Terra-Dynamics Consulting Inc.
432 Niagara Street, Unit 2 St. Catharines, ON L2M 4W3

October 18, 2021

Mr. Darko Vranich
Burlington 2020 Lakeshore Inc.
366 King Street West
Hamilton, Ontario L8P 1B3

Re: Hydrogeological Dewatering Assessment –
Proposed Residential Development, 2020 Lakeshore Road, Burlington, ON

Dear Mr. Vranich,

1.0 Introduction, Background Information and Purpose

Terra-Dynamics Consulting Inc. respectfully submits this Dewatering Assessment for 2020 Lakeshore Road, Burlington (Site, Figure 1). It is our understanding that a residential building approximately 30 to 40 stories in height, with up to four underground parking levels are to be constructed at the Site (Figure 2). Construction of the basement parking levels will be below (i) the high-water level mark of Lake Ontario at Burlington by approximately 6.8 m, and (ii) the groundwater level in the underlying shale bedrock. The area is municipally serviced for water and sanitary services.

2.0 Methodology

The following methodologies were used to investigate the Site:

A. Submission to the City of Burlington, and acceptance, of a Hydrogeological Dewatering Assessment Terms of Reference (Appendix A).

B. Assessment of regional information including topography, overburden and bedrock.

C. Review of the Soil-Mat Engineers & Consultants Ltd. (Soil-Mat) (2021) geotechnical report and adjacent technical studies.

D. Investigation of Site conditions through monitoring well hydraulic conductivity testing, water level measurements and groundwater quality monitoring.

E. Preparation of a description of the hydrogeological setting using the geotechnical/geological information, water levels and *in-situ* hydraulic conductivity testing.

F. Groundwater Dewatering Assessment.

3.0 Physical Setting

The Site is fairly flat, with topography ranging from 83 to 81 metres above sea level (m ASL), sloping from the northwest to the southeast towards Lake Ontario (City of Burlington, 2020). The Site is an existing hotel with a parking lot within a municipally serviced area. The closest surface waterbody is

Lake Ontario, 50 metres to the south and east of the Site (Figure 2). The high-water level reported by the Department of Fisheries and Oceans is 75.5 metres above sea level (mASL) at the Burlington Station on Lake Ontario (DFO, 2021). The Site is located within the Halton Region Conservation Authority watershed with regulation limits mapped at the Site because of potential erosion hazard associated with the Lake Ontario shoreline.

3.1 Geology

In April, 2021, seven boreholes and monitoring wells into bedrock were completed under the supervision of Soil-Mat Engineers & Consultants Ltd. (Figure 2, Soil-Mat, 2021, Appendix B). Although the regional surficial geology is mapped as sand (Ontario Geological Survey (OGS), 2003), sand was not identified at the Site. The overburden noted in the boreholes was silty clay/clayey silt fill, with some areas of native silty clay/clayey silt beneath the fill as shown on the geologic cross-sections (Figures 3, 4 and 5). The thickness of overburden increases towards Lake Ontario from 2 metres near Lakeshore Road to 7 metres along the southeastern boundary of the Site (Figure 5).

The bedrock is the Queenston Formation, comprised of shales with minor interbeds of siltstones and limestones averaging 100 m in thickness (Singer et al, 2003) and extending further than 200 metres radially from the Site (OGS, 2011). The top of bedrock dips towards the southeast (i.e. towards Lake Ontario) from 79 to 75 m ASL (Figure 2).

Bedrock boreholes were constructed by one of two methods:

A. Boreholes BH2, BH3, BH5 and BH6 were constructed using HQ coring; and
B. Boreholes BH1, BH4 and BH7 were constructed using solid stem augers.

Boreholes were extended to various depths to characterize bedrock conditions (Figures 3, 4 and 5) and were classified herein as shallow (-S), intermediate (-I) or deep (-D) relative to their depth in the bedrock. However, monitoring well BH7-S was also screened across the overlying silty clay/clayey silt and the Queenston Shale bedrock.

3.2 Groundwater Levels

Manual groundwater levels were measured in May and June, 2021 (Table 1). Groundwater levels from June 15, 2021 are most representative of groundwater conditions (Figure 2), as earlier groundwater levels were measured before development of the monitoring wells was completed. Well development was completed as part of hydraulic conductivity testing at the monitoring wells (Section 3.3). Monitoring well BH1-S was dry during each site visit.

Bedrock groundwater levels transition across the Site from being '*unconfined*' in the bedrock along Lakeshore Road (i.e. monitoring wells BH2-I, BH3-I and BH4-S, Figure 4), to being '*confined*' with groundwater levels above the top of bedrock closer to Lake Ontario at monitoring wells BH5-D, BH6-I and BH7-S (Figure 3). This transition from unconfined to confined conditions is shown on cross-section C-C' (Figure 5). This is primarily a reflection of the depth to the bedrock being greater near Lake Ontario not a steep change in water level elevations across the Site. While groundwater levels on June 15, 2021 varied from 73.78-76.27 m ASL, if one excludes shallow monitor BH4-S, the intermediate and deep groundwater levels varied 1.1 metres. The average Lake Ontario water level was 74.75 mASL on June

15, 2021 very similar to the elevations at BH7-S and BH5-D, which are the groundwater monitors closest to Lake Ontario.

Vertical gradients were calculated at two locations, BH4-S/BH3-I and BH6-I/BH5-D. A downward vertical gradient is calculated from the shallow to the intermediate bedrock system at the northeast corner of the Site (BH4-S/BH3-I) of 0.39 m/m. An upward vertical gradient from the deep to the intermediate system (BH6-I/BH5-D) was calculated of 0.08 m/m. This upward vertical gradient indicates the potential for groundwater inflow to the excavation through the base of the excavation as well as the sides (horizontally) in the bedrock.

3.3 Bedrock Hydraulic Conductivity Analyses

Hydraulic conductivity testing of bedrock monitoring wells BH2 through BH7 was completed June 8, 2021 using a bail-down approach after the wells were developed. The test results were analyzed using Hvorslev (1951), or a Bouwer and Rice analysis (Bouwer, 1989) as recommended when the water level is within the screen (Bair, 2005). The analyses were completed in Aqtesolv™ and the results summarized in Table 2 with analyses presented in Appendix C.

There was considerable variation in the hydraulic conductivity testing results, ranging from 10^{-6} to 10^{-9} m/s, with a geometric mean value of $2x10^{-7}$ m/s, and values were lower than published values for weathered shale at 10^{-5} m/s (MECP, 2006). The highest hydraulic conductivity was noted for the deepest monitoring well (BH5-D) which also has an upward gradient (Section 3.2).

Testing of shale bedrock hydraulic conductivities immediately to the northeast of the Site also showed a wide range of hydraulic conductivities from 10^{-6} to 10^{-8} m/s (Peto MacCallum Limited, 2014).

Table 2 – Shale Hydraulic Conductivities

Location	Hydraulic Conductivity (m/s)	Screened Depth (m BGS*)	Screened Depth (m ASL)	Comments
BH2-I	$8x10^{-7}$	14.1-17.1	68.6-65.6	
BH3-I	$8x10^{-7}$	12.1-15.1	70.9-67.9	
BH4-S	$8x10^{-9}$	4.6-7.6	78.2-75.2	Water level within screen
BH5-D	$3x10^{-6}$	17.1-20.1	64.2-61.2	Highest value on-site
BH6-I	$7x10^{-9}$	12.6-15.6	68.5-65.5	
BH7-S	$6x10^{-7}$	4.6-7.6	74.2-71.2	

Note: BGS* - Below ground surface

3.4 Overburden Hydraulic Conductivity

If groundwater is present in the overburden very little contribution to dewatering is expected as the hydraulic conductivity is expected to be ~10^{-8} m/s (MECP, 2006) and bedrock water levels were only modestly above the top of bedrock along the southeast boundary (Figures 3 and 5). Consequently, overburden monitoring wells were not warranted.

3.5 Groundwater Quality Analyses

Groundwater quality samples were collected from monitoring wells (BH2-I, BH5-D, BH6-I and BH7-S, Figure 2) for chemical analyses. The results were compared to the (i) Region of Halton Sanitary Sewer By-law Discharge Limits (Region of Halton, 2003) and the (ii) City of Burlington DRAFT Storm Sewer Discharge Limits (City of Burlington, 2019). There are no provincial water quality critieria relevant to this hydrogeologic dewatering assessment. These four monitoring wells were chosen to represent conditions at various depths around the Site. The water quality results are summarized on Table 2 and the laboratory report in Appendix D.

Draft City of Burlington Storm Sewer Discharge Limits were exceeded for a number of parameters:

1. Biological oxygen demand (BH6-I),
2. 4AAP-Phenolics, (BH5-D and BH6-I),
3. Manganese (all locations),
4. Zinc (BH5-D),
5. Chloroform (BH6-I), and
6. Nonylphenol (BH5-D, BH6-I and BH7-S).

The elevated manganese concentrations (0.20-0.33 mg/L, Table 2) measured at all locations are considered natural/ambient for the Queenston Shale (Golder, 2006). It is our understanding the manganese can be reasonably treated for removal through chlorination, aeration and sedimentation (Tchobangoglous and Schroeder, 1987). However it is unclear if the other exceedances are natural or consistent concentrations, consequently additional groundwater sampling would be required to confirm.

Although the Region of Halton Sanitary Sewer By-law Discharge Limits were only exceeded for the total suspended solids (TSS) criterion at one location (BH7-S) and TSS can likely be addressed with filtration and/or settling of the future dewatering discharge, as well as dilution via other groundwater at the Site with lower total suspended solids, the Region of Halton does not allow construction dewatering water to be directed to the sanitary sewer (Region of Halton, 2021).

3.6 Hydrogeologic Setting

The overburden at the Site is not expected to contribute significantly to dewatering having a low hydraulic conductivity (Section 3.3) and may function as an aquitard. Consequently, if the overburden is saturated, this unit may increase dewatering volumes somewhat but volumes are expected to be small given the limited saturated thickness of the overburden along the southeast portion of the Site and low hydraulic conductivity (Section 3.2).

The upper shale bedrock is dry closer to Lakeshore Road (unconfined) with the water table above the top of bedrock (confined) at Lake Ontario. Although the hydraulic conductivities of the shale were generally low, the higher hydraulic conductivity at BH5-D of 10^{-6} m/s does not represent a low permeability unit (MECP, 2008) and an upward gradient was observed relative to BH6-I. Given this information, groundwater contribution to dewatering will include both (i) a rate per metre depth and (ii) from the base of the excavation.

4.0 Groundwater Dewatering Assessment

To estimate dewatering flow rates to drain the excavation for construction of underground parking, analytical equations for radial flow to both (a) a mixed, and (b) water table aquifers were used from Powers et al (2007) and a radius of influence calculation from Cashman and Preene (2021).

4.1 Horizontal Groundwater Inflow

The daily *horizontal* flow rate was calculated as between 16,953 to 26,440 L/day (Tables D-1 and D-2, Appendix E) based upon the following conservative assumptions which incorporate a number of safety factors:

1. Water level of 75.5 m ASL (representing the Lake Ontario high-water level as a substitution for March/April seasonally high water levels) above the base of excavation at 68.7 m ASL;
2. Hydraulic conductivity of $2x10^{-7}$ m/s, the geometric mean for the Site;
3. Rectangular excavation was modelled as two circular systems with some overlap;
4. Dewatering reaches equilibrium conditions after 2 weeks, at an average rate of between 12 to 18 Litres per minute (2.6 to 4.0 Imperial gallons per minute)

The range in horizontal discharge rate reflects the changing conditions across the Site from the groundwater level being within the bedrock along the northwest boundary (unconfined conditions, Table D-2) to above the top of bedrock closer to Lake Ontario (confined conditions, Table D-1). After a year, daily horizontal flow rates are calculated as less than 4,000 L/day (Tables D-3 and D-4, Appendix E).

4.2 Vertical Groundwater Inflow

There is also potential for vertical groundwater inflow through the base of the excavation. This is indicated by an upwards gradient in comparison of water levels at BH6-I and BH5-D (Section 3.2). However, this potential is associated with the deeper portions of the excavation, as the upper shallow bedrock along Lakeshore Road, showed a downward vertical gradient at BH4-S and BH3-I (Section 3.2).

The amount of vertical groundwater inflow was calculated as 10,578 L/day, based upon [*equation 1*].

$$Q=KiA \quad [\textit{equation 1}]$$

where Q=groundwater inflow, K=Hydraulic Conductivity ($2x10^{-7}$ m/s), i=vertical gradient (0.08 m/m) and A=Area of base of excavation (7,652 m^2)

4.3 Ministry of the Environment, Conservation & Parks (MECP) Permit to Take Water (PTTW) and Environment Activity and Sector Registry (EASR)

Construction dewatering upon full excavation is expected to be initially 37,018 L/day based upon a horizontal groundwater inflow of 26,440 L/day and a vertical groundwater inflow of 10,578 L/day and subsequently decline. Consequently, a Ministry of the Environment, Conservation & Parks (MECP) Environmental Activity and Sector Registry (EASR) temporary 'Construction Site Dewatering' approval is not required for Site dewatering with a dewatering rate less than 50,000 L/day (MECP, 2021). Groundwater

infiltration should be adequately controlled using construction dewatering techniques such as pumping from sumps in the base of the excavation (Preene, 2020).

4.4 Zone of Influence

The radial dewatering zone of influence was calculated as less than 50 metres from the excavation after 2 weeks of dewatering a full excavation (Tables D-1 and D-2, Appendix E). If dewatering of the full excavation continued for a year, the drawdown at 50 metres from the excavation is calculated as 1 m through extrapolation of the Cooper-Jacoub radius of influence (Tables D-3 and D-4, Appendix E). However, this a conservative value as it does not include precipitation.

Minimal risk of overburden settlement/damage is anticipated given water levels are already within the bedrock except adjacent Lake Ontario, and construction dewatering through the shale should not dewater Lake Ontario where the overburden is thicker.

5.0 Conclusions

The following conclusions are provided:

1. Groundwater levels at the Site were both within (unconfined conditions), and above the shale bedrock (unconfined conditions). Hydraulic conductivity values showed variation across the site and at depth similar to conditions to the northwest, where tested;

2. Construction dewatering for underground construction does not require an EASR from the MECP to dewater the shale bedrock to the proposed excavation depth;

3. The groundwater quality parameter of managanese is naturally occurring within the shale bedrock. Concentrations of manganese exceed the Draft City of Burlington Storm Sewer Water Quality Criteria and will require treatment for discharge to the storm sewer. A limited number of other parameters may also exceed the criteria;

4. The Region of Halton does not allow discharge of dewatering waters to their sanitary sewers; and

5. No negative effects to private wells or watercourses are expected from construction dewatering operations.

6.0 Recommendations

The following recommendations are provided:

1. Monitoring wells should be resampled for laboratory water quality analyses to confirm if any parameters except manganese require treatment for discharge of dewatering waters to the City of Burlington storm sewer;

2. Underground construction should be completed in a waterproof manner to prevent the need for permanent dewatering water treatment; and

3. Soil-Mat Engineers & Consultants Ltd. should evaluate the potential for base instability from buoyancy uplift associated with the upward gradient at the base of the excavation.

7.0 Limitations

Subsurface dewatering assessments, by their nature, have inherent limitations and uncertainties primarily due to the heterogeneities in geologic conditions causing differences in hydraulic conductivity and hydraulic gradients in areas of a site not investigated by boreholes and/or monitoring wells. It is believed that these uncertainties have been addressed through interpretation of other existing regional-based geologic conditions and site-specific data at the places investigated, e.g. the geometric mean hydraulic conductivity was used rather than the highest hydraulic conductivity measured. Conditions may vary in the subsurface at places not investigated. The assessment of dewatering potential, including the evaluation of risk and/or impact, is valid only for the assumptions and conditions outlined in this report and the conditions as they were observed at the time of the investigation. Should knowledge of the site conditions change, the assessments of risks posed by the site may differ from that presented in this report.

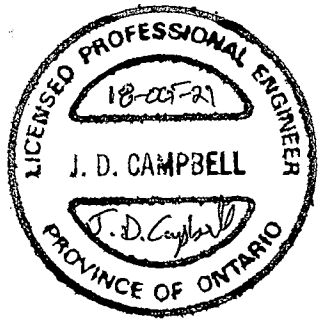
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We trust this information is sufficient. Please do not hesitate to contact us if you have any questions or require additional information for your review.

Yours truly,

TERRA-DYNAMICS CONSULTING INC.

