S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS

Functional Servicing & Stormwater Management Report

2072 LAKESHORE ROAD

CITY OF BURLINGTON

ACAMAR DWELLING CORP.

December 2024

SLA File: 23028

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1.0 INTRODUCTION AND BACKGROUND

1.1 OVERVIEW

S. Llewellyn & Associates Limited has been retained by Acamar Dwelling Corp. to provide Consulting Engineering services for the proposed development at 2072 Lakeshore Road in the City of Burlington, Region of Halton (see Figure 1.0 for location plan).

The proposed development consists of constructing a 20-storey mixed-use building including asphalt driveways, underground parking and concrete curbing.

This Functional Servicing and Stormwater management Report will provide detailed information of the proposed servicing scheme for this development. Please refer to the Engineering Plans prepared by S. Llewellyn and Associates Limited and the Site Plan prepared by Graziani + Corazza Architects Inc. for additional information.

1.2 BACKGROUND INFORMATION

The following documents were referenced in the preparation of this report:

Ref. 1: MOE Stormwater Management Practices Planning and Design Manual (Ministry of Environment, March 2003)

Ref. 2: City of Burlington Standard Drawings (City of Burlington, March 2014)

Ref. 3: Halton Region Water and Wastewater Linear Design Manual (Halton Region, May 2014)

Ref. 4: Low Impact Development Stormwater Management Planning and Design Guide (Credit Valley Conservation Authority / Toronto and Region Conservation Authority, 2010)

Ref. 5: Stormwater Management Design Guidelines (City of Burlington, May 21, 2020)



Figure 1.0 – Location Plan

1.3 GEOTECHNICAL & HYDROGEOLOGICAL INVESTIGATIONS

Geotechnical and Hydrogeological Investigation Reports were prepared by Grounded Engineering dated July 4, 2023 and July 20, 2023 respectively. Seven boreholes were advanced between March 6 and 16, 2023 to depths ranging between 8.0m and 27.9m below grade. Asphalt was encountered at the surface of all boreholes except boreholes BH103 and BH104 which had 0.15m of topsoil and 1.5m of granular fill materials respectively. All boreholes have granular fill material underlaying the surface to depths ranging from 0.6m to 2.5m. Except for BH103 that has a 1.2m layer of Sand below the granular fill layer and overlaying the encountered clayey silt layer, a clayey silt layer was encountered (below the granular material in all other boreholes) and extending to depths of 0.5m to 2.4m. Bedrock of Queenston formation was encountered beneath the overburden soils in all boreholes extending to depths of 4.8m to 24.8m. Given the site's stratigraphy, a considerable amount of rock breaking will have to be done to achieve the proposed seven (7) levels of underground parking on site.

The groundwater quality determined by laboratory analyses revealed compliance to Region of Halton parameters for the sanitary and storm sewer limits. Temporary construction dewatering will be required and the dewatering flowrate; taking into consideration precipitation volumes, is a factored flow rate of 234,000 L/day (2.7 l/s), which is less than the allowable discharge rates noted in Table 2.4 of this report. The factored permanent drainage rate was also estimated to be 195,000 L/day (2.3 l/s).

Registration on the MOECC Environmental Activity and Sector Registry (EASR) Posting for Water Taking will be required for construction since the temporary construction dewatering flow rate is more than 50,000 L/day. An application for permission to take water will not be required for neither the construction nor permanent drainage; as the

daily flowrates are less than 400,000L/day respectively. An application for permission to discharge to the storm sewer system will be required unless the subsurface structure of the building is designed as watertight or onsite disposal facilities are implemented.

For additional information, refer to the Geotechnical and Hydrogeological Investigations in Appendix D and E, respectively.

2.0 STORMWATER MANAGEMENT

The following stormwater management (SWM) criteria will be applied to the site, in accordance with the City of Burlington requirements:

Quantity Control
The 100-year post development flow rate shall be controlled to the 2-year pre-development flow rate. Additionally, the maximum pre-development imperviousness of 36% is to be used for the pre-development calculations.

Quality Control
The stormwater runoff from the proposed condition site must meet Level 1 (Enhanced) stormwater quality control (80% TSS removal, 90% average annual runoff treatment).

2.1 EXISTING CONDITIONS

In the existing condition, there is an existing commercial building with associated asphalt parking lot and landscaped areas. The site is bounded by Lakeshore Road to the north, Old lakeshore Road to the south, Pearl Street to the west and a parking lot to the east. Most of the runoff from the site is captured by an existing catchbasin within the asphalt parking lot on site that outlets to the 450mmø storm sewer along Old Lakeshore Road. The remainder of the site sheet drains to Lakeshore Road; where the runoff is captured by the existing catchbasin connected to the 750mmø storm sewer along Lakeshore Road.

Two (2) catchment areas, Catchment 101 and Catchment 102 has been identified in the existing conditions. Catchment 101 represents the discharge to the existing 450mmø storm sewer along Old Lakeshore Road. Catchment 102 represents the discharge to the existing 750mmø storm sewer along Lakeshore Road. See Table 2.1 below and the Existing Conditions Storm Drainage Area Plan in Appendix A for details.

Table 2.1 – Existing Conditions Catchment Areas

Catchment ID	Description	Area (ha)	Percent Impervious	Runoff Coefficient
101	To Old Lakeshore Road	0.13	77	0.76
102	To Lakeshore Road	0.02	59	0.66

The existing conditions discharge from the site was calculated using the SWMHYMO Hydrologic Modelling Program for the 2-year to 100-year City of Burlington design storms. A summary of the results can be found in Table 2.2 and Table 2.3.

Table 2.2 – Existing Condition Stormwater Discharge (To Old Lakeshore Road)	
Storm Event	Catchment 101 Discharge (m^3/s)
2-year	0.022
5-year	0.029
10-year	0.034
25-year	0.040
50-year	0.044
100-year	0.049

Table 2.3 – Existing Condition Stormwater Discharge (To Lakeshore Road)	
Storm Event	Catchment 102 Discharge (m^3/s)
2-year	0.003
5-year	0.004
10-year	0.004
25-year	0.005
50-year	0.006
100-year	0.007

Allowable Discharge Rates

The 100-year post-development flow rate shall be controlled to the 2-year pre-development flow rate. However, the maximum pre-development imperviousness of 36% will be used for the pre-development calculations since the existing conditions site is greater than 36% impervious. The allowable discharge rate for the 2-year storm event has been calculated using the SWMHYMO Hydrologic Modelling Program. A summary of the results can be found in Table 2.4 below:

Table 2.4 – Allowable Discharge Rates	
Storm Event	Post-Development Allowable Discharge (m^3/s)
2-year	0.012

2.2 PROPOSED CONDITIONS

It is proposed to develop the site by constructing a 20-storey mixed-use building including seven levels of underground parking, asphalt driveways and concrete curbs. It is proposed to service the site with a 200mmø storm sewer, designed and constructed in accordance with the City of Burlington standards.

Three (3) catchment areas, Catchment 201, 202 and 203 have been identified in the proposed condition. Catchment 201 represents controlled drainage from the site, which will be captured by the roof and discharged to the existing 450mmø storm sewer along Old Lakeshore Road. Catchment 202 represents uncontrolled drainage from the site which will discharge to Lakeshore Road. Catchment 203 represents the uncontrolled sheet drainage from the site to Old Lakeshore Road. See Table 2.5 below and the Post-Development Storm Drainage Area Plan in Appendix A for details.

Table 2.5 – Proposed Condition Catchment Areas

Catchment ID	Description	Area (ha)	Percent Impervious	Runoff Coefficient
201	Controlled drainage to Old Lakeshore	0.12	99%	0.95
202	Uncontrolled drainage to Lakeshore	0.01	82%	0.90
203	Uncontrolled drainage to Old Lakeshore	0.02	86%	0.90

Water Quantity Control

It is proposed to apply quantity control measures to the runoff from Catchment 201 by means of a 75mmø outlet on the cast-in-place storage tank.

With the installation of quantity control measures for Catchment 201, it will be required to provide on-site stormwater storage. On-site storage will be provided by a cast-in-place concrete storage tank within the underground parking. See Table 2.6 and Appendix A for the stage-storage-discharge relationship of the orifice control and on-site storage.

Table 2.6 – Proposed Condition Stage-Storage-Discharge (Catchment 201)

Elevation (m)	Storage (m^3)	Discharge (m^3/s)
80.70 (Orifice Invert)	0	0.0000
81.00 (Overflow Weir flowing to the Bottom of Weir)	5	0.0060
78.05 (Bottom of Tank)	5	0.0060
78.85 (0.80m Deep)	19	0.0060
79.65 (1.60m Deep)	34	0.0060
80.70 (2.65m Deep)	53	0.0060
81.00 (Weir)	53	0.0060
81.20 (Overflow Pipe)	57	0.0080
81.70 (Top of Tank)	66	0.0115

An analysis was performed on the Proposed Condition site using the SWMHYMO hydrologic modeling program to determine the required volume of stormwater storage during the 2-year to 100-year City of Burlington design storms. A summary of the results can be found in Table 2.7 and the detailed SWMHYMO input/output information can be

found in Appendix A. Table 2.8 compares the pre-development flows and post-development flows to Lakeshore Road.

Table 2.7 – Proposed Condition Stormwater Discharge (To Old Lakeshore)

Storm Event	Catchment 201 Controlled Discharge (m^3/s)	Catchment 203 Uncontrolled Discharge (m^3/s)	Total Discharge (m^3/s)	Allowable Discharge (m^3/s)	Required Storage (m^3)
2-Yr	0.006	0.004	0.010	0.012	17.1
5-Yr	0.006	0.005	0.011	0.012	23.8
10-Yr	0.006	0.006	0.012	0.012	28.9
25-Yr	0.006	0.007	0.013	0.012	35.6
50-Yr	0.006	0.008	0.014	0.012	40.7
100-Yr	0.006	0.008	0.014	0.012	46.1

Table 2.8 – Proposed Condition Stormwater Discharge (To Lakeshore Road)

Storm Event	Catchment 102 Discharge (m^3/s) (Existing Condition)	Catchment 202 Discharge (m^3/s) (Proposed Condition)
2-year	0.003	0.002
5-year	0.004	0.002
10-year	0.004	0.003
25-year	0.005	0.003
50-year	0.006	0.004
100-year	0.007	0.004

This analysis determined the following:

- The proposed condition discharge rates to Old Lakeshore Road will not exceed the allowable discharge rate during the 2-year to 10-year storm events with the installation of a 75mmø orifice control.

- The proposed condition discharge rate will exceed the allowable discharge rate by 1 l/s during the 25-year storm event and 2 l/s during the 50-year and 100-year events. This is considered a negligible increase and will not have a negative impact on the downstream conveyance system.

- Catchment 201 will require 46.1m^3 of stormwater storage during the 100-year event, which can be accommodated with the provision of a 66m^3 storage capacity.

- The proposed condition discharge rates to Lakeshore Road will not exceed the pre-development discharge rates during the 2-year to 100-year design storms.

Water Quality Control

No quality control measures are required since the site consists mostly of rooftop, walkways and landscaped area which is considered clean runoff.

2.3 SEDIMENT AND EROSION CONTROL

In order to minimize erosion during the grading and site servicing period of construction, the following measures will be implemented:

- Install silt fencing along the outer boundary of the site to ensure that sediment does not migrate to the adjacent properties;
- Install a mud mat at the construction entrance of the site to reduce mud tracking and sediment leaving the site via construction traffic;
- Install sediment control (silt sacks) in the proposed catchbasins as well as the nearby existing catchbasins to ensure that no untreated runoff enters the existing conveyance system;
- Stabilize all disturbed or landscaped areas with hydro seeding/sodding to minimize the opportunity for erosion.

To ensure and document the effectiveness of the erosion and sediment control structures, an appropriate inspection and maintenance program is necessary. The program will include the following activities:

- Inspection of the erosion and sediment controls (e.g. silt fences, sediment traps, outlets, vegetation, etc.) with follow up reports to the governing municipality; and
- The developer and/or their contractor shall be responsible for any costs incurred during the remediation of problem areas.

3.0 SANITARY SEWER SERVICING

3.1 EXISTING CONDITIONS

There is an existing 200mmø sanitary sewer located adjacent to the site along Old Lakeshore Road as well as an existing 450mmø sanitary sewer along Lakeshore Road.

3.2 SANITARY DEMAND

Sanitary discharge from the site was estimated in accordance with the Halton Region Water and Wastewater Linear Design Manual. Table 3.1 summarizes the sanitary sewer discharge rate for the subject lands.

Table 3.1 - Post-Development Sanitary Sewer Discharge

Population [A]	Avg. Demand [B] (l/s)	Peaking Factor [C]	Infiltration [D] (l/s)	**Peak Flow [E] (l/s)**
272 persons	0.87	4.0	0.04	**3.52**

[A] Population = (165 units x 1.62 persons/unit) + (394m^2 commercial x 90 persons/hectare) = 272 persons
[B] Average demand = (275 l/cap/day x population)
[C] Peaking Factor = $1+((14/(4+P^{0.5})))$ with P expressed in thousands Min = 2.0
[D] Infiltration flow based on 0.286 l/ha/sec infiltration rate x Site Area (0.15 hectares)
[E] Peak Flow = (Average Flow x Peaking Factor) + Infiltration

3.3 PROPOSED SANITARY SERVICING AND CAPACITY ANALYSIS

The proposed site will be serviced by a 200mmø sanitary sewer, designed and constructed in accordance with City of Burlington and Region of Halton standards. Drainage from this sewer will discharge to the existing 450mmø sanitary sewer adjacent to the site along Lakeshore Road.

The minimum grade of the proposed 200mmø sanitary sewer will be 2.0%. At this minimum grade, the proposed sanitary sewer will have a capacity of 0.039 m^3/s (39 l/s). Therefore, the proposed 200mmø sanitary sewer at a minimum grade of 2.0% is adequately sized to service the proposed development.

The existing 450mmø sanitary sewer flows east along Lakeshore Road and outlets to the Junction Street Wastewater Pumping Station located at 2137 Lakeshore Road. Halton Region completed a Municipal Class Environmental Assessment Study in June 2018 for upgrades to this pumping station and forcemain. The EA Study indicated that the pumping station and forcemain construction was anticipated in 2028. Further discussion with Halton Region is required to determine if the upgrades are required to accommodate the proposed development and to confirm the timeline for the upgrades.

4.0 DOMESTIC AND FIRE WATER SUPPLY SERVICING

4.1 EXISTING CONDITIONS

The existing municipal water distribution system consists of a 300mmø watermain located adjacent to the site along Old Lakeshore Road, Lakeshore Road and Pearl Street. There is an existing fire hydrant adjacent to the site along Pearl Street.

4.2 DOMESTIC WATER DEMAND

Water demand for the site was estimated in accordance with the Halton Region Water and Wastewater Linear Design Manual. Tables 4.1 summarizes the domestic water demand requirements for the Average Daily, Maximum Daily and Peaking Hourly demand scenarios.

Table 4.1 - Post-Development Domestic Water Demand

Population [A*]	Average Daily Demand [B] (l/s)	Max. Daily Peaking Factor [C]	Max. Hourly Peaking Factor [D]	**Max. Daily Demand [E] (l/s)**	**Max. Hourly Demand [F] (l/s)**
272 persons	0.87	3.0	4.5	**2.61**	**3.92**

[A] Population = (165 units x 1.62 persons/unit) + (394m^2 commercial x 90 persons/hectare) = 272 persons
[B] Average Daily Demand = 275 l/cap/day x population
[C] Max. Daily Peaking Factor = 3.0
[D] Max. Hourly Peaking Factor = 4.5
[E] Max. Daily Demand = Average Daily Demand x Max. Daily Peaking Factor
[F] Max. Hourly Demand = Average Daily Demand x Max. Hourly Peaking Factor

4.3 FIRE FLOW DEMAND

Fire flow demands for the proposed development are governed by a number of guidelines and criteria, such as the Water Supply for Public Fire Protection (Fire Underwriters Survey, 2020), Ontario Building Code (OBC), and various codes and standards published by the National Fire Protection Association (NFPA).

The proposed building is non-combustible construction (C=0.8), with limited combustible occupancy (-15% correction) and a fully supervised sprinkler system (-50% correction). Exposure components are based on the following:

North Face: 10% correction (20.1m to 30.0m)
South Face: 10% correction (20.1m to 30.0m)
East Face: 25% correction (0m to 3.0m)
West Face: 10% correction (20.1m to 30.0m)
Total: 55%

It is estimated that the required fire flow for the proposed development will be **167 l/s**. See the Fire Flow Demand Requirements in Appendix B for details.

The existing hydrant fronting the site on Pearl Street is located within the 90m separation from the building face adjacent to a street (as per Sentence 3.2.5.7 of the 2012 Ontario Building Code), no additional private hydrants are proposed for this development.

The following hydrant flow test data for the public fire hydrant in closest proximity to the proposed development has been analyzed to determine if the municipal system adjacent to the subject site is adequate to provide the required fire flow, with a minimum pressure of 20 psi. Table 4.2 summarizes the hydrant flow data made available by Vipond & P.U.C.

Based on the below hydrant flow test data, the theoretical available flow rate is **540 l/s**, while the minimum required fire flow for the proposed development is only **167 l/s**.

Therefore, based on the below analysis, the proposed water distribution system will have the capacity and pressure required to adequately service the subject land.

Table 4.2 – Hydrant Flow Data (Vipond & P.U.C.)	
Location	2072 Lakeshore Road, Burlington
Test Date	2023-11-30
Static Pressure	73 psi
Residual Pressure (One outlet)	71 psi
Residual Pressure (Two outlets)	69 psi
Test Flow (One outlet)	1280 USGPM (80.8 l/s)
Test Flow (Two outlets)	2130 USGPM (134.4 l/s)
Theoretical Flow @ 20 psi	**8560 USGPM (540.1 l/s)**

4.4 PROPOSED WATER SERVICING AND ANALYSIS

Proposed water servicing for the site consists of connecting two 200mmø watermains to the existing 300mmø watermain adjacent to the site along Pearl Street. Domestic water service to the proposed development will be achieved with a 150mm domestic water service line that will tee-off one of the 200mm watermain before the property line. All proposed water services will be designed and constructed in accordance with City of Burlington and Region of Halton standards.

5.0 CONCLUSIONS AND RECOMMENDATIONS

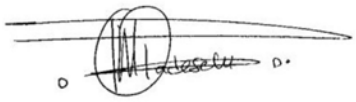
Based on the information provided herein, it is concluded that the proposed development at 2072 Lakeshore Road can be constructed to meet the requirements of the City of Burlington and Region of Halton. Therefore, it is recommended that:

- The development be graded and serviced in accordance with the Preliminary Grading & Erosion Control Plan and the Preliminary Servicing Plan prepared by S. Llewellyn & Associates Limited;
- A 75mmø orifice control be installed as per the Preliminary Servicing Plan and this report to provide adequate quantity control for the proposed site;
- The development be graded in accordance with the Preliminary Grading & Erosion Control Plan prepared by S. Llewellyn & Associates Limited;
- Erosion and sediment controls be installed as described in this report and shown on the Preliminary Grading & Erosion Control Plan prepared by S. Llewellyn & Associates Limited;
- The proposed sanitary and water servicing system be installed as per the Preliminary Servicing Plan and this report to adequately service the proposed development.

We trust the information enclosed herein is satisfactory. Should you have any questions please do not hesitate to contact our office.

Prepared by:

S. LLEWELLYN & ASSOCIATES LIMITED



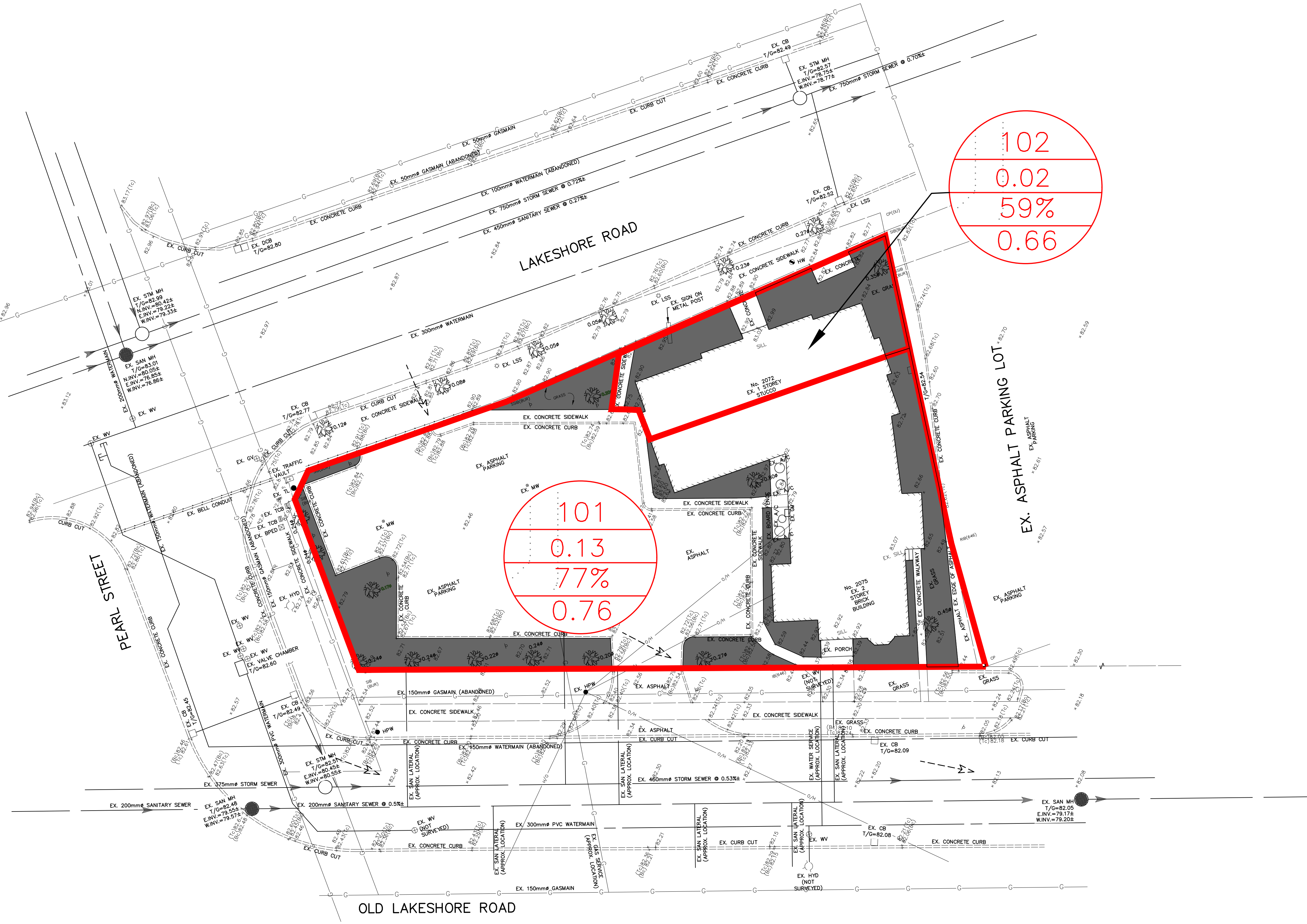


O. Oladeselu, M.Eng.

S. Nelson, P.Eng.

APPENDIX A
STORMWATER QUANTITY INFORMATION

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LEGEND

PERVIOUS AREA

101	DRAINAGE AREA I.D.
0.15	DRAINAGE AREA (ha)
74%	PERCENT IMPERVIOUS
0.75	RUNOFF COEFFICIENT

DRAINAGE AREA BOUNDARY

----⋗> PRE–DEVELOPMENT SHEET DRAIN

DAP – 01
PRE–DEVELOPMENT
STORM DRAINAGE AREA PLAN

SCALE: 1:400

PROJECT: 2072 LAKESHORE ROAD
PROJECT No.: 23028

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LAKESHORE ROAD

OLD LAKESHORE ROAD

PEARL STREET

EX. ASPHALT PARKING LOT

201
0.12
100%
0.95

202
0.01
82%
0.90

203
0.02
86%
0.90

LEGEND

101 — DRAINAGE AREA I.D.

1.67 — DRAINAGE AREA (ha)

15% — PERCENT IMPERVIOUS

0.35 — RUNOFF COEFFICIENT

DRAINAGE AREA BOUNDARY

DAP - 02
POST-DEVELOPMENT
STORM DRAINAGE AREA PLAN

SCALE: 1:400

PROJECT: 2072 LAKESHORE ROAD
PROJECT No.: 23028

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STAGE-STORAGE-DISCHARGE CALCULATIONS

Catchment 201
Outlet Device No. 1 (Quantity)

Type:	Tank Outlet
Diameter (mm)	**75**
Area (m^2)	0.00442
Invert Elev. (m)	80.70
C/L Elev. (m)	80.74
Disch. Coeff. (C_d)	0.6
Discharge (Q) =	$C_d A (2 g H)^{0.5}$
Number of Orifices:	1

