THURBER ENGINEERING LTD.

FINAL
HYDROGEOLOGICAL ASSESSMENT REPORT
CLARK AVENUE EXTENSION
RUTHERFORD ROAD TO KENNEDY ROAD
CITY OF BRAMPTON

Report

To

HDR Inc.

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TABLE OF CONTENTS

TABLES

THURBER

FIGURES

APPENDICES

1. INTRODUCTION

This report presents the results of a preliminary hydrogeological assessment completed by Thurber Engineering Ltd. (Thurber) in conjunction with a geotechnical investigation in support of the Municipal Class Environmental Assessment Study (EA) for the Clark Boulevard Extension and Eastern Avenue widening in the City of Brampton, Ontario. The limits of the project site are from Rutherford Road to Kennedy Road for a total length of approximately 900 m (the Site).

The project is expected to consist of the construction of a new 4-lane urban cross-section segment of Clark Boulevard between Rutherford Road and Hansen Road. This extension will also involve construction of a bridge or culvert for the crossing of a Spring Creek tributary. In addition, Eastern Avenue is to be widened from a 2-lane rural cross section to a 4-lane urban cross section.

The purpose of the Preliminary Hydrogeological Investigation Report is to conduct a preliminary assessment of the hydrogeological conditions, evaluation of potential construction dewatering requirements and methods, anticipated impacts, Permit To Take Water (PTTW) requirements, discharge requirements, and disposal options for groundwater collected from dewatering operations (including mitigation measures).

The hydrogeological components of the investigation included the following tasks:

- Measurement of groundwater levels on completion of installation and again afterwards once groundwater levels have stabilized;
- Conduct in-situ hydraulic conductivity testing at three of the installed monitoring wells; and,
- Collect groundwater samples for chemical testing in accordance with Peel Region Sewer Use Bylaws from the installed monitoring wells.

Note, a Ministry of the Environment, Conservation and Parks (MECP) water well search or door-to-door survey of private water supply wells was not completed as part of this preliminary assignment. Recommendations for further studies is presented herein.

It is a condition of this report that Thurber's performance of its professional services is subject to the attached Statement of Limitations and Conditions.

2. BACKGROUND REVIEW

2.1 Site Description

The existing alignment of Eastern Avenue from Kennedy Road to Hansen Avenue is an east-west arterial road under the jurisdiction of the City of Brampton (the City) and consists of a 2-lane rural cross-section with a posted speed limit of 50 km/hr. Eastern Avenue is currently classified as a minor arterial road with an ultimate right-of-way of 26 to 30 meters.

The existing Clark Boulevard, east of Rutherford Road is an east-west arterial road under the jurisdiction of the City and consists of a 4-lane urban cross-section with a posted speed limit of 50 km/hr. The proposed extension of Clark Boulevard is located at the westerly limit of Clark Boulevard and would extend to Hansen Road. This extension of Clark Boulevard would be classified as a minor arterial road with an ultimate right-of-way of 26 to 30 meters.

The Clark Boulevard extension would require a crossing of a tributary of Spring Creek. The crossing would be located approximate 125 m west of Rutherford Road South where the creek flows in an easterly direction. The recommendations include a channel re-alignment to permit a more perpendicular crossing of the channel.

The area of the proposed extension of Clark Boulevard east of the creek is currently occupied by a vacant parcel of industrial property owned by the City of Brampton at 25 Rutherford Road South. West of the creek the area of the extension is occupied by 35 Rutherford Road South, which currently contains a manufacturing plant for pre-fabricated concrete products.

The area surrounding the project corridor within 500 m of the Site (the Study Area) mainly consists of industrial properties along both sides of Eastern Avenue and the proposed Clark Boulevard extension. The Site and Study Area are shown on Figure 1.

2.2 Site Physiographic, Geologic and Hydrogeologic Settings

Based on the information in *The Physiography of Southern Ontario*[1] by Chapman and Putnam (1984), the Study Area is located within the Peel Plain physiographic region. The Peel Plain is characterized by a level to undulating topography gradually sloping towards Lake Ontario with surficial soil comprising a thin lacustrine clay underlain by till. The predominant physiographic landform within the study area is comprised of Bevelled Till Plains. A physiographic region map of the Study Area is shown on Figure 2 and the mapped physiographic landforms within the Study Area are illustrated on Figure 3.

Based on *Surficial Geology of Southern Ontario*[2]*,* the surficial geology of the Study Area generally comprises of fine textured glaciolacustrine deposits of silt and clay and interbedded flow till composed of rainout deposits and silt and clay. The mapped surficial geology of the Study Area is illustrated on Figure 4.

[1] Chapman, L.J. and Putnam, D.F. 1984. The Physiography of Southern Ontario, Ontario Geological Survey Special Volume 2, Third Edition. Accompanied by Map P.2715, Scale 1:600,000.
[2] Ontario Geological Survey, 2010: Surficial geology of Southern Ontario; Ontario Geological Survey, Miscellaneous Release--Data 128-REV

According to *Paleozoic Geology of Southern Ontario*[3], the overburden soils are underlain by shale, siltstone, minor limestone and sandstone bedrock of the Queenston Formation. The mapped bedrock geology of the Study Area is illustrated on Figure 5.

The topography on the Site generally slopes down gradually towards the east and the shallow groundwater flow direction is expected to follow topography in a general easterly direction.

2.3 Environmental Setting

Based on a review of Ministry of Natural Resources and Forestry (MNRF) online mapping, natural features within the Study Area include the following:

- A tributary of Spring Creek, which flows generally in a west to east direction, originating at Hansen Road, 100 m north of Eastern Avenue. The tributary crosses Rutherford Road 80 m south of Clark Boulevard. Spring Creek is a tributary of Etobicoke Creek and flows into Etobicoke Creek approximately 650 m south of Courtney Park Drive East and West Service Road. Etobicoke Creek in turn flows into Lake Ontario, approximately 20 km southeast of the Study Area.
- A small wooded area is located around the banks of the tributary of Spring Creek, between Hansen Road and Rutherford Road.

No Areas of Natural Scientific Interest (ANSI) and no wetlands are located in the Study Area.

The mapped natural features within the Study Area are illustrated on Figure 6.

Drainage along Eastern Avenue flows easterly through ditches on both sides of the road to a ditch on the east side of Hansen Road, which in turn flows north to the tributary of Spring Creek 100 m north. The tributary of Spring Creek is channelized from Hansen Road to beyond the Rutherford Road. The creek bed has a concrete block lining through this section as a likely means to protect from erosion.

The Site is located within the Etobicoke Creek watersheds, which is regulated by the Toronto and Region Conservation Authority (TRCA). The Study Area lies within the Toronto Source Water Protection Area (SPA) and partially lies within a Highly Vulnerable Aquifer area (HVA), which is located generally within the north and east halves of the Study Area.

The Site is not located in the designated area of the Oak Ridges Moraine Conservation Act[4] or the designated area of the Niagara Escarpment Planning and Development Act. In addition, the

[3] Armstrong, D.K. and Dodge, J.E.P., 2007: Paleozoic geology of southern Ontario; Ontario Geological Survey, Miscellaneous Release--Data 219.

Site does not lie within any Wellhead Protection Areas (WHPA) or within a Significant Groundwater Recharge Area (SGRA).

Parts of the proposed Clark Boulevard extension between Hansen Road and Rutherford Road are within 30 m of a water body (the tributary of Spring Creek) and the floodplains for the tributary is designated as “Regulated Areas” by the TRCA.

In general, the land use surrounding the current alignment is primarily industrial and commercial properties.

3. INVESTIGATION PROCEDURES

3.1 Subsurface Investigation

The borehole investigation field program was carried out between August 16 and September 23, 2021, and consisted of drilling and sampling a total of twenty five (25) boreholes.

The subsurface stratigraphy encountered in these boreholes generally consisted of pavement structure, topsoil, or mixed fill which was generally underlain by native silty clay to clayey silt or sands and silts soils and sand and silt tills, over shale bedrock. However, the factual data presented on the Record of Borehole sheets takes precedence over this general description and must be used for interpretation of the site conditions. It should be recognized and expected that soil conditions will vary between and beyond borehole locations. A summary of the drilled boreholes details and locations is provided in Table 3-1.

Table 3-1: Borehole Details

Structure	Approximate Location	Borehole No.	Approx. Ground Elevation (m)	Borehole Termination Depth (m)	Approx. Borehole Termination Elevation (m)
Clark Boulevard Extension Creek Crossing	West Side of Creek – 35 Rutherford Road	BR-01	215.7	8.8 (refusal to augering)	206.9
		BR-02	215.4	8.4 (refusal to augering)	207.0
	East Side of Creek – 25 Rutherford Road	BR-03	215.2	8.7 (refusal to augering)	206.5
		BR-04	215.7	9.4 (refusal to augering)	206.2
Clark Boulevard Extension	35 Rutherford Road	CE-01	217.8	3.7	214.1
		CE-02	217.1	3.7	213.4

Structure	Approximate Location	Borehole No.	Approx. Ground Elevation (m)	Borehole Termination Depth (m)	Approx. Borehole Termination Elevation (m)
		CE-03	216.0	3.2	212.8
	25 Rutherford Road	CE-04	215.9	3.7	212.3
	Rutherford Road	RR-01	215.7	2.1	213.6
		RR-02	215.3	2.1	213.2
Eastern Avenue	Eastern Avenue	EA-02	223.1	2.1	221.0
		EA-03	222.9	2.9	220.0
		EA-04	222.8	2.9	219.9
		EA-05	222.4	6.7	215.7
		EA-06	222.1	2.1	220.0
		EA-07	221.5	2.9	218.6
		EA-08	220.0	1.8	218.2
		EA-09	220.7	2.1	218.5
		EA-10	220.4	2.1	218.2
		EA-11	219.6	2.9	216.7
		EA-12	218.3	1.8	216.5
		EA-13	218.9	2.1	216.8
		EA-014	218.1	4.1	214.0
		EA-15	217.7	2.1	215.5
	Hansen Road	EA-16	217.6	2.1	215.5

The approximate locations of the completed boreholes are shown on the Borehole Location Drawings 30427-1 and 30427-2 in Appendix B.

Groundwater conditions were observed in the open boreholes throughout the drilling operations. Monitoring wells were installed in selected boreholes to permit monitoring of the groundwater levels, conduct hydraulic conductivity testing, and collect ground water samples for chemical analysis. The monitoring wells consisted of 50 mm diameter PVC pipe with a slotted screen sealed at a selected depth within the borehole. The installation details are summarized in Table 3-2.

Table 3-2: Monitoring Well Details

Borehole No.	Monitoring Well Bottom		Slotted Screen Length (m)
	Depth (mbgs)	Elevation (masl)	
BR-03	8.5	206.7	1.5
BR-04	9.1	206.6	1.5
EA-05	6.0	216.4	1.5
EA-14	4.0	214.1	1.5

Physical laboratory testing of soil samples was carried out at Thurber's laboratory. All recovered soil samples were subjected to visual identification and to natural moisture content determination. Selected samples were also subjected to grain size distribution analysis (hydrometer and/or sieve) and Atterberg Limits testing, where appropriate. Laboratory testing results are summarized on the Record of Borehole sheets included in Appendix A and are presented on the figures included in Appendix C.

3.2 Groundwater Sampling and Chemical Analysis

Groundwater quality samples were collected from selected wells for the purpose of considering disposal options and potential treatment needs at a preliminary level. The results provided in this report are representative of the water sampled from the selected wells at the time of sampling and provide a general understanding of groundwater quality under those conditions; however, the water quality may vary significantly from the results obtained based on location, time, meteorological conditions, and in particular based on construction and dewatering methods. The concentration of suspended solids in the groundwater or in water that is collected during construction dewatering (e.g., from a sump in an open excavation) will significantly affect the concentrations of many regulated parameters, particularly metals. The value of testing groundwater quality during the investigation is primarily to identify the types of potential contaminants that may need to be managed before discharge, the extent to which they are dissolved and therefore unlikely to be filtered by physical means alone, and the presence of

anthropogenic contaminants that are listed in the given discharge criteria that may require specific treatment.

The monitoring wells were developed on October 27, 2021 and November 4, 2021, prior to any sampling or in-situ testing, by purging at least three well volumes. The purpose of purging was to remove excess sediment that may have entered the well during installation, to increase the representativeness of the natural groundwater in the well and to improve the transmissivity of the sand pack and well screen. Development was assessed to be completed based on the number of well volumes purged, stabilization of general chemistry parameters of the pumped groundwater (pH, temperature, conductivity) over time, and qualitative observations such as a decrease in turbidity of the pumped water.

A sample set of unfiltered groundwater and a set of field filtered samples were collected from the monitoring well installed in Boreholes EA-05 using standard sampling techniques (i.e., bailer). The samples were preserved in prepared laboratory sample bottles and stored in a cooler on ice to maintain storage temperatures required by the MECP's *Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act,* as amended (the MECP Analytical Protocols). The samples were submitted to AGAT Laboratories in Mississauga, Ontario for analysis the parameters listed in the Limits of Storm Water Discharge of the Peel Region *Wastewater Bylaw* (No. 53-2010) (the Bylaw) for assessing the potential option of disposing of dewatering discharge.

AGAT is accredited by the Canadian Association for Laboratory Accreditation (CALA) for the testing of the parameters referenced in this report. The analytical methods used by the laboratory are presented in the Certificates of Analysis in Appendix D. The analytical procedures were conducted in accordance with the MECP Analytical Protocols.

A summary of the groundwater samples collected and submitted for chemical analysis is presented in Table 3-3.

Table 3-3: Groundwater Samples Submitted for Chemical Analysis

Location	Sample IDs	Filtered/ Unfiltered	Type of Chemical Analysis
EA-05	EA-05	Unfiltered	Peel Region Storm Sewer Discharge
EA-05	EA-05F	Field Filtered	Peel Region Storm Sewer Discharge

Exceedances of the above standards within the groundwater analytical results are discussed in Section 4.2 and a summary of the exceedances and the laboratory certificates of analysis are included in Appendix D.

3.3 Single Well Response Tests

Rising head single well response tests (slug tests) were carried out on the 50 mm diameter wells installed in Boreholes EA-05, BR-03 and BR-04. The well in Borehole EA-05 is screened in firm to very stiff clayey silt. The majority of the well in Borehole BR-03 is screened in very dense sandy silt till and partially in shale. The well in Borehole BR-04 was screened partially in sandy silt till and partially in shale of the Queenston Formation. A summary of the tests completed, and the depths and screened materials is presented in Section 4.3 and the tests results can be found in Appendix E. The tests were completed using the following method:

- In advance of conducting a slug test, the monitoring well was developed to remove excess sediment and to improve the transmissivity of the sand pack and well screen;
- Once the water level returned to a stabilized level, the static water level was measured and recorded, and a datalogger was inserted into the well approximately 1 cm to 5 cm from the bottom of the well. The datalogger was set to record water levels every 1 to 10 seconds, depending on the anticipated rate of recovery of each well;
- A slug of groundwater was removed from the well to induce a difference in hydraulic head between the well and the surrounding formation (rising head test);
- Manual and electronic measurements of the water level were recorded until the water level in the well recovered sufficiently; and,
- Manual measurements were compared to electronic measurements for quality control of the data.

4. TESTING RESULTS AND ANALYSIS

4.1 Groundwater Level Monitoring

Groundwater levels at monitoring wells were measured manually on October 27, November 04, and November 23, 2021. A summary of the water levels recorded in the monitoring wells is provided in Table 4-1.

Table 4-1: Measured Groundwater Levels

Borehole	Date	Measured Water Level	
		Depth (mbgs)	Elevation (masl)
BR-03	October 27, 2021	1.91	213.27
	November 4, 2021	1.46	213.73
	November 23, 2021	1.52	213.66
BR-04	October 27, 2021	2.24	213.43
	November 4, 2021	2.09	213.58
	November 23, 2021	2.13	213.54
EA-05	November 4, 2021	1.09	221.33
	November 23, 2021	1.21	221.21
EA-14	November 23, 2021	0.54	217.54

Notes: mgbs – meters below ground surface
masl – meters above sea level

4.2 Groundwater Quality Results

The groundwater chemical testing results of both the field filtered sample and the unfiltered sample are presented in the laboratory Certificates of Analysis in Appendix D. The groundwater analytical results that exceeded the applicable limits and objectives are presented in the following tables.

Peel Region Wastewater Bylaw

The concentration of the parameters listed in the Bylaw in the groundwater samples collected from Borehole EA-05 were below the Bylaw limits for discharge to storm sewers, except where noted in bold in Table 4-2.

Table 4-2: Groundwater Concentrations Exceeding the Peel Region Bylaw Limits

Sample ID	Parameter	Units	Measured Concentration	Storm Sewer Limits
EA-05	Fecal Coliform	CFU/100ml	**30**	0
	Phenols	mg/L	**0.090**	0.008
	Total Arsenic	mg/L	**0.036**	0.02
	Total Chromium	mg/L	**0.116**	0.08
	Total Copper	mg/L	**0.129**	0.05
	Total Manganese	mg/L	**4.25**	0.05
	Total Nickel	mg/L	**0.126**	0.08
	Total Phosphorous	mg/L	**9.91**	0.4
	TSS	mg/L	**12400**	15
	Total Zinc	mg/L	**0.311**	0.04
EA-05F	Phenols	mg/L	**0.028**	0.008
	Total Manganese	mg/L	**0.169**	0.05

TSS – Total Suspended Solids

TKN – Total Kjeldahl Nitrogen

The concentrations of several parameters in the unfiltered groundwater sample exceeded the Bylaw limits for discharge to a storm sewer, including the following: Fecal Coliform, Phenols, Total Arsenic, Total Chromium, Total Copper, Total Manganese, Total Nickel, Total Suspended Solids (TSS), and Total Zinc. The concentrations of the parameters which had exceedances in the unfiltered samples were greatly reduced in the field filtered samples however the concentrations of Phenols and Total Manganese also exceeded the Bylaw limits for discharge to a storm sewer.

It is expected that groundwater would require treatment prior to discharge into surface water or any storm sewers. Treatment to remove suspended sediment and associated metals, and possible adjustment of the temperature if discharging to surface water, would likely be the minimum requirements. Additional sampling and testing in comparison to Provincial Water Quality Objectives (PWQOs) will be required if groundwater is to be discharged towards surface water. Where feasible, it is recommended that groundwater should be discharged at least 30 m away from any surface water bodies.

Pre-treatment of dewatering discharge will be the responsibility of the dewatering contractor to ensure that the quality of the dewatering discharge effluent meets applicable discharge criteria. Should the dewatering discharge be contaminated such that the groundwater cannot be treated

to the appropriate water quality criteria, the dewatering contractor shall be responsible for transporting the contaminated groundwater off-site for disposal at an appropriate licensed facility.

4.3 Hydraulic Conductivity

The slug tests were analyzed using the Hvorslev method. The test results indicated that the hydraulic conductivity of the screened formations ranged from 4.6×10^{-9} to 1.9×10^{-6} m/s. Plots of the slug test results are included in Appendix E. The hydraulic conductivity values calculated from the in-situ slug tests are summarized in Table 4-3.

Table 4-3: Single Well Response Test Results

Monitoring Well	Hydraulic Conductivity (m/s)	Screened Formation
EA-05	4.6×10^{-9}	Clayey Silt
BR-03	1.9×10^{-6}	Sandy Silt Till and Shale
BR-04	1.9×10^{-8}	Sandy Silt Till and Shale

5. DEWATERING ASSESSMENT

Groundwater taking for construction dewatering is governed by the Ontario Water Resources Act (OWRA), Environmental Protection Act (EPA) and the Water Taking and Transfer Regulation 387/04, a regulation under the OWRA. If the water taking rate will be greater than 50,000 L/day and less than 400,000 L/day, then registration on the Environmental Activity and Sector Registry will be required. If the water taking rate will be greater than 400,000 L/day, then a Category 3 Permit to Take Water will be required. On July 1, 2021, changes to EASR registrations came into effect, and storm water values no longer contribute to EASR maximum water taking rates. They are still, however, applicable to maximum water taking rates for PTTWs. A preliminary assessment of the need for water taking permitting is provided herein; however, additional analysis will be required to confirm this.

For the purposes of estimating water taking, the estimated withdrawal rates are conservatively assessed in order to reduce the likelihood that actual pumping rates might exceed the permit allowance thereby stopping work and delaying the Project.

Based on information provided by HDR, it is understood that the structures that may require dewatering include the box culvert crossing structure and channel realignment and any proposed improvements to Eastern Avenue, or the Clark Boulevard Extension, including any utility installations or storm drainage infrastructure. Currently there is only sufficient design information to provide a preliminary dewatering estimate for the box culvert crossing structure and channel realignment. Additional design information will be required to provide a preliminary dewatering

estimate for any of the proposed utility installations or storm drainage infrastructure for Eastern Avenue or the Clark Boulevard Extension. Once engineering drawings for the project, including drawings for structural drainage, any utility installations, and the structure for the creek crossing, are finalized, detailed dewatering estimates should be completed during detailed design, well in advance of construction to support permitting requirements.

The dimensions and conditions that were assumed for the preliminary dewatering assessment are provided in Table 5-1.

Table 5-1: Assumed Excavation Dimensions and Ground Conditions

Structure	Assumed Excavation Footprint (m)	Lowest Assumed Elevation of Excavation (m)	Assumed Groundwater Elevation (m)	Geologic Units to Dewater
Box culvert crossing structure and channel realignment	60 x 15	213	213.73	Silty clay fill, silt, and silt till, possible sand layers

It is assumed that all excavations would be open cut. The excavation and dewatering methods that will be used in the field will be determined by the selected contractor. The following approach was used to estimate the budgeted peak water taking rate:

- Lowering of groundwater to 1.0 m below the bottom of the excavation, to facilitate a dry, stable work area was assumed.
- A base ground water extraction flow rate was estimated, and a factor of safety of three was applied to this flow rate to provide an allowance for removal of water from storage, variation in hydraulic conductivity, actual excavation dimensions and geometry, and ground water levels due to seasonality or other factors, etc.