Jayme D. Campbell, P.Eng.
Senior Water Resource Engineer



Attachments
Figure 1 Location of Subject Lands
Figure 2 Site Details
Figure 3 Hydrogeologic Cross-section A-A'
Figure 4 Hydrogeologic Cross-section B-B'

Figure 5 Hydrogeologic Cross-section C-C'
Table 1 Manual Groundwater Level Measurements
Table 2 Groundwater Quality Sample results
Appendix A Terms of Reference
Appendix B Monitoring Well logs
Appendix C Hydraulic Conductivity Analyses
Appendix D Water Quality Analyses
Appendix E Dewatering Calculations

cc. Peter Horn, Horn Design & Consulting Inc.
Stephen Sears and Yaroslav Mormil, Soil-Mat Engineers & Consultants Ltd

8.0 References

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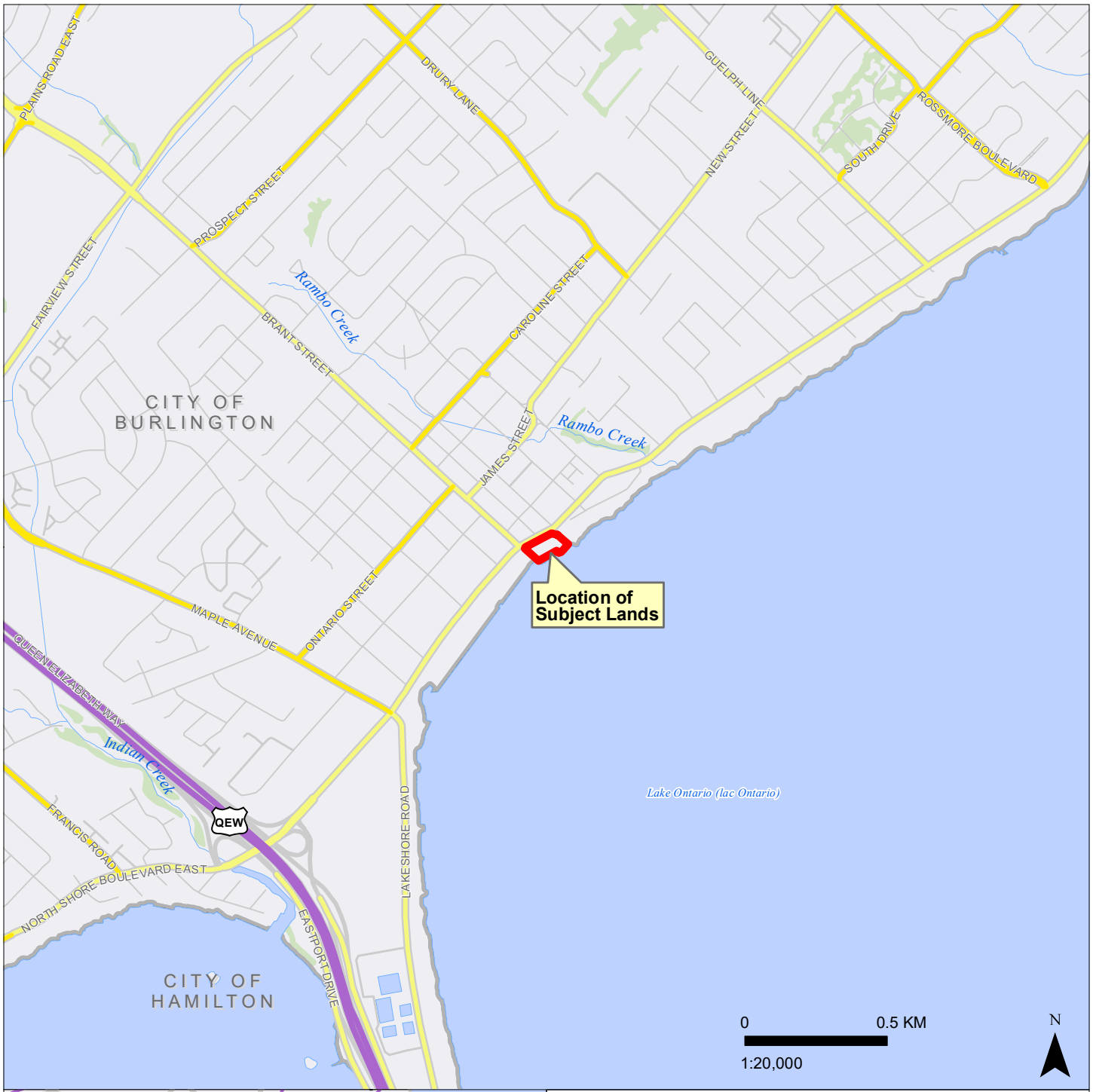
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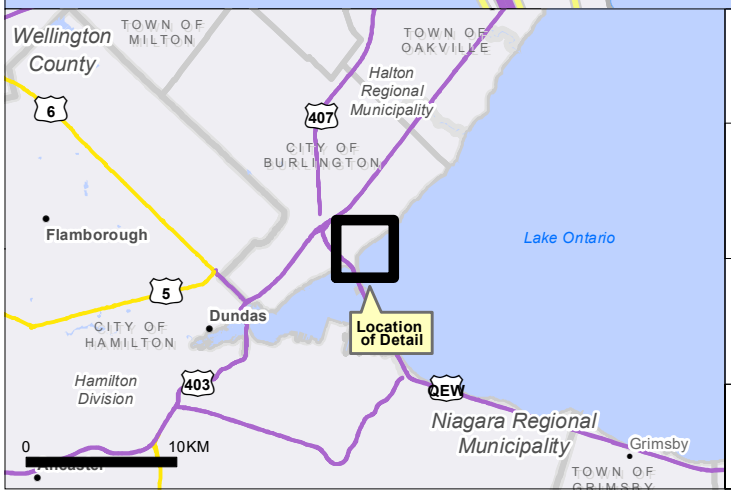
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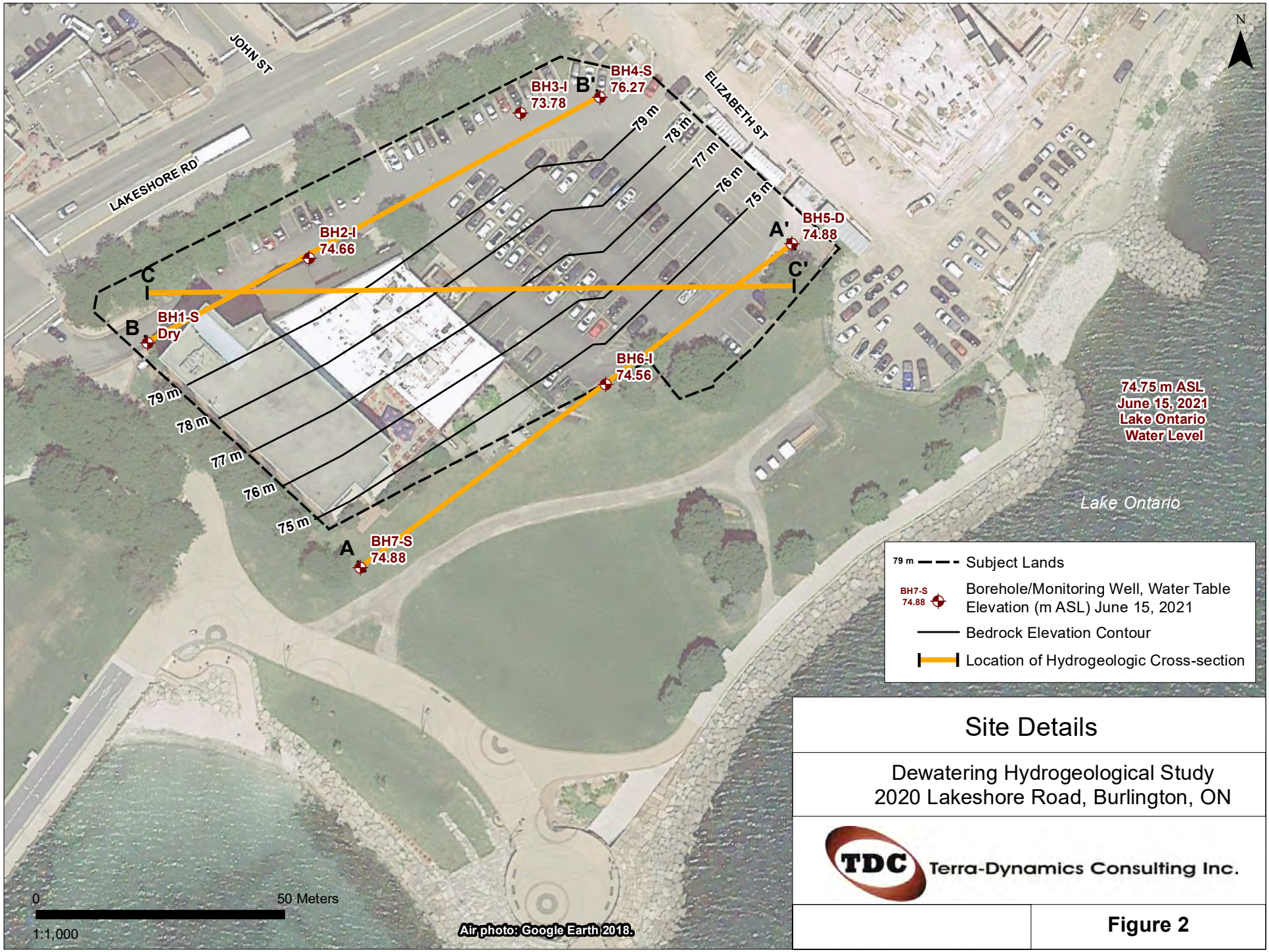
Location of Subject Lands

Dewatering Hydrogeological Study
2020 Lakeshore Road, Burlington, ON

TDC Terra-Dynamics Consulting Inc.

Figure 1

Path: H:\TERRA_DYNAMICS\9447 - TD ___ 2020 Lakeshore Road\gis\mxd\Figure 1 Location of Subject Lands.mxd Revised: June 25, 2021



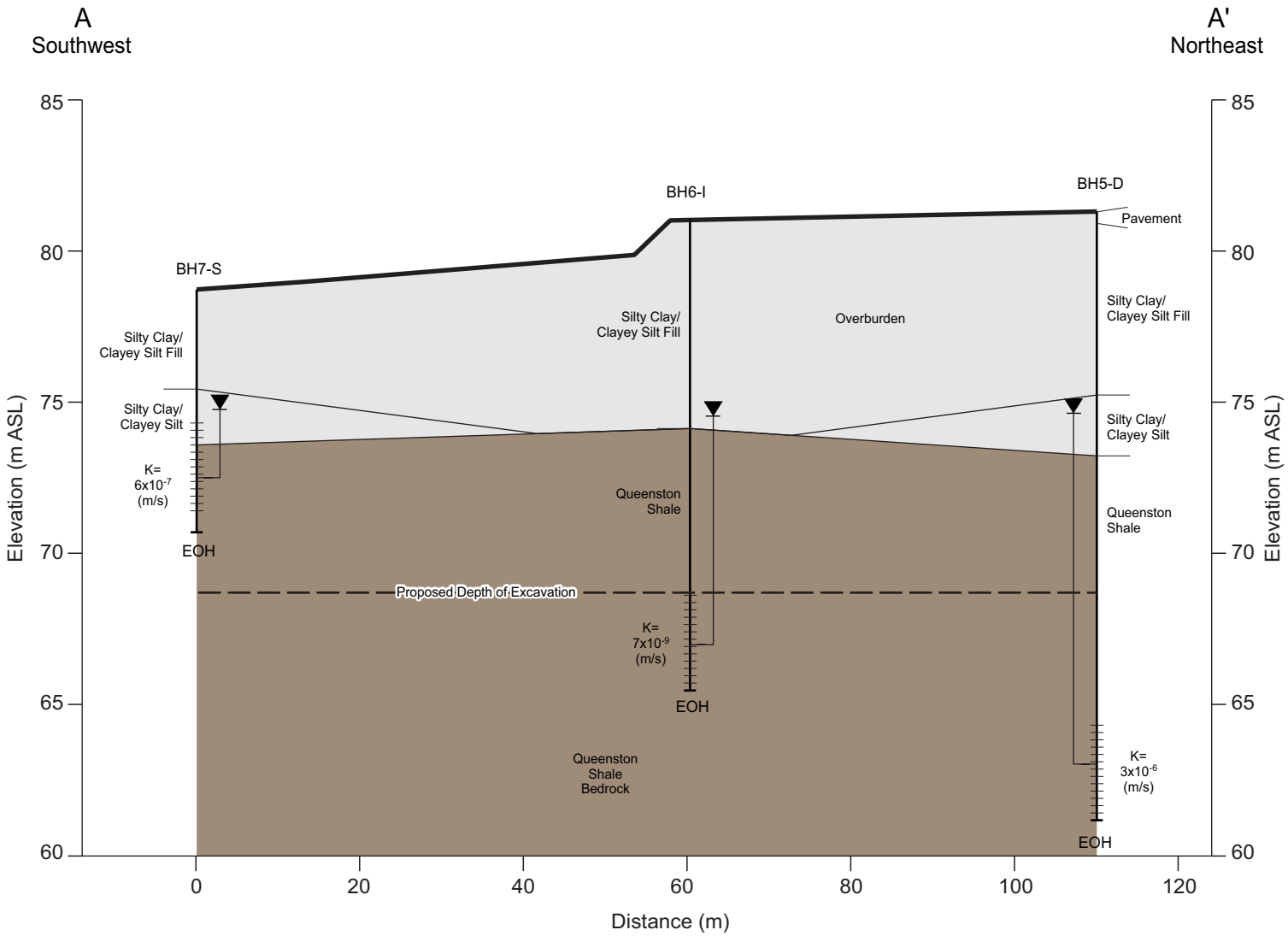
Site Details

Dewatering Hydrogeological Study
2020 Lakeshore Road, Burlington, ON

TDC Terra-Dynamics Consulting Inc.

Figure 2

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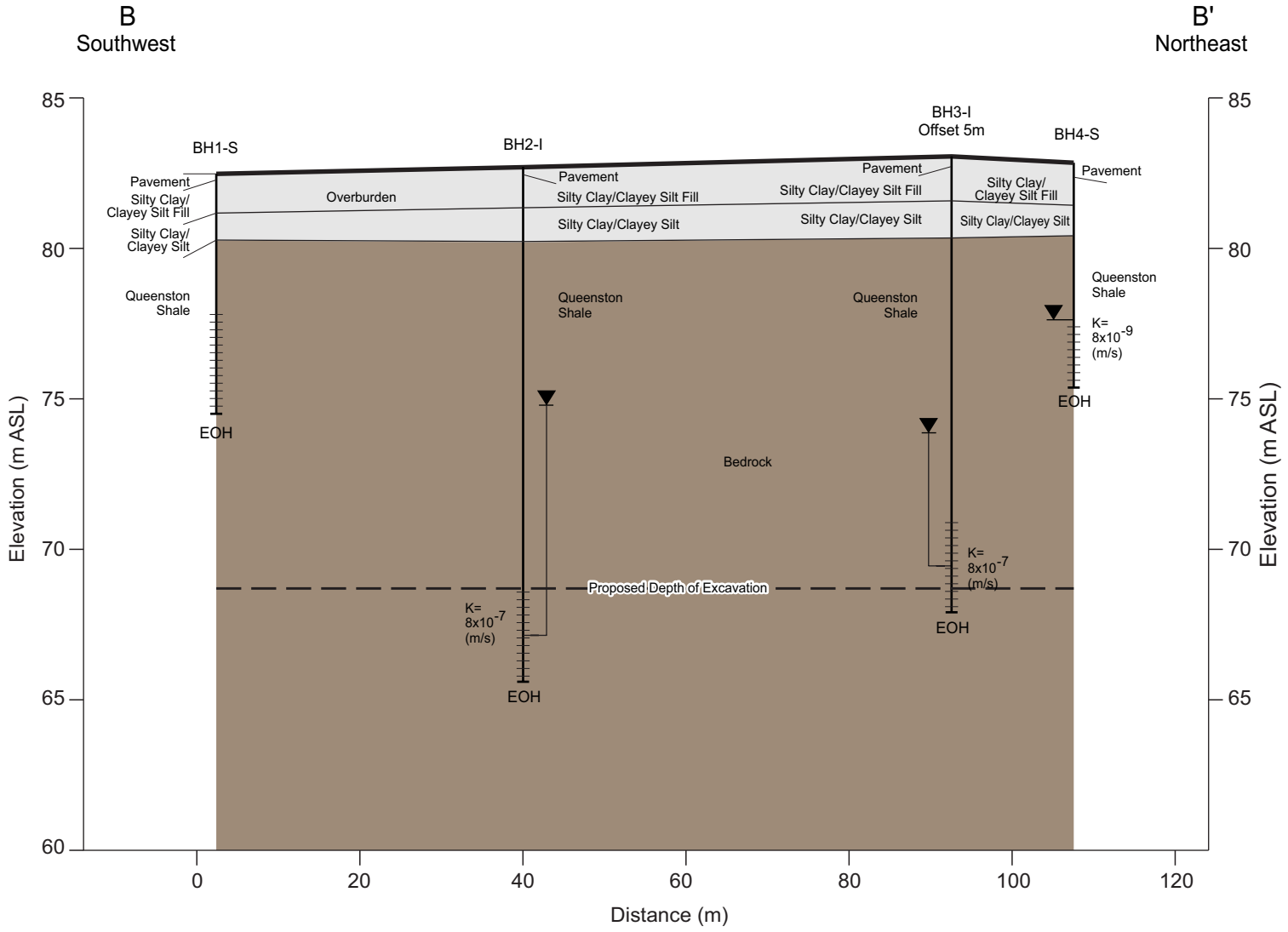
- Water Level June 15, 2021 mASL
- Well Screen
- EOH End of Hole
- K= 3x10-7 Hydraulic Conductivity (m/s)
- Overburden
- Queenston Shale Bedrock

Hydrogeologic Cross-section A-A'

Dewatering Hydrogeological Study
2020 Lakeshore Road, Burlington, ON

Terra-Dynamics Consulting Inc.