		SWM Pond Volumes			Outlet No. 1	
	Elevation m	Area m^2	Tank Incremental Volume	Active Storage Volume m^3	H m	Discharge m^3/s
Orifice Invert	80.70	17.0	0.0	0	0.000	0.0000
Weir	81.00	17.0	5.1	5	0.263	0.0060
Bottom of Tank	78.05	18.0	0.0	5	0.263	0.0060
0.8m Deep	78.85	18.0	14.4	19	0.263	0.0060
1.6m Deep	79.65	18.0	14.4	34	0.263	0.0060
Orifice Invert	80.70	18.0	18.9	53	0.263	0.0060
Weir	81.00	18.0	0.3	53	0.263	0.0060
3.15m Deep (Overflow Pipe)	81.20	18.0	3.6	57	0.463	0.0080
Top of Tank	81.70	18.0	9.0	66	0.963	0.0115

```
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00004> *#               BURLINGTON, ONTARIO
00005> *#  JOB NUMBER  : 23028
00006> *#       Date   : MAY 2024
00007> *#    Revised   :
00008> *#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
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00041>                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
00042> *%-----------------|-------------------------------------------------------|
00043> *# ALLOWABLE - EXISTING CONDITIONS (Allowable Discharge)
00044> CALIB STANDHYD      ID=[3], NHYD=["101"], DT=[1](min), AREA=[0.15](ha),
00045>                     XIMP=[0.36], TIMP=[0.36], DWF=[0](cms), LOSS=[2],
00046>                     SCS curve number CN=[75],
00047>                     Pervious   surfaces: IAper=[8.5](mm), SLPP=[2.0](%),
00048>                                          LGP=[20](m), MNP=[0.250], SCP=[0](min),
00049>                     Impervious surfaces: IAimp=[1.0](mm), SLPI=[2.0](%),
00050>                                          LGI=[20](m), MNI=[0.013], SCI=[0](min),
00051>                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
00052> *%-----------------|-------------------------------------------------------|
00053>
00054> *#************************************************************************|
00055> *#
00056> *#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
00057> *#        =============================================
00058> *#
00059> **#***********************************************************************|
00060> *# CATCHMENT 201 - PROPOSED CONDITIONS (Controlled To Old Lakeshore Road)
00061> CALIB STANDHYD      ID=[4], NHYD=["201"], DT=[1](min), AREA=[0.12](ha),
00062>                     XIMP=[0.99], TIMP=[0.99], DWF=[0](cms), LOSS=[2],
00063>                     SCS curve number CN=[75],
00064>                     Pervious   surfaces: IAper=[8.5](mm), SLPP=[2.0](%),
00065>                                          LGP=[8](m), MNP=[0.250], SCP=[0](min),
00066>                     Impervious surfaces: IAimp=[1.0](mm), SLPI=[2.0](%),
00067>                                          LGI=[8](m), MNI=[0.013], SCI=[0](min),
00068>                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
00069> *%-----------------|-------------------------------------------------------|
00070> *# CATCHMENT 202 - PROPOSED CONDITIONS (Uncontrolled To Lakeshore Road)
00071> CALIB STANDHYD      ID=[5], NHYD=["202"], DT=[1](min), AREA=[0.01](ha),
00072>                     XIMP=[0.82], TIMP=[0.82], DWF=[0](cms), LOSS=[2],
00073>                     SCS curve number CN=[75],
00074>                     Pervious   surfaces: IAper=[8.5](mm), SLPP=[2.0](%),
00075>                                          LGP=[7](m), MNP=[0.250], SCP=[0](min),
00076>                     Impervious surfaces: IAimp=[1.0](mm), SLPI=[2.0](%),
00077>                                          LGI=[7](m), MNI=[0.013], SCI=[0](min),
00078>                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
00079> *%-----------------|-------------------------------------------------------|
00080> *# CATCHMENT 203 - PROPOSED CONDITIONS (Uncontrolled To Old Lakeshore Road)
00081> CALIB STANDHYD      ID=[6], NHYD=["203"], DT=[1](min), AREA=[0.02](ha),
00082>                     XIMP=[0.86], TIMP=[0.86], DWF=[0](cms), LOSS=[2],
00083>                     SCS curve number CN=[75],
00084>                     Pervious   surfaces: IAper=[8.5](mm), SLPP=[3.0](%),
00085>                                          LGP=[9](m), MNP=[0.250], SCP=[0](min),
00086>                     Impervious surfaces: IAimp=[1.0](mm), SLPI=[3.0](%),
00087>                                          LGI=[9](m), MNI=[0.013], SCI=[0](min),
00088>                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
00089> *%-----------------|-------------------------------------------------------|
00090> *# ROUTE CATCHMENT 201 THROUGH ORIFICE CONTROL
00091> *
00092> ROUTE RESERVOIR     IDout=[7],   NHYD=["201"],  IDin=[4],
00093>                     RDT=[1](min),
00094>                           TABLE of ( OUTFLOW-STORAGE ) values
00095>                                    (cms) - (ha-m)
00096>                                     0.0000 , 0.0000
00097>                                     0.0060 , 0.0005
00098>                                     0.0060 , 0.0005
00099>                                     0.0060 , 0.0019
00100>                                     0.0060 , 0.0034
00101>                                     0.0060 , 0.0053
00102>                                     0.0060 , 0.0053
00103>                                     0.0080 , 0.0057
00104>                                     0.0115 , 0.0066
00105>                                     -1   ,  -1      (max twenty pts)
00106>                           IDovf=[8], NHYDovf=["OVF"]
00107> *%-----------------|-------------------------------------------------------|
00108> ADD HYD             IDsum=[9], NHYD=["Total"], IDs to add=[6+7+8]
00109> *%-----------------|-------------------------------------------------------|
00110> * RUN REMAINING DESIGN STORMS (City of Burlington 5 TO 100-YR)
00111> *
00112> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[005]
00113>                     BUR6_005.stm
00114> *
00115> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[010]
00116>                     BUR6_010.stm
00117> *
00118> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[025]
00119>                     BUR6_025.stm
00120> *
00121> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[050]
00122>                     BUR6_050.stm
00123> *
00124> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[100]
00125>                     BUR6_100.stm
00126> *
00127> *%-----------------|-------------------------------------------------------|
00128> FINISH
00129>
00130>
00131>
00132>
00133>
00134>
00135>
00136>
```

```
00001> ================================================================================
00002>
00003>    SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999    =========
00004>    S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
00005>    SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
00006>        S  W W W  M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
00007>    SSSSS   W W   M   M  H   H    Y    M   M   OOO           9      9   =========
00008>                                                          9   9  9   9   # 3902680
00009>          StormWater Management HYdrologic Model           999    999    =========
00010>
00011>  ********************************************************************************
00012>  ***************************** SWMHYMO Ver/4.05  ********************************
00013>  *********  A single event and continuous hydrologic simulation model  *********
00014>  *********     based on the principles of HYMO and its successors      *********
00015>  *********                   OTTHYMO-83 and OTTHYMO-89.                *********
00016>  ********************************************************************************
00017>  ******** Distributed by:  J.F. Sabourin and Associates Inc.           *********
00018>  *********                 Ottawa,  Ontario: (613) 836-3884           *********
00019>  *********                 Gatineau, Quebec: (819) 243-6858           *********
00020>  *********                 E-Mail: swmhymo@jfsa.Com                   *********
00021>  ********************************************************************************
00022>
00023>  ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
00024>  +++++++++ Licensed user: S. Llewellyn & Associates Ltd                +++++++++
00025>  +++++++++                 Burlington          SERIAL#:3902680        +++++++++
00026>  ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
00027>
00028>  ********************************************************************************
00029>  **********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++             *********
00030>  **********           Maximum value for ID numbers  :     10            *********
00031>  **********           Max. number of rainfall points: 105408            *********
00032>  **********           Max. number of flow points    : 105408            *********
00033>  ********************************************************************************
00034>
00035>
00036>  **********************   D E T A I L E D   O U T P U T   **********************
00037>  ********************************************************************************
00038>  *         DATE: 2024-12-10     TIME: 16:00:20     RUN COUNTER: 000148          *
00039>  ********************************************************************************
00040>  * Input   filename: T:\projects\23028\SWMHYMO\23028.dat                        *
00041>  * Output  filename: T:\projects\23028\SWMHYMO\23028.out                        *
00042>  * Summary filename: T:\projects\23028\SWMHYMO\23028.sum                        *
00043>  * User comments:                                                              *
00044>  * 1:_____________________________________________________________________     *
00045>  * 2:_____________________________________________________________________     *
00046>  * 3:_____________________________________________________________________     *
00047>  ********************************************************************************
00048>
00049> --------------------------------------------------------------------------------
00050> 001:0001--------------------------------------------------------------------------
00051> *#*****************************************************************************|
00052> *#  Project Name: 2072 LAKESHORE ROAD
00053> *#               BURLINGTON, ONTARIO
00054> *#  JOB NUMBER  : 23028
00055> *#       Date   : MAY 2024
00056> *#    Revised   :
00057> *#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
00058> *#       File   : 23028.DAT
00059> *#*****************************************************************************|
00060> *
00061>   ** END OF RUN :   1
00062>
00063>  ********************************************************************************
00064>
00065>
00066>
00067>
00068>
00069>  --------------------
00070> | START            |  Project  dir.: T:\projects\23028\SWMHYMO\
00071>  ------------------  Rainfall dir.: T:\projects\23028\SWMHYMO\
00072>     TZERO =   .00 hrs on       0
00073>     METOUT=   2 (output = METRIC)
00074>     NRUN  = 002
00075>     NSTORM=   1
00076>              #  1=BUR6_002.stm
00077> --------------------------------------------------------------------------------
00078> 002:0002--------------------------------------------------------------------------
00079> *#*****************************************************************************|
00080> *#  Project Name: 2072 LAKESHORE ROAD
00081> *#               BURLINGTON, ONTARIO
00082> *#  JOB NUMBER  : 23028
00083> *#       Date   : MAY 2024
00084> *#    Revised   :
00085> *#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
00086> *#       File   : 23028.DAT
00087> *#*****************************************************************************|
00088> *
00089> --------------------------------------------------------------------------------
00090> 002:0002--------------------------------------------------------------------------
00091> *
00092>  --------------------
00093> | READ STORM       |    Filename: Burlington 2-yr 6hr CHICAGO  (A=681.52,
00094> | Ptotal=  40.93 mm|    Comments: Burlington 2-yr 6hr CHICAGO  (A=681.52,
00095>  --------------------
00096>                TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
00097>                 hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
00098>                 .17   1.715 |   1.67   8.325 |   3.17   4.467 |   4.67   2.213
00099>                 .33   1.858 |   1.83  19.646 |   3.33   3.978 |   4.83   2.105
00100>                 .50   2.032 |   2.00  78.391 |   3.50   3.595 |   5.00   2.008
00101>                 .67   2.247 |   2.17  25.776 |   3.67   3.286 |   5.17   1.920
00102>                 .83   2.522 |   2.33  13.777 |   3.83   3.030 |   5.33   1.841
00103>                1.00   2.888 |   2.50   9.511 |   4.00   2.815 |   5.50   1.769
00104>                1.17   3.399 |   2.67   7.331 |   4.17   2.632 |   5.67   1.703
00105>                1.33   4.172 |   2.83   6.005 |   4.33   2.474 |   5.83   1.642
00106>                1.50   5.492 |   3.00   5.111 |   4.50   2.335 |   6.00   1.586
00107>
00108> --------------------------------------------------------------------------------
00109> 002:0003--------------------------------------------------------------------------
00110> *
00111> *#*****************************************************************************|
00112> *#
00113> *#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
00114> *#        ==============================================
00115> *#
00116> **#****************************************************************************|
00117> *# CATCHMENT 101 - EXISTING CONDITIONS (To Old Lakeshore Road)
00118>  ----------------------
00119> | CALIB STANDHYD     |   Area    (ha)=     .13
00120> | 01:101    DT= 1.00 |   Total Imp(%)=   77.00   Dir. Conn.(%)=   77.00
00121>  ----------------------
00122>                              IMPERVIOUS    PERVIOUS (i)
00123>      Surface Area     (ha)=        .10          .03
00124>      Dep. Storage     (mm)=       1.00         8.50
00125>      Average Slope     (%)=       2.00         2.00
00126>      Length            (m)=      20.00        20.00
00127>      Mannings n            =       .013         .250
00128>
00129>      Max.eff.Inten.(mm/hr)=      78.39        11.25
00130>                 over (min)        1.00        12.00
00131>      Storage Coeff.  (min)=        .87 (ii)   12.03 (ii)
00132>      Unit Hyd. Tpeak (min)=       1.00        12.00
00133>      Unit Hyd. peak  (cms)=       1.16          .09
00134>                                                          *TOTALS*
00135>      PEAK FLOW       (cms)=        .02          .00          .022 (iii)
00136>      TIME TO PEAK    (hrs)=       2.00         2.18         2.000
00137>      RUNOFF VOLUME    (mm)=      39.93         8.98        32.814
00138>      TOTAL RAINFALL   (mm)=      40.93        40.93        40.933
00139>      RUNOFF COEFFICIENT   =        .98          .22          .802
00140>
00141>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00142>            CN* =  75.0    Ia = Dep. Storage  (Above)
00143>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00144>            THAN THE STORAGE COEFFICIENT.
00145>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00146>
00147> --------------------------------------------------------------------------------
00148> 002:0004--------------------------------------------------------------------------
00149> *# CATCHMENT 102 - EXISTING CONDITIONS (To Lakeshore Road)
00150>  ----------------------
00151> | CALIB STANDHYD     |   Area    (ha)=     .02
00152> | 02:101    DT= 1.00 |   Total Imp(%)=   59.00   Dir. Conn.(%)=   59.00
00153>  ----------------------
00154>                              IMPERVIOUS    PERVIOUS (i)
00155>      Surface Area     (ha)=        .01          .01
00156>      Dep. Storage     (mm)=       1.00         8.50
00157>      Average Slope     (%)=       3.50         3.50
00158>      Length            (m)=      10.00        10.00
00159>      Mannings n            =       .013         .250
00160>
00161>      Max.eff.Inten.(mm/hr)=      78.39        15.17
00162>                 over (min)        1.00         6.00
00163>      Storage Coeff.  (min)=        .49 (ii)    6.01 (ii)
00164>      Unit Hyd. Tpeak (min)=       1.00         6.00
00165>      Unit Hyd. peak  (cms)=       1.48          .19
00166>                                                          *TOTALS*
00167>      PEAK FLOW       (cms)=        .00          .00          .003 (iii)
00168>      TIME TO PEAK    (hrs)=       1.93         2.07         2.000
00169>      RUNOFF VOLUME    (mm)=      39.93         8.98        27.243
00170>      TOTAL RAINFALL   (mm)=      40.93        40.93        40.933
00171>      RUNOFF COEFFICIENT   =        .98          .22          .666
00172>
00173>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00174>            CN* =  75.0    Ia = Dep. Storage  (Above)
00175>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00176>            THAN THE STORAGE COEFFICIENT.
00177>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00178>
00179> --------------------------------------------------------------------------------
00180> 002:0005--------------------------------------------------------------------------
00181> *# ALLOWABLE - EXISTING CONDITIONS (Allowable Discharge)
00182>  ----------------------
00183> | CALIB STANDHYD     |   Area    (ha)=     .15
00184> | 03:101    DT= 1.00 |   Total Imp(%)=   36.00   Dir. Conn.(%)=   36.00
00185>  ----------------------
00186>                              IMPERVIOUS    PERVIOUS (i)
00187>      Surface Area     (ha)=        .05          .10
00188>      Dep. Storage     (mm)=       1.00         8.50
00189>      Average Slope     (%)=       2.00         2.00
00190>      Length            (m)=      20.00        20.00
00191>      Mannings n            =       .013         .250
00192>
00193>      Max.eff.Inten.(mm/hr)=      78.39        11.25
00194>                 over (min)        1.00        12.00
00195>      Storage Coeff.  (min)=        .87 (ii)   12.03 (ii)
00196>      Unit Hyd. Tpeak (min)=       1.00        12.00
00197>      Unit Hyd. peak  (cms)=       1.16          .09
00198>                                                          *TOTALS*
00199>      PEAK FLOW       (cms)=        .01          .00          .012 (iii)
00200>      TIME TO PEAK    (hrs)=       2.00         2.18         2.000
00201>      RUNOFF VOLUME    (mm)=      39.93         8.98        20.125
00202>      TOTAL RAINFALL   (mm)=      40.93        40.93        40.933
00203>      RUNOFF COEFFICIENT   =        .98          .22          .492
00204>
00205>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00206>            CN* =  75.0    Ia = Dep. Storage  (Above)
00207>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00208>            THAN THE STORAGE COEFFICIENT.
00209>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00210>
00211> --------------------------------------------------------------------------------
00212> 002:0006--------------------------------------------------------------------------
00213> *#*****************************************************************************|
00214> *#
00215> *#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
00216> *#        ==============================================
00217> *#
00218> **#****************************************************************************|
00219> *# CATCHMENT 201 - PROPOSED CONDITIONS (Controlled To Old Lakeshore Road)
00220>  ----------------------
00221> | CALIB STANDHYD     |   Area    (ha)=     .12
00222> | 04:201    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
00223>  ----------------------
00224>                              IMPERVIOUS    PERVIOUS (i)
00225>      Surface Area     (ha)=        .12          .00
00226>      Dep. Storage     (mm)=       1.00         8.50
00227>      Average Slope     (%)=       2.00         2.00
00228>      Length            (m)=      8.00         8.00
00229>      Mannings n            =       .013         .250
00230>
00231>      Max.eff.Inten.(mm/hr)=      78.39        15.17
00232>                 over (min)        1.00         6.00
00233>      Storage Coeff.  (min)=        .50 (ii)    6.22 (ii)
00234>      Unit Hyd. Tpeak (min)=       1.00         6.00
00235>      Unit Hyd. peak  (cms)=       1.47          .19
00236>                                                          *TOTALS*
00237>      PEAK FLOW       (cms)=        .03          .00          .026 (iii)
00238>      TIME TO PEAK    (hrs)=       1.95         2.07         2.000
00239>      RUNOFF VOLUME    (mm)=      39.93         8.98        39.623
00240>      TOTAL RAINFALL   (mm)=      40.93        40.93        40.933
00241>      RUNOFF COEFFICIENT   =        .98          .22          .968
00242>
00243>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00244>            CN* =  75.0    Ia = Dep. Storage  (Above)
00245>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00246>            THAN THE STORAGE COEFFICIENT.
00247>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00248>
00249> --------------------------------------------------------------------------------
00250> 002:0007--------------------------------------------------------------------------
00251> *# CATCHMENT 202 - PROPOSED CONDITIONS (Uncontrolled To Lakeshore Road)
00252>  ----------------------
00253> | CALIB STANDHYD     |   Area    (ha)=     .01
00254> | 05:202    DT= 1.00 |   Total Imp(%)=   82.00   Dir. Conn.(%)=   82.00
00255>  ----------------------
00256>                              IMPERVIOUS    PERVIOUS (i)
00257>      Surface Area     (ha)=        .01          .00
00258>      Dep. Storage     (mm)=       1.00         8.50
00259>      Average Slope     (%)=       2.00         2.00
00260>      Length            (m)=      7.00         7.00
00261>      Mannings n            =       .013         .250
00262>
00263>      Max.eff.Inten.(mm/hr)=      78.39        15.17
00264>                 over (min)        1.00         6.00
00265>      Storage Coeff.  (min)=        .46 (ii)    5.74 (ii)
00266>      Unit Hyd. Tpeak (min)=       1.00         6.00
00267>      Unit Hyd. peak  (cms)=       1.50          .19
00268>                                                          *TOTALS*
00269>      PEAK FLOW       (cms)=        .00          .00          .002 (iii)
00270>      TIME TO PEAK    (hrs)=       1.92         2.07         2.000
```

```
00271>      RUNOFF VOLUME    (mm)=      39.93         8.98         34.361
00272>      TOTAL RAINFALL   (mm)=      40.93        40.93         40.933
00273>      RUNOFF COEFFICIENT   =        .98          .22           .839
00274>
00275>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00276>            CN* =  75.0    Ia = Dep. Storage  (Above)
00277>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00278>            THAN THE STORAGE COEFFICIENT.
00279>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00280>
00281> ---------------------------------------------------------------------------
00282> 002:0008-----------------------------------------------------------------
00283> *# CATCHMENT 203 - PROPOSED CONDITIONS (Uncontrolled To Old Lakeshore Road)
00284> ---------------------
00285> | CALIB STANDHYD     |   Area    (ha)=     .02
00286> | 06:203    DT= 1.00 |   Total Imp(%)=   86.00   Dir. Conn.(%)=   86.00
00287> ---------------------
00288>                                IMPERVIOUS    PERVIOUS (i)
00289>      Surface Area     (ha)=        .02          .00
00290>      Dep. Storage     (mm)=       1.00         8.50
00291>      Average Slope     (%)=       3.00         3.00
00292>      Length            (m)=       9.00         9.00
00293>      Mannings n            =       .013         .250
00294>
00295>      Max.eff.Inten.(mm/hr)=      78.39        15.17
00296>                  over (min)        1.00         6.00
00297>      Storage Coeff.  (min)=        .48 (ii)    5.91 (ii)
00298>      Unit Hyd. Tpeak (min)=       1.00         6.00
00299>      Unit Hyd. peak  (cms)=       1.49          .19
00300>                                                          *TOTALS*
00301>      PEAK FLOW        (cms)=        .00          .00          .004 (iii)
00302>      TIME TO PEAK     (hrs)=       1.93         2.07         2.000
00303>      RUNOFF VOLUME     (mm)=      39.93         8.98        35.600
00304>      TOTAL RAINFALL   (mm)=      40.93        40.93         40.933
00305>      RUNOFF COEFFICIENT   =        .98          .22           .870
00306>
00307>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00308>            CN* =  75.0    Ia = Dep. Storage  (Above)
00309>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00310>            THAN THE STORAGE COEFFICIENT.
00311>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00312>
00313> ---------------------------------------------------------------------------
00314> 002:0009-----------------------------------------------------------------
00315> *# ROUTE CATCHMENT 201 THROUGH ORIFICE CONTROL
00316> *
00317> ---------------------
00318> | ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
00319> |  IN>04:(201   )    |
00320> | OUT<07:(201   )    |    =========  OUTLFOW STORAGE TABLE  =========
00321> ---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
00322>                            (cms)     (ha.m.)   |    (cms)    (ha.m.)
00323>                             .000  .0000E+00    |     .006  .5300E-02
00324>                             .006  .5000E-03    |     .006  .5300E-02
00325>                             .006  .5000E-03    |     .008  .5700E-02
00326>                             .006  .1900E-02    |     .012  .6600E-02
00327>                             .006  .3400E-02    |     .000  .0000E+00
00328>
00329>      ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
00330>      --------------------       (ha)     (cms)     (hrs)        (mm)
00331>      INFLOW >04: (201   )        .12      .026     2.000      39.623
00332>      OUTFLOW<07: (201   )        .12      .006     1.867      39.623
00333>     OVERFLOW<08: (OVF   )        .00      .000      .000        .000
00334>
00335>                     TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
00336>                     CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
00337>                     PERCENTAGE OF TIME OVERFLOWING    (%)=      .00
00338>
00339>
00340>                     PEAK   FLOW   REDUCTION [Qout/Qin](%)=   23.173
00341>                     TIME SHIFT OF PEAK FLOW          (min)=    -8.00
00342>                     MAXIMUM  STORAGE   USED       (ha.m.)=.1711E-02
00343>
00344> ---------------------------------------------------------------------------
00345> 002:0010-----------------------------------------------------------------
00346> ------------------------
00347> | ADD HYD (Total     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00348> ------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
00349>                        ID1 06:203          .02      .004    2.00  35.60    .000
00350>                       +ID2 07:201          .12      .006    1.87  39.62    .000
00351>                       +ID3 08:OVF          .00      .000     .00    .00    .000
00352>                        ==========================================================
00353>                        SUM 09:Total        .14      .010    2.00  39.05    .000
00354>
00355>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00356>
00357> ---------------------------------------------------------------------------
00358> 002:0011-----------------------------------------------------------------
00359> * RUN REMAINING DESIGN STORMS (City of Burlington 5 TO 100-YR)
00360> *
00361>   ** END OF RUN :   4
00362>
00363> ***************************************************************************
00364>
00365>
00366>
00367>
00368>
00369> ---------------------
00370> | START            |  Project  dir.: T:\projects\23028\SWMHYMO\
00371> ---------------------  Rainfall dir.: T:\projects\23028\SWMHYMO\
00372>     TZERO =   .00 hrs on       0
00373>     METOUT=  2 (output = METRIC)
00374>     NRUN  = 005
00375>     NSTORM=   1
00376>              #  1=BUR6_005.stm
00377> ---------------------------------------------------------------------------
00378> 005:0002-----------------------------------------------------------------
00379> *#*************************************************************************|
00380> *#  Project Name: 2072 LAKESHORE ROAD
00381> *#               BURLINGTON, ONTARIO
00382> *#  JOB NUMBER  : 23028
00383> *#       Date   : MAY 2024
00384> *#    Revised   :
00385> *#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
00386> *#       File   : 23028.DAT
00387> *#*************************************************************************|
00388> *
00389> ---------------------------------------------------------------------------
00390> 005:0002-----------------------------------------------------------------
00391> *
00392> ---------------------
00393> | READ STORM       |    Filename: Burlington 5-yr 6hr CHICAGO    (A=802.04
00394> | Ptotal=  53.05 mm|    Comments: Burlington 5-yr 6hr CHICAGO    (A=802.04
00395> ---------------------
00396>               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
00397>               hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr |   hrs   mm/hr
00398>               .17   2.348 |  1.67  10.690 |  3.17   5.897 |  4.67   3.004
00399>               .33   2.537 |  1.83  24.479 |  3.33   5.279 |  4.83   2.862
00400>               .50   2.766 |  2.00 101.312 |  3.50   4.790 |  5.00   2.734
00401>               .67   3.048 |  2.17  31.941 |  3.67   4.394 |  5.17   2.619
00402>               .83   3.407 |  2.33  17.333 |  3.83   4.065 |  5.33   2.514
00403>              1.00   3.881 |  2.50  12.145 |  4.00   3.788 |  5.50   2.419
00404>              1.17   4.539 |  2.67   9.469 |  4.17   3.550 |  5.67   2.331
00405>              1.33   5.523 |  2.83   7.826 |  4.33   3.344 |  5.83   2.251
00406>              1.50   7.185 |  3.00   6.709 |  4.50   3.164 |  6.00   2.176
00407>
00408> ---------------------------------------------------------------------------
00409> 005:0003-----------------------------------------------------------------
00410> *
00411> *#*************************************************************************|
00412> *#
00413> *#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
00414> *#        ==============================================
00415> *#
00416> **#************************************************************************|
00417> *# CATCHMENT 101 - EXISTING CONDITIONS (To Old Lakeshore Road)
00418> ---------------------
00419> | CALIB STANDHYD     |   Area    (ha)=     .13
00420> | 01:101    DT= 1.00 |   Total Imp(%)=   77.00   Dir. Conn.(%)=   77.00
00421> ---------------------
00422>                                IMPERVIOUS    PERVIOUS (i)
00423>      Surface Area     (ha)=        .10          .03
00424>      Dep. Storage     (mm)=       1.00         8.50
00425>      Average Slope     (%)=       2.00         2.00
00426>      Length            (m)=      20.00        20.00
00427>      Mannings n            =       .013         .250
00428>
00429>      Max.eff.Inten.(mm/hr)=     101.31        23.95
00430>                  over (min)        1.00         9.00
00431>      Storage Coeff.  (min)=        .79 (ii)    9.03 (ii)
00432>      Unit Hyd. Tpeak (min)=       1.00         9.00
00433>      Unit Hyd. peak  (cms)=       1.22          .13
00434>                                                          *TOTALS*
00435>      PEAK FLOW        (cms)=        .03          .00          .029 (iii)
00436>      TIME TO PEAK     (hrs)=       2.00         2.12         2.000
00437>      RUNOFF VOLUME     (mm)=      52.05        15.36        43.614
00438>      TOTAL RAINFALL   (mm)=      53.05        53.05        53.053
00439>      RUNOFF COEFFICIENT   =        .98          .29           .822
00440>
00441>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00442>            CN* =  75.0    Ia = Dep. Storage  (Above)
00443>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00444>            THAN THE STORAGE COEFFICIENT.
00445>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00446>
00447> ---------------------------------------------------------------------------
00448> 005:0004-----------------------------------------------------------------
00449> *# CATCHMENT 102 - EXISTING CONDITIONS (To Lakeshore Road)
00450> ---------------------
00451> | CALIB STANDHYD     |   Area    (ha)=     .02
00452> | 02:101    DT= 1.00 |   Total Imp(%)=   59.00   Dir. Conn.(%)=   59.00
00453> ---------------------
00454>                                IMPERVIOUS    PERVIOUS (i)
00455>      Surface Area     (ha)=        .01          .01
00456>      Dep. Storage     (mm)=       1.00         8.50
00457>      Average Slope     (%)=       3.50         3.50
00458>      Length            (m)=      10.00        10.00
00459>      Mannings n            =       .013         .250
00460>
00461>      Max.eff.Inten.(mm/hr)=     101.31        29.37
00462>                  over (min)        1.00         5.00
00463>      Storage Coeff.  (min)=        .44 (ii)    4.68 (ii)
00464>      Unit Hyd. Tpeak (min)=       1.00         5.00
00465>      Unit Hyd. peak  (cms)=       1.53          .24
00466>                                                          *TOTALS*
00467>      PEAK FLOW        (cms)=        .00          .00          .004 (iii)
00468>      TIME TO PEAK     (hrs)=       1.93         2.05         2.000
00469>      RUNOFF VOLUME     (mm)=      52.05        15.36        37.009
00470>      TOTAL RAINFALL   (mm)=      53.05        53.05        53.053
00471>      RUNOFF COEFFICIENT   =        .98          .29           .698
00472>
00473>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00474>            CN* =  75.0    Ia = Dep. Storage  (Above)
00475>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00476>            THAN THE STORAGE COEFFICIENT.
00477>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00478>
00479> ---------------------------------------------------------------------------
00480> 005:0005-----------------------------------------------------------------
00481> *# ALLOWABLE - EXISTING CONDITIONS (Allowable Discharge)
00482> ---------------------
00483> | CALIB STANDHYD     |   Area    (ha)=     .15
00484> | 03:101    DT= 1.00 |   Total Imp(%)=   36.00   Dir. Conn.(%)=   36.00
00485> ---------------------
00486>                                IMPERVIOUS    PERVIOUS (i)
00487>      Surface Area     (ha)=        .05          .10
00488>      Dep. Storage     (mm)=       1.00         8.50
00489>      Average Slope     (%)=       2.00         2.00
00490>      Length            (m)=      20.00        20.00
00491>      Mannings n            =       .013         .250
00492>
00493>      Max.eff.Inten.(mm/hr)=     101.31        23.95
00494>                  over (min)        1.00         9.00
00495>      Storage Coeff.  (min)=        .79 (ii)    9.03 (ii)
00496>      Unit Hyd. Tpeak (min)=       1.00         9.00
00497>      Unit Hyd. peak  (cms)=       1.22          .13
00498>                                                          *TOTALS*
00499>      PEAK FLOW        (cms)=        .02          .00          .017 (iii)
00500>      TIME TO PEAK     (hrs)=       2.00         2.12         2.000
00501>      RUNOFF VOLUME     (mm)=      52.05        15.36        28.570
00502>      TOTAL RAINFALL    (mm)=      53.05        53.05        53.053
00503>      RUNOFF COEFFICIENT   =        .98          .29           .539
00504>
00505>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00506>            CN* =  75.0    Ia = Dep. Storage  (Above)
00507>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00508>            THAN THE STORAGE COEFFICIENT.
00509>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00510>
00511> ---------------------------------------------------------------------------
00512> 005:0006-----------------------------------------------------------------
00513> *#*************************************************************************|
00514> *#
00515> *#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
00516> *#        ===============================================
00517> *#
00518> **#************************************************************************|
00519> *# CATCHMENT 201 - PROPOSED CONDITIONS (Controlled To Old Lakeshore Road)
00520> ---------------------
00521> | CALIB STANDHYD     |   Area    (ha)=     .12
00522> | 04:201    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
00523> ---------------------
00524>                                IMPERVIOUS    PERVIOUS (i)
00525>      Surface Area     (ha)=        .12          .00
00526>      Dep. Storage     (mm)=       1.00         8.50
00527>      Average Slope     (%)=       2.00         2.00
00528>      Length            (m)=       8.00         8.00
00529>      Mannings n            =       .013         .250
00530>
00531>      Max.eff.Inten.(mm/hr)=     101.31        29.37
00532>                  over (min)        1.00         5.00
00533>      Storage Coeff.  (min)=        .45 (ii)    4.84 (ii)
00534>      Unit Hyd. Tpeak (min)=       1.00         5.00
00535>      Unit Hyd. peak  (cms)=       1.51          .23
00536>                                                          *TOTALS*
00537>      PEAK FLOW        (cms)=        .03          .00          .033 (iii)
00538>      TIME TO PEAK     (hrs)=       1.95         2.05         2.000
00539>      RUNOFF VOLUME     (mm)=      52.05        15.36        51.686
00540>      TOTAL RAINFALL    (mm)=      53.05        53.05        53.053
```

```
00541>      RUNOFF COEFFICIENT   =       .98          .29           .974
00542>
00543>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00544>            CN* =  75.0    Ia = Dep. Storage  (Above)
00545>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00546>            THAN THE STORAGE COEFFICIENT.
00547>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00548>
00549> ---------------------------------------------------------------------------
00550> 005:0007-----------------------------------------------------------------------
00551> *# CATCHMENT 202 - PROPOSED CONDITIONS (Uncontrolled To Lakeshore Road)
00552> ----------------------
00553> | CALIB STANDHYD     |   Area    (ha)=     .01
00554> | 05:202    DT= 1.00 |   Total Imp(%)=   82.00   Dir. Conn.(%)=   82.00
00555> ----------------------
00556>                              IMPERVIOUS    PERVIOUS (i)
00557>      Surface Area     (ha)=        .01          .00
00558>      Dep. Storage     (mm)=       1.00         8.50
00559>      Average Slope     (%)=       2.00         2.00
00560>      Length            (m)=       7.00         7.00
00561>      Mannings n            =       .013         .250
00562>
00563>      Max.eff.Inten.(mm/hr)=     101.31        30.61
00564>                 over (min)        1.00         4.00
00565>      Storage Coeff.  (min)=        .42 (ii)     4.40 (ii)
00566>      Unit Hyd. Tpeak (min)=       1.00         4.00
00567>      Unit Hyd. peak  (cms)=       1.54          .27
00568>                                                          *TOTALS*
00569>      PEAK FLOW       (cms)=        .00          .00          .002 (iii)
00570>      TIME TO PEAK    (hrs)=       1.92         2.03         2.000
00571>      RUNOFF VOLUME    (mm)=      52.05        15.36        45.448
00572>      TOTAL RAINFALL   (mm)=      53.05        53.05        53.053
00573>      RUNOFF COEFFICIENT   =        .98          .29          .857
00574>
00575>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00576>            CN* =  75.0    Ia = Dep. Storage  (Above)
00577>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00578>            THAN THE STORAGE COEFFICIENT.
00579>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00580>
00581> ---------------------------------------------------------------------------
00582> 005:0008-----------------------------------------------------------------------
00583> *# CATCHMENT 203 - PROPOSED CONDITIONS (Uncontrolled To Old Lakeshore Road)
00584> ----------------------
00585> | CALIB STANDHYD     |   Area    (ha)=     .02
00586> | 06:203    DT= 1.00 |   Total Imp(%)=   86.00   Dir. Conn.(%)=   86.00
00587> ----------------------
00588>                              IMPERVIOUS    PERVIOUS (i)
00589>      Surface Area     (ha)=        .02          .00
00590>      Dep. Storage     (mm)=       1.00         8.50
00591>      Average Slope     (%)=       3.00         3.00
00592>      Length            (m)=       9.00         9.00
00593>      Mannings n            =       .013         .250
00594>
00595>      Max.eff.Inten.(mm/hr)=     101.31        29.37
00596>                 over (min)        1.00         5.00
00597>      Storage Coeff.  (min)=        .43 (ii)     4.60 (ii)
00598>      Unit Hyd. Tpeak (min)=       1.00         5.00
00599>      Unit Hyd. peak  (cms)=       1.53          .24
00600>                                                          *TOTALS*
00601>      PEAK FLOW       (cms)=        .00          .00          .005 (iii)
00602>      TIME TO PEAK    (hrs)=       1.93         2.05         2.000
00603>      RUNOFF VOLUME    (mm)=      52.05        15.36        46.916
00604>      TOTAL RAINFALL   (mm)=      53.05        53.05        53.053
00605>      RUNOFF COEFFICIENT   =        .98          .29          .884
00606>
00607>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00608>            CN* =  75.0    Ia = Dep. Storage  (Above)
00609>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00610>            THAN THE STORAGE COEFFICIENT.
00611>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00612>
00613> ---------------------------------------------------------------------------
00614> 005:0009-----------------------------------------------------------------------
00615> *# ROUTE CATCHMENT 201 THROUGH ORIFICE CONTROL
00616> *
00617> ----------------------
00618> | ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
00619> |  IN>04:(201   )    |
00620> | OUT<07:(201   )    |    =========  OUTLFOW STORAGE TABLE  =========
00621> ----------------------    OUTFLOW    STORAGE    |  OUTFLOW    STORAGE
00622>                              (cms)     (ha.m.)   |    (cms)     (ha.m.)
00623>                               .000  .0000E+00    |     .006  .5300E-02
00624>                               .006  .5000E-03    |     .006  .5300E-02
00625>                               .006  .5000E-03    |     .008  .5700E-02
00626>                               .006  .1900E-02    |     .012  .6600E-02
00627>                               .006  .3400E-02    |     .000  .0000E+00
00628>
00629>      ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
00630>      --------------------       (ha)     (cms)     (hrs)       (mm)
00631>      INFLOW >04: (201   )        .12      .033     2.000     51.686
00632>      OUTFLOW<07: (201   )        .12      .006     1.850     51.686
00633>     OVERFLOW<08: (OVF   )        .00      .000      .000       .000
00634>
00635>                     TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
00636>                     CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
00637>                     PERCENTAGE OF TIME OVERFLOWING    (%)=      .00
00638>
00639>
00640>                     PEAK   FLOW   REDUCTION [Qout/Qin](%)=   17.914
00641>                     TIME SHIFT OF PEAK FLOW          (min)=    -9.00
00642>                     MAXIMUM  STORAGE   USED       (ha.m.)=.2380E-02
00643>
00644> ---------------------------------------------------------------------------
00645> 005:0010-----------------------------------------------------------------------
00646> ----------------------
00647> | ADD HYD (Total     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00648> ----------------------                    (ha)     (cms)   (hrs)   (mm)    (cms)
00649>                        ID1 06:203          .02     .005    2.00   46.92    .000
00650>                       +ID2 07:201          .12     .006    1.85   51.69    .000
00651>                       +ID3 08:OVF          .00     .000     .00     .00    .000
00652>                        ==========================================================
00653>                        SUM 09:Total         .14     .011    2.00   51.00    .000
00654>
00655>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00656>
00657> ---------------------------------------------------------------------------
00658> 005:0011-----------------------------------------------------------------------
00659> * RUN REMAINING DESIGN STORMS (City of Burlington 5 TO 100-YR)
00660> *
00661> ---------------------------------------------------------------------------
00662> 005:0002-----------------------------------------------------------------------
00663> *
00664>   ** END OF RUN :   9
00665>
00666> ***************************************************************************
00667>
00668>
00669>
00670>
00671>
00672> ----------------------
00673> | START              |  Project  dir.: T:\projects\23028\SWMHYMO\
00674> ----------------------  Rainfall dir.: T:\projects\23028\SWMHYMO\
00675>     TZERO =   .00 hrs on        0
00676>     METOUT=   2 (output = METRIC)
00677>     NRUN  = 010
00678>     NSTORM=   1
00679>              #  1=BUR6_010.stm
00680> ---------------------------------------------------------------------------
00681> 010:0002-----------------------------------------------------------------------
00682> *#*************************************************************************|
00683> *#  Project Name: 2072 LAKESHORE ROAD
00684> *#               BURLINGTON, ONTARIO
00685> *#  JOB NUMBER  : 23028
00686> *#       Date   : MAY 2024
00687> *#    Revised   :
00688> *#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
00689> *#       File   : 23028.DAT
00690> *#*************************************************************************|
00691> *
00692> ---------------------------------------------------------------------------
00693> 010:0002-----------------------------------------------------------------------
00694> *
00695> --------------------
00696> | READ STORM       |    Filename: Burlington 10-yr 6hr CHICAGO     (A=918.
00697> | Ptotal=  61.10 mm|    Comments: Burlington 10-yr 6hr CHICAGO     (A=918.
00698> --------------------
00699>                 TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
00700>                  hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
00701>                  .17   2.714 |   1.67  12.326 |   3.17   6.808 |   4.67   3.472
00702>                  .33   2.933 |   1.83  28.176 |   3.33   6.095 |   4.83   3.308
00703>                  .50   3.197 |   2.00 116.310 |   3.50   5.532 |   5.00   3.161
00704>                  .67   3.523 |   2.17  36.748 |   3.67   5.075 |   5.17   3.027
00705>                  .83   3.937 |   2.33  19.967 |   3.83   4.696 |   5.33   2.907
00706>                 1.00   4.483 |   2.50  14.001 |   4.00   4.376 |   5.50   2.796
00707>                 1.17   5.242 |   2.67  10.921 |   4.17   4.102 |   5.67   2.695
00708>                 1.33   6.377 |   2.83   9.030 |   4.33   3.864 |   5.83   2.602
00709>                 1.50   8.291 |   3.00   7.743 |   4.50   3.656 |   6.00   2.516
00710>
00711> ---------------------------------------------------------------------------
00712> 010:0003-----------------------------------------------------------------------
00713> *
00714> *#*************************************************************************|
00715> *#
00716> *#         PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
00717> *#         ==============================================
00718> *#
00719> **#************************************************************************|
00720> *# CATCHMENT 101 - EXISTING CONDITIONS (To Old Lakeshore Road)
00721> ----------------------
00722> | CALIB STANDHYD     |   Area    (ha)=     .13
00723> | 01:101    DT= 1.00 |   Total Imp(%)=   77.00   Dir. Conn.(%)=   77.00
00724> ----------------------
00725>                              IMPERVIOUS    PERVIOUS (i)
00726>      Surface Area     (ha)=        .10          .03
00727>      Dep. Storage     (mm)=       1.00         8.50
00728>      Average Slope     (%)=       2.00         2.00
00729>      Length            (m)=      20.00        20.00
00730>      Mannings n            =       .013         .250
00731>
00732>      Max.eff.Inten.(mm/hr)=     116.31        34.63
00733>                 over (min)        1.00         8.00
00734>      Storage Coeff.  (min)=        .74 (ii)     7.86 (ii)
00735>      Unit Hyd. Tpeak (min)=       1.00         8.00
00736>      Unit Hyd. peak  (cms)=       1.26          .14
00737>                                                          *TOTALS*
00738>      PEAK FLOW       (cms)=        .03          .00          .034 (iii)
00739>      TIME TO PEAK    (hrs)=       2.00         2.10         2.000
00740>      RUNOFF VOLUME    (mm)=      60.10        20.16        50.914
00741>      TOTAL RAINFALL   (mm)=      61.10        61.10        61.101
00742>      RUNOFF COEFFICIENT   =        .98          .33          .833
00743>
00744>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00745>            CN* =  75.0    Ia = Dep. Storage  (Above)
00746>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00747>            THAN THE STORAGE COEFFICIENT.
00748>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00749>
00750> ---------------------------------------------------------------------------
00751> 010:0004-----------------------------------------------------------------------
00752> *# CATCHMENT 102 - EXISTING CONDITIONS (To Lakeshore Road)
00753> ----------------------
00754> | CALIB STANDHYD     |   Area    (ha)=     .02
00755> | 02:101    DT= 1.00 |   Total Imp(%)=   59.00   Dir. Conn.(%)=   59.00
00756> ----------------------
00757>                              IMPERVIOUS    PERVIOUS (i)
00758>      Surface Area     (ha)=        .01          .01
00759>      Dep. Storage     (mm)=       1.00         8.50
00760>      Average Slope     (%)=       3.50         3.50
00761>      Length            (m)=      10.00        10.00
00762>      Mannings n            =       .013         .250
00763>
00764>      Max.eff.Inten.(mm/hr)=     116.31        40.88
00765>                 over (min)        1.00         4.00
00766>      Storage Coeff.  (min)=        .41 (ii)     4.13 (ii)
00767>      Unit Hyd. Tpeak (min)=       1.00         4.00
00768>      Unit Hyd. peak  (cms)=       1.55          .28
00769>                                                          *TOTALS*
00770>      PEAK FLOW       (cms)=        .00          .00          .004 (iii)
00771>      TIME TO PEAK    (hrs)=       1.92         2.03         2.000
00772>      RUNOFF VOLUME    (mm)=      60.10        20.16        43.724
00773>      TOTAL RAINFALL   (mm)=      61.10        61.10        61.101
00774>      RUNOFF COEFFICIENT   =        .98          .33          .716
00775>
00776>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00777>            CN* =  75.0    Ia = Dep. Storage  (Above)
00778>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00779>            THAN THE STORAGE COEFFICIENT.
00780>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00781>
00782> ---------------------------------------------------------------------------
00783> 010:0005-----------------------------------------------------------------------
00784> *# ALLOWABLE - EXISTING CONDITIONS (Allowable Discharge)
00785> ----------------------
00786> | CALIB STANDHYD     |   Area    (ha)=     .15
00787> | 03:101    DT= 1.00 |   Total Imp(%)=   36.00   Dir. Conn.(%)=   36.00
00788> ----------------------
00789>                              IMPERVIOUS    PERVIOUS (i)
00790>      Surface Area     (ha)=        .05          .10
00791>      Dep. Storage     (mm)=       1.00         8.50
00792>      Average Slope     (%)=       2.00         2.00
00793>      Length            (m)=      20.00        20.00
00794>      Mannings n            =       .013         .250
00795>
00796>      Max.eff.Inten.(mm/hr)=     116.31        34.63
00797>                 over (min)        1.00         8.00
00798>      Storage Coeff.  (min)=        .74 (ii)     7.86 (ii)
00799>      Unit Hyd. Tpeak (min)=       1.00         8.00
00800>      Unit Hyd. peak  (cms)=       1.26          .14
00801>                                                          *TOTALS*
00802>      PEAK FLOW       (cms)=        .02          .01          .021 (iii)
00803>      TIME TO PEAK    (hrs)=       1.98         2.10         2.000
00804>      RUNOFF VOLUME    (mm)=      60.10        20.16        34.537
00805>      TOTAL RAINFALL   (mm)=      61.10        61.10        61.101
00806>      RUNOFF COEFFICIENT   =        .98          .33          .565
00807>
00808>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00809>            CN* =  75.0    Ia = Dep. Storage  (Above)
00810>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
```

```
00811>           THAN THE STORAGE COEFFICIENT.
00812>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00813>
00814> ---------------------------------------------------------------------------
00815> 010:0006-----------------------------------------------------------------
00816> *#*************************************************************************|
00817> *#
00818> *#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
00819> *#        ==============================================
00820> *#
00821> **#************************************************************************|
00822> *# CATCHMENT 201 - PROPOSED CONDITIONS (Controlled To Old Lakeshore Road)
00823> ---------------------
00824> | CALIB STANDHYD     |   Area    (ha)=     .12
00825> | 04:201    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
00826> ---------------------
00827>                              IMPERVIOUS    PERVIOUS (i)
00828>      Surface Area     (ha)=        .12          .00
00829>      Dep. Storage     (mm)=       1.00         8.50
00830>      Average Slope     (%)=       2.00         2.00
00831>      Length            (m)=       8.00         8.00
00832>      Mannings n             =      .013         .250
00833>
00834>      Max.eff.Inten.(mm/hr)=     116.31        40.88
00835>                    over (min)        1.00         4.00
00836>      Storage Coeff.  (min)=        .43 (ii)    4.27 (ii)
00837>      Unit Hyd. Tpeak (min)=       1.00         4.00
00838>      Unit Hyd. peak  (cms)=       1.53          .27
00839>                                                          *TOTALS*
00840>      PEAK FLOW       (cms)=        .04          .00          .038 (iii)
00841>      TIME TO PEAK    (hrs)=       1.93         2.03         2.000
00842>      RUNOFF VOLUME    (mm)=      60.10        20.16        59.702
00843>      TOTAL RAINFALL   (mm)=      61.10        61.10        61.101
00844>      RUNOFF COEFFICIENT   =        .98          .33          .977
00845>
00846>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00847>            CN* =  75.0    Ia = Dep. Storage  (Above)
00848>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00849>            THAN THE STORAGE COEFFICIENT.
00850>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00851>
00852> ---------------------------------------------------------------------------
00853> 010:0007-----------------------------------------------------------------
00854> *# CATCHMENT 202 - PROPOSED CONDITIONS (Uncontrolled To Lakeshore Road)
00855> ---------------------
00856> | CALIB STANDHYD     |   Area    (ha)=     .01
00857> | 05:202    DT= 1.00 |   Total Imp(%)=   82.00   Dir. Conn.(%)=   82.00
00858> ---------------------
00859>                              IMPERVIOUS    PERVIOUS (i)
00860>      Surface Area     (ha)=        .01          .00
00861>      Dep. Storage     (mm)=       1.00         8.50
00862>      Average Slope     (%)=       2.00         2.00
00863>      Length            (m)=       7.00         7.00
00864>      Mannings n             =      .013         .250
00865>
00866>      Max.eff.Inten.(mm/hr)=     116.31        40.88
00867>                    over (min)        1.00         4.00
00868>      Storage Coeff.  (min)=        .40 (ii)    3.94 (ii)
00869>      Unit Hyd. Tpeak (min)=       1.00         4.00
00870>      Unit Hyd. peak  (cms)=       1.56          .29
00871>                                                          *TOTALS*
00872>      PEAK FLOW       (cms)=        .00          .00          .003 (iii)
00873>      TIME TO PEAK    (hrs)=       1.92         2.03         2.000
00874>      RUNOFF VOLUME    (mm)=      60.10        20.16        52.911
00875>      TOTAL RAINFALL   (mm)=      61.10        61.10        61.101
00876>      RUNOFF COEFFICIENT   =        .98          .33          .866
00877>
00878>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00879>            CN* =  75.0    Ia = Dep. Storage  (Above)
00880>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00881>            THAN THE STORAGE COEFFICIENT.
00882>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00883>
00884> ---------------------------------------------------------------------------
00885> 010:0008-----------------------------------------------------------------
00886> *# CATCHMENT 203 - PROPOSED CONDITIONS (Uncontrolled To Old Lakeshore Road)
00887> ---------------------
00888> | CALIB STANDHYD     |   Area    (ha)=     .02
00889> | 06:203    DT= 1.00 |   Total Imp(%)=   86.00   Dir. Conn.(%)=   86.00
00890> ---------------------
00891>                              IMPERVIOUS    PERVIOUS (i)
00892>      Surface Area     (ha)=        .02          .00
00893>      Dep. Storage     (mm)=       1.00         8.50
00894>      Average Slope     (%)=       3.00         3.00
00895>      Length            (m)=       9.00         9.00
00896>      Mannings n             =      .013         .250
00897>
00898>      Max.eff.Inten.(mm/hr)=     116.31        40.88
00899>                    over (min)        1.00         4.00
00900>      Storage Coeff.  (min)=        .41 (ii)    4.06 (ii)
00901>      Unit Hyd. Tpeak (min)=       1.00         4.00
00902>      Unit Hyd. peak  (cms)=       1.55          .28
00903>                                                          *TOTALS*
00904>      PEAK FLOW       (cms)=        .01          .00          .006 (iii)
00905>      TIME TO PEAK    (hrs)=       1.92         2.03         2.000
00906>      RUNOFF VOLUME    (mm)=      60.10        20.16        54.509
00907>      TOTAL RAINFALL   (mm)=      61.10        61.10        61.101
00908>      RUNOFF COEFFICIENT   =        .98          .33          .892
00909>
00910>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
00911>            CN* =  75.0    Ia = Dep. Storage  (Above)
00912>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
00913>            THAN THE STORAGE COEFFICIENT.
00914>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
00915>
00916> ---------------------------------------------------------------------------
00917> 010:0009-----------------------------------------------------------------
00918> *# ROUTE CATCHMENT 201 THROUGH ORIFICE CONTROL
00919> *
00920> ---------------------
00921> | ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
00922> |  IN>04:(201   )    |
00923> | OUT<07:(201   )    |    =========  OUTLFOW STORAGE TABLE  =========
00924> ---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
00925>                            (cms)    (ha.m.)   |    (cms)    (ha.m.)
00926>                             .000  .0000E+00    |     .006  .5300E-02
00927>                             .006  .5000E-03    |     .006  .5300E-02
00928>                             .006  .5000E-03    |     .008  .5700E-02
00929>                             .006  .1900E-02    |     .012  .6600E-02
00930>                             .006  .3400E-02    |     .000  .0000E+00
00931>
00932>      ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
00933>      --------------------       (ha)     (cms)     (hrs)       (mm)
00934>      INFLOW >04: (201   )        .12      .038     2.000     59.702
00935>      OUTFLOW<07: (201   )        .12      .006     1.833     59.702
00936>     OVERFLOW<08: (OVF   )        .00      .000      .000       .000
00937>
00938>                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
00939>                    CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
00940>                    PERCENTAGE OF TIME OVERFLOWING    (%)=      .00
00941>
00942>
00943>                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=   15.594
00944>                    TIME SHIFT OF PEAK FLOW          (min)=   -10.00
00945>                    MAXIMUM  STORAGE   USED       (ha.m.)=.2885E-02
00946>
00947> ---------------------------------------------------------------------------
00948> 010:0010-----------------------------------------------------------------
00949> ----------------------
00950> | ADD HYD (Total     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
00951> ----------------------                    (ha)     (cms)   (hrs)   (mm)    (cms)
00952>                       ID1 06:203            .02      .006    2.00  54.51    .000
00953>                      +ID2 07:201            .12      .006    1.83  59.70    .000
00954>                      +ID3 08:OVF            .00      .000     .00    .00    .000
00955>                       ==========================================================
00956>                       SUM 09:Total           .14      .012    2.00  58.96    .000
00957>
00958>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
00959>
00960> ---------------------------------------------------------------------------
00961> 010:0011-----------------------------------------------------------------
00962> * RUN REMAINING DESIGN STORMS (City of Burlington 5 TO 100-YR)
00963> *
00964> ---------------------------------------------------------------------------
00965> 010:0002-----------------------------------------------------------------
00966> *
00967> ---------------------------------------------------------------------------
00968> 010:0002-----------------------------------------------------------------
00969> *
00970>   ** END OF RUN :  24
00971>
00972> ***************************************************************************
00973>
00974>
00975>
00976>
00977>
00978> --------------------
00979> | START            |  Project  dir.: T:\projects\23028\SWMHYMO\
00980> --------------------  Rainfall dir.: T:\projects\23028\SWMHYMO\
00981>     TZERO =   .00 hrs on        0
00982>     METOUT=   2 (output = METRIC)
00983>     NRUN  = 025
00984>     NSTORM=   1
00985>               #  1=BUR6_025.stm
00986> ---------------------------------------------------------------------------
00987> 025:0002-----------------------------------------------------------------
00988> *#************************************************************************|
00989> *#  Project Name: 2072 LAKESHORE ROAD
00990> *#               BURLINGTON, ONTARIO
00991> *#  JOB NUMBER   : 23028
00992> *#       Date    : MAY 2024
00993> *#    Revised    :
00994> *#    Company    : S. LLEWELLYN AND ASSOCIATES LTD.
00995> *#       File    : 23028.DAT
00996> *#************************************************************************|
00997> *
00998> ---------------------------------------------------------------------------
00999> 025:0002-----------------------------------------------------------------
01000> *
01001> --------------------
01002> | READ STORM       |    Filename: Burlington 25-yr 6hr CHICAGO      (A=106
01003> | Ptotal= 71.35 mm|    Comments: Burlington 25-yr 6hr CHICAGO      (A=106
01004> --------------------
01005>               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
01006>                hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
01007>                .17   3.182 |   1.67  14.410 |   3.17   7.968 |   4.67   4.068
01008>                .33   3.437 |   1.83  32.881 |   3.33   7.135 |   4.83   3.876
01009>                .50   3.746 |   2.00 135.380 |   3.50   6.477 |   5.00   3.704
01010>                .67   4.128 |   2.17  42.866 |   3.67   5.943 |   5.17   3.548
01011>                .83   4.612 |   2.33  23.321 |   3.83   5.499 |   5.33   3.407
01012>               1.00   5.251 |   2.50  16.365 |   4.00   5.125 |   5.50   3.278
01013>               1.17   6.138 |   2.67  12.771 |   4.17   4.805 |   5.67   3.160
01014>               1.33   7.465 |   2.83  10.563 |   4.33   4.527 |   5.83   3.051
01015>               1.50   9.700 |   3.00   9.061 |   4.50   4.284 |   6.00   2.950
01016>
01017> ---------------------------------------------------------------------------
01018> 025:0003-----------------------------------------------------------------
01019> *
01020> *#************************************************************************|
01021> *#
01022> *#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
01023> *#        ==============================================
01024> *#
01025> **#***********************************************************************|
01026> *# CATCHMENT 101 - EXISTING CONDITIONS (To Old Lakeshore Road)
01027> ---------------------
01028> | CALIB STANDHYD     |   Area    (ha)=     .13
01029> | 01:101    DT= 1.00 |   Total Imp(%)=   77.00   Dir. Conn.(%)=   77.00
01030> ---------------------
01031>                              IMPERVIOUS    PERVIOUS (i)
01032>      Surface Area     (ha)=        .10          .03
01033>      Dep. Storage     (mm)=       1.00         8.50
01034>      Average Slope     (%)=       2.00         2.00
01035>      Length            (m)=      20.00        20.00
01036>      Mannings n             =      .013         .250
01037>
01038>      Max.eff.Inten.(mm/hr)=     135.38        49.60
01039>                    over (min)        1.00         7.00
01040>      Storage Coeff.  (min)=        .70 (ii)    6.86 (ii)
01041>      Unit Hyd. Tpeak (min)=       1.00         7.00
01042>      Unit Hyd. peak  (cms)=       1.29          .16
01043>                                                          *TOTALS*
01044>      PEAK FLOW       (cms)=        .04          .00          .040 (iii)
01045>      TIME TO PEAK    (hrs)=       1.98         2.08         2.000
01046>      RUNOFF VOLUME    (mm)=      70.35        26.78        60.325
01047>      TOTAL RAINFALL   (mm)=      71.35        71.35        71.347
01048>      RUNOFF COEFFICIENT   =        .99          .38          .846
01049>
01050>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01051>            CN* =  75.0    Ia = Dep. Storage  (Above)
01052>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
01053>            THAN THE STORAGE COEFFICIENT.
01054>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01055>
01056> ---------------------------------------------------------------------------
01057> 025:0004-----------------------------------------------------------------
01058> *# CATCHMENT 102 - EXISTING CONDITIONS (To Lakeshore Road)
01059> ---------------------
01060> | CALIB STANDHYD     |   Area    (ha)=     .02
01061> | 02:101    DT= 1.00 |   Total Imp(%)=   59.00   Dir. Conn.(%)=   59.00
01062> ---------------------
01063>                              IMPERVIOUS    PERVIOUS (i)
01064>      Surface Area     (ha)=        .01          .01
01065>      Dep. Storage     (mm)=       1.00         8.50
01066>      Average Slope     (%)=       3.50         3.50
01067>      Length            (m)=      10.00        10.00
01068>      Mannings n             =      .013         .250
01069>
01070>      Max.eff.Inten.(mm/hr)=     135.38        55.10
01071>                    over (min)        1.00         4.00
01072>      Storage Coeff.  (min)=        .39 (ii)    3.69 (ii)
01073>      Unit Hyd. Tpeak (min)=       1.00         4.00
01074>      Unit Hyd. peak  (cms)=       1.57          .30
01075>                                                          *TOTALS*
01076>      PEAK FLOW       (cms)=        .00          .00          .005 (iii)
01077>      TIME TO PEAK    (hrs)=       1.92         2.02         2.000
01078>      RUNOFF VOLUME    (mm)=      70.35        26.78        52.482
01079>      TOTAL RAINFALL   (mm)=      71.35        71.35        71.347
01080>      RUNOFF COEFFICIENT   =        .99          .38          .736
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01081>
01082>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01083>            CN* =  75.0    Ia = Dep. Storage  (Above)
01084>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
01085>            THAN THE STORAGE COEFFICIENT.
01086>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01087>
01088> ---------------------------------------------------------------------------
01089> 025:0005----------------------------------------------------------------------
01090> *# ALLOWABLE - EXISTING CONDITIONS (Allowable Discharge)
01091> ---------------------
01092> | CALIB STANDHYD     |   Area    (ha)=     .15
01093> | 03:101    DT= 1.00 |   Total Imp(%)=   36.00   Dir. Conn.(%)=   36.00
01094> ---------------------
01095>                              IMPERVIOUS    PERVIOUS (i)
01096>      Surface Area     (ha)=        .05          .10
01097>      Dep. Storage     (mm)=       1.00         8.50
01098>      Average Slope     (%)=       2.00         2.00
01099>      Length            (m)=      20.00        20.00
01100>      Mannings n            =       .013         .250
01101>
01102>      Max.eff.Inten.(mm/hr)=     135.38        49.60
01103>                 over (min)        1.00         7.00
01104>      Storage Coeff.  (min)=        .70 (ii)    6.86 (ii)
01105>      Unit Hyd. Tpeak (min)=       1.00         7.00
01106>      Unit Hyd. peak  (cms)=       1.29          .16
01107>                                                          *TOTALS*
01108>      PEAK FLOW       (cms)=        .02           .01          .027 (iii)
01109>      TIME TO PEAK    (hrs)=       1.98          2.08         2.000
01110>      RUNOFF VOLUME    (mm)=      70.35         26.78        42.461
01111>      TOTAL RAINFALL   (mm)=      71.35         71.35        71.347
01112>      RUNOFF COEFFICIENT   =        .99           .38          .595
01113>
01114>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01115>            CN* =  75.0    Ia = Dep. Storage  (Above)
01116>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
01117>            THAN THE STORAGE COEFFICIENT.
01118>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01119>
01120> ---------------------------------------------------------------------------
01121> 025:0006----------------------------------------------------------------------
01122> *#*************************************************************************|
01123> *#
01124> *#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
01125> *#        ==============================================
01126> *#
01127> **#************************************************************************|
01128> *# CATCHMENT 201 - PROPOSED CONDITIONS (Controlled To Old Lakeshore Road)
01129> ---------------------
01130> | CALIB STANDHYD     |   Area    (ha)=     .12
01131> | 04:201    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
01132> ---------------------
01133>                              IMPERVIOUS    PERVIOUS (i)
01134>      Surface Area     (ha)=        .12          .00
01135>      Dep. Storage     (mm)=       1.00         8.50
01136>      Average Slope     (%)=       2.00         2.00
01137>      Length            (m)=       8.00         8.00
01138>      Mannings n            =       .013         .250
01139>
01140>      Max.eff.Inten.(mm/hr)=     135.38        55.10
01141>                 over (min)        1.00         4.00
01142>      Storage Coeff.  (min)=        .40 (ii)    3.81 (ii)
01143>      Unit Hyd. Tpeak (min)=       1.00         4.00
01144>      Unit Hyd. peak  (cms)=       1.56          .29
01145>                                                          *TOTALS*
01146>      PEAK FLOW       (cms)=        .04           .00          .045 (iii)
01147>      TIME TO PEAK    (hrs)=       1.93          2.02         2.000
01148>      RUNOFF VOLUME    (mm)=      70.35         26.78        69.911
01149>      TOTAL RAINFALL   (mm)=      71.35         71.35        71.347
01150>      RUNOFF COEFFICIENT   =        .99           .38          .980
01151>
01152>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01153>            CN* =  75.0    Ia = Dep. Storage  (Above)
01154>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
01155>            THAN THE STORAGE COEFFICIENT.
01156>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01157>
01158> ---------------------------------------------------------------------------
01159> 025:0007----------------------------------------------------------------------
01160> *# CATCHMENT 202 - PROPOSED CONDITIONS (Uncontrolled To Lakeshore Road)
01161> ---------------------
01162> | CALIB STANDHYD     |   Area    (ha)=     .01
01163> | 05:202    DT= 1.00 |   Total Imp(%)=   82.00   Dir. Conn.(%)=   82.00
01164> ---------------------
01165>                              IMPERVIOUS    PERVIOUS (i)
01166>      Surface Area     (ha)=        .01          .00
01167>      Dep. Storage     (mm)=       1.00         8.50
01168>      Average Slope     (%)=       2.00         2.00
01169>      Length            (m)=       7.00         7.00
01170>      Mannings n            =       .013         .250
01171>
01172>      Max.eff.Inten.(mm/hr)=     135.38        55.10
01173>                 over (min)        1.00         4.00
01174>      Storage Coeff.  (min)=        .37 (ii)    3.52 (ii)
01175>      Unit Hyd. Tpeak (min)=       1.00         4.00
01176>      Unit Hyd. peak  (cms)=       1.58          .31
01177>                                                          *TOTALS*
01178>      PEAK FLOW       (cms)=        .00           .00          .003 (iii)
01179>      TIME TO PEAK    (hrs)=       1.92          2.02         2.000
01180>      RUNOFF VOLUME    (mm)=      70.35         26.78        62.504
01181>      TOTAL RAINFALL   (mm)=      71.35         71.35        71.347
01182>      RUNOFF COEFFICIENT   =        .99           .38          .876
01183>
01184>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01185>            CN* =  75.0    Ia = Dep. Storage  (Above)
01186>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
01187>            THAN THE STORAGE COEFFICIENT.
01188>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01189>
01190> ---------------------------------------------------------------------------
01191> 025:0008----------------------------------------------------------------------
01192> *# CATCHMENT 203 - PROPOSED CONDITIONS (Uncontrolled To Old Lakeshore Road)
01193> ---------------------
01194> | CALIB STANDHYD     |   Area    (ha)=     .02
01195> | 06:203    DT= 1.00 |   Total Imp(%)=   86.00   Dir. Conn.(%)=   86.00
01196> ---------------------
01197>                              IMPERVIOUS    PERVIOUS (i)
01198>      Surface Area     (ha)=        .02          .00
01199>      Dep. Storage     (mm)=       1.00         8.50
01200>      Average Slope     (%)=       3.00         3.00
01201>      Length            (m)=       9.00         9.00
01202>      Mannings n            =       .013         .250
01203>
01204>      Max.eff.Inten.(mm/hr)=     135.38        55.10
01205>                 over (min)        1.00         4.00
01206>      Storage Coeff.  (min)=        .38 (ii)    3.62 (ii)
01207>      Unit Hyd. Tpeak (min)=       1.00         4.00
01208>      Unit Hyd. peak  (cms)=       1.57          .30
01209>                                                          *TOTALS*
01210>      PEAK FLOW       (cms)=        .01           .00          .007 (iii)
01211>      TIME TO PEAK    (hrs)=       1.92          2.02         2.000
01212>      RUNOFF VOLUME    (mm)=      70.35         26.78        64.247
01213>      TOTAL RAINFALL   (mm)=      71.35         71.35        71.347
01214>      RUNOFF COEFFICIENT   =        .99           .38          .900
01215>
01216>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01217>            CN* =  75.0    Ia = Dep. Storage  (Above)
01218>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
01219>            THAN THE STORAGE COEFFICIENT.
01220>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01221>
01222> ---------------------------------------------------------------------------
01223> 025:0009----------------------------------------------------------------------
01224> *# ROUTE CATCHMENT 201 THROUGH ORIFICE CONTROL
01225> *
01226> ---------------------
01227> | ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
01228> |  IN>04:(201   )    |
01229> | OUT<07:(201   )    |    =========  OUTLFOW STORAGE TABLE  =========
01230> ---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
01231>                            (cms)     (ha.m.)   |    (cms)     (ha.m.)
01232>                             .000  .0000E+00    |     .006  .5300E-02
01233>                             .006  .5000E-03    |     .006  .5300E-02
01234>                             .006  .5000E-03    |     .008  .5700E-02
01235>                             .006  .1900E-02    |     .012  .6600E-02
01236>                             .006  .3400E-02    |     .000  .0000E+00
01237>
01238>      ROUTING RESULTS           AREA     QPEAK     TPEAK        R.V.
01239>      --------------------      (ha)     (cms)     (hrs)        (mm)
01240>      INFLOW >04: (201   )       .12      .045     2.000      69.911
01241>      OUTFLOW<07: (201   )       .12      .006     1.767      69.911
01242>     OVERFLOW<08: (OVF   )       .00      .000      .000       .000
01243>
01244>                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
01245>                    CUMULATIVE TIME OF OVERFLOWS  (hours)=       .00
01246>                    PERCENTAGE OF TIME OVERFLOWING    (%)=       .00
01247>
01248>
01249>                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=   13.389
01250>                    TIME SHIFT OF PEAK FLOW        (min)=   -14.00
01251>                    MAXIMUM  STORAGE   USED       (ha.m.)=.3561E-02
01252>
01253> ---------------------------------------------------------------------------
01254> 025:0010----------------------------------------------------------------------
01255> -------------------------
01256> | ADD HYD (Total     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
01257> -------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
01258>                          ID1 06:203          .02     .007    2.00  64.25    .000
01259>                         +ID2 07:201          .12     .006    1.77  69.91    .000
01260>                         +ID3 08:OVF          .00     .000     .00    .00    .000
01261>                          ========================================================
01262>                          SUM 09:Total        .14     .013    2.00  69.10    .000
01263>
01264>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
01265>
01266> ---------------------------------------------------------------------------
01267> 025:0011----------------------------------------------------------------------
01268> * RUN REMAINING DESIGN STORMS (City of Burlington 5 TO 100-YR)
01269> *
01270> ---------------------------------------------------------------------------
01271> 025:0002----------------------------------------------------------------------
01272> *
01273> ---------------------------------------------------------------------------
01274> 025:0002----------------------------------------------------------------------
01275> *
01276> ---------------------------------------------------------------------------
01277> 025:0002----------------------------------------------------------------------
01278> *
01279>   ** END OF RUN :  49
01280>
01281> ****************************************************************************
01282>
01283>
01284>
01285>
01286>
01287> --------------------
01288> | START            |  Project  dir.: T:\projects\23028\SWMHYMO\
01289> --------------------  Rainfall dir.: T:\projects\23028\SWMHYMO\
01290>     TZERO =   .00 hrs on       0
01291>     METOUT=   2 (output = METRIC)
01292>     NRUN  = 050
01293>     NSTORM=   1
01294>               #  1=BUR6_050.stm
01295> ---------------------------------------------------------------------------
01296> 050:0002----------------------------------------------------------------------
01297> *#************************************************************************|
01298> *#  Project Name: 2072 LAKESHORE ROAD
01299> *#               BURLINGTON, ONTARIO
01300> *#  JOB NUMBER  : 23028
01301> *#       Date   : MAY 2024
01302> *#    Revised   :
01303> *#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
01304> *#       File   : 23028.DAT
01305> *#************************************************************************|
01306> *
01307> ---------------------------------------------------------------------------
01308> 050:0002----------------------------------------------------------------------
01309> *
01310> --------------------
01311> | READ STORM       |    Filename: Burlington 50-yr 6hr CHICAGO     (A=1172
01312> | Ptotal=  78.93 mm|    Comments: Burlington 50-yr 6hr CHICAGO     (A=1172
01313> --------------------
01314>               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
01315>                hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
01316>                .17   3.533 |   1.67  15.961 |   3.17   8.836 |   4.67   4.516
01317>                .33   3.817 |   1.83  36.356 |   3.33   7.913 |   4.83   4.304
01318>                .50   4.160 |   2.00 149.296 |   3.50   7.185 |   5.00   4.113
01319>                .67   4.582 |   2.17  47.374 |   3.67   6.593 |   5.17   3.940
01320>                .83   5.119 |   2.33  25.806 |   3.83   6.102 |   5.33   3.783
01321>               1.00   5.827 |   2.50  18.121 |   4.00   5.688 |   5.50   3.640
01322>               1.17   6.809 |   2.67  14.149 |   4.17   5.333 |   5.67   3.509
01323>               1.33   8.278 |   2.83  11.707 |   4.33   5.025 |   5.83   3.388
01324>               1.50  10.753 |   3.00  10.045 |   4.50   4.755 |   6.00   3.277
01325>
01326> ---------------------------------------------------------------------------
01327> 050:0003----------------------------------------------------------------------
01328> *
01329> *#************************************************************************|
01330> *#
01331> *#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
01332> *#        ==============================================
01333> *#
01334> **#***********************************************************************|
01335> *# CATCHMENT 101 - EXISTING CONDITIONS (To Old Lakeshore Road)
01336> ---------------------
01337> | CALIB STANDHYD     |   Area    (ha)=     .13
01338> | 01:101    DT= 1.00 |   Total Imp(%)=   77.00   Dir. Conn.(%)=   77.00
01339> ---------------------
01340>                              IMPERVIOUS    PERVIOUS (i)
01341>      Surface Area     (ha)=        .10          .03
01342>      Dep. Storage     (mm)=       1.00         8.50
01343>      Average Slope     (%)=       2.00         2.00
01344>      Length            (m)=      20.00        20.00
01345>      Mannings n            =       .013         .250
01346>
01347>      Max.eff.Inten.(mm/hr)=     149.30        62.22
01348>                 over (min)        1.00         6.00
01349>      Storage Coeff.  (min)=        .67 (ii)    6.30 (ii)
01350>      Unit Hyd. Tpeak (min)=       1.00         6.00
```

```
01351>      Unit Hyd. peak  (cms)=       1.31          .18
01352>                                                          *TOTALS*
01353>      PEAK FLOW       (cms)=        .04          .00          .044 (iii)
01354>      TIME TO PEAK    (hrs)=       1.98         2.07         2.000
01355>      RUNOFF VOLUME    (mm)=      77.93        31.98        67.364
01356>      TOTAL RAINFALL   (mm)=      78.93        78.93        78.932
01357>      RUNOFF COEFFICIENT   =        .99          .41          .853
01358>
01359>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01360>            CN* =  75.0    Ia = Dep. Storage  (Above)
01361>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
01362>            THAN THE STORAGE COEFFICIENT.
01363>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01364>
01365> ------------------------------------------------------------------------------
01366> 050:0004------------------------------------------------------------------------
01367> *# CATCHMENT 102 - EXISTING CONDITIONS (To Lakeshore Road)
01368> ----------------------
01369> | CALIB STANDHYD     |   Area    (ha)=     .02
01370> | 02:101    DT= 1.00 |   Total Imp(%)=   59.00   Dir. Conn.(%)=   59.00
01371> ----------------------
01372>                              IMPERVIOUS    PERVIOUS (i)
01373>      Surface Area     (ha)=        .01          .01
01374>      Dep. Storage     (mm)=       1.00         8.50
01375>      Average Slope     (%)=       3.50         3.50
01376>      Length            (m)=      10.00        10.00
01377>      Mannings n            =       .013         .250
01378>
01379>      Max.eff.Inten.(mm/hr)=     149.30        68.07
01380>                    over (min)        1.00         3.00
01381>      Storage Coeff.  (min)=        .38 (ii)     3.40 (ii)
01382>      Unit Hyd. Tpeak (min)=       1.00         3.00
01383>      Unit Hyd. peak  (cms)=       1.58          .34
01384>                                                          *TOTALS*
01385>      PEAK FLOW       (cms)=        .00          .00          .006 (iii)
01386>      TIME TO PEAK    (hrs)=       1.92         2.02         2.000
01387>      RUNOFF VOLUME    (mm)=      77.93        31.98        59.093
01388>      TOTAL RAINFALL   (mm)=      78.93        78.93        78.932
01389>      RUNOFF COEFFICIENT   =        .99          .41          .749
01390>
01391>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01392>            CN* =  75.0    Ia = Dep. Storage  (Above)
01393>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
01394>            THAN THE STORAGE COEFFICIENT.
01395>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01396>
01397> ------------------------------------------------------------------------------
01398> 050:0005------------------------------------------------------------------------
01399> *# ALLOWABLE - EXISTING CONDITIONS (Allowable Discharge)
01400> ----------------------
01401> | CALIB STANDHYD     |   Area    (ha)=     .15
01402> | 03:101    DT= 1.00 |   Total Imp(%)=   36.00   Dir. Conn.(%)=   36.00
01403> ----------------------
01404>                              IMPERVIOUS    PERVIOUS (i)
01405>      Surface Area     (ha)=        .05          .10
01406>      Dep. Storage     (mm)=       1.00         8.50
01407>      Average Slope     (%)=       2.00         2.00
01408>      Length            (m)=      20.00        20.00
01409>      Mannings n            =       .013         .250
01410>
01411>      Max.eff.Inten.(mm/hr)=     149.30        62.22
01412>                    over (min)        1.00         6.00
01413>      Storage Coeff.  (min)=        .67 (ii)     6.30 (ii)
01414>      Unit Hyd. Tpeak (min)=       1.00         6.00
01415>      Unit Hyd. peak  (cms)=       1.31          .18
01416>                                                          *TOTALS*
01417>      PEAK FLOW       (cms)=        .02          .01          .032 (iii)
01418>      TIME TO PEAK    (hrs)=       1.98         2.07         2.000
01419>      RUNOFF VOLUME    (mm)=      77.93        31.98        48.525
01420>      TOTAL RAINFALL   (mm)=      78.93        78.93        78.932
01421>      RUNOFF COEFFICIENT   =        .99          .41          .615
01422>
01423>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01424>            CN* =  75.0    Ia = Dep. Storage  (Above)
01425>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
01426>            THAN THE STORAGE COEFFICIENT.
01427>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01428>
01429> ------------------------------------------------------------------------------
01430> 050:0006------------------------------------------------------------------------
01431> *#############################################################################|
01432> *#
01433> *#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
01434> *#        ==============================================
01435> *#
01436> **#############################################################################|
01437> *# CATCHMENT 201 - PROPOSED CONDITIONS (Controlled To Old Lakeshore Road)
01438> ----------------------
01439> | CALIB STANDHYD     |   Area    (ha)=     .12
01440> | 04:201    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
01441> ----------------------
01442>                              IMPERVIOUS    PERVIOUS (i)
01443>      Surface Area     (ha)=        .12          .00
01444>      Dep. Storage     (mm)=       1.00         8.50
01445>      Average Slope     (%)=       2.00         2.00
01446>      Length            (m)=       8.00         8.00
01447>      Mannings n            =       .013         .250
01448>
01449>      Max.eff.Inten.(mm/hr)=     149.30        66.21
01450>                    over (min)        1.00         4.00
01451>      Storage Coeff.  (min)=        .39 (ii)     3.56 (ii)
01452>      Unit Hyd. Tpeak (min)=       1.00         4.00
01453>      Unit Hyd. peak  (cms)=       1.57          .31
01454>                                                          *TOTALS*
01455>      PEAK FLOW       (cms)=        .05          .00          .049 (iii)
01456>      TIME TO PEAK    (hrs)=       1.93         2.02         2.000
01457>      RUNOFF VOLUME    (mm)=      77.93        31.98        77.473
01458>      TOTAL RAINFALL   (mm)=      78.93        78.93        78.932
01459>      RUNOFF COEFFICIENT   =        .99          .41          .982
01460>
01461>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01462>            CN* =  75.0    Ia = Dep. Storage  (Above)
01463>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
01464>            THAN THE STORAGE COEFFICIENT.
01465>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01466>
01467> ------------------------------------------------------------------------------
01468> 050:0007------------------------------------------------------------------------
01469> *# CATCHMENT 202 - PROPOSED CONDITIONS (Uncontrolled To Lakeshore Road)
01470> ----------------------
01471> | CALIB STANDHYD     |   Area    (ha)=     .01
01472> | 05:202    DT= 1.00 |   Total Imp(%)=   82.00   Dir. Conn.(%)=   82.00
01473> ----------------------
01474>                              IMPERVIOUS    PERVIOUS (i)
01475>      Surface Area     (ha)=        .01          .00
01476>      Dep. Storage     (mm)=       1.00         8.50
01477>      Average Slope     (%)=       2.00         2.00
01478>      Length            (m)=       7.00         7.00
01479>      Mannings n            =       .013         .250
01480>
01481>      Max.eff.Inten.(mm/hr)=     149.30        68.07
01482>                    over (min)        1.00         3.00
01483>      Storage Coeff.  (min)=        .36 (ii)     3.25 (ii)
01484>      Unit Hyd. Tpeak (min)=       1.00         3.00
01485>      Unit Hyd. peak  (cms)=       1.59          .36
01486>                                                          *TOTALS*
01487>      PEAK FLOW       (cms)=        .00          .00          .004 (iii)
01488>      TIME TO PEAK    (hrs)=       1.92         2.02         2.000
01489>      RUNOFF VOLUME    (mm)=      77.93        31.98        69.661
01490>      TOTAL RAINFALL   (mm)=      78.93        78.93        78.932
01491>      RUNOFF COEFFICIENT   =        .99          .41          .883
01492>
01493>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01494>            CN* =  75.0    Ia = Dep. Storage  (Above)
01495>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
01496>            THAN THE STORAGE COEFFICIENT.
01497>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01498>
01499> ------------------------------------------------------------------------------
01500> 050:0008------------------------------------------------------------------------
01501> *# CATCHMENT 203 - PROPOSED CONDITIONS (Uncontrolled To Old Lakeshore Road)
01502> ----------------------
01503> | CALIB STANDHYD     |   Area    (ha)=     .02
01504> | 06:203    DT= 1.00 |   Total Imp(%)=   86.00   Dir. Conn.(%)=   86.00
01505> ----------------------
01506>                              IMPERVIOUS    PERVIOUS (i)
01507>      Surface Area     (ha)=        .02          .00
01508>      Dep. Storage     (mm)=       1.00         8.50
01509>      Average Slope     (%)=       3.00         3.00
01510>      Length            (m)=       9.00         9.00
01511>      Mannings n            =       .013         .250
01512>
01513>      Max.eff.Inten.(mm/hr)=     149.30        68.07
01514>                    over (min)        1.00         3.00
01515>      Storage Coeff.  (min)=        .37 (ii)     3.35 (ii)
01516>      Unit Hyd. Tpeak (min)=       1.00         3.00
01517>      Unit Hyd. peak  (cms)=       1.59          .35
01518>                                                          *TOTALS*
01519>      PEAK FLOW       (cms)=        .01          .00          .008 (iii)
01520>      TIME TO PEAK    (hrs)=       1.92         2.02         2.000
01521>      RUNOFF VOLUME    (mm)=      77.93        31.98        71.499
01522>      TOTAL RAINFALL   (mm)=      78.93        78.93        78.932
01523>      RUNOFF COEFFICIENT   =        .99          .41          .906
01524>
01525>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01526>            CN* =  75.0    Ia = Dep. Storage  (Above)
01527>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
01528>            THAN THE STORAGE COEFFICIENT.
01529>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01530>
01531> ------------------------------------------------------------------------------
01532> 050:0009------------------------------------------------------------------------
01533> *# ROUTE CATCHMENT 201 THROUGH ORIFICE CONTROL
01534> *
01535> ----------------------
01536> | ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
01537> |  IN>04:(201   )    |
01538> | OUT<07:(201   )    |    =========  OUTLFOW STORAGE TABLE  =========
01539> ----------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
01540>                             (cms)     (ha.m.)   |    (cms)    (ha.m.)
01541>                              .000  .0000E+00    |     .006  .5300E-02
01542>                              .006  .5000E-03    |     .006  .5300E-02
01543>                              .006  .5000E-03    |     .008  .5700E-02
01544>                              .006  .1900E-02    |     .012  .6600E-02
01545>                              .006  .3400E-02    |     .000  .0000E+00
01546>
01547>      ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
01548>      ---------------------       (ha)     (cms)     (hrs)       (mm)
01549>      INFLOW >04: (201   )        .12      .049     2.000     77.473
01550>      OUTFLOW<07: (201   )        .12      .006     1.750     77.472
01551>     OVERFLOW<08: (OVF   )        .00      .000      .000       .000
01552>
01553>                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
01554>                    CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
01555>                    PERCENTAGE OF TIME OVERFLOWING    (%)=      .00
01556>
01557>
01558>                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=   12.136
01559>                    TIME SHIFT OF PEAK FLOW          (min)=   -15.00
01560>                    MAXIMUM  STORAGE   USED       (ha.m.)=.4070E-02
01561>
01562> ------------------------------------------------------------------------------
01563> 050:0010------------------------------------------------------------------------
01564> ------------------------
01565> | ADD HYD (Total     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
01566> ------------------------                  (ha)     (cms)   (hrs)   (mm)    (cms)
01567>                         ID1 06:203         .02      .008   2.00  71.50    .000
01568>                        +ID2 07:201         .12      .006   1.75  77.47    .000
01569>                        +ID3 08:OVF         .00      .000    .00    .00    .000
01570>                         ================================================================
01571>                         SUM 09:Total       .14      .014   2.00  76.62    .000
01572>
01573>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
01574>
01575> ------------------------------------------------------------------------------
01576> 050:0011------------------------------------------------------------------------
01577> * RUN REMAINING DESIGN STORMS (City of Burlington 5 TO 100-YR)
01578> *
01579> ------------------------------------------------------------------------------
01580> 050:0002------------------------------------------------------------------------
01581> *
01582> ------------------------------------------------------------------------------
01583> 050:0002------------------------------------------------------------------------
01584> *
01585> ------------------------------------------------------------------------------
01586> 050:0002------------------------------------------------------------------------
01587> *
01588> ------------------------------------------------------------------------------
01589> 050:0002------------------------------------------------------------------------
01590> *
01591>   ** END OF RUN :  99
01592>
01593> ******************************************************************************
01594>
01595>
01596>
01597>
01598>
01599> ----------------------
01600> | START              |  Project  dir.: T:\projects\23028\SWMHYMO\
01601> ----------------------  Rainfall dir.: T:\projects\23028\SWMHYMO\
01602>     TZERO =   .00 hrs on       0
01603>     METOUT=   2 (output = METRIC)
01604>     NRUN  = 100
01605>     NSTORM=   1
01606>               #  1=BUR6_100.stm
01607> ------------------------------------------------------------------------------
01608> 100:0002------------------------------------------------------------------------
01609> *#############################################################################|
01610> *#  Project Name: 2072 LAKESHORE ROAD
01611> *#               BURLINGTON, ONTARIO
01612> *#  JOB NUMBER  : 23028
01613> *#       Date   : MAY 2024
01614> *#    Revised   :
01615> *#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
01616> *#       File   : 23028.DAT
01617> *#############################################################################|
01618> *
01619> ------------------------------------------------------------------------------
01620> 100:0002------------------------------------------------------------------------
```

```
01621> *
01622> --------------------
01623> | READ STORM       |    Filename: Burlington 100-yr 6hr CHICAGO        (A=
01624> | Ptotal=  86.27 mm|    Comments: Burlington 100-yr 6hr CHICAGO        (A=
01625> --------------------
01626>               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
01627>                hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
01628>                .17   3.862 |   1.67  17.445 |   3.17   9.657 |   4.67   4.936
01629>                .33   4.172 |   1.83  39.736 |   3.33   8.649 |   4.83   4.704
01630>                .50   4.546 |   2.00 163.177 |   3.50   7.853 |   5.00   4.495
01631>                .67   5.008 |   2.17  51.779 |   3.67   7.206 |   5.17   4.306
01632>                .83   5.595 |   2.33  28.205 |   3.83   6.670 |   5.33   4.135
01633>               1.00   6.369 |   2.50  19.806 |   4.00   6.217 |   5.50   3.979
01634>               1.17   7.443 |   2.67  15.465 |   4.17   5.829 |   5.67   3.835
01635>               1.33   9.048 |   2.83  12.795 |   4.33   5.492 |   5.83   3.703
01636>               1.50  11.752 |   3.00  10.979 |   4.50   5.197 |   6.00   3.581
01637>
01638> ------------------------------------------------------------------------------
01639> 100:0003--------------------------------------------------------------------
01640> *
01641> *#*****************************************************************************|
01642> *#
01643> *#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
01644> *#        ==============================================
01645> *#
01646> **#*****************************************************************************|
01647> *# CATCHMENT 101 - EXISTING CONDITIONS (To Old Lakeshore Road)
01648> ----------------------
01649> | CALIB STANDHYD     |   Area    (ha)=     .13
01650> | 01:101    DT= 1.00 |   Total Imp(%)=   77.00   Dir. Conn.(%)=   77.00
01651> ----------------------
01652>                                IMPERVIOUS    PERVIOUS (i)
01653>      Surface Area     (ha)=        .10          .03
01654>      Dep. Storage     (mm)=       1.00         8.50
01655>      Average Slope     (%)=       2.00         2.00
01656>      Length            (m)=      20.00        20.00
01657>      Mannings n             =      .013         .250
01658>
01659>      Max.eff.Inten.(mm/hr)=     163.18        73.29
01660>                    over (min)        1.00         6.00
01661>      Storage Coeff.  (min)=        .65 (ii)    5.92 (ii)
01662>      Unit Hyd. Tpeak (min)=       1.00         6.00
01663>      Unit Hyd. peak  (cms)=       1.33          .19
01664>                                                          *TOTALS*
01665>      PEAK FLOW       (cms)=        .05          .00          .049 (iii)
01666>      TIME TO PEAK    (hrs)=       1.98         2.05         2.000
01667>      RUNOFF VOLUME    (mm)=      85.27        37.23        74.223
01668>      TOTAL RAINFALL   (mm)=      86.27        86.27        86.271
01669>      RUNOFF COEFFICIENT   =        .99          .43          .860
01670>
01671>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01672>            CN* =  75.0    Ia = Dep. Storage  (Above)
01673>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
01674>            THAN THE STORAGE COEFFICIENT.
01675>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01676>
01677> ------------------------------------------------------------------------------
01678> 100:0004--------------------------------------------------------------------
01679> *# CATCHMENT 102 - EXISTING CONDITIONS (To Lakeshore Road)
01680> ----------------------
01681> | CALIB STANDHYD     |   Area    (ha)=     .02
01682> | 02:101    DT= 1.00 |   Total Imp(%)=   59.00   Dir. Conn.(%)=   59.00
01683> ----------------------
01684>                                IMPERVIOUS    PERVIOUS (i)
01685>      Surface Area     (ha)=        .01          .01
01686>      Dep. Storage     (mm)=       1.00         8.50
01687>      Average Slope     (%)=       3.50         3.50
01688>      Length            (m)=      10.00        10.00
01689>      Mannings n             =      .013         .250
01690>
01691>      Max.eff.Inten.(mm/hr)=     163.18        79.70
01692>                    over (min)        1.00         3.00
01693>      Storage Coeff.  (min)=        .36 (ii)    3.21 (ii)
01694>      Unit Hyd. Tpeak (min)=       1.00         3.00
01695>      Unit Hyd. peak  (cms)=       1.59          .36
01696>                                                          *TOTALS*
01697>      PEAK FLOW       (cms)=        .01          .00          .007 (iii)
01698>      TIME TO PEAK    (hrs)=       1.92         2.02         2.000
01699>      RUNOFF VOLUME    (mm)=      85.27        37.23        65.576
01700>      TOTAL RAINFALL   (mm)=      86.27        86.27        86.271
01701>      RUNOFF COEFFICIENT   =        .99          .43          .760
01702>
01703>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01704>            CN* =  75.0    Ia = Dep. Storage  (Above)
01705>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
01706>            THAN THE STORAGE COEFFICIENT.
01707>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01708>
01709> ------------------------------------------------------------------------------
01710> 100:0005--------------------------------------------------------------------
01711> *# ALLOWABLE - EXISTING CONDITIONS (Allowable Discharge)
01712> ----------------------
01713> | CALIB STANDHYD     |   Area    (ha)=     .15
01714> | 03:101    DT= 1.00 |   Total Imp(%)=   36.00   Dir. Conn.(%)=   36.00
01715> ----------------------
01716>                                IMPERVIOUS    PERVIOUS (i)
01717>      Surface Area     (ha)=        .05          .10
01718>      Dep. Storage     (mm)=       1.00         8.50
01719>      Average Slope     (%)=       2.00         2.00
01720>      Length            (m)=      20.00        20.00
01721>      Mannings n             =      .013         .250
01722>
01723>      Max.eff.Inten.(mm/hr)=     163.18        73.29
01724>                    over (min)        1.00         6.00
01725>      Storage Coeff.  (min)=        .65 (ii)    5.92 (ii)
01726>      Unit Hyd. Tpeak (min)=       1.00         6.00
01727>      Unit Hyd. peak  (cms)=       1.33          .19
01728>                                                          *TOTALS*
01729>      PEAK FLOW       (cms)=        .02          .01          .036 (iii)
01730>      TIME TO PEAK    (hrs)=       1.98         2.05         2.000
01731>      RUNOFF VOLUME    (mm)=      85.27        37.23        54.528
01732>      TOTAL RAINFALL   (mm)=      86.27        86.27        86.271
01733>      RUNOFF COEFFICIENT   =        .99          .43          .632
01734>
01735>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01736>            CN* =  75.0    Ia = Dep. Storage  (Above)
01737>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
01738>            THAN THE STORAGE COEFFICIENT.
01739>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01740>
01741> ------------------------------------------------------------------------------
01742> 100:0006--------------------------------------------------------------------
01743> *#*****************************************************************************|
01744> *#
01745> *#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
01746> *#        ===============================================
01747> *#
01748> **#*****************************************************************************|
01749> *# CATCHMENT 201 - PROPOSED CONDITIONS (Controlled To Old Lakeshore Road)
01750> ----------------------
01751> | CALIB STANDHYD     |   Area    (ha)=     .12
01752> | 04:201    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
01753> ----------------------
01754>                                IMPERVIOUS    PERVIOUS (i)
01755>      Surface Area     (ha)=        .12          .00
01756>      Dep. Storage     (mm)=       1.00         8.50
01757>      Average Slope     (%)=       2.00         2.00
01758>      Length            (m)=       8.00         8.00
01759>      Mannings n             =      .013         .250
01760>
01761>      Max.eff.Inten.(mm/hr)=     163.18        79.70
01762>                    over (min)        1.00         3.00
01763>      Storage Coeff.  (min)=        .37 (ii)    3.32 (ii)
01764>      Unit Hyd. Tpeak (min)=       1.00         3.00
01765>      Unit Hyd. peak  (cms)=       1.58          .35
01766>                                                          *TOTALS*
01767>      PEAK FLOW       (cms)=        .05          .00          .054 (iii)
01768>      TIME TO PEAK    (hrs)=       1.93         2.02         2.000
01769>      RUNOFF VOLUME    (mm)=      85.27        37.23        84.791
01770>      TOTAL RAINFALL   (mm)=      86.27        86.27        86.271
01771>      RUNOFF COEFFICIENT   =        .99          .43          .983
01772>
01773>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01774>            CN* =  75.0    Ia = Dep. Storage  (Above)
01775>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
01776>            THAN THE STORAGE COEFFICIENT.
01777>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01778>
01779> ------------------------------------------------------------------------------
01780> 100:0007--------------------------------------------------------------------
01781> *# CATCHMENT 202 - PROPOSED CONDITIONS (Uncontrolled To Lakeshore Road)
01782> ----------------------
01783> | CALIB STANDHYD     |   Area    (ha)=     .01
01784> | 05:202    DT= 1.00 |   Total Imp(%)=   82.00   Dir. Conn.(%)=   82.00
01785> ----------------------
01786>                                IMPERVIOUS    PERVIOUS (i)
01787>      Surface Area     (ha)=        .01          .00
01788>      Dep. Storage     (mm)=       1.00         8.50
01789>      Average Slope     (%)=       2.00         2.00
01790>      Length            (m)=       7.00         7.00
01791>      Mannings n             =      .013         .250
01792>
01793>      Max.eff.Inten.(mm/hr)=     163.18        79.70
01794>                    over (min)        1.00         3.00
01795>      Storage Coeff.  (min)=        .35 (ii)    3.06 (ii)
01796>      Unit Hyd. Tpeak (min)=       1.00         3.00
01797>      Unit Hyd. peak  (cms)=       1.60          .37
01798>                                                          *TOTALS*
01799>      PEAK FLOW       (cms)=        .00          .00          .004 (iii)
01800>      TIME TO PEAK    (hrs)=       1.92         2.02         2.000
01801>      RUNOFF VOLUME    (mm)=      85.27        37.23        76.624
01802>      TOTAL RAINFALL   (mm)=      86.27        86.27        86.271
01803>      RUNOFF COEFFICIENT   =        .99          .43          .888
01804>
01805>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01806>            CN* =  75.0    Ia = Dep. Storage  (Above)
01807>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
01808>            THAN THE STORAGE COEFFICIENT.
01809>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01810>
01811> ------------------------------------------------------------------------------
01812> 100:0008--------------------------------------------------------------------
01813> *# CATCHMENT 203 - PROPOSED CONDITIONS (Uncontrolled To Old Lakeshore Road)
01814> ----------------------
01815> | CALIB STANDHYD     |   Area    (ha)=     .02
01816> | 06:203    DT= 1.00 |   Total Imp(%)=   86.00   Dir. Conn.(%)=   86.00
01817> ----------------------
01818>                                IMPERVIOUS    PERVIOUS (i)
01819>      Surface Area     (ha)=        .02          .00
01820>      Dep. Storage     (mm)=       1.00         8.50
01821>      Average Slope     (%)=       3.00         3.00
01822>      Length            (m)=       9.00         9.00
01823>      Mannings n             =      .013         .250
01824>
01825>      Max.eff.Inten.(mm/hr)=     163.18        79.70
01826>                    over (min)        1.00         3.00
01827>      Storage Coeff.  (min)=        .36 (ii)    3.15 (ii)
01828>      Unit Hyd. Tpeak (min)=       1.00         3.00
01829>      Unit Hyd. peak  (cms)=       1.60          .36
01830>                                                          *TOTALS*
01831>      PEAK FLOW       (cms)=        .01          .00          .008 (iii)
01832>      TIME TO PEAK    (hrs)=       1.92         2.02         2.000
01833>      RUNOFF VOLUME    (mm)=      85.27        37.23        78.546
01834>      TOTAL RAINFALL   (mm)=      86.27        86.27        86.271
01835>      RUNOFF COEFFICIENT   =        .99          .43          .910
01836>
01837>        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
01838>            CN* =  75.0    Ia = Dep. Storage  (Above)
01839>       (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
01840>            THAN THE STORAGE COEFFICIENT.
01841>      (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
01842>
01843> ------------------------------------------------------------------------------
01844> 100:0009--------------------------------------------------------------------
01845> *# ROUTE CATCHMENT 201 THROUGH ORIFICE CONTROL
01846> *
01847> ----------------------
01848> | ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
01849> |  IN>04:(201   )    |
01850> | OUT<07:(201   )    |    =========  OUTLFW STORAGE TABLE  =========
01851> ----------------------    OUTFLOW    STORAGE    |  OUTFLOW    STORAGE
01852>                             (cms)     (ha.m.)    |    (cms)    (ha.m.)
01853>                              .000  .0000E+00     |     .006  .5300E-02
01854>                              .006  .5000E-03     |     .006  .5300E-02
01855>                              .006  .5000E-03     |     .008  .5700E-02
01856>                              .006  .1900E-02     |     .012  .6600E-02
01857>                              .006  .3400E-02     |     .000  .0000E+00
01858>
01859>      ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
01860>      ---------------------       (ha)     (cms)     (hrs)       (mm)
01861>      INFLOW >04: (201   )         .12      .054     2.000      84.791
01862>      OUTFLOW<07: (201   )         .12      .006     1.733      84.791
01863>     OVERFLOW<08: (OVF   )         .00      .000      .000       .000
01864>
01865>                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
01866>                    CUMULATIVE TIME OF OVERFLOWS  (hours)=       .00
01867>                    PERCENTAGE OF TIME OVERFLOWING    (%)=       .00
01868>
01869>
01870>                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=    11.098
01871>                    TIME SHIFT OF PEAK FLOW         (min)=    -16.00
01872>                    MAXIMUM  STORAGE   USED       (ha.m.)=.4607E-02
01873>
01874> ------------------------------------------------------------------------------
01875> 100:0010--------------------------------------------------------------------
01876> ------------------------
01877> | ADD HYD (Total     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
01878> ------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
01879>                        ID1 06:203          .02      .008    2.00  78.55    .000
01880>                       +ID2 07:201          .12      .006    1.73  84.79    .000
01881>                       +ID3 08:OVF          .00      .000     .00    .00    .000
01882>                        ========================================================
01883>                        SUM 09:Total         .14      .014    2.00  83.90    .000
01884>
01885>    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
01886>
01887> ------------------------------------------------------------------------------
01888> 100:0011--------------------------------------------------------------------
01889> * RUN REMAINING DESIGN STORMS (City of Burlington 5 TO 100-YR)
01890> *
```

```
01891> -------------------------------------------------------------------------------
01892> 100:0002-----------------------------------------------------------------------
01893> *
01894> -------------------------------------------------------------------------------
01895> 100:0002-----------------------------------------------------------------------
01896> *
01897> -------------------------------------------------------------------------------
01898> 100:0002-----------------------------------------------------------------------
01899> *
01900> -------------------------------------------------------------------------------
01901> 100:0002-----------------------------------------------------------------------
01902> *
01903> -------------------------------------------------------------------------------
01904> 100:0002-----------------------------------------------------------------------
01905> *
01906>       FINISH
01907> -------------------------------------------------------------------------------
01908> *******************************************************************************
01909>      WARNINGS / ERRORS / NOTES
01910>      -------------------------
01911>    Simulation ended on 2024-12-10     at 16:00:22
01912> ===============================================================================
01913>
01914>
```

