025 mg/L	99.2	80.0	120	----
Zinc, total	7440-66-6	E420	0.003	mg/L	0.025 mg/L	99.5	80.0	120	----
Total Metals (QCLot: 1193575)									
Mercury, total	7439-97-6	E508	0.000005	mg/L	0.0001 mg/L	102	80.0	120	----
Aggregate Organics (QCLot: 1188319)									
Oil & grease (gravimetric)	----	E567	5	mg/L	200 mg/L	95.6	70.0	130	----
Aggregate Organics (QCLot: 1188320)									
Oil & grease, mineral (gravimetric)	----	E567SG	5	mg/L	100 mg/L	91.9	70.0	130	----
Aggregate Organics (QCLot: 1189120)									
Carbonaceous biochemical oxygen demand [CBOD]	----	E555	2	mg/L	198 mg/L	86.2	85.0	115	----
Aggregate Organics (QCLot: 1196136)									
Phenols, total (4AAP)	----	E562	0.001	mg/L	0.02 mg/L	105	85.0	115	----
Volatile Organic Compounds (QCLot: 1195468)									
Benzene	71-43-2	E611D	0.5	µg/L	100 µg/L	97.9	70.0	130	----
Chloroform	67-66-3	E611D	0.5	µg/L	100 µg/L	100	70.0	130	----
Dichlorobenzene, 1,2-	95-50-1	E611D	0.5	µg/L	100 µg/L	92.3	70.0	130	----
Dichlorobenzene, 1,4-	106-46-7	E611D	0.5	µg/L	100 µg/L	95.6	70.0	130	----
Dichloroethylene, cis-1,2-	156-59-2	E611D	0.5	µg/L	100 µg/L	98.0	70.0	130	----
Dichloromethane	75-09-2	E611D	1	µg/L	100 µg/L	110	70.0	130	----
Dichloropropylene, trans-1,3-	10061-02-6	E611D	0.3	µg/L	100 µg/L	85.4	70.0	130	----
Ethylbenzene	100-41-4	E611D	0.5	µg/L	100 µg/L	90.4	70.0	130	----
Tetrachloroethane, 1,1,2,2-	79-34-5	E611D	0.5	µg/L	100 µg/L	102	70.0	130	----
Tetrachloroethylene	127-18-4	E611D	0.5	µg/L	100 µg/L	94.6	70.0	130	----
Toluene	108-88-3	E611D	0.5	µg/L	100 µg/L	91.1	70.0	130	----
Trichloroethylene	79-01-6	E611D	0.5	µg/L	100 µg/L	96.6	70.0	130	----
Xylene, m+p-	179601-23-1	E611D	0.4	µg/L	200 µg/L	95.9	70.0	130	----
Xylene, o-	95-47-6	E611D	0.3	µg/L	100 µg/L	91.9	70.0	130	----
Polycyclic Aromatic Hydrocarbons (QCLot: 1195722)									
Dibenz(a,h)acridine	226-36-8	E642D	0.05	µg/L	1.6 µg/L	87.3	60.0	130	----
Dibenz(a,j)acridine	224-42-0	E642D	0.05	µg/L	1.6 µg/L	102	60.0	130	----



Sub-Matrix: Water					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		Qualifier
					Concentration	LCS	Low	High	
Analyte	CAS Number	Method	LOR	Unit					
Polycyclic Aromatic Hydrocarbons (QCLot: 1195722) - continued									
Dibenzo(a,i)pyrene	189-55-9	E642D	0.05	µg/L	1.6 µg/L	83.2	60.0	130	----
Dibenzo(c,g)carbazole, 7H-	194-59-2	E642D	0.05	µg/L	1.6 µg/L	91.5	60.0	130	----
Dinitropyrene, 1,3-	75321-20-9	E642D	1	µg/L	1.6 µg/L	102	60.0	130	----
Dinitropyrene, 1,6-	42397-64-8	E642D	1	µg/L	1.6 µg/L	82.1	60.0	130	----
Dinitropyrene, 1,8-	42397-65-9	E642D	1	µg/L	1.6 µg/L	120	60.0	130	----
Methylcholanthrene, 3-	56-49-5	E642D	0.05	µg/L	1.6 µg/L	86.9	60.0	130	----
Polycyclic Aromatic Hydrocarbons (QCLot: 1195774)									
Anthracene	120-12-7	E641A-L	0.01	µg/L	0.5263 µg/L	110	50.0	140	----
Benz(a)anthracene	56-55-3	E641A-L	0.01	µg/L	0.5263 µg/L	125	50.0	140	----
Benzo(a)pyrene	50-32-8	E641A-L	0.005	µg/L	0.5263 µg/L	113	50.0	140	----
Benzo(b+j)fluoranthene	n/a	E641A-L	0.01	µg/L	0.5263 µg/L	79.1	50.0	140	----
Benzo(e)pyrene	192-97-2	E641A-L	0.01	µg/L	0.5263 µg/L	84.3	50.0	140	----
Benzo(g,h,i)perylene	191-24-2	E641A-L	0.01	µg/L	0.5263 µg/L	92.2	50.0	140	----
Benzo(k)fluoranthene	207-08-9	E641A-L	0.01	µg/L	0.5263 µg/L	95.0	50.0	140	----
Chrysene	218-01-9	E641A-L	0.01	µg/L	0.5263 µg/L	122	50.0	140	----
Dibenz(a,h)anthracene	53-70-3	E641A-L	0.005	µg/L	0.5263 µg/L	102	50.0	140	----
Fluoranthene	206-44-0	E641A-L	0.01	µg/L	0.5263 µg/L	113	50.0	140	----
Indeno(1,2,3-c,d)pyrene	193-39-5	E641A-L	0.01	µg/L	0.5263 µg/L	114	50.0	140	----
Perylene	198-55-0	E641A-L	0.01	µg/L	0.5263 µg/L	108	50.0	140	----
Phenanthrene	85-01-8	E641A-L	0.01	µg/L	0.5263 µg/L	110	50.0	140	----
Pyrene	129-00-0	E641A-L	0.01	µg/L	0.5263 µg/L	112	50.0	140	----
Phthalate Esters (QCLot: 1195717)									
bis(2-Ethylhexyl) phthalate [DEHP]	117-81-7	E655F	2	µg/L	6.4 µg/L	134	50.0	140	----
Di-n-butyl phthalate	84-74-2	E655F	1	µg/L	6.4 µg/L	114	50.0	140	----
Semi-Volatile Organics (QCLot: 1195717)									
Dichlorobenzidine, 3,3'-	91-94-1	E655F	0.4	µg/L	1.6 µg/L	# 23.1	50.0	140	RRQC
Chlorinated Phenolics (QCLot: 1195717)									
Pentachlorophenol [PCP]	87-86-5	E655F	0.5	µg/L	4.8 µg/L	106	50.0	140	----
Polychlorinated Biphenyls (QCLot: 1194420)									
Aroclor 1016	12674-11-2	E687	0.02	µg/L	0.2 µg/L	123	60.0	140	----
Aroclor 1221	11104-28-2	E687	0.02	µg/L	0.2 µg/L	123	60.0	140	----
Aroclor 1232	11141-16-5	E687	0.02	µg/L	0.2 µg/L	123	60.0	140	----



Sub-Matrix: Water					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		Qualifier
					Concentration	LCS	Low	High	
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Polychlorinated Biphenyls (QCLot: 1194420) - continued									
Aroclor 1242	53469-21-9	E687	0.02	µg/L	0.2 µg/L	123	60.0	140	----
Aroclor 1248	12672-29-6	E687	0.02	µg/L	0.2 µg/L	119	60.0	140	----
Aroclor 1254	11097-69-1	E687	0.02	µg/L	0.2 µg/L	115	60.0	140	----
Aroclor 1260	11096-82-5	E687	0.02	µg/L	0.2 µg/L	# 142	60.0	140	LCS-ND
Aroclor 1262	37324-23-5	E687	0.02	µg/L	0.2 µg/L	# 142	60.0	140	LCS-ND
Aroclor 1268	11100-14-4	E687	0.02	µg/L	0.2 µg/L	# 142	60.0	140	LCS-ND
Organochlorine Pesticides (QCLot: 1194419)									
Aldrin	309-00-2	E660F	0.008	µg/L	0.2 µg/L	70.0	50.0	150	----
Chlordane, cis- (alpha)	5103-71-9	E660F	0.008	µg/L	0.2 µg/L	99.6	50.0	150	----
Chlordane, trans- (gamma)	5103-74-2	E660F	0.008	µg/L	0.2 µg/L	75.2	50.0	150	----
DDT, 2,4'-	789-02-6	E660F	0.004	µg/L	0.2 µg/L	134	50.0	150	----
DDT, 4,4'-	50-29-3	E660F	0.004	µg/L	0.2 µg/L	87.1	50.0	150	----
Dieldrin	60-57-1	E660F	0.008	µg/L	0.2 µg/L	85.9	50.0	150	----
Hexachlorobenzene	118-74-1	E660F	0.008	µg/L	0.2 µg/L	94.6	50.0	150	----
Hexachlorocyclohexane, gamma-	58-89-9	E660F	0.008	µg/L	0.2 µg/L	103	50.0	150	----
Mirex	2385-85-5	E660F	0.008	µg/L	0.2 µg/L	108	50.0	150	----

Qualifiers

Qualifier	Description
LCS-ND	Lab Control Sample recovery was slightly outside ALS DQO. Reported non-detect results for associated samples were unaffected.
RRQC	Refer to report comments for information regarding this QC result.



Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Laboratory sample ID					Matrix Spike (MS) Report				
					Spike		Recovery (%)	Recovery Limits (%)	
					Concentration	Target	MS	Low	High
Client sample ID	Analyte	CAS Number	Method						Qualifier
Anions and Nutrients (QCLot: 1196134)									
WT2333338-001	MW23-1	Kjeldahl nitrogen, total [TKN]	----	E318	28.2 mg/L	2.5 mg/L	113	70.0	130
Anions and Nutrients (QCLot: 1196135)									
WT2333525-001	Anonymous	Phosphorus, total	7723-14-0	E372-U	ND mg/L	0.1 mg/L	ND	70.0	130
Anions and Nutrients (QCLot: 1197211)									
WT2333628-001	Anonymous	Sulfate (as SO4)	14808-79-8	E235.SO4	101 mg/L	100 mg/L	101	75.0	125
Anions and Nutrients (QCLot: 1197212)									
WT2333628-001	Anonymous	Chloride	16887-00-6	E235.Cl	ND mg/L	100 mg/L	ND	75.0	125
Anions and Nutrients (QCLot: 1197213)									
WT2333628-001	Anonymous	Fluoride	16984-48-8	E235.F	0.978 mg/L	1 mg/L	97.8	75.0	125
Cyanides (QCLot: 1202167)									
WT2333338-001	MW23-1	Cyanide, strong acid dissociable (Total)	----	E333	0.231 mg/L	0.25 mg/L	92.2	75.0	125
Total Metals (QCLot: 1188403)									
BF2300316-002	Anonymous	Aluminum, total	7429-90-5	E420	0.0925 mg/L	0.1 mg/L	92.5	70.0	130
		Antimony, total	7440-36-0	E420	0.0518 mg/L	0.05 mg/L	104	70.0	130
		Arsenic, total	7440-38-2	E420	0.0515 mg/L	0.05 mg/L	103	70.0	130
		Bismuth, total	7440-69-9	E420	0.0488 mg/L	0.05 mg/L	97.6	70.0	130
		Cadmium, total	7440-43-9	E420	0.00514 mg/L	0.005 mg/L	103	70.0	130
		Chromium, total	7440-47-3	E420	0.0120 mg/L	0.0125 mg/L	96.4	70.0	130
		Cobalt, total	7440-48-4	E420	0.0117 mg/L	0.0125 mg/L	93.8	70.0	130
		Copper, total	7440-50-8	E420	0.0122 mg/L	0.0125 mg/L	97.9	70.0	130
		Iron, total	7439-89-6	E420	0.047 mg/L	0.05 mg/L	94.9	70.0	130
		Lead, total	7439-92-1	E420	0.0257 mg/L	0.025 mg/L	103	70.0	130
		Manganese, total	7439-96-5	E420	0.0126 mg/L	0.0125 mg/L	100	70.0	130
		Molybdenum, total	7439-98-7	E420	0.0123 mg/L	0.0125 mg/L	98.7	70.0	130
		Nickel, total	7440-02-0	E420	0.0240 mg/L	0.025 mg/L	96.2	70.0	130
		Selenium, total	7782-49-2	E420	0.0502 mg/L	0.05 mg/L	100	70.0	130
		Silver, total	7440-22-4	E420	0.00483 mg/L	0.005 mg/L	96.6	70.0	130
		Tin, total	7440-31-5	E420	0.0253 mg/L	0.025 mg/L	101	70.0	130
		Titanium, total	7440-32-6	E420	0.0116 mg/L	0.0125 mg/L	92.4	70.0	130
		Vanadium, total	7440-62-2	E420	0.0244 mg/L	0.025 mg/L	97.8	70.0	130



Sub-Matrix: Water					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Total Metals (QCLot: 1188403) - continued										
BF2300316-002	Anonymous	Zinc, total	7440-66-6	E420	0.0240 mg/L	0.025 mg/L	96.1	70.0	130	----
Total Metals (QCLot: 1193575)										
TY2310514-001	Anonymous	Mercury, total	7439-97-6	E508	0.0000936 mg/L	0.0001 mg/L	93.6	70.0	130	----
Aggregate Organics (QCLot: 1196136)										
WT2333533-001	Anonymous	Phenols, total (4AAP)	----	E562	0.0210 mg/L	0.02 mg/L	105	75.0	125	----
Volatile Organic Compounds (QCLot: 1195468)										
WT2333993-001	Anonymous	Benzene	71-43-2	E611D	95.9 µg/L	100 µg/L	95.9	60.0	140	----
		Chloroform	67-66-3	E611D	98.9 µg/L	100 µg/L	98.9	60.0	140	----
		Dichlorobenzene, 1,2-	95-50-1	E611D	90.9 µg/L	100 µg/L	90.9	60.0	140	----
		Dichlorobenzene, 1,4-	106-46-7	E611D	93.7 µg/L	100 µg/L	93.7	60.0	140	----
		Dichloroethylene, cis-1,2-	156-59-2	E611D	96.4 µg/L	100 µg/L	96.4	60.0	140	----
		Dichloromethane	75-09-2	E611D	107 µg/L	100 µg/L	107	60.0	140	----
		Dichloropropylene, trans-1,3-	10061-02-6	E611D	82.6 µg/L	100 µg/L	82.6	60.0	140	----
		Ethylbenzene	100-41-4	E611D	88.7 µg/L	100 µg/L	88.7	60.0	140	----
		Tetrachloroethane, 1,1,2,2-	79-34-5	E611D	102 µg/L	100 µg/L	102	60.0	140	----
		Tetrachloroethylene	127-18-4	E611D	91.8 µg/L	100 µg/L	91.8	60.0	140	----
		Toluene	108-88-3	E611D	89.0 µg/L	100 µg/L	89.0	60.0	140	----
		Trichloroethylene	79-01-6	E611D	94.4 µg/L	100 µg/L	94.4	60.0	140	----
		Xylene, m+p-	179601-23-1	E611D	190 µg/L	200 µg/L	94.8	60.0	140	----
		Xylene, o-	95-47-6	E611D	90.8 µg/L	100 µg/L	90.8	60.0	140	----

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: WT2333338	Page	: 1 of 12
Client	: CF Crozier & Associates	Laboratory	: ALS Environmental - Waterloo
Contact	: Caitlyn MacPhee	Account Manager	: Andrew Martin
Address	: 2800 High Point Drive Milton ON Canada L9T 6P4	Address	: 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	: ----	Telephone	: +1 519 886 6910
Project	: UWS-2521-10807	Date Samples Received	: 16-Oct-2023 17:45
PO	: ----	Issue Date	: 25-Oct-2023 18:43
C-O-C number	: 20-1083366		
Sampler	: CLIENT		
Site	: ----		
Quote number	: 2023 Standing Offer		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

Key

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

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

DQO: Data Quality Objective.

LOR: Limit of Reporting (detection limit).

RPD: Relative Percent Difference.

Workorder Comments

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

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Matrix Spike outliers occur.
- Laboratory Control Sample (LCS) outliers occur - please see following pages for full details.
- Test sample Surrogate recovery outliers exist for all regular sample matrices - please see following pages for full details.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.



Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: Water

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result	Limits	Comment
Laboratory Control Sample (LCS) Recoveries								
Semi-Volatile Organics	QC-MRG4-1195717 002	----	Dichlorobenzidine, 3,3'-	91-94-1	E655F	23.1 % RRQC	50.0-140%	Recovery less than lower control limit
Polychlorinated Biphenyls	QC-MRG2-1194419 002	----	Aroclor 1260	11096-82-5	E687	142 % LCS-ND	60.0-140%	Recovery greater than upper control limit
Polychlorinated Biphenyls	QC-MRG2-1194419 002	----	Aroclor 1262	37324-23-5	E687	142 % LCS-ND	60.0-140%	Recovery greater than upper control limit
Polychlorinated Biphenyls	QC-MRG2-1194419 002	----	Aroclor 1268	11100-14-4	E687	142 % LCS-ND	60.0-140%	Recovery greater than upper control limit

Result Qualifiers

Qualifier	Description
LCS-ND	Lab Control Sample recovery was slightly outside ALS DQO. Reported non-detect results for associated samples were unaffected.
RRQC	Refer to report comments for information regarding this QC result.

Regular Sample Surrogates

Sub-Matrix: Groundwater

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Result	Limits	Comment
Samples Submitted							
Polycyclic Aromatic Hydrocarbons Surrogates	WT2333338-001	MW23-1	Naphthalene-d8	1146-65-2	223 %	60.0-140 %	Recovery greater than upper data quality objective
Semi-Volatile Organics Surrogates	WT2333338-001	MW23-1	Terphenyl-d14, p-	1718-51-0	43.0 %	60.0-140 %	Recovery less than lower data quality objective



Analysis Holding Time Compliance

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

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

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

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

Matrix: **Water**

Evaluation: ✖ = Holding time exceedance ; ✔ = Within Holding Time

Analyte Group : Analytical Method	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Aggregate Organics : Biochemical Oxygen Demand (Carbonaceous) - 5 day										
HDPE [BOD HT-4d] MW23-1	E555	13-Oct-2023	----	----	----		17-Oct-2023	4 days	4 days	✓
Aggregate Organics : Mineral Oil & Grease by Gravimetry										
Amber glass (hydrochloric acid) MW23-1	E567SG	13-Oct-2023	19-Oct-2023	28 days	6 days	✓	19-Oct-2023	40 days	0 days	✓
Aggregate Organics : Oil & Grease by Gravimetry										
Amber glass (hydrochloric acid) MW23-1	E567	13-Oct-2023	19-Oct-2023	28 days	6 days	✓	19-Oct-2023	40 days	0 days	✓
Aggregate Organics : Phenols (4AAP) in Water by Colorimetry										
Amber glass total (sulfuric acid) [ON MECP] MW23-1	E562	13-Oct-2023	20-Oct-2023	28 days	7 days	✓	20-Oct-2023	28 days	7 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE [ON MECP] MW23-1	E235.Cl	13-Oct-2023	20-Oct-2023	28 days	7 days	✓	23-Oct-2023	28 days	10 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE [ON MECP] MW23-1	E235.F	13-Oct-2023	20-Oct-2023	28 days	7 days	✓	23-Oct-2023	28 days	10 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE [ON MECP] MW23-1	E235.SO4	13-Oct-2023	20-Oct-2023	28 days	7 days	✓	23-Oct-2023	28 days	10 days	✓



Matrix: **Water** Evaluation: ✖ = Holding time exceedance ; ✔ = Within Holding Time

Analyte Group : Analytical Method Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) [ON MECP] MW23-1	E318	13-Oct-2023	23-Oct-2023	28 days	10 days	✓	24-Oct-2023	28 days	11 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid) [ON MECP] MW23-1	E372-U	13-Oct-2023	22-Oct-2023	28 days	9 days	✓	23-Oct-2023	28 days	10 days	✓
Chlorinated Phenolics : BNA (Ontario Sanitary Sewer SVOC Target List) by GC-MS										
Amber glass/Teflon lined cap [ON MECP] MW23-1	E655F	13-Oct-2023	19-Oct-2023	14 days	6 days	✓	23-Oct-2023	40 days	3 days	✓
Cyanides : Total Cyanide										
UV-inhibited HDPE - total (sodium hydroxide) MW23-1	E333	13-Oct-2023	24-Oct-2023	14 days	11 days	✓	24-Oct-2023	14 days	11 days	✓
Microbiological Tests : E. coli (MF-mFC-BCIG)										
Sterile HDPE (Sodium thiosulphate) [ON MECP] MW23-1	E012A.EC	13-Oct-2023	----	----	----		17-Oct-2023	48 hrs	94 hrs	✖ EHTR
Organochlorine Pesticides : OCP Analysis by GC-MS-MS or GC-MS										
Amber glass/Teflon lined cap [ON MECP] MW23-1	E660F	13-Oct-2023	19-Oct-2023	14 days	6 days	✓	24-Oct-2023	40 days	5 days	✓
Phthalate Esters : BNA (Ontario Sanitary Sewer SVOC Target List) by GC-MS										
Amber glass/Teflon lined cap [ON MECP] MW23-1	E655F	13-Oct-2023	19-Oct-2023	14 days	6 days	✓	23-Oct-2023	40 days	3 days	✓
Physical Tests : pH by Meter										
HDPE [ON MECP] MW23-1	E108	13-Oct-2023	20-Oct-2023	14 days	7 days	✓	21-Oct-2023	14 days	8 days	✓
Physical Tests : TSS by Gravimetry										
HDPE [ON MECP] MW23-1	E160	13-Oct-2023	----	----	----		18-Oct-2023	7 days	5 days	✓