Figure 3



▼ Water Level June 15, 2021 mASL

Well Screen

EOH End of Hole

K= $3x10^{-7}$ Hydraulic Conductivity (m/s)

Overburden

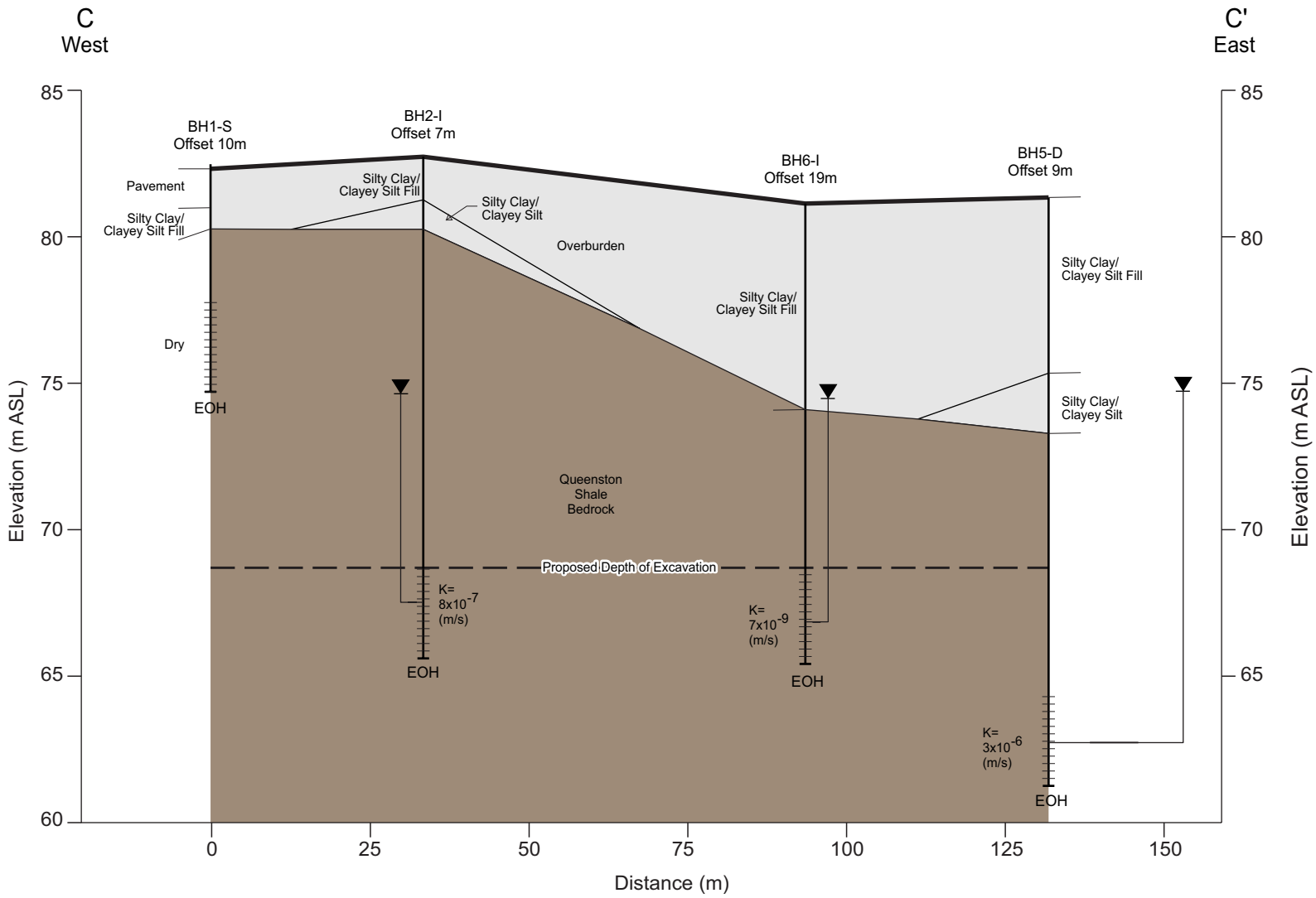
Queenston Shale Bedrock

Hydrogeologic Cross-section B-B'

Dewatering Hydrogeological Study
2020 Lakeshore Road, Burlington, ON

Terra-Dynamics Consulting Inc.

Figure 4



- Water Level June 15, 2021 mASL
- Well Screen
- EOH End of Hole
- K= $3x10^{-7}$ Hydraulic Conductivity (m/s)
- Overburden
- Queenston Shale Bedrock

Hydrogeologic Cross-section C-C'

Dewatering Hydrogeological Study
2020 Lakeshore Road, Burlington, ON

Terra-Dynamics Consulting Inc.

Figure 5

Table 1
Manual Groundwater Level Measurements

Well I.D.	Ground Elevation (m ASL)	Stick-Up (m)	TOC Elevation (m ASL)	Well Depth Elevation (m ASL)	Well Depth below ground (m)	Depth to Shale (m)	Top of Shale Elevation (m ASL)	Date	Water level (m below TOC)	Water Level below ground (m)	Water Level Elevation (m ASL)
BH1-S	82.38	0.00	82.38	74.78	7.60	2.1	80.25	26-May-21	Dry	Dry	Dry
								08-Jun-21	Dry	Dry	Dry
BH2-I	82.73	-0.14	82.59	65.63	17.10	2.4	80.29	26-May-21	8.31	8.17	74.56
								08-Jun-21	7.97	8.11	74.62
								15-Jun-21	7.93	8.07	74.66
BH3-I	82.97	-0.19	82.78	67.86	15.11	2.8	80.21	26-May-21	9.00	8.81	74.16
								08-Jun-21	8.57	8.76	74.21
								15-Jun-21	9.00	9.19	73.78
BH4-S	82.77	-0.16	82.62	75.17	7.60	2.4	80.38	26-May-21	6.59	6.43	76.34
								08-Jun-21	6.06	6.22	76.55
								15-Jun-21	6.35	6.51	76.27
BH5-D	81.29	-0.13	81.16	61.19	20.10	7.9	73.37	26-May-21	6.38	6.25	75.04
								08-Jun-21	6.24	6.36	74.93
								15-Jun-21	6.28	6.41	74.88
BH6-I	81.11	-0.13	80.98	65.51	15.60	7.0	74.11	26-May-21	6.62	6.49	74.62
								08-Jun-21	6.30	6.43	74.68
								15-Jun-21	6.42	6.55	74.56
BH7-S	78.75	-0.16	78.59	71.15	7.60	5.2	73.57	26-May-21	4.03	3.87	74.88
								08-Jun-21	3.68	3.83	74.92
								15-Jun-21	3.71	3.87	74.88

Sample ID		Halton Sanitary Sewer By-law Limits	Burlington Storm Sewer Discharge Limits	BH2-I	BH5-D	BH6-I	BH7-S
Sample Date/Time				15-Jun-21 10:45	15-Jun-21 09:10	15-Jun-21 09:43	15-Jun-21 10:20
Analysis							
E. Coli	cfu/100mL	---		< 2	1140	2	20
pH	No unit	6.0-10.0	6.5-8.5	8.08	7.79	8.06	7.96
Biochemical Oxygen Demand (BOD5)	mg/L	300	15	< 4	12	**30**	< 4
Total Suspended Solids	mg/L	350	---	28	196	19	**1970**
Oil & Grease (total)	mg/L	---	---	< 2	< 2	< 2	< 2
Oil & Grease (animal/vegetable)	mg/L	150	---	< 4	< 4	< 4	< 4
Oil & Grease (mineral/synthetic)	mg/L	15	---	< 4	< 4	< 4	< 4
4AAP-Phenolics	mg/L	1	0.008	< 0.002	**0.011**	**0.011**	< 0.002
Total Kjeldahl Nitrogen	as N mg/L	100	---	2.1	4.5	4.8	1.3
Cyanide (total)	mg/L	2	0.02	< 0.01	< 0.01	< 0.01	< 0.01
Fluoride	mg/L	10	---	0.27	0.10	0.64	0.87
Sulphate	mg/L	1500	---	230	720	810	58
Mercury (total)	mg/L	0.05	0.0004	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Aluminum (total)	mg/L	50	---	0.383	4.37	0.371	1.99
Antimony (total)	mg/L	5	---	< 0.0009	0.0018	< 0.0009	< 0.0009
Arsenic (total)	mg/L	1	0.02	0.0043	0.0043	0.0055	0.0056
Beryllium (total)	mg/L	5	---	0.000021	0.000130	0.000017	0.000098
Cadmium (total)	mg/L	1.0	0.008	0.000008	0.000103	0.000032	0.000058
Chromium (total)	mg/L	3	---	0.00185	0.01238	0.00194	0.00404
Cobalt (total)	mg/L	5	---	0.000537	0.00274	0.000831	0.00177
Copper (total)	mg/L	3	0.04	0.0011	0.0338	0.0015	0.0025
Iron (total)	mg/L	50	---	2.65	4.52	0.464	3.27
Lead (total)	mg/L	3	0.12	0.00047	0.00838	0.00052	0.0192
Manganese (total)	mg/L	5	0.05	**0.198**	**0.296**	**0.327**	**0.319**
Molybdenum (total)	mg/L	5	---	0.00513	0.00652	0.0379	0.0195
Nickel (total)	mg/L	3	0.08	0.0016	0.0105	0.0032	0.0045
Phosphorus (total)	mg/L	10	0.4	0.027	0.347	0.056	0.324
Selenium (total)	mg/L	5	0.02	0.00005	0.00030	0.00028	0.00022
Silver (total)	mg/L	5	0.12	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Tin (total)	mg/L	5	---	0.00972	0.0246	0.0221	0.00969
Titanium (total)	mg/L	5	---	0.0100	0.0451	0.00583	0.0297
Zinc (total)	mg/L	3	0.04	0.007	**0.104**	0.007	0.016
Naphthalene	mg/L	0.14	---	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Benzene	mg/L	0.01	0.002	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Chloroform	mg/L	0.04	0.002	< 0.0005	< 0.0005	**0.0025**	< 0.0005
1,4-Dichlorobenzene	mg/L	0.08	0.0068	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Ethylbenzene	mg/L	0.16	0.002	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Methylene Chloride	mg/L	2	0.0052	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Tetrachloroethylene (perchloroethylene)	mg/L	1	0.0044	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Toluene	mg/L	0.016	0.002	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Trichloroethylene	mg/L	0.4	0.0076	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Chromium VI	µg/L	---	0.08	< 0.2	< 0.2	< 0.2	< 0.2
Polychlorinated Biphenyls (PCBs) - Total	µg/L	---	0.4	< 0.04	< 0.04	< 0.04	< 0.04
Nonylphenol	µg/L	---	1	< 1	**4.2**	**< 2**	**1.5**
Nonylphenol diethoxylate	µg/L	---	---	< 10	< 10	< 10	< 10
Nonylphenol Ethoxylates	µg/L	---	10	< 10	< 10	< 10	< 10
Nonylphenol monoethoxylate	µg/L	---	---	< 10	< 10	< 10	< 10

Notes: Bold and shading indicates a criteria exceedence

Appendix A

Terms of Reference

Terra-Dynamics Consulting Inc.
432 Niagara Street, Unit 2 St. Catharines, ON L2M 4W3

Thomas Douglas, RPP, MCIP
Planner, City of Burlington
426 Brant St., Burlington ON
L7R 3Z6

October 7, 2021

Re: Hydrogeological Study Dewatering – Amended Terms of Reference
Proposed Waterfront Hotel, 2020 Lakeshore Road, Burlington, ON

1.0 Introduction, Background Information and Purpose

Terra-Dynamics Consulting Inc. (Terra-Dynamics) respectfully submits this Terms of Reference to complete a Hydrogeological Study to assess expected dewatering conditions and requirements for construction of a Proposed Waterfront Hotel, at 2020 Lakeshore Road, Burlington (Site). It is our understanding a 30-40 storey building is to be constructed which will include four basement parking levels (NEUF Architectes Canada Inc., 2021). Construction of the basement parking levels will be below (i) the high-water level mark of Lake Ontario, and (ii) the groundwater level in the underlying shale bedrock. As a result, both construction and post-construction dewatering may be required. An Environmental Activity and Sector Registry (EASR) for construction dewatering may be required, with the possibility of a Permit to Take Water (PTTW) needed depending upon the hydraulic conductivity of the shale. However, the area is municipally serviced for water and sanitary services.

2.0 Scope of Work

2.1 Description of Geologic and Hydrogeologic Setting

The Site's geologic and hydrogeologic settings will be described both in a regional, and local context. Available geologic information will be summarized and documented in the report. Other published data sources will be incorporated where appropriate such as nearby geotechnical reporting.

2.2 Field Investigations

Seven bedrock boreholes will be completed across the Site to characterize conditions, and seven bedrock monitoring wells constructed in the boreholes, by a drilling contractor supervised by Soil-Mat Engineers & Consultants. The monitoring wells will be screened at various depths in order to characterize the hydrogeologic bedrock conditions throughout and below the depth of excavation. Monitoring wells will only be completed in the overburden if saturated conditions are encountered in granular materials.

The groundwater monitoring wells will facilitate:

i. Monitoring of water levels in various depths of the shale to determine the vertical gradient;
ii. Characterization of the hydraulic conductivities; and
iii. Collection of groundwater quality samples.

Terra-Dynamics' will complete monitoring well hydraulic conductivity testing of each of the monitoring wells constructed. Testing will be completed using bail-down methods with recovery monitoring completed using datalogging pressure transducers.

During monitoring well testing, four groundwater samples will be collected from the shale for laboratory analysis of water quality. The results will be compared applicable criteria including the City of Burlington's DRAFT Storm Sewer By-law (City of Burlington, 2019) and the Region of Halton Sanitary Sewer By-Law Discharge Limits (Region of Halton, 2003).

2.3 Dewatering Assessment

A conceptual model of flow will be prepared for the Site in hydrogeologic cross-section and include:

a) Analyses of water levels collected;
b) Calculation of vertical and horizontal hydraulic gradients; and
c) Analysis of hydraulic conductivity testing.

These results will be used to calculate the (i) expected dewatering rates for construction and built-out conditions and (ii) the zone of influence. This will use the high-water level from Lake Ontario to represent high water level conditions. Risk of settlement from construction dewatering will also be considered.

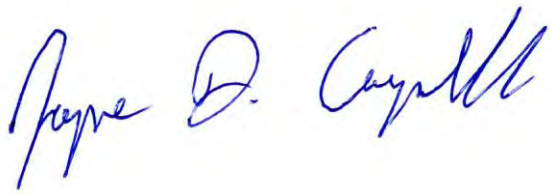
2.4 Provision of a Letter Report

A letter report documenting the results of the above tasks will be prepared for agency review. The report will make recommendations for construction dewatering and future waterproofing including whether an EASR or PTTW is recommended. Information regarding future application to Halton Region for any discharge of construction dewatering will also be provided.

We trust this information is sufficient for your present needs. Please do not hesitate to contact us if you have any questions. Thank you for the opportunity to submit this proposal.

Yours truly,

TERRA-DYNAMICS CONSULTING INC.



Jayme D. Campbell, P. Eng.
Senior Water Resource Engineer

3.0 References

City of Burlington, 2002. Storm Sewer Discharge By-law Number 86-2002.

City of Burlington, 2019. DRAFT Storm Sewer Discharge By-law.

NEUF Architectes Canada Inc., 2021. Proposed Mixed Use Development, Conceptual Architectural Drawings.

Region of Halton, 2003. By-law Number 2-03. A by-law to prohibit, regulate and control discharges into bodes of waters within regional boundaries or into the regional sanitary sewers, sanitary sewage works and all tributary sewer systems.