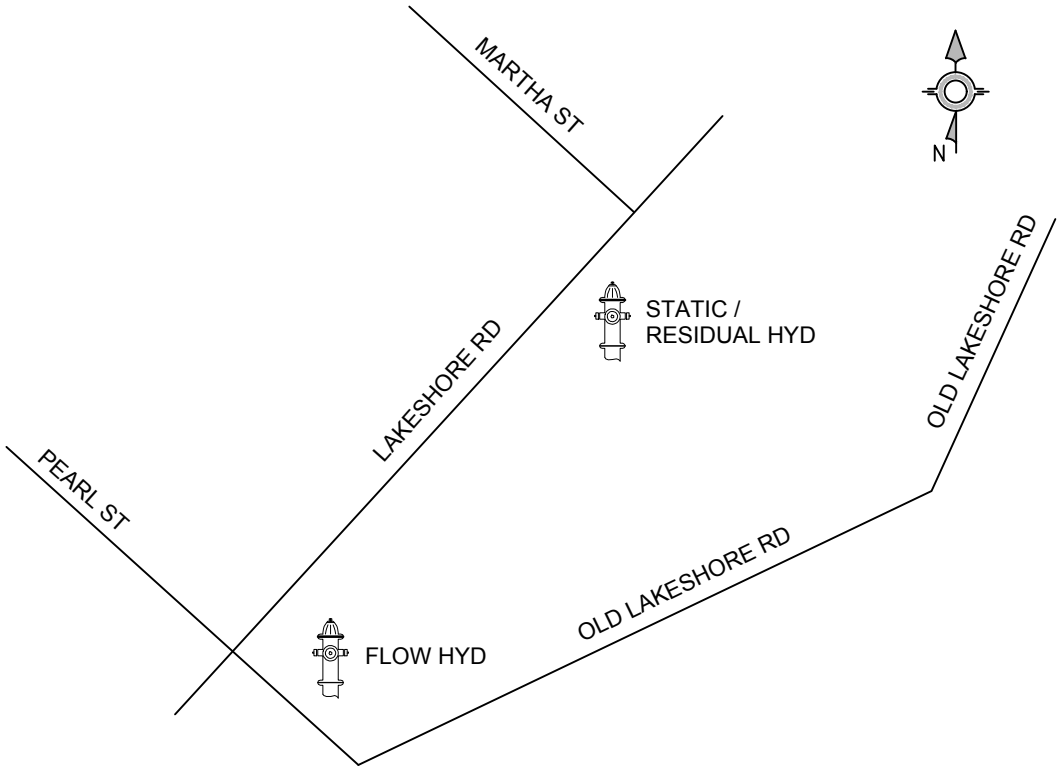
APPENDIX B
FIRE FLOW CALCULATIONS

FLOW TEST RESULTS

DATE : NOVEMBER 30, 2023 TIME : 11:00 AM

LOCATION : 2072 LAKESHORE ROAD
BURLINGTON, ONTARIO

TEST BY : VIPOND & P.U.C.



STATIC PRESSURE : 73

TEST NO.	NO. OF NOZZLES	NOZZLE DIAMETER (INCHES)	RESIDUAL PRESSURE (PSI)	PITOT PRESSURE (PSI)	DISCHARGE (U.S.GPM)
1	1	2-1/2"	71	58	1280
2	2	2-1/2", 2-1/2"	69	40,40	2130

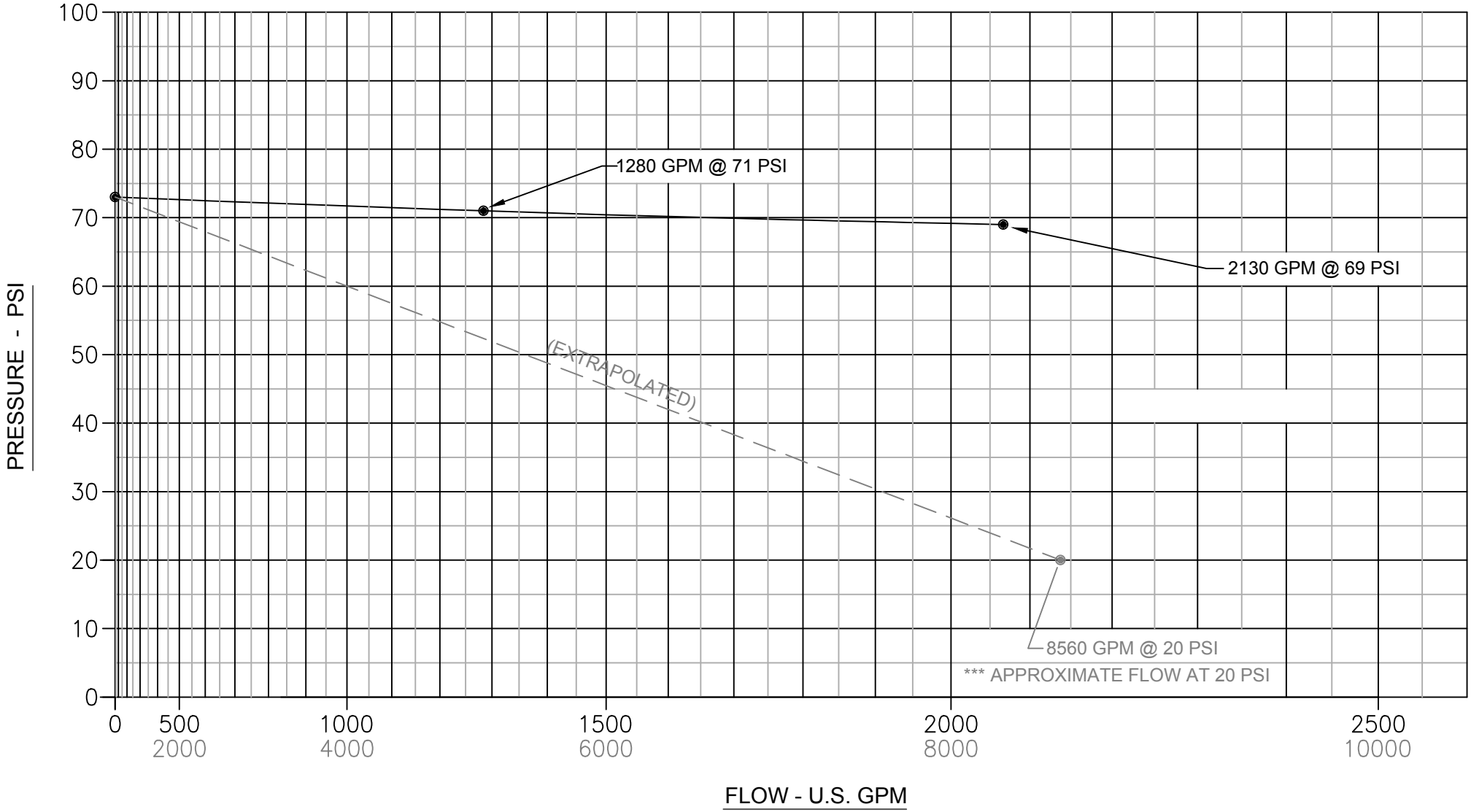
FIRST FOR FIRE PROTECTION
VIPOND INC
est. 1945

2072 LAKESHORE ROAD	PREPARED BY :	JOHN LUCES
BURLINGTON, ONTARIO	OFFICE :	STONEY CREEK
	TEST BY :	VIPOND & P.U.C.
	DATE :	NOVEMBER 30, 2023 11:00 AM

STATIC : 73 PSI

71 PSI @ 1280 GPM

69 PSI @ 2130 GPM



FIRE FLOW DEMAND REQUIREMENTS - FIRE UNDERWRITERS SURVEY (FUS GUIDELINES)

Project Number: 23028
Project Name: 2072 Lakeshore Road, Burlington
Date: Dec-24

Fire flow demands for the FUS method is based on information and guidance provided in "Water Supply for Public Protection" (Fire Underwriters Survey, 2020).

An estimate of the fire flow required is given by the following formula:

$$F = 220\,C\sqrt{A} \qquad (1)$$

where:

F= the required fire flow in litres per minute
C= coefficient related to the type of construction
= 1.5 Type V for wood frame construction .
= 0.8 Type IV-A Mass Timber Construction
= 0.9 Type IV-B Mass Timber Construction
= 1.0 Type IV-C Mass Timber Construction
= 1.5 Type IV-D Mass Timber Construction
= 1.0 Type III Ordinary Construction
= 0.8 Type II Non Combustible Construction
= 0.6 Type I Fire Resistive Construction

A= Total effective floor area in square metres

				(1)		(2)			(3)		(4)		Final Adjusted Fire Flow	
Building / Location	# of Storeys	Total GFA (m^2)	Type of Construction	*Fire Flow "F"* (l/min)	(l/s)	*Occupancy* %	Adjustment (l/min)	Adjusted Fire Flow (l/min)	*Sprinkler* %	Adjustment (l/min)	*Exposure* %	Adjustment (l/min)	(l/min)	(l/s)
19-Storey Mixed Use Building	**19**	**4055**	**0.8**	11000	183.3	**-15**	-1650.0	**9350.0**	**-50**	-4675.0	55	5142.5	**10000**	**167**

Total Effective Floor Area Calculation:

Two largest ajoining floors plus 50% of any floors immediately above them up to eight floors

Floor	Area	Tot. Area	Cumm. Area
1	762	762	762
2	659	659	1421
3-10	659	2634	4055
			4055

(2) Occupancy

Non-Combustible	-25%
Limited Combustible	-15%
Combustible	No Charge
Free Burning	15%
Rapid Burning	25%

(3) Sprinkler

Minimum credit for systems designed to NFPA 13 is 30%.

If the domestic and fire services are supplied by the same municipal water system, then take an additional 10%.

If the sprinkler system is fully supervised (ie. annunciator panel that alerts the Fire Dept., such as a school), then an additional 10% can be taken. Maximum credit = 50%.

(4) Exposure

0 to 3m	25%	
3.1 to 10m	20%	Calculate for all
10.1 to 20m	15%	sides. Maximum
20.1 to 30m	10%	charge shall not
Greater than 30	0%	exceed 75%

Prop. Building

Side	Exposure (m)	Charge (%)
North =	**20.1 to 30m**	**10**
East =	**20.1 to 30m**	**10**
South =	**0 to 3m**	**25**
West =	**20.1 to 30m**	**10**
Total Expoure =		***55***

APPENDIX C
ENGINEERING PLANS

DWG No.: 23028 –C101

S:\23028\WORKING\CURRENT\23028–GRADING AND SERVICING.dwg

GENERAL NOTES:

1. CONSTRUCTION OF SEWERS, AND RELATED APPURTENANCES SHALL BE UNDERTAKEN IN ACCORDANCE WITH THE CURRENT STANDARD DRAWINGS OF THE CITY OF BURLINGTON, THE REGIONAL MUNICIPALITY OF HALTON AND THE ONTARIO PROVINCIAL STANDARD DRAWINGS (OPSD). THE CITY AND THE REGION'S DRAWINGS SHALL TAKE PRECEDENCE OVER THE OPSD DRAWINGS.
2. ONTARIO PROVINCIAL STANDARD DRAWINGS TO BE READ IN CONJUNCTION WITH THE REGION OF HALTON REVISIONS.
3. RELOCATION OF EXISTING SERVICES AND/OR UTILITIES SHALL BE CONSTRUCTED AS SHOWN ON THE DRAWINGS OR AS DIRECTED BY THE ENGINEER.
4. THE CONTRACTOR SHALL OBTAIN ALL PERMITS FOR CONSTRUCTION.
5. NO SUBSTITUTIONS WILL BE ALLOWED WITHOUT WRITTEN APPROVAL FROM THE REGIONAL ENGINEER, CITY OF BURLINGTON OR THE ENGINEER.
6. ALL EXCAVATIONS TO BE BACKFILLED WITH SELECT NATIVE MATERIAL, APPROVED BY THE ENGINEER, TO 95% SPD.
7. THE CONTRACTOR IS RESPONSIBLE FOR INSTALLING AND MAINTAINING SILT CONTROL DEVICES AS SHOWN ON THE DRAWINGS AND AS DIRECTED BT THE ENGINEER.
8. TREE PROTECTION PROCEDURES TO BE IMPLEMENTED IN ACCORDANCE WITH CITY OF BURLINGTON STANDARDS.
9. THESE PLANS ARE NOT TO BE USED FOR CONSTRUCTION UNTIL SEALED BY THE ENGINEER AND INDICATED ISSUED FOR CONSTRUCTION ON THE DRAWING.
10. THIS/THESE PLAN(S) IS/ARE NOT TO BE REPRODUCED IN WHOLE OR IN PART WITHOUT THE WRITTEN PERMISSION OF S. LLEWELLYN AND ASSOCIATES LIMITED.
11. INFORMATION REGARDING ANY EXISTING SERVICES AND/OR UTILITIES SHOWN ON THE APPROVED SET OF CONSTRUCTION DRAWINGS ARE FURNISHED AS THE BEST AVAILABLE INFORMATION. THE CONTRACTOR SHALL INTERPRET THIS INFORMATION AS HE SEES FIT WITH THE UNDERSTANDING THAT THE OWNER AND HIS AGENTS DISCLAIM ALL RESPONSIBILITY FOR ITS ACCURACY AND /OR SUFFICIENCY. THE CONTRACTOR SHALL ASSUME LIABILITY FOR ANY DAMAGE TO EXISTING WORKS.
12. SITE PLAN INFORMATION TAKEN FROM PLANS PREPARED BY GRAZIANI + CORAZZA ARCHITECTS.
13. THIS/THESE PLAN(S) TO BE READ IN CONJUNCTION WITH THE FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT PREPARED BY S. LLEWELLYN AND ASSOCIATES LIMITED DATED JUNE, 2024.
14. THIS PLAN TO BE USED FOR SERVICING AND GRADING ONLY, FOR BUILDING LOCATION REFER TO TO THE SITE PLAN.
15. MUNICIPAL APPROVAL OF THESE DRAWINGS IS FOR MATERIAL AND COMPLIANCE WITH CITY OF BURLINGTON AND PROVINCIAL SPECIFICATIONS AND STANDARDS ONLY. APPROVAL AND INSPECTION OF THE WORKS BY THE CITY OF BURLINGTON STAFF DOES NOT CERTIFIY THE LINE AND GRADE OF THE WORKS NOR RELIEVE THE CONTRACTOR OF CERTIFICATION OF ALL WORKS BY THE OWNER'S ENGINEER.
16. ALTERNATE MATERIALS MAY BE ACCEPTABLE PROVIDED WRITTEN APPROVAL HAS FIRST BEEN OBTAINED FROM THE CITY OF BURLINGTON AND THE THE ENGINEER.
17. THE APPROVAL OF THIS PLAN DOES NOT EXEMPT THE OWNER'S BONDED CONTRACTOR FROM THE REQUIREMENTS TO OBTAIN THE VARIOUS PERMITS/APPROVALS NORMALLY REQUIRED TO COMPLETE A CONSTRUCTION PROJECT, SUCH AS, BUT NOT LIMITED TO THE FOLLOWING:
    - ROAD CUT PERMITS
    - SEWER PERMITS
    - APPROACH APPROVAL PERMITS
    - RELOCATION OF SERVICES
    - COMMITTEE OF ADJUSTMENT
    - ENCROACHMENT AGREEMENTS
18. PRIOR TO CONSTRUCTION THE CONTRACTOR MUST:
    i. CHECK AND VERIFY ALL DIMENSIONS AND EXISTING ELEVATIONS WHICH INCLUDE BUT ARE NOT LIMITED TO THE BENCHMARK ELEVATIONS, EXISTING SERVICE CONNECTIONS, EXISTING INVERTS AND REPORT FINDING IN WRITING TO THE ENGINEER.
    ii. OBTAIN ALL UTILITY LOCATES AND REQUIRED PERMITS AND LICENSES.
    iii. VERIFY ALL FINISHED FLOOR ELEVATIONS AND BASEMENT FLOOR ELEVATIONS WHICH MY APPEAR ON THESE PLANS COMPLY WITH THE FINAL ARCHITECTURAL DRAWINGS.
    iv. CONFIRM ALL DRAWINGS USED FOR CONSTRUCTION ARE OF THE MOST RECENT REVISION.
    v. NOTIFY THE ENGINEER OF THE PROPOSED CONSTRUCTION SCHEDULE FOR COORDINATION OF NECESSARY INSPECTIONS.
19. **THE CONTRACTOR IS RESPONSIBLE FOR CONTACTING THE ENGINEER 48 HOURS PRIOR TO THE COMMENCING SITE WORKS TO ARRANGE FOR INSPECTION. THE ENGINEER SHALL DETERMINE THE EXTENT OF INSPECTION AND TESTING REQUIRED FOR CERTIFICATION OF THE UNDERGROUND SERVICE INSTALLATION AS MANDATED BY THE ONTARIO BUILDING CODE DIVISION C, PART 1, SECTION 1.2.2, GENERAL REVIEW. FAILURE TO MAKE SUITABLE ARRANGEMENTS FOR INSPECTION WILL LEAD TO POST CONSTRUCTION TESTING AND INSPECTION AS DETERMINED BY THE ENGINEER, THE COSTS OF WHICH INCLUDING ANY DELAYS IN CONSTRUCTION SHALL BE BOURNE BY THE CONTRACTOR. FULL PAYMENT FOR UN-INSPECTED WORKS MAY BE WITHHELD UNTIL THE COMPLETION OF THE POST CONSTRUCTION INSPECTION AND TESTING TO THE SATISFACTION OF THE ENGINEER.**
20. INSPECTION BY THE OWNER'S ENGINEER IS FOR CERTIFICATION AND GENERAL CONFORMANCE PURPOSES AND DOES NOT CERTIFY LINE AND GRADE OR IMPLY AN ASSURANCE OF QUALITY CONTROL. THE CONTRACTOR SHALL BE RESPONSIBLE TO ENSURE THE INSTALLATION OF THE WORKS TO PROPER LINE, GRADE AND QUALITY TO CURRENT INDUSTRY STANDARDS.
21. ANY UTILITY RELOCATIONS AND RESTORATIONS DUE TO THE DEVELOPMENT TO BE UNDERTAKEN AT THE EXPENSE OF THE OWNER/DEVELOPER AND SHALL BE COORDINATED BY THE CONTRACTOR.
22. ALL RESTORATIONS AND RECONSTRUCTIONS SHALL BE COMPLETED TO MATCH EXISTING CONDITIONS OR BETTER AND ARE TO BE PERFORMED TO THE SATISFACTION OF THE ENGINEER AND THE CITY OF BURLINGTON.
23. SERVICING CONTRACTOR TO MAINTAIN A "CONFINED TRENCH CONDITION" IN ALL SEWER AND WATERMAIN INSTALLATION TRENCHES.
24. THE SITE SERVICING CONTRACTOR SHALL TERMINATE ALL SERVICES 1.0m FROM THE BUILDING FACE.
25. NO BLASTING WILL BE PERMITTED.

ROADWORKS:

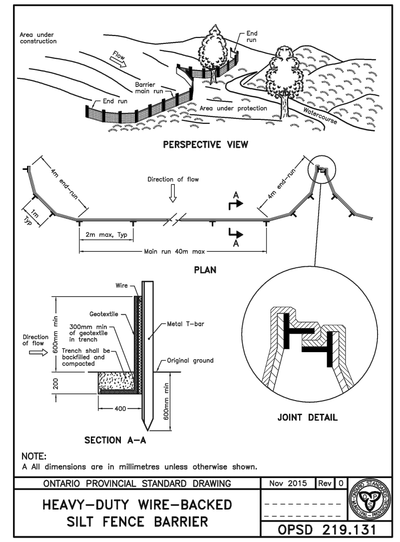
1. APPROVED FILL, FREE OF DELETERIOUS AND ORGANIC MATERIAL AND BOULDERS SHALL BE COMPACTED TO A DRY DENSITY NOT LESS THAN 95% THAN THE STANDARD PROCTOR DENSITY. AFTER COMPACTION, SOIL DENSITY TESTS SHALL BE CONDUCTED TO ENSURE ADEQUATE COMPACTION AND STABILITY OF THE FILL AND TEST RESULTS SHALL BE SUBMITTED TO THE ENGINEER.
2. SUBGRADE TO BE PROOF ROLLED PRIOR TO PLACEMENT OF SUB BASE. UNSUITABLE MATERIAL TO BE REMOVED AND REPLACED WITH SELECT FILL OR GRANULAR "B" AND COMPACTED TO 98% SPD.
3. ASPHALTIC CONCRETE TO BE COMPACTED TO 97% MARSHALL DENSITY.
4. BOULEVARDS TO BE SODDED WITH #1 NURSERY SOD ON A MINIMUM 150mm OF SELECT TOPSOIL.
5. MANHOLE FRAMES AND COVERS AND WATER VALVE BOXES SHALL BE SET FLUSH WITH BASE COURSE ASPHALT AND ADJUSTED TO FINAL GRADE AFTER INSTALLATION OF SURFACE ASPHALT AS PER CITY OF BURLINGTON STANDARD DRAWINGS S-130.
6. TRAFFIC CONTROL SHALL BE MAINTAINED AT ALL TIMES FOR WORKS ON EXISTING ROADWAYS TO THE SATISFACTION OF THE DIRECTOR OF ENGINEERING. THE EXPENSE FOR THE ERECTION OF SIGNS, DELINEATORS AND OTHER TRAFFIC CONTROL DEVICES SHALL BE BORNE BY THE CONTRACTOR.

GRADING NOTES

1. ALONG ADJOINING PROPERTIES GRADE TO MEET EXISTING OR PROPOSED ELEVATIONS WITH SODDED SLOPES (MIN. 3H TO 1V) AND/OR RETAINING WALLS AS SPECIFIED.
2. ALL RETAINING WALLS, WALKWAYS, CURBS, ETC., SHALL BE PLACED A MIN. OF 0.3m OFF THE PROPERTY LINE. ALL WALLS 1.0m OR HIGHER SHALL BE DESIGNED BY A P.ENG.
3. SHOULD A RETAINING WALL BE REQUIRED, THE TOP OF WALL ELEVATIONS SHALL BE SET 150mm ABOVE THE PROPOSED SIDE YARD SWALES.
4. RETAINING WALLS 0.6m IN HEIGHT OR GREATER REQUIRE CONSTRUCTION OF A FENCE OR GUARD RAIL AT THE TOP OF THE REAR OF THE WALL. GUARDS FOR RETAINING WALLS SHALL BE DESIGNED AND CONSTRUCTED IN ACCORDANCE WITH THE REQUIREMENTS OF EXTERIOR GUARDS AS CONTAINED IN THE ONTARIO BUILDING CODE.
5. TOP OF FOUNDATION WALLS FOR BUILDINGS SHALL BE 150mm (MIN) ABOVE FINISHED GRADE.
6. DRIVEWAY SLOPES SHALL NOT BE LESS THAN 2% AND NOT MORE THAN 7.0%. REVERSED SLOPED DRIVEWAYS IN NEW DEVELOPMENTS ARE NOT PERMITTED.
7. IF GRADING IS REQUIRED ON LANDS ADJACENT TO THE DEVELOPMENT WHICH ARE NOT OWNED BY THE DEVELOPER, THEN THE DEVELOPER MUST OBTAIN WRITTEN PERMISSION FROM THE ADJACENT PROPERTY OWNER TO ALLOW THE DEVELOPER TO GRADE ON THE ADJACENT LANDS, OTHERWISE RETAINING WALLS MUST BE USED.
8. THE WRITTEN PERMISSION REQUIRED FROM THE ADJACENT LANDOWNER SHALL BE OBTAINED PRIOR TO ENTERING THE LANDS. SHOULD PERMISSION NOT BE OBTAINED OR IS WITHDRAWN PRIOR TO COMMENCING THE WORK, THEN THE DEVELOPER SHALL LIMIT HIS ACTIVITIES TO THE LIMITS OF THE DEVELOPMENT SITE.
9. DRIVEWAY AND DRIVEWAY APPROACHES SHALL BE LOCATED SUCH THAT HYDRO VAULTS AND OTHER STREET FURNITURE ARE A MIN. OF 1.2m FROM THE DRIVEWAY ENTRANCE CURB RADII.
10. ANY CHANGES IN GRADES AND CATCH BASINS REQUIRE THE APPROVAL OF THE CITY'S MANAGER OF DEVELOPMENT ENGINEERING.

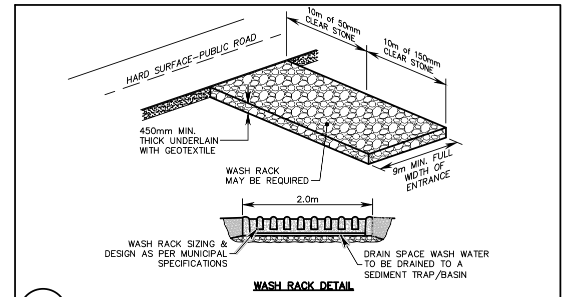
SILTATION AND EROSION CONTROL

1. SILTATION CONTROL BARRIERS SHALL BE PLACED AS DETAILED.
2. ALL SILTATION CONTROL MEASURES SHALL BE CLEANED AND MAINTAINED AFTER EACH RAINFALL AS DIRECTED AND TO THE SATISFACTION OF THE CITY OF BURLINGTON AND/OR THE HALTON CONSERVATION AUTHORITY.
3. ADDITIONAL SILT CONTROL LOCATIONS MAY BE REQUIRED AS DETERMINED BY THE ENGINEER, THE CITY OF BURLINGTON AND/OR THE HALTON CONSERVATION AUTHORITY.



NOTES TO CONTRACTOR:

1. INSPECTION
   CONTRACTOR IS RESPONSIBLE FOR CONTACTING ENGINEER 48 HRS PRIOR TO COMMENCING WORK TO ARRANGE FOR INSPECTION. ENGINEER TO DETERMINE DEGREE OF INSPECTION AND TESTING REQUIRED FOR CERTIFICATION OF UNDERGROUND SERVICE INSTALLATION AS MANDATED BY ONTARIO BUILDING CODE DIVISION C, PART 1, SECTION 1.2.2, GENERAL REVIEW. FAILURE TO NOTIFY ENGINEER WILL RESULT IN EXTENSIVE POST CONSTRUCTION INSPECTION AT CONTRACTORS EXPENSE.
2. CONFIRMATION OF EXISTING INVERTS
   72 HOURS PRIOR TO THE START OF CONSTRUCTION, THE CONTRACTOR IS TO LOCATE, EXPOSE AND VERIFY INVERTS OF EXISTING SEWERS AT CONNECTION POINTS. SHOULD THE CONTRACTOR PROCEED WITHOUT COMPLETING THESE LOCATES, EXTRA COSTS RESULTING FROM DELAYS AND STANDBY TIME WILL NOT BE CONSIDERED.



DETAIL 2 MUD MAT CONSTRUCTION ENTRANCE
SCALE: N.T.S.

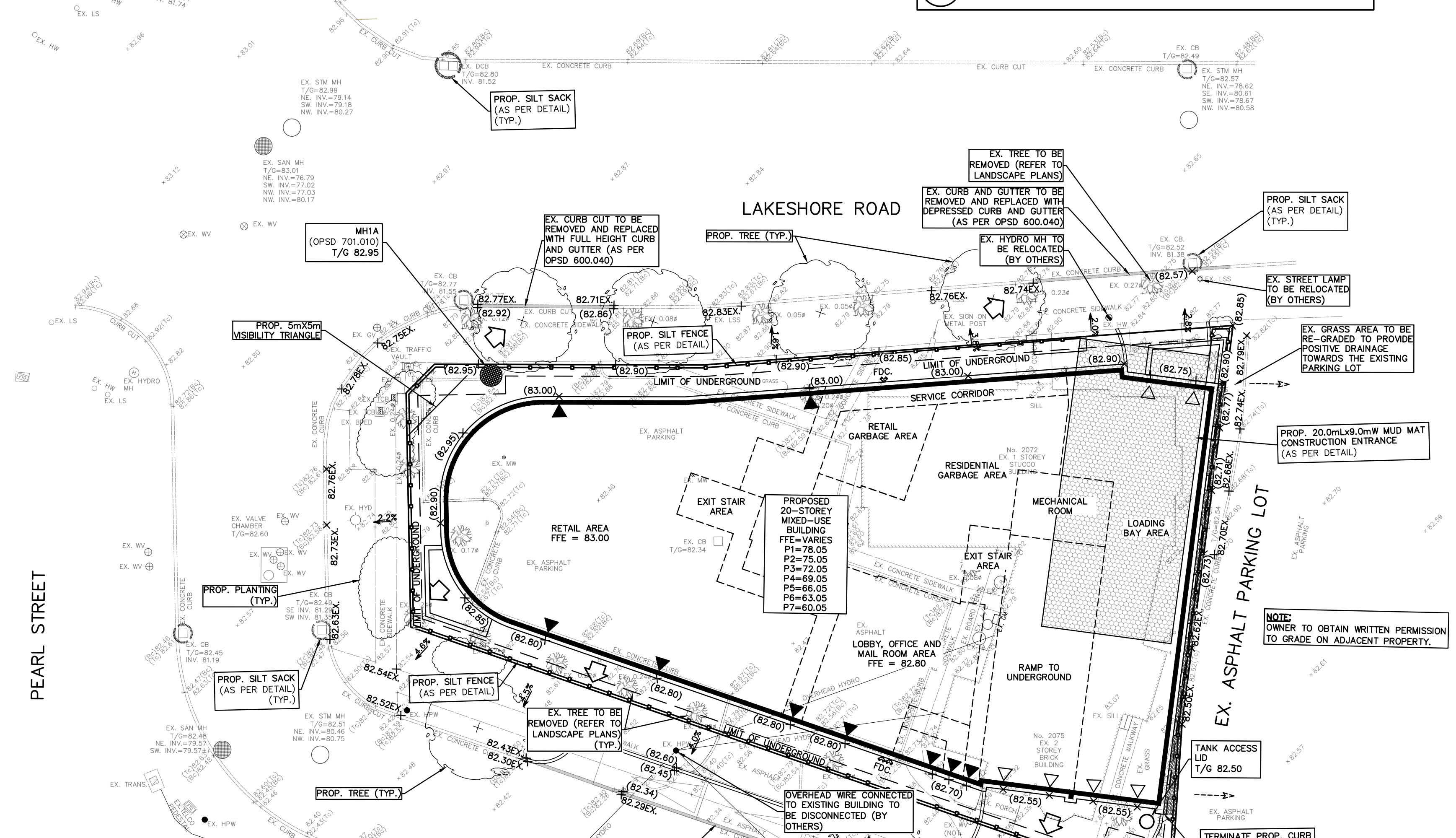


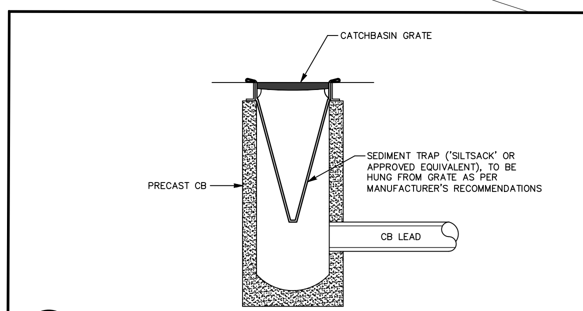
KEY MAP
N.T.S.

LEGEND:

209.00	EXISTING GROUND ELEVATION
(100.00)	PROPOSED GROUND ELEVATION
(100.00)EX	PROPOSED ELEVATION TO MATCH EXISTING
2.0%	PROPOSED DIRECTION OF SHEET FLOW
	EXISTING DIRECTION OF SHEET FLOW
	EXISTING CATCHBASIN
	EXISTING STORM/SANITARY MANHOLE
	PROPOSED CATCHBASIN
	PROPOSED STORM/SANITARY MANHOLE
	PROPOSED SILTATION CONTROL FENCE
	PROPOSED CATCHBASIN SILT SACK
	OVERLAND FLOW

BENCH MARK NOTE:
ELEVATIONS SHOWN HEREON ARE GEODETIC AND ARE RELATED TO CITY OF BURLINGTON BENCHMARK No. 0011991U001 HAVING AN ELEVATION OF 78.331 METRES. (VERTICAL DATUM: CGVD28: 78)





DETAIL 1 CATCH BASIN SEDIMENT TRAP
SCALE: N.T.S.

NO.	DATE	BY	REVISIONS

NOTES TO CONTRACTOR:

1. CONTRACTORS AND SUBCONTRACTORS SHALL NOT SCALE FROM THIS DRAWING.
2. ANY INCONSISTENCIES AND OMISSIONS FOUND ON THE DRAWINGS MUST BE REPORTED TO THE ENGINEER FOR CLARIFICATION BEFORE COMMENCING THE WORK.
3. PRIOR TO THE START OF CONSTRUCTION, THE CONTRACTOR MUST CHECK AND VERIFY ALL DIMENSIONS AND ELEVATIONS AND REPORT ALL FINDINGS TO THE ENGINEER. ONCE CONSTRUCTION HAS COMMENCED, THE CONTRACTOR ACCEPTS RESPONSIBILITY FOR ALL DIMENSIONS, ELEVATIONS, AND SITE CONDITIONS.
4. THE POSITIONS OF POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVER-GROUND UTILITIES AND STRUCTURES ARE NOT NECESSARILY SHOWN ON THE DRAWINGS. WHERE SHOWN ON THE DRAWING, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, THE CONTRACTOR SHALL INFORM THEMSELVES OF THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.
5. ALL DRAWINGS REMAIN THE PROPERTY OF THE ENGINEER AND SHALL NOT BE REPRODUCED, REUSED, OR REVISED WITHOUT THE WRITTEN CONSENT OF S. LLEWELLYN AND ASSOCIATES LIMITED.

DESIGN	0.0	CHK'D	SN	DATE
DRAWN	0.0	CHK'D	SN	DEC. 10, 2024

SCALE 1:200 (0, 5, 10, 20)

APPROVALS

NOT FOR CONSTRUCTION

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S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS
Tel. (905) 631-6978
Website: www.sla.on.ca
email: info@sla.on.ca
3228 South Service Road, Suite #105 East Wing, Burlington, Ont., L7N 3H8

CLIENT
ACAMAR DWELLING CORP.
8700 DUFFERIN STREET
VAUGHAN, ON L4K 4S6

PROJECT NAME
2072 LAKESHORE ROAD
BURLINGTON, ONTARIO

TITLE
PRELIMINARY SITE GRADING AND EROSION CONTROL PLAN

PROJECT No.	DRAWING No.
23028	C101

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Plotted: December 19, 2024 10:36:02 AM By: Olawale Oladeselu

DWG No.: 23028 –C102

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SANITARY SEWERS:

1. SANITARY SEWERS SHALL BE PVC. PVC PIPE IS TO BE BELL AND SPIGOT AND COMPLY TO ASTM D-3034 WITH MINIMUM SDR 35.
2. MINIMUM BEDDING REQUIREMENTS FOR ALL SANITARY SEWER MAINS AND RELATED CONNECTIONS IN A SINGLE TRENCH SHALL BE CLASS B GRANULAR BEDDING AS PER OPSD 802.010 UNLESS OTHERWISE NOTED.
3. SANITARY SEWER MANHOLES FRAME AND COVER AS PER OPSD 401.010.
4. TAPPING AT EXISTING SANITARY SEWERS SHALL BE UNDERTAKEN IN ACCORDANCE WITH REGION OF HALTON REQUIREMENTS.
5. ALL SEWERS TO BE VIDEO INSPECTED.
6. ALL SEWERS TO BE FLUSHED PRIOR TO VIDEO INSPECTION.
7. ALL PVC SEWERS ARE TO BE TESTED FOR DEFLECTION (MANDREL PASSAGE) AFTER INSTALLATION. SANITARY SEWERS SHALL ALSO BE TESTED FOR LEAKAGE (LOW AIR PRESSURE). PRIOR TO ASSUMPTION BY THE CITY, PIPE DEFLECTION TESTING SHALL BE REPEATED.

STORM SEWERS:

1. 300mm–450mm STORM SEWERS SHALL BE PVC, BELL AND SPIGOT AND SHALL COMPLY TO ASTM D-3034 WITH MINIMUM SDR 35.
2. MINIMUM BEDDING REQUIREMENTS FOR ALL SINGLE STORM SEWER MAINS AND ALL RELATED CONNECTIONS SHALL BE HIGH PERFORMANCE CLEAR STONE (HL-8 GRADED) AS PER CITY OF BURLINGTON STANDARD DRAWINGS S-188.
3. STORM SEWER MANHOLES SHALL BE IN ACCORDANCE WITH OPSD 701.010. AND 703.010. FRAME AND COVER AS PER OPSD 401.01 TYPE A. FRAMES TO BE STAMPED "DANGER" AND "STORM".
4. CATCHBASINS SHALL BE IN ACCORDANCE WITH OPSD 705.010. CATCHBASIN MANHOLES SHALL BE IN ACCORDANCE WITH OPSD 701.010 AND 701.030 UNLESS OTHERWISE SPECIFIED. CATCHBASINS TO LOCATED WITHIN LANDSCAPED AREAS TO BE SUMPLESS. FRAME AND COVER FOR CATCHBASINS AND CATCHBASIN MANHOLES SHALL BE AS PER OPSD 400.100 (ROADS) AND PER CITY OF BURLINGTON STANDARD DRAWING S-176 (REAR YARDS).
5. CATCH BASIN AND MANHOLE TOPS SHALL BE INITIALLY SET TO BASE COURSE ASPHALT ELEVATION AND ADJUSTED TO GRADE PRIOR TO PLACEMENT OF TOP LIFT OF ASPHALT.
6. ALL TRENCH EXCAVATIONS ARE TO BE BACKFILLED WITH SELECT NATIVE MATERIAL PLACED IN MAXIMUM 200mm LIFT THICKNESSES WITHIN 3% OF THE OPTIMUM MOISTURE CONTENT AND COMPACTED TO A MINIMUM OF 95% SPD, UNLESS OTHERWISE SPECIFIED.
7. ALL SEWERS TO BE VIDEO INSPECTED.
8. ALL SEWERS TO BE FLUSHED PRIOR TO VIDEO INSPECTION.
9. ALL PVC SEWERS (SANITARY AND STORM) ARE TO BE TESTED FOR DEFLECTION (MANDREL PASSAGE) AFTER INSTALLATION. PRIOR TO ASSUMPTION BY THE CITY, PIPE DEFLECTION TESTING SHALL BE REPEATED.