The water taking will be temporary in nature (less than one year) for the purpose of construction of the box culvert crossing and channel realignment. Dewatering rates were estimated using the Dupuit analytical solution. A radius of influence for the water taking was also estimated. The radius of influence was calculated using the Sichardt equation. The methods and means of dewatering will be determined by the contractor and its subcontractors.

The calculations and equations for the peak flow rate and radius of influence are provided in Appendix F. The base groundwater flow is estimated to be approximately 19,000 L/day. With a safety factor of three on groundwater flow, the estimated peak flow rate flow is approximately 57,000 L/day. The radius of influence is estimated to extend less than 15 m from the edge of the

excavation. Considering the estimated peak water taking rate is greater than 50,000 L/day, but less than 400,000 L/day, registration on the EASR will be required and will require the preparation of a Water Taking Report and Discharge Report in accordance with the regulations.

It should be noted that at this time no dewatering estimate has been completed for the utility installations or storm drainage infrastructure for Eastern Avenue or the Clark Boulevard Extension, and if additional dewatering is required for those structures, then the above dewatering estimate and permitting requirements may be required to be updated.

Based on our understanding of the geology and water table at the Site, it is anticipated that some dewatering will be required for the construction of any utility installations or storm drainage infrastructure for Eastern Avenue or the Clark Boulevard Extension. Groundwater flow rates through the predominantly native silty clay soils would be low due to the relatively low hydraulic conductivity of that soil. However, water may be perched locally within the sandy fill soils, though it would be of limited volume, and water taking estimates must include rainfall and surface water if they cannot be kept separate from groundwater. Thus, depending on the number and size of the excavations, the need for some form or water taking permit may be required.

The radius of influence from the edge of any excavations for utility installations, drainage infrastructure along Eastern Avenue, and the Clark Boulevard extension, is anticipated to be localized and less than 15 m.

Water that is removed from excavations for dewatering must be discharged or disposed of in accordance with current regulations, whether to the natural environment or to a sewer system. The Water Discharge Plan in the case of an EASR registration or the PTTW and associated Hydrogeological Study will specify conditions on the discharge of the groundwater to the environment.

6. IMPACT ASSESSMENT

Lowering of the shallow groundwater level could potentially reduce the groundwater discharge to nearby natural environmental features and groundwater users, and could potentially result in settlement or ground loss, although the likelihood of significant impacts is low due to the low hydraulic conductivity of the silty clay. Any potential impacts during construction dewatering are expected to be temporary in nature. These potential impacts, however, need to be monitored and managed to minimize impact. At this time, only the impacts in relation to dewatering of the box culvert crossing structure and channel realignment are presented below. During the detailed design, a dewatering assessment should be completed to evaluate the potential need for

construction dewatering for the utility installations or storm drainage infrastructure for Eastern Avenue or the Clark Boulevard Extension and any associated impacts should be assessed.

Potential impacts associated with the construction dewatering may include the following:

Impacts to Surface Water and the Natural Environment

Excavations for the box culvert crossing structure and channel realignment will be located within the Etobicoke Creek watershed and likely be carried out adjacent to the stream channel. Groundwater recharge conditions are likely to exist where flow is generally from channel bed into the subsurface.

The watercourse should be temporarily diverted around excavations during construction if required to keep the excavation dry. Watercourses could be diverted from upstream to the downstream channel using cofferdams and diversion pipes, or equivalent.

Dewatering in the vicinity of a watercourse has some potential to temporarily decrease the surface water flow in the watercourse if excavations are open for extended periods, since the watercourse is within the radius of influence. The effect of the dewatering operations on the surface water flow would be more pronounced at low periods of surface water flow (e.g., in the summer). Considering the dewatering will be temporary in duration and the peak estimated dewatering rate for the creek crossing structure was 57,000 L/day with a radius of influence of less than 10 m, any decrease of flow in the watercourse is anticipated to be negligible.

Groundwater of the quality that was encountered in Borehole EA-05 could not be discharged to the natural environment or a storm sewer without pre-treatment due to exceedances of the Bylaw limits (for storm sewer discharge). Water quality observed during construction will vary from the results obtained during this assessment based on a number of factors. Discharge of groundwater to the natural environment may require approval by the TRCA.

Considering that the proposed extension will occur through an area where manufacturing plants exist, additional groundwater quality sampling will be required at the detailed design phase if the dewatering effluent is to be discharged to the natural environment as per TRCA requirements. The groundwater discharge must meet PWQO if it will be discharged to the natural environment.

Impacts to Groundwater Users

Considering the surrounding study area consists of developed urban land primarily composed of commercial and industrial property use and considering the radius of influence for dewatering for the box culvert crossing structure and channel realignment is less than 10 m, it is not anticipated that domestic well users are within the radius of influence; however, an MECP well record search

has not been conducted so this cannot be confirmed at this time. The MECP well record search should be conducted within the radius of influence during detailed design to determine whether a private well survey is warranted.

Geotechnical Impacts

The lowering of groundwater levels can induce ground settlement due to an increase in the effective stress. At the proposed excavations, ground settlements associated with the dewatering activities are anticipated to be minor based on the anticipated groundwater drawdowns discussed in this report; however, an assessment of settlement potential should be completed during detailed design, prior to construction. Also, dewatering through the use of poorly designed wells and extraction systems may draw in silt and sand and cause ground loss.

The low hydraulic conductivity of the silty clay, and the anticipated shallow excavation depths for any utility installations or road widening/construction are not anticipated to result in any ground loss issues. However, an assessment of the settlement potential due to dewatering should be carried out for construction of the bridge or culvert structure for the creek crossing of the Clark Boulevard Extension once final design and locations have been determined.

7. CONCLUSIONS AND RECOMMENDATIONS

7.1 Water Taking Permitting

As discussed in Section 5, the estimated peak water taking rate is greater than 50,000 litres per day but less than 400,000 L/day, based on the preliminary dewatering estimate for the box culvert crossing structure and channel realignment; therefore, registration on the EASR is required and will require the preparation of a Water Taking Report and Discharge Report in accordance with the regulations. It should be noted that at this time no dewatering estimate has been completed for the utility installations or storm drainage infrastructure for Eastern Avenue, or the Clark Boulevard Extension, and if additional dewatering is required for those structures, then the dewatering estimate and permitting requirements may be required to be updated.

Depending on the outcome of further analysis and potentially additional investigation following detailed design, registration on the EASR and preparation of a Water Taking Plan and Water Discharge Plan in the case of peak water taking rates between 50,000 and 400,000 litres per day or application for a Category 3 PTTW and required Hydrogeological Study for water taking rates exceeding 400,000 litres per day, may be required.

The permit application fee from MECP for a Category 3 PTTW is currently $3,000 and the application will be subject to an administrative review as well as a technical review. MECP may request additional information or testing. The review process typically takes three to five months following submission. The registration fee from MECP for registration of water taking for construction dewatering is currently $1,190 and no review period is required.

It would be possible to conduct limited construction dewatering without a permit provided the total daily water taking rate is restricted to 50,000 litres per day or less; however, many elements will not be feasible to construct with that limitation, and the rate of construction of feasible elements may be restricted until a water taking permit is obtained.

Additional terms and conditions may apply as determined by the water taking permit process, including performance, monitoring and reporting requirements among others.

7.2 Groundwater Discharge

Water quality observed during construction will vary from the results obtained herein based on a number of factors. An experienced dewatering contractor and water treatment contractor are recommended to be retained to design and operate dewatering and treatment operations as required. Pre-treatment of dewatering discharge would be the responsibility of the contractor to ensure that the quality of the dewatering discharge effluent meets the PWQOs or Peel Region Sewer Use By-Law No. 53-2010 as applicable and determine if more extensive or specific treatment measures are required. Should the dewatering discharge be contaminated such that the groundwater cannot be treated to the appropriate water quality criteria, the contractor would be responsible for managing the water, including potentially storage and further treatment or transporting the contaminated groundwater off-site for disposal at an appropriate licensed facility.

A discharge permit would be required from the Region of Peel to discharge to a Region of Peel sewer. Discharge to the natural environment may require consultation with MECP, and potentially TRCA and MNRF depending on the discharge location.

7.3 Low Impact Development

Silty clay was encountered below the fill soils in most boreholes along Eastern Avenue and along the proposed Clark Boulevard Extension at depths ranging between 0.6 m and 2.2 m and extended to depths of approximately 1.2 m to 3.0 m.

Infiltration rates measured at ground surface were not conducted as part of this investigation but may be required in design depending on the location of infiltration structures. Based on the hydraulic conductivity for the silty clay presented herein, the estimated infiltration rates for the silty

clay are likely to be less than the 15 mm/hour threshold specified in the Stormwater Management Planning and Design Manual, which indicate the Site may not be suitable for implementation of infiltration. Infiltration into the sandy fill that was identified may be feasible if sufficient thickness and separation from the groundwater table can be identified. An appropriate safety factor as specified in the Low Impact Development Stormwater Management Planning and Design Guide should be applied to the estimated infiltration rate when designing infiltration LIDs to account for the natural variation in infiltration rates.

Based on review of the existing site conditions, the designer may elect to modify the proposed bottom elevation of the LID measures. Additional field infiltration tests may be required to confirm the soil infiltration rates at the surface depending on the location of infiltration structures.

Groundwater depths at the Site were typically between 1.5 and 3.0 m, which may limit the effectiveness of infiltration measures.

7.4 Control of Impacts and Monitoring

The following measures are recommended to mitigate the potential for the dewatering activities to cause negative impacts as assessed previously:

- Monitoring of water levels in the monitoring wells prior to, during, and following construction.
- Monitoring of water quality for groundwater collected within the excavation dewatering systems to confirm the water quality is appropriate for the selected discharge option. Monitoring should include visual observations for contamination such as sheen or pure product, as well as for excessive sediment in the discharge, which could be an indication of ground loss.
- Where possible, it is recommended that groundwater should be discharged at least 30 m away from any water bodies including streams.
- If discharge to sewers or surface water bodies is proposed, treatment of groundwater to meet acceptable levels is required. Suitable treatment would likely include measures to address suspended sediment and associated metals and is anticipated to require additional treatment based on findings to date. The operation and monitoring of discharge facilities should be carried out by an experienced dewatering contractor and water treatment contractor familiar with fisheries and water quality requirements.
- Where discharge is to ground surface or water course, temporary erosion control measures should be developed and installed to control erosion at the discharge points. Additional water quality requirements may be imposed by MECP, TRCA and MNRF.

- Long-term impacts will need to be addressed through the implementation of best management practices to help increase the amount of infiltration to the aquifer system and minimize the environmental impacts of the development.

- Installation of clay plugs or similar are recommended for any open cut trenches to limit the preferential movement of groundwater along the trench.

7.5 Future Work

Additional hydrogeological investigation and analysis will be required to support detailed design. The following recommendation are provided based on the findings of the hydrogeological investigations:

- Additional groundwater level monitoring should be conducted to capture further seasonal variation, and additional groundwater sampling may be warranted depending on potential discharge location. Infiltration testing may also be advisable depending on infiltration concepts that may be developed.
- If groundwater is planned to be discharged to surface water, additional groundwater samples should be collected and analyzed in comparison to PWQOs to assess treatment and groundwater disposal options.
- During the detailed design stage, it will be necessary to refine the analysis of the hydrogeological conditions along the Site to estimate the radius of influence and dewatering rates for the utility installations or storm drainage infrastructure for Eastern Avenue or the Clark Boulevard Extension. Based on the detailed design, additional drilling of boreholes and installation of shallow and deep monitoring wells will be required. Consideration should be given to installing monitoring wells approximately 1 m below the proposed depths of excavation. These findings will be used to confirm the water takings requirements and the appropriate approvals from the MECP prior to commencement of construction. They will also assist in determining whether a private well survey is warranted.
- Monitoring wells should be decommissioned in accordance with O. Reg. 903 if they are no longer in use to prevent the creation of vertical conduits for contaminant transport.

8. CLOSURE

We trust that this report provides the information you require at this time. If you have any questions regarding this report, please contact the undersigned at your earliest convenience.

Yours truly,

Thurber Engineering Ltd.

Paul Coulson, P.Geo.
Hydrogeologist

Alireza Hejazi, Ph.D., P.Eng.
Senior Hydrogeologist

Renato Pasqualoni, P.Eng.
Review Engineer/Principal

THURBER

STATEMENT OF LIMITATIONS AND CONDITIONS

1. STANDARD OF CARE

This Report has been prepared in accordance with generally accepted engineering or environmental consulting practices in the applicable jurisdiction. No other warranty, expressed or implied, is intended or made.

2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report, which is of a summary nature and is not intended to stand alone without reference to the instructions given to Thurber by the Client, communications between Thurber and the Client, and any other reports, proposals or documents prepared by Thurber for the Client relative to the specific site described herein, all of which together constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. THURBER IS NOT RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purposes that were described to Thurber by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the Report, subject to the limitations provided herein, are only valid to the extent that the Report expressly addresses proposed development, design objectives and purposes, and then only to the extent that there has been no material alteration to or variation from any of the said descriptions provided to Thurber, unless Thurber is specifically requested by the Client to review and revise the Report in light of such alteration or variation.

4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT THURBER'S WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS THURBER MAY EXPRESSLY APPROVE. Ownership in and copyright for the contents of the Report belong to Thurber. Any use which a third party makes of the Report, is the sole responsibility of such third party. Thurber accepts no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without Thurber's express written permission.

5. INTERPRETATION OF THE REPORT

a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and the Report is delivered subject to the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.

b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to Thurber. Thurber has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Thurber does not accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by Thurber. Thurber is entitled to rely on such representations, information and instructions and is not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.

c) Design Services: The Report may form part of design and construction documents for information purposes even though it may have been issued prior to final design being completed. Thurber should be retained to review final design, project plans and related documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the Report's recommendations and the final design detailed in the contract documents should be reported to Thurber immediately so that Thurber can address potential conflicts.

d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

7. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.

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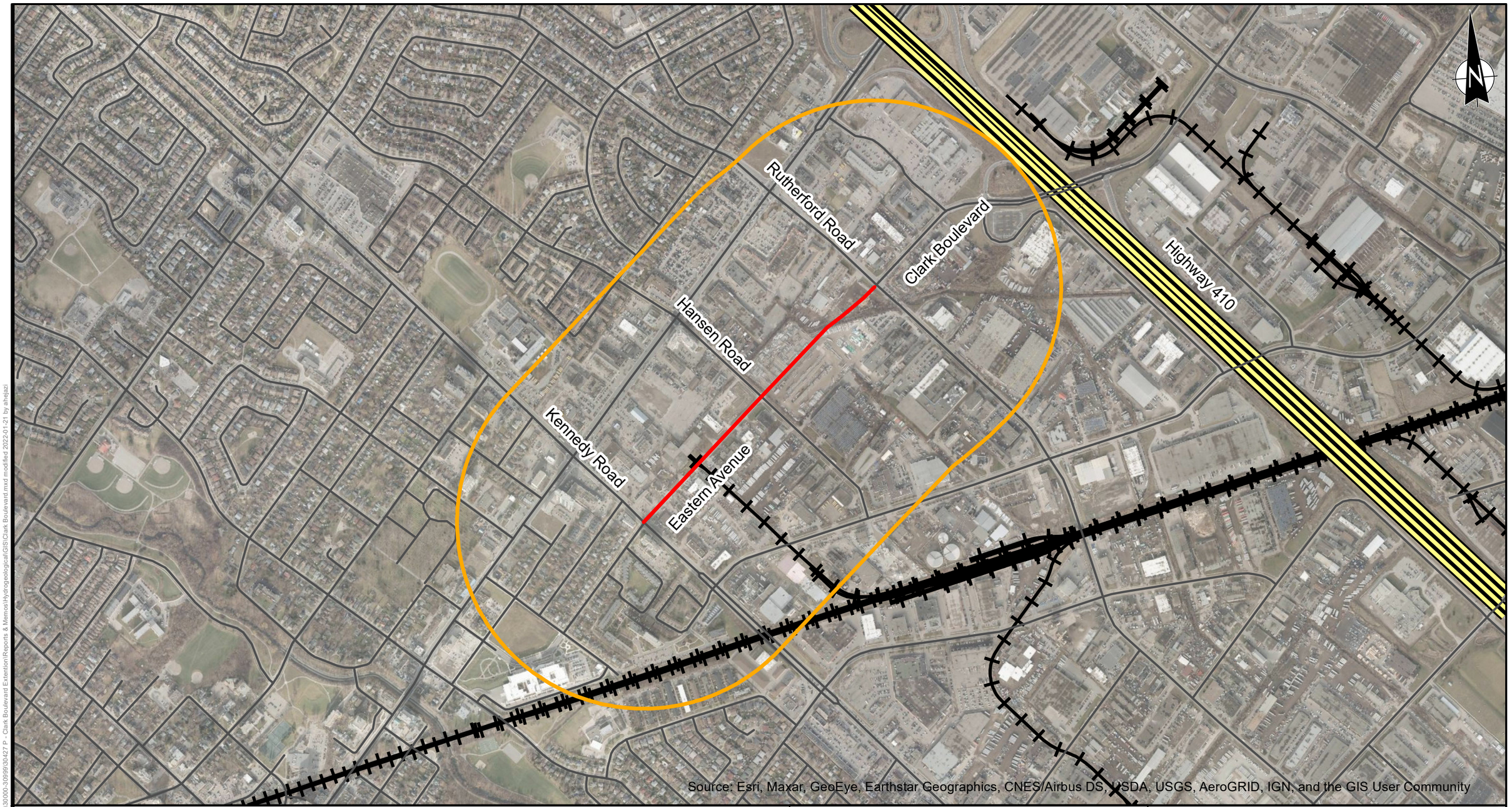
Figures



LEGEND:

- Site
- Study Area (500 m buffer)
- Road
- Freeway
- Railway

200 100 0 200 m

UTM 17 NAD 83

HYDROGEOLOGICAL ASSESSMENT REPORT

CLARK BOULEVARD EXTENSION
BRAMPTON, ON

SITE LOCATION PLAN

PROJECT No. **30427**

THURBER ENGINEERING LTD.

DESIGNED:	DRAWN:	APPROVED:
PC	PC	AH
DATE:	SCALE:	FIGURE NO.
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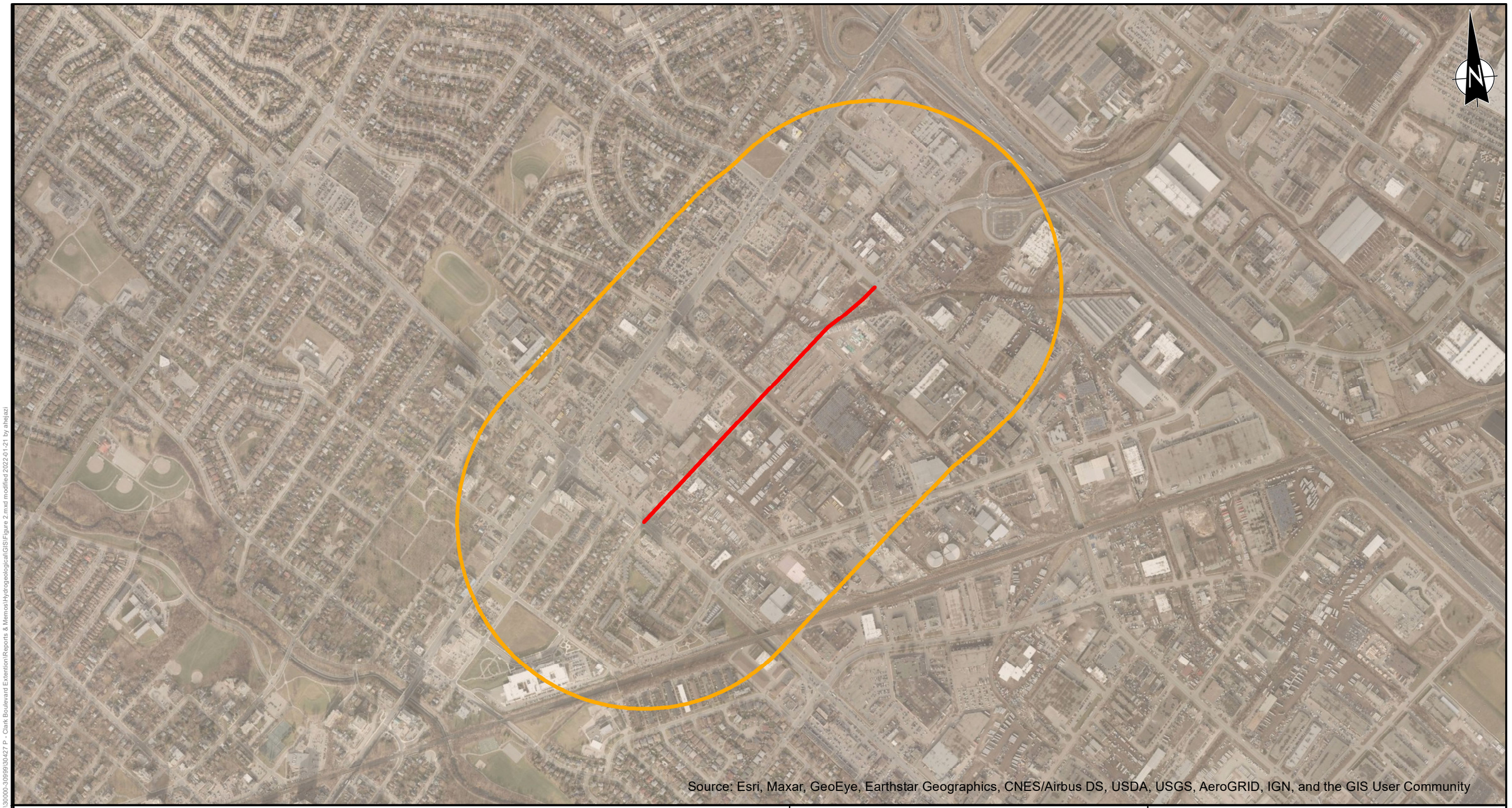

LEGEND:

- Site
- Study Area (500 m buffer)

Physiographic Region

- Peel Plain

200 100 0 200 m

UTM 17 NAD 83

Data Source: Ontario Ministry of Natural Resources and Forestry - Ontario Geological Survey

HYDROGEOLOGICAL ASSESSMENT REPORT

CLARK BOULEVARD EXTENSION
BRAMPTON, ON

PHYSIOGRAPHIC REGION

PROJECT No. **30427**

THURBER ENGINEERING LTD.