Appendix B

Monitoring Well Logs

Log of Borehole No. 01

Project No: SM 301114-G
Project: Proposed Condominium Development
Location: 2020 Lakeshore Road
Client: Vrancor Developments

Project Manager: Yaroslav Mormil, P.Eng.
Borehole Location: See Drawing No.1
UTM Coordinates - N: 4797540
E: 597648

Depth (ft)	Depth (m)	Elevation (m)	Description	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
		82.38	Ground Surface							
0	0		**Pavement Structure** Approximately 100 millimetres of asphaltic concrete over 1220 millimetres of compact granular base.	SS	1	11 9 8 6	17			
3	1	81.06		SS	2	4 8 7 4	15			
4			**Silty Clay / Clayey Silt Fill** Brown, some sand and gravel, occasional hydrocarbons staining, firm.							
6	2	80.25		SS	3	1 2 5 4	7			
7			**Queenston Shale** Red, with more resistant grey layers, highly weathered in upper levels, becoming more sound with depth, hard.	SS	4	9 36 50/4"	100			
10	3			SS	5	36 50/1"	100			
13	4		NOTES: 1. Borehole was advanced using solid stem auger equipment on April 7, 2021 to termination at a depth of 7.8 metres. 2. Borehole was recorded as open and 'dry' upon completion and backfilled as per Ontario Regulation 903. 3. Soil samples will be discarded after 3 months unless otherwise directed by our client. 4. A monitoring well was installed. The following free groundwater level readings have been measured: May 26, 2021 - 7.42 meters (dry)	SS	6	50/2"	100			
16	5									
20	6			SS	7	50/2"	100			
23	7									
25		74.56		SS	8	50/2"	100			
26	8		End of Borehole							
30	9									
33										

Moisture Content w% (10 20 30 40)
Standard Penetration Test blows/300mm (20 40 60 80)

Drill Method: Solid Stem Auger
Drill Date: 7/04/21
Hole Size: 150 millimeters
Drilling Contractor: Davis Drilling Ltd.

Soil-Mat Engineers & Consultants Ltd.
130 Lancing Drive, Hamilton, ON L8W 3A1
T: 905.318.7440 F: 905.318.7455
E: info@soil-mat.ca

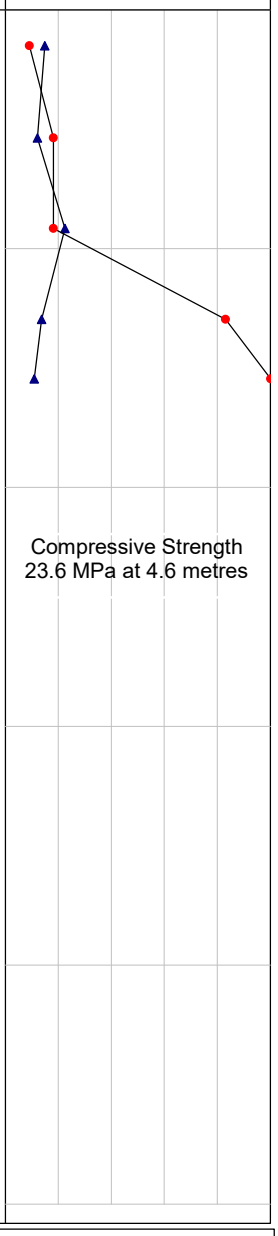
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Checked by: YM
Sheet: 1 of 1

Log of Borehole No. 02

Project No: SM 301114-G
Project: Proposed Condominium Development
Location: 2020 Lakeshore Road
Client: Vrancor Developments

Project Manager: Yaroslav Mormil, P.Eng.
Borehole Location: See Drawing No.1
UTM Coordinates - N: 4797567
E: 597669

Depth (ft / m)	Elevation (m)	Description	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0 / 0	82.73	Ground Surface							
		Pavement Structure Approximately 75 millimetres of asphaltic concrete, overlying 75 millimetres of compact granular base.	SS	1	5 5 4 5	9			
		Silty Clay / Clayey Silt Fill Brown, some sand and gravel, occasional staining, very stiff.	SS	2	3 11 7 8	18			
1 / 1	81.21	**Silty Clay / Clayey Silt** Reddish brown, trace to some sand and gravel, very stiff.	SS	3	3 8 10 11	18			
2 / 2	80.29	**Queenston Shale** Red, with more resistant grey layers, highly weathered in upper levels, becoming more sound with depth, hard.	SS	4	21 40 43 50/3"	83			
			SS	5	50/3"	100			
			HQ	6	RQD=90%				
4 / 3			HQ	7	RQD=86%				
5 / 4			HQ	8	RQD=96%				
6 / 5			HQ	9	RQD=94%				
7 / 6			HQ	10	RQD=74%				
8 / 7									
9 / 8									
10 / 9									
11 / 10									
12 / 11									
13 / 12									
14 / 13									
15 / 14									
16 / 15									
17 / 16									
18 / 17									
19 / 18									
20 / 19									
21 / 20									
22 / 21									
23 / 22									
24 / 23									
25 / 24									
26 / 25									
27 / 26									
28 / 27									
29 / 28									
30 / 29									
31 / 30									
32 / 31									
33 / 32									



Drill Method: Solid Stem Augers
Drill Date: 07/04/21
Hole Size: 150 millimeters
Drilling Contractor: Davis Drilling Ltd.

Soil-Mat Engineers & Consultants Ltd.
130 Lancing Drive, Hamilton, ON L8W 3A1
T: 905.318.7440 F: 905.318.7455
E: info@soil-mat.ca

Datum: Geodetic
Field Logged by: MA
Checked by: YM
Sheet: 1 of 2

Log of Borehole No. 02

Project No: SM 301114-G
Project: Proposed Condominium Development
Location: 2020 Lakeshore Road
Client: Vrancor Developments

Project Manager: Yaroslav Mormil, P.Eng.
Borehole Location: See Drawing No.1
UTM Coordinates - N: 4797567
E: 597669

Depth	Elevation (m)	Description	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
11			HQ	N/A	RQD=90%				
12			HQ	N/A	RQD=96%				
13		NOTES: 1. Borehole was advanced using solid stem auger equipment on April 7, 2021 to termination at a depth of 17.1 metres. 2. Borehole was recorded as open upon completion and backfilled as per Ontario Regulation 903. 3. Soil samples will be discarded after 3 months unless otherwise directed by our client. 4. A monitoring well was installed. The following free groundwater level readings have been measured: May 26, 2021 - 8.17 meters	HQ	N/A	RQD=97%				
14			HQ	11	RQD=88%				
15									
16			HQ	12	RQD=98%				
17	65.63	End of Borehole							
18									
19									

Moisture Content w% (10 20 30 40)
Standard Penetration Test blows/300mm (20 40 60 80)

Compressive Strength 33.8 MPa at 14.5 metres

Compressive Strength 31.5 MPa at 15.8 metres

Drill Method: Solid Stem Augers
Drill Date: 07/04/21
Hole Size: 150 millimeters
Drilling Contractor: Davis Drilling Ltd.

Soil-Mat Engineers & Consultants Ltd.
130 Lancing Drive, Hamilton, ON L8W 3A1
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E: info@soil-mat.ca

Datum: Geodetic
Field Logged by: MA
Checked by: YM
Sheet: 2 of 2

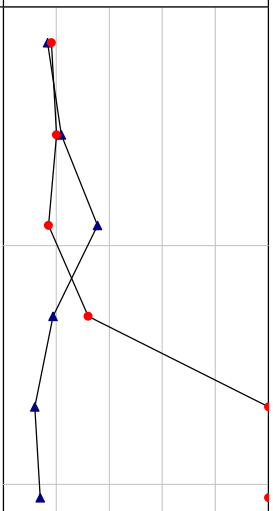
Log of Borehole No. 03

Project No: SM 301114-G
Project: Proposed Condominium Development
Location: 2020 Lakeshore Road
Client: Vrancor Developments

Project Manager: Yaroslav Mormil, P.Eng.
Borehole Location: See Drawing No.1
UTM Coordinates - N: 4797595
E: 597727

Depth (ft / m)	Elevation (m)	Description	Well Data	SAMPLE Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
	82.97	Ground Surface								
0 / 0	82.74	**Pavement Structure** Approximately 90 millimetres of asphaltic concrete over 140 millimetres of compact granular base.		SS	1	9 9 9 8	18			
3 / 1	81.47	**Silty Clay / Clayey Silt Fill** Reddish brown, some sand and gravel, occasional staining, very stiff.		SS	2	9 10 10 11	20			
6 / 2		**Silty Clay/Clayey Silt** Brown, trace sand and gravel, very stiff.		SS	3	3 6 11 17	17			
9 / 3	80.21	**Queenston Shale** Red, with more resistant grey layers, highly weathered in upper levels, becoming more sound with depth, hard.		SS	4	8 16 16 22	32			
				SS	5	50/3"	100			
13 / 4				SS	6	50/3"	100			
16 / 5				HQ	N/A	RQD=60%				
20 / 6				HQ	N/A	RQD=96%				
23 / 7				HQ	N/A	RQD=99%				
26 / 8				HQ	N/A	RQD=73%				
33										

Moisture Content w% (10 20 30 40)
Standard Penetration Test blows/300mm (20 40 60 80)



Drill Method: Solid Stem Augers
Drill Date: 08/04/21
Hole Size: 150 millimeters
Drilling Contractor: Davis Drilling Ltd.

Soil-Mat Engineers & Consultants Ltd.
130 Lancing Drive, Hamilton, ON L8W 3A1
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Datum: Geodetic
Field Logged by: MA
Checked by: YM
Sheet: 1 of 2

Log of Borehole No. 03

Project No: SM 301114-G
Project: Proposed Condominium Development
Location: 2020 Lakeshore Road
Client: Vrancor Developments

Project Manager: Yaroslav Mormil, P.Eng.
Borehole Location: See Drawing No.1
UTM Coordinates - N: 4797595
E: 597727

Depth	Elevation (m)	Description	Well Data	SAMPLE Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
34–36				HQ	7	RQD=91%				
36–38		NOTES:								
38–40		1. Borehole was advanced using solid stem auger equipment on April 8, 2021 to termination at a depth of 15.1 metres.		HQ	8	RQD=85%				
40–42		2. Borehole was recorded as open upon completion and backfilled as per Ontario Regulation 903.								
42–44		3. Soil samples will be discarded after 3 months unless otherwise directed by our client.		HQ	9	RQD=55%				
44–46		4. A monitoring well was installed. The following free groundwater level readings have been measured: May 26, 2021 - 8.81 meters								
46–48				HQ	10	RQD=86%				
48–50	67.86	End of Borehole								
50–65										

Moisture Content w% (10 20 30 40)

Standard Penetration Test blows/300mm (20 40 60 80)

Compressive Strength 20.6 MPa at 10.5 metres

Compressive Strength 20.8 MPa at 14.7 metres

Drill Method: Solid Stem Augers
Drill Date: 08/04/21
Hole Size: 150 millimeters
Drilling Contractor: Davis Drilling Ltd.

Soil-Mat Engineers & Consultants Ltd.
130 Lancing Drive, Hamilton, ON L8W 3A1
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E: info@soil-mat.ca

Datum: Geodetic
Field Logged by: MA
Checked by: YM
Sheet: 2 of 2

Log of Borehole No. 04

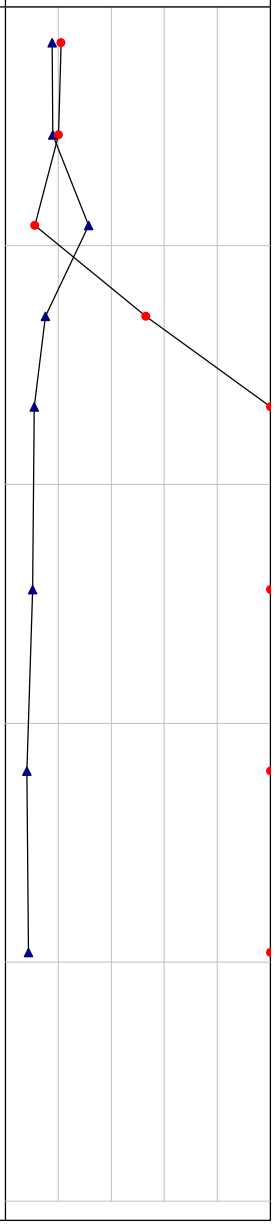
Project No: SM 301114-G
Project: Proposed Condominium Development
Location: 2020 Lakeshore Road
Client: Vrancor Developments

Project Manager: Yaroslav Mormil, P.Eng.
Borehole Location: See Drawing No.1
UTM Coordinates - N: 4797596
E: 597738

Depth (ft)	Depth (m)	Elevation (m)	Description	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
		82.77	Ground Surface							
0	0	82.31	**Pavement Structure** Approximately 100 millimetres of asphaltic concrete over 360 millimetres of compact granular base.							
1			**Silty Clay / Clayey Silt Fill** Brown, occasional organics in the upper levels, some sand and gravel, very stiff.	SS	1	13 13 8 10	21			
2										
3	1			SS	2	9 9 11 10	20			
4										
5		81.17		SS	3	2 3 8 15	11			
6	2		**Silty Clay/Clayey Silt** Brown, trace sand and gravel, stiff.							
7		80.38		SS	4	4 21 32 50	53			
8			**Queenston Shale** Red, with more resistant grey layers, highly weathered in upper levels, becoming more sound with depth, hard.							
9	3			SS	5	45 50/2"	100			
10										
11										
12										
13	4		1. Borehole was advanced using solid stem auger equipment on April 6, 2021 to termination at a depth of 7.6 metres.							
14										
15			2. Borehole was recorded as open and 'dry' upon completion and backfilled as per Ontario Regulation 903.	SS	6	50/2"	100			
16										
17	5									
18			3. Soil samples will be discarded after 3 months unless otherwise directed by our client.							
19										
20	6		4. A monitoring well was installed. The following free groundwater level readings have been measured: May 26, 2021 - 6.43 meters	SS	7	50/2"	100			
21										
22										
23	7									
24										
25		75.15		AS	8	50/0"	100			
26	8		End of Borehole							
27										
28										
29										
30	9									
31										
32										
33										

Auger sample taken at 7.62 meters

Moisture Content w%: 10 20 30 40
Standard Penetration Test blows/300mm: 20 40 60 80



Drill Method: Solid Stem Auger
Drill Date: 6/04/21
Hole Size: 150 millimeters
Drilling Contractor: Davis Drilling Ltd.

Soil-Mat Engineers & Consultants Ltd.
130 Lancing Drive, Hamilton, ON L8W 3A1
T: 905.318.7440 F: 905.318.7455
E: info@soil-mat.ca

Datum: Geodetic
Field Logged by: MA
Checked by: YM
Sheet: 1 of 1

Log of Borehole No. 05

Project No: SM 301114-G
Project: Proposed Condominium Development
Location: 2020 Lakeshore Road
Client: Vrancor Developments

Project Manager: Yaroslav Mormil, P.Eng.
Borehole Location: See Drawing No.1
UTM Coordinates - N: 4797571
E: 597768

Depth (ft)	Depth (m)	Elevation (m)	Description	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
		81.29	Ground Surface							
0	0		**Pavement Structure** Approximately 100 millimetres of asphaltic concrete over 75 millimetres of compact granular base.							
1			**Silty Clay / Clayey Silt Fill** Reddish brown, some sand and gravel, occasional organics, stiff to very stiff.	SS	1	10 5 6 7	11			
2	1			SS	2	5 16 14 12	30			
3				SS	3	17 23 22 18	45			
4				SS	4	14 16 9 8	25			
5	2			SS	5	4 6 6 7	12			
6				SS	6	7 6 5 16	11			
7	3			SS	7	13 13 8 12	21			
8				SS	8	50/1"	100			
9	4			HQ	9	RQD=88%				
10				HQ	10	RQD=77%				
11	5	75.29	**Silty Clay / Clayey Silt** Greyish brown, trace sand and gravel, gravel seam, stiff to very stiff.							
12										
13	6	73.37	**Queenston Shale** Red, with more resistant grey layers, highly weathered in upper levels, becoming more sound with depth, hard.							
14										
15	7									
16										
17										
18	8									
19										
20										
21	9									
22										
23										
24	10									
25										
26										
27	11									
28										
29										
30	12									
31										
32										
33	13									

Moisture Content w% (10 20 30 40)
Standard Penetration Test blows/300mm (20 40 60 80)

Drill Method: Solid Stem Augers
Drill Date: 05/04/21
Hole Size: 150 millimeters
Drilling Contractor: Davis Drilling Ltd.

Soil-Mat Engineers & Consultants Ltd.
130 Lancing Drive, Hamilton, ON L8W 3A1
T: 905.318.7440 F: 905.318.7455
E: info@soil-mat.ca

Datum: Geodetic
Field Logged by: MA
Checked by: YM
Sheet: 1 of 2

Log of Borehole No. 05

Project No: SM 301114-G
Project: Proposed Condominium Development
Location: 2020 Lakeshore Road
Client: Vrancor Developments

Project Manager: Yaroslav Mormil, P.Eng.
Borehole Location: See Drawing No.1
UTM Coordinates - N: 4797571
E: 597768

Depth	Elevation (m)	Symbol	Description	Well Data	SAMPLE Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)	Moisture Content w% (10 20 30 40) / Standard Penetration Test blows/300mm (20 40 60 80)
34						10						
35												
36	11					11	Clean Up					
37												
38					HQ	12	RQD=89%					
39	12											
40												
41												
42					HQ	13	RQD=83%					
43	13											
44												
45												
46	14				HQ	14	RQD=97%					Compressive Strength 29.6 MPa at 14.1
47												
48												
49	15											
50												
51												
52	16				HQ	15	RQD=91%					
53												
54			NOTES:									
55			1. Borehole was advanced using solid stem auger equipment on April 5, 2021 to termination at a depth of 20.1 metres.									
56	17											
57			2. Borehole was recorded as open upon completion and backfilled as per Ontario Regulation 903.									
58					HQ	16	RQD=101%					
59	18		3. Soil samples will be discarded after 3 months unless otherwise directed by our client.									
60												
61			4. A monitoring well was installed. The following free groundwater level readings have been measured: May 26, 2021 - 6.25 meters									
62	19											
63					HQ	17	RQD=97%					
64												
65												
66	20 61.15		End of Borehole									
67												

Drill Method: Solid Stem Augers
Drill Date: 05/04/21
Hole Size: 150 millimeters
Drilling Contractor: Davis Drilling Ltd.