RESTORATIONS:

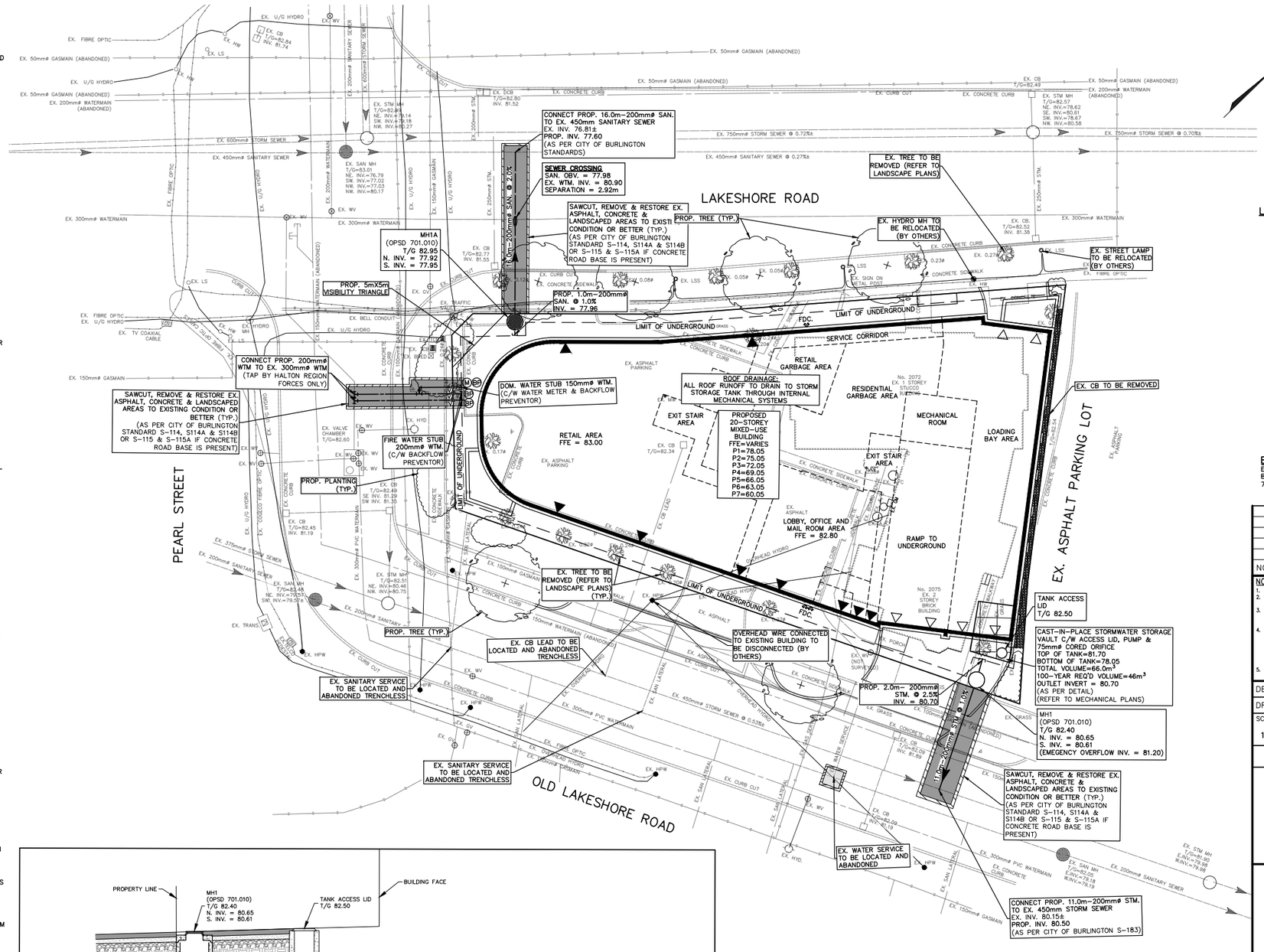
1. ALL TRENCH EXCAVATIONS WITHIN EXISTING ROAD ALLOWANCES SHALL BE AS BACKFILLED AS PER CITY OF BURLINGTON STANDARD DRAWING S-114 AND S-114A, OR S-115 AND S-115A WHERE CONCRETE ROAD BASE IS PRESENT.
2. EXISTING PRIVATE FENCING IS TO BE MAINTAINED THROUGHOUT CONSTRUCTION. WHERE REMOVAL OR RELOCATION OF FENCING IS NECESSARY IT SHALL BE RESTORED OR REPLACED TO ORIGINAL CONDITIONS OR BETTER UNDER THE DIRECTION OF THE ENGINEER.
3. DAMAGED CURB, GUTTER AND SIDEWALK TO BE REPLACED WITH 28 MPa CONCRETE TO EXISTING CONDITIONS OR BETTER.

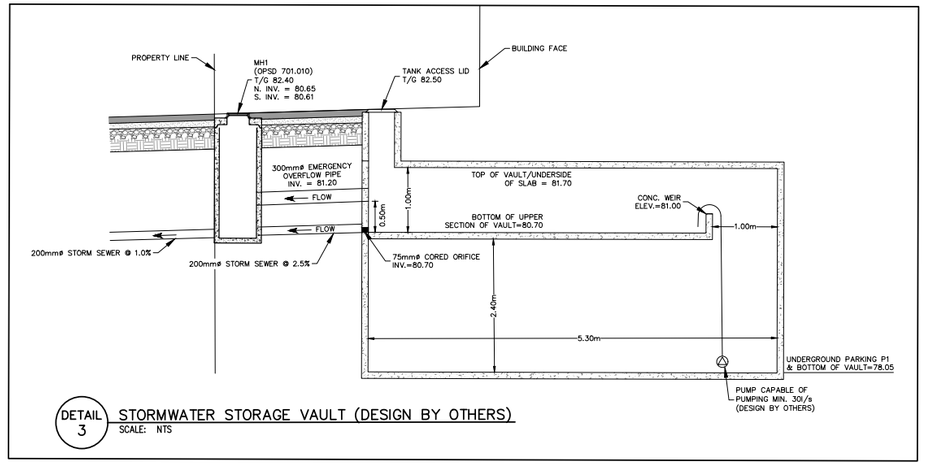
WATERMAINS:

1. FLEXIBLE WATERMAIN PIPE UP TO 300mm DIAMETER TO BE P.V.C. DR-18 AND CONFORM TO A.W.W.A. C-900 WITH MECHANICAL JOINTS AS PER A.W.W.A. C-110, AND TO BE INSTALLED WITH A 10 GAUGE TRACER WIRE.
2. FLEXIBLE PIPE BEDDING TO BE OPSD 802.010 WITH COMPACTED GRANULAR B MATERIAL.
3. MINIMUM COVER TO BE 1.7m TO TOP OF PIPE.
4. DEFLECTION AT JOINTS NOT TO EXCEED 2.5 DEGREES AND SHALL BE EQUAL AT ALL JOINTS.
5. GATE VALVES AND BOXES FOR 150mm DIAMETER WATERMAINS AS PER A.W.W.A. STANDARD C-500 AND ARE TO OPEN TO THE LEFT (COUNTER CLOCKWISE).
6. HYDRANTS SHALL MEET THE REQUIREMENTS OF A.W.W.A. STANDARD C-502 AND SHALL BE SET IN ACCORDANCE WITH REGION OF HALTON, AND CITY OF BURLINGTON BUILDING DEPARTMENT STANDARDS, COMPLETE WITH STEAMER CONNECTIONS. THE 100mm STEAMER PORT SHALL FACE THE FIRE ROUTE AND SHALL BE UNOBSTRUCTED BY ANY PROPOSED LANDSCAPING.
7. ALL FITTINGS TO HAVE MECHANICAL RESTRAINTS THAT MEET UNI-B-13-92.
8. ALL TEMPORARY AND PERMANENT WATERMAIN PLUGS ARE TO BE CONSTRUCTED IN ACCORDANCE WITH OPSD 1103.01.
9. TAPPING AT EXISTING WATERMAINS SHALL BE UNDERTAKEN IN ACCORDANCE WITH REGION OF HALTON REQUIREMENTS.
10. ALL WATER CUSTOMERS SUPPLIED BY A WATERMAIN TO BE SHUT DOWN SHALL BE NOTIFIED BY THE CONTRACTOR AT LEAST 48 HOURS IN ADVANCE OF THE SHUT DOWN AS PER REGION OF HALTON SPECIFICATIONS. NOTIFICATION SHALL TAKE PLACE UNDER THE ENGINEER'S DIRECTION.
11. MINIMUM HORIZONTAL SEPERATION BETWEEN WATERMAINS (INCLUDING PRIVATE SERVICES) AND STORM AND SANITARY SEWERS SHALL BE 2.5m. WATERMAINS MUST HAVE A MINIMUM VERTICAL CLEARANCE OF 500mm BETWEEN ALL OTHER UTILITIES WHEN CROSSING.

SEWER/WATER ABANDONMENT

1. ALL EXISTING UNUSED SEWERS MUST BE PROPERLY ABANDONED BY DISCONNECTING SEWER AT THE MAIN AND GROUTING EITHER END OF THE SEWER WITH A MINIMUM 300mm OF CONCRETE.
2. UNUSED MAINTENANCE HOLES AND CATCHBASINS MUST BE COMPLETELY REMOVED.
3. OPENINGS IN MAINTENANCE HOLES AND CATCHBASINS WHERE SERVICES WERE REMOVED OR ABANDONED MUST BE BRICKED AND PARGED.
4. ALL EXISTING UNUSED WATER SERVICES MUST BE PROPERLY ABANDONED AS FOLLOWS:
   - 4.1. FOR COPPER SERVICES: REMOVE CURB STOP, SHUT OFF MAIN STOP, CUT & CRIMP WATER SERVICE AT THE MAIN.
   - 4.2. FOR PVC SERVICES: REMOVE GATE VALVE, REMOVE TEE AND REPLACE WITH SLEEVE. IF A TAPPING VALVE WAS USED, CONTACT THE REGION OF HALTON FOR FURTHER DIRECTION.
5. ALL EXISTING WATER METERS ON SYSTEMS TO BE ABANDONED MUST BE REMOVED IN ACCORDANCE WITH THE CITY OF BURLINGTON STANDARDS. THE SERVICING CONTRACTOR SHOULD CONTACT THE CITY OF BURLINGTON AND REGION OF HALTON TO ARRANGE FOR THE WORK.





DETAIL 3 — STORMWATER STORAGE VAULT (DESIGN BY OTHERS)
SCALE: NTS



KEY MAP
N.T.S.

LEGEND:

- EXISTING CATCHBASIN
- EXISTING STORM/SANITARY MANHOLE
- PROPOSED CATCHBASIN
- PROPOSED STORM/SANITARY MANHOLE
- PROPOSED CURB STOP/GATE VALVE
- PROPOSED WATER METER
- PROPOSED BACKFLOW PREVENTOR

BENCH MARK NOTE:
ELEVATIONS SHOWN HEREON ARE GEODETIC AND ARE RELATED TO CITY OF BURLINGTON BENCHMARK No. 00119911U001 HAVING AN ELEVATION OF 78.331 METRES. (VERTICAL DATUM: CGVD28: 78)

NO.	DATE	BY	REVISIONS

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NOTES TO CONTRACTOR:

1. INSPECTION
   CONTRACTOR IS RESPONSIBLE FOR CONTACTING ENGINEER 48 HRS PRIOR TO COMMENCING WORK TO ARRANGE FOR INSPECTION. ENGINEER TO DETERMINE DEGREE OF INSPECTION AND TESTING REQUIRED FOR CERTIFICATION OF UNDERGROUND SERVICE INSTALLATION AS MANDATED BY ONTARIO BUILDING CODE DIVISION C, PART 1, SECTION 1.2.2, GENERAL REVIEW. FAILURE TO NOTIFY ENGINEER WILL RESULT IN EXTENSIVE POST CONSTRUCTION INSPECTION AT CONTRACTORS EXPENSE.
2. CONFIRMATION OF EXISTING INVERTS
   72 HOURS PRIOR TO THE START OF CONSTRUCTION, THE CONTRACTOR IS TO LOCATE, EXPOSE AND VERIFY INVERTS OF EXISTING SEWERS AT CONNECTION POINTS. SHOULD THE CONTRACTOR PROCEED WITHOUT COMPLETING THESE LOCATES, EXTRA COSTS RESULTING FROM DELAYS AND STANDBY TIME WILL NOT BE CONSIDERED.

DESIGN	0.0	CHK'D	SN
DRAWN	0.0	CHK'D	SN

DATE: DEC. 10, 2024

SCALE 1:200 (0, 5, 10, 20)

APPROVALS

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S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS
Tel. (905) 631-6978
Website:www.sla.on.ca
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CLIENT
ACAMAR DWELLING CORP.
8700 DUFFERIN STREET
VAUGHAN, ON L4K 4S6

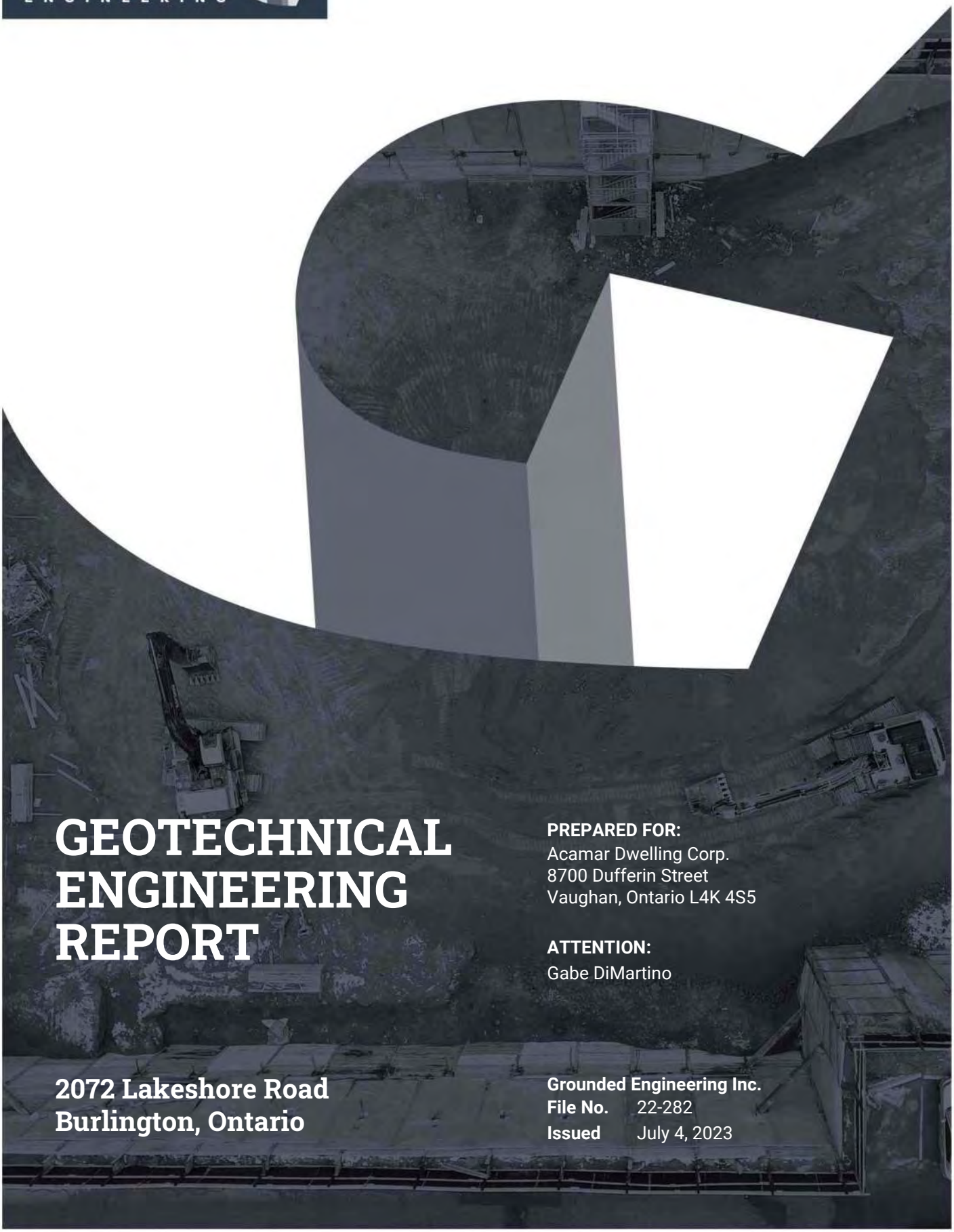
PROJECT NAME
2072 LAKESHORE ROAD
BURLINGTON, ONTARIO

TITLE
PRELIMINARY SITE SERVICING PLAN

PROJECT No. 23028
DRAWING No. C102

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Plotted: December 19, 2024 10:36:08 AM By: Olawale Oladeselu

APPENDIX D
GEOTECHNICAL REPORT



GEOTECHNICAL ENGINEERING REPORT

PREPARED FOR:
Acamar Dwelling Corp.
8700 Dufferin Street
Vaughan, Ontario L4K 4S5

ATTENTION:
Gabe DiMartino

2072 Lakeshore Road
Burlington, Ontario

Grounded Engineering Inc.
File No. 22-282
Issued July 4, 2023

1 Banigan Drive, Toronto ON M4H 1G3 | (647) 264-7909 | groundedeng.ca | Grounded Engineering

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Appendix B – Geotechnical Laboratory Results
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1 Introduction

Acamar Dwelling Corp. has retained Grounded Engineering Inc. ("Grounded") to provide geotechnical engineering design advice for their proposed development at 2072 Lakeshore Road, in Burlington, Ontario.

The proposed project includes demolishing the existing structure and constructing a 25-storey residential tower extending from a low-rise podium, with seven underground parking levels (P7) set at an estimated depth of 22.5± m; therefore, the P7 finished floor elevation (FFE) is estimated to be at Elev. 60.0± m.

Grounded has been provided with the following reports and drawings to assist in our geotechnical scope of work:

- Plan of Survey, "Part of Lots 2, 3 and 4, Registered Plan 92, City of Burlington"; Project No. 19-002, dated February 15, 2019, prepared by Mackay Mackay and Peters Limited.
- Architectural Drawings, "Option 2 Set"; Project No. 2079.22, dated April 25, 2023, prepared by Graziani+Corazza Architects.
- Phase II Environmental Site Assessment, "2072 Lakeshore Road, Burlington"; Project No. 233698.001, dated March 5, 2019, prepared by Pinchin Ltd.

Grounded has been provided with factual borehole information for the subject site from Pinchin as listed above. Those borehole logs are provided in a report signed by Professional Geoscientists / Certified Engineering Technologists. As such, this borehole information (appended) is taken as factual for present purposes. Unless noted, borehole labels appended with "PIN-" refer to Pinchin's boreholes.

Grounded's subsurface investigation of the site to date includes seven (7) boreholes (Boreholes 101 to 107) which were advanced from March 6th to 16th, 2023.

Based on the borehole findings, geotechnical engineering advice for the proposed development is provided for foundations, seismic site classification, earth pressure design, slab on grade design and basement drainage. Construction considerations including excavation, groundwater control, and geostructural engineering design advice are also provided.

Grounded Engineering must conduct the on-site evaluation of founding subgrade as foundation and slab construction proceeds. This is a vital and essential part of the geotechnical engineering function and must not be grouped together with other "third-party inspection services". Grounded will not accept responsibility for foundation performance if Grounded is not retained to carry out all the foundation evaluations during construction.

2 Ground Conditions

The borehole results are detailed on the attached borehole logs. Our assessment of the relevant stratigraphic units is intended to highlight the strata as they relate to geotechnical engineering. The ground conditions reported here will vary between and beyond the borehole locations.

The stratigraphic boundary lines shown on the borehole logs are assessed from non-continuous samples supplemented by drilling observations. These stratigraphic boundary lines represent transitions between soil types and should be regarded as approximate and gradual. They are not exact points of stratigraphic change.

Elevations are measured relative to geodetic datum. The horizontal coordinates are provided relative to the Universal Transverse Mercator (UTM) geographic coordinate system.

The boreholes were surveyed for horizontal coordinates and geodetic elevations with the Sokkia GCX3 system, connected to the Global Navigation Satellite System and the Can-Net Virtual Reference Station Network.

2.1 Stratigraphy

The following stratigraphy summary is based on the borehole results and the geotechnical laboratory testing. Our findings are generally consistent with those reported by Pinchin.

A subsurface profile showing stratigraphy and engineering units is appended and includes the relevant borehole and well information from the other consultants.

A summary of the relevant stratigraphic units is provided as follows. The summary elevations are provided for general guidance only. Details are provided on the borehole logs and in the following subsections. The average existing grade is estimated to be at Elev. 82.5± m. In general, three (3) main stratigraphic units were encountered on site as follows:

1. Surficial pavements/fills and earth fill, overlying
2. A native clayey silt glacial till at about Elev. 80.5± m, overlying
3. Bedrock of the Queenston Formation at about Elev. 79.0± m.

The design groundwater table is hydraulically connected with the water level of Lake Ontario, at about Elev. 75± m.

2.1.1 Surficial Materials and Earth Fill

Surficial fill (pavements, aggregate, topsoil, etc.) thicknesses were observed in individual borehole locations through the top of the open borehole. Thicknesses may vary between and beyond each borehole location.

At existing grade, the surficial materials observed includes 150 mm of topsoil in Borehole 103 and pavements consisting of 40 to 65 mm of asphalt underlain by earth fill in the remaining boreholes (excluding Borehole 104, which observed earth fill at grade).

Underlying the surficial materials, the boreholes observed a layer of earth fill extending to depths of 0.8 to 3.0 m below grade (Elev. 79.6 to 81.5 m). The earth fill varies in composition from sand to gravelly sand, and silt, contains trace amounts of deleterious materials (incl. asphalt fragments, rootlets, topsoil inclusions) with faint to moderate petroleum hydrocarbon odours noted in Boreholes 102, 105 and 107. Borehole 101 experienced practical refusal on an inferred concrete obstruction at a depth of 3.0 m below grade (Elev. 79.6 m); the borehole was subsequently re-located and re-drilled to depth. The earth fill ranges in colour from brown to blackish brown/brownish black.

Due to the variation and inconsistent placement of the earth fill material, the relative density of the earth fill varies.

2.1.2 Glacial Till

Underlying the layer of earth fill, the boreholes observed a native undisturbed glacial till at depths of 0.8 to 3.0 m below grade (Elev. 79.6 to 81.5 m) extending to depths of 3.2 to 3.9 m below grade (Elev. 78.9 to 79.3 m). The glacial till generally consists of a clayey silt matrix (intermittently transitions to sandy silt to silt and sand matrices), contains a variable amount of sand (ranging from trace sand to sandy), trace to some gravel, trace shale fragments, with faint to moderate petroleum hydrocarbon odours noted in Boreholes 102, 105 and 106. The glacial till is reddish brown and moist. A surficial layer of sand was observed overlying the glacial till in Borehole 103 at a depth of 0.8 m below grade (Elev. 81.5 m) extending to a depth of 2.0 m below grade (Elev. 80.3 m), and the glacial till contains intermittent layers of gravelly sand and sandy silt.

The Standard Penetration Test (SPT) results (N-Values) measured in the glacial till ranges from 20 to 66 blows per 300 mm of penetration (bpf), suggesting a very stiff to hard consistency.

2.1.3 Bedrock

Underlying the glacial till, bedrock of the Queenston Formation was confirmed by rock cores recovered in the boreholes at depths of 3.2 to 3.9 m (Elev. 78.9 to 79.3 m) extending to the target depths of 8.0 to 27.9 m below grade (Elev. 54.4 to 74.5 m).

Detailed core logs are included with the corresponding borehole logs. Photographs of the recovered rock core and a guide of rock core terminology are appended. The rock core terminology sheet defines many of the descriptive terms used below.

The bedrock beneath the site is the Queenston Formation, which is a deposit predominantly comprising thin to medium bedded red to reddish brown calcareous shale and siltstone ("shale" by local convention) of Upper Ordovician age. The strength of the intact sound bedrock varies from weak to medium strong. The low-fissility shale contains grey-green mottling and banding

which is occasionally harder than the red shale, possibly indicating a higher carbonate content which is called “limestone” by local convention. However, the Queenston shale within the study area is generally calcareous and is interbedded with stronger calcareous sandstone and silty bioclastic carbonate. Minor amounts of gypsum, in nodules and laminae, are found throughout. These, along with occasional weathered clay seams and partings, indicate the presence of groundwater within the bedrock.

Joints occurring within the shale are closely to very closely spaced, and typically weathered with a veneer to coating of clay. Widely-spaced subvertical joints (closed, planar, clean) were also observed within the shale.

A summary of information with respect to the Queenston Formation was presented in the Ontario Ministry of Transportation and Communications document RR229, *Evaluation of Shales for Construction Projects* (March 1983), as follows.

Table 2.1 – Summary of MTO Queenston Formation Parameters

	Uniaxial Compressive Strength (MPa)	Young’s Modulus (GPa)	Dynamic Modulus (GPa)	Poisson’s Ratio
Average	8.7	1.3	n/a	0.32
Range	7.2 to 9.6	0.5 to 2.3	n/a	0.28 to 0.35

Rock core samples were submitted for testing of unconfined compressive strength (ASTM D7012) and elastic moduli in uniaxial compression (ASTM D7012). The detailed rock laboratory testing results are appended. The test results are summarized as follows:

Borehole ID	Core ID	Depth / Elev. (m)	Bulk Density (kg/m^3)	UCS (MPa)	Young’s Modulus, E (GPa)	Lithology
BH101	RC1	20.2 / 62.4	2637	25.9	3.6	Shale
BH101	RC2	22.9 / 59.7	2640	46.6	9.5	Shale and Limestone
BH102	RC3	23.0 / 59.4	2648	27.9	5.4	Shale
BH102	RC4	26.1 / 56.3	2634	32.4	6.8	Shale
BH103	RC5	26.8 / 55.5	2643	28.6	6.6	Shale and Limestone

Directly below the overburden soils, the uppermost portion of bedrock is typically weathered. The MTO (Ontario Ministry of Transportation and Communications document RR229, *Evaluation of Shales for Construction Projects)* provides a *typical weathering profile of a low durability shale*

reproduced from Skempton, Davis, and Chandler, which characterizes weathered versus unweathered shale as follows:

Table 2.2 – Typical Weathering Profile of a Low Durability Shale

	Zone	Description	Notes
Fully Weathered	IVb	soil-like matrix only	indistinguishable from glacial drift deposits, slightly clayey, may be fissured
Partially Weathered	IVa	soil-like matrix with occasional pellets of shale less than 3 mm dia.	little or no trace of rock structure, although matrix may contain relic fissures
	III	soil-like matrix with frequent angular shale particles up to 25 mm dia.	moisture content of matrix greater than the shale particles
	II	angular blocks of unweathered shale with virtually no matrix separated by weaker chemically weathered but intact shale	spheroidal chemical weathering of shale pieces emanating from relic joints and fissures, and bedding planes
Unweathered (Sound)	I	shale	regular fissuring

In glacial till overburden soils directly overlying bedrock, a zone of till with fragmented shale is often observed and interpreted as either the lowest portion of the till, or as partially weathered Zone III rock. This interpretation is subjective and depends on the investigator. There is occasionally a concentration of boulders in the soil just above the bedrock that can be mistakenly identified as bedrock where rock coring is not performed. Weathering Zones III and IV are frequently not present due to glacial scouring action, which often removes these zones from the bedrock surface.

The Pinchin boreholes observed “till/weathered shale complex”. For practical purposes, based on our own borehole and rock coring findings, we have grouped the “till/shale complex” with the inferred Zone II weathered bedrock.

The bedrock surface as indicated on the Borehole Logs from this investigation is intended to be consistently interpreted as the surface of Zone II unless noted otherwise. Based on examination of the rock cores from this site, the partially weathered rock (Zone II) is approximately 0.1 m thick at the location of Borehole 106 to 3.2 m thick in the location of Borehole 104. Weathered and sound bedrock elevations are summarized as follows:

Borehole	Ground Surface Elevation (m)	Partially Weathered (Zone II) Bedrock		Unweathered/Sound (Zone I) Bedrock	
		Depth (m)	Elevation (m)	Depth (m)	Elevation (m)
101	82.6	3.5	79.1	5.0	77.6
102	82.4	3.2	79.2	4.2	78.2
103	82.3	3.4	78.9	3.9	78.4
104	82.8	3.9	78.9	7.1	75.7

Borehole	Ground Surface Elevation (m)	Partially Weathered (Zone II) Bedrock		Unweathered/Sound (Zone I) Bedrock	
		Depth (m)	Elevation (m)	Depth (m)	Elevation (m)
105	82.5	3.2	79.3	3.6	78.9
106	82.5	3.3	79.2	3.5	79.0
107	82.3	3.2	79.1	3.6	78.7

Rock Quality Designation (RQD) is an index measurement that refers to the total length of pieces of sound core in a core run that are at least 100 mm in length, expressed as a percentage of the total length of that core run. Only natural discontinuities are used in assessing RQD. The RQD of the recovered rock cores ranges from 45 to 95% (on average 69%) in the weathered bedrock, and 47 to 100% (on average 82%) in the sound bedrock.

RQD underrepresents the competency of the Queenston Formation and is not appropriate for horizontally bedded fissile shale. In this formation, the RQD is typically low due to the fissility of the shale as well as the closely spaced horizontal bedding planes. Our results are typical of this formation.

There are near-vertical joint sets within this shale that are typically very widely spaced at over 2 m apart. There are also several faults typically referred to as “shear zones” found within the formation, which are observed as zones of rock rubble within the cores. These faults defy discovery in conventional vertical boreholes.

The jointing and crush zones in the rock are related to the state of stress in the deposit. Research in the Queenston Formation in Southern Ontario has revealed that the bedrock contains locked-in horizontal stresses that could be remnants of the foreshortening that occurred in the earth’s crust during continental glaciation several thousand years ago. Documented experiments have indicated that the major principal stress is of the order of 2 MPa in the upper 1 to 2 metres of the deposit where the rock is weathered and contains more fractures. Intact rock can have an internal major principal stress as high as 4 to 5 MPa. The major and minor principal stresses are horizontal and may be oriented in any direction. The empirical approach to vertical stress below the top of bedrock is to use a uniform pressure distribution below the top of bedrock elevation that is equal to the maximum earth pressure calculated for the lowest level of soil in the profile.

The Queenston has been known to issue gases when penetrated. There are instances where both methane and hydrogen sulphide gas emissions have been detected in excavations made in the Queenston Formation. While there was no specific indication of gas emissions from the boreholes made in this investigation, the potential for gas emissions from this formation is recognized as a design issue to be addressed.

2.2 Groundwater

On completion of drilling, the boreholes were filled with drill fluid (from rock coring) and measuring the unstabilized groundwater level after drilling was not practical. Monitoring wells were installed in each of the boreholes, and stabilized groundwater levels were measured in each of the monitoring wells at a minimum one week after the completion of drilling. The groundwater observations are shown on the Borehole Logs and are summarized as follows.

Borehole No.	Depth of well (m)	Strata Screened	Water Level in Well, Depth/Elev. (m)			
			Highest Level	Date	Most Recent Level	Date
101	27.6	Sound Bedrock	10.2 / 72.7	April 3, 2023	10.1 / 72.5	June 9, 2023
102	7.6	Sound Bedrock	Dry	March 20, 2023	Dry	June 9, 2023
103	27.7	Sound Bedrock	9.0 / 73.3	May 5, 2023	9.2 / 73.1	June 9, 2023
104	9.7	Sound Bedrock	5.4 / 77.4	March 20, 2023	5.8 / 77.0	June 9, 2023
105	7.9	Sound Bedrock	Dry	March 20, 2023	Dry	June 9, 2023
106	7.9	Sound Bedrock	7.8 / 74.7	March 20, 2023	7.8 / 74.7	June 9, 2023
107	9.5	Sound Bedrock	78.6 / 73.7	May 5, 2023	8.7 / 73.6	June 9, 2023
PIN-MW01*	4.6	Sand, Silt and Inferred Bedrock	1.4 / 81.0	Feb 7, 2019	1.4 / 81.0	Feb 7, 2019
PIN-MW02*	4.6	Sand, Silt and Inferred Bedrock	2.2 / 80.3	Feb 7, 2019	2.2 / 80.3	Feb 7, 2019
PIN-MW03	4.6	Sand, Silt and Inferred Bedrock	1.4 / 81.1	Feb 7, 2019	Dry	June 9, 2023

*Monitoring wells were inaccessible; additional water level measurements could not be completed.

Groundwater levels fluctuate with time depending on the amount of precipitation and surface runoff, and may be influenced by known or unknown dewatering activities at nearby sites.

The design groundwater table is hydraulically connected with the water level of Lake Ontario, at about Elev. 75± m. There is also infiltrated stormwater perched in the earth fill which is flowing down towards the groundwater table (as observed and previously reported in the Pinchin monitoring wells).

Locally higher water level readings (at Elev. 77± m) were observed in Borehole 104, which was completed in the north corner of the site. These higher water level readings are considered not representative of the stabilized groundwater condition across the site. Long-term groundwater monitoring is presently ongoing as part of the hydrogeological scope of work; Grounded has prepared a hydrogeological report for this site (File No. 22-282).

Within the zone of excavation, the earth fill will permit the free-flow of water when wet, whereas the native clayey silt glacial till will typically preclude free-flowing water. It can be expected that weathered bedrock and fractures in sound bedrock will produce free-flowing water below the groundwater table.

2.3 Corrosivity and Sulphate Attack

Three (3) soil samples were submitted for corrosivity testing parameters (pH, Resistivity, Electrical Conductivity, Redox Potential, Sulphate, Sulphide and Chloride). The Certificate of Analyses and interpretation sheet is appended.

The soil samples were analysed for soluble sulphate concentration and compared to the Canadian Standard CAN3/CSA A23.1-M94 Table 3, *Additional Requirements for Concrete Subjected to Sulphate Attack*. Corrosivity parameters are also used for assessing soil corrosivity applicable to cast iron alloys, according to the 10-point soil evaluation procedure described in the American Water Work Association (AWWA) C-105 standard.

The analytical results only provide an indication of the potential for corrosion. The results of this analysis are in reference to only the soil samples collected from specific locations, and soil chemistry may vary between and beyond the locations of the analysed samples. In summary:

- All of the samples have negligible sulphate concentrations.
- Two out of the three samples scored greater than 10 points and corrosion protective measures are therefore recommended for cast iron alloys.
- A more recent study by the AWWA has suggested that soil with a resistivity of less than about 2000 ohm.cm should be considered aggressive. All of the samples had resistivity measurements less than 2000 ohm.cm and should be considered aggressive.

3 Geotechnical Engineering Recommendations

Based on the factual data summarized above, we are providing the following geotechnical engineering design recommendations. Contractors must review the factual data while bidding or scoping services for this project and must provide their own opinion as to means, methods, and schedule.

This report assumes that the design features relevant to the geotechnical analyses will be in accordance with applicable codes, standards, and guidelines of practice. If there are any changes to the site development features, or there is any additional information relevant to the interpretations made of the subsurface information with respect to the geotechnical analyses or other recommendations, then Grounded should be retained to review the implications of these changes with respect to the contents of this report.

3.1 Foundation Design Parameters

Foundations made for the proposed P7 level (FFE of Elev. 60± m) will bear on sound bedrock of the Queenston Formation at Elev. 59± m. Conventional spread footings made to bear on this sound bedrock may be designed using a maximum factored geotechnical resistance at ultimate limit state (ULS) of 5 MPa. The net geotechnical reaction at serviceability limit state (SLS) is 4 MPa, for an estimated total settlement of 15 to 20 mm.

Excavations for typical footings will be nominally 1± m below FFE, to as much as 3± m below FFE for the elevator core. Therefore,

- Foundation excavations will extend below the design groundwater table;
- Foundation excavations will penetrate into sound bedrock, which will typically preclude free-flowing water; however, free-flowing water is to be expected in fractures in the bedrock;
- Seepage from the bedrock may be allowed to drain into the foundation excavations and then controlled by a conventional sump pump arrangement.

There must be a minimum of 300 mm between the edge of any footing and the top of a sloped 2V:1H sound rock cut down to another footing.

The lowest levels of unheated underground parking structures two or more levels deep are, although unheated, still warmer than typical outdoor winter temperatures in the Greater Toronto Area. Interior foundations (or pile caps) with 900 mm of frost cover perform adequately, as do perimeter foundations with 600 mm of frost cover. Where foundations are next to ventilation shafts or are exposed to typical outdoor temperatures, 1.2 m of earth cover (or equivalent insulation) is required for frost protection.

The founding subgrade must be cleaned of all unacceptable materials and approved by Grounded prior to pouring concrete for the footings. Such unacceptable materials may include disturbed or caved soils, ponded water, or similar as indicated by Grounded during founding subgrade inspection. During the winter, adequate temporary frost protection for the footing bases and concrete must be provided if construction proceeds during freezing weather conditions. The bedrock surface can weather and deteriorate on exposure to the atmosphere or surface water; hence, foundation bases which remain open for an extended period of time should be protected by a skim coat of lean concrete.

3.2 Earthquake Design Parameters

The Ontario Building Code (2012) stipulates the methodology for earthquake design analysis, as set out in Subsection 4.1.8.7. The determination of the type of analysis is predicated on the importance of the structure, the spectral response acceleration, and the site classification.

The parameters for determination of Site Classification for Seismic Site Response are set out in Table 4.1.8.4A of the Ontario Building Code (2012). The classification is based on the determination of the average shear wave velocity in the 30 metres of the site stratigraphy below spread footing/grade beam elevation, where shear wave velocity (v_s) measurements have been taken. Alternatively, the classification is estimated from the rational analysis of undrained shear strength (s_u) or penetration resistance (N-values) according to the OBC and National Building Code of Canada.

Below the nominal founding elevations (for spread footings) of Elev. 59± m, the boreholes observed sound bedrock of the Queenston Formation. Based on this information, the site designation for seismic analysis is **Class B**, per Table 4.1.8.4.A of the Ontario Building Code (2012). Tables 4.1.8.4.B and 4.1.8.4.C. of the same code provide the applicable acceleration- and velocity-based site coefficients.

3.3 Earth Pressure Design Parameters

At this site, the design parameters for structures subject to unbalanced earth pressures such as basement walls and retaining walls are shown in the table below.

Stratigraphic Unit	γ	φ	K_a	K_o	K_p
Compact Granular Fill Granular 'B' (OPSS.MUNI 1010)	21	32	0.31	0.47	3.25
Existing Earth Fill	19	29	0.35	0.52	2.88
Native Glacial Till	21	32	0.31	0.47	3.25
Sound Bedrock	26	28	n/a		

γ = soil bulk unit weight (kN/m^3)
φ = internal friction angle (degrees)
K_a = active earth pressure coefficient (Rankine, dimensionless)
K_o = at-rest earth pressure coefficient (Rankine, dimensionless)
K_p = passive earth pressure coefficient (Rankine, dimensionless)

These earth pressure parameters assume that grade is horizontal behind the retaining structure. If retained grade is inclined, these parameters do not apply and must be re-evaluated.

The following equation can be used to calculate the unbalanced earth pressure imposed on walls:

$$P = K[\gamma(h - h_w) + \gamma' h_w + q] + \gamma_w h_w$$

P = horizontal pressure (kPa) at depth h
h = the depth at which P is calculated (m)
K = earth pressure coefficient
h_w = height of groundwater (m) above depth h
γ = soil bulk unit weight (kN/m^3)
γ' = submerged soil unit weight (γ - 9.8 kN/m^3)
q = total surcharge load (kPa)

If the wall backfill is drained such that hydrostatic pressures on the wall are effectively eliminated, this equation simplifies to:

$$P = K[\gamma h + q]$$

Where walls are made directly against shoring, prefabricated composite drainage panel covering the blind side of the wall is used to provide drainage. Water from the composite drainage panel is collected and discharged through the basement wall in solid ports directly to the sumps. This is discussed in Section 3.5.

The possible effects of frost on retaining earth structures must be considered. In frost-susceptible soils, pressures induced by freezing pore water are basically irresistible. Insulation typically addresses this issue. Alternatively, non-frost-susceptible backfill may be specified.

The earth pressure design approach for foundation walls below the top of bedrock is empirical and assumes a uniform pressure distribution below the top of bedrock elevation equal to the maximum earth pressure calculated for the lowest level of soil overtop. This approach is conventional and likely conservative, but it is practical insofar as it acknowledges the requirement of having a foundation wall of a consistent width at the lower levels.

Foundation resistance to sliding is proportional to the friction between the rock subgrade and the base of the footing. The factored geotechnical resistance to friction ($\mathbf{R_f}$) at ULS provided in the following equation:

$$R_f = \Phi N \tan \varphi$$

R_f	=	frictional resistance (kN)
Φ	=	reduction factor per Canadian Foundation Engineering Manual (CFEM) Ed. 4 (0.8)
N	=	normal load at base of footing (kN)
φ	=	internal friction angle (see table above)

3.4 Rock Swell

The earth pressure design approach for foundation walls below the top of bedrock is provided in the section above. However, this approach does not recognize the potential for pressures on the basement wall due to time-dependent rock swell that results when locked in horizontal stresses are released. For structures deeper than 2 m below the top of sound rock, rock swell must also be considered. The simplest approach to dealing with rock swell is scheduling. If there is a 120-day gap between rock excavation and construction of the permanent structure that will restrain the rock, experience on similar structures indicates the rock will de-stress and swell, and no significant stresses are imposed on the structural wall. This requirement typically only impacts the lowest basement level (or two) in bedrock, acknowledging the 120-day window.

If the construction schedule does not allow for a 120-day gap, mitigation measures will be required. For structures subjected to unbalanced rock swell pressure (i.e. lowest exterior foundation walls, sumps, elevators, other features cast directly against the rock face), rock squeeze effects can be addressed by providing a crushable layer between the rock and the concrete, such as 50 mm thick Ethafoam 220 Polyethylene Foam planks. The subject walls are typically designed for the 50% compressive strength resistance of the foam. At 50% compression, a 220 Ethafoam 220 Polyethylene Foam plank provides 124 kPa of resistance. At 10% compression (which allows for concrete placement), this material provides 50 kPa of resistance.

Deeper protrusions (sumps, elevator pits, etc.) can be over-excavated as they are not typically constrained by the property lines or adjacent footings. In this case the rock can be horizontally over-excavated by a minimum 600 mm on all sides. Precast pits and sumps are then placed and

backfilled with 19 mm clear stone (OPSS.MUNI 1004). The clear stone backfill then accommodates the rock swell.

Rock squeeze effects are not relevant to foundation excavations as the earth pressures exerted on foundation elements are balanced, and concrete is strong enough to resist the swell pressure and render it null.

3.5 Slab on Grade Design Parameters

At the proposed P7 level, the sound bedrock of the Queenston Formation will provide adequate subgrade for the support of a conventional slab on grade. The modulus of subgrade reaction for slab-on-grade design supported by sound bedrock is 80,000 kPa/m.

If this basement structure is made as a conventional drained structure, a permanent drainage system including subfloor drains is required (see section below). In this case, the slab on grade must be provided with a drainage layer and capillary moisture break, which is achieved by forming the slab on a minimum 200 mm thick layer of 19 mm clear stone (OPSS.MUNI 1004).

Subfloor drains are typically installed in trenches below the capillary moisture break drainage layer per the typical detail appended. If trenches are to be avoided for whatever reason, the subfloor drainage system can be incorporated into the capillary moisture break and drainage layer. In this case, the subfloor drains are laid directly on the flat subgrade and backfilled with a minimum 300 mm thick layer of 19 or 9.5 mm clear stone (OPSS.MUNI 1004), HPB, or approved equivalent, vibrated to a dense state. Any solid collection pipes must be sloped so that they positively discharge to the sumps.

The use of excavated bedrock spoil to restore subgrade elevations is to be specifically prohibited. This bedrock spoil cannot be adequately compacted to provide support for the slab on grade and is not to be reused below any settlement sensitive areas.

3.6 Long-Term Groundwater and Seepage Control

To limit seepage to the extent practicable, exterior grades adjacent to foundation walls should be sloped at a minimum 2 percent gradient away from the wall for 1.2 m minimum.

The requirement for a permanent basement drainage system depends on whether a fully watertight approach is adopted for this site. The following discussion pertains to a drained basement approach only.

For a conventional drained basement approach, perimeter and subfloor drainage systems are required for the underground structure. Subfloor drainage collects and removes the seepage that infiltrates under the floor. Perimeter drainage collects and removes seepage that infiltrates at the foundation walls. The exterior faces of foundation walls should be provided with a layer of waterproofing to protect interior finishes.

Subfloor drainage pipes (min. 100 mm diameter) are to be spaced at an average 9 m (measured on-centres).

The walls of the substructure are to be fully drained to eliminate hydrostatic pressure. Where drained basement walls are made directly against shoring, prefabricated composite drainage panel covering the blind side of the wall is used to provide drainage. Seepage from the composite drainage panel is collected and discharged through the basement wall in solid ports directly to the sumps. A layer of waterproofing placed between the drain core product and the basement wall should be considered to protect interior finishes from moisture.

Typical basement drainage details are appended.

The perimeter and subfloor drainage systems are critical structural elements since they eliminate hydrostatic pressure from acting on the basement walls and floor slab. The sumps that ensure the performance of these systems must have a duplexed pump arrangement providing 100% redundancy, and they must be on emergency power. The sumps should be sized by the mechanical engineer to adequately accommodate the estimated volume of water seepage.

The permanent dewatering requirements are provided in Grounded's Hydrogeological Report (File No. 22-282).

If any water is to be discharged to the storm or sanitary sewers, the City will require Discharge Agreements to be in place.

4 Considerations for Construction

4.1 Excavations

Excavations must be carried out in accordance with the *Occupational Health and Safety Act – Regulation 213/91 – Construction Projects (Part III - Excavations, Section 222 through 242).* These regulations designate four (4) broad classifications of soils to stipulate appropriate measures for excavation safety. For practical purposes, the earth fill (and any sands/silts) is a Type 3 soil, and the glacial till is a Type 2 soil.

In accordance with the regulation's requirements, the soil must be suitably sloped and/or braced where workers must enter a trench or excavation deeper than 1.2 m. Safe excavation slopes (of no more than 3 m in height) by soil type are stipulated as follows, per Section 234:

Soil Type	Base of Slope	Steepest Slope Inclination
1	within 1.2 metres of bottom of trench	1 horizontal to 1 vertical
2	within 1.2 metres of bottom of trench	1 horizontal to 1 vertical
3	from bottom of trench	1 horizontal to 1 vertical
4	from bottom of trench	3 horizontal to 1 vertical

Minimum support system requirements for steeper excavations are stipulated in Sections 235 through 239 and 241 of the Act and Regulations and include provisions for timbering, shoring and moveable trench boxes. Any excavation slopes greater than 3 m in height should be checked by Grounded for global stability issues.

Bedrock is not considered a soil under the Act, per clause 234(2)(d). Vertical excavations made in sound bedrock are generally self-supporting provided the rock bedding is horizontally oriented. If deemed necessary, rock bolts and welded wire mesh/shotcrete (or other means and methods) can be used to protect workers from rock spalling from the face of excavation. The rock face must be inspected by Grounded to determine that no other support system is required to prevent the spalling of loose rock, and to confirm that all loose spall material at risk of falling upon a worker is removed (clause 234(2)(h) of the above noted regulations).

The exposed vertical bedrock face deteriorates with time and exposure. Exposed excavation faces have been found to flake and recede as much as 300 mm within a 12 month exposure. This recession generally takes the form of coin-sized shale particles dropping from the face on a constant basis. If deemed necessary, debris netting draped over the rock face can be used to contain and collect these coin-sized shale particles.

Larger obstructions (e.g. buried concrete debris, other obstructions) not directly observed in the boreholes are likely present in the earth fill. Similarly, larger inclusions (e.g. cobbles and boulders) may be encountered in the native soils. The size and distribution of these obstructions cannot be predicted with boreholes, as the split spoon sampler is not large enough to capture particles of this size. Provision must be made in excavation contracts to allocate risks associated with the time spent and equipment utilized to remove or penetrate such obstructions when encountered.

Excess soil is now governed by Ontario Regulation 406/19: On-Site and Excess Soil Management. As of January 1, 2023, the Project Leader (typically the owner) may be required to file a notice in the excess soil registry and a Qualified Person (within the meaning of O.Reg. 153/04) may be required to prepare the associated planning documents and/or develop and implement a tracking system in accordance with the Soil Rules, to track each load of excess soil during its transportation and deposit before removing excess soil from the project area.

Excavations will penetrate weathered and sound bedrock. Queenston Formation bedrock is a rippable rock that can be removed with conventional excavation equipment once it has been broken by ripper tooth or hoe ram. Creating detailed excavation shapes for foundations etc. is normally accomplished by hoe ram. The removal of rock from a vertical face without over-excavation, which can happen inadvertently by dislodging additional rock, is largely dependent on machine operator skill. The contractor shall exercise caution and implement the appropriate techniques to reduce the amount of disturbance to the rock mass (rock fracturing) with the excavator.

If excavation faces must be made neat (such as beside an existing footing), a line of excavation can be provided by line drilling the rock a series of closely-spaced vertical holes (100 mm

diameter, spaced at 300 mm on centre) to provide a preferential vertical break path for the excavation face.

4.2 Short-Term Groundwater Control

Considerations pertaining to groundwater discharge quantities and quality are discussed in Grounded's hydrogeological report for the site, under separate cover.

The design groundwater table is hydraulically connected with the water level of Lake Ontario, at about Elev. 75± m. There is also infiltrated stormwater perched in the earth fill which is flowing down towards the groundwater table (as observed and previously reported in the Pinchin monitoring wells).

Locally higher water level readings (at Elev. 77± m) were observed in Borehole 104, which was completed in the north corner of the site. These higher water level readings are considered not representative of the stabilized groundwater condition across the site. Long-term groundwater monitoring is presently ongoing as part of the hydrogeological scope of work; Grounded has prepared a hydrogeological report for this site (File No. 22-282).

Within the zone of excavation, the earth fill will permit the free-flow of water when wet, whereas the native clayey silt glacial till will typically preclude free-flowing water. It can be expected that weathered bedrock and fractures in sound bedrock will produce free-flowing water below the groundwater table. On this basis, seepage into excavations may be allowed to drain into the excavation and then controlled by a conventional sump pump arrangement. Nevertheless, delays in excavation will occur as the seepage is controlled and these delays should be anticipated in the construction schedule.

Positive dewatering of the bedrock is not required.

The City / Region will require a Discharge Agreement in the short term, if any water is to be discharged to the storm or sanitary sewers during construction.

4.3 Earth-Retention Shoring Systems

No excavation shall extend below the foundations of existing adjacent structures without adequate alternative support being provided.

Excavation zone of influence guidelines are appended.

Continuous interlocking caisson wall shoring is to be used where the excavation must be constructed as a rigid shoring system. Caisson wall shoring preserves the support capabilities and integrity of the soil beneath existing foundations of adjacent buildings, in a state akin to the at-rest condition. Otherwise, excavations can be supported using conventional soldier pile and lagging walls; however, localized active dewatering of the perched water within the earth fill may be required prior to lagging board installation and during construction (to prevent sloughing soils).

4.3.1 Lateral Earth Pressure Distribution

If the shoring is supported with a single level of earth anchor or bracing, a triangular earth pressure distribution like that used for the basement wall design is appropriate.

Where multiple rows of lateral supports are used to support the shoring walls, research has shown that a distributed pressure diagram more realistically approximates the earth pressure on a shoring system of this type, when restrained by pre-tensioned anchors. A multi-level supported shoring system can be designed based on an earth pressure distribution with a maximum pressure defined by:

$$P = 0.8\,K[\gamma H + q] + \gamma_w h_w$$

P = maximum horizontal pressure (kPa)
K = earth pressure coefficient (see Section 3.3)
H = total depth of the excavation (m)
h_w = height of groundwater (m) above the base of excavation
γ = soil bulk unit weight (kN/m3)
q = total surcharge loading (kPa)

Where shoring walls are drained to effectively eliminate hydrostatic pressure on the shoring system (e.g. pile and lagging walls), h_w is equal to zero. For the design of impermeable shoring, a design groundwater table at Elev. 75± m must be accounted for. There is infiltrated stormwater perched in the earth fill and upper native soils which may accumulate behind a caisson wall. This hydrostatic pressure needs to be accounted for in shoring design.

In cohesive soils, the lateral earth pressure distribution is trapezoidal, uniformly increasing from zero to the maximum pressure defined in the equation above over the top and bottom quarter (H/4) of the shoring. In cohesionless soils, the lateral earth pressure distribution is rectangular.

Where the excavation penetrates the bedrock, the rock excavation is nominally self-supporting in a vertical face, provided the rock bedding is horizontally oriented. The requirement for extending lagging into partially weathered rock depends on the quality of the excavation cut and the degree of weathering.

4.3.2 Soldier Pile Toe Embedment

Soldier pile toes will be made in the sound bedrock of the Queenston Formation. Soldier pile toes resist horizontal movement due to the passive earth pressure acting on the toe below the base of excavation. The maximum factored vertical geotechnical resistance at ULS for the design of a pile embedded in the sound bedrock is 9 MPa. The maximum factored lateral geotechnical resistance at ULS of the undisturbed rock is 1 MPa.

There are zones of soil in the subgrade that are wet, cohesionless, and permeable. Augered holes for piles made into these soils will be prone to caving and blowback. Temporarily cased holes advanced to the bedrock surface may be required to prevent borehole caving during installations in drilled holes. To prevent groundwater issues (groundwater inflow, caving and blowback into

the drill holes, disturbance to placed concrete, etc.) during drilling and installation, construction methods such as utilizing temporary liners, pre-advancing liners deeper than the augered holes, mud/slurry/polymer drilling techniques, tremie pour concrete, or other methods as deemed necessary by the shoring contractor are required. Concrete for shoring piles and fillers must be placed by tremie method wherever there is more than 300 mm of water or fluid at the base of the drill hole.

Exposed bedrock of the Queenston Formation deteriorates with time. Within 12 months of exposure, excavation faces made within this bedrock flake and recede as much as 300 mm, generally in the form of coin-size shale particles dropping from the face on a constant basis. The deteriorated rock loses internal integrity and bearing capability. Solider piles for the shoring system are typically advanced at least 1 metre below the base of the excavation (to be confirmed by the geostructural engineer) to accommodate this weathering and still ensure that the required lateral and vertical bearing resistances can be utilized.

4.3.3 Lateral Bracing Elements

The shoring system at this site will require lateral bracing. If feasible, the shoring system should be supported by pre-stressed soil anchors (tiebacks) extending into the subgrade of the adjacent properties. To limit the movement of the shoring system as much as is practically possible, tiebacks are installed and stressed as excavation proceeds. The use of tiebacks through adjacent properties requires the consent (through encroachment agreements) of the adjacent property owners.

Conventional earth anchors made in Queenston Formation bedrock can be designed using a working adhesion of 600 kPa.

At least one prototype anchor per tieback level must be performance-tested to 200% of the design load to demonstrate the anchor capacity and validate design assumptions. Given the potential variability in soil conditions or installation quality, all production anchors must also be proof-tested to 133% of the design load.

The sound bedrock below the proposed FFE is suitable for the placement of raker foundations. Raker footings established on bedrock at an inclination of 45 degrees can be designed using a maximum factored geotechnical resistance at ULS of 2500 kPa.

4.4 Site Work

To better protect wet undisturbed subgrade, excavations exposing wet soils must be cut neat, inspected, and then immediately protected with a skim coat of concrete (i.e. a mud mat). Wet sands are susceptible to degradation and disturbance due to even mild site work, frost, weather, or a combination thereof.