Matrix: **Water** Evaluation: ✖ = Holding time exceedance ; ✔ = Within Holding Time

Analyte Group : Analytical Method Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Polychlorinated Biphenyls : PCB Aroclors by GC-MS										
Amber glass/Teflon lined cap [ON MECP] MW23-1	E687	13-Oct-2023	19-Oct-2023	14 days	6 days	✓	20-Oct-2023	40 days	1 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs (ON Special List) by GC-MS										
Amber glass/Teflon lined cap [ON MECP] MW23-1	E642D	13-Oct-2023	19-Oct-2023	14 days	6 days	✓	23-Oct-2023	40 days	4 days	✓
Polycyclic Aromatic Hydrocarbons : PAHs by Hexane LVI GC-MS (Low Level)										
Amber glass/Teflon lined cap (sodium bisulfate) MW23-1	E641A-L	13-Oct-2023	19-Oct-2023	14 days	7 days	✓	20-Oct-2023	40 days	1 days	✓
Semi-Volatile Organics : BNA (Ontario Sanitary Sewer SVOC Target List) by GC-MS										
Amber glass/Teflon lined cap [ON MECP] MW23-1	E655F	13-Oct-2023	19-Oct-2023	14 days	6 days	✓	23-Oct-2023	40 days	3 days	✓
Total Metals : Total Mercury in Water by CVAAS										
Glass vial total (hydrochloric acid) [ON MECP] MW23-1	E508	13-Oct-2023	19-Oct-2023	28 days	6 days	✓	20-Oct-2023	28 days	7 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE total (nitric acid) MW23-1	E420	13-Oct-2023	17-Oct-2023	180 days	4 days	✓	17-Oct-2023	180 days	4 days	✓
Volatile Organic Compounds : VOCs (Eastern Canada List) by Headspace GC-MS										
Glass vial (sodium bisulfate) MW23-1	E611D	13-Oct-2023	19-Oct-2023	14 days	6 days	✓	19-Oct-2023	14 days	6 days	✓

Legend & Qualifier Definitions

EHTR: Exceeded ALS recommended hold time prior to sample receipt.

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



Quality Control Parameter Frequency Compliance

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

Matrix: **Water**

Evaluation: ✖ = QC frequency outside specification; ✔ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	Method	QC Lot #	QC	Regular	Actual	Expected	Evaluation
Laboratory Duplicates (DUP)							
Biochemical Oxygen Demand (Carbonaceous) - 5 day	E555	1189120	1	20	5.0	5.0	✓
Chloride in Water by IC	E235.Cl	1197212	1	10	10.0	5.0	✓
E. coli (MF-mFC-BCIG)	E012A.EC	1188922	1	16	6.2	5.0	✓
Fluoride in Water by IC	E235.F	1197213	1	12	8.3	5.0	✓
pH by Meter	E108	1197217	1	12	8.3	5.0	✓
Phenols (4AAP) in Water by Colorimetry	E562	1196136	1	20	5.0	5.0	✓
Sulfate in Water by IC	E235.SO4	1197211	1	10	10.0	5.0	✓
Total Cyanide	E333	1202167	1	1	100.0	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	1196134	1	18	5.5	5.0	✓
Total Mercury in Water by CVAAS	E508	1193575	1	16	6.2	5.0	✓
Total Metals in Water by CRC ICPMS	E420	1188403	1	16	6.2	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	1196135	1	20	5.0	5.0	✓
TSS by Gravimetry	E160	1189031	1	11	9.0	4.7	✓
VOCs (Eastern Canada List) by Headspace GC-MS	E611D	1195468	1	16	6.2	5.0	✓
Laboratory Control Samples (LCS)							
Biochemical Oxygen Demand (Carbonaceous) - 5 day	E555	1189120	1	20	5.0	5.0	✓
BNA (Ontario Sanitary Sewer SVOC Target List) by GC-MS	E655F	1195717	1	12	8.3	5.0	✓
Chloride in Water by IC	E235.Cl	1197212	1	10	10.0	5.0	✓
Fluoride in Water by IC	E235.F	1197213	1	12	8.3	5.0	✓
Mineral Oil & Grease by Gravimetry	E567SG	1188320	1	9	11.1	5.0	✓
OCP Analysis by GC-MS-MS or GC-MS	E660F	1194419	1	2	50.0	5.0	✓
Oil & Grease by Gravimetry	E567	1188319	1	12	8.3	5.0	✓
PAHs (ON Special List) by GC-MS	E642D	1195722	1	7	14.2	5.0	✓
PAHs by Hexane LVI GC-MS (Low Level)	E641A-L	1195774	1	2	50.0	5.0	✓
PCB Aroclors by GC-MS	E687	1194420	1	17	5.8	4.7	✓
pH by Meter	E108	1197217	1	12	8.3	5.0	✓
Phenols (4AAP) in Water by Colorimetry	E562	1196136	1	20	5.0	5.0	✓
Sulfate in Water by IC	E235.SO4	1197211	1	10	10.0	5.0	✓
Total Cyanide	E333	1202167	1	1	100.0	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	1196134	1	18	5.5	5.0	✓
Total Mercury in Water by CVAAS	E508	1193575	1	16	6.2	5.0	✓
Total Metals in Water by CRC ICPMS	E420	1188403	1	16	6.2	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	1196135	1	20	5.0	5.0	✓
TSS by Gravimetry	E160	1189031	1	11	9.0	4.7	✓
VOCs (Eastern Canada List) by Headspace GC-MS	E611D	1195468	1	16	6.2	5.0	✓



Matrix: **Water**

Evaluation: ✖ = QC frequency outside specification; ✔ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
<i>Analytical Methods</i>	<i>Method</i>	<i>QC Lot #</i>	<i>QC</i>	<i>Regular</i>	<i>Actual</i>	<i>Expected</i>	<i>Evaluation</i>
Method Blanks (MB)							
Biochemical Oxygen Demand (Carbonaceous) - 5 day	E555	1189120	1	20	5.0	5.0	✔
BNA (Ontario Sanitary Sewer SVOC Target List) by GC-MS	E655F	1195717	1	12	8.3	5.0	✔
Chloride in Water by IC	E235.Cl	1197212	1	10	10.0	5.0	✔
E. coli (MF-mFC-BCIG)	E012A.EC	1188922	1	16	6.2	5.0	✔
Fluoride in Water by IC	E235.F	1197213	1	12	8.3	5.0	✔
Mineral Oil & Grease by Gravimetry	E567SG	1188320	1	9	11.1	5.0	✔
OCP Analysis by GC-MS-MS or GC-MS	E660F	1194419	1	2	50.0	5.0	✔
Oil & Grease by Gravimetry	E567	1188319	1	12	8.3	5.0	✔
PAHs (ON Special List) by GC-MS	E642D	1195722	1	7	14.2	5.0	✔
PAHs by Hexane LVI GC-MS (Low Level)	E641A-L	1195774	1	2	50.0	5.0	✔
PCB Aroclors by GC-MS	E687	1194420	1	17	5.8	4.7	✔
Phenols (4AAP) in Water by Colorimetry	E562	1196136	1	20	5.0	5.0	✔
Sulfate in Water by IC	E235.SO4	1197211	1	10	10.0	5.0	✔
Total Cyanide	E333	1202167	1	1	100.0	5.0	✔
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	1196134	1	18	5.5	5.0	✔
Total Mercury in Water by CVAAS	E508	1193575	1	16	6.2	5.0	✔
Total Metals in Water by CRC ICPMS	E420	1188403	1	16	6.2	5.0	✔
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	1196135	1	20	5.0	5.0	✔
TSS by Gravimetry	E160	1189031	1	11	9.0	4.7	✔
VOCs (Eastern Canada List) by Headspace GC-MS	E611D	1195468	1	16	6.2	5.0	✔
Matrix Spikes (MS)							
Chloride in Water by IC	E235.Cl	1197212	1	10	10.0	5.0	✔
Fluoride in Water by IC	E235.F	1197213	1	12	8.3	5.0	✔
Phenols (4AAP) in Water by Colorimetry	E562	1196136	1	20	5.0	5.0	✔
Sulfate in Water by IC	E235.SO4	1197211	1	10	10.0	5.0	✔
Total Cyanide	E333	1202167	1	1	100.0	5.0	✔
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	1196134	1	18	5.5	5.0	✔
Total Mercury in Water by CVAAS	E508	1193575	1	16	6.2	5.0	✔
Total Metals in Water by CRC ICPMS	E420	1188403	1	16	6.2	5.0	✔
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	1196135	1	20	5.0	5.0	✔
VOCs (Eastern Canada List) by Headspace GC-MS	E611D	1195468	1	16	6.2	5.0	✔



Methodology References and Summaries

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

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
E. coli (MF-mFC-BCIG)	E012A.EC ALS Environmental - Waterloo	Water	ON E3433 (mod)	Following filtration (0.45 µm), and incubation at 44.5±0.2°C for 24 hours, colonies exhibiting characteristic morphology of the target organism are enumerated.
pH by Meter	E108 ALS Environmental - Waterloo	Water	APHA 4500-H (mod)	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C). For high accuracy test results, pH should be measured in the field within the recommended 15 minute hold time.
TSS by Gravimetry	E160 ALS Environmental - Waterloo	Water	APHA 2540 D (mod)	Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, following by drying of the filter at 104 ± 1°C, with gravimetric measurement of the filtered solids. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.
Chloride in Water by IC	E235.Cl ALS Environmental - Waterloo	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Fluoride in Water by IC	E235.F ALS Environmental - Waterloo	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Sulfate in Water by IC	E235.SO4 ALS Environmental - Waterloo	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318 ALS Environmental - Waterloo	Water	Method Fialab 100, 2018	TKN in water is determined by automated continuous flow analysis with membrane diffusion and fluorescence detection, after reaction with OPA (ortho-phthalaldehyde). This method is approved under US EPA 40 CFR Part 136 (May 2021).
Total Cyanide	E333 ALS Environmental - Waterloo	Water	ISO 14403 (mod)	Total or Strong Acid Dissociable (SAD) Cyanide is determined by Continuous Flow Analyzer (CFA) with in-line UV digestion followed by colourimetric analysis. Method Limitation: High levels of thiocyanate (SCN) may cause positive interference (up to 0.5% of SCN concentration).
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U ALS Environmental - Waterloo	Water	APHA 4500-P E (mod).	Total Phosphorus is determined colourimetrically using a discrete analyzer after heated persulfate digestion of the sample.



Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Total Metals in Water by CRC ICPMS	E420 ALS Environmental - Waterloo	Water	EPA 200.2/6020B (mod)	Water samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Total Mercury in Water by CVAAS	E508 ALS Environmental - Waterloo	Water	EPA 1631E (mod)	Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS
Biochemical Oxygen Demand (Carbonaceous) - 5 day	E555 ALS Environmental - Waterloo	Water	APHA 5210 B (mod)	Samples are diluted and incubated for a specified time period, after which the oxygen depletion is measured using a dissolved oxygen meter. Nitrification inhibitor is added to samples to prevent nitrogenous compounds from consuming oxygen resulting in only carbonaceous oxygen demand being reported by this method. Free chlorine is a negative interference in the BOD method; please advise ALS when free chlorine is present in samples.
Phenols (4AAP) in Water by Colorimetry	E562 ALS Environmental - Waterloo	Water	EPA 9066	This automated method is based on the distillation of phenol and subsequent reaction of the distillate with alkaline ferricyanide (K ₃ Fe(CN) ₆) and 4-amino-antipyrine (4-AAP) to form a red complex which is measured colorimetrically.
Oil & Grease by Gravimetry	E567 ALS Environmental - Waterloo	Water	BC MOE Lab Manual (Oil & Grease) (mod)	The entire water sample is extracted with hexane and the extract is evaporated to dryness. The residue is then weighed to determine Oil and Grease.
Mineral Oil & Grease by Gravimetry	E567SG ALS Environmental - Waterloo	Water	BC MOE Lab Manual (Oil & Grease) (mod)	The entire water sample is extracted with hexane, followed by silica gel treatment after which the extract is evaporated to dryness. The residue is then weighed to determine Mineral Oil and Grease.
VOCs (Eastern Canada List) by Headspace GC-MS	E611D ALS Environmental - Waterloo	Water	EPA 8260D (mod)	Volatile Organic Compounds (VOCs) are analyzed by static headspace GC-MS. Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry's law.
PAHs by Hexane LVI GC-MS (Low Level)	E641A-L ALS Environmental - Waterloo	Water	EPA 8270E (mod)	Polycyclic Aromatic Hydrocarbons (PAHs) are analyzed by large volume injection (LVI) GC-MS.
PAHs (ON Special List) by GC-MS	E642D ALS Environmental - Waterloo	Water	EPA 8270E (mod)	Polycyclic Aromatic Hydrocarbons (PAHs) are analyzed by GC-MS.
BNA (Ontario Sanitary Sewer SVOC Target List) by GC-MS	E655F ALS Environmental - Waterloo	Water	EPA 8270E (mod)	BNA are analyzed by GC-MS.



Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
OCP Analysis by GC-MS-MS or GC-MS	E660F ALS Environmental - Waterloo	Water	EPA 8270E (mod)	Pesticides are analyzed by GC-MS-MS or GC-MS
PCB Aroclors by GC-MS	E687 ALS Environmental - Waterloo	Water	EPA 8270E (mod)	PCB Aroclors are analyzed by GC-MS
Animal & Vegetable Oil & Grease by Gravimetry	EC567A.SG ALS Environmental - Waterloo	Water	APHA 5520 (mod)	Animal & vegetable oil and grease is calculated as follows: Oil & Grease (gravimetric) minus Mineral Oil & Grease (gravimetric)
Total PAH (Ontario Sewer Use Extended List)	EC640A ALS Environmental - Waterloo	Water	Calculation (Sum of the Squares)	Total PAH (Ontario Sewer Use) is the sum of the following PAHs: anthracene, benz(a)anthracene, benzo(a)pyrene, benzo(b+j)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, indeno(1,2,3-c,d)pyrene, phenanthrene, pyrene, benzo(e)pyrene, perylene, 3-methylcholanthrene, 1,3-dinitropyrene, 1,6-dinitropyrene, 1,8-dinitropyrene, 7H-dibenzo(c,g)carbazole, dibenzo(a,i)pyrene, dibenz(a,j)acridine, and dibenz(a,h)acridine. When the PAH is less than LOR, zero is used for calculation.
Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Digestion for TKN in water	EP318 ALS Environmental - Waterloo	Water	APHA 4500-Norg D (mod)	Samples are digested at high temperature using Sulfuric Acid with Copper catalyst, which converts organic nitrogen sources to Ammonia, which is then quantified by the analytical method as TKN. This method is unsuitable for samples containing high levels of nitrate. If nitrate exceeds TKN concentration by ten times or more, results may be biased low.
Digestion for Total Phosphorus in water	EP372 ALS Environmental - Waterloo	Water	APHA 4500-P E (mod).	Samples are heated with a persulfate digestion reagent.
Oil & Grease Extraction for Gravimetry	EP567 ALS Environmental - Waterloo	Water	BC MOE Lab Manual (Oil & Grease) (mod)	The entire water sample is extracted with hexane by liquid-liquid extraction.
VOCs Preparation for Headspace Analysis	EP581 ALS Environmental - Waterloo	Water	EPA 5021A (mod)	Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler. An aliquot of the headspace is then injected into the GC/MS-FID system.
PHCs and PAHs Hexane Extraction	EP601 ALS Environmental - Waterloo	Water	EPA 3511 (mod)	Petroleum Hydrocarbons (PHCs) and Polycyclic Aromatic Hydrocarbons (PAHs) are extracted using a hexane liquid-liquid extraction.
PAHs DCM Extraction	EP642	Water	EPA 3510C (mod)	PAH are extracted from aqueous sample using DCM liquid-liquid extraction.

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Work Order : WT2333338
Client : CF Crozier & Associates
Project : UWS-2521-10807



Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
	ALS Environmental - Waterloo			
BNA Extraction	EP655 ALS Environmental - Waterloo	Water	EPA 3510C (mod)	SVOCs are extracted from aqueous sample using DCM liquid-liquid extraction.
Pesticides, PCB, and Neutral Extractable Chlorinated Hydrocarbons Extraction	EP660 ALS Environmental - Waterloo	Water	EPA 3511 (mod)	Samples are extracted from aqueous sample using an organic solvent liquid-liquid extraction.



www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Chain of Custody (COC) / Analytical Request Form

COC Number: 20-1083366

Page 1 of 1

Contact and company name below will appear on the final report

Company: C.F. Crozier & Associates

Contact: Caitlyn MacPherson

Phone: 519 448 4588

Company address below will appear on the final report

Street: 8800 high pt drive-100

City/Province: Milton

Postal Code: L9T

Invoice To: Same as Report To

Company: C.F. Crozier & Associates

Contact: Mary Hatt

Project Information

ALS Account # / Quote #: 286099 / ER410350

Job #: UWS-2521-16807

PO / AFE:

LSD:

ALS Lab Work Order # (ALS use only):

Sample Identification and/or Coordinates (This description will appear on the report)

MW23-1

Reports / Recipients

Select Report Format: ☒ PDF ☐ EXCEL ☐ EDD (DIGITAL)

Merge QC/QCI Reports with COA ☐ YES ☐ NO ☐ N/A

Complete Results to Criteria on Report - provide details below if box checked

Select Distribution: ☒ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: cmacpherson@cfcrozier.ca

Email 2: cmacpherson@cfcrozier.ca

Email 3:

Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: mhatt@cfcrozier.ca

Email 2:

Oil and Gas Required Fields (client use)

AFE/Cost Center:

Major/Minor Code:

Requisitioner:

Location:

ALS Contact:

Sampler:

Date (dd-mm-yy): 13-10-23

Time (hh:mm): 11:00

Sample Type: GW

Turnaround Time (TAT) Requested

☒ Routine (R) if received by 3pm M-F - no surcharges apply

☐ 4 day (F4) if received by 3pm M-F - 20% rush surcharge minimum

☐ 3 day (F3) if received by 3pm M-F - 25% rush surcharge minimum

☐ 2 day (F2) if received by 3pm M-F - 50% rush surcharge minimum

☐ 1 day (F1) if received by 3pm M-F - 100% rush surcharge minimum

☐ Same day (E2) if received by 10am M-F - 200% rush surcharge. Add may apply to rush requests on weekends, statutory holidays and non-r

Date and Time Required for all EAP TATs:

For all tests with rush TATs requested, please i

Analysis Re

Indicate Filtered (F), Preserved (P) or Filtered ar

NUMBER OF CONTAINERS

CBOD

Cyanide

E. coli

general, TSS

OCPs

oil & grease

PAH

PCB

SVOCs

TKN, TP, Phenol

Total Mercury

total metals

VOCs

SAMPLES ON HOLD

EXTENDED STORAGE REQU

SUSPECTED HAZARD (see n

Drinking Water (DW) Samples (client use)

Are samples taken from a Regulated DW System?

☐ YES ☒ NO

Are samples for human consumption/ use?