Soil-Mat Engineers & Consultants Ltd.
130 Lancing Drive, Hamilton, ON L8W 3A1
T: 905.318.7440 F: 905.318.7455
E: info@soil-mat.ca

Datum: Geodetic
Field Logged by: MA
Checked by: YM
Sheet: 2 of 2

Log of Borehole No. 06

Project No: SM 301114-G
Project: Proposed Condominium Development
Location: 2020 Lakeshore Road
Client: Vrancor Developments

Project Manager: Yaroslav Mormil, P.Eng.
Borehole Location: See Drawing No.1
UTM Coordinates - N: 4797533
E: 597735

Depth (ft)	Depth (m)	Elevation (m)	Description	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
		81.11	Ground Surface							
0	0		**Topsoil** Approximately 100 millimetres of topsoil.							
1–6	0–2		**Silty Clay / Clayey Silt Fill** Reddish brown, occasional construction debris and organics, some sand and gravel, firm to very stiff.	SS	1	8 7 5 5	12			
				SS	2	3 13 3 1	16			
				SS	3	5 12 8 3	20			
				SS	4	3 3 4 4	7			
				SS	5	4 4 3 3	7			
				SS	6	3 6 3 1	9			
				SS	7	3 3 1 7	4			
				SS	8	3 7 12 10	19			
22	7	74.11	**Queenston Shale** Red, with more resistant grey layers, highly weathered in upper levels, becoming more sound with depth, hard.	SS	9	13 18 16 50/5"	32			
				SS	10	50/2"	100			
26	8			HQ	11					
28–32	9			HQ	12	RQD=90%				
33										

Moisture Content w% (10 20 30 40)
Standard Penetration Test blows/300mm (20 40 60 80)

Compressive Strength
28.1 MPa at 8.3 metres

Drill Method: Solid Stem Augers
Drill Date: 07/04/21
Hole Size: 150 millimeters
Drilling Contractor: Davis Drilling Ltd.

Soil-Mat Engineers & Consultants Ltd.
130 Lancing Drive, Hamilton, ON L8W 3A1
T: 905.318.7440 F: 905.318.7455
E: info@soil-mat.ca

Datum: Geodetic
Field Logged by: MA
Checked by: YM
Sheet: 1 of 2

Log of Borehole No. 06

Project No: SM 301114-G
Project: Proposed Condominium Development
Location: 2020 Lakeshore Road
Client: Vrancor Developments

Project Manager: Yaroslav Mormil, P.Eng.
Borehole Location: See Drawing No.1
UTM Coordinates - N: 4797533
E: 597735

Depth	Elevation (m)	Symbol	Description	Well Data	SAMPLE Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)	Moisture Content w% (10 20 30 40) / Standard Penetration Test blows/300mm (20 40 60 80)
34–36	11				HQ	13	RQD=91%					
37–39	12				HQ	14	RQD=91%					
40–42	13				HQ	15	RQD=93%					
43–49	14–15				HQ	16	RQD=94%					
51	65.46		End of Borehole									

NOTES:

1. Borehole was advanced using solid stem auger equipment on April 7, 2021 to termination at a depth of 15.6 metres.

2. Borehole was recorded as open upon completion and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

4. A monitoring well was installed. The following free groundwater level readings have been measured:
May 26, 2021 - 6.49 meters

Drill Method: Solid Stem Augers
Drill Date: 07/04/21
Hole Size: 150 millimeters
Drilling Contractor: Davis Drilling Ltd.

Soil-Mat Engineers & Consultants Ltd.
130 Lancing Drive, Hamilton, ON L8W 3A1
T: 905.318.7440 F: 905.318.7455
E: info@soil-mat.ca

Datum: Geodetic
Field Logged by: MA
Checked by: YM
Sheet: 2 of 2

Log of Borehole No. 07

Project No: SM 301114-G
Project: Proposed Condominium Development
Location: 2020 Lakeshore Road
Client: Vrancor Developments

Project Manager: Yaroslav Mormil, P.Eng.
Borehole Location: See Drawing No.1
UTM Coordinates - N: 4797495
E: 597682

Depth (ft / m)	Elevation (m)	Description	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0 / 0	78.75	Ground Surface							
0 / 0	78.47	**Topsoil** Approximately 275 millimetres of topsoil.							
1 / 0		**Silty Clay / Clayey Silt Fill** Brown, some sand and gravel, stiff to hard.	SS	1	4 3 3 12	6			
2 / 1			SS	2	6 11 23 12	34			
3 / 1			SS	3	6 12 15 16	27			
7 / 2			SS	4	2 3 8 10	11			
10 / 3	75.40		SS	5	3 8 10 8	18			
11 / 3		**Silty Clay / Clayey Silt** Redish brown, trace to some sand and gravel, very stiff.							
16 / 4			SS	6	4 4 15 18	19			
16 / 5	73.57								
17 / 5		**Queenston Shale** Red, with more resistant grey layers, highly weathered in upper levels, becoming more sound with depth, hard.							
20 / 6			SS	7	50/3"	100			
25 / 7	70.93		SS	8	50/2"	100			
26 / 8		End of Borehole							

Moisture Content w% (10 20 30 40)

Standard Penetration Test blows/300mm (20 40 60 80)

NOTES:
1. Borehole was advanced using solid stem auger equipment on April 5, 2021 to termination at a depth of 7.8 metres.
2. Borehole was recorded as open and 'dry' upon completion and backfilled as per Ontario Regulation 903.
3. Soil samples will be discarded after 3 months unless otherwise directed by our client.
4. A monitoring well was installed. The following free groundwater level readings have been measured:
May 26, 2021 - 3.87 meters

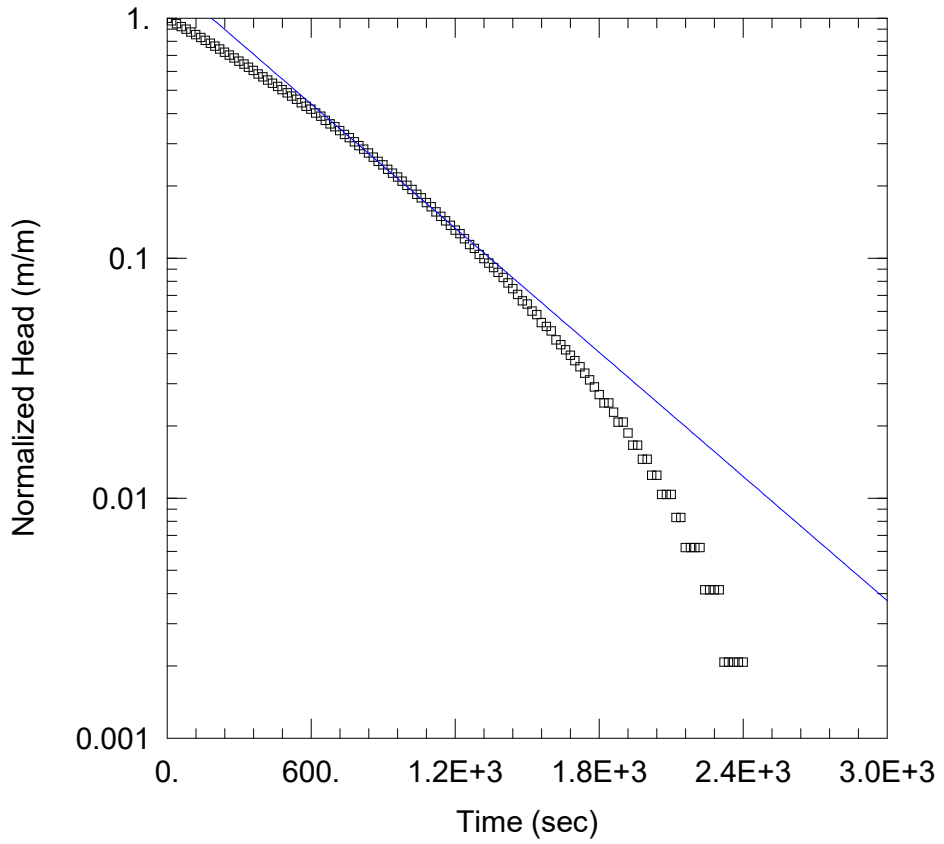
Drill Method: Solid Stem Auger
Drill Date: 5/04/21
Hole Size: 150 millimeters
Drilling Contractor: Davis Drilling Ltd.

Soil-Mat Engineers & Consultants Ltd.
130 Lancing Drive, Hamilton, ON L8W 3A1
T: 905.318.7440 F: 905.318.7455
E: info@soil-mat.ca

Datum: Geodetic
Field Logged by: MA
Checked by: YM
Sheet: 1 of 1

Appendix C

Hydraulic Conductivity Analyses



RISING-HEAD TEST

Data Set: C:\...\BH2.aqt
Date: 06/23/21 Time: 08:57:13

PROJECT INFORMATION

Company: Terra-Dynamics Consulting Inc.
Client: Soil-Mat
Location: 2020 Lakeshore Road, Burlingto
Test Well: BH2
Test Date: June 8, 2021

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

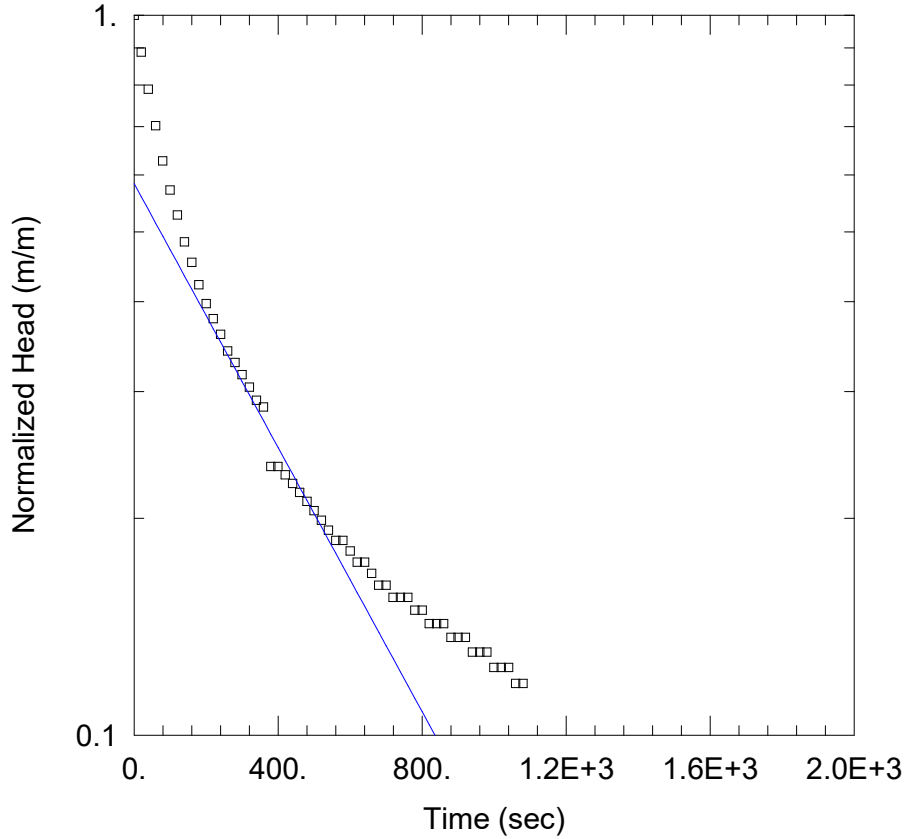
K = 7.848E-7 m/sec
y0 = 6.963 m

AQUIFER DATA

Saturated Thickness: 8.99 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH2)

Initial Displacement: 4.82 m
Total Well Penetration Depth: 8.99 m
Casing Radius: 0.025 m
Static Water Column Height: 8.99 m
Screen Length: 3.05 m
Well Radius: 0.048 m



RISING-HEAD TEST

Data Set: C:\...\BH3.aqt
Date: 06/23/21 Time: 08:59:40

PROJECT INFORMATION

Company: Terra-Dynamics Consulting Inc.
Client: Soil-Mat
Location: 2020 Lakeshore Road, Burlingto
Test Well: BH3
Test Date: June 8, 2021

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

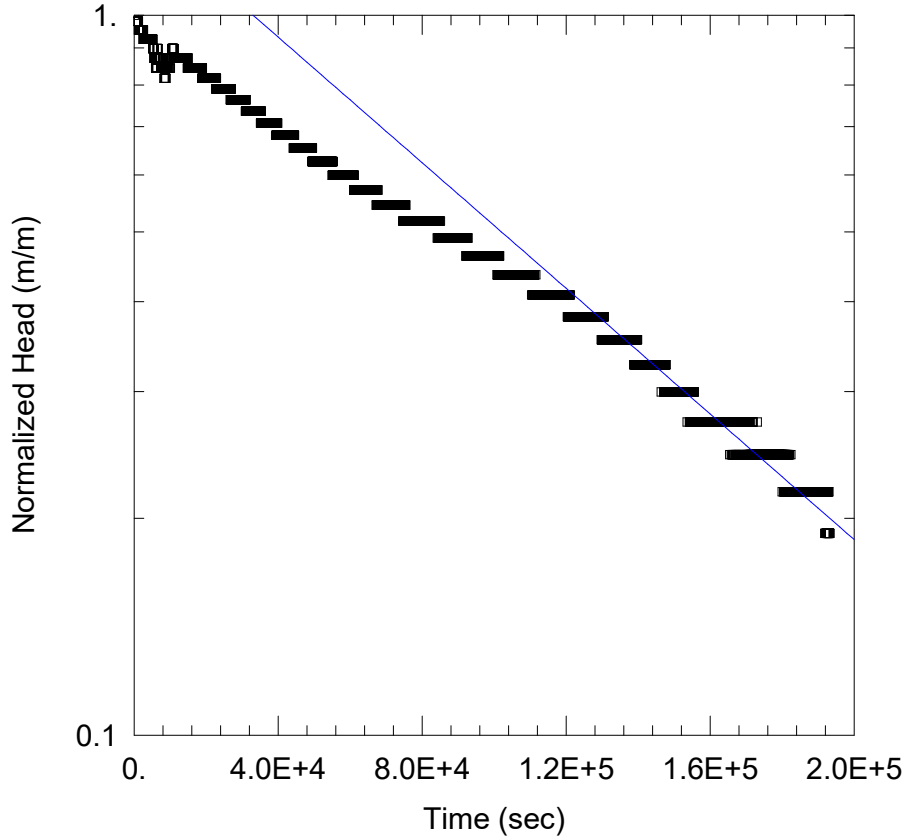
K = 7.773E-7 m/sec
y0 = 0.9395 m

AQUIFER DATA

Saturated Thickness: 5.82 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH3)

Initial Displacement: 1.61 m
Total Well Penetration Depth: 5.82 m
Casing Radius: 0.025 m
Static Water Column Height: 5.82 m
Screen Length: 3.05 m
Well Radius: 0.048 m



RISING-HEAD TEST

Data Set: C:\...\BH4.aqt
Date: 06/22/21 Time: 14:31:23

PROJECT INFORMATION

Company: Terra-Dynamics Consulting Inc.
Client: Soil-Mat
Location: 2020 Lakeshore Road, Burlingto
Test Well: BH4
Test Date: June 8, 2021