The effects of work on site can greatly impact soil integrity. Care must be taken to prevent this damage. Site work carried out during periods of inclement weather may result in the subgrade

becoming disturbed, unless a granular working mat is placed to preserve the subgrade soils in their undisturbed condition. Subgrade preparation activities should not be conducted in wet weather and the project must be scheduled accordingly.

If site work causes disturbance to the subgrade, removal of the disturbed soils and the use of granular fill material for site restoration or underfloor fill will be required at additional cost to the project.

It is construction activity itself that often imparts the most severe loading conditions on the subgrade. Special provisions such as end dumping and forward spreading of earth and aggregate fills, restricted construction lanes, and half-loads during placement of the granular base and other work may be required, especially if construction is carried out during unfavourable weather.

Adequate temporary frost protection for the founding subgrade must be provided if construction proceeds in freezing weather conditions. The subgrade at this site is susceptible to frost damage. The slab on grade should not be placed on frozen subgrade, to prevent settlement of the slab as the subgrade thaws. Areas of frozen subgrade should be removed during subgrade preparation. Depending on the project context, consideration should be given to frost effects (heaving, softening, etc.) on exposed subgrade surfaces.

4.5 Engineering Review

By issuing this report, Grounded Engineering has assumed the role of Geotechnical Engineer of Record for this site. Grounded should be retained to review the structural engineering drawings prior to issue or construction to ensure that the recommendations in this report have been appropriately implemented.

All foundation installations must be reviewed in the field by Grounded, the Geotechnical Engineer of Record, as they are constructed. The on-site review of foundation installations and the condition of the founding subgrade as the foundations are constructed is as much a part of the geotechnical engineering design function as the design itself; it is also required by Section 4.2.2.2 of the Ontario Building Code. If Grounded is not retained to carry out foundation engineering field review during construction, then Grounded accepts no responsibility for the performance or non-performance of the foundations, even if they are constructed in general conformance with the engineering design advice contained in this report.

The long-term performance of a slab on grade is highly dependent upon the subgrade support and drainage conditions. Strict procedures must be maintained during construction to maintain the integrity of the subgrade to the extent possible. The design advice in this report is based on an assessment of the subgrade support capabilities as indicated by the boreholes. These conditions may vary across the site depending on the final design grades and therefore, the preparation of the subgrade and the compaction of all fill should be monitored by Grounded at the time of construction to confirm material quality, thickness, and to ensure adequate compaction.

A visual pre-construction survey of adjacent lands and buildings is recommended to be completed prior to the start of any construction. This documents the baseline condition and can prevent unwarranted damage claims. Any shoring system, regardless of the execution and design, has the potential for movement. Small changes in stress or soil volume can cause cracking in adjacent buildings.

5 Limitations and Restrictions

Grounded should be retained to review the structural and geostructural engineering drawings prior to issue or construction to ensure that the recommendations in this report have been appropriately implemented.

5.1 Investigation Procedures

The geotechnical engineering analysis and advice provided here are based in part on factual data obtained from investigations at this site conducted by other consultants as described above, as well as the factual borehole information observed and recorded by Grounded. This previous consultant subsurface information is provided in a professional engineer's signed and sealed geotechnical report, and as such this borehole information is taken as factual for present purposes.

Borehole drilling services were provided to Grounded by a specialist professional contractor. The drilling was observed and recorded by Grounded's field supervisor on a full-time basis. Drilling was conducted using conventional drilling rigs equipped with hollow stem augers and rock coring was carried out with HQ size diamond bit core drilling barrels. As drilling proceeded, groundwater observations were made in the boreholes. Based on examination of recovered borehole samples, our field supervisor made a record of borehole and drilling observations. The field samples were secured in air-tight clean jars and bags and taken to the Grounded soil laboratory where they were each logged and reviewed by the geotechnical engineering team and the senior reviewer.

The Split-Barrel Method technique (ASTM D1586) was used to obtain the soils samples. The sampling was conducted at conventional intervals and not continuously. As such, stratigraphic interpolation between samples is required and stratigraphic boundary lines do not represent exact depths of geological change. They should be taken as gradual transition zones between soil or rock types.

A carefully conducted, fully comprehensive investigation and sampling scope of work carried out under the most stringent level of oversight may still fail to detect certain ground conditions. As such, users of this report must be aware of the risks inherent in using engineered field investigations to observe and record subsurface conditions. As a necessary requirement of working with discrete test locations, Grounded has assumed that the conditions between test locations are the same as the test locations themselves, for the purposes of providing geotechnical engineering advice.

It is not possible to design a field investigation with enough test locations that would provide complete subsurface information, nor is it possible to provide geotechnical engineering advice that completely identifies or quantifies every element that could affect construction, scheduling, or tendering. Contractors undertaking work based on this report (in whole or in part) must make their own determination of how they may be affected by the subsurface conditions, based on their own analysis of the factual information provided and based on their own means and methods. Contractors using this report must be aware of the risks implicit in using factual information at discrete test locations to infer subsurface conditions across the site and are directed to conduct their own investigations as needed.

5.2 Site and Scope Changes

Natural occurrences, the passage of time, local construction, and other human activity all have the potential to directly or indirectly alter the subsurface conditions at or near the project site. Contractual obligations related to groundwater or stormwater control, disturbed soils, frost protection, etc. must be considered with attention and care as they relate to potential site alteration.

The geotechnical engineering advice provided in this report is based on the factual observations made from the site investigations as reported. It is intended for use by the owner and their retained design team. If there are changes to the features of the development or to the scope, the interpreted subsurface information, geotechnical engineering design parameters, advice, and discussion on construction considerations may not be relevant or complete for the project. Grounded should be retained to review the implications of such changes with respect to the contents of this report.

5.3 Report Use

The authorized users of this report are Acamar Dwelling Corp. and their design team, for whom this report has been prepared. Grounded Engineering Inc. maintains the copyright and ownership of this document. Reproduction of this report in any format or medium requires explicit prior authorization from Grounded Engineering Inc.

The local municipal/regional governing bodies may also make use of and rely upon this report, subject to the limitations as stated.

6 Closure

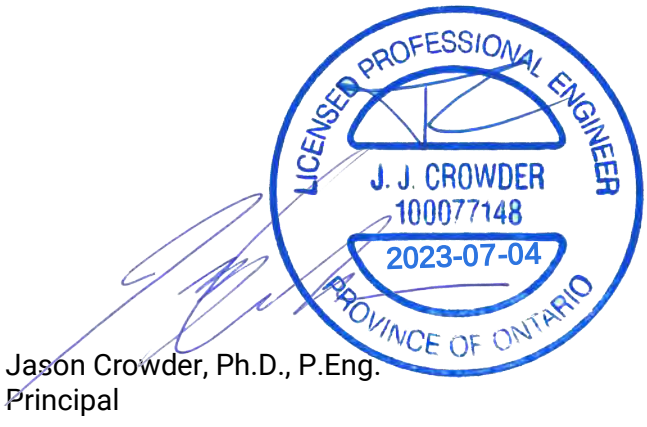
If the design team has any questions regarding the discussion and advice provided, please do not hesitate to have them contact our office. We trust that this report meets your requirements at present.

For and on behalf of our team,

GROUNDED ENGINEERING



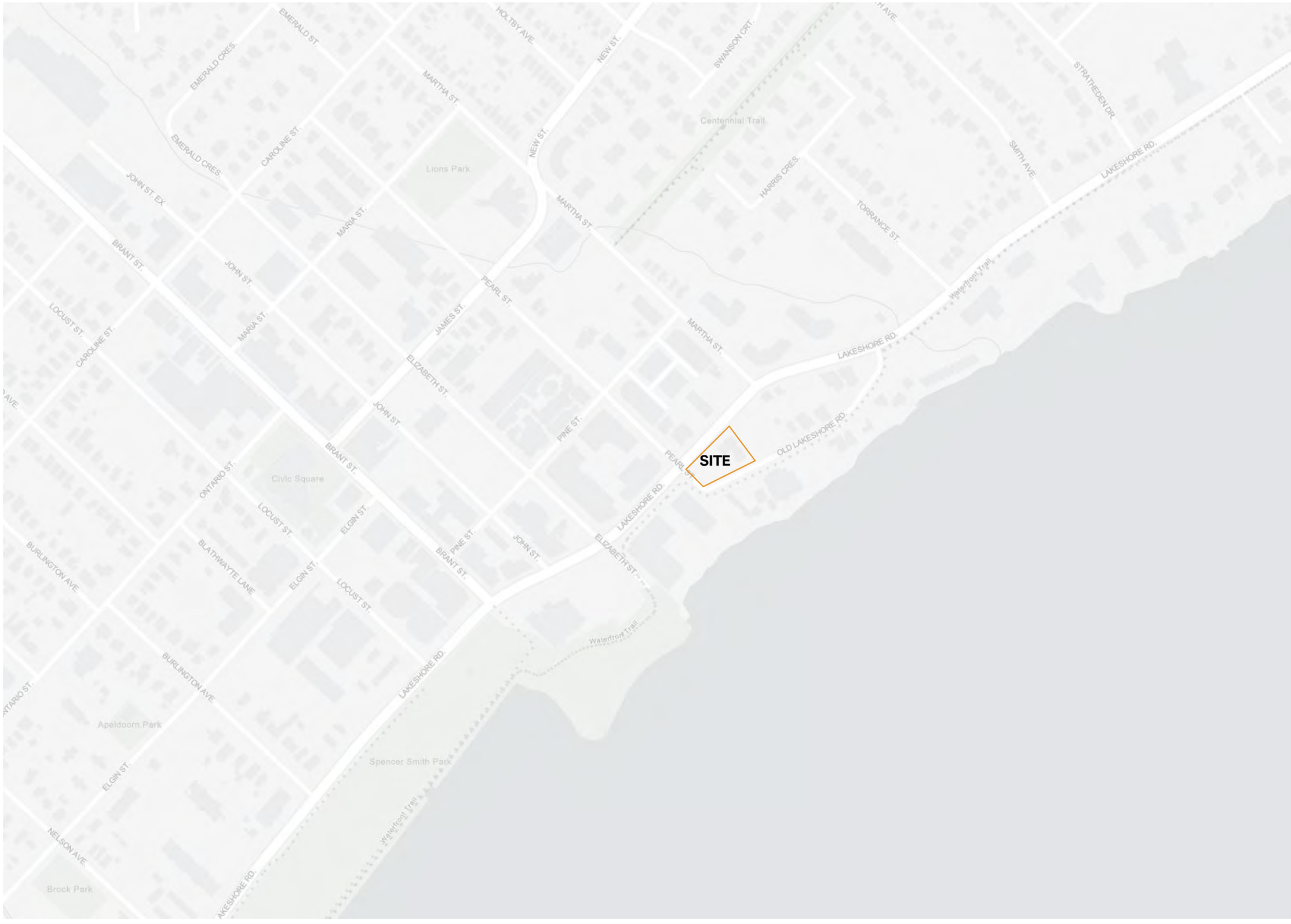
Nick Ng, P.Eng.
Project Engineer



Jason Crowder, Ph.D., P.Eng.
Principal

FIGURES





GROUNDED ENGINEERING

1 BANIGAN DRIVE, TORONTO, ONT., M4H 1G3
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LEGEND

APPROXIMATE PROPERTY BOUNDARY

Note

Reference

ArcGIS My Map 2022.

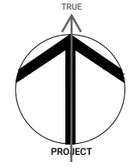
Project

2072 LAKESHORE ROAD BURLINGTON, ONTARIO

Figure Title

SITE LOCATION PLAN

North



Date

MARCH 2023

Scale

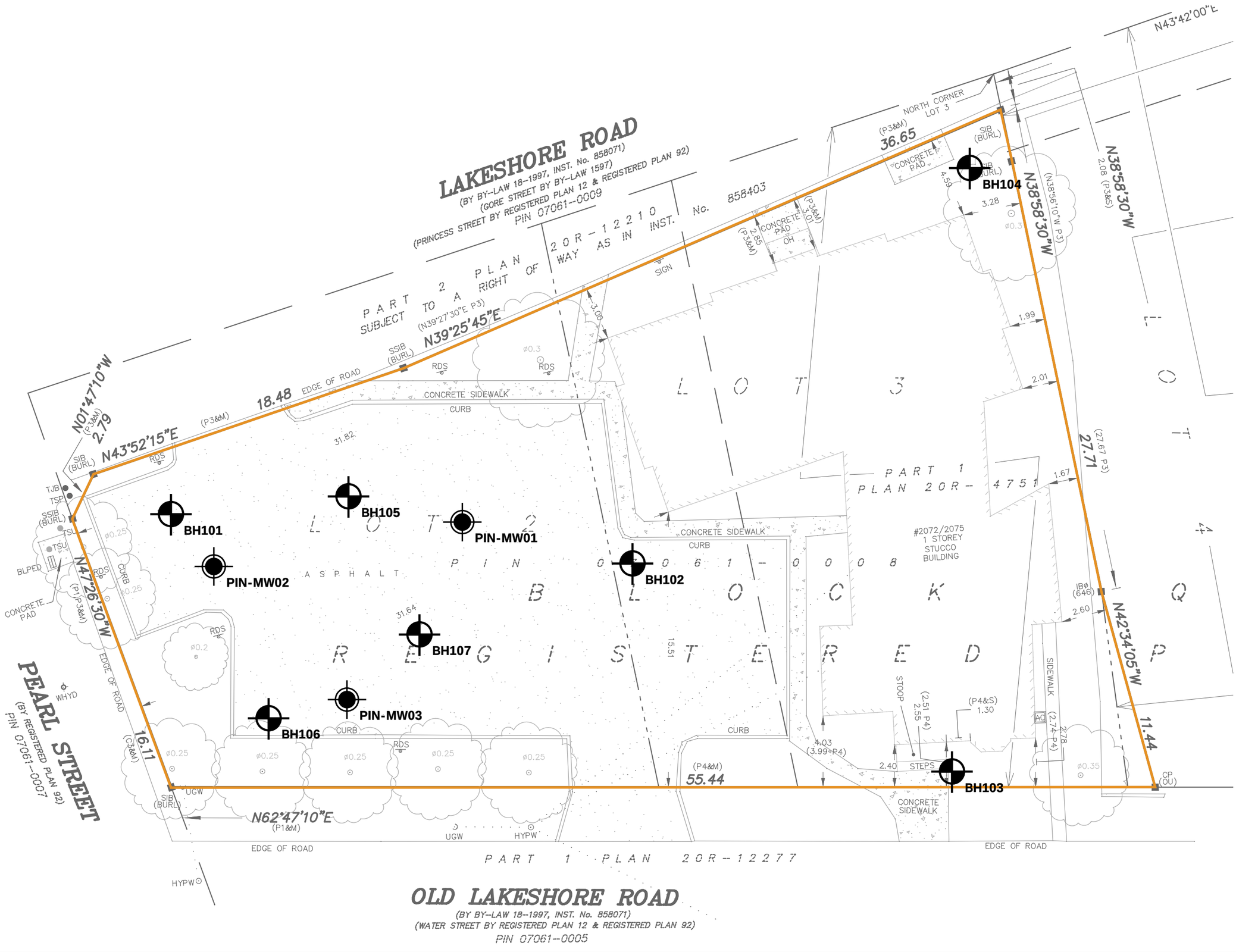
N.T.S

Job No

22-282

Figure No

FIGURE 1



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LEGEND

- APPROXIMATE SITE BOUNDARY
- MONITORING WELL/BOREHOLE BY GROUNDED
- MONITORING WELL/BOREHOLE BY OTHERS

Note

Reference

Plan of Survey, "Part of Lots 2, 3 and 4, Registered Plan 92, City of Burlington"; Project No. 19-002, dated February 15, 2019, prepared by Mackay Mackay and Peters Limited.

Project

2072 LAKESHORE ROAD BURLINGTON, ONTARIO

Figure Title

BOREHOLE LOCATION PLAN (EXISTING CONDITION)

North

TRUE

PROJECT

Date

MARCH 2023

Scale

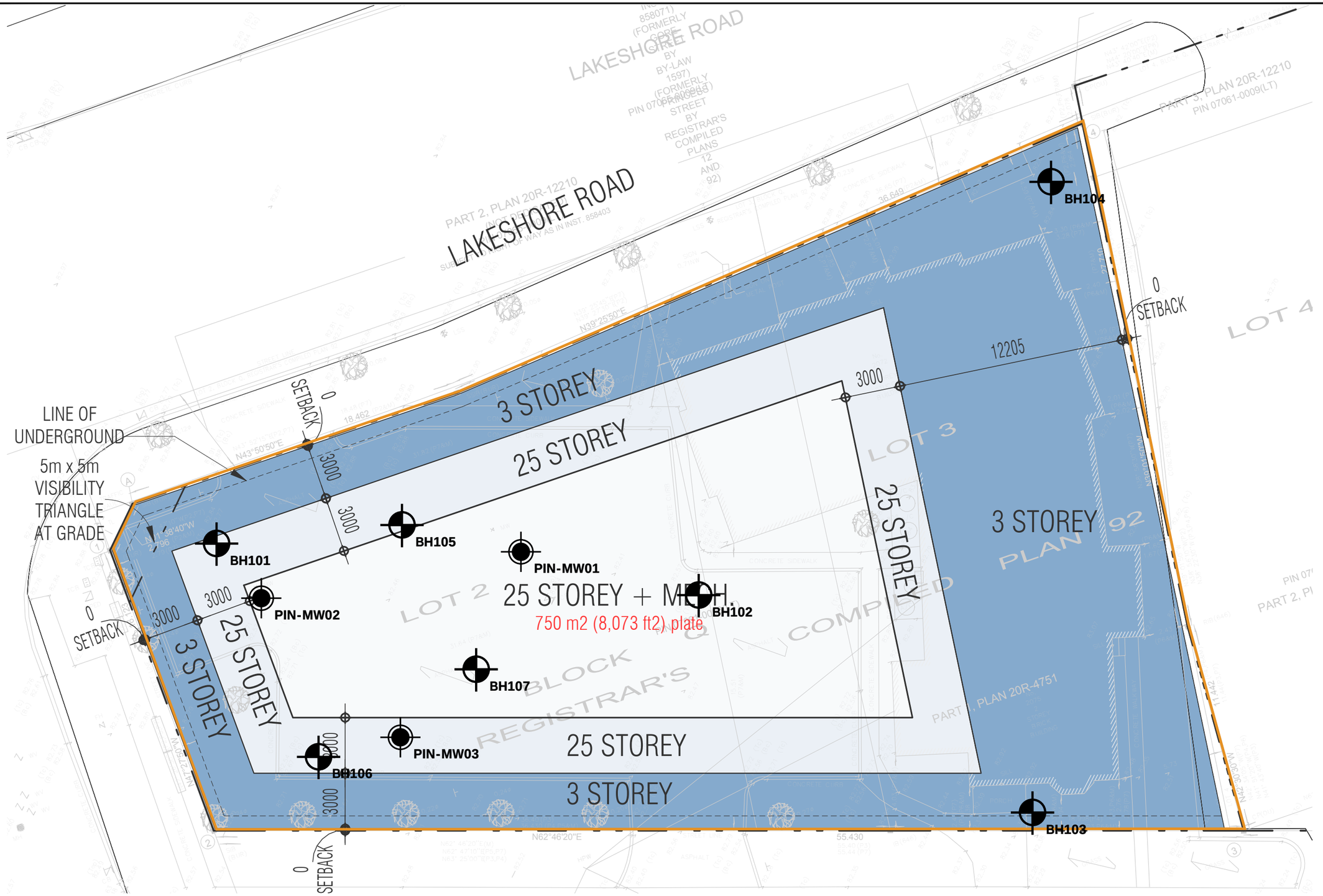
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Job No

22-282

Figure No

FIGURE 2



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1 BANIGAN DRIVE, TORONTO, ONT., M4H 1G3
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LEGEND

- APPROXIMATE SITE BOUNDARY
- MONITORING WELL/BOREHOLE BY GROUNDED
- MONITORING WELL/BOREHOLE BY OTHERS

Note

Reference

Architectural Drawing, "Conceptual Site Plan - Option 2"; Project Number 2079.22, dated April 25, 2023, prepared by Graziani+Corazza Architects.

Project

2072 LAKESHORE ROAD BURLINGTON, ONTARIO

Figure Title

BOREHOLE LOCATION PLAN (PROPOSED CONDITION)

North

TRUE
PROJECT

Date

MARCH 2023

Scale

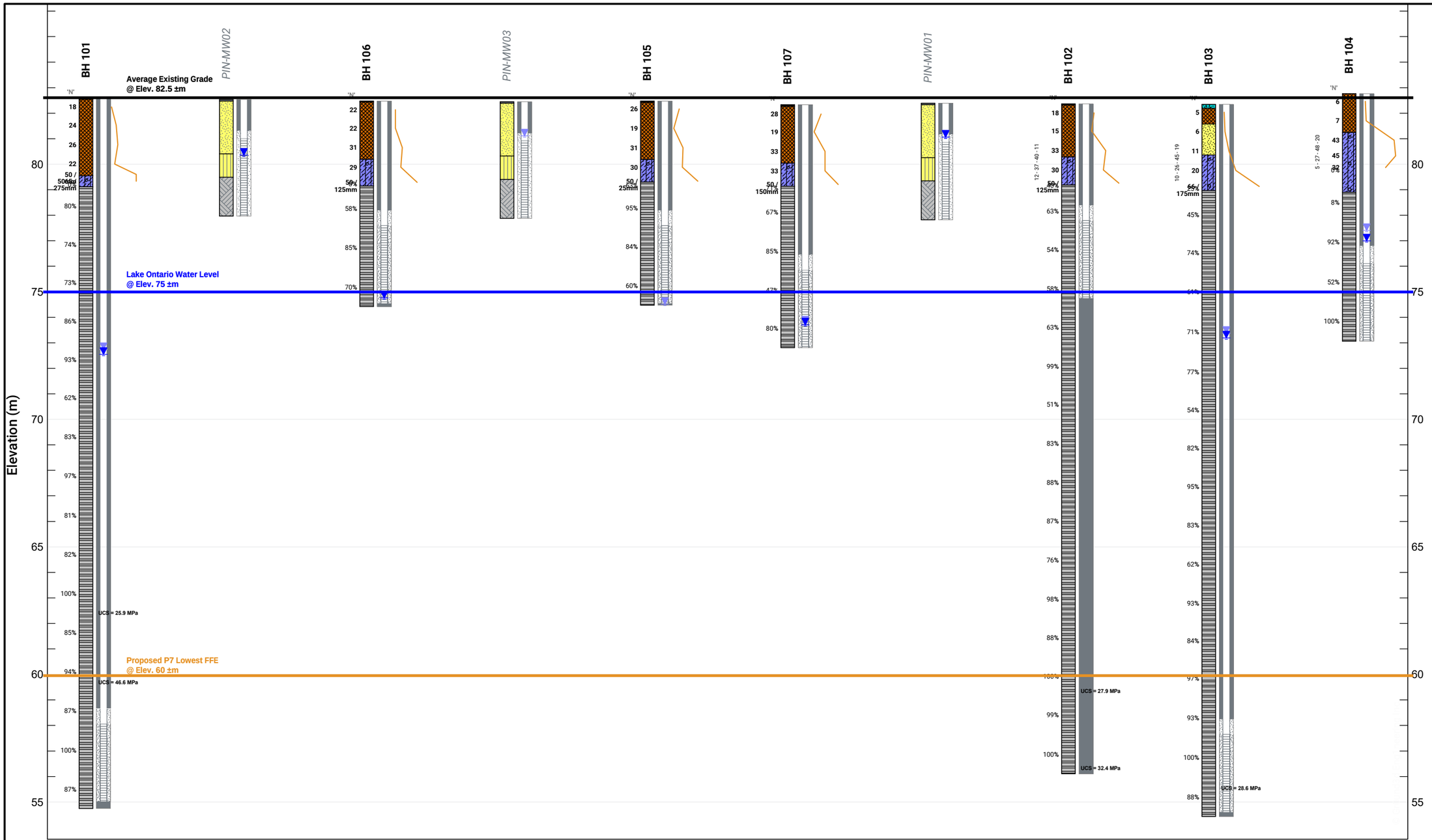
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Job No

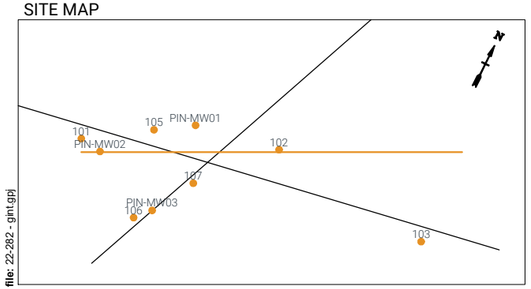
22-282

Figure No

FIGURE 3



SITE MAP



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Boreholes Equally Spaced

BOREHOLE STRATIGRAPHY LEGEND

- Asphalt
- Topsoil
- Fill
- Sand
- Clayey Silt Till
- Silt
- Bedrock (cored)
- Bedrock (inferred)

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LEGEND

- FILL
- GRAVELS (gravel to gravelly sand)
- SILT TO SAND (not till)
- COHESIONLESS TILLS
- COHESIVE SOILS (clayey silt to clay, incl. tills)
- DISTURBED/REWORKED/ORGANIC

BH 101 BOREHOLES BY GROUNDED

T-BH7 BOREHOLES BY OTHERS

- water level, unstabilized
- water level, stabilized (latest)
- water level, stabilized (highest)

Project

2072 LAKESHORE ROAD BURLINGTON, ON

Figure Title

SUBSURFACE PROFILE

ALL GROUNDED AND PINCHIN BOREHOLES

Date: JUNE 2023

Scale: AS INDICATED

Job No: 22-282

Figure No: **FIGURE 4**

APPENDIX A



BOREHOLE LOG TERMINOLOGY

GROUNDED ENGINEERING

SAMPLING/TESTING METHODS

SS: split spoon sample

AS: auger sample

GS: grab sample

FV: shear vane

DP: direct push

PMT: pressuremeter test

ST: shelby tube

CORE: soil coring

RUN: rock coring

SYMBOLS & ABBREVIATIONS

MC: moisture content

LL: liquid limit

PL: plastic limit

PI: plasticity index

γ: soil unit weight (bulk)

G_s: specific gravity

S_u: undrained shear strength

▽ unstabilized water level

▼ 1st water level measurement

▼ 2nd water level measurement most recent

▼ water level measurement

ENVIRONMENTAL SAMPLES

M&I: metals and inorganic parameters

PAH: polycyclic aromatic hydrocarbon

PCB: polychlorinated biphenyl

VOC: volatile organic compound

PHC: petroleum hydrocarbon

BTEX: benzene, toluene, ethylbenzene and xylene

PPM: parts per million

FIELD MOISTURE (based on tactile inspection)

DRY: no observable pore water

MOIST: inferred pore water, not observable (i.e. grey, cool, etc.)

WET: visible pore water

COHESIONLESS

Relative Density	N-Value
Very Loose	<4
Loose	4 - 10
Compact	10 - 30
Dense	30 - 50
Very Dense	>50

COHESIVE

Consistency	N-Value	Su (kPa)
Very Soft	<2	<12
Soft	2 - 4	12 - 25
Firm	4 - 8	25 - 50
Stiff	8 - 15	50 - 100
Very Stiff	15 - 30	100 - 200
Hard	>30	>200

COMPOSITION

Term	% by weight
trace silt	<10
some silt	10 - 20
silt***y***	20 - 35
sand ***and*** silt	>35

ASTM STANDARDS

ASTM D1586 Standard Penetration Test (SPT)
Driving a 51 mm O.D. split-barrel sampler ("split spoon") into soil with a 63.5 kg weight free falling 760 mm. The blows required to drive the split spoon 300 mm ("bpf") after an initial penetration of 150 mm is referred to as the N-Value.

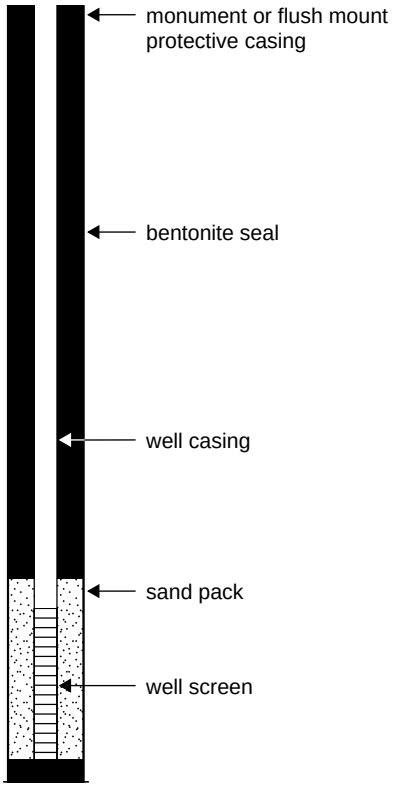
ASTM D3441 Cone Penetration Test (CPT)
Pushing an internal still rod with a outer hollow rod ("sleeve") tipped with a cone with an apex angle of 60° and a cross-sectional area of 1000 mm^2 into soil. The resistance is measured in the sleeve and at the tip to determine the skin friction and the tip resistance.

ASTM D2573 Field Vane Test (FVT)
Pushing a four blade vane into soil and rotating it from the surface to determine the torque required to shear a cylindrical surface with the vane. The torque is converted to the shear strength of the soil using a limit equilibrium analysis.

ASTM D1587 Shelby Tubes (ST)
Pushing a thin-walled metal tube into the in-situ soil at the bottom of a borehole, removing the tube and sealing the ends to prevent soil movement or changes in moisture content for the purposes of extracting a relatively undisturbed sample.

ASTM D4719 Pressuremeter Test (PMT)
Place an inflatable cylindrical probe into a pre-drilled hole and expanding it while measuring the change in volume and pressure in the probe. It is inflated under either equal pressure increments or equal volume increments. This provides the stress-strain response of the soil.

WELL LEGEND



ROCK CORE TERMINOLOGY (MTO SHALE)

TCR **Total Core Recovery** the total length of recovery (soil or rock) per run, as a percentage of the drilled length
SCR **Solid Core Recovery** the total length of sound full-diameter rock core pieces per run, as a percentage of the drilled length
RQD **Rock Quality Designation** the sum of all pieces of sound rock core in a run which are 10 cm or greater in length, as a percentage of the drilled length

Natural Fracture Frequency (typically per 0.3 m) The number of natural discontinuities (joints, faults, etc.) which are present per 0.3m. Ignores mechanical or drill-induced breaks, and closed discontinuities (e.g. bedding planes).

LOGGING DISCONTINUITIES

Discontinuity Type

BP bedding parting
CL cleavage
CS crushed seam
FZ fracture zone
MB mechanical break
IS infilled seam
JT Joint
SS shear surface
SZ shear zone
VN vein
VO void

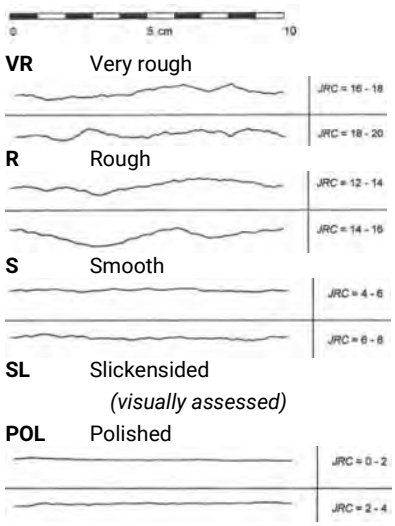
Coating

CN Clean
SN Stained
OX Oxidized
VN Veneer
CT Coating (>1 mm)

Dip Inclination

H	horizontal/flat	0 - 20°
D	dipping	20 - 50°
SV	sub-vertical	50 - 90°
V	vertical	90±°

Roughness (Barton et al.)



VR Very rough
R Rough
S Smooth
SL Slickensided *(visually assessed)*
POL Polished

Spacing in Discontinuity Sets (*ISRM 1981*)

VC	very close	< 60 mm
C	close	60 – 200 mm
M	mod. close	0.2 to 0.6 m
W	wide	0.6 to 2 m
VW	very wide	> 2 m

Aperture Size

T	closed / tight	< 0.5 mm
GA	gapped	0.5 to 10 mm
OP	open	> 10 mm

Planarity

PR	Planar
UN	Undulating
ST	Stepped
IR	Irregular
DIS	Discontinuous
CU	Curved

GENERAL

Degree of Weathering (*after MTO, RR229 Evaluation of Shales for Construction Projects*)

Zone	Degree	Description
Z1	unweathered	shale, regular jointing
Z2	partially weathered	angular blocks of unweathered shale, no matrix, with chemically weathered but intact shale
Z3		soil-like matrix with frequent angular shale fragments < 25mm diameter
Z4a		soil-like matrix with occasional shale fragments < 3mm diameter
Z4b	fully weathered	soil-like matrix only

Strength classification (*after Marinos and Hoek, 2001; ISRM 1981b*)

Grade		UCS (MPa)	Field Estimate (Description)
R6	extremely strong	> 250	can only be chipped by geological hammer
R5	very strong	100 - 250	requires many blows from geological hammer
R4	strong	50 - 100	requires more than one blow from geological hammer
R3	medium strong	25 - 50	can't be scraped, breaks under one blow from geological hammer
R2	weak	5 - 25	can be peeled / scraped with knife with difficulty
R1	very weak	1 - 5	easily scraped / peeled, crumbles under firm blow of geo. hammer
R0	extremely weak	< 1	indented by thumbnail

Bedding Thickness (*Q. J. Eng. Geology, Vol 3, 1970*)

Very thickly bedded	> 2 m
Thickly bedded	0.6 – 2m
Medium bedded	200 – 600mm
Thinly bedded	60 – 200mm
Very thinly bedded	20 – 60mm
Laminated	6 – 20mm
Thinly Laminated	< 6mm

GROUNDED ENGINEERING

Date Started : Mar 7, 2023
Position : E: 597841, N: 4797701 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 101

File No. : 22-282 **Project** : 2072 Lakeshore Road, Burlington, ON **Client** : Trinity Point

drill method : *LC rig*

hollow stem augers OD=215 mm

rock coring (HQ) OD=96 mm

elev depth (m)	description	graphic log	number	type	SPT N-value
82.6	**GROUND SURFACE**				
	50mm **ASPHALT**				
	FILL, sand, some gravel, trace to some silt, compact, brown, moist ...at 0.4 m, trace asphalt fragments		1	SS	18
			2	SS	24
			3	SS	26
			4	SS	22
79.6 3.0	...at 3.0 m, inferred concrete obstruction		5	SS	50 / 50mm
			6	SS	65 / 275mm
79.1 3.5	**CLAYEY SILT**, trace shale fragments, trace sand, trace gravel, hard, reddish brown, moist (GLACIAL TILL)				
	QUEENSTON FORMATION (See rock core log for details)		2	RUN	
			3	RUN	
			4	RUN	
			5	RUN	
			6	RUN	
			7	RUN	
			8	RUN	
			9	RUN	

depth scale (m): 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14

well details

elevation (m): 82 81 80 79 78 77 76 75 74 73 72 71 70 69 68

undrained shear strength (kPa)
○ unconfined ✚ field vane
● pocket penetrometer ■ Lab Vane
40 80 120 160

SPT N-values (bpf)
× dynamic cone
10 20 30 40

headspace vapour (ppm)
× hexane ☐ isobutylene
⊠ methane
100 200 300

moisture / plasticity
PL MC LL
10 20 30

5.0 m (Elev. 77.6 m): transition to sound bedrock

unstabilized water level

lab data and comments

grain size distribution (%) (MIT)
GR SA SI CL

SS3: BTEX, EC/SAR, H-Ms, Metals, ORPs, PAHs, pH, PHCs, VOCs

SS4: BTEX, EC/SAR, H-Ms, Metals, ORPs, PAHs, pH, PHCs, VOCs
3.0m: auger grinding and sampler bouncing with practical refusal, re-located borehole and re-drilled to depth, resumed sampling
3.3m: Run 1 encountered inferred caved materials overlapping with the SS6 interval

file: 22-282 - gint.gpj

Tech : CSH/MW | **PM** : NN | **Rev** : NN

(continued next page)

GROUNDED ENGINEERING

Date Started : Mar 7, 2023
Position : E: 597841, N: 4797701 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 101

File No. : 22-282 **Project** : 2072 Lakeshore Road, Burlington, ON **Client** : Trinity Point

drill method : LC rig

rock coring (HQ) OD=96 mm

elev depth (m)	description (continued)	graphic log	number	type	SPT N-value
	QUEENSTON FORMATION (See rock core log for details) *(continued)*		9	RUN	
			10	RUN	
			11	RUN	
			12	RUN	
			13	RUN	
			14	RUN	
			15	RUN	
			16	RUN	
			17	RUN	
54.8					
27.8	**END OF BOREHOLE**				

depth scale (m): 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27

well details

elevation (m): 67, 66, 65, 64, 63, 62, 61, 60, 59, 58, 57, 56, 55

undrained shear strength (kPa): unconfined, field vane, pocket penetrometer, Lab Vane; 40, 80, 120, 160

SPT N-values (bpf): dynamic cone; 10, 20, 30, 40

headspace vapour (ppm): hexane, isobutylene, methane; 100, 200, 300

moisture / plasticity: PL, MC, LL; 10, 20, 30

unstabilized water level

lab data and comments

grain size distribution (%) (MIT): GR SA SI CL

Contained drill water upon completion of drilling. Unstabilized water level and cave not measured.

50 mm dia. monitoring well installed.
No. 10 screen

GROUNDWATER LEVELS

date	depth (m)	elevation (m)
Mar 20, 2023	10.2	72.4
Apr 3, 2023	9.9	72.7
Jun 9, 2023	10.1	72.5

file: 22-282 - gint.gpj

Tech : CSH/MW | **PM** : NN | **Rev** : NN

GROUNDED ENGINEERING

Date Started : Mar 7, 2023
Position : E: 597841, N: 4797701 (UTM 17T)
Elev. Datum : Geodetic

ROCK CORE LOG 101

File No. : 22-282 **Project** : 2072 Lakeshore Road, Burlington, ON **Client** : Trinity Point

Rock coring started at 3.3m below grade — elev. depth (m) 79.3

CLAYEY SILT, trace shale fragments, trace sand, trace gravel, hard, reddish brown, moist (GLACIAL TILL)
3.3 — Run R1 — TCR = **0%** SCR = **0%** RQD = **0%**
3.5

QUEENSTON FORMATION
Shale, reddish brown, thinly bedded to medium bedded, weak; joints are horizontal, closed to gapped, clean, calcareous

Run R2 — TCR = **98%** SCR = **92%** RQD = **80%**
77.6

... at 5.0 m (Elev. 77.6 m), transition to sound rock

5.0 — Run R3 — TCR = **100%** SCR = **98%** RQD = **74%**
76.1

6.5 — Run R4 — TCR = **90%** SCR = **80%** RQD = **73%**
74.6

8.0 — Run R5 — TCR = **98%** SCR = **95%** RQD = **86%**
73.1

9.5 — Run R6 — TCR = **98%** SCR = **98%** RQD = **93%**
71.6

11.0 — Run R7 — TCR = **98%** SCR = **87%** RQD = **62%**
70.1

12.5 — Run R8 — TCR = **98%** SCR = **89%** RQD = **83%**
68.6

14.0 — Run R9 — TCR = **100%** SCR = **100%** RQD = **97%**
67.0

15.6 — Run R10 — TCR = **100%** SCR = **95%** RQD = **81%**
65.5

17.1 — Run R11 — TCR = **100%** SCR = **90%** RQD = **82%**

elevation (m)	natural fracture frequency	notes and comments
79	core loss	**3.3 / 79.3 - 3.5 / 79.1m:** inferred caved materials and subsequent core loss
	4	**3.5 / 79.1m:** observed weathered bedrock, with 25mm of rubblized core
	3	**3.8 / 78.8m:** 75mm of rubblized core
	1	
78	1	
	0	
	2	
	1	
77	3	**5.7 / 76.9 - 5.9 / 76.7m:** JT SV PR SU CN 125mm
	1	
	2	
76	4	
	1	
	3	**7.3 / 75.3m:** 25mm of rubblized core
75	4	**7.4 / 75.2m:** IS CI 63mm
	0	
	1	
74	2	
	2	
	1	
73	4	
	1	
	3	
	1	
72	2	
	1	
	0	
	0	**11.5 / 71.1m:** 50mm of rubblized core
71	7	**11.6 / 71.0m:** IS CI 38mm
	4	
	1	**12.3 / 70.3m:** 25mm of rubblized core
70	4	**12.5 / 70.1m:** JT D PR SU CN
	7	**12.9 / 69.7m:** 25mm of rubblized core
	3	
69	0	
	0	
	0	
68	0	
	1	
	2	
	0	
67	0	
	0	
	0	
66	0	**16.8 / 65.8m:** JT D PR SU CN; , with 150mm of rubblized core
	4	**17.0 / 65.6m:** JT D PR SU CN
	5	
65	0	
	1	**17.9 / 64.7m:** 38mm of rubblized core
	2	**18.2 / 64.4m:** JT D PR SU CN

(continued next page)
Tech : CSH/MW | **PM** : NN | **Rev** : NN

file: 22-282 - gint.gpj

GROUNDED ENGINEERING

Date Started : Mar 7, 2023
Position : E: 597841, N: 4797701 (UTM 17T)
Elev. Datum : Geodetic

ROCK CORE LOG 101

File No. : 22-282 **Project** : 2072 Lakeshore Road, Burlington, ON **Client** : Trinity Point

depth (m)	graphic log	stratigraphy	Run / elev. depth (m)	recovery
		QUEENSTON FORMATION	79.3	
		Shale, reddish brown, thinly bedded to medium bedded, weak; joints are horizontal, closed to gapped, clean, calcareous	R11 63.9	
19			18.7 R12 62.4	TCR = **100**% SCR = **100**% RQD = **100**%
20			20.2 R13 60.9	TCR = **99**% SCR = **98**% RQD = **85**%
21			21.7 R14 59.3	TCR = **100**% SCR = **100**% RQD = **94**%
22			23.3 R15 57.8	TCR = **100**% SCR = **95**% RQD = **87**%
23			24.8 R16 56.3	TCR = **100**% SCR = **100**% RQD = **100**%
24			26.3 R17 54.8	TCR = **100**% SCR = **96**% RQD = **87**%
25			27.9m	
26		**END OF COREHOLE**		
27				

shale weathering zones: Z1 | Z2 | Z3 | Z4

UCS (MPa) ● — 5 25 50 100 250

estimated strength: R1 | R2 | R3 | R4 | R5 | R6

elevation (m)	natural fracture frequency	laboratory testing	notes and comments
64	2		
	7		
	0		
63	0		
	0		
	0	**El. 62.4m**: UCS = 25.9 MPa E = 3.60 GPa ϒ = 25.9 kN/m³	
62	0		
	0		
	1		**21.2 / 61.4m:** JT D PR SU CN
61	3		
	0		
	0		
60	0		
	0	**El. 59.7m**: UCS = 46.6 MPa E = 9.50 GPa ϒ = 25.9 kN/m³	
	1		**23.3 / 59.3m:** JT D PR SU CN
59	0		
	1		
	2		
58	0		
	0		
	2		
57	0		
	0		
	0		
	0		
56	0		
	0		**26.8 / 55.8m:** calcareous, green-grey band
	3		**26.8 / 55.8m:** JT D PR SU CN
	2		**27.3 / 55.3m:** JT D PR SU CN
55	2		

file: 22-282 - gint.gpj

Tech : CSH/MW | **PM** : NN | **Rev** : NN

GROUNDED ENGINEERING

Date Started : Mar 9, 2023
Position : E: 597865, N: 4797712 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 102

File No. : 22-282 **Project** : 2072 Lakeshore Road, Burlington, ON **Client** : Trinity Point

drill method : LC rig

elev depth (m)	description	graphic log	number	type	SPT N-value
82.4	**GROUND SURFACE**				
	50mm **ASPHALT**		1	SS	18
	FILL, sand, some gravel, trace to some silt, moderate petroleum hydrocarbon odour, compact, brown, moist				
	...at 0.4 m, trace asphalt fragments		2	SS	15
	...at 1.5 m, dense		3A	SS	33
80.3 / 2.1	**CLAYEY SILT**, some gravel, trace sand, moderate petroleum hydrocarbon odour, hard, reddish brown, moist (GLACIAL TILL)		3B		
	...at 2.6 m, layer of silt and sand glacail till, some gravel, some clay, dense, reddish brown, moist		4	SS	30
79.2 / 3.2	**QUEENSTON FORMATION** (See rock core log for details)		5	SS	50 / 125mm
			1	RUN	
			2	RUN	
			3	RUN	
			4	RUN	
			5	RUN	
			6	RUN	
			7	RUN	
			8	RUN	
			9	RUN	

hollow stem augers OD=215 mm

rock coring (HQ) OD=96 mm

depth scale (m): 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14

well details

elevation (m): 82 81 80 79 78 77 76 75 74 73 72 71 70 69 68

undrained shear strength (kPa)
○ unconfined + field vane
● pocket penetrometer ■ Lab Vane
40 80 120 160

SPT N-values (bpf)
× dynamic cone
10 20 30 40

headspace vapour (ppm)
× hexane □ isobutylene
⊠ methane
100 200 300

moisture / plasticity
PL MC LL
10 20 30

4.2 m (Elev. 78.2 m): transition to sound bedrock

unstabilized water level

lab data and comments

grain size distribution (%) (MIT)
GR SA SI CL

SS2: BTEX, PAHs, PHCs, VOCs

3A: EC/SAR, H-Ms, Metals, ORPs, pH

12 37 40 11

SS4: BTEX, EC/SAR, H-Ms, Metals, ORPs, PAHs, pH, PHCs, VOCs

3.0m: auger grinding

RUN7: BTEX, H-Ms, Metals, ORPs, PAHs, pH, PHCs, VOCs

file: 22-282 - gint.gpj

Tech : CSH/MW | **PM** : NN | **Rev** : NN

(continued next page)

GROUNDED ENGINEERING

Date Started : Mar 9, 2023
Position : E: 597865, N: 4797712 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 102

File No. : 22-282 **Project** : 2072 Lakeshore Road, Burlington, ON **Client** : Trinity Point

drill method : *LC rig*
rock coring (HQ) OD=96 mm

elev depth (m)	description	graphic log	samples: number	samples: type	samples: SPT N-value
	(continued)				
	QUEENSTON FORMATION (See rock core log for details) *(continued)*		9	RUN	
			10	RUN	
			11	RUN	
			12	RUN	
			13	RUN	
			14	RUN	
			15	RUN	
			16	RUN	
56.1 26.3	**END OF BOREHOLE**				

depth scale (m): 15 16 17 18 19 20 21 22 23 24 25 26

well details

elevation (m): 67 66 65 64 63 62 61 60 59 58 57

undrained shear strength (kPa)
○ unconfined + field vane
● pocket penetrometer ■ Lab Vane
40 80 120 160

SPT N-values (bpf)
× dynamic cone
10 20 30 40

headspace vapour (ppm)
× hexane □ isobutylene
▣ methane
100 200 300

moisture / plasticity
PL MC LL
10 20 30

unstabilized water level

lab data and comments

grain size distribution (%) (MIT)
GR SA SI CL

Contained drill water upon completion of drilling. Unstabilized water level and cave not measured.

50 mm dia. monitoring well installed.
No. 10 screen

GROUNDWATER LEVELS

date	depth (m)	elevation (m)
Mar 20, 2023	dry	n/a
Apr 3, 2023	dry	n/a
May 5, 2023	dry	n/a
Jun 9, 2023	dry	n/a

file: 22-282 - gint.gpj

Tech : CSH/MW | **PM** : NN | **Rev** : NN

GROUNDED ENGINEERING

Date Started : Mar 9, 2023
Position : E: 597865, N: 4797712 (UTM 17T)
Elev. Datum : Geodetic

ROCK CORE LOG 102

File No. : 22-282 **Project** : 2072 Lakeshore Road, Burlington, ON **Client** : Trinity Point

Rock coring started at 2.9m below grade

CLAYEY SILT, some gravel, trace sand, moderate petroleum hydrocarbon odour, hard, reddish brown, moist (GLACIAL TILL)

QUEENSTON FORMATION
Shale, reddish brown, thinly bedded to medium bedded, weak; joints are horizontal, closed to gapped, clean, calcareous
... at 4.2 m (Elev. 78.2 m), transition to sound rock

Run	elev. depth (m)	recovery
	79.5	
R1	2.9	TCR = **88%** SCR = **55%** RQD = **40%**
	3.5	
R2		TCR = **100%** SCR = **88%** RQD = **63%**
	77.4	
R3	5.0	TCR = **100%** SCR = **92%** RQD = **54%**
	75.9	
R4	6.5	TCR = **100%** SCR = **85%** RQD = **58%**
	74.4	
R5	8.0	TCR = **100%** SCR = **87%** RQD = **63%**
	72.9	
R6	9.5	TCR = **99%** SCR = **99%** RQD = **99%**
	71.4	
R7	11.0	TCR = **100%** SCR = **90%** RQD = **51%**
	69.9	
R8	12.5	TCR = **100%** SCR = **100%** RQD = **83%**
	68.3	
R9	14.1	TCR = **99%** SCR = **99%** RQD = **88%**
	66.8	
R10	15.6	TCR = **100%** SCR = **98%** RQD = **87%**
	65.3	
R11	17.1	TCR = **100%** SCR = **97%** RQD = **76%**

shale weathering zones: Z1 Z2 Z3 Z4
UCS (MPa) / estimated strength: 5 25 50 100 250; R1 R2 R3 R4 R5 R6
natural fracture frequency: n/a, 0, 3, 3, 1, 0, 3, 3, 1, 3, 3, 4, 2, 1, 3, 4, 3, 5, 1, 5, 0, 1, 1, 2, 0, 0, 0, 0, 4, 2, 7, 5, 7, 0, 1, 0, 0, 0, 3, 0, 0, 0, 0, 1, 2, 7, 0, 3, 2, 1

laboratory testing

notes and comments

2.9 / 79.5 - 3.2 / 79.2m: recovered caved materials and native soil
3.2 / 79.2m: observed weathered bedrock
3.7 / 78.7m: 25mm of rubblized core
3.9 / 78.4m: JT SV PR SU CN 88mm
4.9 / 77.5m: JT SV PR SU CN 25mm
6.3 / 76.0m: 50mm of rubblized core
7.3 / 75.1m: 63mm of rubblized core
7.4 / 75.0m: 25mm of rubblized core
8.1 / 74.3m: 50mm of rubblized core
8.2 / 74.1m: 50mm of rubblized core
8.4 / 74.0m: JT SV PR SU CN 75mm
8.6 / 73.7m: 50mm of rubblized core
12.2 / 70.1m: 13mm of rubblized core
12.4 / 70.0m: 38mm of rubblized core

(continued next page)
Tech : CSH/MW | **PM** : NN | **Rev** : NN

file: 22-282 - gint.gpj

GROUNDED ENGINEERING

Date Started : Mar 9, 2023
Position : E: 597865, N: 4797712 (UTM 17T)
Elev. Datum : Geodetic

ROCK CORE LOG 102

File No. : 22-282 **Project** : 2072 Lakeshore Road, Burlington, ON **Client** : Trinity Point

depth (m)	graphic log	stratigraphy	Run elev depth (m)	recovery	elevation (m)	shale weathering zones Z1 Z2 Z3 Z4	UCS (MPa) 5 25 50 100 250 / estimated strength R1 R2 R3 R4 R5 R6	natural fracture frequency	laboratory testing	notes and comments	elevation (m)
18		**QUEENSTON FORMATION** **Shale**, reddish brown, thinly bedded to medium bedded, weak; joints are horizontal, closed to gapped, clean, calcareous	**79.5** R11 63.8	TCR = **100**% SCR = **97**% RQD = **76**%	64			6			64
			18.6 R12 62.2	TCR = **100**% SCR = **100**% RQD = **98**%	63			0 0 0 0 0 0			63
19											
20			20.2 R13 60.7	TCR = **99**% SCR = **94**% RQD = **88**%	62			2 0 0 1 0		**20.2 / 62.1m:** calcareous, green-grey band **20.9 / 61.5m:** calcareous, green-grey band	62
21											
22			21.7 R14 59.2	TCR = **100**% SCR = **100**% RQD = **100**%	61			4 0 0 0			61
23			23.2 R15 57.7	TCR = **99**% SCR = **99**% RQD = **99**%	60			0 1 0 0 1	**El. 59.4m**: UCS = 27.9 MPa E = 5.40 GPa γ = 26.0 kN/m^3		60
24					59						59
25			24.7 R16 56.1	TCR = **100**% SCR = **100**% RQD = **100**%	58			0 0 0 1 0			58
26			**26.3m**		57			1	**El. 56.3m**: UCS = 32.4 MPa E = 6.80 GPa γ = 25.8 kN/m^3		57
		END OF COREHOLE									

file: 22-282 - gint.gpj

Tech : CSH/MW | **PM** : NN | **Rev** : NN

GROUNDED ENGINEERING

Date Started : Mar 15, 2023
Position : E: 597887, N: 4797709 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 103

File No. : 22-282 **Project** : 2072 Lakeshore Road, Burlington, ON **Client** : Trinity Point

drill method : LC rig

hollow stem augers OD=215 mm

rock coring (HQ) OD=96 mm

elev depth (m)	description	graphic log	number	type	SPT N-value
82.3	**GROUND SURFACE**				
82.1 / 0.2	150mm **TOPSOIL**				
	FILL, sand, trace silt, trace rock fragments, trace rootlets, loose, blackish brown, moist		1	SS	5
81.5 / 0.8	**SAND**, some silt, trace gravel, loose to compact, brown, moist to wet		2	SS	6
80.3 / 2.0	**CLAYEY SILT**, trace sand, trace gravel, very stiff, reddish brown, moist (GLACIAL TILL)		3A	SS	11
			3B		
			4	SS	20
	...at 3.0 m, layer of sandy silt glacial till, some clay, some gravel, some shale fragments, hard, reddish brown, moist		5	SS	66 / 175mm
78.9 / 3.4			1	RUN	
	QUEENSTON FORMATION (See rock core log for details)		2	RUN	
			3	RUN	
			4	RUN	
			5	RUN	
			6	RUN	
			7	RUN	
			8	RUN	
			9	RUN	

depth scale (m): 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14

well details

elevation (m): 82 81 80 79 78 77 76 75 74 73 72 71 70 69 68

undrained shear strength (kPa)
○ unconfined + field vane
● pocket penetrometer ■ Lab Vane
40 80 120 160

SPT N-values (bpf)
× dynamic cone
10 20 30 40

headspace vapour (ppm)
× hexane □ isobutylene
⊠ methane
100 200 300

moisture / plasticity
PL MC LL
10 20 30

3.9 m (Elev. 78.4 m): transition to sound bedrock

unstabilized water level

lab data and comments

grain size distribution (%) (MIT)
GR SA SI CL

SS2: BTEX, PAHs, PHCs, VOCs

3A: EC/SAR, H-Ms, Metals, ORPs, pH

10 26 45 19

SS4: BTEX, EC/SAR, H-Ms, Metals, ORPs, PAHs, pH, PHCs, VOCs

(continued next page)

Tech : CSH | **PM** : NN | **Rev** : NN

file: 22-282 - gint.gpj

GROUNDED ENGINEERING

Date Started : Mar 15, 2023
Position : E: 597887, N: 4797709 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 103

File No. : 22-282 **Project** : 2072 Lakeshore Road, Burlington, ON **Client** : Trinity Point

drill method : LC rig

rock coring (HQ) OD=96 mm

elev depth (m)	description (continued)	graphic log	number	type	SPT N-value
	QUEENSTON FORMATION (See rock core log for details) *(continued)*		9	RUN	
			10	RUN	
			11	RUN	
			12	RUN	
			13	RUN	
			14	RUN	
			15	RUN	
			16	RUN	
			17	RUN	
54.4					
27.9	**END OF BOREHOLE**				

depth scale (m): 15 16 17 18 19 20 21 22 23 24 25 26 27

well details

elevation (m): 67 66 65 64 63 62 61 60 59 58 57 56 55

undrained shear strength (kPa)
○ unconfined + field vane
● pocket penetrometer ■ Lab Vane
40 80 120 160

SPT N-values (bpf)
× dynamic cone
10 20 30 40

headspace vapour (ppm)
× hexane □ isobutylene
▣ methane
100 200 300

moisture / plasticity
PL MC LL
10 20 30

unstabilized water level

lab data and comments

grain size distribution (%) (MIT)
GR SA SI CL

RUN12: BTEX, EC/SAR, H-Ms, Metals, ORPs, PAHs, pH, PHCs, VOCs

Borehole was filled with drill water upon completion of drilling.