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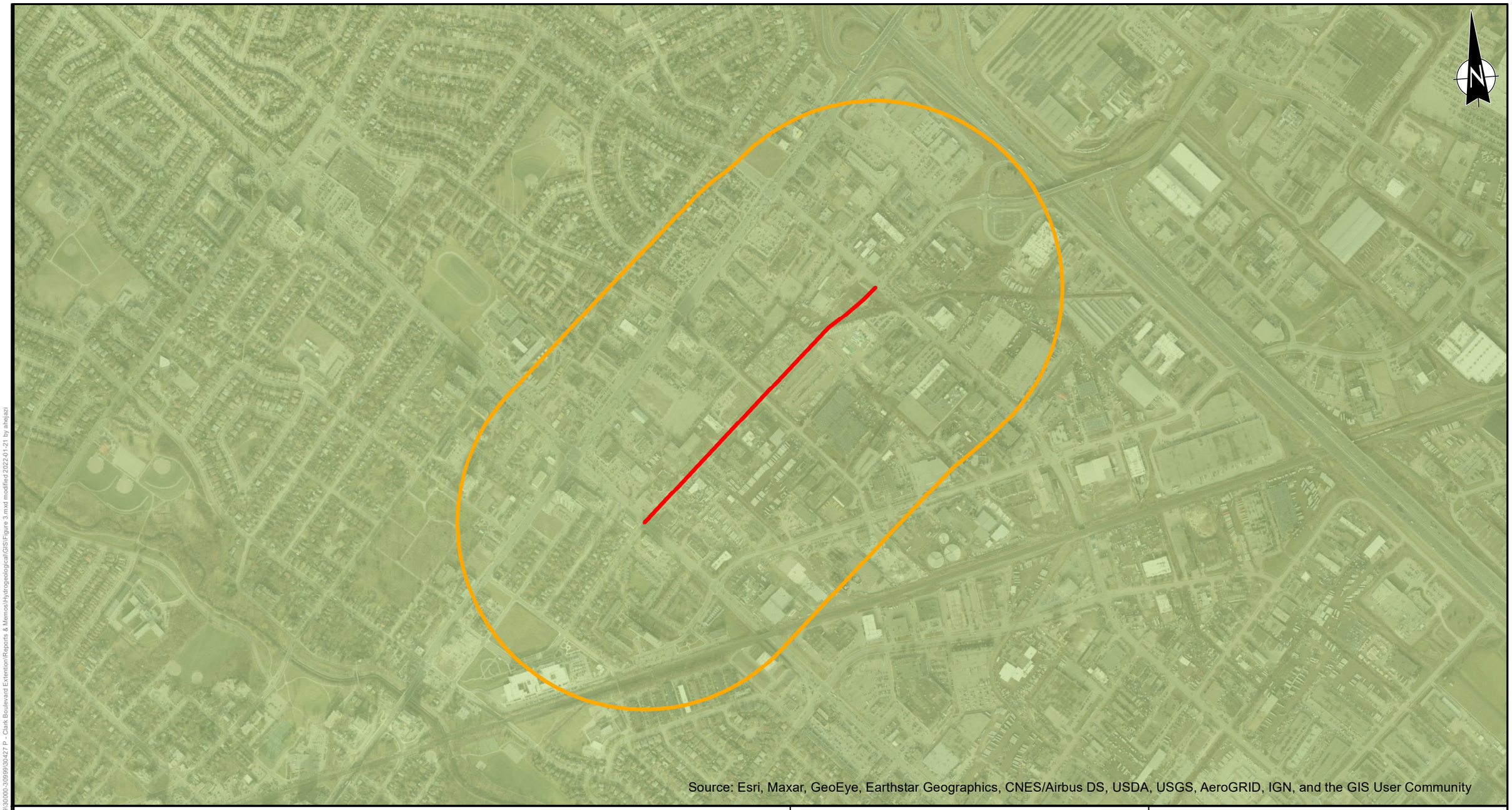

LEGEND:

- Site
- Study Area (500 m buffer)

Physiographic Landform

- Bevelled Till Plains

200 100 0 200 m

UTM 17 NAD 83

Data Source: Ontario Ministry of Natural Resources and Forestry - Ontario Geological Survey

HYDROGEOLOGICAL ASSESSMENT REPORT

CLARK BOULEVARD EXTENSION
BRAMPTON, ON

PHYSIOGRAPHIC LANDFORMS

PROJECT No. **30427**

THURBER ENGINEERING LTD.

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LEGEND:

- Site
- Study Area (500 m buffer)

Surficial Geology

- 3: Paleozoic bedrock
- 5d: Glaciolacustrine-derived silty to clayey till
- 8b: Interbedded flow till, rainout deposits and silt and clay
- 19: Modern alluvial deposits

Data Source: Ontario Ministry of Natural Resources and Forestry - Ontario Geological Survey

200 100 0 200 m

UTM 17 NAD 83

HYDROGEOLOGICAL ASSESSMENT REPORT

CLARK BOULEVARD EXTENSION
BRAMPTON, ON

SURFICIAL GEOLOGY

PROJECT No. **30427**

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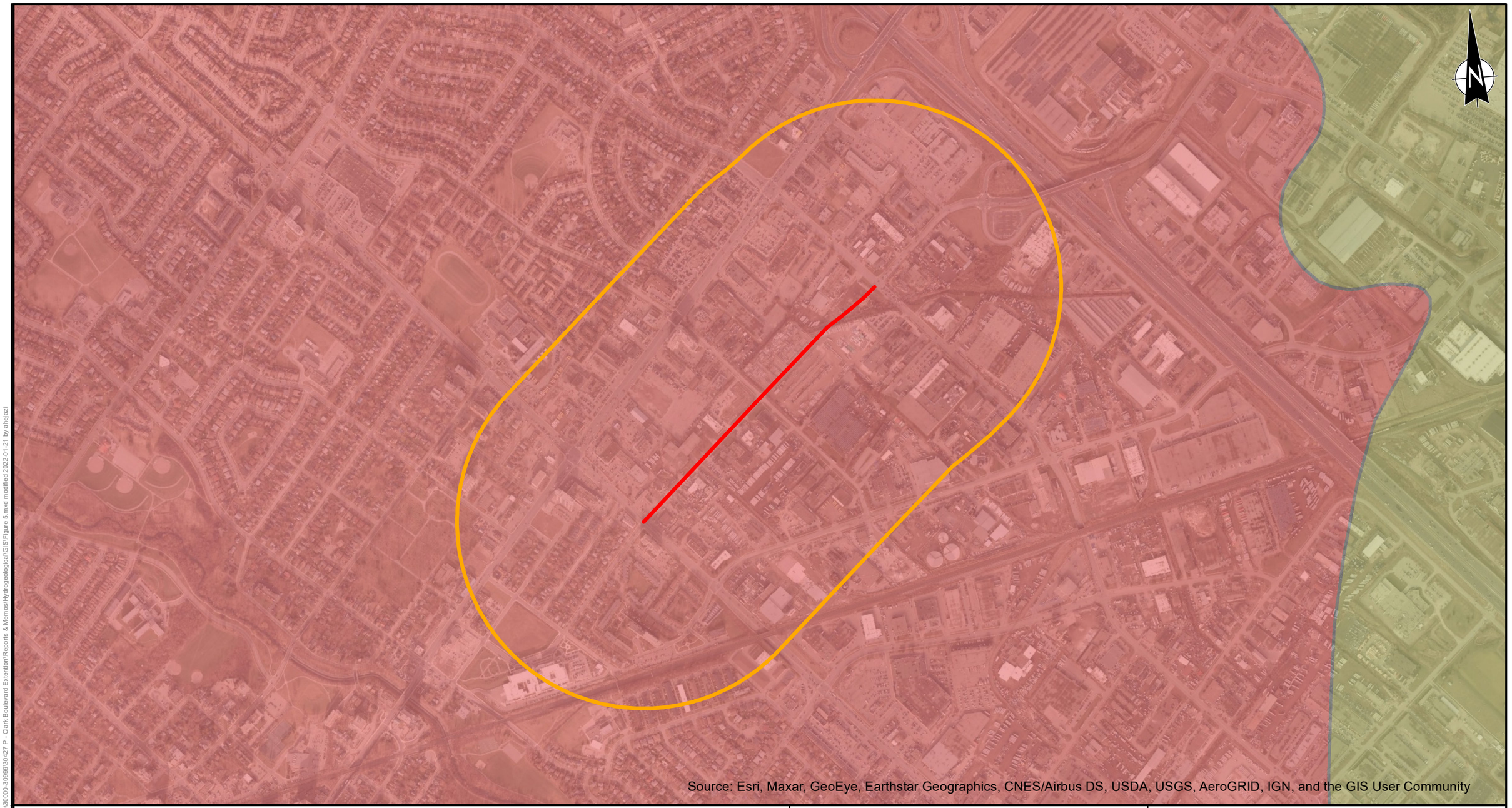

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LEGEND:

- Site
- Study Area (500 m buffer)

Bedrock Formation

- Georgian Bay
- Queenston

200 100 0 200 m

UTM 17 NAD 83

Data Source: Ontario Ministry of Natural Resources and Forestry - Ontario Geological Survey

HYDROGEOLOGICAL ASSESSMENT REPORT

CLARK BOULEVARD EXTENSION
BRAMPTON, ON

BEDROCK GEOLOGY

PROJECT No. **30427**

THURBER ENGINEERING LTD.

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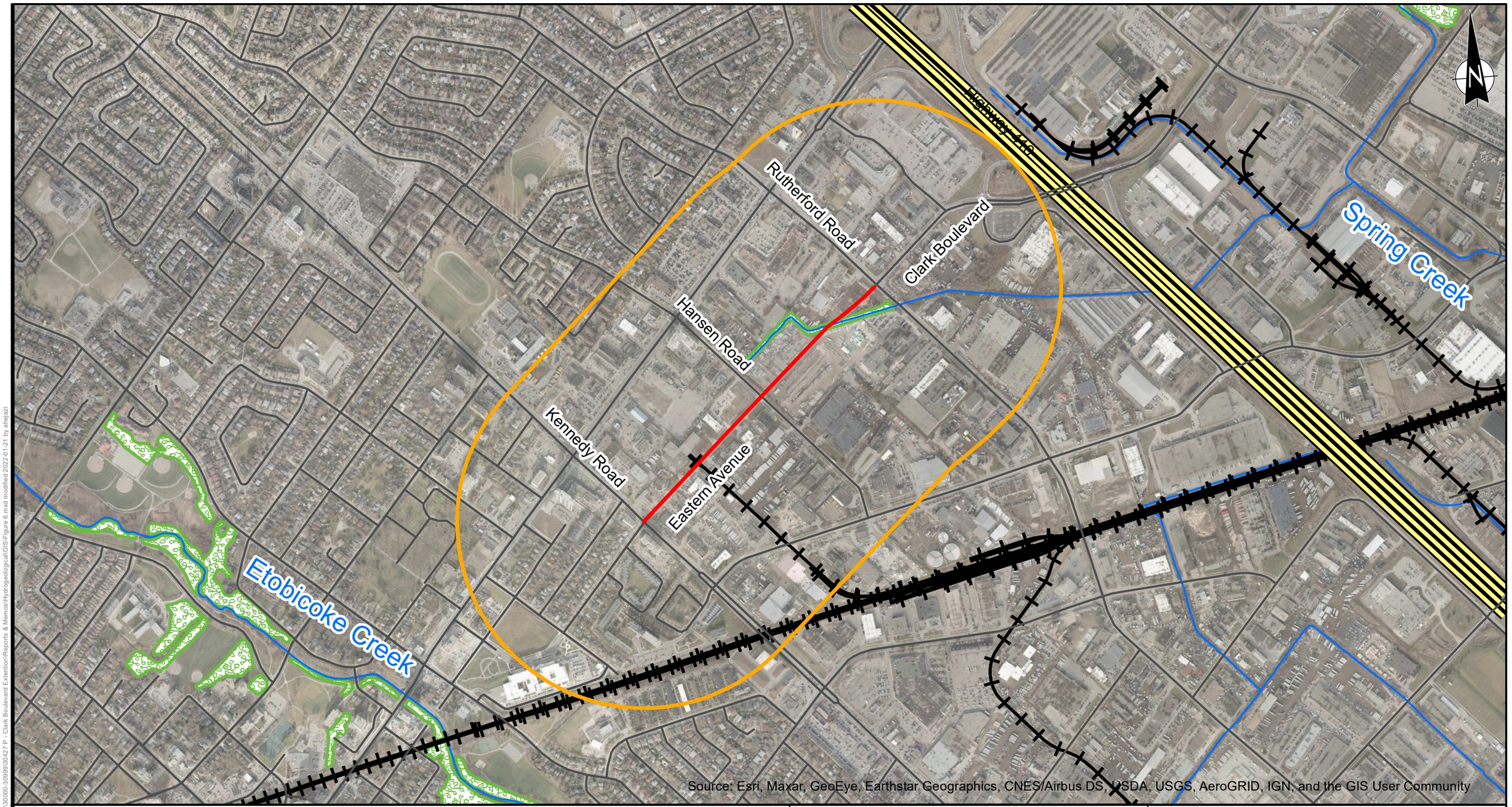

LEGEND:

- Site
- Study Area (500 m buffer)
- Road
- Freeway
- Railway
- Watercourse
- Wooded Areas

200 100 0 200 m

UTM 17 NAD 83

Data Source: Ontario Ministry of Natural Resources and Forestry - Make a Map: Natural Heritage Areas

HYDROGEOLOGICAL ASSESSMENT REPORT

CLARK BOULEVARD EXTENSION
BRAMPTON, ON

NEARBY NATURAL FEATURES

PROJECT No. **30427**

THURBER ENGINEERING LTD.

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Appendix A

Record of Borehole Sheets

RECORD OF BOREHOLE BR-01

PROJECT : Clark Boulevard Extension
LOCATION : Brampton, ON
STARTED : August 19, 2021
COMPLETED : August 19, 2021
N 4 839 136.9 E 601 441.3

Project No. 30427
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS / DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✚ Q - ✖ rem V - ● Cpen ▲ 40 80 120 160) / WATER CONTENT, PERCENT (wp w wl 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		215.71							
	Hollow Stem Augers	**GRAVEL**, sandy, some silt, compact, brown, moist: (FILL)		0.00	1	SS	29				
				215.02							
1		**CLAY**, silty, some sand, trace gravel, firm, brown, moist: (FILL)		0.69	2	SS	6	Grain Size Analysis: Gr 0%/ Sa 20%/ Si 49%/ Cl 31%			
2					3	SS	8				
				213.50							
		SILT, some sand, trace clay, trace gravel, compact, brown, moist		2.21	4	SS	20				
3					5	SS	28	Grain Size Analysis: Gr 1%/ Sa 19%/ Si 72%/ Cl 8%			
4				211.59							
		SILT, some sand to sandy, trace clay, trace gravel, very dense, brown, moist: (TILL)		4.11	6	SS	85/ 0.250				
5											
6					7	SS	70/ 0.275				
7											
					8	SS	50/ 0.125				
8				207.49							
		SAND and **GRAVEL**, some cobbles, very dense, grey, moist		8.22							
				206.89	9	SS	100/ 0.100				
9		END OF BOREHOLE AT 8.81m UPON AUGER REFUSAL ON ASSUMED BEDROCK. BOREHOLE DRY UPON COMPLETION OF DRILLING. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND GROUT TO SURFACE.		8.81							

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : OA
CHECKED : CZ

THURBER

THURBER2S TEL-30427.GPJ 11/8/21

RECORD OF BOREHOLE BR-02

PROJECT : Clark Boulevard Extension
LOCATION : Brampton, ON
STARTED : August 19, 2021
COMPLETED : August 19, 2021

Project No. 30427
SHEET 1 OF 1
DATUM Geodetic

N 4 839 147.3 E 601 491.1

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
		GROUND SURFACE		215.36				
	Hollow Stem Augers	**SAND**, silty, some gravel, trace clay, dense, brown, moist: (FILL)		0.00	1	SS	35	Grain Size Analysis: Gr 15%/Sa 56%/Si 23%/ Cl 6%
				214.67				
1		**CLAY**, silty, trace to some sand, trace to some gravel, firm to stiff, dark grey to brown, moist: (FILL)		0.69	2	SS	8	
2					3	SS	10	
		SAND, gravelly, some cobbles, compact, brown, moist		213.07 2.29	4	SS	21	
3		**SAND** and **SILT**, trace clay, some gravel, some cobbles and boulders, very dense, brown, moist: (TILL)		212.39 2.97	5	SS	56	Grain Size Analysis: Gr 13%/Sa 46%/Si 37%/ Cl 4%
4								
					6	SS	50/0.150	
5								
6					7	SS	50/0.150	
7								
					8	SS	50/0.100	
8		**CLAY**, silty, some gravel, highly weathered shale, hard, grey, moist: (TILL)		207.38 7.97				
		END OF BOREHOLE AT 8.38m UPON AUGER REFUSAL ON BEDROCK. WATER LEVEL AT 7.62m UPON COMPLETION OF DRILLING. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND GROUT TO SURFACE.		206.98 8.38	9	SS	50/0.150	
9								

SHEAR STRENGTH: Cu, KPa
nat V - ✚ Q - ✖
rem V - ● Cpen ▲
40 80 120 160

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

▽ 7.62m

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION
August 19, 2021

▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : OA
CHECKED : CZ

THURBER

THURBER2S TEL-30427.GPJ 11/8/21

RECORD OF BOREHOLE BR-03

PROJECT : Clark Boulevard Extension
LOCATION : Brampton, ON
STARTED : August 16, 2021
COMPLETED : August 16, 2021

Project No. 30427
SHEET 1 OF 1
DATUM Geodetic

N 4 839 171.2 E 601 470.4

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
		GROUND SURFACE		215.18				
		TOPSOIL: (75mm)		0.08				
		SAND and **GRAVEL**, compact to dense, brown, moist: (FILL)			1	SS	19	
					2	SS	32	
				213.71				
	Hollow Stem Augers	**SAND**, silty, some gravel, trace clay, compact to very dense, brown, moist		1.47	3	SS	15	Grain Size Analysis: Gr 16%/Sa 50%/Si 33%/ Cl 1%
					4	SS	54	
					5	SS	50/ 0.100	
				211.32				
		SAND and **GRAVEL**, some silt, very dense, grey, moist		3.86	6	SS	93/ 0.225	
				209.73				
	Tricone	**SILT**, sandy, some clay, trace gravel, very dense, grey, wet: (TILL)		5.45	7	SS	80/ 0.250	
		Highly weathered shale fragments			8	SS	90/ 0.300	Grain Size Analysis: Gr 6%/ Sa 33%/Si 50%/ Cl 11%
				206.95				
		SHALE, hard, grey, moist: (Georgian Bay Formation)		8.23				
				206.51	9	SS	50/ 0.125	
		END OF BOREHOLE AT 8.66m. UPON AUGER REFUSAL ON ASSUMED BEDROCK WATER LEVEL UNKNOWN UPON COMPLETION OF DRILLING. Well installation consists of 50mm diameter Schedule 40 PVC pipe with a 3.05m slotted screen.		8.66				

SHEAR STRENGTH: Cu, KPa
nat V - ✚ Q - ✖
rem V - ● Cpen ▲
40 80 120 160

WATER CONTENT, PERCENT
wp w wl
10 20 30 40

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

Bentonite
Filter Sand
Slotted Screen

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : OA
CHECKED : CZ

THURBER

THURBER2S TEL-30427.GPJ 11/8/21

RECORD OF BOREHOLE BR-04

PROJECT : Clark Boulevard Extension
LOCATION : Brampton, ON
STARTED : August 16, 2021
COMPLETED : August 18, 2021

Project No. 30427
SHEET 1 OF 2
DATUM Geodetic

N 4 839 183.1 E 601 523.0

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS / DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✤, rem V - ●, Q - ✖, Cpen ▲) 40 80 120 160 / WATER CONTENT, PERCENT wp w wl 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		215.67							
		SAND, silty, some gravel, some brick fragments, compact, brown, moist: (FILL)		0.00	1	SS	30				
				214.91							
1	Hollow Stem Augers	**SILT**, clayey, with sand, some organics, firm to stiff, brown, wet		0.76	2	SS	9	Grain Size Analysis: Gr 4%/ Sa 28%/ Si 48%/ Cl 20%			
					3	SS	6				
2				213.46							
		SAND, silty, some gravel, trace clay, dense, brown, moist		2.21	4	SS	48				
3											
					5	SS	42	Grain Size Analysis: Gr 19%/Sa 44%/ Si 33%/ Cl 4%			Bentonite
4				211.55							
		SILT, sandy, some clay, some gravel, some shale fragments, dense to very dense, grey, moist: (TILL)		4.11							
					6	SS	30				
5											
6	Tricone				7	SS	80/ 0.300	Grain Size Analysis: Gr 14%/Sa 20%/ Si 53%/ Cl 13%			
											Filter Sand
7											
					8	SS	100/ 0.175				
8											
		SHALE, hard, grey, moist: (Georgian Bay Formation)		207.51 8.15							Slotted Screen
9											
					9	SS	94/ 0.225				
		END OF BOREHOLE AT 9.37m. ON AUGER REFUSAL IN BEDROCK WATER LEVEL UNKNOWN UPON COMPLETION OF DRILLING.		206.29 9.37							