☐ YES ☒ NO

SHIPMENT RELEASE (client use)

Released by: cmacpherson

Date: 10-13-2023

Time: 2:40

Time: 2:40

Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)

City of Hamilton

Initial Shipment Reception (ALS use only)

Date: 13-10-23

Time: 13-10-23

Time: 13-10-23

Time: 13-10-23

Time: 13-10-23

Time: 13-10-23

Time: 13-10-23

Environmental Division Waterloo

Work Order Reference WT2333338



Telephone : +1 519 886 8910

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

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

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

OS-953 8-142
OK-307 GC-949
066-992 MM-975
W-323 CN-1100
NW-101

APPENDIX H1

Groundwater Levels

						Water Level (EXP, 2018)								Crozier (2023 - 2024)							
						04-Jun-18		05-Jun-18		13-Jun-18		14-Jun-18		19-Jun-18		04-Aug-23		13-Oct-23		26-Oct-23	
Monitoring Well Name	Tag #	Reported Depth (mbgs)	Measured Depth (mbgs)	Estimated Ground Elevation (masl)	Slick Up (m)	WL (mbgs)	WL (masl)	WL (mbgs)	WL (masl)	WL (mbgs)	WL (masl)	WL (mbgs)	WL (masl)	WL (mbgs)	WL (masl)	WL (mbgs)	WL (masl)	WL (mbgs)	WL (masl)		
MW 1	A228456	7.30	7.86	237.93	0.96			0.78	237.15			1.03	236.90			0.56	237.37	2.35	235.58		237.93
MW 5		6.00		228.75	1.069			0.73	228.02			0.92	227.83			0.86	227.89		228.75	0.77	227.98
MW 7		9.20		222.10	0.884	0.27	221.83					0.58	221.52			0.64	221.46		222.10	0.49	221.61
MW 8		7.70	8.06	232.15	0.8	0.53	231.62					0.65	231.50			0.58	231.57		232.15	0.76	231.39
MW 9		6.10		233.03	0.88	0.74	232.29					0.93	232.10			0.90	232.13		233.03	1.11	231.92
MW 11		7.00		231.57	2.53			-1.2	232.77			-1.37	232.94			unlocated	unlocated	unlocated	unlocated	unlocated	unlocated
MW 12	A242020	5.70	5.58	232.18	0.876			0.04	232.14	0.19	231.99					-0.16	232.34		232.18		232.18
MW 13		5.90		230.40	1.025			-0.19	230.59	0.18	230.22					0.22	230.18	DRY	DRY		230.40
MW 15		7.50		232.19	0.922	0.65	231.54							0.54	231.65	0.45	231.74	2.35	229.84		232.19
MW 17	A228485	6.10		231.03	0.883			0.5	230.53	0.61	230.42					0.52	230.51		231.03	0.80	230.23
MW 18		6.30		233.81	0.905	-0.85	234.66			0.47	233.34					*	*	*	*		233.81
MW 25		6.10		235.30	0.95			0.34	234.96	0.46	234.84					0.52	234.78	DRY	DRY		235.30
MW 29 - S	A242646	6.20	2.39	231.97	0.74			-2.63	234.60	-2.8	234.77	-2.73	234.70			0.89	231.08	0.96	231.01		231.97
MW 29 - D		9.90		231.97	0.94			-2.57	234.54	-2.82	234.79	-2.79	234.76			-0.94	232.91	-0.94	232.91		231.97
MW 30 - S	A242044	6.00	1.46	233.53	0.864			1.18	232.35	0.3	233.23					DRY	-	DRY	DRY		233.53
MW 30 - D	A242045	10.60	10.52	233.53	0.98			-0.7	234.23	-0.57	234.10			-0.45	233.98	-0.624	234.15	0.91	232.62		233.53
MW 31 - S	A226454	6.10	1.39	231.94	0.82			0.2	231.74	0.31	231.63					DRY	-	DRY	DRY		231.94
MW 31 - D		9.30		231.94	2.44			-1.12	233.06	-1.13	233.07					-1.4	233.34	-1.4	233.34		231.94
MW 32 - S		6.10		221.99	0.905	0.46	221.53					0.63	221.36			0.75	221.24		221.99	DRY	DRY
MW 32 - D		12.40		221.99	0.765	0.56	221.43					0.73	221.26			0.62	221.37		221.99	3.19	218.80
MW 33 - S		6.10		229.31	0.93	0.66	228.65					0.88	228.43			0.92	228.39		229.31	DRY	DRY
MW 33 - D		11.00		229.31	0.95	0.71	228.60					0.94	228.37			0.79	228.52		229.31	DRY	DRY
MW23-1		7.01		239.9	1.08													1.31	238.59		239.90
MW23-2		7.01		242.8	1													3.4	239.40		242.80
MW23-3		7.62		240.1	1.12													3.17	236.93		240.10
MW23-4		5.48		240.08	1.05													2.04	238.04		240.08
MW23-5		8.23		233.13	1.03															2.17	230.96
MW23-6		9.1		235.93	1.05													2.7	233.23		235.93
MW23-7		9.1		229.33	1.12															2.27	227.06
MW23-8		5.48		226.24	1.05															2.15	224.09
MW23-9		5.18		225	1.12															4.40	220.60
MW23-10		6.09		233.83	1.07													2.41	231.42		233.83
MW23-11		6.71		237.03	1.08													1.48	235.55		237.03
MW23-12		6.1		232.69	0.98													4.34	228.35		232.69
MW 34			3.85	240	1.01													2.89	237.11		240.00
MW 35			7.05	240	0.85													2.67	237.33		240.00
MW 36			6.71	240	0.86													2.64	237.36		240.00
MW 37			6.9	240	0.83													2.4	237.60		240.00
MW 38			7.04	240	1.01													1.64	238.36		240.00

* Damaged well discovered August 4, 2023

**Ground elevation field measured using handheld GPS.

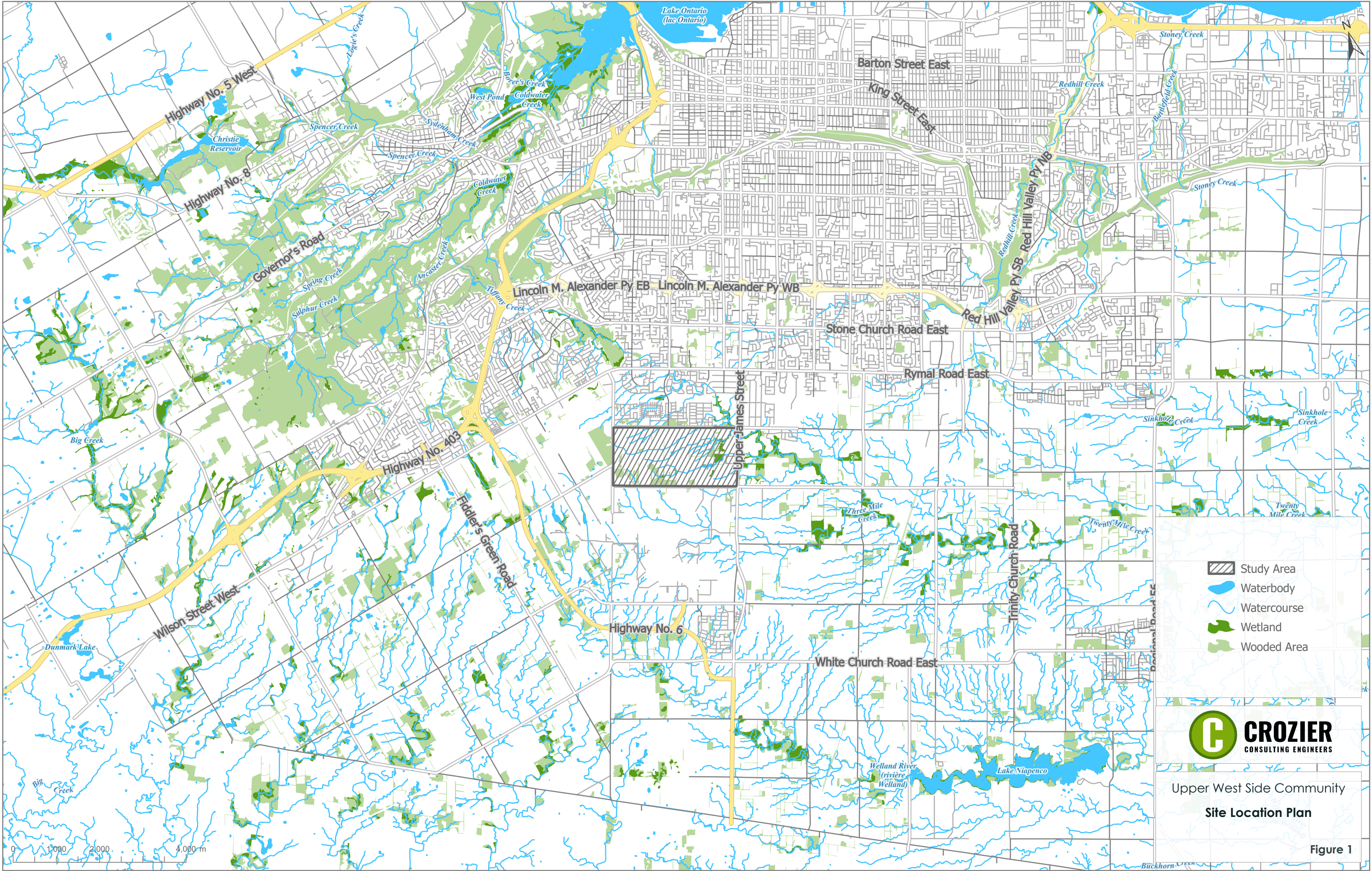
APPENDIX H2

Surface Water Levels

			Water Level (Crozier 2023)														
UTM			26-Oct-23														
Piezometer Name	X	Y	Measured Depth (mbgs)	Estimated Ground Elevation (mgs)	Stick Up (m)	WL In Pipe (mbgs)	WL Out Pipe (mbgs)	WL Gradient	WL In Pipe (mbgs)	WL Out Pipe (mbgs)	WL Gradient (mbgs)	WL In Pipe (mbgs)	WL Out Pipe (mbgs)	WL Gradient (mbgs)	WL In Pipe (mbgs)	WL Out Pipe (mbgs)	WL Gradient (mbgs)
PZ1	586835	4782253	0.97	235.27	1.30	DRY	DRY	DRY									
PZ2	586857	4782230	1.04	235.82	1.24	DRY	DRY	DRY									
PZ3	586710	4782551	0.80	235.82	1.48	0.45	-0.08	0.53									
PZ4	587083	4782731	1.09	232.11	1.19	0.75	-0.02	0.77									
PZ5	587133	4782731	0.91	232.39	1.37	0.52	-0.03	0.55									
PZ6	587681	4782644	1.07	228.34	1.21	DRY	DRY	DRY									
PZ7	587625	4782662	1.18	227.87	1.10	1.09	-0.02	1.11									
PZ8	587861	4782504	0.95	227.84	1.33	0.86	-0.02	0.88									
PZ9	587953	4782334	1.04	225.44	1.24	DRY	DRY	DRY									
PZ10	587853	4782068	1.05	225.00	1.23	0.89	0.02	0.87									
PZ11	588652	4782268	1.82	221.11	0.46	DRY	DRY	DRY									
PZ12	588524	4782231	0.98	221.11	1.30	DRY	DRY	DRY									
PZ13	588880	4782534	0.99	217.65	1.29	0.65	-0.01	0.66									
PZ14	589293	4782557	0.96	216.00	1.32	DRY	DRY	DRY									
PZ15	587343	4782129	0.95	233.53	1.33	DRY	DRY	DRY									