50 mm dia. monitoring well installed.
No. 10 screen

GROUNDWATER LEVELS

date	depth (m)	elevation (m)
Mar 20, 2023	10.4	71.9
Apr 3, 2023	10.1	72.2
May 5, 2023	9.0	73.3
Jun 9, 2023	9.2	73.1

file: 22-282 - gint.gpj

Tech : CSH | **PM** : NN | **Rev** : NN

GROUNDED ENGINEERING

Date Started : Mar 15, 2023
Position : E: 597887, N: 4797709 (UTM 17T)
Elev. Datum : Geodetic

ROCK CORE LOG 103

File No. : 22-282 **Project** : 2072 Lakeshore Road, Burlington, ON **Client** : Trinity Point

Rock coring started at 3.0m below grade

CLAYEY SILT, trace sand, trace gravel, very stiff, reddish brown, moist
(GLACIAL TILL)

QUEENSTON FORMATION
Shale, reddish brown, thinly bedded to medium bedded, weak; joints are horizontal, closed to gapped, clean, calcareous
... at 3.9 m (Elev. 78.4 m), transition to sound rock

Run	elev. depth (m)	recovery
	79.3	
R1	3.0 – 3.6	TCR = **100%** SCR = **70%** RQD = **25%**
R2	3.6 – 77.2	TCR = **100%** SCR = **90%** RQD = **45%**
R3	5.1 – 75.7	TCR = **100%** SCR = **88%** RQD = **74%**
R4	6.6 – 74.2	TCR = **100%** SCR = **74%** RQD = **61%**
R5	8.1 – 72.6	TCR = **100%** SCR = **78%** RQD = **71%**
R6	9.7 – 71.0	TCR = **100%** SCR = **95%** RQD = **77%**
R7	11.3 – 69.6	TCR = **100%** SCR = **93%** RQD = **54%**
R8	12.7 – 68.1	TCR = **100%** SCR = **95%** RQD = **82%**
R9	14.2 – 66.6	TCR = **100%** SCR = **98%** RQD = **95%**
R10	15.7 – 65.1	TCR = **100%** SCR = **95%** RQD = **83%**
R11	17.2	TCR = **100%** SCR = **97%** RQD = **62%**

natural fracture frequency	notes and comments
core loss	**3.0 / 79.3 - 3.2 / 79.1m:** inferred caved materials and subsequent core loss
>10	**3.2 / 79.1 - 3.4 / 78.9m:** observed native soil
3	**3.4 / 78.9m:** observed weathered bedrock
2	
2	**4.1 / 78.2m:** JT SV UN R GA CN 50mm
2	**4.2 / 78.2m:** JT SV UN R GA CN 38mm
1	**4.7 / 77.6m:** JT SV UN R GA CN 88mm
3	**5.2 / 77.1m:** JT SV UN R GA CN 50mm
2	**5.3 / 77.1m:** JT SV IR R GA CN 25mm
1	
1	
5	**6.2 / 76.1m:** 38mm of rubblized core
5	**6.6 / 75.8m:** JT SV CU R T CN
9	**6.7 / 75.7m:** 113mm of rubblized core
4	**7.1 / 75.3m:** 50mm of rubblized core
>10	**7.4 / 74.9m:** 25mm of rubblized core
1	**7.9 / 74.4m:** 38mm of rubblized core
3	**8.1 / 74.2 - 8.3 / 74.0m:** IS CI 175mm; , with 25mm of rubblized core
3	**8.5 / 73.9m:** 75mm of rubblized core
6	**8.7 / 73.6m:** 50mm of rubblized core
3	
2	
4	**9.8 / 72.5m:** IS CI 50mm
1	
0	
4	
1	
0	
5	**11.6 / 70.7m:** 50mm of rubblized core
3	**11.7 / 70.7m:** JT D UN R GA CN
8	**11.8 / 70.5m:** JT D UN R GA CN
4	
7	
3	
0	
0	
0	
0	
3	
0	**14.8 / 67.5m:** JT SV ST R GA CN
0	
0	
1	
0	
1	
5	
1	
2	
4	**17.8 / 64.6m:** JT D UN R GA CN
1	

(continued next page)

Tech : CSH | **PM** : NN | **Rev** : NN

file: 22-282 - gint.gpj

GROUNDED ENGINEERING

Date Started : Mar 15, 2023
Position : E: 597887, N: 4797709 (UTM 17T)
Elev. Datum : Geodetic

ROCK CORE LOG 103

File No. : 22-282 **Project** : 2072 Lakeshore Road, Burlington, ON **Client** : Trinity Point

depth (m)	graphic log	stratigraphy	Run	elev depth (m)	recovery	elevation (m)	shale weathering zones	UCS (MPa) / estimated strength	natural fracture frequency	laboratory testing	notes and comments	elevation (m)
				79.3			Z1 Z2 Z3 Z4	5 25 50 100 250 R1 R2 R3 R4 R5 R6				
		QUEENSTON FORMATION **Shale**, reddish brown, thinly bedded to medium bedded, weak; joints are horizontal, closed to gapped, clean, calcareous	R11	63.5	TCR = **100**% SCR = **97**% RQD = **62**%	64			3			64
19				18.8					0			
			R12	62.0	TCR = **100**% SCR = **100**% RQD = **93**%	63			0 0 2 0 0			63
20				20.3		62			0 0		**20.4 / 61.9m:** calcareous, green-grey band	62
21			R13	60.6	TCR = **100**% SCR = **96**% RQD = **84**%				5		**21.0 / 61.3m:** 63mm of rubblized core	
				21.7		61			0 0 0			61
22			R14	59.0	TCR = **100**% SCR = **98**% RQD = **97**%	60			2 0 0			60
23				23.3		59			1 2			59
24			R15	57.5	TCR = **100**% SCR = **97**% RQD = **93**%	58			0 0 0 3			58
25				24.8		57			3 0			57
			R16	55.9	TCR = **100**% SCR = **100**% RQD = **100**%				0 0 0			
26				26.4		56			0 1	**El. 55.5m**: UCS = 28.6 MPa E = 6.60 GPa γ = 25.9 kN/m^3	**26.7 / 55.7m:** calcareous, green-grey band **26.7 / 55.6m:** JT D PR R GA CN	56
27			R17	54.4	TCR = **100**% SCR = **100**% RQD = **88**%	55			0 0 0			55
				27.9m								
		END OF COREHOLE										

file: 22-282 - gint.gpj

Tech : CSH | **PM** : NN | **Rev** : NN

BOREHOLE LOG 104

Date Started : Mar 6, 2023
Position : E: 597872, N: 4797741 (UTM 17T)
Elev. Datum : Geodetic

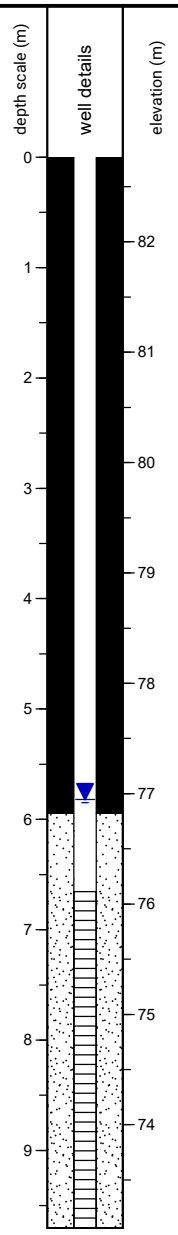
File No. : 22-282 **Project** : 2072 Lakeshore Road, Burlington, ON **Client** : Trinity Point

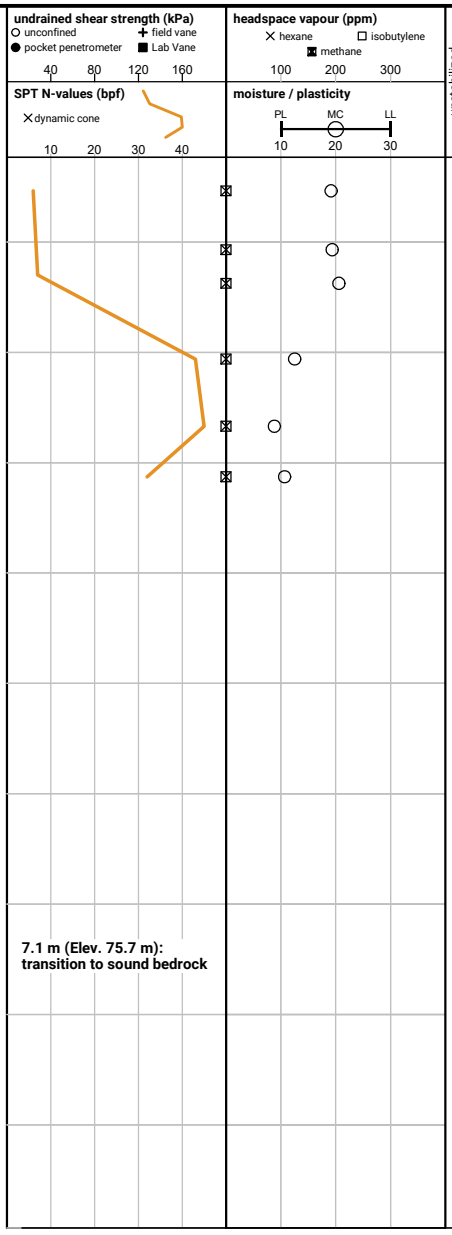
drill method : LC rig

elev depth (m)	description	graphic log	samples: number	samples: type	samples: SPT N-value
82.8	**GROUND SURFACE**				
	FILL, silt, some sand, some gravel, some rootlets, trace clay, trace topsoil inclusions, loose, brownish black, moist		1	SS	6
	...at 0.2 m, sand fill, some gravel, trace silt, brown with oxidation staining, moist to wet		2A		
	...at 0.9 m, no topsoil inclusions, mottled brownish grey		2B	SS	7
81.3					
1.5	**CLAYEY SILT**, sandy, trace gravel, hard, reddish brown, moist (GLACIAL TILL)		3	SS	43
			4	SS	45
			5	SS	32
	...at 3.0 m, sandy silt, clayey, trace gravel, trace shale fragments		1	RUN	
78.9					
3.9	**QUEENSTON FORMATION** (See rock core log for details)		2	RUN	
			3	RUN	
			4	RUN	
			5	RUN	
73.1					
9.7	**END OF BOREHOLE**				

hollow stem augers OD=215 mm

rock coring (HQ) OD=96 mm





unstabilized water level

lab data and comments

grain size distribution (%) (MIT)
GR SA SI CL

SS1: BTEX, EC/SAR, H-Ms, Metals, ORPs, PAHs, pH, PHCs, VOCs

SS3: BTEX, PAHs, PHCs, VOCs
1.8m: auger grinding
5 27 48 20

SS4: EC/SAR, H-Ms, Metals, ORPs, pH
2.6m: auger grinding with refusal, and Run 1 encountered inferred caved materials overlapping with the SS4 and SS5 intervals

Contained drill water upon completion of drilling. Unstabilized water level and cave not measured.

50 mm dia. monitoring well installed.
No. 10 screen

GROUNDWATER LEVELS

date	depth (m)	elevation (m)
Mar 20, 2023	5.4	77.4
Apr 3, 2023	5.5	77.3
May 5, 2023	5.7	77.1
Jun 9, 2023	5.8	77.0

file: 22-282 - gint.gpj

Tech : CSH/MW | **PM** : NN | **Rev** : NN

GROUNDED ENGINEERING

Date Started : Mar 6, 2023
Position : E: 597872, N: 4797741 (UTM 17T)
Elev. Datum : Geodetic

ROCK CORE LOG 104

File No. : 22-282 **Project** : 2072 Lakeshore Road, Burlington, ON **Client** : Trinity Point

depth (m)	stratigraphy	Run elev / depth (m)	recovery	elevation (m)	shale weathering zones (Z1 Z2 Z3 Z4)	UCS (MPa) 5 25 50 100 250 / estimated strength (R1 R2 R3 R4 R5 R6)	natural fracture frequency	laboratory testing	notes and comments	elevation (m)
	Rock coring started at 2.5m below grade	**80.3**								
3	**CLAYEY SILT**, sandy, trace gravel, hard, reddish brown, moist (GLACIAL TILL)	2.5 R1 79.3	TCR = **69%** SCR = **0%** RQD = **0%**	80			n/a		**2.5 / 80.3 - 3.2 / 79.6m:** inferred caved materials	80
							n/a		**3.2 / 79.6 - 3.9 / 78.9m:** recovered native soil	
4	**QUEENSTON FORMATION** **Shale**, reddish brown, thinly bedded to medium bedded, weak; joints are horizontal, closed to gapped, clean, calcareous	3.5 R2 77.8	TCR = **98%** SCR = **64%** RQD = **8%**	79			n/a		**3.9 / 78.9m:** observed weathered bedrock	79
							>10		**4.2 / 78.6m:** 75mm of rubblized core	
							>10		**4.4 / 78.4m:** 50mm of rubblized core	
5		5.0 R3 76.2	TCR = **100%** SCR = **98%** RQD = **92%**	78			4			78
							6			
							4			
6							3		**5.5 / 77.3m:** JT SV PR R GA CN 50mm	
				77			3			77
							6			
7	**... at 7.1 m (Elev. 75.7 m), transition to sound rock**	6.6 R4 74.6	TCR = **100%** SCR = **95%** RQD = **52%**				5		**6.4 / 76.4m:** 75mm of rubblized core	
				76			4		**6.7 / 76.1m:** JT SV IR R T CN 25mm	76
							2		**6.7 / 76.0m:** 25mm of rubblized core	
							1			
8				75			3		**7.6 / 75.1m:** JT SV IR R T CN 25mm	75
							2			
		8.2 R5 73.1	TCR = **100%** SCR = **100%** RQD = **100%**				1			
9				74			1			74
							0			
							1			
							1			
							0			
		9.7m								
	END OF COREHOLE									

file: 22-282 - gint.gpj

Tech : CSH/MW | **PM** : NN | **Rev** : NN

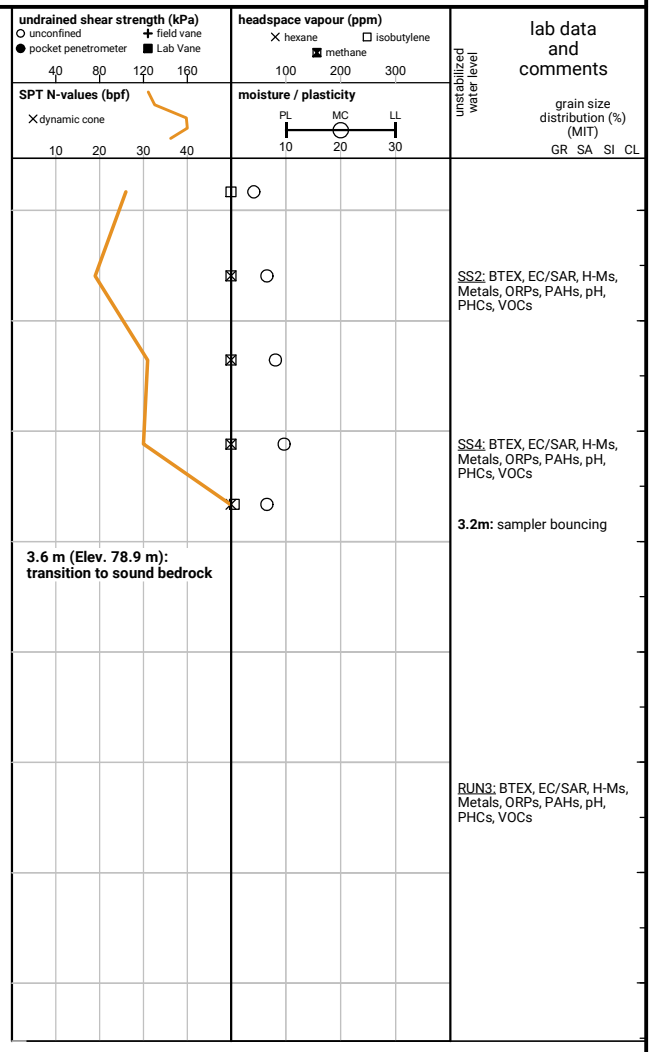
GROUNDED ENGINEERING

Date Started : Mar 14, 2023
Position : E: 597849, N: 4797707 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 105

File No. : 22-282 **Project** : 2072 Lakeshore Road, Burlington, ON **Client** : Trinity Point

drill method : LC rig	elev depth (m)	description	graphic log	samples: number	samples: type	samples: SPT N-value
	82.5	**GROUND SURFACE**				
hollow stem augers OD=215 mm		50mm **ASPHALT**		1	SS	26
		FILL, gravelly sand, trace to some silt, faint petroleum hydrocarbon odour, compact to dense, brownish grey, moist		2	SS	19
				3	SS	31
	80.2 2.3	**CLAYEY SILT**, some gravel, trace sand, hard, brownish red, moist (GLACIAL TILL)		4	SS	30
	79.3 3.2	...at 3.1 m, some shale fragments, faint petroleum hydrocarbon odour		5	SS	50 / 25mm
rock coring (HQ) OD=96 mm		**QUEENSTON FORMATION** (See rock core log for details)		1	RUN	
				2	RUN	
				3	RUN	
				4	RUN	
	74.5 8.0	**END OF BOREHOLE**				



Water level and cave not measured upon completion of drilling.

50 mm dia. monitoring well installed.
No. 10 screen

GROUNDWATER LEVELS

date	depth (m)	elevation (m)
Mar 20, 2023	dry	n/a
Apr 3, 2023	dry	n/a
May 5, 2023	dry	n/a
Jun 9, 2023	dry	n/a

file: 22-282 - gint.gpj

Tech : CSH/MW | **PM** : NN | **Rev** : NN

GROUNDED ENGINEERING

Date Started : Mar 14, 2023
Position : E: 597849, N: 4797707 (UTM 17T)
Elev. Datum : Geodetic

ROCK CORE LOG 105

File No. : 22-282 **Project** : 2072 Lakeshore Road, Burlington, ON **Client** : Trinity Point

depth (m)	graphic log	stratigraphy	Run elev depth (m)	recovery	elevation (m)	shale weathering zones Z1 Z2 Z3 Z4	UCS (MPa) 5 25 50 100 250 estimated strength R1 R2 R3 R4 R5 R6	natural fracture frequency	laboratory testing	notes and comments	elevation (m)
		Rock coring started at 3.2m below grade	**79.3**								
		QUEENSTON FORMATION **Shale**, reddish brown, thinly bedded to medium bedded, weak; joints are horizontal, closed to gapped, clean, calcareous **... at 3.6 m (Elev. 78.9 m), transition to sound rock**	3.2 R1 3.5	TCR = **100%** SCR = **100%** RQD = **63%**				2			
4			R2 77.6	TCR = **100%** SCR = **100%** RQD = **95%**	79			2 2 0 0		**3.6 / 78.9m:** JT D PR S GA CN	79
5			4.9 R3 76.0	TCR = **84%** SCR = **98%** RQD = **84%**	78			1 4 1 0		**4.7 / 77.8m:** JT SV PR S T CN 50mm	78
6			6.5 R4 74.5	TCR = **97%** SCR = **85%** RQD = **60%**	77			1 2 3 1		**6.3 / 76.2m:** JT SV PR R T CN 25mm	77
7					76			4 4 7		**7.3 / 75.1m:** JT SV IR R T CN 25mm **7.6 / 74.9m:** 38mm of rubblized core **7.8 / 74.7 - 7.9 / 74.6m:** 125mm of rubblized core	76
8		**END OF COREHOLE**	**8.0m**		75						75

file: 22-282 - gint.gpj

Tech : CSH/MW | **PM** : NN | **Rev** : NN

BOREHOLE LOG 106

Date Started : Mar 13, 2023
Position : E: 597852, N: 4797695 (UTM 17T)
Elev. Datum : Geodetic

File No. : 22-282 **Project** : 2072 Lakeshore Road, Burlington, ON **Client** : Trinity Point

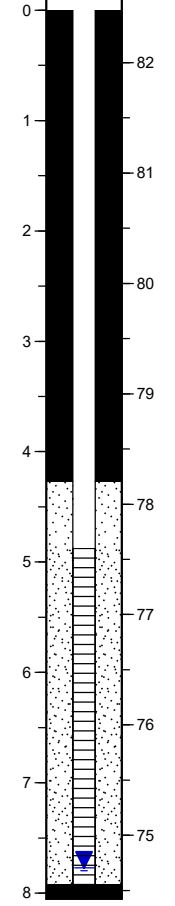
drill method : *LC rig*

elev depth (m)	description	graphic log	number	type	SPT N-value
82.5	**GROUND SURFACE**				
	40mm **ASPHALT**				
	FILL, sand, some gravel, trace to some silt, moderate petroleum hydrocarbon odour, compact to dense, brown, moist		1	SS	22
			2	SS	22
			3	SS	31
80.2 / 2.3	**CLAYEY SILT**, some gravel, trace sand, trace shale fragments, very stiff to hard, brownish red, moist (GLACIAL TILL)		4	SS	29
			5	SS	50 / 125mm
79.2 / 3.3	...at 3.2 m, layer of gravelly sand, trace silt, moderate petroleum hydrocarbon odour, very dense, grey, wet		1	RUN	
	QUEENSTON FORMATION (See rock core log for details)		2	RUN	
			3	RUN	
			4	RUN	
74.4 / 8.1	**END OF BOREHOLE**				

hollow stem augers OD=215 mm

rock coring (HQ) OD=96 mm

depth scale (m) / well details / elevation (m)

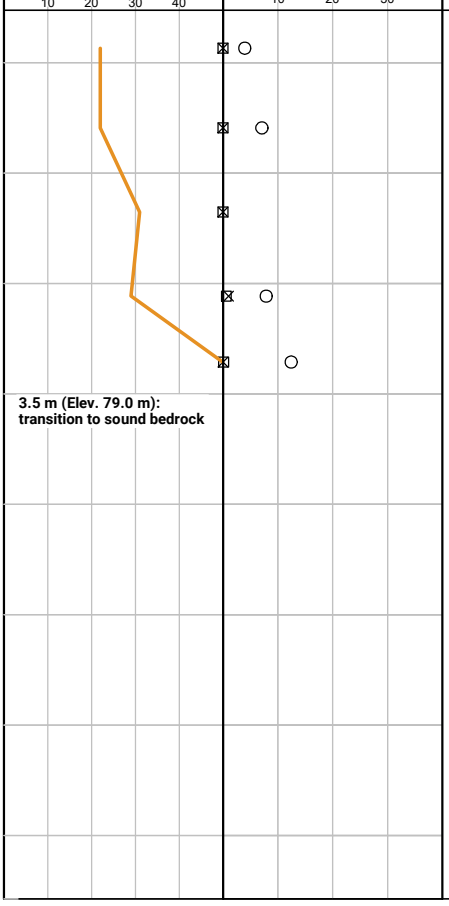


undrained shear strength (kPa)
○ unconfined + field vane
● pocket penetrometer ■ Lab Vane
40 80 120 160

SPT N-values (bpf)
× dynamic cone
10 20 30 40

headspace vapour (ppm)
× hexane □ isobutylene
⊠ methane
100 200 300

moisture / plasticity
PL MC LL
10 20 30



3.5 m (Elev. 79.0 m): transition to sound bedrock

unstabilized water level

lab data and comments

grain size distribution (%) (MIT)
GR SA SI CL

SS3: BTEX, EC/SAR, H-Ms, Metals, ORPs, PAHs, pH, PHCs, VOCs

2.4m: auger grinding

SS4: BTEX, EC/SAR, H-Ms, Metals, ORPs, PAHs, pH, PHCs, VOCs
2.9m: auger grinding
3.0m: Run 1 encountered inferred caved materials overlapping with the SS5 interval

Contained drill water upon completion of drilling. Unstabilized water level and cave not measured.

50 mm dia. monitoring well installed.
No. 10 screen

GROUNDWATER LEVELS

date	depth (m)	elevation (m)
Mar 20, 2023	7.8	74.7
Apr 3, 2023	7.8	74.7
May 5, 2023	7.8	74.7
Jun 9, 2023	7.8	74.7

file: 22-282 - gint.gpj

Tech : CSH/MW | **PM** : NN | **Rev** : NN

GROUNDED ENGINEERING

Date Started : Mar 13, 2023
Position : E: 597852, N: 4797695 (UTM 17T)
Elev. Datum : Geodetic

ROCK CORE LOG 106

File No. : 22-282 **Project** : 2072 Lakeshore Road, Burlington, ON **Client** : Trinity Point

depth (m)	graphic log	stratigraphy	Run / elev. depth (m)	recovery	elevation (m)	shale weathering zones (Z1 Z2 Z3 Z4)	UCS (MPa) 5 25 50 100 250 / estimated strength (R1 R2 R3 R4 R5 R6)	natural fracture frequency	laboratory testing	notes and comments	elevation (m)
		Rock coring started at 3.0m below grade	**79.5**								
		CLAYEY SILT, some gravel, trace sand, trace shale fragments, very stiff to hard, brownish red, moist (GLACIAL TILL)	3.0 R1	TCR = **100%** SCR = **16%** RQD = **0%**				n/a		**3.0 / 79.4 - 3.4 / 79.1m:** inferred caved materials	
			3.5		79			1		**3.4 / 79.1m:** observed weathered bedrock	79
4		**QUEENSTON FORMATION** **Shale**, reddish brown, thinly bedded to medium bedded, weak; joints are horizontal, closed to gapped, clean, calcareous **... at 3.5 m (Elev. 79.0 m), transition to sound rock**	R2	TCR = **100%** SCR = **100%** RQD = **58%**				1			
								4			
								4		**4.3 / 78.2m:** JT D PR R GA OX	
					78			2		**4.3 / 78.1m:** JT D PR R GA OX	78
			77.5					1			
5			5.0					0			
			R3	TCR = **100%** SCR = **97%** RQD = **85%**	77			1			77
								3			
6								0			
								2			
			76.0		76			4			76
			6.5					0			
7			R4	TCR = **100%** SCR = **88%** RQD = **70%**				2			
					75			4		**7.5 / 75.0m:** IS Cl 38mm	75
								>10		**7.5 / 74.9m:** 38mm of rubblized core	
8			74.4							**7.7 / 74.7m:** 50mm of rubblized core	
			8.1m							**7.9 / 74.6m:** JT SV IR R T CN	
		END OF COREHOLE									

file: 22-282 - gint.gpj

Tech : CSH/MW | **PM** : NN | **Rev** : NN

GROUNDED ENGINEERING

Date Started : Mar 13, 2023
Position : E: 597857, N: 4797703 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 107

File No. : 22-282 **Project** : 2072 Lakeshore Road, Burlington, ON **Client** : Trinity Point

drill method : *LC rig*

elev depth (m)	description	graphic log	samples: number	samples: type	samples: SPT N-value
82.3	**GROUND SURFACE**				
	65mm **ASPHALT**				
	FILL, sand, some gravel, trace silt, faint petroleum hydrocarbon odour, compact to dense, brown, moist		1	SS	28
			2	SS	19
			3	SS	33
80.0					
2.3	**CLAYEY SILT**, some gravel, trace sand, trace shale fragments, hard, reddish brown, moist (GLACIAL TILL)		4	SS	33
79.1			5	SS	50 / 150mm
3.2	**QUEENSTON FORMATION** (See rock core log for details)		1	RUN	
			2	RUN	
			3	RUN	
			4	RUN	
			5	RUN	
72.8					
9.5					

hollow stem augers OD=215 mm

rock coring (HQ) OD=96 mm

depth scale (m): 0 1 2 3 4 5 6 7 8 9

well details

elevation (m): 82 81 80 79 78 77 76 75 74 73

undrained shear strength (kPa)
○ unconfined + field vane
● pocket penetrometer ■ Lab Vane
40 80 120 160

SPT N-values (bpf)
× dynamic cone
10 20 30 40

headspace vapour (ppm)
× hexane □ isobutylene
▣ methane
100 200 300

moisture / plasticity
PL MC LL
10 20 30

3.6 m (Elev. 78.7 m): transition to sound bedrock

unstabilized water level

lab data and comments

grain size distribution (%) (MIT)
GR SA SI CL

SS3: BTEX, EC/SAR, H-Ms, Metals, ORPs, PAHs, pH, PHCs, VOCs

2.4m: auger grinding

SS4: BTEX, EC/SAR, H-Ms, Metals, ORPs, PAHs, pH, PHCs, VOCs
3.0m: sampler bouncing
3.1m: Run 1 encountered inferred caved materials overlapping with the SS5 interval

END OF BOREHOLE

Water level and cave not measured upon completion of drilling.

50 mm dia. monitoring well installed.
No. 10 screen

GROUNDWATER LEVELS

date	depth (m)	elevation (m)
Mar 20, 2023	8.9	73.4
Apr 3, 2023	8.7	73.6
May 5, 2023	8.6	73.7
Jun 9, 2023	8.7	73.6

file: 22-282 - gint.gpj

Tech : CSH/MW | **PM** : NN | **Rev** : NN

GROUNDED ENGINEERING

Date Started : Mar 13, 2023
Position : E: 597857, N: 4797703 (UTM 17T)
Elev. Datum : Geodetic

ROCK CORE LOG 107

File No. : 22-282 **Project** : 2072 Lakeshore Road, Burlington, ON **Client** : Trinity Point

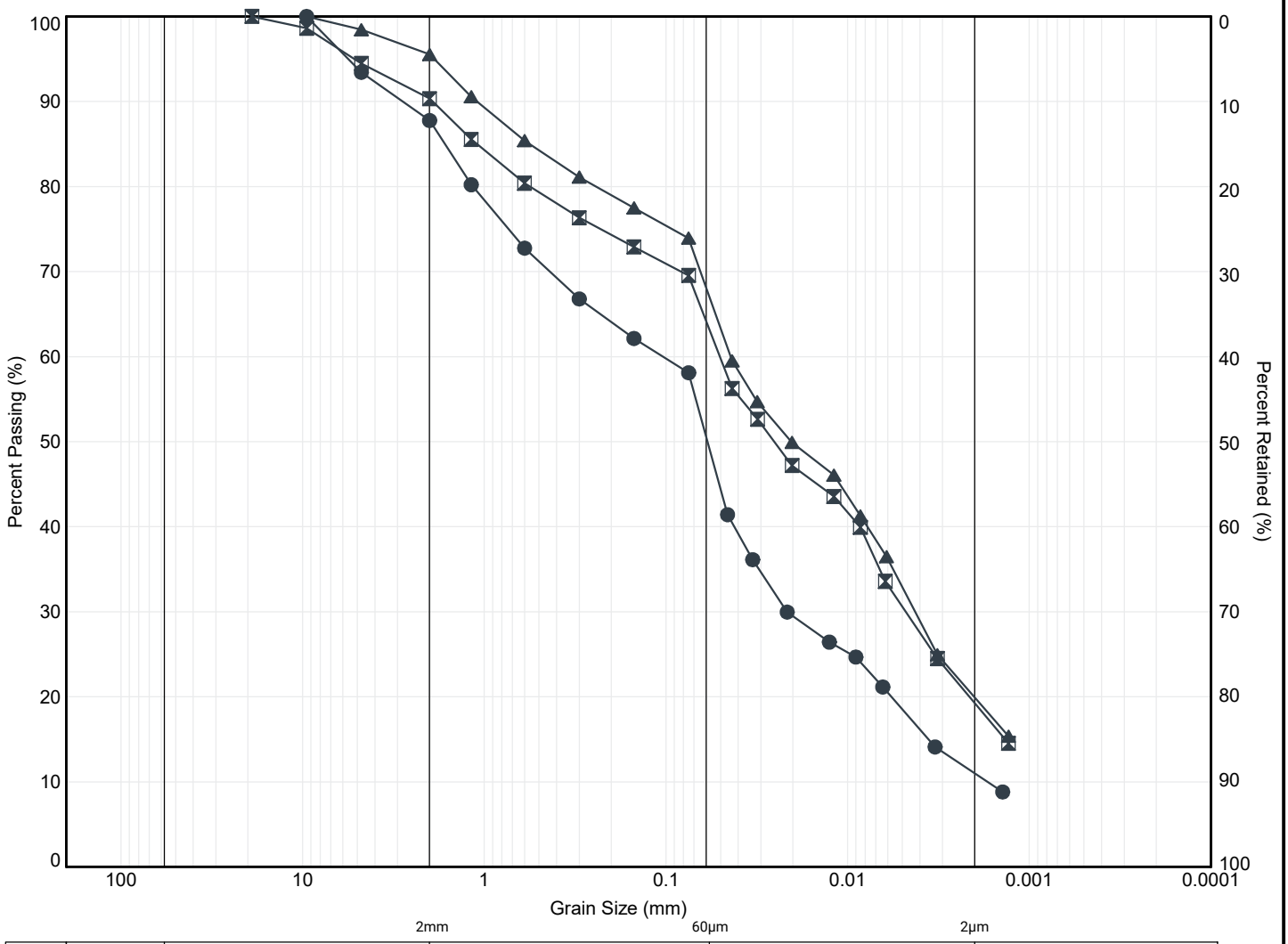
Rock coring started at 3.1m below grade

depth (m)	stratigraphy	Run	elev depth (m)	recovery	elevation (m)	shale weathering zones	UCS (MPa) / estimated strength	natural fracture frequency	laboratory testing	notes and comments	elevation (m)
			79.2								
	CLAYEY SILT, some gravel, trace sand, trace shale fragments, hard, reddish brown, moist (GLACIAL TILL)	R1	3.1	TCR = **100**% SCR = **100**% RQD = **71**%				n/a		**3.1 / 79.2 - 3.2 / 79.1m:** inferred caved materials	
			3.5		79			7		**3.2 / 79.1m:** observed weathered bedrock	79
	QUEENSTON FORMATION **Shale**, reddish brown, thinly bedded to medium bedded, weak; joints are horizontal, closed to gapped, clean, calcareous **... at 3.6 m (Elev. 78.7 m), transition to sound rock**	R2		TCR = **100**% SCR = **93**% RQD = **67**%				4			
4								5		**3.9 / 78.4m:** 25mm of rubblized core	
					78			3			78
								2			
			77.3					1		**4.7 / 77.6m:** JT SV UN R GA OX 38mm	
5			5.0					1			
					77			2			77
		R3		TCR = **100**% SCR = **93**% RQD = **85**%				1			
								3		**6.0 / 76.3m:** 50mm of rubblized core	
6			75.8		76			2		**6.3 / 76.0 - 6.4 / 75.9m:** JT SV PR R T CN 100mm	76
			6.5					4		**6.6 / 75.8m:** JT D PR R T CN	
								1			
		R4		TCR = **100**% SCR = **90**% RQD = **47**%				3			
7					75			7		**7.3 / 75.1 - 7.4 / 74.9m:** 125mm of rubblized core	75
								5		**7.5 / 74.8m:** 63mm of rubblized core	
			74.3					0			
8			8.0					6			
					74			1		**8.4 / 73.9m:** JT SV UN R T CN 50mm	74
		R5		TCR = **100**% SCR = **92**% RQD = **80**%				6		**8.5 / 73.9m:** 25mm of rubblized core	
								1		**8.9 / 73.5m:** IS Cl; , with 12mm of rubblized core	
9			72.8		73			0			73
			9.5m								

END OF COREHOLE

APPENDIX B





MIT SYSTEM	COBBLES	GRAVEL			SAND			SILT	CLAY
		COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE		

MIT SYSTEM

	Borehole	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
●	**102**	SS4	2.6	79.8	12	37	40	11
⊠	**103**	SS4	2.6	79.8	10	26	45	19
▲	**104**	SS4	2.6	80.2	5	27	48	20

GROUNDED ENGINEERING

Title: **GRAIN SIZE DISTRIBUTION GLACIAL TILL**

File No.: **22-282**

file: 22-282 - gint.gpj

APPENDIX C



BOREHOLE 101

Borehole 101 – Box 1 – Runs 1, 2 and 3



Depth: 3.3 to 6.5 m below grade (Elev. 79.3 to 76.1 m)

Borehole 101 – Box 2 – Runs 4 and 5



Depth: 6.5 to 9.5 m below grade (Elev. 76.1 to 73.1 m)

Borehole 101 – Box 3 – Runs 6 and 7



Depth: 9.5 to 12.5 m below grade (Elev. 73.1 to 70.1 m)

Borehole 101 – Box 4 – Runs 8 and 9



Depth: 12.5 to 15.6 m below grade (Elev. 70.1 to 67.0 m)

Borehole 101 – Box 5 – Runs 10 and 11



Depth: 15.6 to 18.7 m below grade (Elev. 67.0 to 63.9 m)

Borehole 101 – Box 6 – Runs 12 and 13



Depth: 18.7 to 21.7 m below grade (Elev. 63.9 to 60.9 m)

Borehole 101 – Box 7 – Runs 14 and 15



Depth: 21.7 to 24.8 m below grade (Elev. 60.9 to 57.8 m)

Borehole 101 – Box 8 – Runs 16 and 17



Depth: 24.8 to 27.8 m below grade (Elev. 57.8 to 54.8 m)

BOREHOLE 102

Borehole 102 – Box 1 – Runs 1, 2 and 3



Depth: 2.9 to 5.8 m below grade (Elev. 79.5 to 76.6 m)

Borehole 102 – Box 2 – Runs 3, 4 and 5



Depth: 5.8 to 8.5 m below grade (Elev. 76.6 to 73.9 m)

Borehole 102 – Box 3 – Runs 5 and 6



Depth: 8.5 to 11.0 m below grade (Elev. 73.9 to 71.4 m)

Borehole 102 – Box 4 – Runs 7 and 8



Depth: 11.0 to 14.1 m below grade (Elev. 71.4 to 68.3 m)

Borehole 102 – Box 5 – Runs 9 and 10



Depth: 14.1 to 17.1 m below grade (Elev. 68.3 to 65.3 m)

Borehole 102 – Box 6 – Runs 11 and 12



Depth: 17.1 to 20.2 m below grade (Elev. 65.3 to 62.2 m)

Borehole 102 – Box 7 – Runs 13 and 14



Depth: 20.2 to 23.2 m below grade (Elev. 62.2 to 59.2 m)

Borehole 102 – Box 8 – Runs 15 and 16



Depth: 23.2 to 26.3 m below grade (Elev. 59.2 to 56.1 m)

BOREHOLE 103

Borehole 103 – Box 1 – Runs 1, 2 and 3



Depth: 3.0 to 6.0 m below grade (Elev. 79.3 to 76.3 m)

Borehole 103 – Box 2 – Runs 3, 4 and 5



Depth: 6.0 to 8.7 m below grade (Elev. 76.3 to 73.6 m)

Borehole 103 – Box 3 – Runs 5 and 6



Depth: 8.7 to 11.3 m below grade (Elev. 73.6 to 71.0 m)

Borehole 103 – Box 4 – Runs 7 and 8



Depth: 11.3 to 14.2 m below grade (Elev. 71.0 to 68.1 m)

Borehole 103 – Box 5 – Runs 9 and 10



Depth: 14.2 to 17.2 m below grade (Elev. 68.1 to 65.1 m)

Borehole 103 – Box 6 – Runs 11 and 12



Depth: 17.2 to 20.3 m below grade (Elev. 65.1 to 62.0 m)

Borehole 103 – Box 7 – Runs 13 and 14



Depth: 20.3 to 23.3 m below grade (Elev. 62.0 to 59.0 m)

Borehole 103 – Box 8 – Runs 15 and 16



Depth: 23.3 to 26.4 m below grade (Elev. 59.0 to 55.9 m)

Borehole 103 – Box 9 – Run 17



Depth: 26.4 to 27.9 m below grade (Elev. 55.9 to 54.4 m)

BOREHOLE 104

Borehole 104 – Box 1 – Runs 1, 2 and 3



Depth: 2.5 to 5.7 m below grade (Elev. 80.3 to 77.1 m)

Borehole 105 – Box 2 – Runs 3, 4 and 5



Depth: 5.7 to 8.6 m below grade (Elev. 77.1 to 74.2 m)

Borehole 105 – Box 3 – Run 5



Depth: 8.6 to 9.7 m below grade (Elev. 74.2 to 73.1 m)

BOREHOLE 105

Borehole 105 – Box 1– Runs 1, 2 and 3



Depth: 3.2 to 5.9 m below grade (Elev. 79.3 to 76.6 m)

Borehole 105 – Box 2 – Runs 3 and 4



Depth: 5.9 to 8.0 m below grade (Elev. 76.6 to 74.5 m)

BOREHOLE 106

Borehole 106 – Box 1 – Runs 1, 2 and 3



Depth: 3.0 to 6.0 m below grade (Elev. 79.5 to 76.5 m)

Borehole 106 – Box 2 – Runs 3 and 4



Depth: 6.0 to 8.1 m below grade (Elev. 76.5 to 74.4 m)

BOREHOLE 107

Borehole 107 – Box 1 – Runs 1, 2 and 3



Depth: 3.1 to 6.0 m below grade (Elev. 79.2 to 76.3 m)

Borehole 107 – Box 2 – Runs 3, 4 and 5



Depth: 6.0 to 8.9 m below grade (Elev. 76.3 to 73.4 m)

Borehole 107 – Box 3 – Run 5



Depth: 8.9 to 9.5 m below grade (Elev. 73.4 to 72.8 m)

Geomechanica Inc.
Unit 14 – 1240 Speers Rd.
Oakville Ontario
Canada L6L 2X4

March 30, 2023

Mr. Nick Ng
Grounded Engineering
1 Banigan Drive
Toronto, ON
Canada, M4H 1E9

Re: UCS Testing
(Grounded Project No. 22-282)

Dear Mr. Ng:

On March 15th and and March 21st, 2023, four (4) HQ-sized core samples and one (1) HQ-sized core sample were received by Geomechanica Inc. via drop-off by Grounded personnel, respectively. These samples were identified as being from Grounded project 22-282. From these samples, five (5) Uniaxial Compressive Strength (UCS) test specimens were prepared and tested.

Details regarding the steps of specimen preparation and testing along with the test results are presented in the accompanying laboratory report and summary spreadsheet.

Sincerely,



Bryan Tatone Ph.D., P. Eng.

Geomechanica Inc.
Tel: (647) 478-9767
Email: bryan.tatone@geomechanica.com

GEOMECHANICA

Rock Laboratory Testing Results

A report submitted to:

NIck Ng
Grounded Engineering Inc.
1 Banigan Drive
Toronto, Ontario
Canada, M4H 1G3

Prepared by:

Bryan Tatone, PhD, PEng

Omid Mahabadi, PhD, PEng
Geomechanica Inc.
#900-390 Bay St.
Toronto ON
M5H 2Y2 Canada
Tel: +1-647-478-9767
lab@geomechanica.com

March 30, 2023
Project number: 22-282

Abstract

This document summarizes the results of rock laboratory testing, including 5 Uniaxial Compressive Strength (UCS) tests. The UCS and Young's modulus values along with photographs of specimens before and after testing are presented herein.

In this document:

1 Uniaxial Compressive Strength Tests 1
Appendices 4

Disclaimer: This report was prepared by Geomechanica Inc. for Grounded Engineering Inc.. The material herein reflects Geomechanica Inc.'s best judgment given the information available at the time of preparation. Any use which a third party makes of this report, any reliance on or decision to be made based on it, are the responsibility of such third parties. Geomechanica Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

1 Uniaxial Compressive Strength Tests

1.1 Overview

This section summarizes the results of uniaxial compressive strength (UCS) testing. The testing was performed in Geomechanica's rock testing laboratory using a 150 ton (1.3 MN) Forney loading frame equipped with pressure-compensated control valve to maintain an axial displacement rate of approximately 0.15 mm/min (Figure 1). The preparation and testing procedure for each specimen included the following:

1. Unwrapping the core sample, inspecting it for damage, and re-wrapping it in electrical tape to minimize exposure to moisture during subsequent specimen preparation.
2. Diamond cutting the core sample to obtain a cylindrical specimen with an appropriate length (length:diameter = 2:1) and nearly parallel end faces.
3. Diamond grinding of the specimen to obtain flat (within ± 0.025 mm) and parallel end faces (within 0.25°).
4. Placing the specimen into the loading frame, applying a 1 kN axial load, and removing the electrical tape.
5. Axially loading the specimen to rupture while continuously recording axial force and axial deformation to determine the peak strength (UCS) and tangent Young's modulus.



Figure 1: Forney loading frame setup for UCS testing.

Using a precision V-block mounted on the magnetic chuck of the surface grinder, test specimens met the end flatness, end parallelism, and perpendicularity criteria set out in ASTM D4543-19. The side straightness

criteria, as checked with a feeler gauge, was met for all specimens. The length to diameter ratio was not met for several specimens due to the short sample lengths provided (as noted in Table 1). Testing of the specimens followed ASTM D7012-14 with the following note:

- Testing included measurement of the UCS and elastic modulus, but not the Poisson's ratio. This represents a hybrid between Methods C and D of ASTM D7012-14.

1.2 Results

The results of UCS testing are summarized in Table 1. The corresponding stress-strain curves are presented in Figure 2. The Young's modulus is the tangent modulus calculated as the slope of the best-fit line through a selection of data points defining the stress-strain curve at 50% of the UCS strength. The stress ranges used to establish the best-fit lines along with additional specimen details and measurements are provided in the summary spreadsheet that accompanies this report.

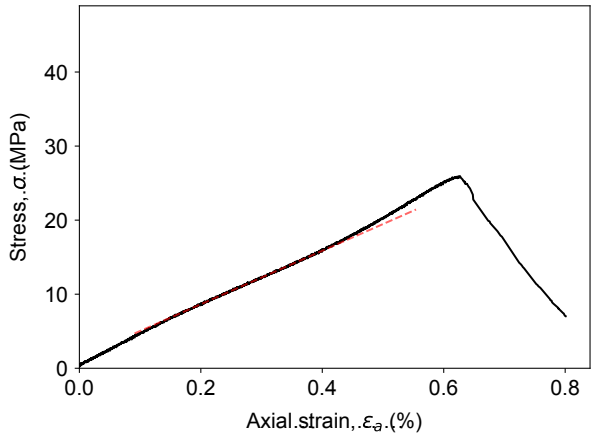
Table 1: Summary of Uniaxial Compression test results.

Sample	Depth (ft' in")	Bulk density ρ (g/cm^3)	UCS (MPa)	Young's modulus E (GPa)	Lithology	Failure description
BH101, RC1	66'3" - 67'2.5"	2.637	25.9	3.6	Red Shale	1
BH101, RC2	75'2" - 76'1"	2.640	46.6	9.5	Red Shale and Limestone	3, 1
BH102, RC3	75'6" - 76'1"	2.648	27.9	5.4	Red Shale	1
BH102, RC4	85'5.5" - 86'2"	2.634	32.4	6.8	Red Shale	3
BH103, RC5	87'11.75" - 88'9.5"	2.643	28.6	6.6	Red Shale and Limestone	4

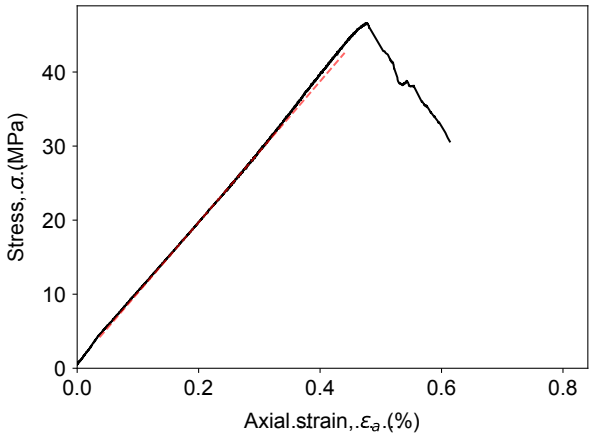
[1] Failure localized in softer shale layer
[3] Axial splitting failure
[4] Inclined shear failure

1.3 Specimen photographs

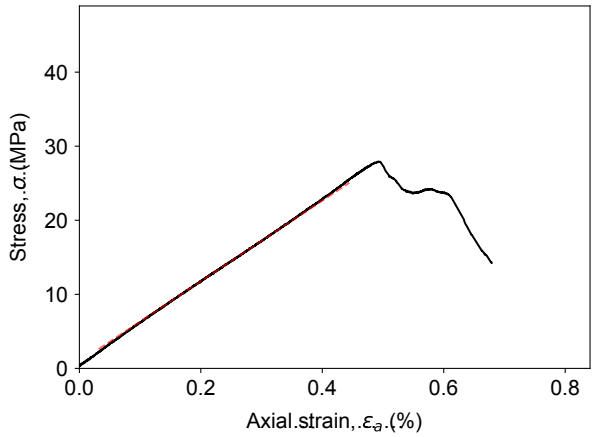
Photographs of the specimens before and after testing are presented in the Appendix of this report.



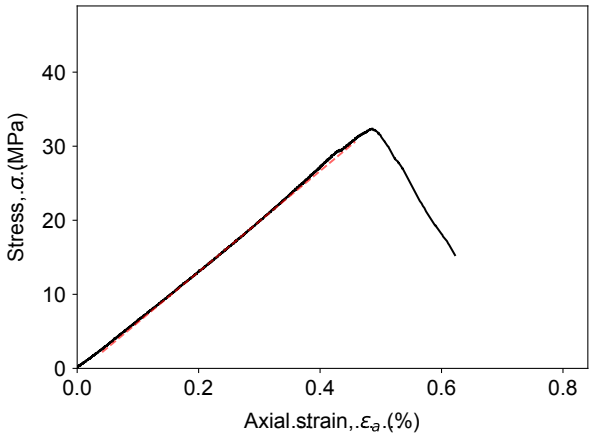
(a) BH101-RC1



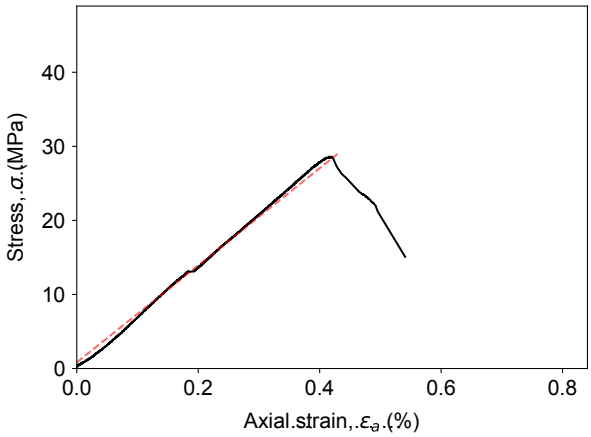
(b) BH101-RC2



(c) BH102-RC3



(d) BH102-RC4



(e) BH103-RC5

Figure 2: Measured stress-strain curves.

Appendices

Specimen sheets

- BH101, RC1
- BH101, RC2
- BH102, RC3
- BH102, RC4
- BH103, RC5

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Uniaxial Compression Test

Client	Grounded Engineering Inc.	**Project**	22-282
Sample	BH101, RC1	**Depth**	66'3" - 67'2.5"

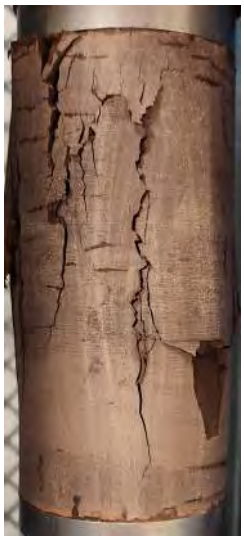
Specimen parameters	
Diameter (mm) [a]	63.17
Length (mm) [a]	129.56
Bulk density ρ (g/cm^3)	2.637
UCS (MPa)	25.9
Young's modulus E (GPa) [b]	3.6
Lithology	Red Shale
Failure description [c]	1

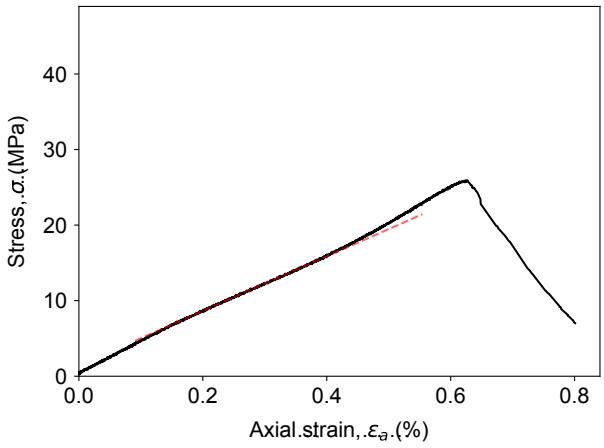
[a] Additional specimen measurement/details provided in accompanying summary spreadsheet.
[b] Tangent modulus, calculated as the slope of the best fit line through $\pm$300 data points on either side of the point representing 50.0% of the peak strength.
[c] Failure description: [1] Failure localized in softer shale layer;

Prior to testing



After testing





Remarks: Loading rate: 0.15 mm/min.