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : OA
CHECKED : CZ

THURBER

THURBER2S TEL-30427.GPJ 11/8/21

RECORD OF BOREHOLE BR-04

PROJECT : Clark Boulevard Extension
LOCATION : Brampton, ON
STARTED : August 16, 2021
COMPLETED : August 18, 2021
N 4 839 183.1 E 601 523.0

Project No. 30427
SHEET 2 OF 2
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✤, rem V - ●, Q - ✖, Cpen ▲; 40 80 120 160) / WATER CONTENT, PERCENT (wp, w, wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		Well installation consists of 50mm diameter Schedule 40 PVC pipe with a 3.05m slotted screen.									
11											
12											
13											
14											
15											
16											
17											
18											
19											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : OA
CHECKED : CZ

THURBER

THURBER2S TEL-30427.GPJ 11/8/21

RECORD OF BOREHOLE CE-01

PROJECT : Clark Boulevard Extension
LOCATION : Brampton, ON
STARTED : August 20, 2021
COMPLETED : August 20, 2021

Project No. 30427
SHEET 1 OF 1
DATUM Geodetic

N 4 838 981.8 E 601 303.5

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
		GROUND SURFACE		217.77				
	Hollow Stem Augers	**GRAVEL,** sandy, very dense, grey, moist: (FILL)		0.00	1	SS	87/ 0.275	
		CLAY, silty, some sand, trace gravel, stiff, grey, moist: (FILL)		217.08 0.69	2	SS	11	Grain Size Analysis: Gr 0%/ Sa 16%/ Si 50%/ Cl 34%
1		**CLAY**, silty, trace sand, trace gravel, very stiff to hard, brown, moist		216.24 1.52	3	SS	17	
2					4	SS	43	
3		**SILT**, sandy, some gravel, trace clay, some boulders, dense, grey, moist: (TILL)		214.80 2.97	5	SS	50	
		END OF BOREHOLE AT 3.66m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.		214.11 3.66				
4								
5								
6								
7								
8								
9								

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH: Cu, KPa
nat V - ✚ Q - ✖
rem V - ● Cpen ▲
40 80 120 160

WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : OA
CHECKED : CZ

THURBER

THURBER2S TEL-30427.GPJ 11/8/21

RECORD OF BOREHOLE CE-02

PROJECT : Clark Boulevard Extension
LOCATION : Brampton, ON
STARTED : August 20, 2021
COMPLETED : August 20, 2021

Project No. 30427
SHEET 1 OF 1
DATUM Geodetic

N 4 839 025.4 E 601 327.9

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
		GROUND SURFACE		217.06				
	Hollow Stem Augers	**GRAVEL**, sandy, compact, brown, moist: (FILL)		0.00	1	SS	22	
				216.37				
1		**SILT**, clayey, with sand, trace gravel, hard, brown, moist		0.69	2	SS	23	Grain Size Analysis: Gr 5%/ Sa 31%/ Si 42%/ Cl 22%
2					3	SS	21	
					4	SS	13	
3					5	SS	35	
				213.40				
4		END OF BOREHOLE AT 3.66m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.		3.66				
5								
6								
7								
8								
9								

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH: Cu, KPa
nat V - ✤ Q - ✖
rem V - ● Cpen ▲
40 80 120 160

WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : OA
CHECKED : CZ

THURBER

THURBER2S TEL-30427.GPJ 11/8/21

RECORD OF BOREHOLE CE-03

PROJECT : Clark Boulevard Extension
LOCATION : Brampton, ON
STARTED : August 20, 2021
COMPLETED : August 20, 2021

Project No. 30427
SHEET 1 OF 1
DATUM Geodetic

N 4 839 092.3 E 601 410.5

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	COMMENTS
		GROUND SURFACE		216.03				
	Hollow Stem Augers	**GRAVEL**, sandy, very dense, brown, moist: (FILL)		0.00	1	SS	60	
				215.34				
1		**SILT**, clayey, trace to some sand, trace to some gravel, stiff, brown, moist		0.69	2	SS	9	
2					3	SS	8	
				213.83				
		SILT, sandy, some gravel, trace clay, dense to very dense, brown, moist: (TILL)		2.20	4	SS	34	Grain Size Analysis: Gr 19%/Sa 39%/ Si 34%/ Cl 8%
		300mm dia. boulders at 2.74m						
3		Very dense		212.83	5	SS	50/ 0.150	
		END OF BOREHOLE AT 3.20m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS TO SURFACE.		3.20				
4								
5								
6								
7								
8								
9								

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH: Cu, KPa
nat V - ✚ Q - ✖
rem V - ● Cpen ▲
40 80 120 160

WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : OA
CHECKED : CZ

THURBER

THURBER2S TEL-30427.GPJ 11/8/21

RECORD OF BOREHOLE CE-04

PROJECT : Clark Boulevard Extension
LOCATION : Brampton, ON
STARTED : August 16, 2021
COMPLETED : August 16, 2021

Project No. 30427
SHEET 1 OF 1
DATUM Geodetic

N 4 839 225.4 E 601 557.7

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
		GROUND SURFACE		215.94				
		TOPSOIL: (100mm)		0.10				
		SAND, silty, some gravel, some topsoil, compact to loose, brown, moist: (FILL)			1	SS	20	
1	Hollow Stem Augers	**SILT**, clayey, some sand, trace gravel, firm, grey, wet		214.95 0.99	2	SS	5	
2					3	SS	5	Grain Size Analysis: Gr 0%/ Sa 17%/ Si 53%/ Cl 30%
					4	SS	6	
3		**SAND**, gravelly, very loose, brown, wet		212.97 2.97	5	SS	3	
		END OF BOREHOLE AT 3.66m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS TO SURFACE.		212.28 3.66				
4								
5								
6								
7								
8								
9								

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH: Cu, KPa
nat V - ✚ Q - ✖
rem V - ● Cpen ▲
40 80 120 160

WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : OA
CHECKED : CZ

THURBER

THURBER2S TEL-30427.GPJ 11/8/21

RECORD OF BOREHOLE EA-02

PROJECT : Clark Boulevard Extension
LOCATION : Brampton, ON
STARTED : September 15, 2021
COMPLETED : September 15, 2021
N 4 838 664.0 E 600 971.2

Project No. 30427
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	COMMENTS
		GROUND SURFACE		223.14				
		ASPHALT: (160mm)		0.00				
		SAND, gravelly, some silt, brown, moist: (GRANULAR BASE)		0.16	1	GS		
	Hollow Stem Augers	**SILT**, clayey, some sand, trace gravel, very stiff, brown, moist		222.45 0.69	2	SS	15	Grain Size Analysis: Gr 1%/ Sa 20%/ Si 51%/ Cl 28%
					3	SS	21	
		END OF BOREHOLE AT 2.13m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS, THEN ASPHALT TO SURFACE.		221.00 2.13				

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH: Cu, KPa
nat V - ✚ Q - ✖
rem V - ● Cpen ▲
40 80 120 160

WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : AF
CHECKED : CZ

THURBER

THURBER2S TEL-30427.GPJ 11/8/21

RECORD OF BOREHOLE EA-03

PROJECT : Clark Boulevard Extension
LOCATION : Brampton, ON
STARTED : September 15, 2021
COMPLETED : September 15, 2021

Project No. 30427
SHEET 1 OF 1
DATUM Geodetic

N 4 838 683.6 E 601 002.3

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
		GROUND SURFACE		222.89				
	Hollow Stem Augers	**SAND**, gravelly, some silt, brown, moist: (FILL)		0.00	1	GS		
				222.20				
1		**SILT**, clayey, trace sand, trace gravel, very stiff, brown, moist: (FILL)		0.69	2	SS	18	
				221.44				
		SILT, clayey, some sand, trace gravel, very stiff to hard, brown, moist		1.45	3	SS	19	Grain Size Analysis: Gr 6%/ Sa 21%/ Si 47%/ Cl 26%
2					4	SS	53	
				219.99				
3		END OF BOREHOLE AT 2.90m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS TO SURFACE.		2.90				
4								
5								
6								
7								
8								
9								

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH: Cu, KPa
nat V - ✚ Q - ✖
rem V - ● Cpen ▲
40 80 120 160

WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : AF
CHECKED : CZ

THURBER

THURBER2S TEL-30427.GPJ 11/8/21

RECORD OF BOREHOLE EA-04

PROJECT : Clark Boulevard Extension
LOCATION : Brampton, ON
STARTED : September 15, 2021
COMPLETED : September 15, 2021

Project No. 30427
SHEET 1 OF 1
DATUM Geodetic

N 4 838 703.8 E 601 005.6

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
		GROUND SURFACE		222.82				
	Hollow Stem Augers	**SAND**, some silt and gravel, brown, moist: (FILL)		0.00	1	GS		
				222.13				
1		**SILT**, clayey, some sand, trace gravel, firm, brown, moist: (FILL)		0.69	2	SS	7	Grain Size Analysis: Gr 0%/ Sa 19%/ Si 53%/ Cl 28%
				221.37				
2		**SILT**, clayey, some sand, trace gravel, firm to very stiff, brown, moist		1.45	3	SS	8	
					4	SS	16	
				219.92				
3		END OF BOREHOLE AT 2.90m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS TO SURFACE.		2.90				
4								
5								
6								
7								
8								
9								

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH: Cu, KPa
nat V - ✚ Q - ✖
rem V - ● Cpen ▲
40 80 120 160

WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : AF
CHECKED : CZ

THURBER

THURBER2S TEL-30427.GPJ 11/8/21

RECORD OF BOREHOLE EA-05

PROJECT : Clark Boulevard Extension
LOCATION : Brampton, ON
STARTED : September 23, 2021
COMPLETED : September 23, 2021
N 4 838 728.6 E 601 043.1

Project No. 30427
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✤ rem V - ● Q - ✖ Cpen ▲) 40 80 120 160 / WATER CONTENT, PERCENT (wp w wl) 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		222.42							
		ASPHALT: (225mm)		0.00							
		SAND, gravelly, trace silt, brown to grey, moist: (GRANULAR BASE)		0.23	1	GS		Grain Size Analysis: Gr 35%/Sa 62%/ Si & Cl 3%			
				221.71	2	SS	27				
		SILT, clayey, some sand, trace gravel, hard to very stiff, brown, wet:		0.71	3	SS	41				
1											
					4	SS	26				
2											Bentonite
					5	SS	34				
3	Hollow Stem Augers										
					6	SS	15				
4											Filter Sand
		Firm			7	SS	7	Grain Size Analysis: Gr 2%/ Sa 22%/ Si 47%/ Cl 29%			
5											Slotted Screen
		Very stiff			8	SS	24				
6											
					9	SS	29				
				215.71							
7		END OF BOREHOLE AT 6.71m. BOREHOLE OPEN AND DRY UPON COMPLETION. Well installation consists of 50mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		6.71							
8											
9											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : RB
CHECKED : CZ

THURBER

THURBER2S TEL-30427.GPJ 11/8/21

RECORD OF BOREHOLE EA-06

PROJECT : Clark Boulevard Extension
LOCATION : Brampton, ON
STARTED : September 15, 2021
COMPLETED : September 15, 2021
N 4 838 750.9 E 601 054.9

Project No. 30427
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✤, rem V - ●, Q - ✖, Cpen ▲) 40 80 120 160 / WATER CONTENT, PERCENT (wp, w, wl) 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		222.09							
		ASPHALT: (160mm)		0.00							
		SAND, gravelly, some silt, brown, moist: (GRANULAR BASE)		0.16	1	GS			○		
				221.33							
1		**CLAY**, silty, trace sand and gravel, very stiff to hard, brown, moist:		0.76	2	SS	17	Grain Size Analysis: Gr 0%/ Sa 8%/ Si 51%/ Cl 41%	○		
2					3	SS	34		○		
				219.95							
		END OF BOREHOLE AT 2.13m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS, THEN ASPHALT TO SURFACE.		2.13							
3											
4											
5											
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : OA
CHECKED : CZ

THURBER

THURBER2S TEL-30427.GPJ 11/8/21

RECORD OF BOREHOLE EA-07

PROJECT : Clark Boulevard Extension
LOCATION : Brampton, ON
STARTED : September 15, 2021
COMPLETED : September 15, 2021
N 4 838 768.1 E 601 086.7

Project No. 30427
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	COMMENTS
		GROUND SURFACE		221.49				
	Hollow Stem Augers	**SAND**, gravelly, some silt, brown, moist: (FILL)		0.00	1	GS		
				220.80				
1		**CLAY**, silty, trace sand and gravel, firm to stiff, brown, moist: (FILL)		0.69	2	SS	6	
2					3	SS	10	
				219.28				
		CLAY, silty, trace sand and gravel, very stiff, brown, moist		2.21	4	SS	15	Grain Size Analysis: Gr 4%/ Sa 31%/ Si 45%/ Cl 20%
3				218.59				
		END OF BOREHOLE AT 2.90m. BOREHOLE OPEN AND WATER LEVEL AT 0.82m UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS TO SURFACE.		2.90				
4								
5								
6								
7								
8								
9								

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH: Cu, KPa
nat V - ✚ Q - ✖
rem V - ● Cpen ▲
40 80 120 160

WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION
September 15, 2021

▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : AF
CHECKED : CZ

THURBER

THURBER2S TEL-30427.GPJ 11/8/21

RECORD OF BOREHOLE EA-08

PROJECT : Clark Boulevard Extension
LOCATION : Brampton, ON
STARTED : September 23, 2021
COMPLETED : September 23, 2021
N 4 838 792.4 E 601 090.0

Project No. 30427
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS	SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, Cpen ▲) 40 80 120 160 / WATER CONTENT, PERCENT wp w wl 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		220.02				DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100			
0	Continuous Split Spoon	**TOPSOIL:** (50mm)		0.05							
		SAND, silty, some clay, trace gravel, very loose to loose, brown, moist: (FILL)			1	SS	2		○		
1					2	SS	6		○		
					3	SS	2	Grain Size Analysis: Gr 5%/ Sa 48%/ Si 30%/ Cl 17%	○		
				218.19					○		
2		END OF BOREHOLE AT 1.83m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE.		1.83							
3											
4											
5											
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : RB
CHECKED : CZ

THURBER

THURBER2S TEL-30427.GPJ 11/8/21

RECORD OF BOREHOLE EA-09

PROJECT : Clark Boulevard Extension
LOCATION : Brampton, ON
STARTED : September 15, 2021
COMPLETED : September 15, 2021
N 4 838 814.3 E 601 129.3

Project No. 30427
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	COMMENTS / DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✤, rem V - ●, Q - ✖, Cpen ▲) 40 80 120 160 / WATER CONTENT, PERCENT wp w wl 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		220.67							
	Hollow Stem Augers	**ASPHALT:** (250mm)		0.00							
		SAND, gravelly, some silt, brown, moist: (GRANULAR BASE)		0.25	1	GS		Grain Size Analysis: Gr 28%/Sa 50%/ Si 17%/ Cl 5%	○		
				219.98							
1		**SILT**, clayey, some sand, trace gravel, stiff, brown, moist		0.69	2	SS	10		○		
				219.22							
		SAND, silty, compact, brown, moist		1.45	3	SS	17		○		
2				218.53							
		END OF BOREHOLE AT 2.13m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.		2.13							
3											
4											
5											
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : AF
CHECKED : CZ

THURBER

THURBER2S TEL-30427.GPJ 11/8/21

RECORD OF BOREHOLE EA-10

PROJECT : Clark Boulevard Extension
LOCATION : Brampton, ON
STARTED : September 15, 2021
COMPLETED : September 15, 2021
N 4 838 834.2 E 601 142.4

Project No. 30427
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	COMMENTS
		GROUND SURFACE		220.35				
		ASPHALT: (175mm)		0.00				
		SAND, gravelly, some silt, brown, moist: (GRANULAR BASE)		0.18	1	GS		
	Hollow Stem Augers	**SILT**, clayey, some sand, trace gravel, stiff, brown, moist		219.66 0.69	2	SS	8	Grain Size Analysis: Gr 2%/ Sa 23%/ Si 47%/ Cl 28%
					3	SS	10	
		END OF BOREHOLE AT 2.13m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.		218.21 2.13				

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH: Cu, KPa
nat V - ✚ Q - ✖
rem V - ● Cpen ▲
40 80 120 160

WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : AF
CHECKED : CZ

THURBER

THURBER2S TEL-30427.GPJ 11/8/21

RECORD OF BOREHOLE EA-11

PROJECT : Clark Boulevard Extension
LOCATION : Brampton, ON
STARTED : September 16, 2021
COMPLETED : September 16, 2021

Project No. 30427
SHEET 1 OF 1
DATUM Geodetic

N 4 838 856.4 E 601 175.1

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✤, rem V - ●, Q - ✖, Cpen ▲) 40 80 120 160 / WATER CONTENT, PERCENT wp w wl 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		219.64							
	Solid Stem Augers	**SAND**, gravelly, some silt, brown, moist: (FILL)		0.00	1	GS			○		
				218.95							
1		**SILT**, clayey, some sand, trace gravel, firm, brown, moist: (FILL)		0.69	2	SS	5		○		
				218.19							
		SILT, clayey, trace sand and gravel, hard, brown, moist		1.45	3	SS	39		○		
2				217.43							
		SILT, sandy, some clay, some gravel, compact, brown, moist: (TILL)		2.21	4	SS	28	Grain Size Analysis: Gr 19%/Sa 39%/ Si 29%/ Cl 13%	○		
				216.74							
3		END OF BOREHOLE AT 2.90m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS TO SURFACE.		2.90							
4											
5											
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : AF
CHECKED : CZ

THURBER

THURBER2S TEL-30427.GPJ 11/8/21

RECORD OF BOREHOLE EA-12

PROJECT : Clark Boulevard Extension
LOCATION : Brampton, ON
STARTED : September 23, 2021
COMPLETED : September 23, 2021
N 4 838 882.4 E 601 179.4

Project No. 30427
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS / DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✤, rem V - ●, Q - ✖, Cpen ▲) 40 80 120 160 / WATER CONTENT, PERCENT (wp, w, wl) 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		218.34							
		TOPSOIL: (25mm)		0.08							
	Continuous Sampling	**SAND**, some gravel, some silt, very loose, brown, moist: (FILL)		217.73	1	SS	1	Grain Size Analysis: Gr 16%/Sa 66%/ Si 16%/ Cl 2%	○		
1		**SILT**, clayey, some sand, trace gravel, stiff, brown, moist		0.61 217.12	2	SS	11				
		SAND, silty, some gravel, trace clay, compact, brown, moist (Till)		1.22 216.51	3	SS	23				
2		END OF BOREHOLE AT 1.83m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE.		1.83							
3											
4											
5											
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : RB
CHECKED : CZ

THURBER

THURBER2S TEL-30427.GPJ 11/8/21

RECORD OF BOREHOLE EA-13

PROJECT : Clark Boulevard Extension
LOCATION : Brampton, ON
STARTED : September 23, 2021
COMPLETED : September 23, 2021
N 4 838 902.1 E 601 217.7

Project No. 30427
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✤, rem V - ●, Q - ✖, Cpen ▲) 40 80 120 160 / WATER CONTENT, PERCENT wp w wl 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		218.90							
	Hollow Stem Augers	**ASPHALT:** (250mm)		0.00							
		SAND and **GRAVEL**, trace silt, brown, moist: (GRANULAR BASE)		0.25	1	GS		Grain Size Analysis: Gr 30%/Sa 52%/ Si & Cl 18%	○		
				218.14	2	SS	19				
1		**CLAY**, silty, some sand, trace gravel, very stiff to hard, brown, moist		0.76	3	SS	19		○		
2				216.76	4	SS	43				
		END OF BOREHOLE AT 2.13m. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO SURFACE.		2.13							
3											
4											
5											
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : RB
CHECKED : CZ

THURBER

THURBER2S TEL-30427.GPJ 11/8/21

RECORD OF BOREHOLE EA-14

PROJECT : Clark Boulevard Extension
LOCATION : Brampton, ON
STARTED : September 23, 2021
COMPLETED : September 23, 2021
N 4 838 934.0 E 601 240.8

Project No. 30427
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	COMMENTS	SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, Cpen ▲) 40 80 120 160 / WATER CONTENT, PERCENT wp w wl 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		218.08				DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100			
		ASPHALT: (200mm)		0.00							
		SAND and **GRAVEL**, trace silt, compact, brown, moist: (GRANULAR BASE)		0.20	1	GS					
					2	SS	14				Bentonite
1	Hollow Stem Augers	**CLAY**, silty, some sand, trace gravel, trace oxidation, very stiff, mottled brown/grey, moist		217.09 0.99	3	SS	16				
					4	SS	15				Filter Sand
2		**SAND**, silty, gravelly, trace clay, very dense, brown, wet: (TILL)		215.87 2.21	5	SS	69	Grain Size Analysis: Gr 23%/Sa 43%/ Si 24%/ Cl 10%			
3					6	SS	75				Slotted Screen
4				213.96	7	SS	57/ 0.150				
		END OF BOREHOLE AT 4.11m UPON AUGER REFUSAL ON PROBABLE BEDROCK. Well installation consists of 50mm diameter Schedule 40 PVC pipe with a 1.52m slotted screen.		4.11							
5											
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : RB
CHECKED : CZ

THURBER

THURBER2S TEL-30427.GPJ 11/8/21

RECORD OF BOREHOLE EA-15

PROJECT : Clark Boulevard Extension
LOCATION : Brampton, ON
STARTED : August 18, 2021
COMPLETED : August 18, 2021
N 4 838 947.9 E 601 261.6