** Ground elevation field measured using handheld GPS.

FIGURES



Study Area

Waterbody

Watercourse

Wetland

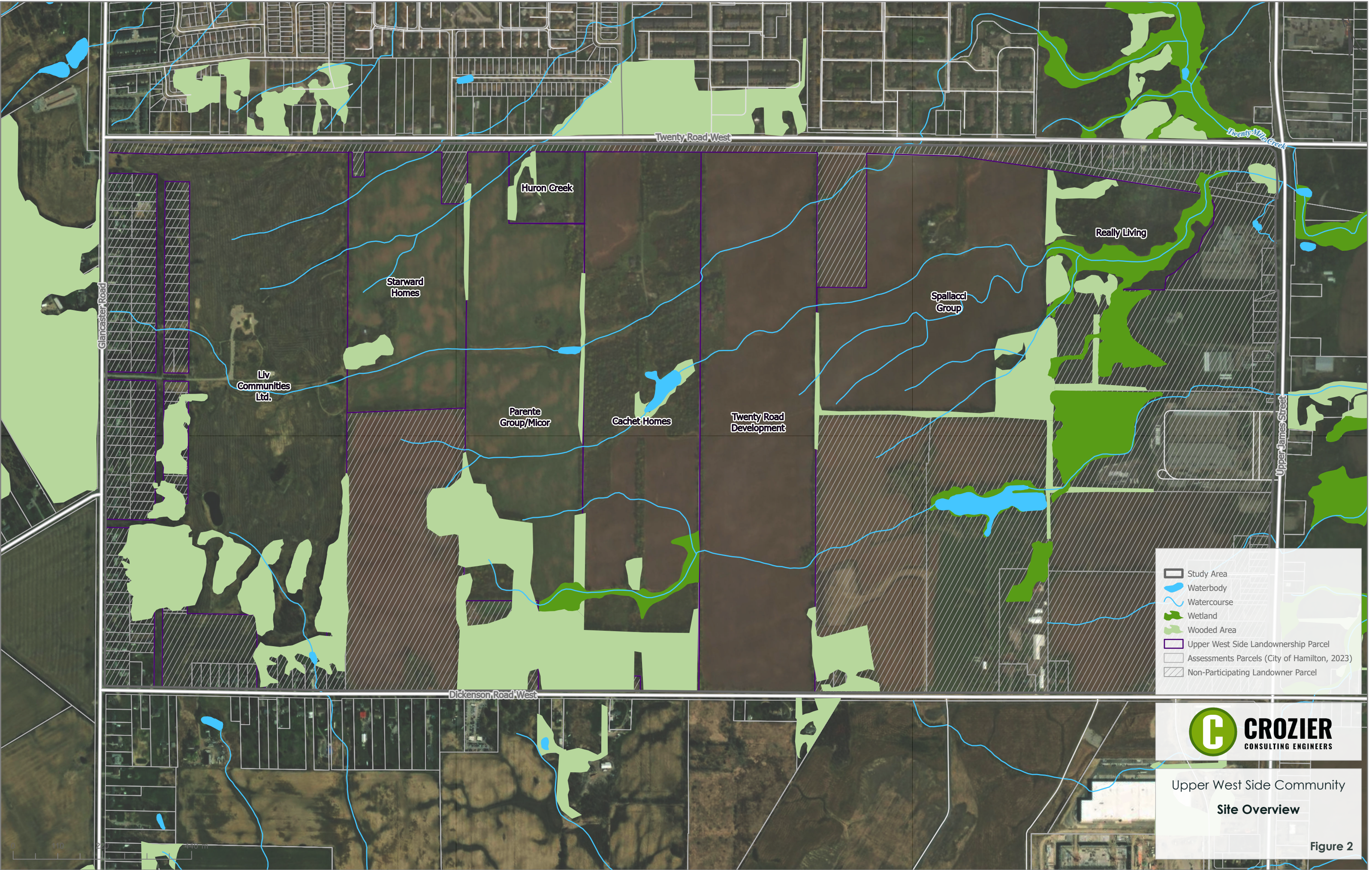
Wooded Area

CROZIER

CONSULTING ENGINEERS

Upper West Side Community
Site Location Plan

Figure 1



Study Area

Waterbody

Watercourse

Wetland

Wooded Area

Upper West Side Landownership Parcel

Assessments Parcels (City of Hamilton, 2023)

Non-Participating Landowner Parcel

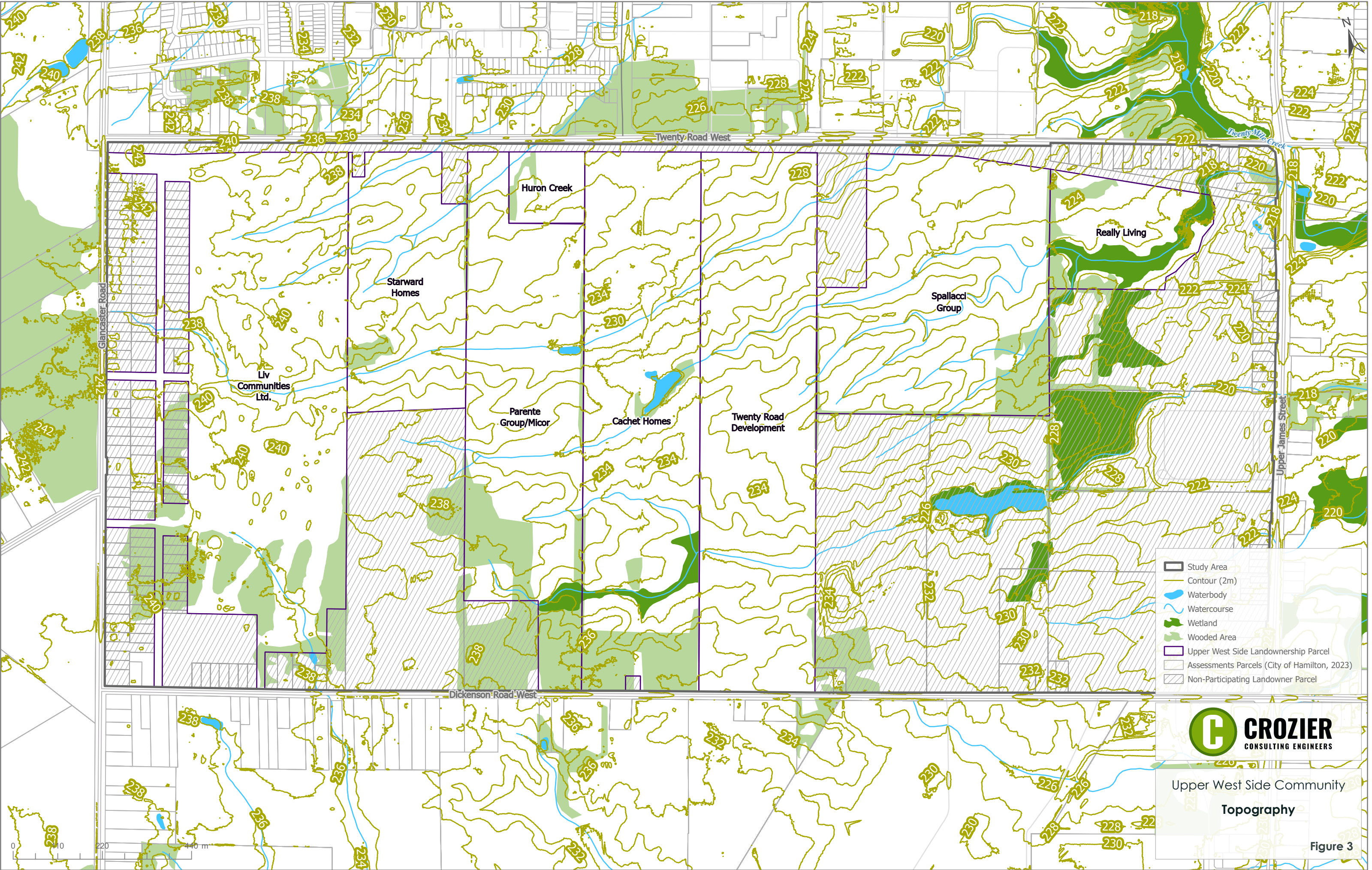
C

CROZIER
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Upper West Side Community

Site Overview

Figure 2

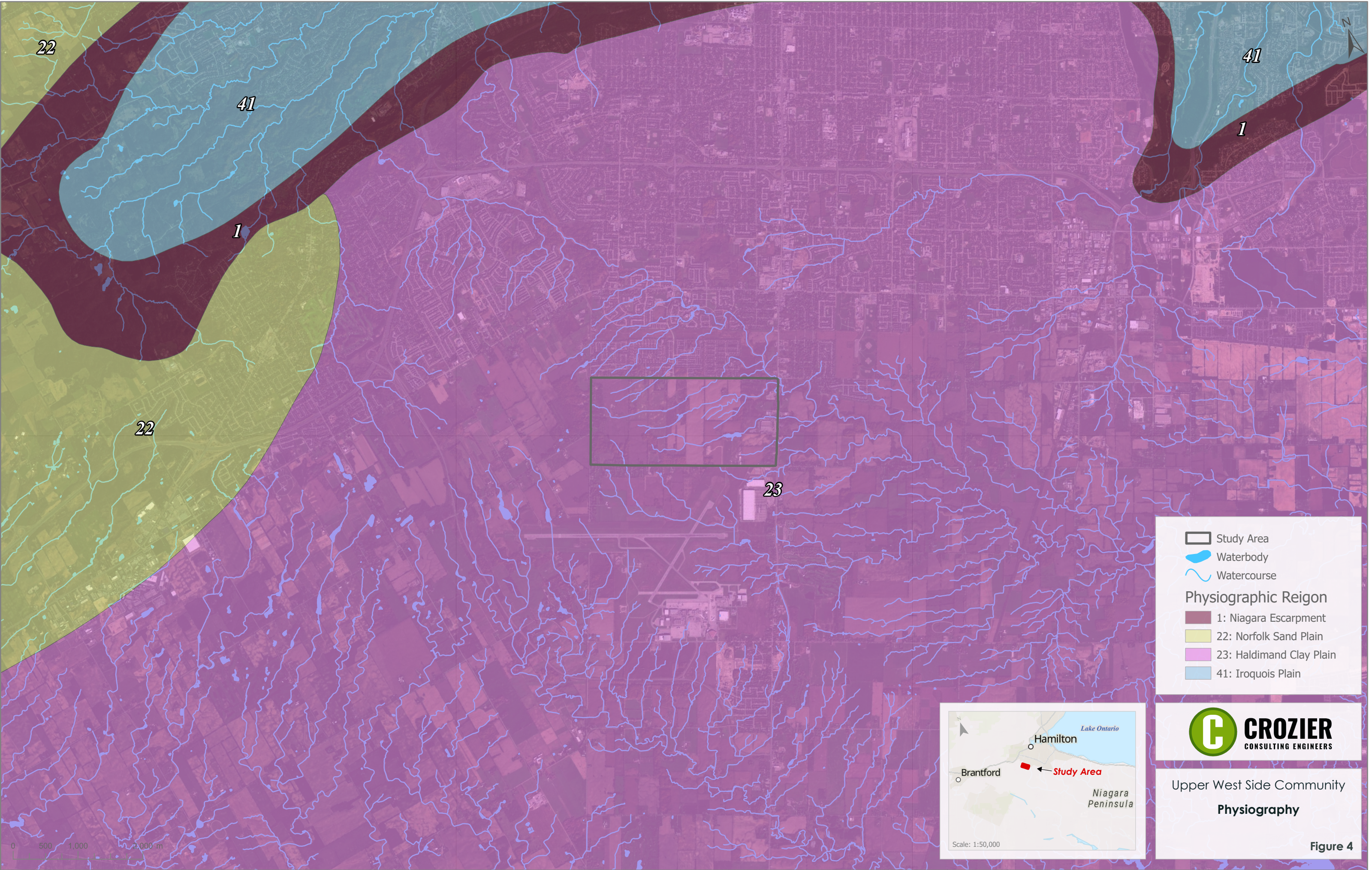


- Study Area
- Contour (2m)
- Waterbody
- Watercourse
- Wetland
- Wooded Area
- Upper West Side Landownership Parcel
- Assessments Parcels (City of Hamilton, 2023)
- Non-Participating Landowner Parcel