Performed by	MB/MB	**Date**	2023-03-27

GEOMECHANICA

Uniaxial Compression Test

Client	Grounded Engineering Inc.	**Project**	22-282
Sample	BH101, RC2	**Depth**	75'2" - 76'1"

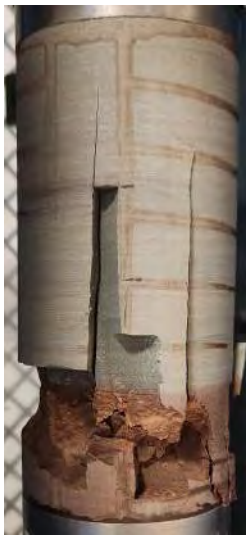
Specimen parameters	
Diameter (mm) [a]	63.05
Length (mm) [a]	129.25
Bulk density ρ (g/cm^3)	2.640
UCS (MPa)	46.6
Young's modulus E (GPa) [b]	9.5
Lithology	Red Shale and Limestone
Failure description [c]	3, 1

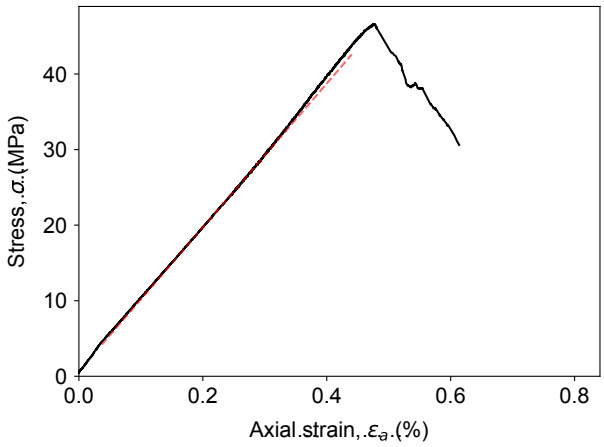
[a] Additional specimen measurement/details provided in accompanying summary spreadsheet.
[b] Tangent modulus, calculated as the slope of the best fit line through ±300 data points on either side of the point representing 50.0% of the peak strength.
[c] Failure description: [3] Axial splitting failure; [1] Failure localized in softer shale layer;

Prior to testing



After testing





Remarks: Loading rate: 0.15 mm/min.

Performed by	MB/MB	**Date**	2023-03-27

GEOMECHANICA

Uniaxial Compression Test

Client	Grounded Engineering Inc.	**Project**	22-282
Sample	BH102, RC3	**Depth**	75'6" - 76'1"

Specimen parameters	
Diameter (mm) [a]	63.10
Length (mm) [a]	129.35
Bulk density ρ (g/cm^3)	2.648
UCS (MPa)	27.9
Young's modulus E (GPa) [b]	5.4
Lithology	Red Shale
Failure description [c]	1

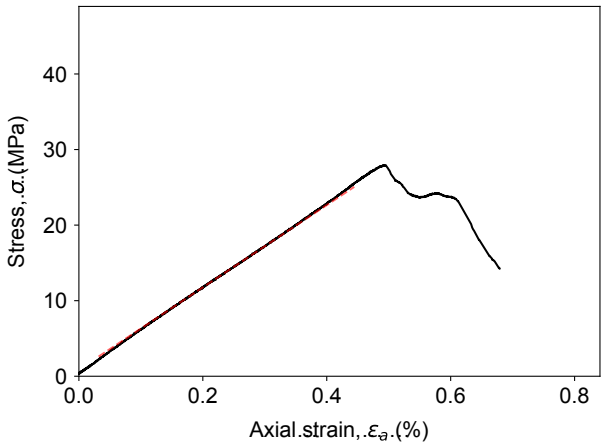
[a] Additional specimen measurement/details provided in accompanying summary spreadsheet.
[b] Tangent modulus, calculated as the slope of the best fit line through ±300 data points on either side of the point representing 50.0% of the peak strength.
[c] Failure description: [1] Failure localized in softer shale layer;

Prior to testing



After testing





Remarks: Loading rate: 0.15 mm/min.

Performed by	MB/MB	**Date**	2023-03-27

GEOMECHANICA

Uniaxial Compression Test

Client	Grounded Engineering Inc.	**Project**	22-282
Sample	BH102, RC4	**Depth**	85'5.5" - 86'2"

Specimen parameters	
Diameter (mm) [a]	63.07
Length (mm) [a]	129.45
Bulk density ρ (g/cm^3)	2.634
UCS (MPa)	32.4
Young's modulus E (GPa) [b]	6.8
Lithology	Red Shale
Failure description [c]	3

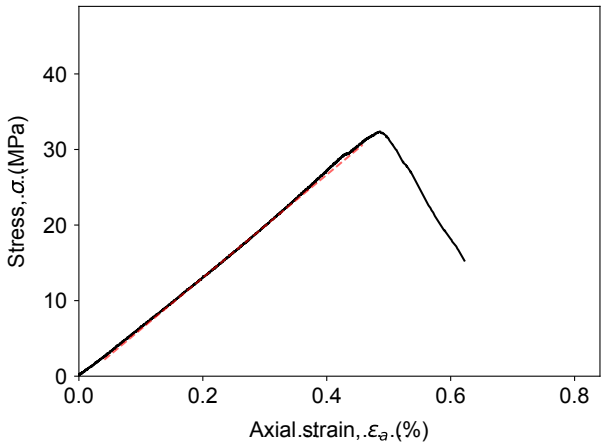
[a] Additional specimen measurement/details provided in accompanying summary spreadsheet.
[b] Tangent modulus, calculated as the slope of the best fit line through ±300 data points on either side of the point representing 50.0% of the peak strength.
[c] Failure description: [3] Axial splitting failure;

Prior to testing



After testing





Remarks: Loading rate: 0.15 mm/min.

Performed by	MB/MB	**Date**	2023-03-27

GEOMECHANICA

Uniaxial Compression Test

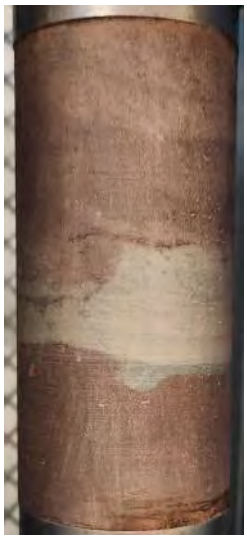
Client	Grounded Engineering Inc.	**Project**	22-282
Sample	BH103, RC5	**Depth**	87'11.75" - 88'9.5"

Specimen parameters

Diameter (mm) [a]	63.12
Length (mm) [a]	128.97
Bulk density ρ (g/cm^3)	2.643
UCS (MPa)	28.6
Young's modulus E (GPa) [b]	6.6
Lithology	Red Shale and Limestone
Failure description [c]	4

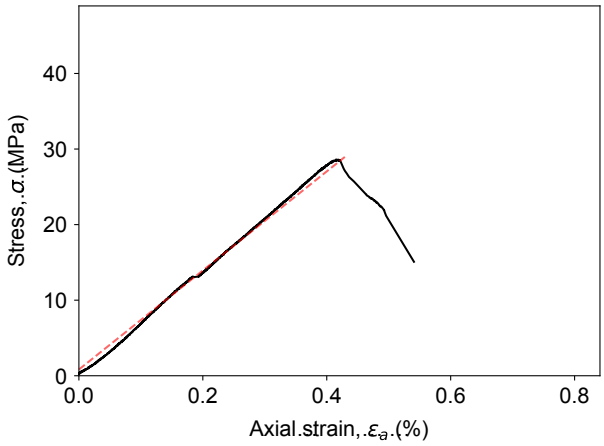
[a] Additional specimen measurement/details provided in accompanying summary spreadsheet.
[b] Tangent modulus, calculated as the slope of the best fit line through ±300 data points on either side of the point representing 50.0% of the peak strength.
[c] Failure description: [4] Inclined shear failure;

Prior to testing



After testing





Remarks: Loading rate: 0.15 mm/min.

Performed by	MB/MB	**Date**	2023-03-27

APPENDIX D





PINCHIN

PROJECT NAME: PHASE II ENVIRONMENTAL SITE ASSESSMENT			
CLIENT NAME: THE DAVID LANDRY FAMILY TRUST			
PROJECT LOCATION: 2072 LAKESHORE ROAD, BURLINGTON, ONTARIO			
FIGURE NAME: KEY MAP			FIGURE NO.: 1
APPROXIMATE SCALE: AS SHOWN	PROJECT NO.: 233963.001	DATE: FEB. 2019	



PINCHIN

PROJECT NAME: PHASE II ENVIRONMENTAL SITE ASSESSMENT			
CLIENT NAME: THE DAVID LANDRY FAMILY TRUST			
PROJECT LOCATION: 2072 LAKESHORE ROAD, BURLINGTON, ONTARIO			
FIGURE NAME: MONITORING WELL LOCATION PLAN			FIGURE NO.: 2
APPROXIMATE SCALE: AS SHOWN	PROJECT NO.: 233963.001	DATE: FEB. 2019	

Log of Borehole: MW01

Project #: 233963.001 **Logged By:** AH

Project: Phase II Environmental Site Assessment

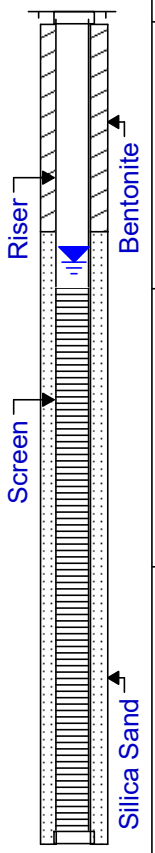
Client: The David Landry Family Trust

Location: 2072 Lakeshore Road, Burlington, Ontario

Drill Date: February 2, 2019

SUBSURFACE PROFILE

Depth (ft / m)	Description	Measured Depth (m)
0 / 0	Ground Surface	0.00
	Asphalt	
	Sand Brown, some gravel, damp.	
3 / 1	Wet below 1.52 mbgs.	
7 / 2		2.13
	Silt Red-brown to grey, trace weathered shale, damp.	
10 / 3	Sampler refusal at 3.05 mbgs. Augered to 4.57 mbgs for well installation.	3.05
	Silt Till / Weathered Shale Complex (Inferred) Red-brown to grey, damp.	
15 / 4		4.57
	End of Borehole	
18 / 5	Soil vapour concentrations measured using a RKI Eagle 2 equipped with a photoionization detector (PID) and a combustible gas indicator (CGI).	
20 / 6		



Water level measured at 1.38 mbgs on February 7, 2019.

SAMPLE

Recovery (%)	Sample ID	Soil Vapour Concentration (ppm) CGI/PID	Laboratory Analysis
30	MW01-1	0/0	PAHs
90	MW01-2	0/0	Grain Size, PHCs, VOCs
	MW01-3	0/0	pH

Contractor: Strata

Drilling Method: Direct Push & Solid Stem Auger

Well Casing Size: 5.1 cm

Grade Elevation: NM

Top of Casing Elevation: NM

Sheet: 1 of 1

Log of Borehole: MW02

Project #: 233963.001 ***Logged By:*** AH

Project: Phase II Environmental Site Assessment

Client: The David Landry Family Trust

Location: 2072 Lakeshore Road, Burlington, Ontario

Drill Date: February 2, 2019

SUBSURFACE PROFILE					SAMPLE			
Depth (ft / m)	Symbol	Description	Measured Depth (m)	Monitoring Well Details	Recovery (%)	Sample ID	Soil Vapour Concentration (ppm) CGI/PID	Laboratory Analysis
0 / 0		Ground Surface	0.00					
		Asphalt						
1		***Sand*** Brown, some gravel, damp.			60	MW02-1	0/0	
2 / 1						MW02-2	0/2	
3		Wet below 1.52 mbgs.						
4								
5								
6 / 2			2.13			MW02-3	0/2	PHCs, VOCs, Lead
7		***Silt*** Red-brown to grey, trace weathered shale, damp.			80			
8						MW02-4	0/0	
9								
10 / 3		Sampler refusal at 3.05 mbgs. Augered to 4.57 mbgs for well installation.	3.05					
11		***Silt Till / Weathered Shale Complex (Inferred)*** Red-brown to grey, damp.						
12								
13 / 4								
14								
15			4.57					
		End of Borehole						
16 / 5								
17								
18								
19								
20 / 6								

Riser, Bentonite, Screen, Silica Sand

Water level measured at 2.23 mbgs on February 7, 2019.

Soil vapour concentrations measured using a RKI Eagle 2 equipped with a photoionization detector (PID) and a combustible gas indicator (CGI).

Contractor: Strata

Grade Elevation: NM

Drilling Method: Direct Push & Solid Stem Auger

Top of Casing Elevation: NM

Well Casing Size: 5.1 cm

Sheet: 1 of 1

Log of Borehole: MW03

Project #: 233963.001 **Logged By:** AH

Project: Phase II Environmental Site Assessment

Client: The David Landry Family Trust

Location: 2072 Lakeshore Road, Burlington, Ontario

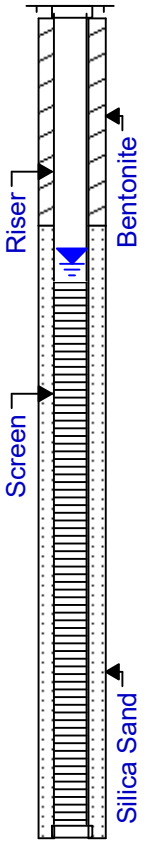
Drill Date: February 2, 2019

SUBSURFACE PROFILE

Depth (ft / m)	Description	Measured Depth (m)
0 / 0	Ground Surface	0.00
	Asphalt	
	Sand Brown, some gravel, damp.	
	Wet below 1.52 mbgs.	
7 / 2		2.13
	Silt Red-brown to grey, trace weathered shale, damp.	
	Sampler refusal at 3.05 mbgs. Augered to 4.57 mbgs for well installation.	3.05
	Silt Till / Weathered Shale Complex (Inferred) Red-brown to grey, damp.	
15 / 4.57		4.57
	End of Borehole	

Soil vapour concentrations measured using a RKI Eagle 2 equipped with a photoionization detector (PID) and a combustible gas indicator (CGI).

Monitoring Well Details



Water level measured at 1.42 mbgs on February 7, 2019.

SAMPLE

Recovery (%)	Sample ID	Soil Vapour Concentration (ppm) CGI/PID	Laboratory Analysis
60	MW03-1	0/0	
	MW03-2	0/0	pH
80	MW03-3	0/0	PHCs, VOCs, Lead
	MW03-4	0/0	

Contractor: Strata

Grade Elevation: NM

Drilling Method: Direct Push & Solid Stem Auger

Top of Casing Elevation: NM

Well Casing Size: 5.1 cm

Sheet: 1 of 1

APPENDIX E



CORROSIVITY (BVL)

Bureau Veritas Job Number: C376714
Report Date: 2023/03/28

Grounded Engineering Inc.
Client Project #: 22-282
Site Location: 2072 LAKESHORE ROAD

Sampler Initials: NG

SOIL CORROSIVITY PACKAGE (SOIL)

Bureau Veritas ID			VHZ730	VHZ731	VHZ732
Sampling Date			2023-03-13	2023-03-13	2023-03-09
Sampling Time					
COC Number			915722-32-01	915722-32-01	915722-32-01
	UNITS	**RDL**	**BH107 SS4**	**BH107 SS2**	**BH102 SS2**
Calculated Parameters					
Resistivity	ohm-cm		770.00	780.00	1500
Inorganics					
Soluble (20:1) Chloride (Cl-)	ug/g	20	1100	750	300
Conductivity	umho/cm	2	1300	1280	647
Available (CaCl2) pH	pH		7.9	8.11	8.1
Soluble (20:1) Sulphate (SO4)	ug/g	20	68	20	20
Sulphide	mg/kg	0.5	<0.5	0.80	1.00
Physical Testing					
Moisture-Subcontracted	%	0.3	11	6.3	7.4
Subcontracted Analysis					
Redox Potential	mV		230	290	240

RDL = Reportable Detection Limit

INTERPRETATION

AWWA C-105 Standard		**Points**	**Points**	**Points**
% Moisture		2	1	1
pH		0	0	0
Redox Potential		0	0	0
Resistivity		8	8	1
Acid Volatile Sulphides		0	2	2
TOTAL SCORE (AWWA C-105)		**10**	**11**	**4**
Sample		**BH107 SS4**	**BH107 SS2**	**BH102 SS2**
Corrosion Protection Recommended?		**YES**	**YES**	**No**
Resistivity less than 2000 ohm.cm?		**YES**	**YES**	**YES**
Anions and Nutrients (Soil)				
Sulphate	%	0.0068	0.002	0.002
CLASS OF EXPOSURE		**Negligible**	**Negligible**	**Negligible**

Your Project #: 22-282
Site Location: 2072 LAKESHORE ROAD
Your C.O.C. #: 915722-32-01

Attention: Nick Ng

Grounded Engineering Inc.
1 Banigan Drive
Toronto, ON
CANADA M4H 1G3

Report Date: 2023/03/28
Report #: R7564170
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C376714
Received: 2023/03/17, 15:14

Sample Matrix: Soil
Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Chloride (20:1 extract)	3	2023/03/22	2023/03/23	CAM SOP-00463	MOE E3013 m
Conductivity	3	2023/03/22	2023/03/22	CAM SOP-00414	OMOE E3530 v1 m
Moisture (Subcontracted) (1, 2)	3	N/A	2023/03/25	AB SOP-00002	CCME PHC-CWS m
Sulphide in Soil (1)	3	N/A	2023/03/22	AB SOP-00080	EPA9030B/SM4500S2-DF
pH CaCl2 EXTRACT	3	2023/03/21	2023/03/21	CAM SOP-00413	EPA 9045 D m
Redox Potential (3)	3	2023/03/21	2023/03/22	CAM SOP-00421	SM 2580 B
Resistivity of Soil	3	2023/03/18	2023/03/22	CAM SOP-00414	SM 23 2510 m
Sulphate (20:1 Extract)	3	2023/03/22	2023/03/23	CAM SOP-00464	MOE E3013 m

Remarks:

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

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

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

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) This test was performed by Bureau Veritas Calgary (19th), 4000 19th Street NE , Calgary, AB, T2E 6P8
(2) Offsite analysis requires that subcontracted moisture be reported.
(3) Oxidation-Reduction Potential (ORP) values are determined using a Ag/AgCl reference electrode. The test is therefore, not SCC accredited for this matrix.

Your Project #: 22-282
Site Location: 2072 LAKESHORE ROAD
Your C.O.C. #: 915722-32-01

Attention: Nick Ng

Grounded Engineering Inc.
1 Banigan Drive
Toronto, ON
CANADA M4H 1G3

Report Date: 2023/03/28
Report #: R7564170
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C376714
Received: 2023/03/17, 15:14

Encryption Key

Please direct all questions regarding this Certificate of Analysis to:
Marijane Cruz, Senior Project Manager
Email: Marijane.Cruz@bureauveritas.com
Phone# (905)817-5756

==========

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.

Bureau Veritas Job #: C376714
Report Date: 2023/03/28

Grounded Engineering Inc.
Client Project #: 22-282
Site Location: 2072 LAKESHORE ROAD
Sampler Initials: NG

SOIL CORROSIVITY PACKAGE (SOIL)

Bureau Veritas ID		VHZ730		VHZ731			VHZ731			VHZ732		
Sampling Date		2023/03/13		2023/03/13			2023/03/13			2023/03/09		
COC Number		915722-32-01		915722-32-01			915722-32-01			915722-32-01		
	UNITS	BH107 SS4	RDL	BH107 SS2	RDL	QC Batch	BH107 SS2 Lab-Dup	RDL	QC Batch	BH102 SS2	RDL	QC Batch
Calculated Parameters												
Resistivity	ohm-cm	770		780		8560314				1500		8560314
CONVENTIONALS												
Redox Potential	mV	230	N/A	290	N/A	8564005	260	N/A	8564005	240	N/A	8564005
Inorganics												
Soluble (20:1) Chloride (Cl-)	ug/g	1100	40	750	20	8566150				300	20	8566150
Conductivity	umho/cm	1300	2	1280	2	8566227	1360	2	8566227	647	2	8566227
Available (CaCl2) pH	pH	7.90		8.11		8563702	8.09		8563702	8.10		8563702
Soluble (20:1) Sulphate (SO4	ug/g	68	20	<20	20	8566166				<20	20	8566166
Sulphide	mg/kg	<0.5 (1)	0.5	0.8 (1)	0.5	8576121				1.0 (1)	0.5	8576121
Physical Testing												
Moisture-Subcontracted	%	11	0.30	6.3	0.30	8576124				7.4	0.30	8576124

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
N/A = Not Applicable
(1) Sample contained greater than 10% headspace at time of extraction.

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Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

Bureau Veritas Job #: C376714
Report Date: 2023/03/28

Grounded Engineering Inc.
Client Project #: 22-282
Site Location: 2072 LAKESHORE ROAD
Sampler Initials: NG

TEST SUMMARY

Bureau Veritas ID: VHZ730
Sample ID: BH107 SS4
Matrix: Soil

Collected: 2023/03/13
Shipped:
Received: 2023/03/17

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8566150	2023/03/22	2023/03/23	Massarat Jan
Conductivity	AT	8566227	2023/03/22	2023/03/22	Gurparteek KAUR
Moisture (Subcontracted)	BAL	8576124	N/A	2023/03/25	Ashley Henderson
Sulphide in Soil	SPEC	8576121	N/A	2023/03/22	Ly Vu
pH CaCl2 EXTRACT	AT	8563702	2023/03/21	2023/03/21	Taslima Aktar
Redox Potential	COND	8564005	2023/03/21	2023/03/22	Kien Tran
Resistivity of Soil		8560314	2023/03/22	2023/03/22	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8566166	2023/03/22	2023/03/23	Massarat Jan

Bureau Veritas ID: VHZ731
Sample ID: BH107 SS2
Matrix: Soil

Collected: 2023/03/13
Shipped:
Received: 2023/03/17

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8566150	2023/03/22	2023/03/23	Massarat Jan
Conductivity	AT	8566227	2023/03/22	2023/03/22	Gurparteek KAUR
Moisture (Subcontracted)	BAL	8576124	N/A	2023/03/25	Ashley Henderson
Sulphide in Soil	SPEC	8576121	N/A	2023/03/22	Ly Vu
pH CaCl2 EXTRACT	AT	8563702	2023/03/21	2023/03/21	Taslima Aktar
Redox Potential	COND	8564005	2023/03/21	2023/03/22	Kien Tran
Resistivity of Soil		8560314	2023/03/22	2023/03/22	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8566166	2023/03/22	2023/03/23	Massarat Jan

Bureau Veritas ID: VHZ731 Dup
Sample ID: BH107 SS2
Matrix: Soil

Collected: 2023/03/13
Shipped:
Received: 2023/03/17

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Conductivity	AT	8566227	2023/03/22	2023/03/22	Gurparteek KAUR
pH CaCl2 EXTRACT	AT	8563702	2023/03/21	2023/03/21	Taslima Aktar
Redox Potential	COND	8564005	2023/03/21	2023/03/22	Kien Tran

Bureau Veritas ID: VHZ732
Sample ID: BH102 SS2
Matrix: Soil

Collected: 2023/03/09
Shipped:
Received: 2023/03/17

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8566150	2023/03/22	2023/03/23	Massarat Jan
Conductivity	AT	8566227	2023/03/22	2023/03/22	Gurparteek KAUR
Moisture (Subcontracted)	BAL	8576124	N/A	2023/03/25	Ashley Henderson
Sulphide in Soil	SPEC	8576121	N/A	2023/03/22	Ly Vu
pH CaCl2 EXTRACT	AT	8563702	2023/03/21	2023/03/21	Taslima Aktar
Redox Potential	COND	8564005	2023/03/21	2023/03/22	Kien Tran
Resistivity of Soil		8560314	2023/03/22	2023/03/22	Automated Statchk

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Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

Bureau Veritas Job #: C376714
Report Date: 2023/03/28

Grounded Engineering Inc.
Client Project #: 22-282
Site Location: 2072 LAKESHORE ROAD
Sampler Initials: NG

TEST SUMMARY

Bureau Veritas ID: VHZ732
Sample ID: BH102 SS2
Matrix: Soil

Collected: 2023/03/09
Shipped:
Received: 2023/03/17

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Sulphate (20:1 Extract)	KONE/EC	8566166	2023/03/22	2023/03/23	Massarat Jan

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Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

GENERAL COMMENTS

Cooler custody seal present and intact.

Results relate only to the items tested.

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Bureau Veritas Job #: C376714
Report Date: 2023/03/28

QUALITY ASSURANCE REPORT

Grounded Engineering Inc.
Client Project #: 22-282
Site Location: 2072 LAKESHORE ROAD
Sampler Initials: NG

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
8563702	Available (CaCl2) pH	2023/03/21			100	97 - 103			0.23	N/A
8564005	Redox Potential	2023/03/22			102	95 - 105			11	35
8566150	Soluble (20:1) Chloride (Cl-)	2023/03/23	102	70 - 130	103	70 - 130	<20	ug/g	NC	35
8566166	Soluble (20:1) Sulphate (SO4)	2023/03/23	93	70 - 130	93	70 - 130	<20	ug/g	NC	35
8566227	Conductivity	2023/03/22			104	90 - 110	<2	umho/cm	6.6	10
8576121	Sulphide	2023/03/22	105	75 - 125	120	75 - 125	<0.5	mg/kg	14	30
8576124	Moisture-Subcontracted	2023/03/25					<0.30	%		

N/A = Not Applicable

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

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

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

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

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

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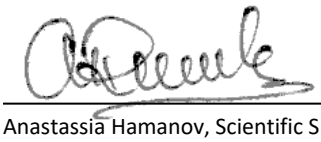
Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

Bureau Veritas Job #: C376714
Report Date: 2023/03/28

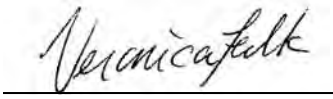
Grounded Engineering Inc.
Client Project #: 22-282
Site Location: 2072 LAKESHORE ROAD
Sampler Initials: NG

VALIDATION SIGNATURE PAGE

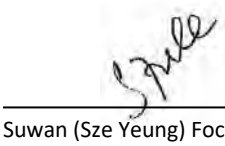
The analytical data and all QC contained in this report were reviewed and validated by:



Anastassia Hamanov, Scientific Specialist



Veronica Falk, B.Sc., P.Chem., QP, Scientific Specialist, Organics



Suwan (Sze Yeung) Fock, B.Sc., Scientific Specialist

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Page of

CHAIN OF CUSTODY RECORD

INVOICE TO:	REPORT TO:	PROJECT INFORMATION:	Laboratory Use Only:
Company Name: #36876 Grounded Engineering Inc.	Company Name:	Quotation #: C20852	Bureau Veritas Job #: / Bottle Order #: 915722
Attention: ~~Sean Morris~~ Nick Ng	Attention: Sean Morris Nick Ng	P.O. #:	
Address: 1 Banigan Drive Toronto ON M4H 1G3	Address: 647 344 7936	Project: ~~22-317~~ 22-282	
Tel: ~~(289) 697-0973~~ 647 344 7936	Tel: (289) 697-0973 Fax:	Project Name: 2072 Lakeshore Road	COC #: C#915722-32-01 / Project Manager: Marijane Cruz
Email: ~~smorris@groundedeng.ca~~ ng@groundedeng.ca	Email: ~~smorris@groundedeng.ca~~ ng@groundedeng.ca	Site #: / Sampled By:	

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE BUREAU VERITAS DRINKING WATER CHAIN OF CUSTODY

Regulation 153 (2011): ☐ Table 1 ☐ Res/Park ☑ Medium/Fine ☐ Table 2 ☐ Ind/Comm ☐ Coarse ☐ Table 3 ☑ Agr/Other ☐ For RSC ☐ Table ___

Other Regulations: ☐ CCME ☐ Sanitary Sewer Bylaw ☐ Reg 558 ☐ Storm Sewer Bylaw ☐ MISA Municipality ___ ☐ PWQO ☐ Reg 406 Table ___ ☐ Other ___

Special Instructions:

Include Criteria on Certificate of Analysis (Y/N)? ___

Turnaround Time (TAT) Required:
Please provide advance notice for rush projects
Regular (Standard) TAT: ☑
(will be applied if Rush TAT is not specified)
Standard TAT = 5-7 Working days for most tests.
Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.
Job Specific Rush TAT (if applies to entire submission)
Date Required: ___ Time Required: ___ ☐
Rush Confirmation Number: ___ *(call lab for #)*

ANALYSIS REQUESTED (PLEASE BE SPECIFIC):

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered (please circle): Metals / Hg / Cr VI	O Reg 406 Excess Soil Bulk VOCs/F1-F4	O Reg 406 Excess Soil Bulk Inorganics	O Reg 406 Excess Soil Bulk PAHs	O Reg 406 Excess Soil SPLP VOCs	SPLP PAHs	Soil Corrosivity	# of Bottles	Comments
1		BH107 SS4	Mar 13, 2023	PM	Soil							✓		
2		BH107 SS2	Mar 13, 2023	PM	Soil							✓		
3		BH102 SS2	Mar 9, 2023	PM	Soil							✓		
4														
5														
6														
7														
8														
9														
10														

17-Mar-23 15:14
Marijane Cruz
C376714
RJM ENV-1378

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# Jars used and not submitted
Nick Ng	2023/03/16	PM	[illegible]	23/03/17	10:9:9	
				2023/03/17	15:14	

Laboratory Use Only: Time Sensitive / Temperature (°C) on Recei: 10 | 9 | 9 / Custody Seal: Present ✓ / Intact

1 cc

* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BUREAU VERITAS'S STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.BVNA.COM/ENVIRONMENTAL-LABORATORIES/RESOURCES/COC-TERMS-AND-CONDITIONS.

* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

** SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT WWW.BVNA.COM/ENVIRONMENTAL-LABORATORIES/RESOURCES/CHAIN-CUSTODY-FORMS-COCS.

SAMPLES MUST BE KEPT COOL (< 10° C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BUREAU VERITAS.

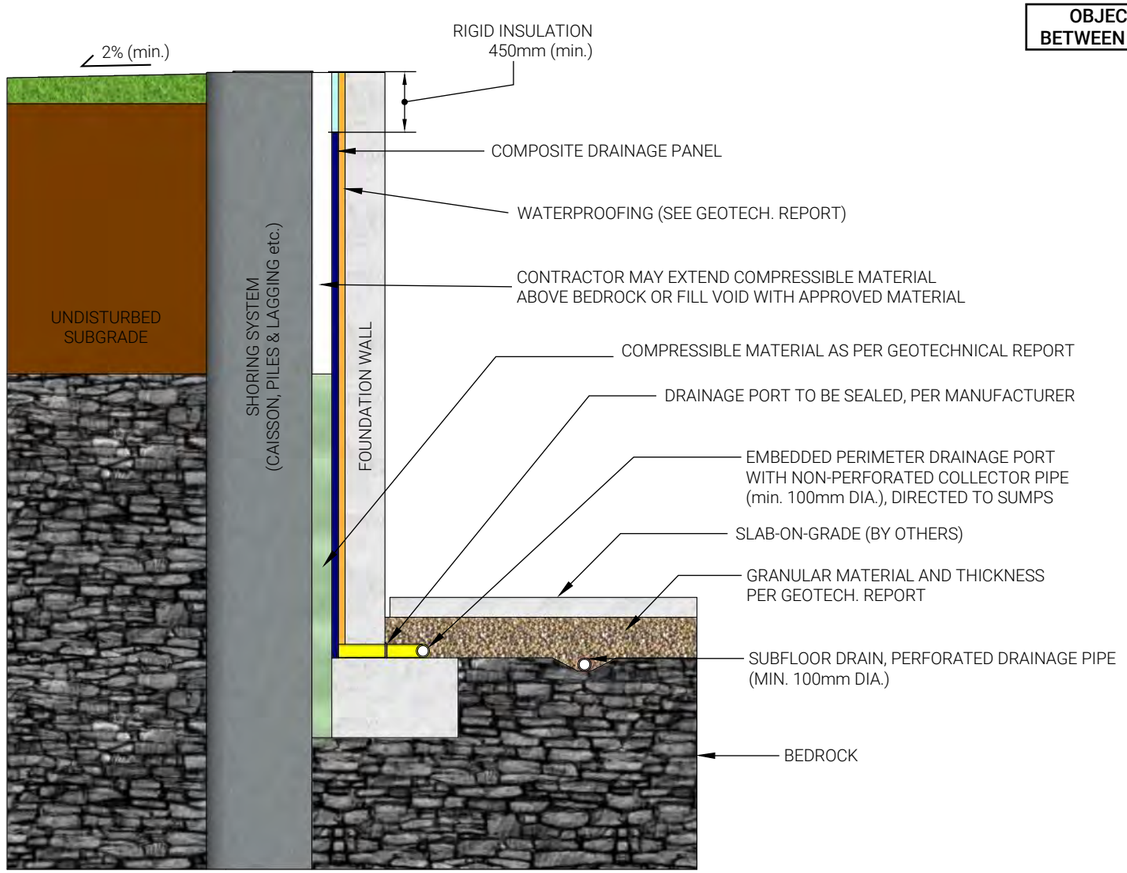
White: Bureau Veritas Yellow: Client

Bureau Veritas Canada (2019) Inc.

264323

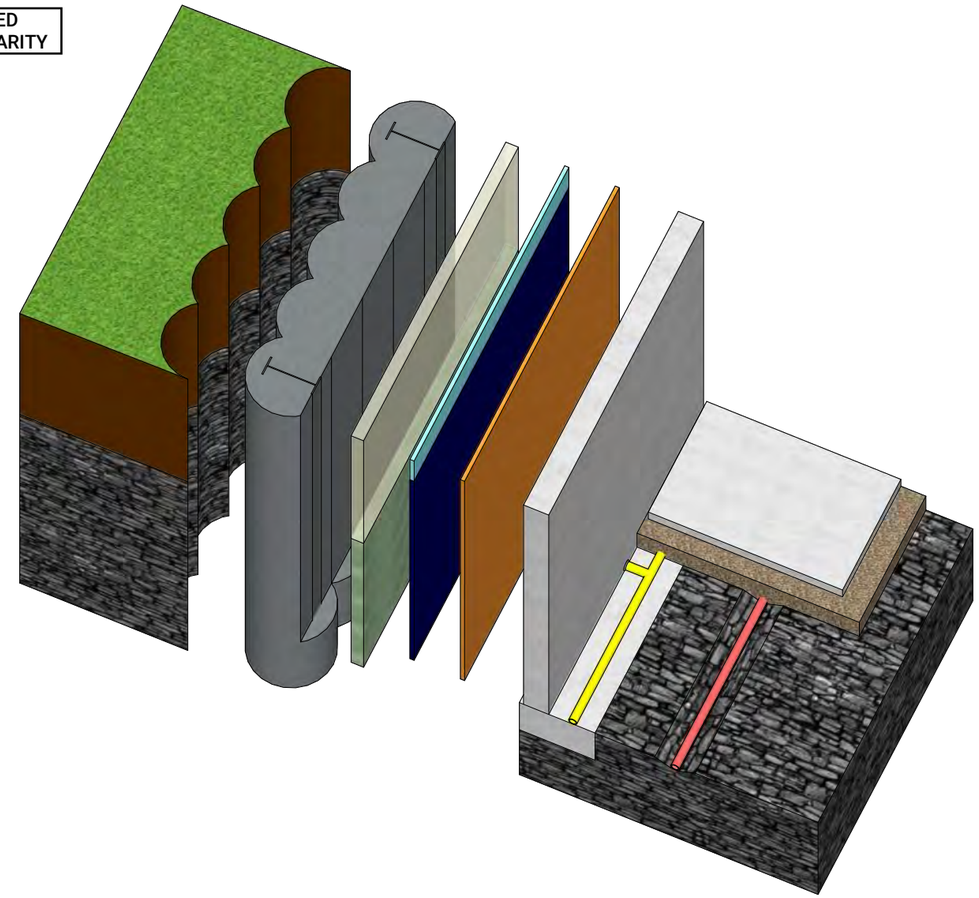
APPENDIX F





SECTIONAL VIEW

OBJECTS ARE COLOR-CODED BETWEEN TWO VIEWS FOR CLARITY



ISOMETERIC VIEW

SUBFLOOR DRAINAGE SYSTEM

1. THE SUBFLOOR DRAINS SHOULD BE SET IN PARALLEL ROWS, IN ONE DIRECTION, AND SPACED AS PER THE GEOTECHNICAL REPORT.
2. THE INVERT OF THE PIPES SHOULD BE A MINIMUM OF 300mm BELOW THE UNDERSIDE OF THE SLAB-ON-GRADE.
3. A CAPILLARY MOISTURE BARRIER (I.E. DRAINAGE LAYER) CONSISTING OF A MINIMUM 200 mm LAYER OF CLEAR STONE (OPSS MUNI 1004) COMPACTED TO A DENSE STATE (OR AS PER THE GEOTECHNICAL REPORT). WHERE VEHICULAR TRAFFIC IS REQUIRED, THE UPPER 50 mm OF THE CAPILLARY MOISTURE BARRIER MAY BE REPLACED WITH GRANULAR A (OPSS MUNI 1010) COMPACTED TO A MINIMUM 98% SPMDD.

PERIMETER DRAINAGE SYSTEM

1. FOR A DISTANCE OF 1.2m FROM THE BUILDING, THE GROUND SURFACE SHOULD HAVE A MINIMUM 2% GRADE.
2. PREFABRICATED COMPOSITE DRAINAGE PANEL (CONTINUOUS COVER, AS PER MANUFACTURER'S REQUIREMENTS) IS RECOMMENDED BETWEEN THE BASEMENT WALL AND RIGID SHORING WALL. THE DRAINAGE PANEL MAY CONSIST OF MIRADRAIN 6000 OR AN APPROVED EQUIVALENT.
3. PERIMETER DRAINAGE IS TO BE COLLECTED IN NON-PERFORATED PIPES AND CONVEYED DIRECTLY TO THE BUILDING SUMPS.
4. PERIMETER DRAINAGE PORTS SHOULD BE SPACED A MAXIMUM 3m ON-CENTRE. EACH PORT SHOULD HAVE A MINIMUM CROSS-SECTIONAL AREA OF 1500 mm2.

GENERAL NOTES

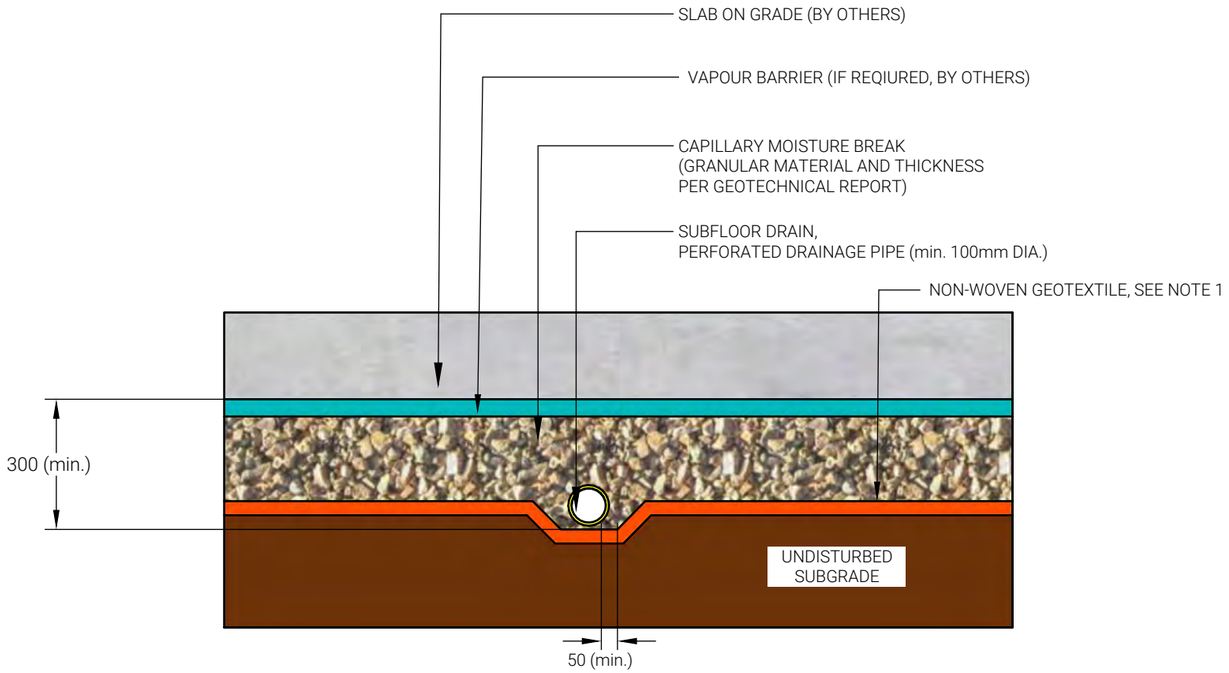
1. THERE SHOULD BE NO STRUCTURAL CONNECTION BETWEEN THE SLAB-ON-GRADE AND THE FOUNDATION WALL OR FOOTING.
2. THERE SHOULD BE NO CONNECTION BETWEEN THE SUBFLOOR AND PERIMETER DRAINAGE SYSTEMS.
3. THIS IS ONLY A TYPICAL BASEMENT DRAINAGE DETAIL. THE GEOTECHNICAL REPORT SHOULD BE CONSULTED FOR SITE SPECIFIC RECOMMENDATIONS.
4. THE FINAL BASEMENT DRAINAGE DESIGN SHOULD BE REVIEWED BY THE GEOTECHNICAL ENGINEER TO CONFIRM THE DESIGN IS ACCEPTABLE.

GROUNDED ENGINEERING

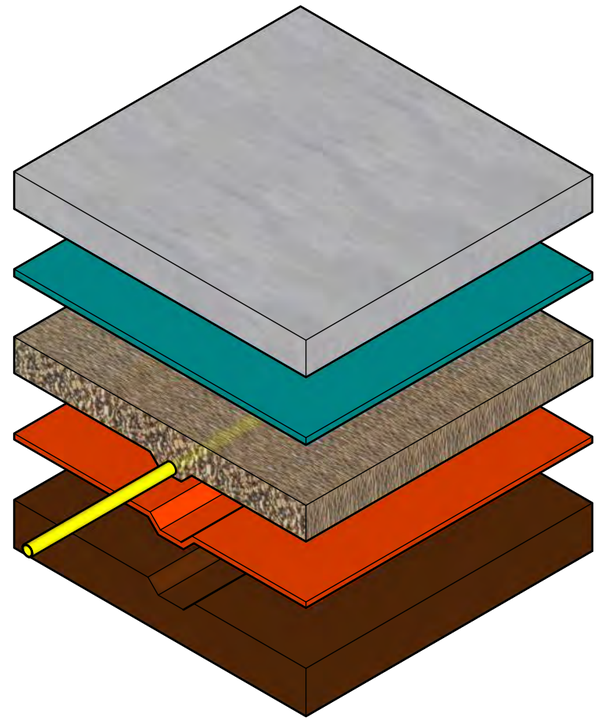
Title

FOUNDATION WALL BLINDSIDE DRAINAGE SYSTEM (IN DEEP ROCK) DETAIL

OBJECTS ARE COLOR-CODED BETWEEN TWO VIEWS FOR CLARITY



SECTIONAL VIEW



ISOMETRIC VIEW

NOTES

1. WHEN THE SUBGRADE CONSISTS OF COHESIONLESS SOIL, IT MUST BE SEPARATED FROM THE SUBFLOOR DRAINAGE LAYER USING A NON-WOVEN GEOTEXTILE (WITH AN APPARENT OPENING SIZE OF < 0.250mm AND A TEAR RESISTANCE OF > 200 N).

2. TYPICAL SCHEMATIC ONLY. MUST BE READ IN CONJUNCTION WITH GEOTECHNICAL REPORT.

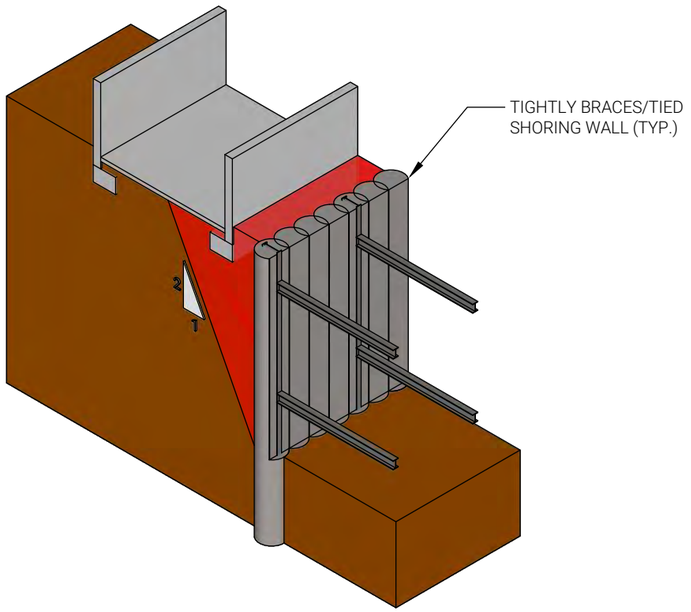
GROUNDED ENGINEERING

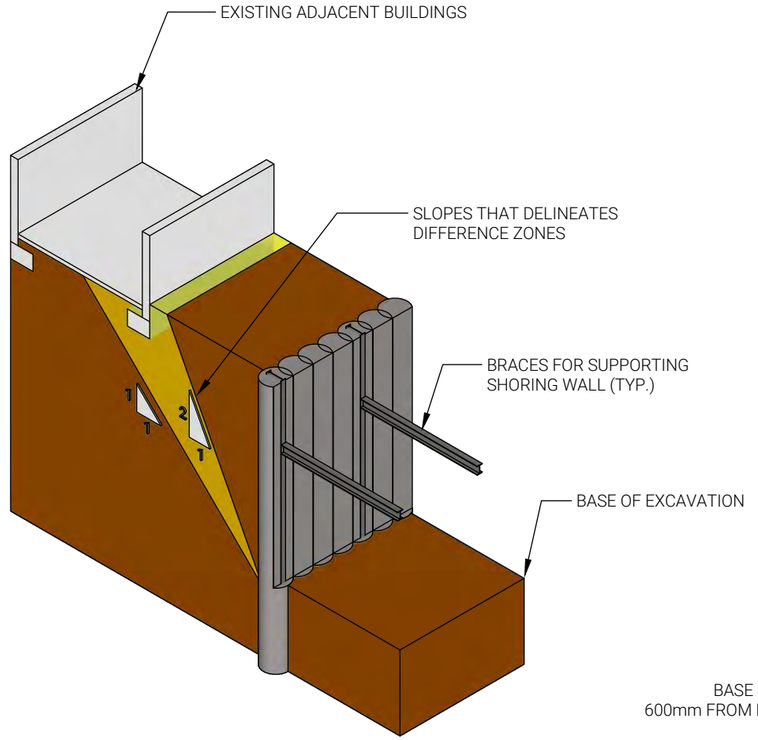
Title

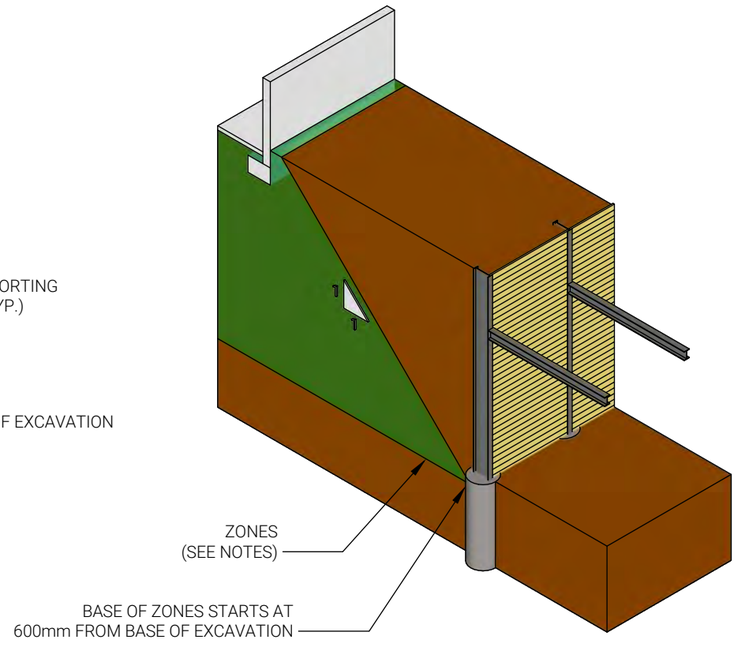
BASEMENT SUBDRAIN TYPICAL DETAIL

APPENDIX G









ZONE A (RED)

FOUNDATIONS WITHIN THIS ZONE OFTEN REQUIRE UNDERPINNING OR SHORING SYSTEM. HORIZONTAL AND VERTICAL PRESSURES ON EXCAVATION WALL OF NON-UNDERPINNED FOUNDATION MUST BE CONSIDERED

ZONE B (YELLOW)

FOUNDATIONS WITHIN THIS ZONE OFTEN DO NOT REQUIRE UNDERPINNING BUT MAY REQUIRE SHORING SYSTEM. HORIZONTAL AND VERTICAL PRESSURES ON EXCAVATION WALL OF NON-UNDERPINNED FOUNDATION MUST BE CONSIDERED

ZONE C (GREEN)

FOUNDATIONS WITHIN THIS ZONE USUALLY DO NOT REQUIRE UNDERPINNING OR SHORING SYSTEM

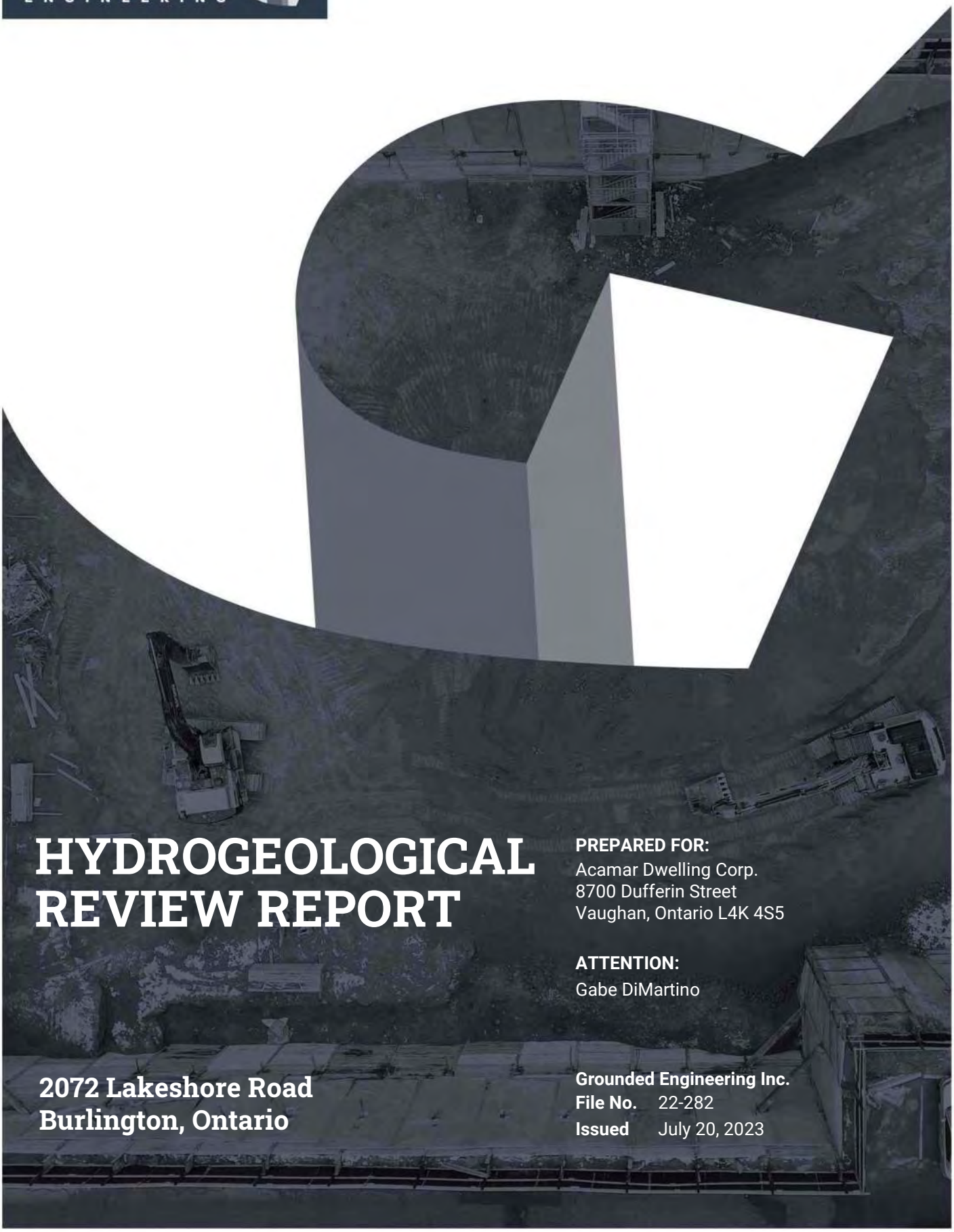
NOTES:
1. USER'S GUIDE - NBC 2005 STRUCTURAL COMMENTARIES (PART 4 OF DIVISION B) - COMMENTARY K.

GROUNDED ENGINEERING

Title

EXCAVATION ZONE OF INFLUENCE GUIDELINES

APPENDIX E
HYDROGEOLOGICAL REPORT



HYDROGEOLOGICAL REVIEW REPORT

PREPARED FOR:
Acamar Dwelling Corp.
8700 Dufferin Street
Vaughan, Ontario L4K 4S5

ATTENTION:
Gabe DiMartino

2072 Lakeshore Road
Burlington, Ontario

Grounded Engineering Inc.
File No. 22-282
Issued July 20, 2023

1 Banigan Drive, Toronto ON M4H 1G3 | (647) 264-7909 | groundedeng.ca | Grounded Engineering

Executive Summary

Grounded Engineering Inc. (Grounded) was retained by Acamar Dwelling Corp. to conduct a Hydrogeological Review for the proposed redevelopment of 2072 Lakeshore Road in Burlington, Ontario (site). The conclusions of the investigation are summarized as follows:

Site Information

Existing Development

Site	Above Grade Levels	Below Grade Levels		
		Level #	Lowest Finished Floor	
			Depth (m)	Elevation (masl)
2072 Lakeshore Road, Burlington	1	n/a	n/a	n/a

Proposed Development

Site	Above Grade Levels	Below Grade Levels			
		Level #	Lowest Finished Floor		Approximate Base of Foundations (masl)
			Depth (m)	Elevation (masl)	
2072 Lakeshore Road, Burlington	25	P7	22.5	60.0	59.0

Site Conditions

Site Stratigraphy

Stratum/Formation	Depth Range (mbgs)	Elevation Range (masl)	Hydraulic Conductivity (m/s)	Method
Earth Fill	0.0 to 2.0	82.5 to 80.5	1.0×10^{-4}	Literature
Native Glacial Till	2.0 to 3.5	80.5 to 79.0	1.0×10^{-7}	Literature
Weathered Bedrock	3.5 to 4.5	79.0 to 78.0	1.0×10^{-7}	Literature
Sound Bedrock (Fractures)	Below 4.5	Below 78.0	7.7×10^{-7}*	Slug Test

*Considering a K2 to K1 ratio of 0.1 for sound bedrock.
**A hydraulic conductivity of 4.3×10^{-6} m/s is considered for sound bedrock with fractures, which will produce more free-flowing water.