Project No. 30427
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✚, rem V - ●, Q - ✖, Cpen ▲) (40 80 120 160) / WATER CONTENT, PERCENT (wp, w, wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		217.65							
	Hollow Stem Augers	**ASPHALT:** (250mm)		0.00							
		SAND, gravelly, loose, grey, moist: (GRANULAR BASE)		0.25	1	SS	9				
				216.96							
		SILT, clayey, some sand, trace gravel, stiff, brown, moist		0.69							
1					2	SS	14	Grain Size Analysis: Gr 5%/ Sa 26%/ Si 46%/ Cl 23%			
					3	SS	21				
2				215.51							
		END OF BOREHOLE AT 2.13m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS THEN ASPHALT TO SURFACE.		2.13							
3											
4											
5											
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : OA
CHECKED : CZ

THURBER

THURBER2S TEL-30427.GPJ 11/8/21

RECORD OF BOREHOLE EA-16

PROJECT : Clark Boulevard Extension
LOCATION : Brampton, ON
STARTED : August 18, 2021
COMPLETED : August 18, 2021
N 4 838 980.7 E 601 271.4

Project No. 30427
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	COMMENTS: DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)	SHEAR STRENGTH: Cu, KPa (nat V - ✤, rem V - ●, Q - ✖, Cpen ▲) 40 80 120 160 / WATER CONTENT, PERCENT (wp, w, wl) 10 20 30 40	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		217.64							
		ASPHALT: (275mm)		0.00							
		SAND, gravelly, compact, brown, moist: (GRANULAR BASE)		217.36 0.28	1	SS	20		○		
		SILT, clayey, with sand, trace gravel, stiff, brown, moist		216.95 0.69	2	SS	12	Grain Size Analysis: Gr 2%/ Sa 30%/ Si 45%/ Cl 23%	○		
1	Hollow Stem Augers										
					3	SS	9		○		
2				215.50							
		END OF BOREHOLE AT 2.13m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS THEN ASPHALT TO SURFACE.		2.13							
3											
4											
5											
6											
7											
8											
9											

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : OA
CHECKED : CZ

THURBER

THURBER2S TEL-30427.GPJ 11/8/21

RECORD OF BOREHOLE RR-01

PROJECT : Clark Boulevard Extension
LOCATION : Brampton, ON
STARTED : August 18, 2021
COMPLETED : August 18, 2021
N 4 839 278.1 E 601 576.7

Project No. 30427
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
		GROUND SURFACE		215.69				
	Hollow Stem Augers	**ASPHALT:** (250mm)		0.00				
		GRAVEL, sandy, some asphalt, very dense, brown, moist: (GRANULAR BASE)		0.25	1	SS	50	
				214.93				
1		**SILT**, clayey, some sand, trace gravel, stuff, brown, moist		0.76	2	SS	13	Grain Size Analysis: Gr 2%/ Sa 23%/ Si 49%/ Cl 26%
2					3	SS	15	
				213.55				
		END OF BOREHOLE AT 2.13m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND CUTTINGS, THEN ASPHALT TO SURFACE.		2.13				
3								
4								
5								
6								
7								
8								
9								

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH: Cu, KPa
nat V - ✚ Q - ✖
rem V - ● Cpen ▲
40 80 120 160

WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : OA
CHECKED : CZ

THURBER

THURBER2S TEL-30427.GPJ 11/8/21

RECORD OF BOREHOLE RR-02

PROJECT : Clark Boulevard Extension
LOCATION : Brampton, ON
STARTED : August 18, 2021
COMPLETED : August 18, 2021
N 4 839 239.6 E 601 618.2

Project No. 30427
SHEET 1 OF 1
DATUM Geodetic

DEPTH SCALE (metres)	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	COMMENTS
		GROUND SURFACE		215.34				
	Hollow Stem Augers	**ASPHALT:** (300mm)		0.00				
		SAND, gravelly, some asphalt fragments, dense, brown, moist: (GRANULAR BASE)		215.03 0.30	1	SS	47	
		CLAY, silty, some sand, some gravel, stiff, grey, moist: (FILL)		214.65 0.69	2	SS	9	
1		**SILT**, clayey, with sand, trace gravel, stiff, greyish brown, moist		213.81 1.52	3	SS	12	Grain Size Analysis: Gr 1%/ Sa 27%/ Si 44%/ Cl 28%
2		END OF BOREHOLE AT 2.13m. BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH CUTTINGS, THEN ASPHALT TO SURFACE.		213.20 2.13				
3								
4								
5								
6								
7								
8								
9								

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH: Cu, KPa
nat V - ✚ Q - ✖
rem V - ● Cpen ▲
40 80 120 160

WATER CONTENT, PERCENT
wp w wl
10 20 30 40

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

GROUNDWATER ELEVATIONS

▽ WATER LEVEL UPON COMPLETION ▼ WATER LEVEL IN WELL/PIEZOMETER

LOGGED : OA
CHECKED : CZ

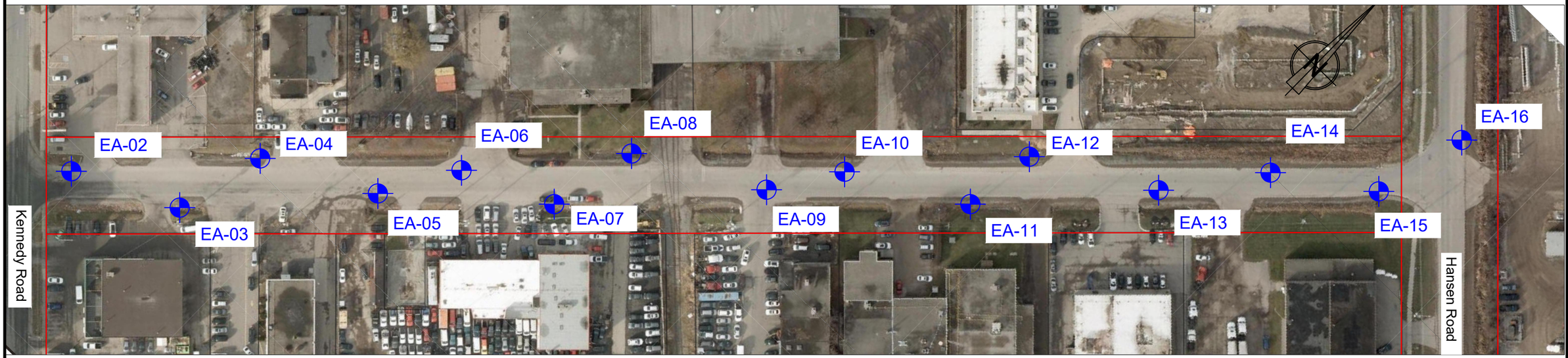
THURBER

THURBER2S TEL-30427.GPJ 11/8/21

THURBER

Appendix B

Borehole Location Plans



Eastern Avenue

Borehole Location

GEOTECHNICAL INVESTIGATION

CLARK BOULEVARD EXTENSION
BRAMPTON, ON

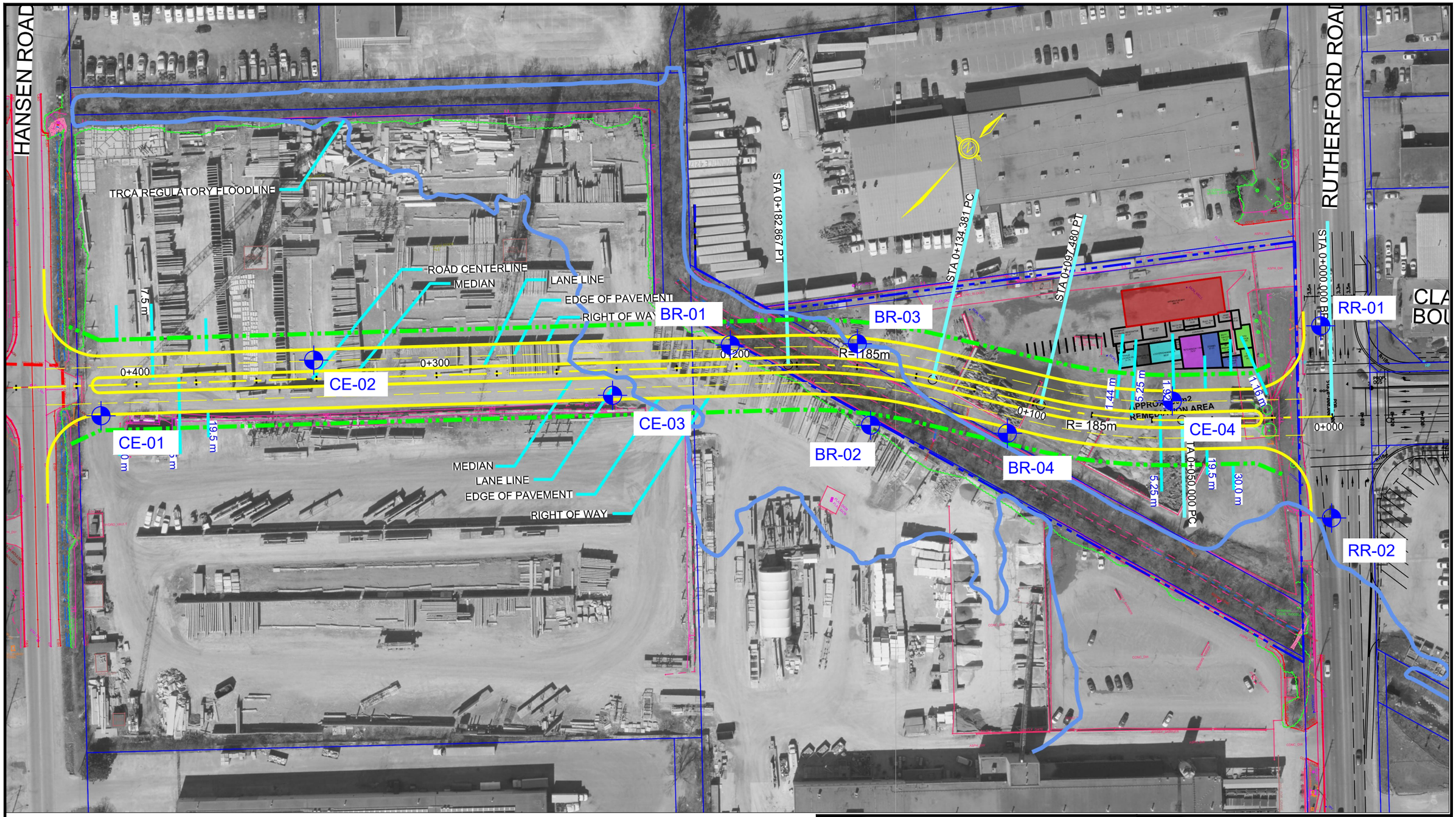
BOREHOLE LOCATION PLAN

JOB# 30427

THURBER ENGINEERING LTD.

ENGINEER :	DRAWN :	APPROVED :
CZ	CZ	RP
DATE :	SCALE :	DRAWING No.
NOVEMBER 2021	NTS	30427-1

FILENAME: C:\Users\czanatta\Documents\Thurber\Clark Blvd\Borehole Location Plan.dwg
PLOTDATE: Nov 22, 2021 - 3:08 PM



Borehole Location

GEOTECHNICAL INVESTIGATION

CLARK BOULEVARD EXTENSION
BRAMPTON, ON

BOREHOLE LOCATION PLAN

JOB# 30427

THURBER ENGINEERING LTD.

ENGINEER :	DRAWN :	APPROVED :
CZ	CZ	RP
DATE :	SCALE :	DRAWING No.
NOVEMBER 2021	NTS	30427-2

FILENAME: C:\Users\czanatta\Documents\Thurber\Clark Blvd\Borehole Location Plan.dwg
PLOTDATE: Nov 22, 2021 - 3:06 PM

THURBER

Appendix C

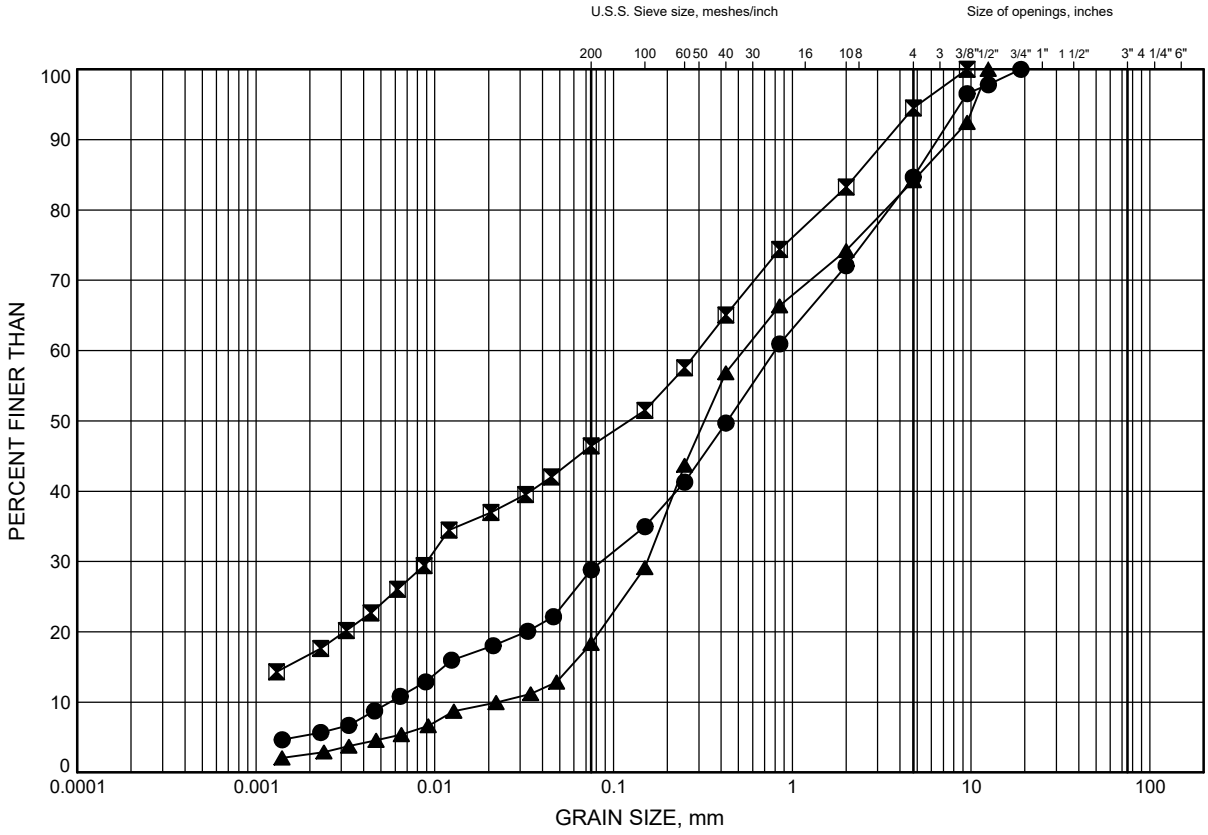
Geotechnical Laboratory Soil Test Results

Clark Boulevard Extension

GRAIN SIZE DISTRIBUTION

FIGURE B1

Silty SAND to SAND FILL



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BR-02	0.30	215.05
⊠	EA-08	1.52	218.49
▲	EA-12	0.61	217.73

Date November 2021

Project 30427

THURBER

Prep'd AN

Chkd. CZ

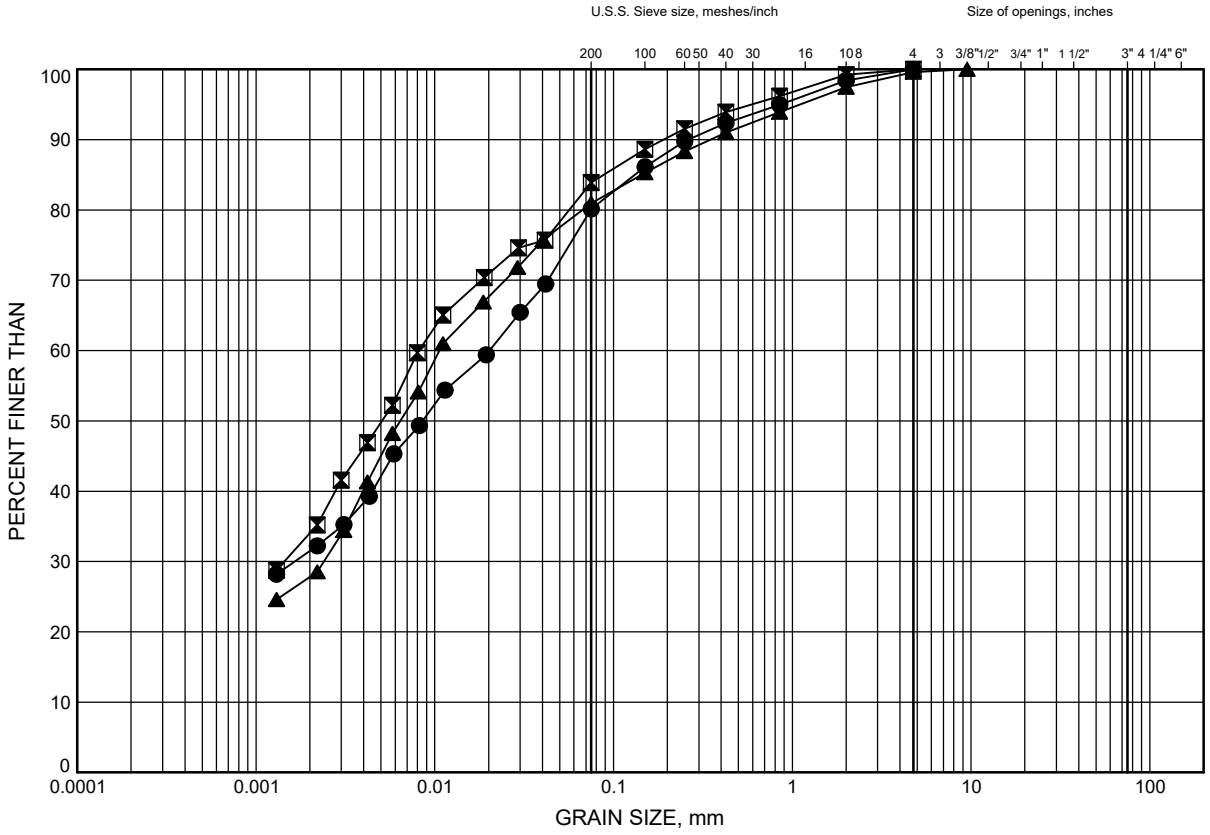
GRAIN SIZE DISTRIBUTION - THURBER TEL-30427.GPJ 11/22/21

Clark Boulevard Extension

GRAIN SIZE DISTRIBUTION

FIGURE B2

Silty CLAY FILL



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BR-01	1.07	214.64
⊠	CE-01	1.07	216.70
▲	EA-04	1.07	221.75

Date November 2021

Project 30427

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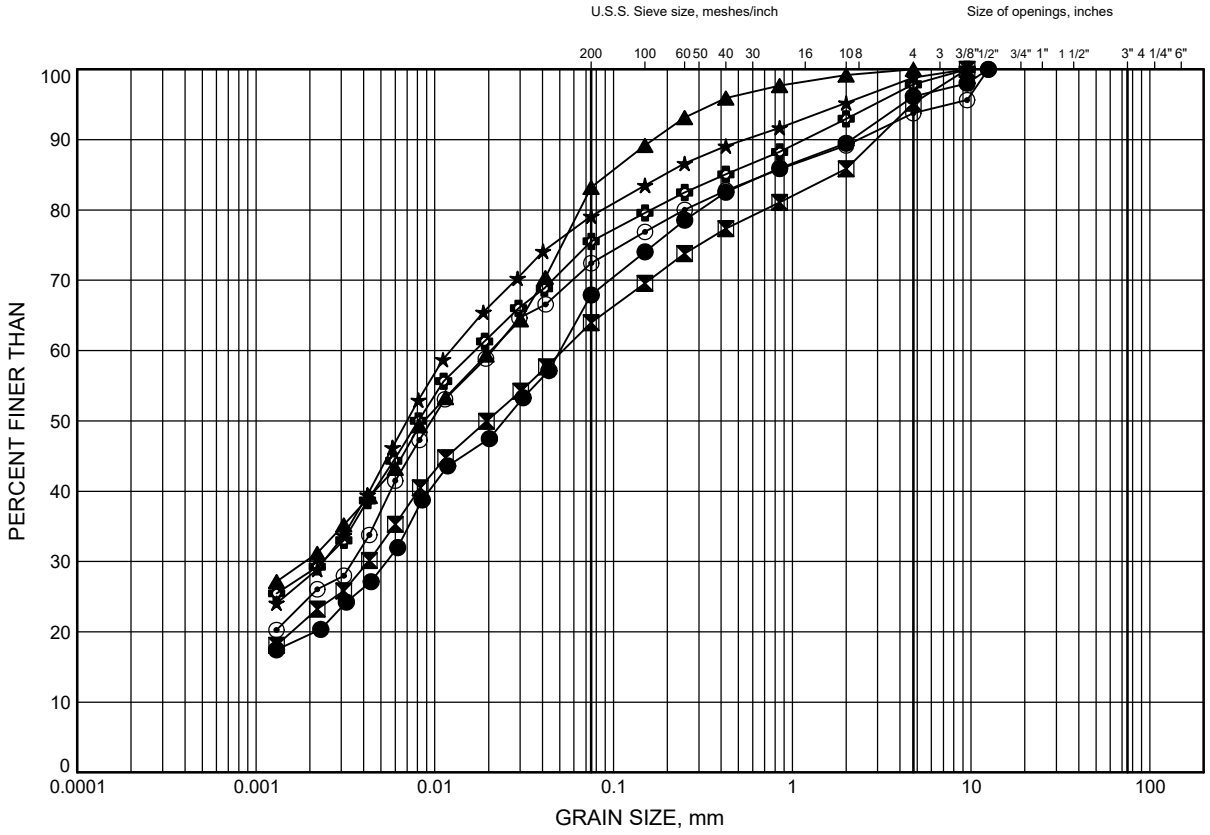
GRAIN SIZE DISTRIBUTION - THURBER TEL-30427.GPJ 11/22/21