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

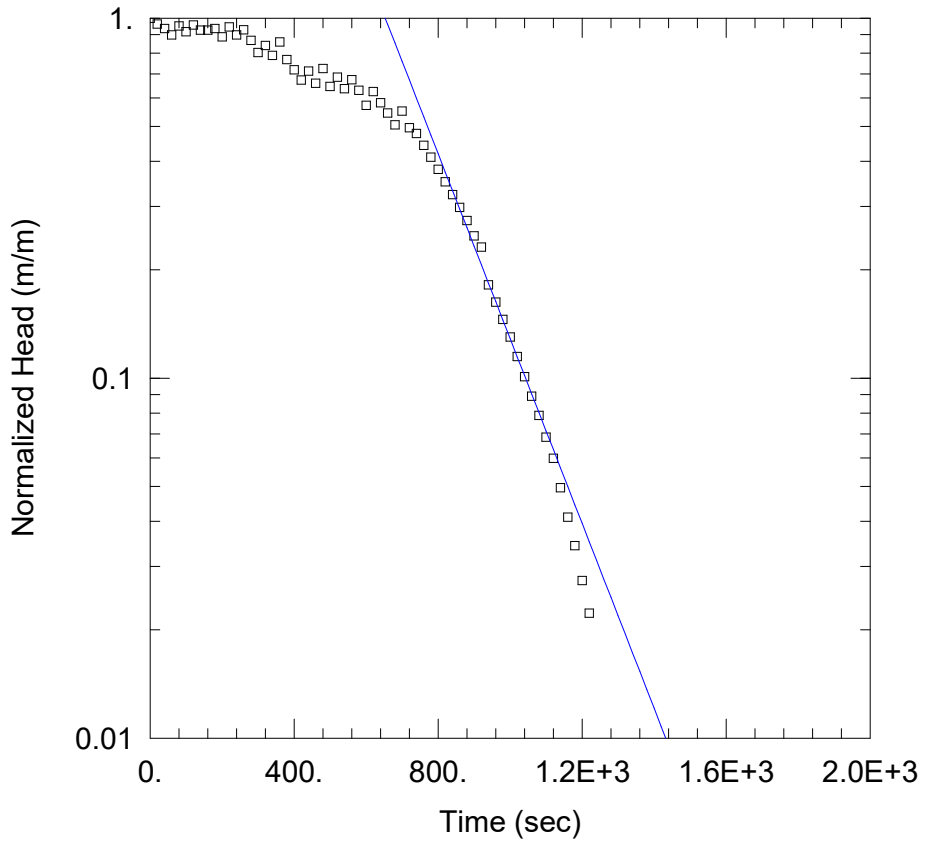
K = 7.917E-9 m/sec
y0 = 0.5115 m

AQUIFER DATA

Saturated Thickness: 0.9758 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH4)

Initial Displacement: 0.3672 m
Total Well Penetration Depth: 3.05 m
Casing Radius: 0.025 m
Static Water Column Height: 0.9758 m
Screen Length: 3.05 m
Well Radius: 0.075 m



RISING-HEAD TEST

Data Set: C:\...\BH5.aqt
Date: 06/23/21 Time: 09:03:35

PROJECT INFORMATION

Company: Terra-Dynamics Consulting Inc.
Client: Soil-Mat
Location: 2020 Lakeshore Road, Burlingto
Test Well: BH5
Test Date: June 8, 2021

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev

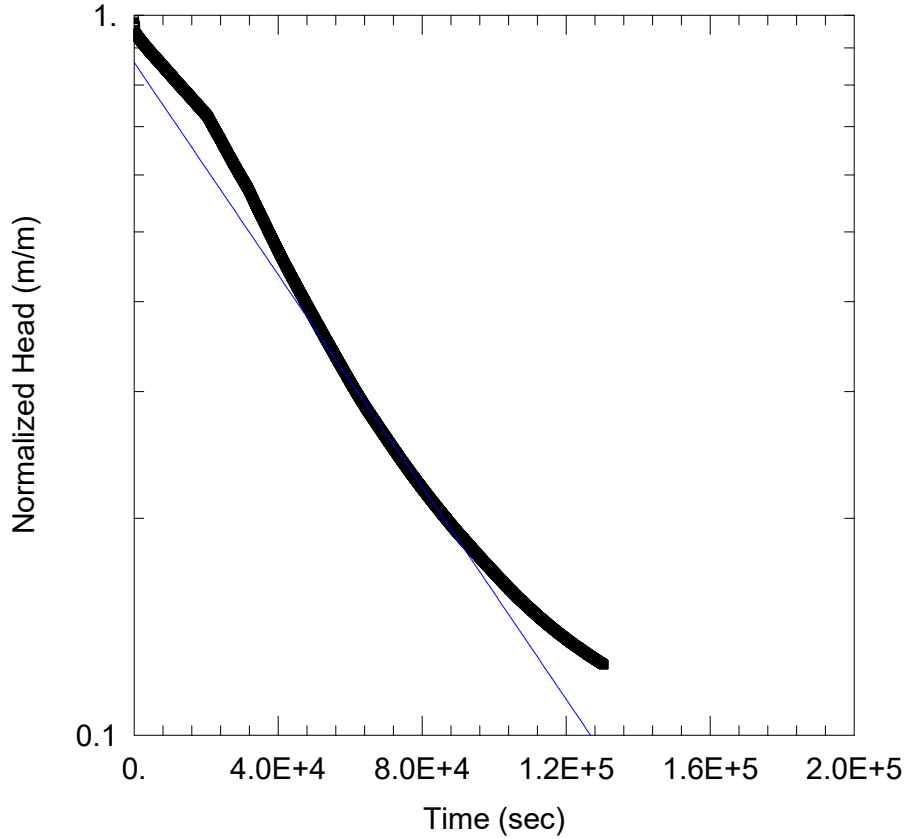
K = 2.515E-6 m/sec
y0 = 277.7 m

AQUIFER DATA

Saturated Thickness: 13.74 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH5)

Initial Displacement: 5.84 m
Total Well Penetration Depth: 13.74 m
Casing Radius: 0.025 m
Static Water Column Height: 13.74 m
Screen Length: 3.05 m
Well Radius: 0.048 m



RISING-HEAD TEST

Data Set: C:\...\BH6.aqt
Date: 06/23/21 Time: 09:01:28

PROJECT INFORMATION

Company: Terra-Dynamics Consulting Inc.
Client: Soil-Mat
Location: 2020 Lakeshore Road, Burlingto
Test Well: BH6
Test Date: June 8, 2021

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

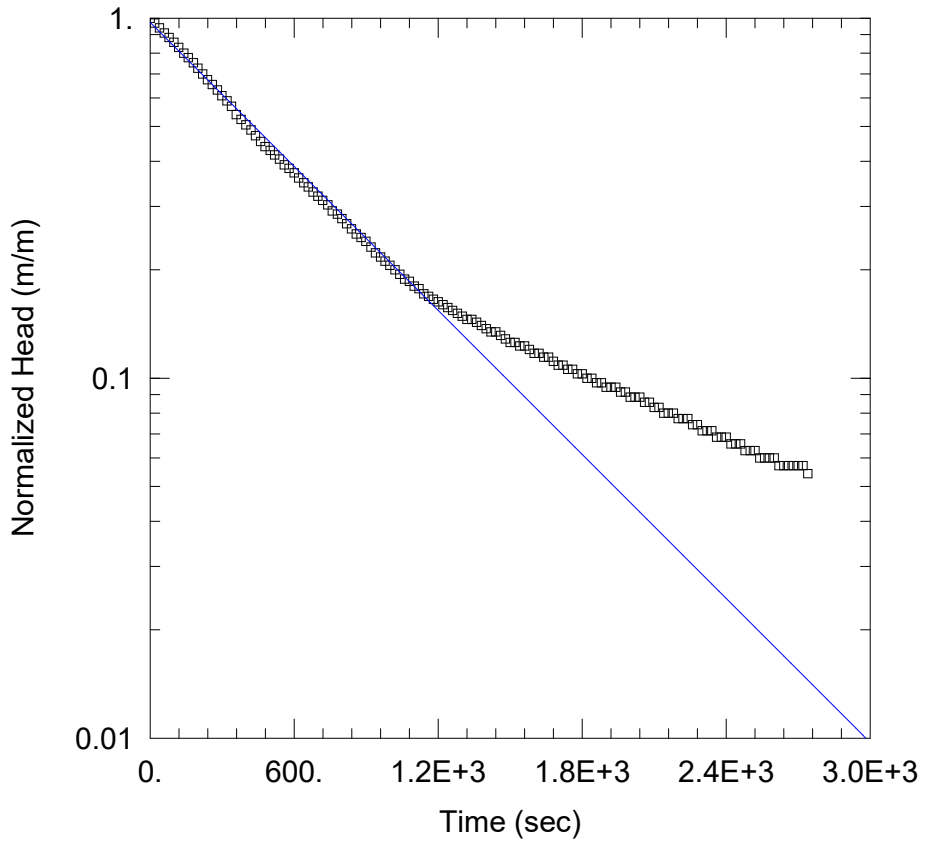
K = 6.728E-9 m/sec
y0 = 7.359 m

AQUIFER DATA

Saturated Thickness: 9.17 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH6)

Initial Displacement: 8.56 m
Total Well Penetration Depth: 9.17 m
Casing Radius: 0.025 m
Static Water Column Height: 9.17 m
Screen Length: 3.05 m
Well Radius: 0.048 m



RISING-HEAD TEST

Data Set: C:\...\BH7.aqt
Date: 06/22/21 Time: 15:15:58

PROJECT INFORMATION

Company: Terra-Dynamics Consulting Inc.
Client: Soil-Mat
Location: 2020 Lakeshore Road, Burlingto
Test Well: BH7
Test Date: June 8, 2021

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev

K = 5.83E-7 m/sec
y0 = 3.408 m

AQUIFER DATA

Saturated Thickness: 3.77 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH7)

Initial Displacement: 3.5 m
Total Well Penetration Depth: 3.77 m
Casing Radius: 0.025 m
Static Water Column Height: 3.77 m
Screen Length: 3.05 m
Well Radius: 0.075 m

Appendix D

Water Quality Analyses





FINAL REPORT

CA15407-JUN21 R2

Prepared for

Terra-Dynamics Consulting Inc.

FINAL REPORT

First Page

CLIENT DETAILS

Client	Terra-Dynamics Consulting Inc.
Address	404 Queenston Street St. Catharines, ON L2P 2Y2. Canada
Contact	David Slaine
Telephone	905-646-7931
Facsimile	
Email	dslaine@terra-dynamics.com; kslaine@terra-dynamics.com
Project	
Order Number	
Samples	Solution (4)

LABORATORY DETAILS

Project Specialist	Catharine Arnold, B.Sc., C.Chem
Laboratory	SGS Canada Inc.
Address	185 Concession St., Lakefield ON, K0L 2H0
Telephone	705-652-2618
Facsimile	705-652-6365
Email	catharine.arnold@sgs.com
SGS Reference	CA15407-JUN21
Received	06/16/2021
Approved	06/25/2021
Report Number	CA15407-JUN21 R2
Date Reported	06/25/2021

COMMENTS

SIGNATORIES

Catharine Arnold, B.Sc., C.Chem



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Client: Terra-Dynamics Consulting Inc.
Project:
Project Manager: David Slaine
Samplers: Briar MacIntyre

PACKAGE: **SANSEW - General Chemistry**
(WATER)

L1 = SANSEW / WATER / - - Halton Sewer Discharge By Law - Sanitary and Combined Sewer Discharge - BL_2_03

L2 = SANSEW / WATER / - - Halton Sewer Discharge By Law - Storm Sewer Discharge - BL_2_03

				Sample Number	8	9	10	11
				Sample Name	BH-5	BH-6	BH-7	BH-2
				Sample Matrix	Solution	Solution	Solution	Solution
				Sample Date	15/06/2021	15/06/2021	15/06/2021	15/06/2021
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**	**Result**	**Result**
General Chemistry								
Biochemical Oxygen Demand (BOD5)	mg/L	2	300		12	30	< 4↑	< 4↑
Total Suspended Solids	mg/L	2	350		196	19	1970	28
Total Kjeldahl Nitrogen	as N mg/L	0.5	100		4.5	4.8	1.3	2.1

PACKAGE: **SANSEW - Metals and Inorganics**
(WATER)

L1 = SANSEW / WATER / - - Halton Sewer Discharge By Law - Sanitary and Combined Sewer Discharge - BL_2_03

L2 = SANSEW / WATER / - - Halton Sewer Discharge By Law - Storm Sewer Discharge - BL_2_03

				Sample Number	8	9	10	11
				Sample Name	BH-5	BH-6	BH-7	BH-2
				Sample Matrix	Solution	Solution	Solution	Solution
				Sample Date	15/06/2021	15/06/2021	15/06/2021	15/06/2021
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**	**Result**	**Result**
Metals and Inorganics								
Cyanide (total)	mg/L	0.01	2		< 0.01	< 0.01	< 0.01	< 0.01
Fluoride	mg/L	0.06	10		0.10	0.64	0.87	0.27
Sulphate	mg/L	0.2	1500		720	810	58	230
Aluminum (total)	mg/L	0.001	50		4.37	0.371	1.99	0.383
Antimony (total)	mg/L	0.0009	5		0.0018	< 0.0009	< 0.0009	< 0.0009
Arsenic (total)	mg/L	0.0002	1		0.0043	0.0055	0.0056	0.0043
Beryllium (total)	mg/L	0.000007	5		0.000130	0.000017	0.000098	0.000021
Cadmium (total)	mg/L	0.000003	1		0.000103	0.000032	0.000058	0.000008

Client: Terra-Dynamics Consulting Inc.
Project:
Project Manager: David Slaine
Samplers: Briar MacIntyre

PACKAGE: **SANSEW - Metals and Inorganics**
(WATER)

L1 = SANSEW / WATER / - - Halton Sewer Discharge By Law - Sanitary and Combined Sewer Discharge - BL_2_03

L2 = SANSEW / WATER / - - Halton Sewer Discharge By Law - Storm Sewer Discharge - BL_2_03

				Sample Number	8	9	10	11
				Sample Name	BH-5	BH-6	BH-7	BH-2
				Sample Matrix	Solution	Solution	Solution	Solution
				Sample Date	15/06/2021	15/06/2021	15/06/2021	15/06/2021
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**	**Result**	**Result**
Metals and Inorganics (continued)								
Chromium (total)	mg/L	0.00008	3		0.01238	0.00194	0.00404	0.00185
Cobalt (total)	mg/L	0.000004	5		0.00274	0.000831	0.00177	0.000537
Copper (total)	mg/L	0.0002	3		0.0338	0.0015	0.0025	0.0011
Iron (total)	mg/L	0.007	50		4.52	0.464	3.27	2.65
Lead (total)	mg/L	0.00009	3		0.00838	0.00052	0.0192	0.00047
Manganese (total)	mg/L	0.00001	5		0.296	0.327	0.319	0.198
Molybdenum (total)	mg/L	0.00004	5		0.00652	0.0379	0.0195	0.00513
Nickel (total)	mg/L	0.0001	3		0.0105	0.0032	0.0045	0.0016
Phosphorus (total)	mg/L	0.003	10		0.347	0.056	0.324	0.027
Selenium (total)	mg/L	0.00004	5		0.00030	0.00028	0.00022	0.00005
Silver (total)	mg/L	0.00005	5		< 0.00005	< 0.00005	< 0.00005	< 0.00005
Tin (total)	mg/L	0.00006	5		0.0246	0.0221	0.00969	0.00972
Titanium (total)	mg/L	0.00005	5		0.0451	0.00583	0.0297	0.0100
Zinc (total)	mg/L	0.002	3		0.104	0.007	0.016	0.007

Client: Terra-Dynamics Consulting Inc.
Project:
Project Manager: David Slaine
Samplers: Briar MacIntyre

PACKAGE: **SANSEW - Microbiology** (WATER)

L1 = SANSEW / WATER / - - Halton Sewer Discharge By Law - Sanitary and Combined Sewer Discharge - BL_2_03

L2 = SANSEW / WATER / - - Halton Sewer Discharge By Law - Storm Sewer Discharge - BL_2_03

				Sample Number	8	9	10	11
				Sample Name	BH-5	BH-6	BH-7	BH-2
				Sample Matrix	Solution	Solution	Solution	Solution
				Sample Date	15/06/2021	15/06/2021	15/06/2021	15/06/2021
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**	**Result**	**Result**
Microbiology								
E. Coli	cfu/100mL	-		200	1140	2	20	< 2↑

PACKAGE: **SANSEW - Nonylphenol and Ethoxylates** (WATER)

L1 = SANSEW / WATER / - - Halton Sewer Discharge By Law - Sanitary and Combined Sewer Discharge - BL_2_03

L2 = SANSEW / WATER / - - Halton Sewer Discharge By Law - Storm Sewer Discharge - BL_2_03

				Sample Number	8	9	10	11
				Sample Name	BH-5	BH-6	BH-7	BH-2
				Sample Matrix	Solution	Solution	Solution	Solution
				Sample Date	15/06/2021	15/06/2021	15/06/2021	15/06/2021
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**	**Result**	**Result**
Nonylphenol and Ethoxylates								
Nonylphenol	µg/L	1.0			4.2	< 2↑	1.5	< 1
Nonylphenol diethoxylate	µg/L	10			< 10	< 10	< 10	< 10
Nonylphenol Ethoxylates	µg/L	10			< 10	< 10	< 10	< 10
Nonylphenol monoethoxylate	µg/L	10			< 10	< 10	< 10	< 10

PACKAGE: **SANSEW - Oil and Grease** (WATER)

L1 = SANSEW / WATER / - - Halton Sewer Discharge By Law - Sanitary and Combined Sewer Discharge - BL_2_03

L2 = SANSEW / WATER / - - Halton Sewer Discharge By Law - Storm Sewer Discharge - BL_2_03