Upper West Side Community
Topography

Figure 3



- Study Area
- Waterbody
- Watercourse

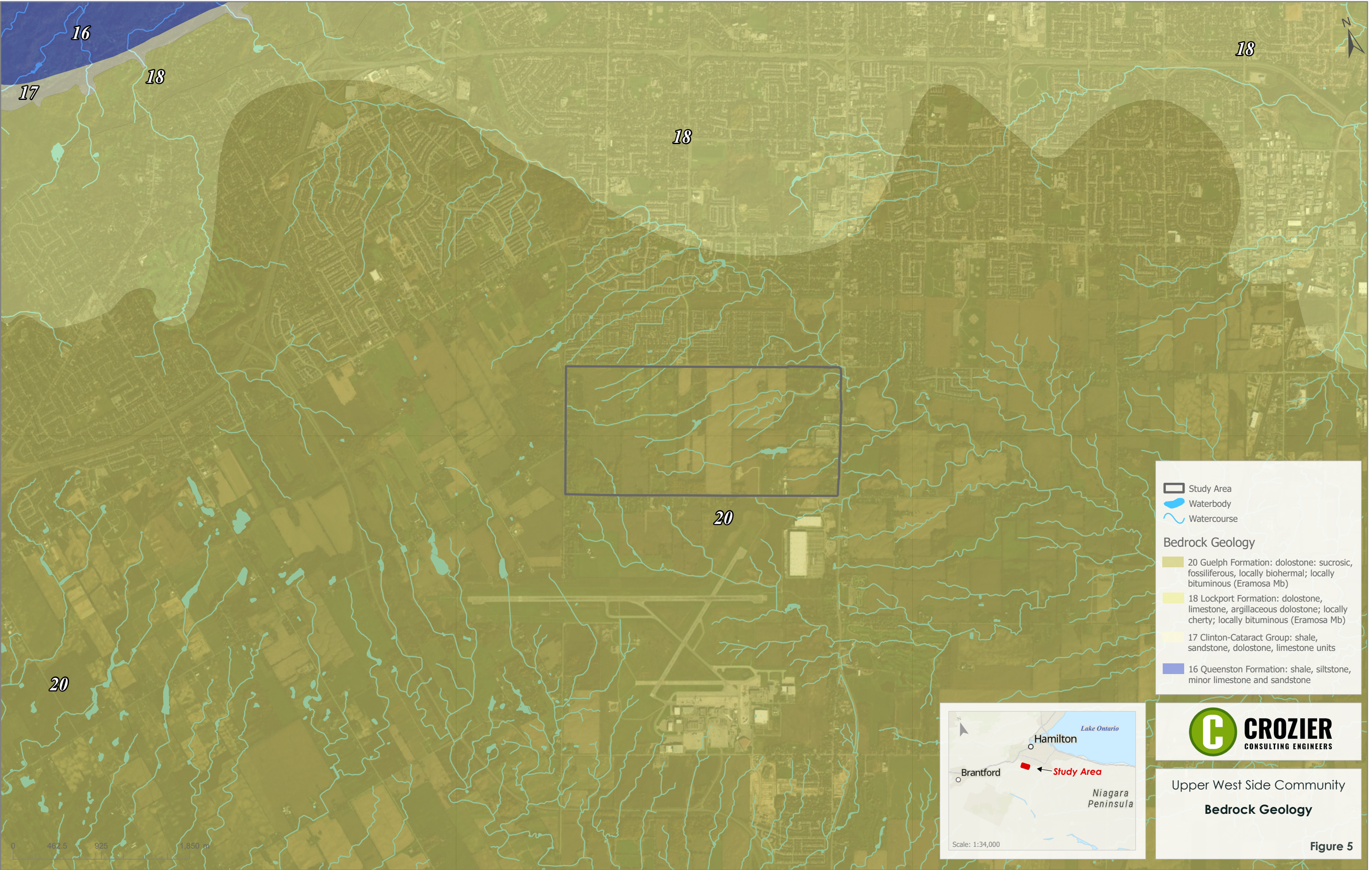
Physiographic Reigion


- 1: Niagara Escarpment
- 22: Norfolk Sand Plain
- 23: Haldimand Clay Plain
- 41: Iroquois Plain





Upper West Side Community
Physiography

Figure 4





 Study Area


 Waterbody


 Watercourse

Bedrock Geology

 20 Guelph Formation: dolostone: sucrosic, fossiliferous, locally biohermal; locally bituminous (Eramosa Mb)

 18 Lockport Formation: dolostone, limestone, argillaceous dolostone; locally cherty; locally bituminous (Eramosa Mb)

 17 Clinton-Cataract Group: shale, sandstone, dolostone, limestone units

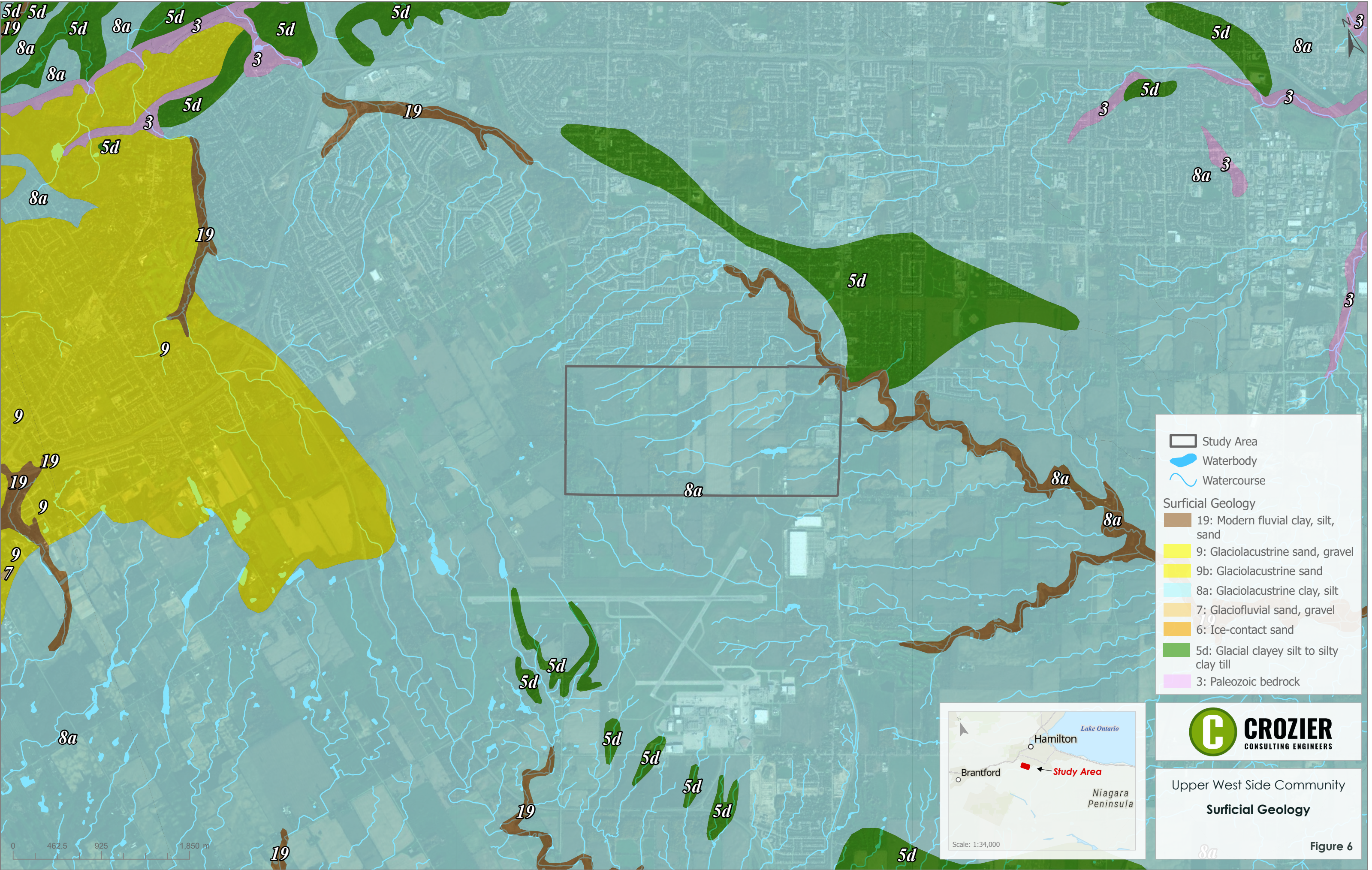
 16 Queenston Formation: shale, siltstone, minor limestone and sandstone