Clark Boulevard Extension

GRAIN SIZE DISTRIBUTION

FIGURE B3

Clayey SILT to Silty CLAY



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BR-04	1.07	214.60
⊠	CE-02	1.07	215.99
▲	CE-04	1.83	214.11
★	EA-02	1.07	222.07
⊙	EA-03	1.83	221.06
✿	EA-05	4.88	217.54

Date November 2021

Project 30427

THURBER

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Chkd. CZ

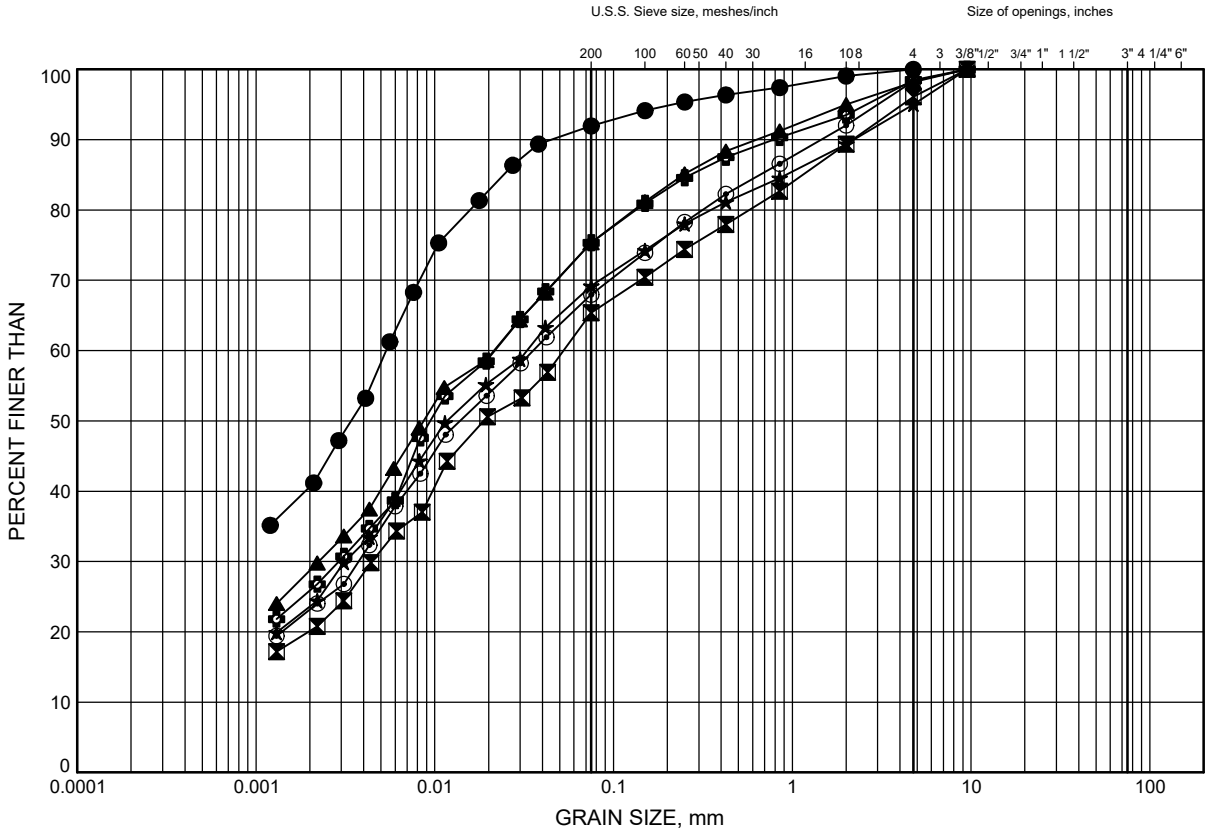
GRAIN SIZE DISTRIBUTION - THURBER TEL-30427.GPJ 11/22/21

Clark Boulevard Extension

GRAIN SIZE DISTRIBUTION

FIGURE B4

Clayey SILT to Silty CLAY



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	EA-06	1.07	221.02
⊠	EA-07	2.59	218.90
▲	EA-10	1.07	219.28
★	EA-15	1.07	216.58
⊙	EA-16	1.07	216.57
✿	RR-01	1.07	214.62

Date November 2021

Project 30427

THURBER

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Chkd. CZ

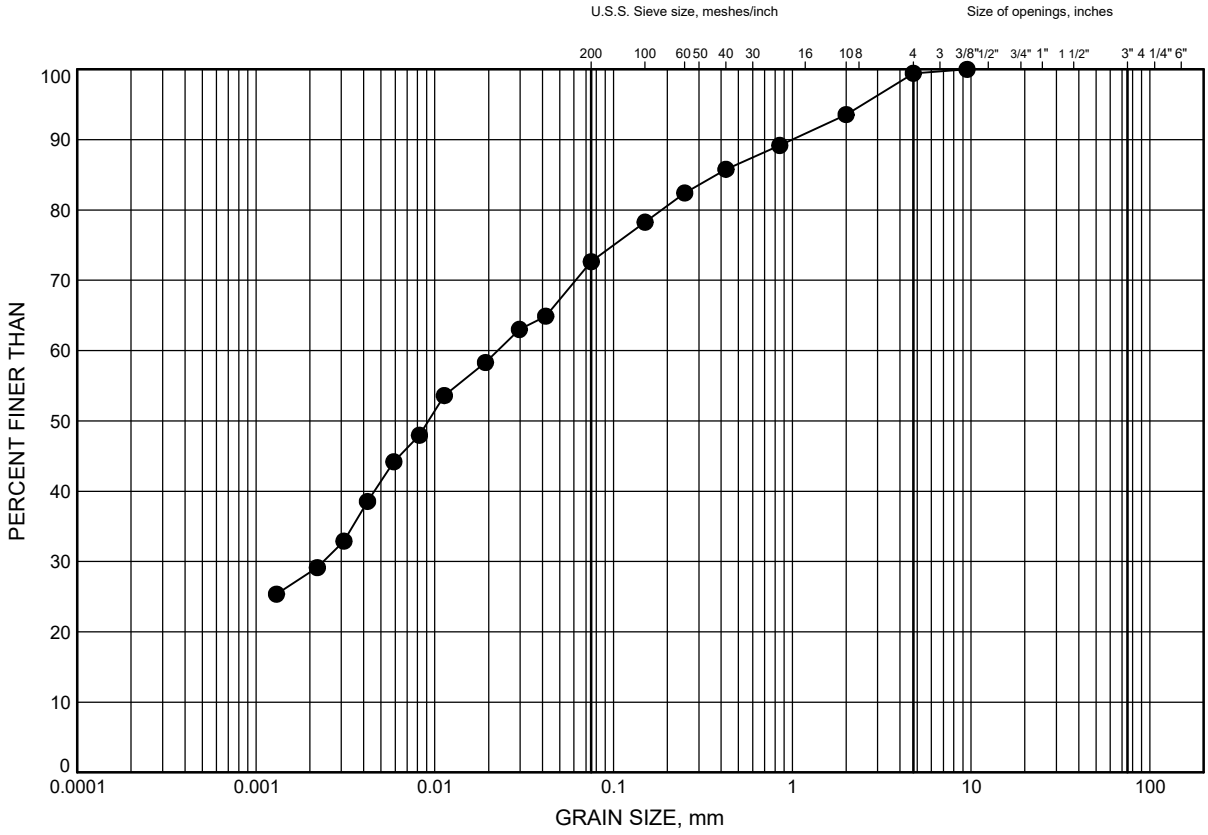
GRAIN SIZE DISTRIBUTION - THURBER TEL-30427.GPJ 11/22/21

Clark Boulevard Extension

GRAIN SIZE DISTRIBUTION

FIGURE B5

Clayey SILT to Silty CLAY



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	RR-02	1.83	213.51

Date November 2021

Project 30427

THURBER

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Chkd. CZ

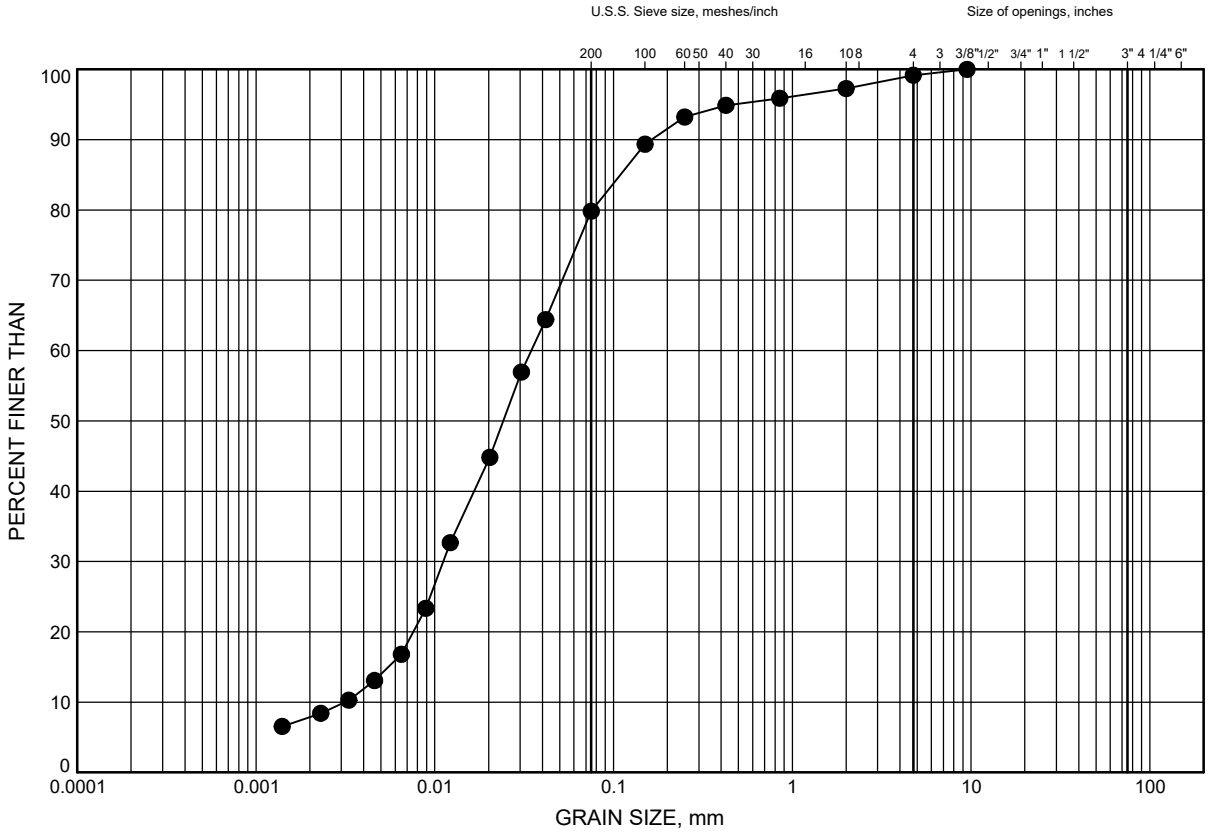
GRAIN SIZE DISTRIBUTION - THURBER TEL-30427.GPJ 11/22/21

Clark Boulevard Extension

GRAIN SIZE DISTRIBUTION

FIGURE B6

SILT



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BR-01	3.35	212.35

Date November 2021

Project 30427

THURBER

Prep'd AN

Chkd. CZ

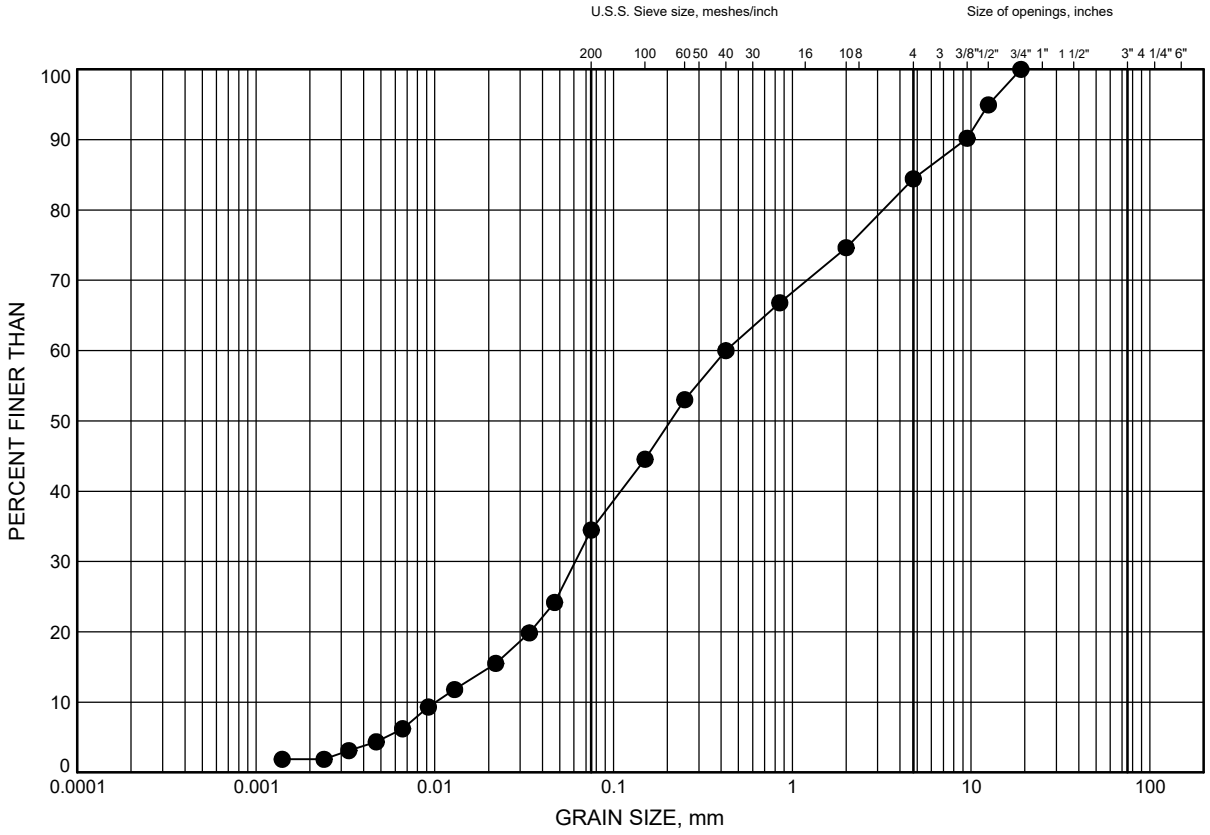
GRAIN SIZE DISTRIBUTION - THURBER TEL-30427.GPJ 11/22/21

Clark Boulevard Extension

GRAIN SIZE DISTRIBUTION

FIGURE B7

Silty SAND



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BR-03	1.83	213.35

Date November 2021

Project 30427

THURBER

Prep'd AN

Chkd. CZ

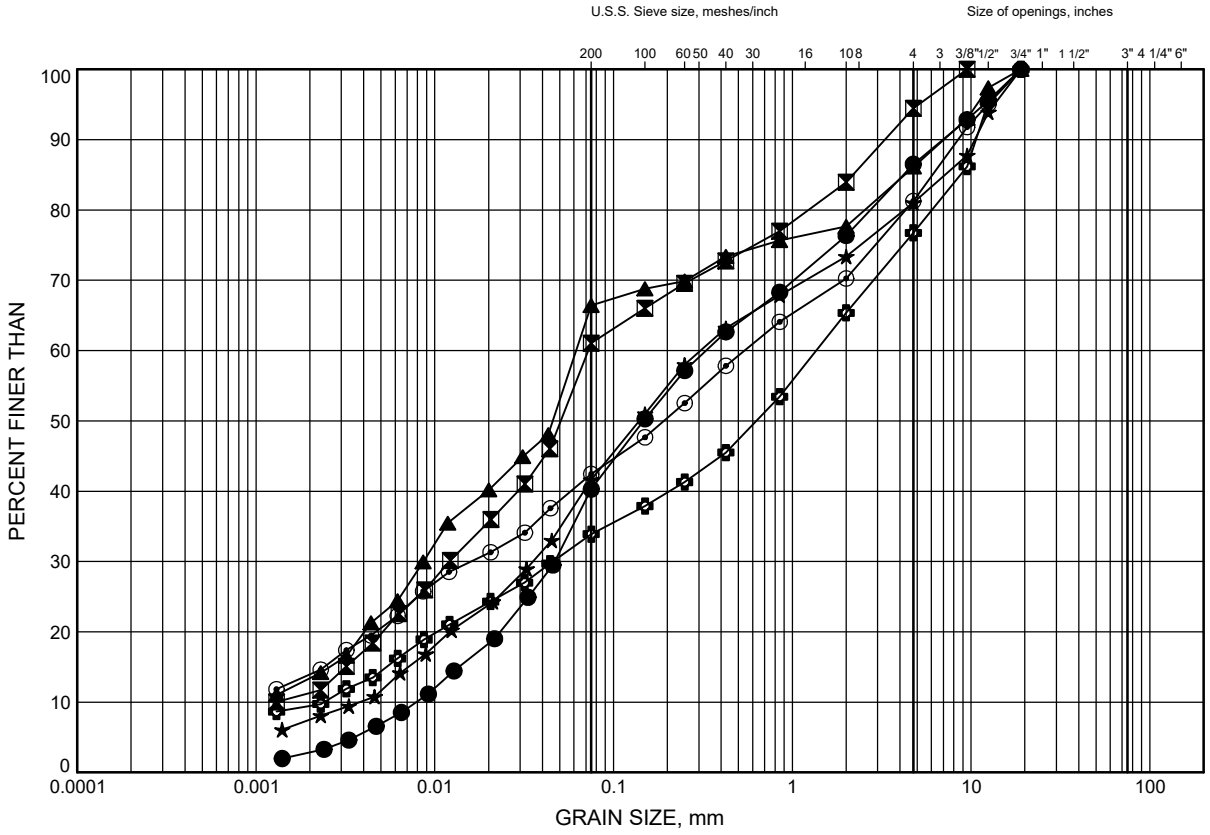
GRAIN SIZE DISTRIBUTION - THURBER TEL-30427.GPJ 11/22/21

Clark Boulevard Extension

GRAIN SIZE DISTRIBUTION

FIGURE B8

Sandy SILT to Silty SAND TILL



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BR-02	3.35	212.00
⊠	BR-03	7.77	207.40
▲	BR-04	6.32	209.34
★	CE-03	2.55	213.47
⊙	EA-11	2.59	217.05
✿	EA-14	2.59	215.49

Date November 2021

Project 30427

THURBER

Prep'd AN

Chkd. CZ

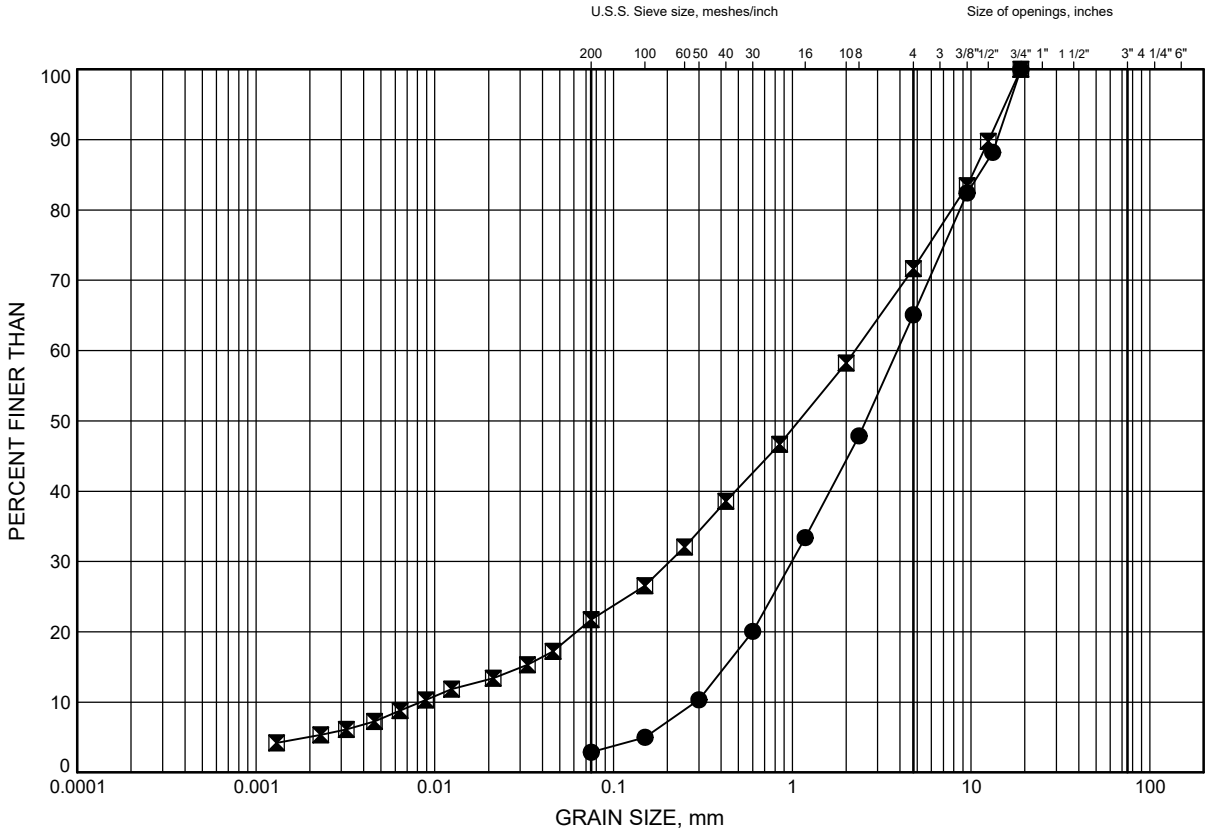
GRAIN SIZE DISTRIBUTION - THURBER TEL-30427.GPJ 11/22/21

Clark Boulevard Extension

GRAIN SIZE DISTRIBUTION

FIGURE B9

SAND and GRAVEL to Gravelly SAND (Granular Road Base)