				Sample Number	8	9	10	11
				Sample Name	BH-5	BH-6	BH-7	BH-2
				Sample Matrix	Solution	Solution	Solution	Solution
				Sample Date	15/06/2021	15/06/2021	15/06/2021	15/06/2021
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**	**Result**	**Result**
Oil and Grease								
Oil & Grease (total)	mg/L	2			< 2	< 2	< 2	< 2
Oil & Grease (animal/vegetable)	mg/L	4	150		< 4	< 4	< 4	< 4

Client: Terra-Dynamics Consulting Inc.
Project:
Project Manager: David Slaine
Samplers: Briar MacIntyre

PACKAGE: **SANSEW - Oil and Grease** (WATER)

L1 = SANSEW / WATER / - - Halton Sewer Discharge By Law - Sanitary and Combined Sewer Discharge - BL_2_03

L2 = SANSEW / WATER / - - Halton Sewer Discharge By Law - Storm Sewer Discharge - BL_2_03

					Sample Number	8	9	10	11
					Sample Name	BH-5	BH-6	BH-7	BH-2
					Sample Matrix	Solution	Solution	Solution	Solution
					Sample Date	15/06/2021	15/06/2021	15/06/2021	15/06/2021
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**	**Result**	**Result**
Oil and Grease (continued)								
Oil & Grease (mineral/synthetic)	mg/L	4	15		< 4	< 4	< 4	< 4

PACKAGE: **SANSEW - Other (ORP)** (WATER)

L1 = SANSEW / WATER / - - Halton Sewer Discharge By Law - Sanitary and Combined Sewer Discharge - BL_2_03

L2 = SANSEW / WATER / - - Halton Sewer Discharge By Law - Storm Sewer Discharge - BL_2_03

					Sample Number	8	9	10	11
					Sample Name	BH-5	BH-6	BH-7	BH-2
					Sample Matrix	Solution	Solution	Solution	Solution
					Sample Date	15/06/2021	15/06/2021	15/06/2021	15/06/2021
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**	**Result**	**Result**
Other (ORP)								
pH	No unit	0.05	10	8.5	7.79	8.06	7.96	8.08
Mercury (total)	mg/L	0.00001	0.05		< 0.00001	< 0.00001	0.00000	< 0.00001
Chromium VI	µg/L	0.2			< 0.2	< 0.2	< 0.2	< 0.2

PACKAGE: **SANSEW - PCBs** (WATER)

L1 = SANSEW / WATER / - - Halton Sewer Discharge By Law - Sanitary and Combined Sewer Discharge - BL_2_03

L2 = SANSEW / WATER / - - Halton Sewer Discharge By Law - Storm Sewer Discharge - BL_2_03

					Sample Number	8	9	10	11
					Sample Name	BH-5	BH-6	BH-7	BH-2
					Sample Matrix	Solution	Solution	Solution	Solution
					Sample Date	15/06/2021	15/06/2021	15/06/2021	15/06/2021
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**	**Result**	**Result**
PCBs								
Polychlorinated Biphenyls (PCBs) - Total	µg/L	0.04			< 0.04	< 0.04	< 0.04	< 0.04

Client: Terra-Dynamics Consulting Inc.
Project:
Project Manager: David Slaine
Samplers: Briar MacIntyre

PACKAGE: **SANSEW - Phenols** (WATER)

L1 = SANSEW / WATER / - - Halton Sewer Discharge By Law - Sanitary and Combined Sewer Discharge - BL_2_03

L2 = SANSEW / WATER / - - Halton Sewer Discharge By Law - Storm Sewer Discharge - BL_2_03

				Sample Number	8	9	10	11
				Sample Name	BH-5	BH-6	BH-7	BH-2
				Sample Matrix	Solution	Solution	Solution	Solution
				Sample Date	15/06/2021	15/06/2021	15/06/2021	15/06/2021
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**	**Result**	**Result**
Phenols								
4AAP-Phenolics	mg/L	0.002	1		0.011	0.011	< 0.002	< 0.002

PACKAGE: **SANSEW - SVOCs - PAHs** (WATER)

L1 = SANSEW / WATER / - - Halton Sewer Discharge By Law - Sanitary and Combined Sewer Discharge - BL_2_03

L2 = SANSEW / WATER / - - Halton Sewer Discharge By Law - Storm Sewer Discharge - BL_2_03

				Sample Number	8	9	10	11
				Sample Name	BH-5	BH-6	BH-7	BH-2
				Sample Matrix	Solution	Solution	Solution	Solution
				Sample Date	15/06/2021	15/06/2021	15/06/2021	15/06/2021
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**	**Result**	**Result**
SVOCs - PAHs								
Naphthalene	mg/L	0.0005	0.14		< 0.0005	< 0.0005	< 0.0005	< 0.0005

PACKAGE: **SANSEW - VOCs** (WATER)

L1 = SANSEW / WATER / - - Halton Sewer Discharge By Law - Sanitary and Combined Sewer Discharge - BL_2_03

L2 = SANSEW / WATER / - - Halton Sewer Discharge By Law - Storm Sewer Discharge - BL_2_03

				Sample Number	8	9	10	11
				Sample Name	BH-5	BH-6	BH-7	BH-2
				Sample Matrix	Solution	Solution	Solution	Solution
				Sample Date	15/06/2021	15/06/2021	15/06/2021	15/06/2021
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**	**Result**	**Result**
VOCs								
Chloroform	mg/L	0.0005	0.04		< 0.0005	0.0025	< 0.0005	< 0.0005
1,4-Dichlorobenzene	mg/L	0.0005	0.08		< 0.0005	< 0.0005	< 0.0005	< 0.0005
Methylene Chloride	mg/L	0.0005	2		< 0.0005	< 0.0005	< 0.0005	< 0.0005
Tetrachloroethylene (perchloroethylene)	mg/L	0.0005	1		< 0.0005	< 0.0005	< 0.0005	< 0.0005
Trichloroethylene	mg/L	0.0005	0.4		< 0.0005	< 0.0005	< 0.0005	< 0.0005

Client: Terra-Dynamics Consulting Inc.

Project:

Project Manager: David Slaine

Samplers: Briar MacIntyre

PACKAGE: **SANSEW - VOCs - BTEX** (WATER)

L1 = SANSEW / WATER / - - Halton Sewer Discharge By Law - Sanitary and Combined Sewer Discharge - BL_2_03

L2 = SANSEW / WATER / - - Halton Sewer Discharge By Law - Storm Sewer Discharge - BL_2_03

					Sample Number	8	9	10	11
					Sample Name	BH-5	BH-6	BH-7	BH-2
					Sample Matrix	Solution	Solution	Solution	Solution
					Sample Date	15/06/2021	15/06/2021	15/06/2021	15/06/2021
Parameter	**Units**	**RL**	**L1**	**L2**	**Result**	**Result**	**Result**	**Result**
VOCs - BTEX								
Benzene	mg/L	0.0005	0.01		< 0.0005	< 0.0005	< 0.0005	< 0.0005
Ethylbenzene	mg/L	0.0005	0.16		< 0.0005	< 0.0005	< 0.0005	< 0.0005
Toluene	mg/L	0.0005	0.016		< 0.0005	< 0.0005	< 0.0005	< 0.0005

EXCEEDANCE SUMMARY

Parameter	Method	Units	Result	SANSEW / WATER / - - Halton Sewer Discharge By Law - Sanitary and Combined Sewer Discharge - BL_2_03 L1	SANSEW / WATER / - - Halton Sewer Discharge By Law - Storm Sewer Discharge - BL_2_03 L2
BH-5					
E.Coli	SM 9222D	cfu/100mL	1140		200
BH-7					
Total Suspended Solids	SM 2540D	mg/L	1970	350	

QC SUMMARY

Anions by IC

Method: EPA300/MA300-Ions1.3 | Internal ref.: ME-CA-[ENVIIC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Sulphate	DIO0385-JUN21	mg/L	0.2	<0.2	8	20	96	90	110	92	75	125
Sulphate	DIO0387-JUN21	mg/L	0.2	<0.2	2	20	100	90	110	90	75	125
Sulphate	DIO0393-JUN21	mg/L	0.2	<0.2	7	20	96	90	110	NV	75	125

Biochemical Oxygen Demand

Method: SM 5210 | Internal ref.: ME-CA-[ENVIEWL-LAK-AN-007

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Biochemical Oxygen Demand (BOD5)	BOD0033-JUN21	mg/L	2	< 2	2	30	105	70	130	109	70	130

QC SUMMARY

Cyanide by SFA

Method: SM 4500 I Internal ref.: ME-CA-[ENVISFA-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Cyanide (total)	SKA0187-JUN21	mg/L	0.01	<0.01	ND	10	93	90	110	82	75	125

Fluoride by Specific Ion Electrode

Method: SM 4500 I Internal ref.: ME-CA-[ENVIEWL-LAK-AN-014

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Fluoride	EWL0351-JUN21	mg/L	0.06	<0.06	0	10	104	90	110	107	75	125

Hexavalent Chromium by SFA

Method: EPA218.6/EPA3060A I Internal ref.: ME-CA-[ENVISKA-LAK-AN-012

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Chromium VI	SKA0193-JUN21	ug/L	0.2	<0.2	ND	20	99	80	120	92	75	125

QC SUMMARY

Mercury by CVAAS

Method: EPA 7471A/SM 3112B | Internal ref.: ME-CA-[ENVISPE-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Mercury (total)	EHG0021-JUN21	mg/L	0.00001	< 0.00001	ND	20	101	80	120	123	70	130

QC SUMMARY

Metals in aqueous samples - ICP-MS

Method: SM 3030/EPA 200.8 | Internal ref.: ME-CA-IENVISPE-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Silver (total)	EMS0112-JUN21	mg/L	0.00005	<0.00005	ND	20	107	90	110	93	70	130
Aluminum (total)	EMS0112-JUN21	mg/L	0.001	<0.001	1	20	108	90	110	70	70	130
Arsenic (total)	EMS0112-JUN21	mg/L	0.0002	<0.0002	11	20	105	90	110	108	70	130
Beryllium (total)	EMS0112-JUN21	mg/L	0.000007	<0.00007	0	20	93	90	110	95	70	130
Cadmium (total)	EMS0112-JUN21	mg/L	0.000003	<0.000003	0	20	102	90	110	107	70	130
Cobalt (total)	EMS0112-JUN21	mg/L	0.000004	<0.000004	1	20	104	90	110	99	70	130
Chromium (total)	EMS0112-JUN21	mg/L	0.00008	<0.00008	9	20	102	90	110	104	70	130
Copper (total)	EMS0112-JUN21	mg/L	0.0002	<0.0002	1	20	102	90	110	111	70	130
Iron (total)	EMS0112-JUN21	mg/L	0.007	<0.007	5	20	105	90	110	125	70	130
Manganese (total)	EMS0112-JUN21	mg/L	0.00001	<0.00001	0	20	100	90	110	109	70	130
Molybdenum (total)	EMS0112-JUN21	mg/L	0.00004	<0.00004	4	20	105	90	110	103	70	130
Nickel (total)	EMS0112-JUN21	mg/L	0.0001	<0.0001	2	20	104	90	110	92	70	130
Lead (total)	EMS0112-JUN21	mg/L	0.00009	<0.00001	3	20	107	90	110	95	70	130
Phosphorus (total)	EMS0112-JUN21	mg/L	0.003	<0.003	1	20	99	90	110	NV	70	130
Antimony (total)	EMS0112-JUN21	mg/L	0.0009	<0.0009	ND	20	99	90	110	102	70	130
Selenium (total)	EMS0112-JUN21	mg/L	0.00004	<0.00004	ND	20	106	90	110	107	70	130
Tin (total)	EMS0112-JUN21	mg/L	0.00006	<0.00006	11	20	101	90	110	NV	70	130
Titanium (total)	EMS0112-JUN21	mg/L	0.00005	<0.00005	13	20	101	90	110	NV	70	130
Zinc (total)	EMS0112-JUN21	mg/L	0.002	<0.002	1	20	102	90	110	85	70	130
Silver (total)	EMS0120-JUN21	mg/L	0.00005	<0.00005	ND	20	98	90	110	100	70	130

QC SUMMARY

Metals in aqueous samples - ICP-MS (continued)

Method: SM 3030/EPA 200.8 | Internal ref.: ME-CA-IENVISPE-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Aluminum (total)	EMS0120-JUN21	mg/L	0.001	<0.001	4	20	94	90	110	110	70	130
Arsenic (total)	EMS0120-JUN21	mg/L	0.0002	<0.0002	13	20	98	90	110	105	70	130
Beryllium (total)	EMS0120-JUN21	mg/L	0.000007	<0.00007	9	20	92	90	110	87	70	130
Cadmium (total)	EMS0120-JUN21	mg/L	0.000003	<0.000003	13	20	99	90	110	111	70	130
Cobalt (total)	EMS0120-JUN21	mg/L	0.000004	<0.000004	3	20	98	90	110	101	70	130
Chromium (total)	EMS0120-JUN21	mg/L	0.00008	<0.00008	2	20	100	90	110	109	70	130
Copper (total)	EMS0120-JUN21	mg/L	0.0002	<0.0002	1	20	95	90	110	78	70	130
Iron (total)	EMS0120-JUN21	mg/L	0.007	<0.007	ND	20	104	90	110	100	70	130
Manganese (total)	EMS0120-JUN21	mg/L	0.00001	<0.00001	1	20	96	90	110	99	70	130
Molybdenum (total)	EMS0120-JUN21	mg/L	0.00004	<0.00004	4	20	98	90	110	105	70	130
Nickel (total)	EMS0120-JUN21	mg/L	0.0001	<0.0001	7	20	97	90	110	96	70	130
Lead (total)	EMS0120-JUN21	mg/L	0.00009	<0.00001	5	20	103	90	110	106	70	130
Phosphorus (total)	EMS0120-JUN21	mg/L	0.003	<0.003	15	20	100	90	110	NV	70	130
Antimony (total)	EMS0120-JUN21	mg/L	0.0009	<0.0009	9	20	103	90	110	107	70	130
Selenium (total)	EMS0120-JUN21	mg/L	0.00004	<0.00004	5	20	91	90	110	98	70	130
Tin (total)	EMS0120-JUN21	mg/L	0.00006	<0.00006	ND	20	95	90	110	NV	70	130
Titanium (total)	EMS0120-JUN21	mg/L	0.00005	<0.00005	5	20	94	90	110	NV	70	130
Zinc (total)	EMS0120-JUN21	mg/L	0.002	<0.002	4	20	96	90	110	116	70	130

QC SUMMARY

Microbiology

Method: SM 9222D | Internal ref.: ME-CA-IENVIMIC-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
E. Coli	BAC9318-JUN21	cfu/100mL	-	ACCEPTED	ACCEPTED							

Nonylphenol and Ethoxylates

Method: ASTM D7065-06 | Internal ref.: ME-CA-IENVIGC-LAK-AN-015

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Nonylphenol	GCM0319-JUN21	ug/L	1.0	< 1			88	55	120			
Nonylphenol diethoxylate	GCM0319-JUN21	ug/L	10	< 10			88	55	120			
Nonylphenol Ethoxylates	GCM0319-JUN21	ug/L	10	< 10								
Nonylphenol monoethoxylate	GCM0319-JUN21	ug/L	10	< 10			90	55	120			

QC SUMMARY

Oil & Grease

Method: MOE E3401 | Internal ref.: ME-CA-[ENV]GC-LAK-AN-019

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Oil & Grease (total)	GCM0348-JUN21	mg/L	2	<2	NSS	20	98	75	125			

Oil & Grease-AV/MS

Method: MOE E3401/SM 5520F | Internal ref.: ME-CA-[ENV]GC-LAK-AN-019

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Oil & Grease (animal/vegetable)	GCM0348-JUN21	mg/L	4	< 4	NSS	20	NA	70	130			
Oil & Grease (mineral/synthetic)	GCM0348-JUN21	mg/L	4	< 4	NSS	20	NA	70	130			

pH

Method: SM 4500 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
pH	EWL0338-JUN21	No unit	0.05	NA	0		100			NA		

QC SUMMARY

Phenols by SFA

Method: SM 5530B-D | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
4AAP-Phenolics	SKA0186-JUN21	mg/L	0.002	<0.002	0	10	96	80	120	103	75	125
4AAP-Phenolics	SKA0201-JUN21	mg/L	0.002	<0.002	ND	10	100	80	120	87	75	125

Polychlorinated Biphenyls

Method: MOE E3400/EPA 8082A | Internal ref.: ME-CA-[ENV]GC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Polychlorinated Biphenyls (PCBs) - Total	GCM0313-JUN21	ug/L	0.04	< 0.04	ND	30	96	60	140	128	60	140

QC SUMMARY

Semi-Volatile Organics

Method: EPA 3510C/8270D | Internal ref.: ME-CA-[ENV]GC-LAK-AN-005

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Naphthalene	GCM0347-JUN21	mg/L	0.0005	< 0.0005	ND	30	95	50	140	99	50	140

Suspended Solids

Method: SM 2540D | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Total Suspended Solids	EWL0347-JUN21	mg/L	2	< 2	0	10	95	90	110	NA		
Total Suspended Solids	EWL0381-JUN21	mg/L	2	< 2	2	10	105	90	110	NA		

Total Nitrogen

Method: SM 4500-N C/4500-NO3- F | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-002

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Total Kjeldahl Nitrogen	SKA0232-JUN21	as N mg/L	0.5	<0.5	1	10	93	90	110	92	75	125

QC SUMMARY

Volatile Organics

Method: EPA 5030B/8260C | Internal ref.: ME-CA-[ENVIGC-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
1,4-Dichlorobenzene	GCM0353-JUN21	mg/L	0.0005	<0.0005	ND	30	93	60	130	99	50	140
Benzene	GCM0353-JUN21	mg/L	0.0005	<0.0005	ND	30	98	60	130	102	50	140
Chloroform	GCM0353-JUN21	mg/L	0.0005	<0.0005	ND	30	94	60	130	99	50	140
Ethylbenzene	GCM0353-JUN21	mg/L	0.0005	<0.0005	ND	30	97	60	130	103	50	140
Methylene Chloride	GCM0353-JUN21	mg/L	0.0005	<0.0005	ND	30	96	60	130	99	50	140
Tetrachloroethylene (perchloroethylene)	GCM0353-JUN21	mg/L	0.0005	<0.0005	ND	30	97	60	130	101	50	140
Toluene	GCM0353-JUN21	mg/L	0.0005	<0.0005	ND	30	96	60	130	101	50	140
Trichloroethylene	GCM0353-JUN21	mg/L	0.0005	<0.0005	ND	30	96	60	130	99	50	140

QC SUMMARY

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

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

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS Insufficient sample for analysis.
RL Reporting Limit.
↑ Reporting limit raised.
↓ Reporting limit lowered.
NA The sample was not analysed for this analyte
ND Non Detect

Samples analysed as received. Solid samples expressed on a dry weight basis. "Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act" published by the Ministry and dated March 9, 2004 as amended.