Upper West Side Community

Bedrock Geology

Figure 5



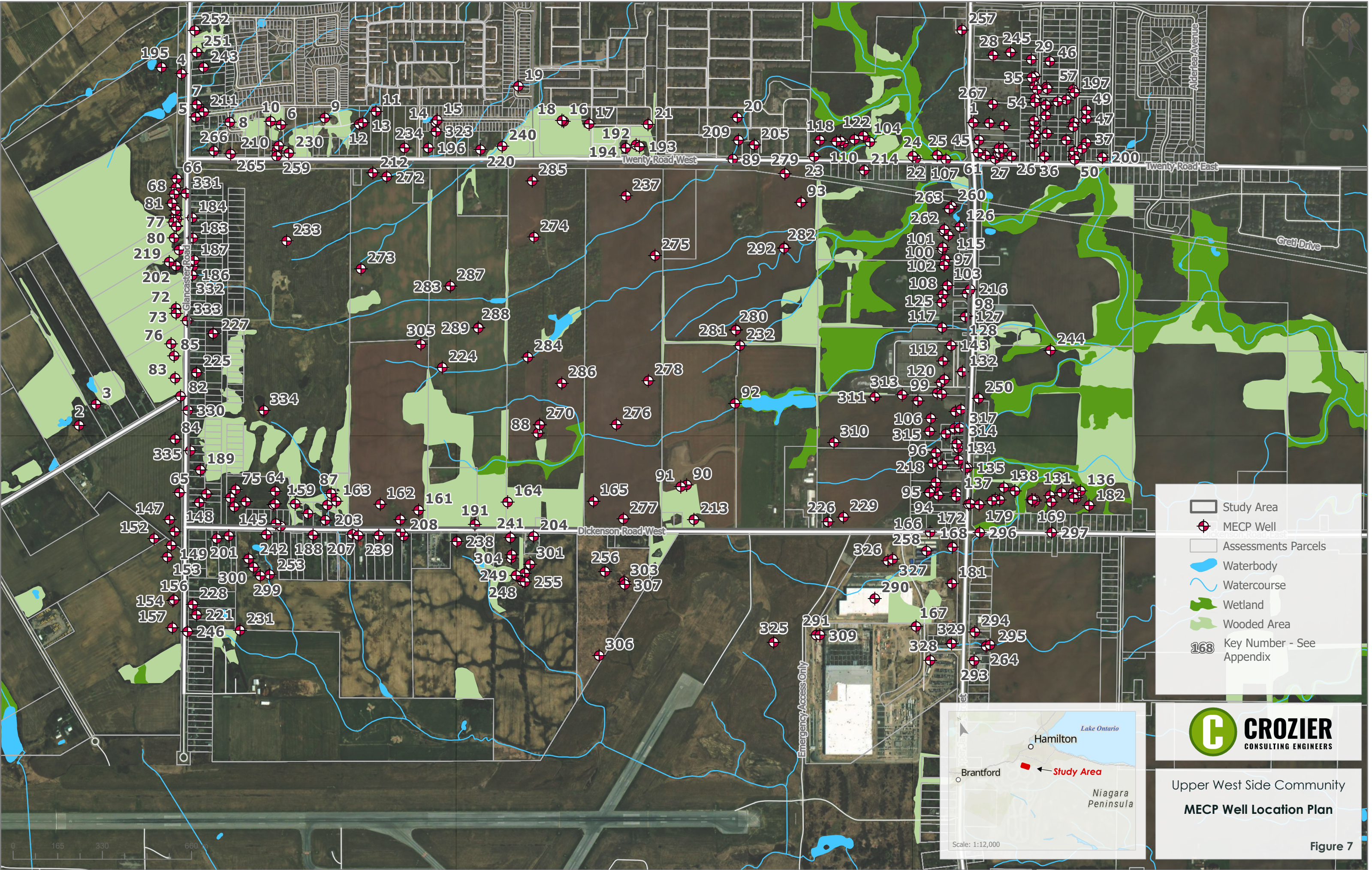


CROZIER
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Upper West Side Community

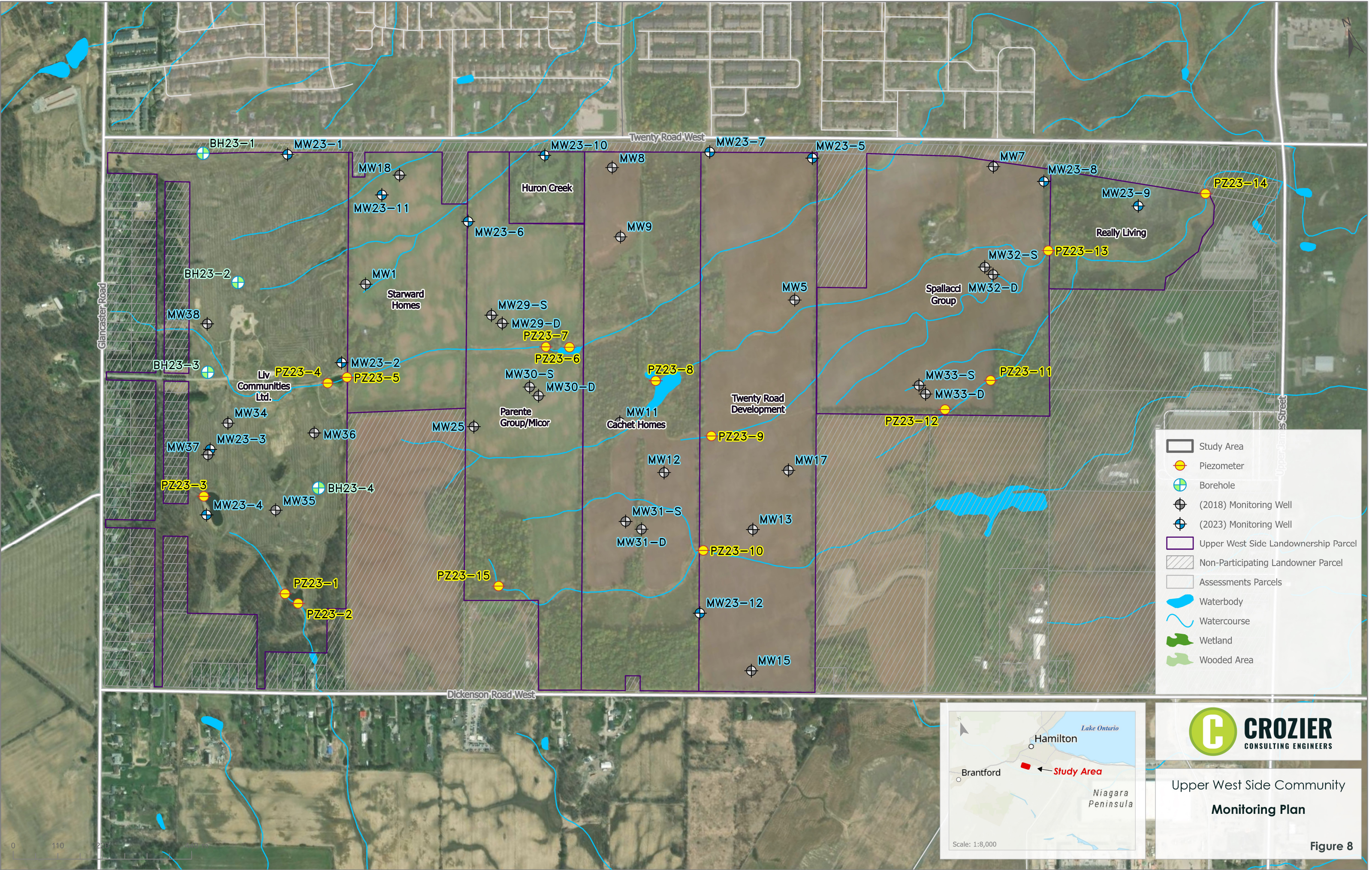
Surficial Geology

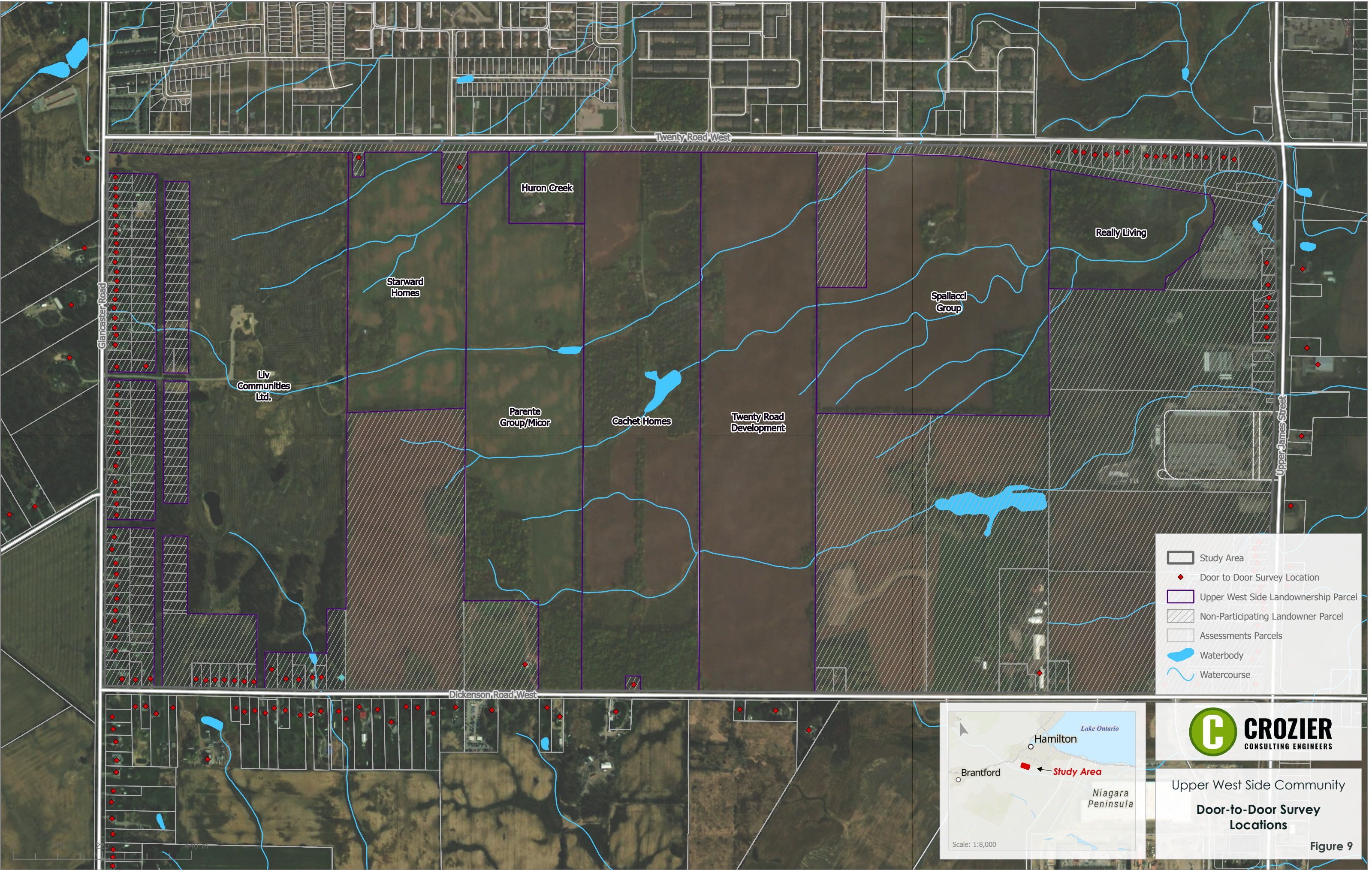
Figure 6



Upper West Side Community
MECP Well Location Plan

Figure 7





Upper West Side Community
Door-to-Door Survey
Locations

Figure 9