SILT and CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	SAND			GRAVEL		

LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	EA-05	0.38	222.04
⊠	EA-09	0.46	220.21

Date November 2021

Project 30427

THURBER

Prep'd AN

Chkd. CZ

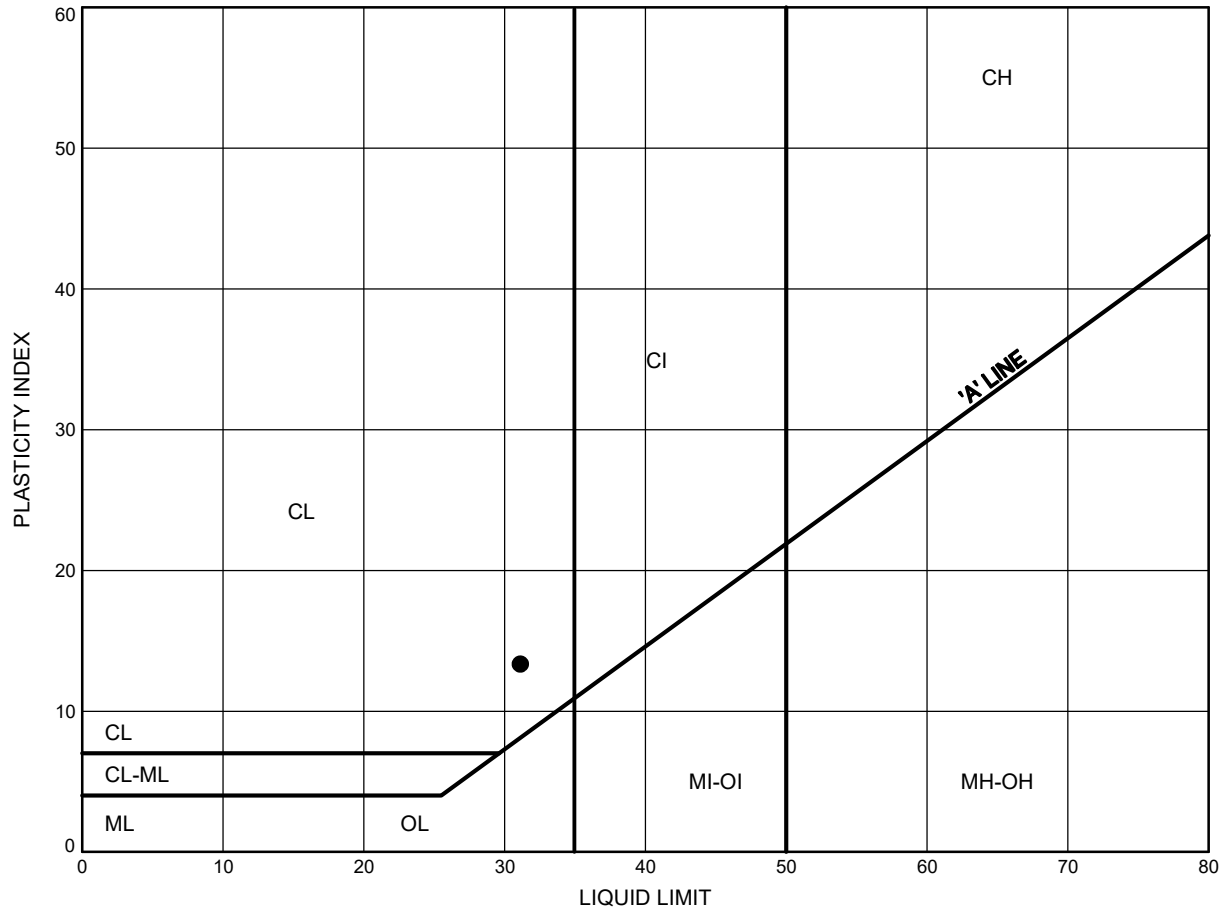
GRAIN SIZE DISTRIBUTION - THURBER TEL-30427.GPJ 11/22/21

Clark Boulevard Extension

ATTERBERG LIMITS TEST RESULTS

FIGURE B10

Sandy SILT TILL



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	BR-04	6.32	209.34

Date November 2021

Project 30427

THURBER

Prep'd AN

Chkd. CZ

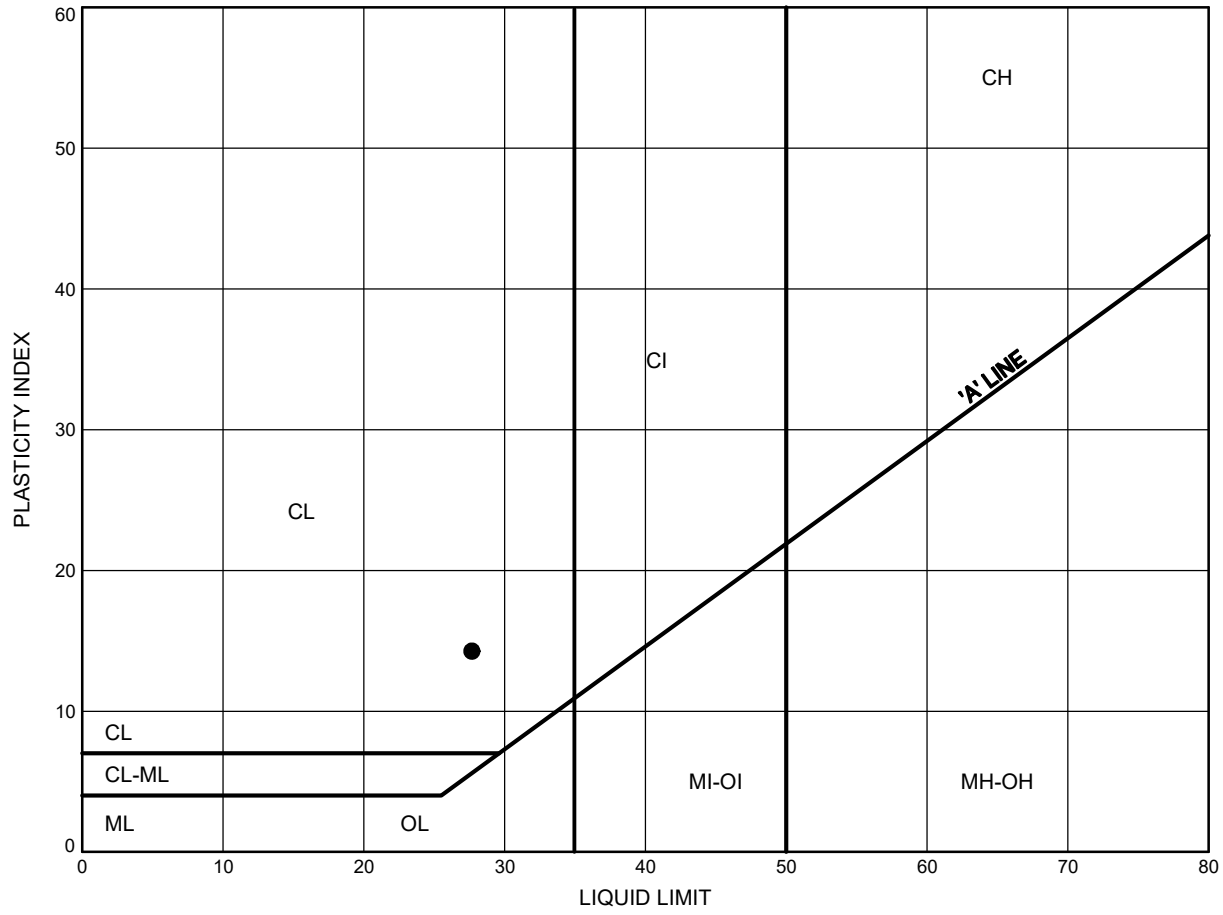
THURBALT TEL-30427.GPJ 11/22/21

Clark Boulevard Extension

ATTERBERG LIMITS TEST RESULTS

FIGURE B11

Silty CLAY to Clayey SILT



LEGEND

SYMBOL	BOREHOLE	DEPTH (m)	ELEV. (m)
●	EA-05	4.88	217.54

Date November 2021

Project 30427

THURBER

Prep'd AN

Chkd. CZ

THURBALT TEL-30427.GPJ 11/22/21

THURBER

Appendix D

Laboratory Certificates of Analysis

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: THURBER ENGINEERING LTD
SUITE 103, 2010 WINSTON PARK DRIVE
OAKVILLE, ON L6H5R7
(905) 829-8666

ATTENTION TO: Cary Zanatta

PROJECT: 30427

AGAT WORK ORDER: 21T834299

MICROBIOLOGY ANALYSIS REVIEWED BY: Nivine Basily, Inorganics Report Writer

TRACE ORGANICS REVIEWED BY: Oksana Gushyla, Trace Organics Lab Supervisor

WATER ANALYSIS REVIEWED BY: Yris Verastegui, Report Reviewer

DATE REPORTED: Dec 02, 2021

PAGES (INCLUDING COVER): 14

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*Notes

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 21T834299

PROJECT: 30427

CLIENT NAME: THURBER ENGINEERING LTD

ATTENTION TO: Cary Zanatta

SAMPLING SITE:

SAMPLED BY:

E. Coli (Using MI Agar)

DATE RECEIVED: 2021-11-24

DATE REPORTED: 2021-12-02

		SAMPLE DESCRIPTION:		EA-05	EA-05F
		SAMPLE TYPE:		Water	Water
		DATE SAMPLED:		2021-11-23	2021-11-23
Parameter	Unit	G / S	RDL	3245716	3245854
Escherichia coli	CFU/100mL	200		0	1

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Peel Storm By-Law 53-2010
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

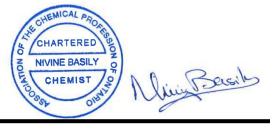
3245716 Escherichia coli RDL = 10 CFU/100mL.
RDL > 1 indicates dilutions of the sample.

The sample was diluted prior to filtration due to the presence of sediments.

3245854 Escherichia coli RDL = 1 CFU/100mL.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:



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Certificate of Analysis

AGAT WORK ORDER: 21T834299

PROJECT: 30427

CLIENT NAME: THURBER ENGINEERING LTD

ATTENTION TO: Cary Zanatta

SAMPLING SITE:

SAMPLED BY:

Fecal Coliforms in Water

DATE RECEIVED: 2021-11-24

DATE REPORTED: 2021-12-02

			SAMPLE DESCRIPTION:	EA-05	EA-05F
			SAMPLE TYPE:	Water	Water
			DATE SAMPLED:	2021-11-23	2021-11-23
Parameter	Unit	G / S	RDL	3245716	3245854
Fecal Coliform	CFU/100mL	0		30	0

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Peel Storm By-Law 53-2010
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

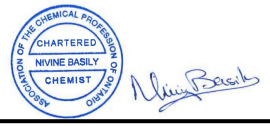
3245716 Fecal Coliforms RDL = 10 CFU/100mL
RDL > 1 indicates dilutions of the sample.

The sample was diluted prior to filtration due to the presence of sediments.

3245854 Fecal Coliforms RDL = 1 CFU/100mL

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:



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Certificate of Analysis

AGAT WORK ORDER: 21T834299

PROJECT: 30427

CLIENT NAME: THURBER ENGINEERING LTD

ATTENTION TO: Cary Zanatta

SAMPLING SITE:

SAMPLED BY:

Peel Region Storm - Organics

DATE RECEIVED: 2021-11-24

DATE REPORTED: 2021-12-02

		SAMPLE DESCRIPTION:		EA-05	EA-05F
		SAMPLE TYPE:		Water	Water
		DATE SAMPLED:		2021-11-23	2021-11-23
Parameter	Unit	G / S	RDL	3245716	3245854
Methylene Chloride	mg/L	0.0052	0.0006	<0.0006	<0.0006
cis-1,2-Dichloroethylene	mg/L	0.0056	0.0004	<0.0004	<0.0004
Chloroform	mg/L	0.002	0.0004	<0.0004	<0.0004
Benzene	mg/L	0.002	0.0004	<0.0004	<0.0004
Trichloroethylene	mg/L	0.008	0.0004	<0.0004	<0.0004
Toluene	mg/L	0.002	0.0004	<0.0004	0.0008
Tetrachloroethene	mg/L	0.0044	0.0004	<0.0004	<0.0004
trans-1,3-Dichloropropene	mg/L	0.0056	0.0006	<0.0006	<0.0006
Ethylbenzene	mg/L	0.002	0.0002	<0.0002	<0.0002
1,1,2,2-Tetrachloroethane	mg/L	0.017	0.0002	<0.0002	<0.0002
1,2-Dichlorobenzene	mg/L	0.0056	0.0002	<0.0002	<0.0002
1,4-Dichlorobenzene	mg/L	0.0068	0.0002	<0.0002	<0.0002
m & p-Xylene	mg/L		0.0004	<0.0004	<0.0004
o-Xylene	mg/L		0.0002	<0.0002	<0.0002
Xylenes (Total)	mg/L	0.0044	0.0001	<0.0001	<0.0001
PCBs	mg/L	0.0004	0.0002	<0.0002	<0.0002
Di-n-butyl phthalate	mg/L	0.015	0.0005	0.0011	0.0015
Bis(2-Ethylhexyl)phthalate	mg/L	0.0088	0.0005	<0.0005	<0.0005
Surrogate	Unit	Acceptable Limits			
Toluene-d8	% Recovery	50-140		98	99
4-Bromofluorobenzene	% Recovery	50-140		98	76
Decachlorobiphenyl	%	50-140		75	89
2,4,6-Tribromophenol	%	50-140		96	89
2-Fluorophenol	%	50-140		93	85
Chrysene-d12	%	50-140		92	94
phenol-d6 surrogate	%	50-140		101	99

Certified By:

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 21T834299

PROJECT: 30427

CLIENT NAME: THURBER ENGINEERING LTD

ATTENTION TO: Cary Zanatta

SAMPLING SITE:

SAMPLED BY:

Peel Region Storm - Organics

DATE RECEIVED: 2021-11-24

DATE REPORTED: 2021-12-02

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Peel Storm By-Law 53-2010
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

3245716-3245854 Dilution factor=2
The sample was diluted because it was foamy. The reporting detection limit has been corrected for the dilution factor used.
Xylenes total is a calculated parameter. The calculated value is the sum of m&p-Xylene and o-Xylene.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 21T834299

PROJECT: 30427

CLIENT NAME: THURBER ENGINEERING LTD

ATTENTION TO: Cary Zanatta

SAMPLING SITE:

SAMPLED BY:

CBOD5

DATE RECEIVED: 2021-11-24

DATE REPORTED: 2021-12-02

SAMPLE DESCRIPTION:				EA-05		EA-05F
SAMPLE TYPE:				Water		Water
DATE SAMPLED:				2021-11-23		2021-11-23
Parameter	Unit	G / S	RDL	3245716	RDL	3245854
Biochemical Oxygen Demand, Carbonaceous	mg/L	15	6.00	<6.00	2.00	3.00

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Peel Storm By-Law 53-2010
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

3245716 RDL for BOD is raised due to insufficient DO depletion at selected dilution levels.

Analysis performed at AGAT Halifax (unless marked by *)

Certified By: Iris Verástegui

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 21T834299

PROJECT: 30427

CLIENT NAME: THURBER ENGINEERING LTD

ATTENTION TO: Cary Zanatta

SAMPLING SITE:

SAMPLED BY:

Peel Storm Sewer Use By-law - Inorganics

DATE RECEIVED: 2021-11-24

DATE REPORTED: 2021-12-02

		SAMPLE DESCRIPTION:		EA-05		EA-05F
		SAMPLE TYPE:		Water		Water
		DATE SAMPLED:		2021-11-23		2021-11-23
Parameter	Unit	G / S	RDL	3245716	RDL	3245854
pH	pH Units	6.0-9.0	NA	7.89	NA	7.89
Total Kjeldahl Nitrogen	mg/L	1	0.10	0.77	0.10	0.67
Phenols	mg/L	0.008	0.008	0.090	0.008	0.028
Total Phosphorus	mg/L	0.4	1.2	9.91	0.02	0.06
Total Suspended Solids	mg/L	15	10	12400	10	<10
Total Cyanide	mg/L	0.02	0.002	<0.002	0.002	<0.002
Total Arsenic	mg/L	0.02	0.015	0.036	0.015	<0.015
Total Cadmium	mg/L	0.008	0.001	<0.001	0.001	<0.001
Total Chromium	mg/L	0.08	0.015	0.116	0.015	<0.015
Total Copper	mg/L	0.05	0.010	0.129	0.010	<0.010
Total Lead	mg/L	0.120	0.020	0.042	0.020	<0.020
Total Manganese	mg/L	0.05	0.020	4.25	0.020	0.169
Total Mercury	mg/L	0.0004	0.0002	<0.0002	0.0002	<0.0002
Total Nickel	mg/L	0.08	0.015	0.126	0.015	<0.015
Total Selenium	mg/L	0.02	0.002	0.003	0.002	0.002
Total Silver	mg/L	0.12	0.010	<0.010	0.010	<0.010
Total Zinc	mg/L	0.04	0.020	0.311	0.020	<0.020

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Peel Storm By-Law 53-2010
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

3245716-3245854 Dilution required, RDL has been increased accordingly.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: Iris Verástegui

AGAT Laboratories

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Exceedance Summary

AGAT WORK ORDER: 21T834299

PROJECT: 30427

CLIENT NAME: THURBER ENGINEERING LTD

ATTENTION TO: Cary Zanatta

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	UNIT	GUIDEVALUE	RESULT
3245716	EA-05	ON Peel SM	Fecal Coliforms in Water	Fecal Coliform	CFU/100mL	0	30
3245716	EA-05	ON Peel SM	Peel Storm Sewer Use By-law - Inorganics	Phenols	mg/L	0.008	0.090
3245716	EA-05	ON Peel SM	Peel Storm Sewer Use By-law - Inorganics	Total Arsenic	mg/L	0.02	0.036
3245716	EA-05	ON Peel SM	Peel Storm Sewer Use By-law - Inorganics	Total Chromium	mg/L	0.08	0.116
3245716	EA-05	ON Peel SM	Peel Storm Sewer Use By-law - Inorganics	Total Copper	mg/L	0.05	0.129
3245716	EA-05	ON Peel SM	Peel Storm Sewer Use By-law - Inorganics	Total Manganese	mg/L	0.05	4.25
3245716	EA-05	ON Peel SM	Peel Storm Sewer Use By-law - Inorganics	Total Nickel	mg/L	0.08	0.126
3245716	EA-05	ON Peel SM	Peel Storm Sewer Use By-law - Inorganics	Total Phosphorus	mg/L	0.4	9.91
3245716	EA-05	ON Peel SM	Peel Storm Sewer Use By-law - Inorganics	Total Suspended Solids	mg/L	15	12400
3245716	EA-05	ON Peel SM	Peel Storm Sewer Use By-law - Inorganics	Total Zinc	mg/L	0.04	0.311
3245854	EA-05F	ON Peel SM	Peel Storm Sewer Use By-law - Inorganics	Phenols	mg/L	0.008	0.028
3245854	EA-05F	ON Peel SM	Peel Storm Sewer Use By-law - Inorganics	Total Manganese	mg/L	0.05	0.169

AGAT Laboratories

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Quality Assurance

CLIENT NAME: THURBER ENGINEERING LTD

AGAT WORK ORDER: 21T834299

PROJECT: 30427

ATTENTION TO: Cary Zanatta

SAMPLING SITE:

SAMPLED BY:

Microbiology Analysis

RPT Date: Dec 02, 2021			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
E. Coli (Using MI Agar)															
Escherichia coli	3243507		0	0	NA										
Comments: NA - % RPD Not Applicable.															
Fecal Coliforms in Water															
Fecal Coliform	3245716	3245716	30	30	0.0%										

Certified By:

AGAT Laboratories

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CANADA L4Z 1Y2
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FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: THURBER ENGINEERING LTD

AGAT WORK ORDER: 21T834299

PROJECT: 30427

ATTENTION TO: Cary Zanatta

SAMPLING SITE:

SAMPLED BY:

Trace Organics Analysis

RPT Date: Dec 02, 2021			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Peel Region Storm - Organics															
Methylene Chloride	3251511		<0.0003	<0.0003	NA	< 0.0003	95%	50%	140%	98%	60%	130%	110%	50%	140%
cis-1,2-Dichloroethylene	3251511		<0.0002	<0.0002	NA	< 0.0002	114%	50%	140%	95%	60%	130%	81%	50%	140%
Chloroform	3251511		<0.0002	<0.0002	NA	< 0.0002	115%	50%	140%	113%	60%	130%	86%	50%	140%
Benzene	3251511		<0.0002	<0.0002	NA	< 0.0002	83%	50%	140%	82%	60%	130%	87%	50%	140%
Trichloroethylene	3251511		<0.0002	<0.0002	NA	< 0.0002	117%	50%	140%	104%	60%	130%	84%	50%	140%
Toluene	3251511		0.0005	0.0005	NA	< 0.0002	116%	50%	140%	96%	60%	130%	50%	50%	140%
Tetrachloroethene	3251511		<0.0002	<0.0002	NA	< 0.0002	83%	50%	140%	105%	60%	130%	109%	50%	140%
trans-1,3-Dichloropropene	3251511		<0.0003	<0.0003	NA	< 0.0003	109%	50%	140%	109%	60%	130%	104%	50%	140%
Ethylbenzene	3251511		<0.0001	<0.0001	NA	< 0.0001	73%	50%	140%	102%	60%	130%	83%	50%	140%
1,1,2,2-Tetrachloroethane	3251511		<0.0001	<0.0001	NA	< 0.0001	113%	50%	140%	116%	60%	130%	114%	50%	140%
1,2-Dichlorobenzene	3251511		<0.0001	<0.0001	NA	< 0.0001	83%	50%	140%	97%	60%	130%	85%	50%	140%
1,4-Dichlorobenzene	3251511		<0.0001	<0.0001	NA	< 0.0001	86%	50%	140%	95%	60%	130%	90%	50%	140%
m & p-Xylene	3251511		<0.0002	<0.0002	NA	< 0.0002	100%	50%	140%	105%	60%	130%	88%	50%	140%
o-Xylene	3251511		<0.0001	<0.0001	NA	< 0.0001	75%	50%	140%	102%	60%	130%	87%	50%	140%
PCBs	3245309		< 0.0002	< 0.0002	NA	< 0.0002	103%	50%	140%	84%	50%	140%	77%	50%	140%
Di-n-butyl phthalate	3254493		< 0.0005	< 0.0005	NA	< 0.0005	78%	50%	140%	90%	50%	140%	106%	50%	140%
Bis(2-Ethylhexyl)phthalate	3254493		< 0.0005	< 0.0005	NA	< 0.0005	85%	50%	140%	98%	50%	140%	95%	50%	140%

Comments: When the average of the sample and duplicate results is less than 5x the RDL, the Relative Percent Difference (RPD) will be indicated as Not Applicable (NA).