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-- End of Analytical Report --

SGS Environment, Health & Safety

Request for Laboratory Services and CHAIN OF CUSTODY

No: 014815

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Page _____ of _____

Laboratory Information Section - Lab use only

Received By: Hillary N
Received Date: 06 / 16 / 21 (mm/dd/yy)
Received Time: 9 : 45 (hr : min)
Received By (signature): xm
Custody Seal Present: Yes ☐ No ☑
Custody Seal Intact: Yes ☐ No ☑
Cooling Agent Present: Yes ☑ No ☐ Type: Ice Pack
Temperature Upon Receipt (°C) 16 , 16 , 16
LAB LIMS #: CA15407-Jun21

REPORT INFORMATION	INVOICE INFORMATION
Company: Terra - Dynamics Consulting	☒ (same as Report Information)
Contact: David Slaine	Company:
Address: 432 Niagara St unit 2 St. Catharines, ON, L2M 4W3	Contact:
Phone:	Address:
Fax:	Phone:
Email: dslaine@terra-dynamics.com	Email: jcampbell@terra-dynamics.com

Quotation #: 2021 879
Project #: 2020 Lakeshore Rd.
P.O. #:
Site Location/ID: Burlington

TURNAROUND TIME (TAT) REQUIRED

☒ Regular TAT (5-7days)

TAT's are quoted in business days (exclude statutory holidays & weekends). Samples received after 6pm or on weekends: TAT begins next business day

RUSH TAT (Additional Charges May Apply): ☐ 1 Day ☐ 2 Days ☐ 3 Days ☐ 4 Days

PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION

Specify Due Date: _____

NOTE: DRINKING (POTABLE) WATER SAMPLES FOR HUMAN CONSUMPTION MUST BE SUBMITTED WITH SGS DRINKING WATER CHAIN OF CUSTODY

REGULATIONS

Regulation 153/04:
☐ Table 1 ☐ Res/Park Soil Texture: ☐ Coarse
☐ Table 2 ☐ Ind/Com ☐ Medium
☐ Table 3 ☐ Agri/Other ☐ Fine
☐ Table _____

Other Regulations:
☐ Reg 347/558 (3 Day min TAT)
☐ PWQO ☐ MMER
☐ CCME ☐ Other:
☐ MISA _____

Sewer By-Law:
☒ Sanitary
☑ Storm
Municipality: Burlington Storm, Halton Sewer

RECORD OF SITE CONDITION (RSC) ☐ YES ☐ NO

ANALYSIS REQUESTED

	SAMPLE IDENTIFICATION	Time ~~DATE~~ SAMPLED	Date ~~TIME~~ SAMPLED	# OF BOTTLES	MATRIX
1	BH-5	9:10	06/15/21	14	
2	BH-6	9:45	↓	↓	
3	BH-7	10:20			
4	BH-2	10:45			
5					
6					
7					
8					
9					
10					
11					
12					

M & I: Field Filtered (Y/N); Metals & Inorganics incl CrVI, CN, Hg pH,(B(HWS),EC,SAR–soil) (Cl, Na-water); Full Metals Suite ICP metals plus B(HWS-soil only) Hg, CrVI; ICP Metals only Sb,As,Ba,Be,B,Cd,Cr,Co,Cu,Pb,Mo,Ni, Se,Ag,Ti,U,V,Zn

SVOC: PAHs only; SVOCs all incl PAHs, ABNs, CPs

PCB: PCBs Total ☐ Aroclor ☐

PHC: F1-F4 + BTEX; F1-F4 only no BTEX

VOC: VOCs all incl BTEX; BTEX only

Pest: Pesticides Organochlorine or specify other

Other (please specify): Sewer Use: Specify pkg:; Water Characterization Pkg General ☐ Extended ☐

TCLP: Specify TCLP tests ☐M&I ☐VOC ☐PCB ☐B(a)P ☐ABN ☐Ignit.

COMMENTS:

☒ Please See Attached ☒ Encoding list

☒ Note: 4 Coolers ☒

Observations/Comments/Special Instructions

Sampled By (NAME): Brian MacIntyre Signature:
Relinquished by (NAME): PRESTYN SIDER Signature:
Date: 06 / 15 / 21 (mm/dd/yy)
Date: 06 / 15 / 21 (mm/dd/yy)

Pink Copy - Client
Yellow & White Copy - SGS

Revision #: 1.2
Date of Issue: 09 Sept, 2019

Note: Submission of samples to SGS is acknowledgement that you have been provided direction on sample collection/handling and transportation of samples. {2} Submission of samples to SGS is considered authorization for completion of work. Signatures may appear on this form or be retained on file in the contract, or in an alternative format (e.g. shipping documents). {3} Results may be sent by email to an unlimited number of addresses for no additional cost. Fax is available upon request. This document is issued by the Company under its General Conditions of Service accessible at http://www.sgs.com/terms_and_conditions.htm. (Printed copies are available upon request.) Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein.

COST SUMMARY

	Unit Cost	Qty	Cost
Burlington Storm and Halton Sanitary pH, BOD, TSS, Sulphate, O&G(tot), O&G(animal/vegetable), O&G(mineral/synthetic), Phenolics (4AAP), TKN, Cyanide, Fluoride, Mercury, Silver, Aluminum, Arsenic, Beryllium, Cadmium, Cobalt, Chromium, Copper, Iron, Manganese, Molybdenum, Nickel, Phosphorus, Lead, Antimony, Selenium, Tin, Titanium, Zinc, Benzene, Chloroform, 1,4 Dichlorobenzene, Ethylbenzene, Methylene Chloride, Tetrachloroethylene, Toluene, Trichloroethylene, Naphthalene Plus: NP/NPE, PCBs, pH, CrVI	CA$ 603.50	4	CA$ 2,414.00
Environmental Disposal Fee (routine samples)	CA$ 5.00	4	CA$ 20.00
		Subtotal	**CA$ 2,434.00**

- **Prices shown are based on sample quantities indicated, and can change based on quantities submitted.**
- **Turnaround times for routine samples indicated in this quote are 5-7 days from receipt of samples.**

RE: [EXTERNAL] SGS_HP_MFP Scan Document

Arnold, Catharine (Lakefield) <Catharine.Arnold@sgs.com>
Wed 2021-06-16 12:03 PM
To: Thompson, Lisa (Lakefield) <Lisa.Thompson@sgs.com>; LR.Envlogin1 (Lakefield) <LR.Envlogin1@sgs.com>

Please analyze the E.Coli for this sample as per the client (Jayme Campbell).

-----Original Message-----
From: Thompson, Lisa (Lakefield) <Lisa.Thompson@sgs.com>
Sent: Wednesday, June 16, 2021 11:19 AM
To: Arnold, Catharine (Lakefield) <Catharine.Arnold@sgs.com>
Subject: FW: [EXTERNAL] SGS_HP_MFP Scan Document

Can you look into this?

-----Original Message-----
From: SGS_HP_MFP [mailto:SGS_HP_MFP@sgsna.com]
Sent: June-16-21 11:09 AM
To: Thompson, Lisa (Lakefield) <Lisa.Thompson@sgs.com>
Cc: LR.Envlogin1 (Lakefield) <LR.Envlogin1@sgs.com>
Subject: [EXTERNAL] SGS_HP_MFP Scan Document

*** WARNING: this message is from an EXTERNAL SENDER. Please be cautious, particularly with links and attachments. *** _____

We rec'd bacti bottles but no micro tests indicated on their attached quote. Just looking to confirm their tests as we also dont have a Burlington storm template.

Appendix E

Dewatering Calculations

Table E-1 Dewatering Assessment
2 Weeks

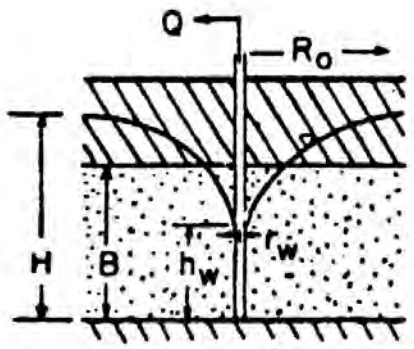
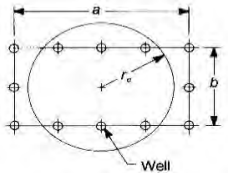
Radial flow, mixed aquifer	Inputs	Comments
H=Initial water level (m)	6.8	
h_w=Remaining saturated thickness (m)	0	
B=aquifer thickness (m)	5.6	
K=Hydraulic Conductivity (m/s)	2.E-07	
a=Rectangular Excavation Length (m)	60	Modelled as two circular systems to keep a/b < 1.5, actual length 120 metres
b=Rectangular Excavation Width (m)	65	
	Calculations	
R_w=Re=Effective radius Calc (m)	35	$r_e = \sqrt{\frac{ab}{\pi}}$
Time of dewatering (hours)	336	
Specific Storage	1.E-04	Sykes et al, 2008 (S_s = 1x10-4)
R_0=Radius of Influence Calc (Cooper&Jacob) (m)	47	$R_o = \sqrt{\frac{2.25kDt}{S}}$
Q_w=Flow Rate (m^3/s)	9.8E-05	$Q_w = \frac{\pi K(2BH - B^2 - h_w^2)}{\ln R_0/r_w}$
Q_w=Flow Rate (m^3/day)	8	
Q_w=Flow Rate (L/day)	8,476	
Q_w=Flow Rate (L/day)*2 [as excavation split up]	16,953	Flow rate multiplied by two representing two circular systems for entire excavation

Table E-2 Dewatering Assessment
2 Weeks

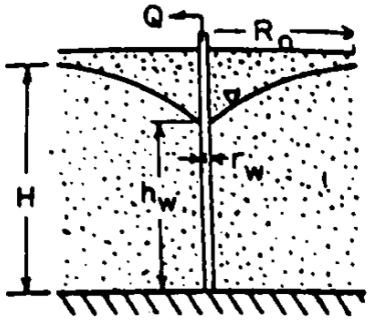
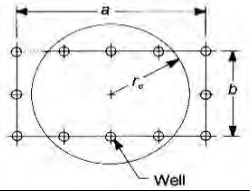
Radial flow, water table aquifer	Inputs	Comments
H=Initial saturated thickness (m)	6.8	
h_w=Remaining saturated thickness (m)	0	
K=Hydraulic Conductivity (m/s)	2.E-07	
a=Rectangular Excavation Length (m)	60	Modelled as two circular systems to keep a/b < 1.5, actual length 90 metres
b=Rectangular Excavation Width (m)	65	
	Calculations	
R_w=Re=Effective radius Calc (m)	35	$r_e = \sqrt{\frac{ab}{\pi}}$
Time of dewatering (hours)	336	
Specific Storage	1.E-04	Sykes et al, 2008 (S_s = 1x10-4)
R_0=Radius of Influence Calc (Cooper&Jacob) (m)	43	$R_o = \sqrt{\frac{2.25kDt}{S}}$
Q_w=Flow Rate (m^3/s)	0.000153	$Q_w = \frac{\pi K(H^2 - h_w^2)}{\ln R_0 / r_w}$
Q_w=Flow Rate (m^3/day)	13	
Q_w=Flow Rate (L/day)	13,220	
Q_w=Flow Rate (L/day)*2 [as excavation split up]	26,440	Flow rate multiplied by two representing two circular systems for entire excavation

Table E-3 Dewatering Assessment

1 Year

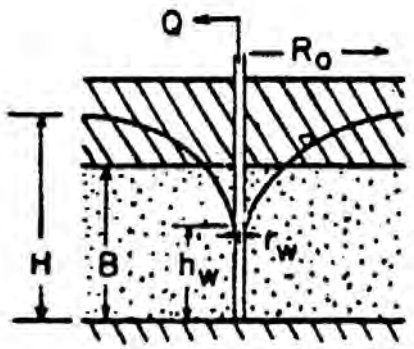
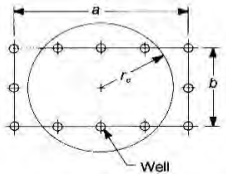
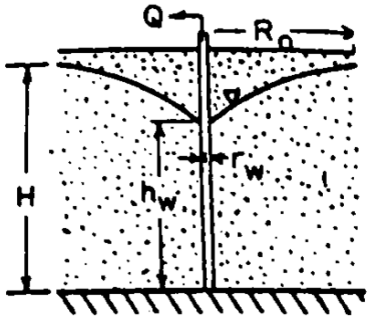
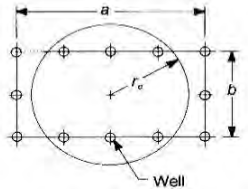
Radial flow, mixed aquifer	Inputs	Comments
H=Initial water level (m)	6.8	
h_w=Remaining saturated thickness (m)	0	
B=aquifer thickness (m)	5.6	
K=Hydraulic Conductivity (m/s)	2.E-07	
a=Rectangular Excavation Length (m)	60	Modelled as two circular systems to keep a/b < 1.5, actual length 120 metres
b=Rectangular Excavation Width (m)	65	
	Calculations	
R_w=Re=Effective radius Calc (m)	35	$r_e = \sqrt{\frac{ab}{\pi}}$
Time of dewatering (hours)	8766	
Specific Storage	1.E-04	Sykes et al, 2008 (S_s = 1x10-4)
R_0=Radius of Influence Calc (Cooper&Jacob) (m)	240	$R_o = \sqrt{\frac{2.25kDt}{S}}$
Q_w=Flow Rate (m^3/s)	1.5E-05	$Q_w = \frac{\pi K(2BH - B^2 - h_w^2)}{\ln R_0/r_w}$
Q_w=Flow Rate (m^3/day)	1	
Q_w=Flow Rate (L/day)	1,269	
Q_w=Flow Rate (L/day)*2 [as excavation split up]	2,537	Flow rate multiplied by two representing two circular systems for entire excavation

Table E-4 Dewatering Assessment

1 Year

Radial flow, water table aquifer	Inputs	Comments
H=Initial saturated thickness (m)	6.8	
h_w=Remaining saturated thickness (m)	0	
K=Hydraulic Conductivity (m/s)	3.E-07	
a=Rectangular Excavation Length (m)	60	Modelled as two circular systems to keep a/b < 1.5, actual length 90 metres
b=Rectangular Excavation Width (m)	65	
	Calculations	
R_w=Re=Effective radius Calc (m)	35	$r_e = \sqrt{\frac{ab}{\pi}}$
Time of dewatering (hours)	8766	
Specific Storage	1.E-04	Sykes et al, 2008 (S_s = 1x10-4)
R_0=Radius of Influence Calc (Cooper&Jacob) (m)	266	$R_o = \sqrt{\frac{2.25kDt}{S}}$
Q_w=Flow Rate (m^3/s)	0.000022	$Q_w = \frac{\pi K(H^2 - h_w^2)}{\ln R_0 / r_w}$
Q_w=Flow Rate (m^3/day)	2	
Q_w=Flow Rate (L/day)	1,862	
Q_w=Flow Rate (L/day)*2 [as excavation split up]	3,723	Flow rate multiplied by two representing two circular systems for entire excavation