Certified By:

AGAT Laboratories

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Quality Assurance

CLIENT NAME: THURBER ENGINEERING LTD

AGAT WORK ORDER: 21T834299

PROJECT: 30427

ATTENTION TO: Cary Zanatta

SAMPLING SITE:

SAMPLED BY:

Water Analysis

RPT Date: Dec 02, 2021			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Peel Storm Sewer Use By-law - Inorganics															
pH	3245263		7.61	7.73	1.6%	NA	103%	90%	110%						
Total Kjeldahl Nitrogen	3245716	3245716	0.77	0.69	11.0%	< 0.10	100%	70%	130%	101%	80%	120%	102%	70%	130%
Phenols	3235378		<0.001	<0.001	NA	< 0.001	109%	90%	110%	105%	90%	110%	115%	80%	120%
Total Phosphorus	3245716	3245716	9.91	10.6	6.7%	< 0.02	97%	70%	130%	99%	80%	120%	106%	70%	130%
Total Suspended Solids	3260570		<10	<10	NA	< 10	100%	80%	120%						
Total Cyanide	3244694		0.002	0.002	NA	< 0.002	116%	70%	130%	93%	80%	120%	98%	70%	130%
Total Arsenic	3248802		<0.015	<0.015	NA	< 0.015	88%	70%	130%	92%	80%	120%	98%	70%	130%
Total Cadmium	3248802		<0.001	<0.001	NA	< 0.001	100%	70%	130%	100%	80%	120%	105%	70%	130%
Total Chromium	3248802		<0.015	<0.015	NA	< 0.015	102%	70%	130%	102%	80%	120%	107%	70%	130%
Total Copper	3248802		<0.010	<0.010	NA	< 0.010	105%	70%	130%	110%	80%	120%	113%	70%	130%
Total Lead	3248802		<0.020	<0.020	NA	< 0.020	98%	70%	130%	106%	80%	120%	103%	70%	130%
Total Manganese	3248802		0.061	0.057	NA	< 0.020	95%	70%	130%	100%	80%	120%	98%	70%	130%
Total Mercury	3248939		<0.0002	<0.0002	NA	< 0.0002	104%	70%	130%	104%	80%	120%	97%	70%	130%
Total Nickel	3248802		<0.015	<0.015	NA	< 0.015	108%	70%	130%	107%	80%	120%	109%	70%	130%
Total Selenium	3248802		<0.002	0.004	NA	< 0.002	95%	70%	130%	96%	80%	120%	102%	70%	130%
Total Silver	3248802		<0.010	<0.010	NA	< 0.010	101%	70%	130%	111%	80%	120%	107%	70%	130%
Total Zinc	3248802		0.025	0.024	NA	< 0.020	100%	70%	130%	101%	80%	120%	102%	70%	130%
CBOD5															
Biochemical Oxygen Demand, Carbonaceous	3254918		181	172	5.1%	< 2	91%	70%	130%						

Comments: NA signifies Not Applicable.
If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.
Matrix spike: Spike level < native concentration. Matrix spike acceptance limits do not apply.

Certified By: Iris Verástegui

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: THURBER ENGINEERING LTD

AGAT WORK ORDER: 21T834299

PROJECT: 30427

ATTENTION TO: Cary Zanatta

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Microbiology Analysis			
Escherichia coli	MIC-93-7010	EPA 1604	Membrane Filtration
Fecal Coliform	MIC-93-7000	SM 9222 D	MF/INCUBATOR
Trace Organics Analysis			
Methylene Chloride	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
cis-1,2-Dichloroethylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Chloroform	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Benzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Trichloroethylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Toluene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Tetrachloroethene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
trans-1,3-Dichloropropene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Ethylbenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,1,2,2-Tetrachloroethane	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,2-Dichlorobenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
1,4-Dichlorobenzene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
m & p-Xylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
o-Xylene	VOL-91-5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
Xylenes (Total)	VOL-91-5001	modified from EPA 5030B & EPA 8260D	CALCULATION
Toluene-d8	VOL-91- 5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
4-Bromofluorobenzene	VOL-91- 5001	modified from EPA 5030B & EPA 8260D	(P&T)GC/MS
PCBs	ORG-91-5112	modified from EPA SW-846 3510C & 8082A	GC/ECD
Decachlorobiphenyl	ORG-91-5112	modified from EPA SW846 3510C & 8082A	GC/ECD
Di-n-butyl phthalate	ORG-91-5114	modified from EPA SW-846 3510C & 8270E	GC/MS
Bis(2-Ethylhexyl)phthalate	ORG-91-5114	modified from EPA SW-846 3510C & 8270E	GC/MS
2,4,6-Tribromophenol	ORG-91-5114	modified from EPA 3510C and EPA 8270E	GC/MS
2-Fluorophenol	ORG-91-5114	modified from EPA 3510C and EPA 8270E	GC/MS
Chrysene-d12	ORG-91-5114	modified from EPA 3510C and EPA 8270E	GC/MS
phenol-d6 surrogate	ORG-91-5114	modified from EPA 3510C and EPA 8270E	GC/MS

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Method Summary

CLIENT NAME: THURBER ENGINEERING LTD

AGAT WORK ORDER: 21T834299

PROJECT: 30427

ATTENTION TO: Cary Zanatta

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Biochemical Oxygen Demand, Carbonaceous	INOR-121-6023	SM 5210 B	INCUBATOR
pH	INOR-93-6000	modified from SM 4500-H+ B	PC TITRATE
Total Kjeldahl Nitrogen	INOR-93-6048	modified from EPA 351.2 and SM 4500-NORG D	LACHAT FIA
Phenols	INOR-93-6072	modified from SM 5530 D	LACHAT FIA
Total Phosphorus	INOR-93-6022	modified from SM 4500-P B and SM 4500-P E	SPECTROPHOTOMETER
Total Suspended Solids	INOR-93-6028	modified from EPA 1684,ON MOECC E3139,SM 2540C,D	BALANCE
Total Cyanide	INOR-93-6051	modified from MOECC E3015; SM 4500-CN- A, B, & C	TECHNICON AUTO ANALYZER
Total Arsenic	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Cadmium	MET -93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Chromium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Copper	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Lead	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Manganese	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Mercury	MET-93-6100	modified from EPA 245.2 and SM 3112 B	CVAAS
Total Nickel	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Selenium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Silver	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Zinc	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS

AGAT Laboratories

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Laboratory Use Only

Work Order #: 21T834299.

Cooler Quantity:

Arrival Temperatures: 11.6 | 11.5 | 11.4
6.6 | 9.9 | 9.1

Custody Seal Intact: ☐ Yes ☐ No ☐ N/A

Notes: ICE PACK

Report Information:

Company: Thurber Engineering
Contact: Cory Zanatta
Address: 2010 Winston Park Drive

Phone: 905-829-8666 Fax:

Reports to be sent to:
1. Email: czanatta@thurber.ca
2. Email:

Project Information:

Project: 30427
Site Location:
Sampled By:
AGAT Quote #: PO:

Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☑ No ☐

Company:
Contact:
Address:
Email:

Regulatory Requirements:

(Please check all applicable boxes)

☐ Regulation 153/04
Table (Indicate One) ☐ Ind/Com ☐ Res/Park ☐ Agriculture
Soil Texture (Check One) ☐ Coarse ☐ Fine

☐ Excess Soils R406
Table (Indicate One)

☐ Regulation 558

☐ CCME

☑ Sewer Use ☐ Sanitary ☑ Storm
Peel (Region)

☐ Prov. Water Quality Objectives (PWQO)

☐ Other
(Indicate One)

Is this submission for a **Record of Site Condition?** ☐ Yes ☐ No

Report Guideline on *Certificate of Analysis* ☐ Yes ☐ No

Turnaround Time (TAT) Required:

Regular TAT ☑ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day

OR Date Required (Rush Surcharges May Apply):

Please provide prior notification for rush TAT
*TAT is exclusive of weekends and statutory holidays

For 'Same Day' analysis, please contact your AGAT CPM

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI, DOC (Y/N)	O. Reg 153: Metals & Inorganics	O. Reg 153: Metals - ☐ CrVI, ☐ Hg, ☐ HWSB	O. Reg 153: BTEX, F1-F4 PHCs Analyze F4G if required ☐ Yes ☐ No	O. Reg 153: PAHs	O. Reg 153: PCBs	O. Reg 153: VOC	O. Reg 558: Landfill Disposal Characterization TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	O. Reg 406: Excess Soils SPLP Rainwater Leach SPLP: ☐ Metals ☐ VOCs ☐ SVOCs	O. Reg 406: Excess Soils Characterization Package pH, ICPMS Metals, BTEX, F1-F4	Salt - EC/SAR	Region of Peel Storm Sewer	Potentially Hazardous or High Concentration (Y/N)
EA-05	Nov 23/21	AM/PM															✓	
EA-05 F	Nov 23/21	AM/PM																
		AM/PM																
		AM/PM																
		AM/PM																
		AM/PM																
		AM/PM																
		AM/PM																
		AM/PM																
		AM/PM																
		AM/PM																

Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
				11/24/21	9:35
	11/24/21	11:00			

Page 1 of 1

Nº: T 126261

Pink Copy - Client | Yellow Copy - AGAT | White Copy- AGAT

Date Issued: March 9, 2021

THURBER

Appendix E

Single Well Response Test Analyses

THURBER ENGINEERING LTD.

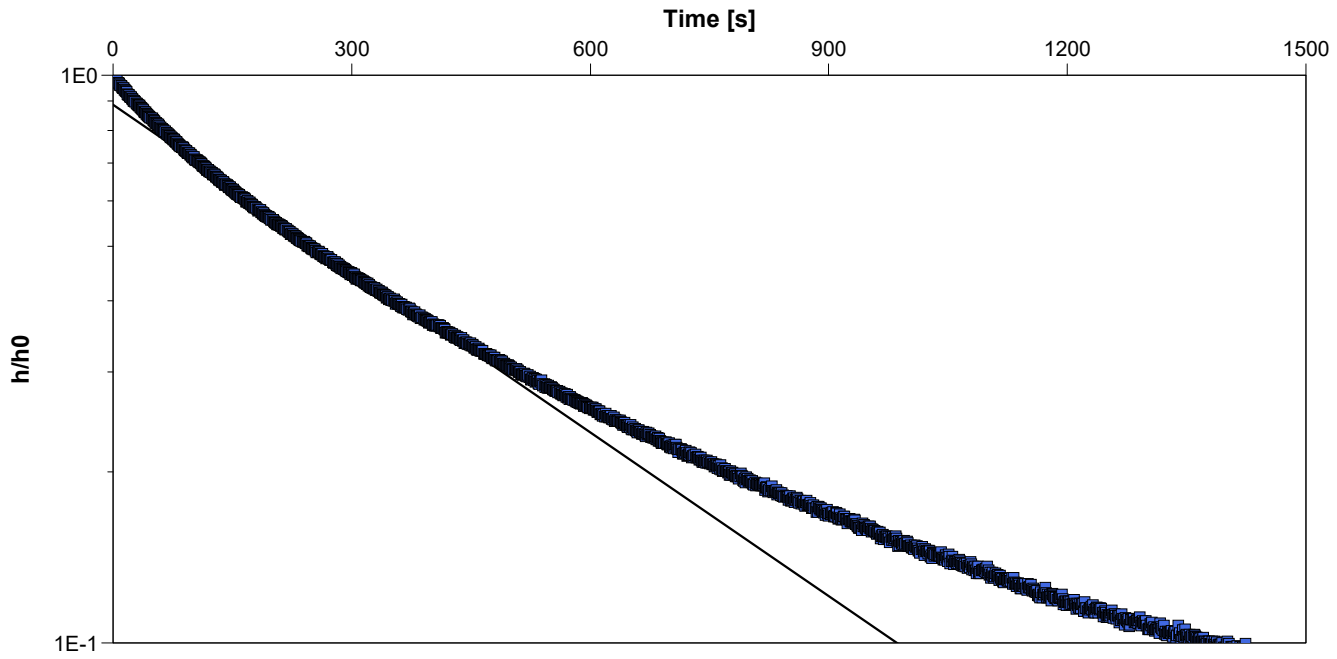
Slug Test Analysis Report

Project: Clark Boulevard Extension

Number: 30427

Client: HDR

Location: Brampton, Ontario	Slug Test: BR-03	Test Well: BR-03
Test Conducted by: RB		Test Date: 2021-11-04
Analysis Performed by: PC	BR-03 SWRT Analysis	Analysis Date: 2022-01-06
Aquifer Thickness:		
Checked by:		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
BR-03	1.9×10^{-6}	

Monitoring well screened within sandy silt till.

Rising Head Test

THURBER ENGINEERING LTD.

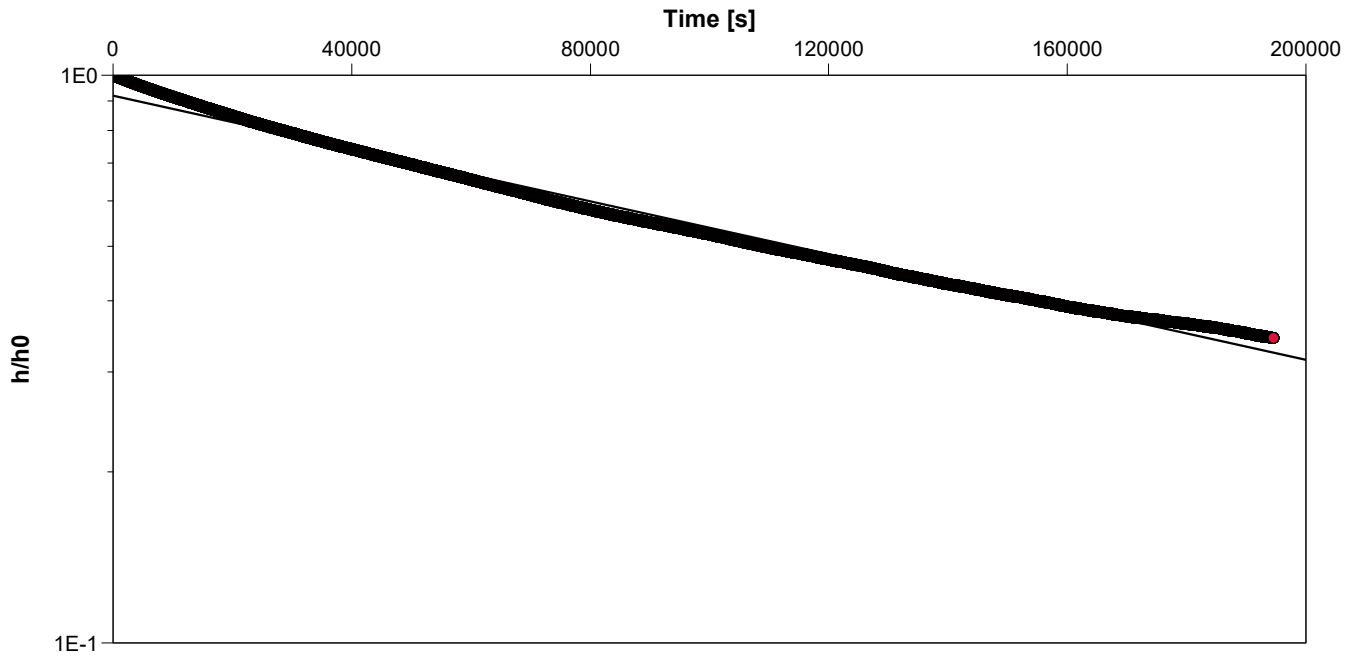
Slug Test Analysis Report

Project: Clark Boulevard Extension

Number: 30427

Client: HDR

Location: Brampton, Ontario	Slug Test: EA-05A	Test Well: EA-05A
Test Conducted by: RB		Test Date: 2021-11-04
Analysis Performed by: PC	EA-05A SWRT Analysis	Analysis Date: 2022-01-06
Aquifer Thickness:		
Checked by:		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
EA-05A	4.6×10^{-9}	

Monitoring well screened within silty clay.

Rising Head Test

THURBER ENGINEERING LTD.

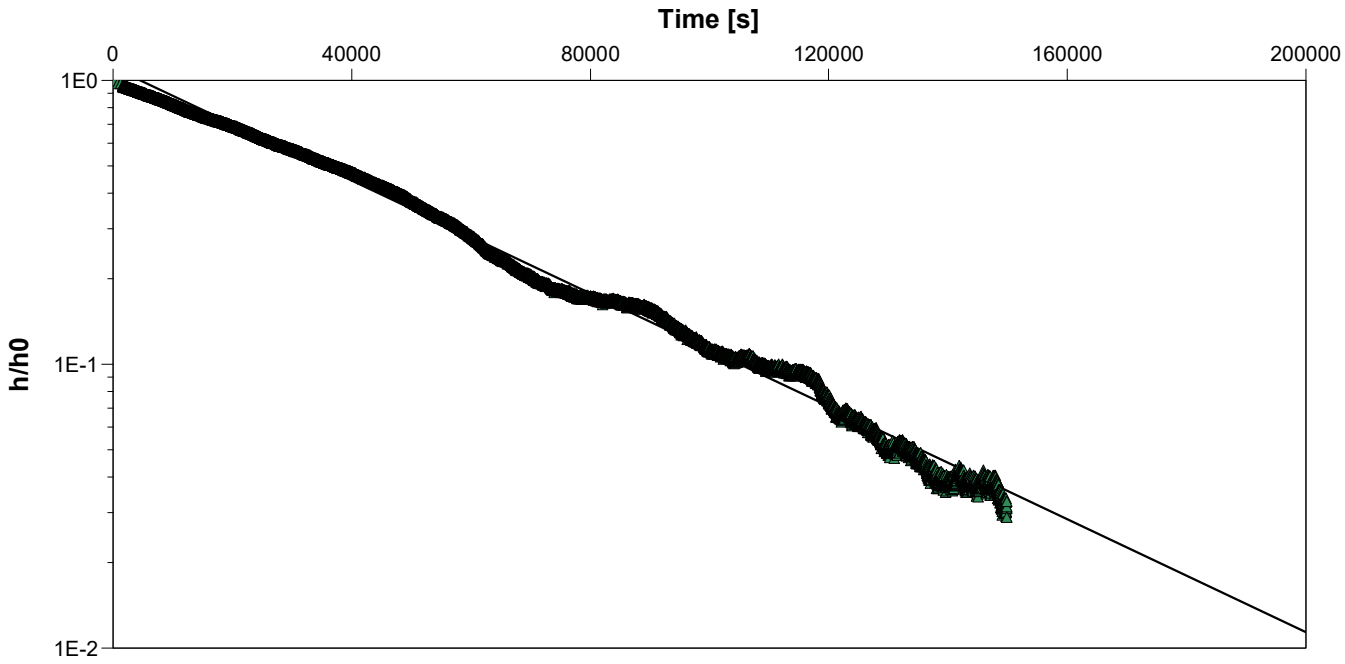
Slug Test Analysis Report

Project: Clark Boulevard Extension

Number: 30427

Client: HDR

Location: Brampton	Slug Test: BR-03	Test Well: BR-04
Test Conducted by: RB		Test Date: 2021-11-04
Analysis Performed by: CZ	BR-04	Analysis Date: 2022-01-14
Aquifer Thickness:		



Calculation using Hvorslev

Observation Well	Hydraulic Conductivity [m/s]	
BR-04	2.00×10^{-8}	

THURBER

Appendix F

Preliminary Dewatering Estimates

Dewatering Calculations for Unconfined Scenarios

Parameter	Units	Box culvert crossing structure and channel realignment
Geologic Unit to Dewater		Silty clay fill, silt and silt till, and possible sand layers
Input Hydraulic Conductivity in m/s (K)	m/s	1.9E-06
Hydraulic Conductivity converted to m/day	m/day	0.2
Input height of groundwater pressure (H)	m	4.73
Input dewatering height (h)	m	3.0
Input length of excavation (x, a)	m	60
Input width of excavation (b)	m	15
Input/calculate radius of trench (r_w or r_s)	m	7.5
Length to width ratio	unitless	4.0
Net water table lowering	m	1.73
Equation Type		Trench
Radii of Influence		
Sichardt Equation (Ro based on K, H, h)	m	7
Ro = Sichardt + (rw or rs)	**m**	**15**
Calculated Flow Rate		
Base groundwater flow	**L/day**	**19,000**
Partial Penetration Factor	unitless	1.00
Safety factor on groundwater flow	unitless	3
Groundwater flow with safety factor	L/day	57,000
Rainfall entering excavation	mm	-
Duration to remove rainfall	hours	-
Flow rate to remove rainfall	L/day	-
Budgeted peak flow rate	**L/day**	**57,000**
=	L/s	0.7
=	gal/min	9

Flow rate estimates rounded to nearest 1,000 L/day.