Groundwater Elevation

Design Groundwater Elevation (masl)	**Elev. 75± m**

Groundwater Quality				
Sample ID	**Sample Date**	**Sample Expiry Date**	**Halton Storm Sewer Limits**	**Halton Sanitary Sewer Limits**
BH103 SWE	Mar 21, 2023	Dec 21, 2023	Meets	Meets

Groundwater Control

Stored Groundwater (pre-excavation/dewatering)					
Volume of Excavation (m^3)	**Volume of Excavation Below Water Table (m^3)**	**Estimated Volume of Stored Groundwater**		**Estimated Volume of Available Groundwater**	
		m^3	**L**	**m^3**	**L**
35,300	23,800	5,200	5,200,000	4,600	4,600,000

Short Term (Construction) Steady State Groundwater Quantity – Safety Factor of 2.0 Used					
Estimated Groundwater Seepage		**Design Rainfall Event (25mm)**		**Estimated Total Daily Water Takings**	
L/day	**L/min**	**L/day**	**L/min**	**L/day**	**L/min**
195,000	135.4	39,000	27.1	234,000	162.5

Long Term (Permanent) Steady State Groundwater Quantity – Safety Factor of 2.0 Used					
Estimated Groundwater Seepage		**Estimated Infiltrated Stormwater – Design Rainfall Event (25mm)**		**Estimated Total Daily Water Takings**	
L/day	**L/min**	**L/day**	**L/min**	**L/day**	**L/min**
190,000	131.9	5,000	3.5	195,000	135.4

Land Stability		
	Short Term (Construction)	**Long Term (Permanent)**
Maximum Zone of Influence (m)	Negligible	Negligible
Maximum Potential Settlement (mm)	<2	<2

Regulatory Requirements	
Environmental Activity and Sector Registry (EASR) Posting	Required
Short Term Permit to Take Water (PTTW)	Not Required
Long Term Permit to Take Water (PTTW)	Not Required
Short Term Discharge Agreement	Required
Long Term Discharge Agreement	Required

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Figure 1 – Study Area Map
Figure 2 – Borehole and Monitoring Well Location Plan (Existing Condition)
Figure 3 – Borehole and Monitoring Well Location Plan (Proposed Condition)
Figure 4 – Subsurface Profile

APPENDICES

Appendix A – Borehole Logs
Appendix B – Aquifer Response Tests
Appendix C – Grain Size Analysis
Appendix D – HydrogeoSieveXL Data
Appendix E – Laboratory Certificate of Analysis
Appendix F – Finite Element Model
Appendix G – Dewatering Calculations
Appendix H – Factual Information by Previous Consultant (Pinchin)

1 Introduction

Acamar Dwelling Corp. has retained Grounded Engineering Inc. ("Grounded") to provide hydrogeological engineering design advice for their proposed development at 2072 Lakeshore Road, in Burlington, Ontario.

Property Information	
Location of Site	2072 Lakeshore Road, Burlington, Ontario L7R 1E3
Ownership of Site	Acamar Dwelling Corp.
Site Dimensions (m)	Equivalent dimensions of 27.1±m (N-S) x 56.7± m (W-E)
Site Area (m^2)	1,533 m^2

Existing Development	
Number of Building Structures	One (1)
Number of Above Grade Levels	One (1)
Number of Underground Levels	n/a
Sub-Grade Depth of Development (m)	n/a
Sub-Grade Area (m^2)	n/a
Land Use Classification	Commercial

Proposed Development	
Number of Building Structures	One (1)
Number of Above Grade Levels	25-storeys
Number of Underground Levels	P7
Sub-Grade Depth of Development (m)	22.5± m
Sub-Grade Area (m^2)	1,410± m^2
Land Use Classification	Mixed-Use Residential and Commercial

Qualified Person and Hydrogeological Review Information	
Qualified Person	Matt Bielaski, P.Eng., $QP_{ESA/RA}$
Consulting Firm	Grounded Engineering Inc.
Date of Hydrogeological Review	July 20, 2023
Scope of Work	▪ Review of MECP Water Well Records for the area ▪ Review of geological information for the area ▪ Review of topographic information for the area ▪ Advancement of seven (7) boreholes to a maximum depth of 27.9 m, which were instrumented with 7 monitoring wells. ▪ Three (3) boreholes by the previous consultant (Pinchin) were advanced at the site to a maximum depth of 4.6 m, and were instrumented with 3 monitoring wells. The boreholes/monitoring wells are relied upon for stratigraphy, groundwater levels and monitoring well construction data. ▪ Completion of slug tests in selected available monitoring wells ▪ Groundwater elevation monitoring for three (3) months on a monthly basis ▪ Groundwater sampling and analysis to the Region of Halton Sewer Use Limits ▪ Assessment of groundwater controls and potential impacts ▪ Report preparation in accordance with Ontario Water Resources Act, Ontario Regulation 387/04

General Hydrogeological Characterization	
Site Topography	The site has an approximate ground surface elevation of 82.5 masl.
Local Physiographic Features	The site is composed of a native clayey silt glacial till overlying bedrock of the Queenston Formation.
Regional Physiographic Features	The West St Lawrence Lowland consists of a limestone plain (elevation 200–250 masl) that is separated by a broad, shale lowland from a broader dolomite and limestone plateau west of Lake Ontario. This plateau is bounded by the Niagara Escarpment. From the escarpment the plateau slopes gently southwest to lakes Huron and Erie (elevation 173 masl). Glaciation has mantled this region with several layers of glacial till (i.e., an unsorted mixture of clay, sand, etc.), the youngest forming extensive, undulating till plains, often enclosing rolling drumlin fields.
Watershed	The site is located within the Lower Rambo Creek Watershed. Locally, groundwater is anticipated to flow southeast towards Lake Ontario.
Surface Drainage	Surface water is expected to flow towards municipal catch basins located on or adjacent to the site, via Lakeshore Road to the North, Old Lakeshore Road to the south and east, and Pearl Street to the west.

2 Study Area Map

A map has been enclosed which shows the following information:

- All monitoring wells identified on site
- All monitoring wells identified off site within the study area
- All boreholes identified on site
- All buildings identified on site and within the study area
- The Site boundaries
- Any watercourses and drainage features within the study area.

3 Geology and Physical Hydrogeology

The site stratigraphy, including soil materials, composition and texture are presented in detail on the borehole logs in Appendix A. A summary of stratigraphic units that were encountered at the site is outlined as follows:

Site Stratigraphy

Stratum/Formation	Depth Range (mbgs)	Elevation Range (masl)	Hydraulic Conductivity (m/s)	Method of Determination
Earth Fill	0.0 to 2.0	82.5 to 80.5	1.0×10^{-4}	Literature
Native Glacial Till	2.0 to 3.5	80.5 to 79.0	1.0×10^{-7}	Literature
Weathered Bedrock	3.5 to 4.5	79.0 to 78.0	1.0×10^{-7}	Literature
Sound Bedrock	Below 4.5	Below 78.0	$4.3 \times 10^{-7*}$	Slug Test

*Considering a K2 to K1 ratio of 0.1 for sound bedrock.
**A hydraulic conductivity of 4.3×10^{-6} m/s is considered for sound bedrock with fractures, which will produce more free-flowing water.

Surface Water

Surface Water Body	Distance from site (m)	Direction from site	Hydraulically Connected to Site (yes/no)
Lake Ontario	110	South	Yes

4 Monitoring Well Information

Well ID	Well Diameter (mm)	Ground Surface (masl)	Top of Screen (masl)	Bottom of Screen (masl)	Screened Geological Unit
101	50	82.6	58.1	55.0	Sound Bedrock
102	50	82.4	77.8	74.8	Sound Bedrock
103	50	82.3	57.7	54.6	Sound Bedrock
104	50	82.8	76.1	73.1	Sound Bedrock
105	50	82.5	77.6	74.6	Sound Bedrock
106	50	82.5	77.6	74.6	Sound Bedrock
107	50	82.3	75.9	72.8	Sound Bedrock
PIN-MW01	50	82.4	80.9	77.8	Sand, Silt and Inferred Bedrock
PIN-MW02	50	82.5	81.0	78.0	Sand, Silt and Inferred Bedrock
PIN-MW03	50	82.5	80.9	77.9	Sand, Silt and Inferred Bedrock

5 Groundwater Elevations

Well ID	Groundwater Elevation (masl)				
	Mar 20, 2023	April 3, 2203	May 5, 2023	June 9, 2023	Maximum
101	10.2 / 72.4	9.9 / 72.7	n/a	10.1 / 72.5	**72.5**
102	Dry	Dry	Dry	Dry	**Dry**
103	10.4 / 71.9	10.1 / 72.2	9.0 / 73.3	9.2 / 73.1	**73.1**
104	5.4 / 77.4	5.5 / 77.3	5.7 / 77.1	5.8 / 77.0	**77.4**
105	Dry	Dry	Dry	Dry	**Dry**
106	7.8 / 74.7	7.8 / 74.7	7.8 / 74.7	7.8 / 74.7	**74.7**
107	8.9 / 73.4	8.7 / 73.6	8.6 / 73.7	8.7 / 73.6	**73.7**
PIN-MW01	n/a	n/a	n/a	n/a	**n/a**
PIN-MW02	n/a	n/a	n/a	n/a	**n/a**
PIN-MW03	1.4 / 81.1	n/a	n/a	Dry	**81.1**

The design groundwater table is hydraulically connected with the water level of Lake Ontario, at about Elev. 75± m. There is also infiltrated stormwater perched in the earth fill which is flowing down towards the groundwater table (as observed and previously reported in the Pinchin monitoring wells).

Locally higher water level readings (at Elev. 77± m) were observed in Borehole 104, which was completed in the north corner of the site. These higher water level readings are considered not representative of the stabilized groundwater condition across the site.

Within the zone of excavation, the earth fill will permit the free-flow of water when wet, whereas the native clayey silt glacial till will typically preclude free-flowing water. It can be expected that weathered bedrock and fractures in sound bedrock will produce free-flowing water below the groundwater table.

Based on the measured groundwater elevations, the anticipated groundwater flow direction at this site is to the south/southeast.

Groundwater levels fluctuate with time depending on the amount of precipitation and surface runoff and may be influenced by known or unknown dewatering activities at nearby sites.

6 Aquifer Testing

6.1 Pumping Test

A pumping test was not attempted at the site. Slug tests were conducted and are presented in the section below.

6.2 Single Well Response Test (Slug Test)

The hydraulic conductivities from the monitoring wells were determined based on slug tests (single-well response tests). These tests involve rapid removal of water or addition of a “slug” which displaces a known volume of water from a single well, and then monitoring the water level in the well until it recovers. The results of the slug tests were analyzed using the Bouwer and Rice method (1976). The hydraulic properties of the strata applicable to the site are as follows:

Well ID	Well Screen Elevation (masl)	Screened Geological Unit	Hydraulic Conductivity (m/s)
BH101	58.1 - 55.0	Sound Bedrock	3.8×10^{-7}
BH102	77.8 - 74.7	Sound Bedrock	3.0×10^{-7}
BH103	57.7 - 54.6	Sound Bedrock	4.3×10^{-6}
BH104	76.1 - 73.1	Sound Bedrock	2.8×10^{-7}

Well ID	Well Screen Elevation (masl)	Screened Geological Unit	Hydraulic Conductivity (m/s)
BH105	77.6 - 74.5	Sound Bedrock	1.9×10^{-6}
BH106	77.6 - 74.6	Sound Bedrock	4.5×10^{-7}

6.3 Soil Grain Size Distribution

The hydraulic conductivities of various soil types can also be estimated from grain size analyses. An assessment of the grain sizes was conducted using the excel-based tool, HydrogeoSieve XL (*HydrogeoSieve XL ver.2.2, J.F. Devlin, University of Kansas, 2015*). HydrogeoSieve XL compares the results of the grain size analyses against fifteen (15) different analytical methods.

Given our experience in the area as well as published literature, some of the geometric means provided for the soil were biased low by one or more methods. In these instances, the values determined by these methods were excluded from the mean. The table below illustrates the hydraulic conductivity values estimated from the mean of the analytical methods where the soil met the applicable analysis criteria.

Sample ID	Soil Description	Applicable Analysis Methods	Hydraulic Conductivity (m/s)
BH102 SS4	Silt and Sand Glacial Till, some gravel, some clay	Sauerbrei, Barr, Alyamani and Sen	5.7×10^{-8}
BH103 SS4	Sandy Silt Glacial Till, some clay, some gravel	Sauerbrei, Barr, Alyamani and Sen	1.1×10^{-8}
BH104 SS4	Sandy Silt Glacial Till, some clay, trace gravel	Sauerbrei, Barr, Alyamani and Sen	8.2×10^{-9}

The results of the analyses are presented in Appendix D.

6.4 Literature

According to Freeze and Cherry (1979), the typical hydraulic conductivity of the strata investigated at the site are:

Stratum/Formation	Hydraulic Conductivity (m/s)
Earth Fill	10^{-2} to 10^{-6}
Sands	10^{-2} to 10^{-7}
Silts	10^{-5} to 10^{-9}
Glacial Tills	10^{-6} to 10^{-12}
Bedrock (Shale)	10^{-6} to 10^{-13}

7 Water Quality

One (1) unfiltered groundwater sample was collected and analyzed by a Canadian laboratory accredited and licensed by Standards Council of Canada and or Canadian Association for Laboratory Accreditation.

The sample was collected directly from monitoring well Borehole 103 on March 21, 2023. The sample was analyzed for the following parameters:

- Halton Sewer Discharge By-Law for Sanitary & Combined Discharge (2-03)
- Halton Sewer Discharge By-Law for Storm Discharge (2-03)

The groundwater sample **met** the **Limits for Storm Sewer Discharge** for all parameters analyzed.

The groundwater sample **met** the **Limits for Sanitary and Combined Sewer Discharge** for all parameters analyzed.

A true copy of the analysis report, Certificate of Analysis and a chain of custody record for the sample are enclosed.

8 Proposed Construction Method

For design purposes, the stabilized groundwater table is hydraulically connected to Lake Ontario at about Elev. 75± m. The lowest (P7) FFE is at about Elev. 60± m. Therefore,

- Bulk excavation will extend through the overburden soils and weathered bedrock, and penetrate into sound bedrock below the elevation of the design groundwater table.
- Foundation excavations will extend below the design groundwater table.
- Foundation excavations will penetrate sound bedrock, which will typically preclude free-flowing water; however, it can be expected that fractures in the sound bedrock will produce free-flowing water below the groundwater table.

The proposed shoring at the site may consist of conventional soldier piling and lagging.

The design groundwater table is hydraulically connected with the water level of Lake Ontario, at about Elev. 75± m. There is also infiltrated stormwater perched in the earth fill which is flowing down towards the groundwater table (as observed and previously reported in the Pinchin monitoring wells).

Within the zone of excavation, the earth fill will permit the free-flow of water when wet, whereas the native clayey silt glacial till will typically preclude free-flowing water. It can be expected that weathered bedrock and fractures in sound bedrock will produce free-flowing water below the groundwater table. On this basis, seepage into excavations may be allowed to drain into the excavation and then controlled by a conventional sump pump arrangement. Nevertheless, delays

in excavation will occur as the seepage is controlled and these delays should be anticipated in the construction schedule.

Positive dewatering of the bedrock is not required.

The City / Region will require a Discharge Agreement in the short term, if any water is to be discharged to the storm or sanitary sewers during construction.

9 Private Water Drainage System (PWDS)

If the proposed development consists of drained foundations, then a private water drainage system will be required. The total sub floor drain area will be approximately 1413± m^2 based on the drawings which have been provided.

If the development is designed with a private water drainage system, the drainage system is a critical structural element since it keeps water pressure from acting on the basement walls and floor slab. As such, the sump that ensures the performance of this system must have a duplexed pump arrangement for 100% pumping redundancy and these pumps must be on emergency power. The size of the sump should be adequate to accommodate the estimated groundwater seepage. It is anticipated that the groundwater seepage can be controlled with typical, widely available, commercial/residential sump pumps.

If the proposed development is designed as a watertight structure, then a private water drainage system will not be required. However, the structure must then be designed to resist hydrostatic pressure and uplift forces.

10 Groundwater Extraction and Discharge

Numerical analyses were conducted for both short term and long term dewatering scenarios. The modeling was conducted using computer software, which deploys the finite element modelling method. The Finite Element Model (FEM) for groundwater seepage indicates the short term (construction) and long term (permanent) dewatering requirements as provided below. The finite element model results are presented in Appendix E.

The groundwater seepage estimates, which have been provided, represent the steady state groundwater seepage. There will also be an initial drawdown of the groundwater before a steady state condition is reached. The rate of the initial drawdown, and therefore discharge, is dependent on the dewatering contractor and how the groundwater is being dealt with at the site.

An estimated initial volume of stored groundwater has been provided below, which will require removal before steady state is reached. In addition to the stored groundwater, there will also be additional transient groundwater flow during the initial drawdown. Transient flow volumes (and therefore discharge volumes) are a function of the rate of drawdown and will need to be accounted for in the dewatering plan for this site.

Please note that if excavation is exposed to the elements, stormwater will have to be managed. The short term control of groundwater should consider stormwater management from rainfall events. A dewatering system should be designed to consider the removal of rainfall from excavation. A design storm of 25 mm has been used in the quantity estimates.

As required by Ontario Regulation 63/16, a plan for discharge must consider the conveyance of stormwater from a 100-year storm. The additional volume that will be generated in the occurrence of a 100-year storm event is approximately 145,000 L.

The following design considerations and values have been incorporated into the numerical modelling:

- A Factor of Safety of 2.0 was used for all groundwater seepage volume calculations.
- The design hydraulic conductivities for the site are:

Design Hydraulic Conductivity	
Stratum/Formation	**K (m/s)**
Earth Fill	1.0×10^{-4}
Native Glacial Till	1.0×10^{-7}
Weathered Bedrock	1.0×10^{-7}
Sound Bedrock	4.3×10^{-7}*

*Considering a K2 to K1 ratio of 0.1 for sound bedrock.
**A hydraulic conductivity of 4.3×10^{-6} m/s is considered for sound bedrock with fractures, which will produce more free-flowing water.

Stored Groundwater (pre-excavation/dewatering)					
Volume of Excavation (m^3)	**Volume of Excavation Below Water Table (m^3)**	**Estimated Volume of Stored Groundwater**		**Estimated Volume of Available Groundwater**	
		m^3	**L**	**m^3**	**L**
35,300	23,800	5,200	5,200,000	4,600	4,600,000

Short Term (Construction) Steady State Groundwater Quantity – Safety Factor of 2.0 Used					
Estimated Groundwater Seepage		**Design Rainfall Event (25mm)**		**Estimated Total Daily Water Takings**	
L/day	**L/min**	**L/day**	**L/min**	**L/day**	**L/min**
195,000	135.4	39,000	27.1	234,000	162.5

Long Term (Permanent) Steady State Groundwater Quantity – Safety Factor of 2.0 Used					
Estimated Groundwater Seepage		Estimated Infiltrated Stormwater – Design Rainfall Event (25mm)		Estimated Total Daily Water Takings	
L/day	L/min	L/day	L/min	L/day	L/min
190,000	131.9	5,000	3.5	195,000	135.4

Regulatory Requirements	
Environmental Activity and Sector Registry (EASR) Posting	Required
Short Term Permit to Take Water (PTTW)	Not Required
Long Term Permit to Take Water (PTTW)	Not Required
Short Term Discharge Agreement	Required
Long Term Discharge Agreement	Required

The city/municipality will require Discharge Agreements in the short and long terms, if any water is to be discharged to the storm or sanitary sewers. It should be noted that securing a permit to take water on a permanent basis may not be supported by regulatory agencies.

Please note:

- After controlling groundwater during construction (sumps and pumps), it is anticipated that the groundwater table will rise to the elevation of the subfloor drainage system in the event of a drained structure.
- The proposed pump schedule for short term construction dewatering has not been completed. As such, the actual peak short term discharge rate is not available at the time of writing this report. The pump schedule must be specified by either the dewatering contractor retained or the mechanical consultant.
- The proposed pump schedule for long term permanent drainage has not been completed. As such the actual peak long term discharge rate is not available at the time writing of this report. The pump schedule must be specified by the mechanical consultant.
- On-site containment (infiltration gallery/dry well etc.) has or has not been considered as part of the proposed development at this time. If this option is considered, additional work will have to be conducted (i.e. infiltration testing).

11 Evaluation of Impact

11.1 Zone of Influence (ZOI)

The Zone of Influence (ZOI) with respect to groundwater was calculated based on the estimated groundwater taking rate and the hydraulic conductivity of the unit which water will be taken at the Site.

As positive dewatering of the bedrock is not required, a ZOI with respect to groundwater seepage at the site is expected to be negligible.

11.2 Land Stability

The impacts to land stability on adjacent structures due to the proposed short and long term dewatering at the site are summarized as follows:

Land Stability		
	Short Term (Construction)	**Long Term (Permanent)**
Dewatering Thickness (m)	16.6	15.5
Increase in Effective Stress (kPa)	160	150
Maximum Theoretical Settlement due to Dewatering (mm)	<2	<2
Public Realm Theoretical Settlement due to Dewatering (mm)	<2	<2

The theoretical maximum induced settlement occurs directly adjacent to the proposed excavation and decreases in a nonlinear fashion with distance away from the excavation.

On this basis, the impact of the proposed dewatering on the existing adjacent structures is considered by Grounded to be within acceptable limits.

11.3 City's Sewage Works

Negative impacts to City's sewage works may occur in terms of the quantity or quality of the groundwater discharged. This report provided the estimated quantity of the water discharge. However, this report does not speak to the sewer capacities. The sewer capacity analysis is provided under a separate cover by the civil consultant.

The quality of the proposed groundwater discharge is provided in Section 7. As noted in that section, the groundwater sample met the Limits for Storm Sewer Discharge and met the Limits for Sanitary and Combined Sewer Discharge.

As such additional treatment will not be required before the water can be discharged to the Storm Sewer and additional treatment will not be required before the water can be discharged to the Sanitary and Combined Sewer, to avoid impacts to the City's sewage works caused by groundwater quality.

11.4 Natural Environment

There are no natural waterbodies within the ZOI that will be affected by the proposed construction dewatering or permanent drainage. Any groundwater which will be taken from the site will be

discharged (if required) into the City's sewer systems and not into any natural waterbody. As such, there will be no impact to the natural environment caused by the water takings at the site.

11.5 Local Drinking Water Wells

The site is located within the municipal boundaries of the City of Burlington. The site and surrounding area are provided with municipal piped water and sewer supply. There is no use of the groundwater for water supply in this area of Burlington. As such, there will be no impact to drinking water wells.

11.6 Contamination Source

The site and immediately surrounding area currently consist mostly of residential and commercial areas. These land uses are not anticipated to be a source of potential contamination and are not expected to provide an Area of Potential Environmental Concern for the site. As such, the pumping of groundwater at the site is not anticipated to facilitate the movement of potential contaminants onto the site. Evaluation of the environmental condition of the site will be completed under a separate cover.

12 Proposed Mitigation Measures and Monitoring Plan

As a result of dewatering and draining the soil/bedrock, changes in groundwater level have the potential to cause settlement based on the change in the effective stresses within the ZOI. The extent of the negative impact identified in previous sections will be limited to the ZOI caused by the groundwater taking at the site.

Both the temporary construction dewatering system and the permanent building drainage system must be properly installed and screened to ensure sediments and fines will not be removed, which is typically a primary cause of dewatering related settlement.

13 Limitations

Natural occurrences, the passage of time, local construction, and other human activity all have the potential to directly or indirectly alter the subsurface conditions at or near the project site. Contractual obligations related to groundwater or stormwater control must be considered with attention and care as they relate this potential site alteration.

The hydrogeological engineering advice provided in this report is based on the factual observations made from the site investigations as reported. It is intended for use by the owner and their retained design team. If there are changes to the features of the development or to the scope, the interpreted subsurface information, geotechnical engineering design parameters, advice, and discussion on construction considerations may not be relevant or complete for the

project. Grounded should be retained to review the implications of such changes with respect to the contents of this report.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Grounded accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report, including consequential financial effects on transactions or property values, or requirements for follow-up actions and costs.

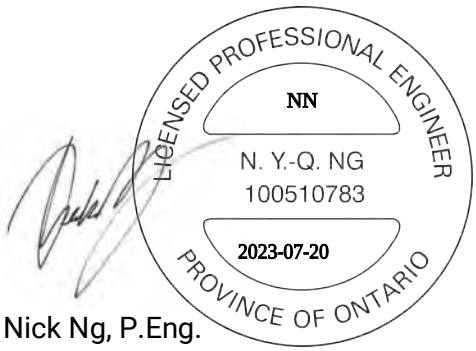
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14 Closure

If there are any questions regarding the discussion and advice provided, please do not hesitate to contact our office. We trust that this report meets your requirements at present.

For and on behalf of our team,

GROUNDED ENGINEERING



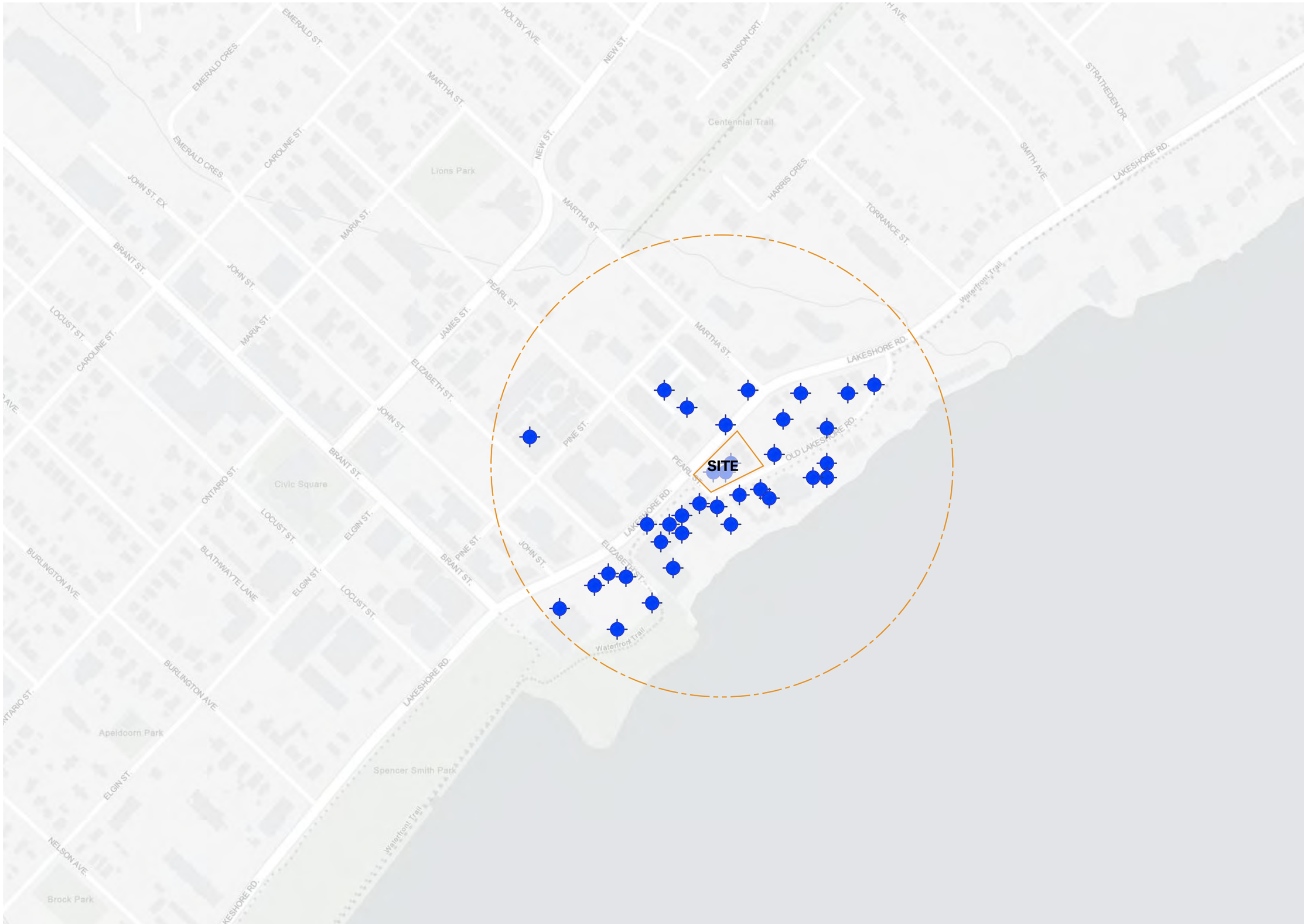
Nick Ng, P.Eng.
Project Engineer



Matt Bielaski, P.Eng., $QP_{ESA/RA}$
Principal

FIGURES





GROUNDED ENGINEERING

1 BANIGAN DRIVE, TORONTO, ONT., M4H 1G3
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LEGEND

- APPROXIMATE PROPERTY BOUNDARY
- STUDY AREA (250 m RADIUS)
- APPROXIMATE MECP WELL LOCATION (SINGLE/CLUSTER WELL)

Note

Reference

ArcGIS My Map 2022.

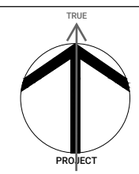
Project

2072 LAKESHORE ROAD BURLINGTON, ONTARIO

Figure Title

SITE LOCATION PLAN

North



Date

MARCH 2023

Scale

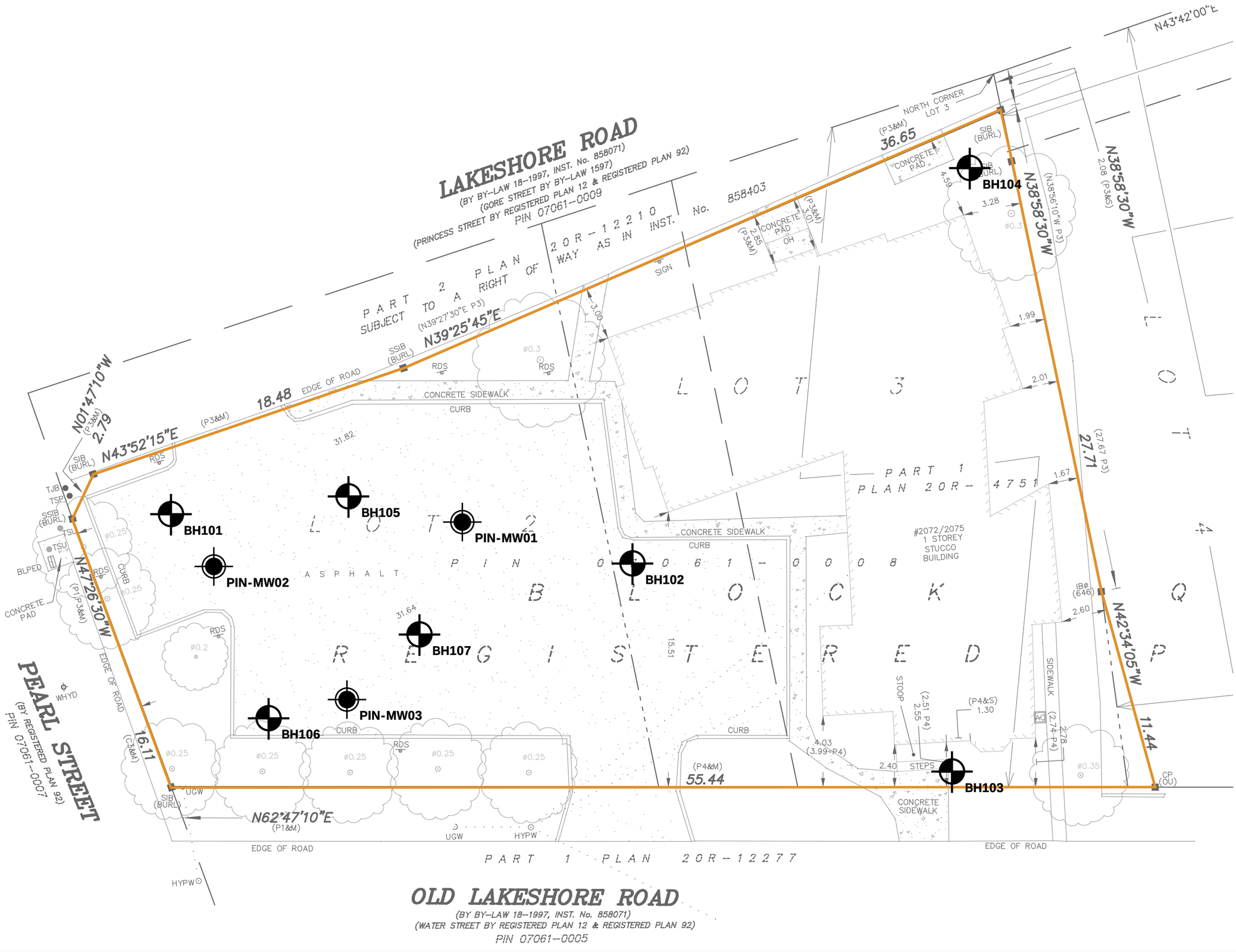
N.T.S

Job No

22-282

Figure No

FIGURE 1



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LEGEND

- APPROXIMATE SITE BOUNDARY
- MONITORING WELL/BOREHOLE BY GROUNDED
- MONITORING WELL/BOREHOLE BY OTHERS

Note

Reference

Plan of Survey, "Part of Lots 2, 3 and 4, Registered Plan 92, City of Burlington"; Project No. 19-002, dated February 15, 2019, prepared by Mackay Mackay and Peters Limited.

Project

2072 LAKESHORE ROAD BURLINGTON, ONTARIO

Figure Title

BOREHOLE LOCATION PLAN (EXISTING CONDITION)

North

TRUE

PROJECT

Date

MARCH 2023

Scale

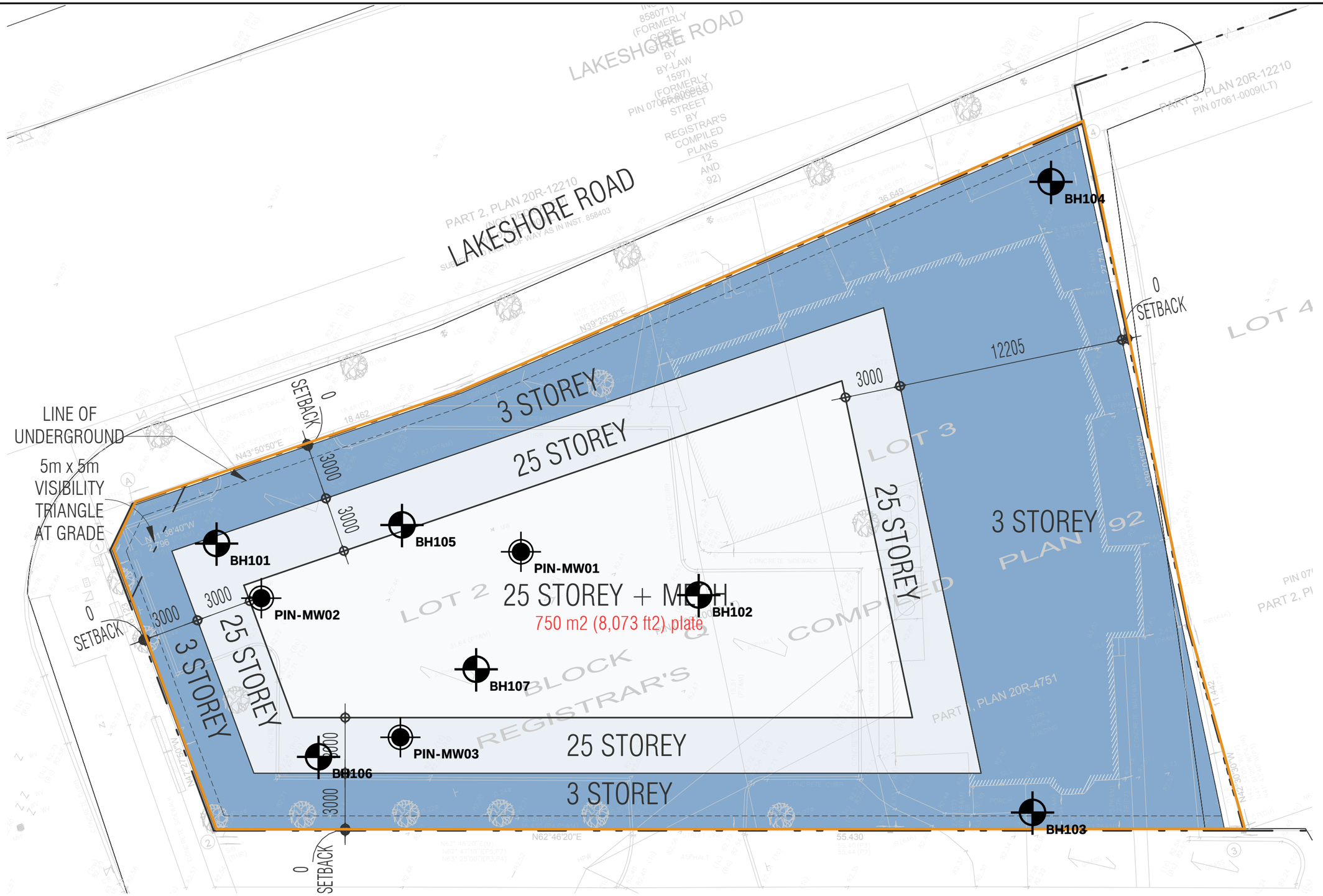
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Job No

22-282

Figure No

FIGURE 2



GROUNDED ENGINEERING

1 BANIGAN DRIVE, TORONTO, ONT., M4H 1G3
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LEGEND

- APPROXIMATE SITE BOUNDARY
- MONITORING WELL/BOREHOLE BY GROUNDED
- MONITORING WELL/BOREHOLE BY OTHERS

Note

Reference

Architectural Drawing, "Conceptual Site Plan - Option 2"; Project Number 2079.22, dated April 25, 2023, prepared by Graziani+Corazza Architects.

Project

2072 LAKESHORE ROAD BURLINGTON, ONTARIO

Figure Title

BOREHOLE LOCATION PLAN (PROPOSED CONDITION)

North

TRUE
PROJECT

Date

MARCH 2023

Scale

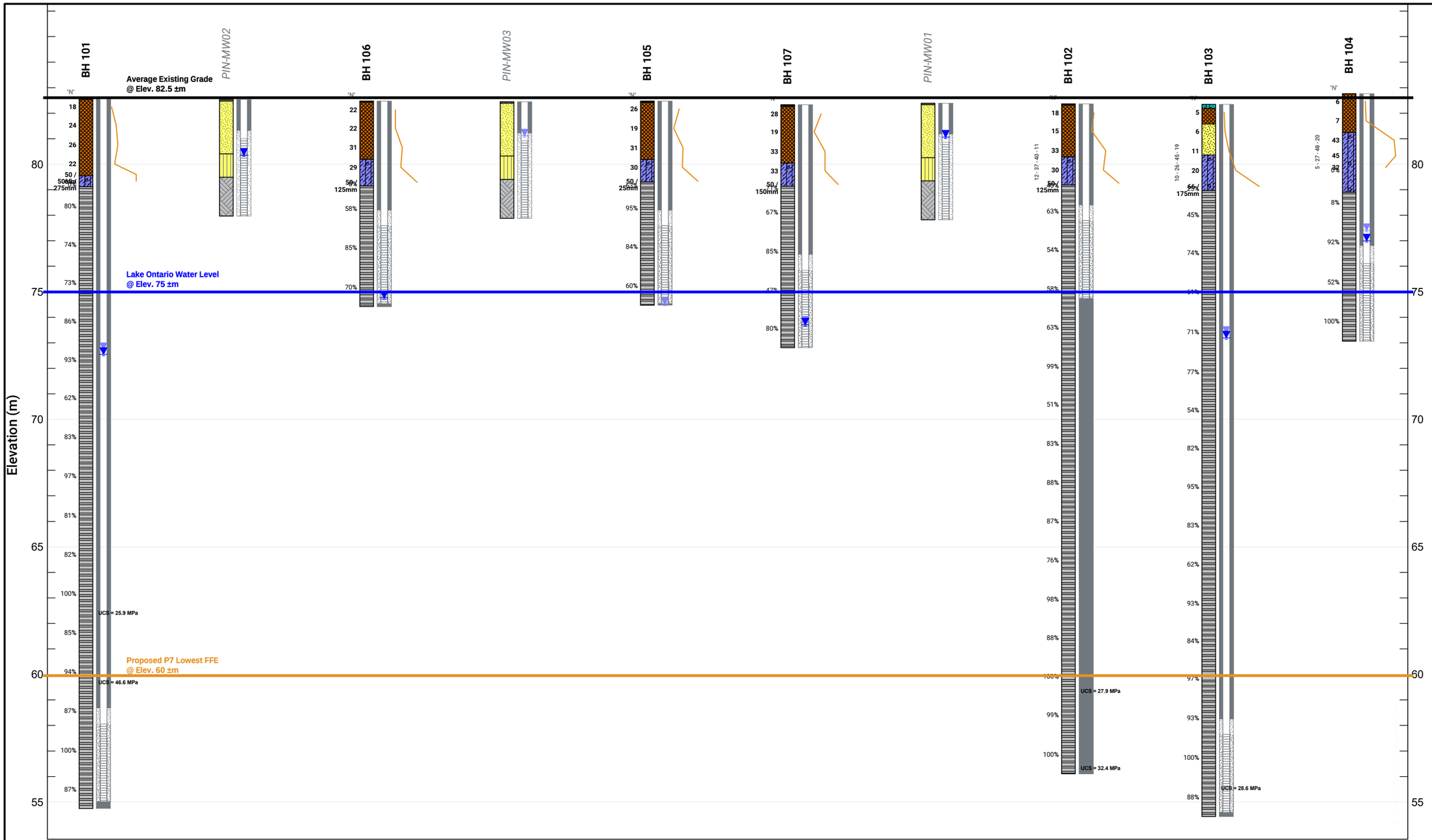
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Job No

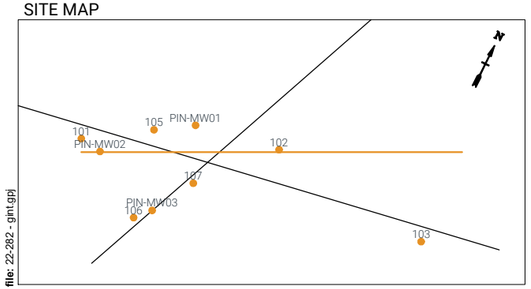
22-282

Figure No

FIGURE 3



SITE MAP



file: 22-282 - gint.gpj

Boreholes Equally Spaced

BOREHOLE STRATIGRAPHY LEGEND

- Asphalt
- Topsoil
- Fill
- Sand
- Clayey Silt Till
- Silt
- Bedrock (cored)
- Bedrock (inferred)

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LEGEND

- FILL
- GRAVELS (gravel to gravelly sand)
- SILT TO SAND (not till)
- COHESIONLESS TILLS
- COHESIVE SOILS (clayey silt to clay, incl. tills)
- DISTURBED/REWORKED/ORGANIC

BH 101 BOREHOLES BY GROUNDED

T-BH7 BOREHOLES BY OTHERS

- water level, unstabilized
- water level, stabilized (latest)
- water level, stabilized (highest)

Project

2072 LAKESHORE ROAD BURLINGTON, ON

Figure Title

SUBSURFACE PROFILE

ALL GROUNDED AND PINCHIN BOREHOLES

Date: JUNE 2023

Scale: AS INDICATED

Job No: 22-282

Figure No: **FIGURE 4**

APPENDIX A



BOREHOLE LOG TERMINOLOGY

GROUNDED ENGINEERING

SAMPLING/TESTING METHODS

SS: split spoon sample

AS: auger sample

GS: grab sample

FV: shear vane

DP: direct push

PMT: pressuremeter test

ST: shelby tube

CORE: soil coring

RUN: rock coring

SYMBOLS & ABBREVIATIONS

MC: moisture content

LL: liquid limit

PL: plastic limit

PI: plasticity index

γ: soil unit weight (bulk)

G_s: specific gravity

S_u: undrained shear strength

▽ unstabilized water level

▼ 1st water level measurement

▼ 2nd water level measurement most recent

▼ water level measurement

ENVIRONMENTAL SAMPLES

M&I: metals and inorganic parameters

PAH: polycyclic aromatic hydrocarbon

PCB: polychlorinated biphenyl

VOC: volatile organic compound

PHC: petroleum hydrocarbon

BTEX: benzene, toluene, ethylbenzene and xylene

PPM: parts per million

FIELD MOISTURE (based on tactile inspection)

DRY: no observable pore water

MOIST: inferred pore water, not observable (i.e. grey, cool, etc.)

WET: visible pore water

COHESIONLESS

Relative Density	N-Value
Very Loose	<4
Loose	4 - 10
Compact	10 - 30
Dense	30 - 50
Very Dense	>50

COHESIVE

Consistency	N-Value	Su (kPa)
Very Soft	<2	<12
Soft	2 - 4	12 - 25
Firm	4 - 8	25 - 50
Stiff	8 - 15	50 - 100
Very Stiff	15 - 30	100 - 200
Hard	>30	>200

COMPOSITION

Term	% by weight
trace silt	<10
some silt	10 - 20
silt***y***	20 - 35
sand ***and*** silt	>35

ASTM STANDARDS

ASTM D1586 Standard Penetration Test (SPT)
Driving a 51 mm O.D. split-barrel sampler ("split spoon") into soil with a 63.5 kg weight free falling 760 mm. The blows required to drive the split spoon 300 mm ("bpf") after an initial penetration of 150 mm is referred to as the N-Value.

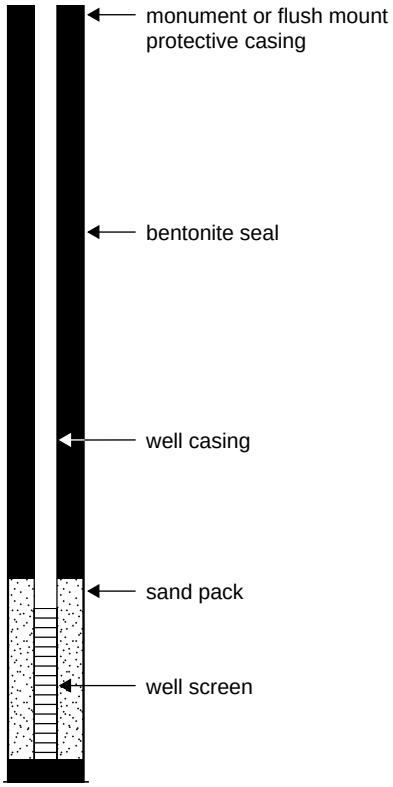
ASTM D3441 Cone Penetration Test (CPT)
Pushing an internal still rod with a outer hollow rod ("sleeve") tipped with a cone with an apex angle of 60° and a cross-sectional area of 1000 mm^2 into soil. The resistance is measured in the sleeve and at the tip to determine the skin friction and the tip resistance.

ASTM D2573 Field Vane Test (FVT)
Pushing a four blade vane into soil and rotating it from the surface to determine the torque required to shear a cylindrical surface with the vane. The torque is converted to the shear strength of the soil using a limit equilibrium analysis.

ASTM D1587 Shelby Tubes (ST)
Pushing a thin-walled metal tube into the in-situ soil at the bottom of a borehole, removing the tube and sealing the ends to prevent soil movement or changes in moisture content for the purposes of extracting a relatively undisturbed sample.

ASTM D4719 Pressuremeter Test (PMT)
Place an inflatable cylindrical probe into a pre-drilled hole and expanding it while measuring the change in volume and pressure in the probe. It is inflated under either equal pressure increments or equal volume increments. This provides the stress-strain response of the soil.

WELL LEGEND



ROCK CORE TERMINOLOGY (MTO SHALE)

TCR **Total Core Recovery** the total length of recovery (soil or rock) per run, as a percentage of the drilled length
SCR **Solid Core Recovery** the total length of sound full-diameter rock core pieces per run, as a percentage of the drilled length
RQD **Rock Quality Designation** the sum of all pieces of sound rock core in a run which are 10 cm or greater in length, as a percentage of the drilled length

Natural Fracture Frequency (typically per 0.3 m) The number of natural discontinuities (joints, faults, etc.) which are present per 0.3m. Ignores mechanical or drill-induced breaks, and closed discontinuities (e.g. bedding planes).

LOGGING DISCONTINUITIES

Discontinuity Type

BP bedding parting
CL cleavage
CS crushed seam
FZ fracture zone
MB mechanical break
IS infilled seam
JT Joint
SS shear surface
SZ shear zone
VN vein
VO void

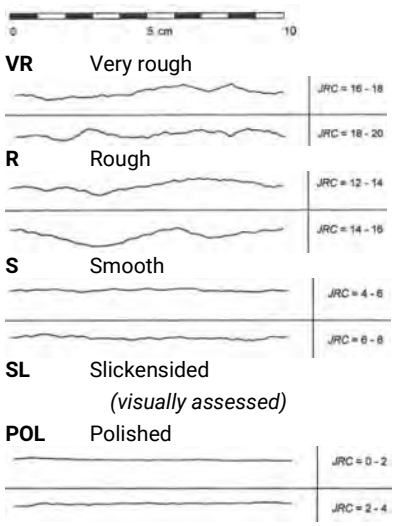
Coating

CN Clean
SN Stained
OX Oxidized
VN Veneer
CT Coating (>1 mm)

Dip Inclination

H	horizontal/flat	0 - 20°
D	dipping	20 - 50°
SV	sub-vertical	50 - 90°
V	vertical	90±°

Roughness (Barton et al.)



VR Very rough
R Rough
S Smooth
SL Slickensided *(visually assessed)*
POL Polished

Spacing in Discontinuity Sets (*ISRM 1981*)

VC	very close	< 60 mm
C	close	60 – 200 mm
M	mod. close	0.2 to 0.6 m
W	wide	0.6 to 2 m
VW	very wide	> 2 m

Aperture Size

T	closed / tight	< 0.5 mm
GA	gapped	0.5 to 10 mm
OP	open	> 10 mm

Planarity

PR	Planar
UN	Undulating
ST	Stepped
IR	Irregular
DIS	Discontinuous
CU	Curved

GENERAL

Degree of Weathering (*after MTO, RR229 Evaluation of Shales for Construction Projects*)

Zone	Degree	Description
Z1	unweathered	shale, regular jointing
Z2	partially weathered	angular blocks of unweathered shale, no matrix, with chemically weathered but intact shale
Z3		soil-like matrix with frequent angular shale fragments < 25mm diameter
Z4a		soil-like matrix with occasional shale fragments < 3mm diameter
Z4b	fully weathered	soil-like matrix only

Strength classification (*after Marinos and Hoek, 2001; ISRM 1981b*)

Grade		UCS (MPa)	Field Estimate (Description)
R6	extremely strong	> 250	can only be chipped by geological hammer
R5	very strong	100 - 250	requires many blows from geological hammer
R4	strong	50 - 100	requires more than one blow from geological hammer
R3	medium strong	25 - 50	can't be scraped, breaks under one blow from geological hammer
R2	weak	5 - 25	can be peeled / scraped with knife with difficulty
R1	very weak	1 - 5	easily scraped / peeled, crumbles under firm blow of geo. hammer
R0	extremely weak	< 1	indented by thumbnail

Bedding Thickness (*Q. J. Eng. Geology, Vol 3, 1970*)

Very thickly bedded	> 2 m
Thickly bedded	0.6 – 2m
Medium bedded	200 – 600mm
Thinly bedded	60 – 200mm
Very thinly bedded	20 – 60mm
Laminated	6 – 20mm
Thinly Laminated	< 6mm

GROUNDED ENGINEERING

Date Started : Mar 7, 2023
Position : E: 597841, N: 4797701 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 101

File No. : 22-282 **Project** : 2072 Lakeshore Road, Burlington, ON **Client** : Trinity Point

drill method : *LC rig*

hollow stem augers OD=215 mm

rock coring (HQ) OD=96 mm

elev depth (m)	description	graphic log	number	type	SPT N-value
82.6	**GROUND SURFACE**				
	50mm **ASPHALT**				
	FILL, sand, some gravel, trace to some silt, compact, brown, moist ...at 0.4 m, trace asphalt fragments		1	SS	18
			2	SS	24
			3	SS	26
			4	SS	22
79.6 3.0	...at 3.0 m, inferred concrete obstruction		5	SS	50 / 50mm
			6	SS	65 / 275mm
79.1 3.5	**CLAYEY SILT**, trace shale fragments, trace sand, trace gravel, hard, reddish brown, moist (GLACIAL TILL)				
	QUEENSTON FORMATION (See rock core log for details)		2	RUN	
			3	RUN	
			4	RUN	
			5	RUN	
			6	RUN	
			7	RUN	
			8	RUN	
			9	RUN	

depth scale (m): 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14

well details

elevation (m): 82 81 80 79 78 77 76 75 74 73 72 71 70 69 68

undrained shear strength (kPa)
○ unconfined ✚ field vane
● pocket penetrometer ■ Lab Vane
40 80 120 160

SPT N-values (bpf)
× dynamic cone
10 20 30 40

headspace vapour (ppm)
× hexane ☐ isobutylene
⊠ methane
100 200 300

moisture / plasticity
PL MC LL
10 20 30

5.0 m (Elev. 77.6 m): transition to sound bedrock

unstabilized water level

lab data and comments

grain size distribution (%) (MIT)
GR SA SI CL

SS3: BTEX, EC/SAR, H-Ms, Metals, ORPs, PAHs, pH, PHCs, VOCs

SS4: BTEX, EC/SAR, H-Ms, Metals, ORPs, PAHs, pH, PHCs, VOCs
3.0m: auger grinding and sampler bouncing with practical refusal, re-located borehole and re-drilled to depth, resumed sampling
3.3m: Run 1 encountered inferred caved materials overlapping with the SS6 interval

file: 22-282 - gint.gpj

Tech : CSH/MW | **PM** : NN | **Rev** : NN

(continued next page)

GROUNDED ENGINEERING

Date Started : Mar 7, 2023
Position : E: 597841, N: 4797701 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 101

File No. : 22-282 **Project** : 2072 Lakeshore Road, Burlington, ON **Client** : Trinity Point

drill method : LC rig

rock coring (HQ) OD=96 mm

elev depth (m)	description (continued)	graphic log	number	type	SPT N-value
	QUEENSTON FORMATION (See rock core log for details) *(continued)*		9	RUN	
			10	RUN	
			11	RUN	
			12	RUN	
			13	RUN	
			14	RUN	
			15	RUN	
			16	RUN	
			17	RUN	
54.8					
27.8	**END OF BOREHOLE**				

depth scale (m): 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27

well details

elevation (m): 67, 66, 65, 64, 63, 62, 61, 60, 59, 58, 57, 56, 55

undrained shear strength (kPa): unconfined, field vane, pocket penetrometer, Lab Vane; 40, 80, 120, 160

SPT N-values (bpf): dynamic cone; 10, 20, 30, 40

headspace vapour (ppm): hexane, isobutylene, methane; 100, 200, 300

moisture / plasticity: PL, MC, LL; 10, 20, 30

unstabilized water level

lab data and comments

grain size distribution (%) (MIT): GR SA SI CL

Contained drill water upon completion of drilling. Unstabilized water level and cave not measured.

50 mm dia. monitoring well installed.
No. 10 screen

GROUNDWATER LEVELS

date	depth (m)	elevation (m)
Mar 20, 2023	10.2	72.4
Apr 3, 2023	9.9	72.7
Jun 9, 2023	10.1	72.5

file: 22-282 - gint.gpj

Tech : CSH/MW | **PM** : NN | **Rev** : NN

GROUNDED ENGINEERING

Date Started : Mar 7, 2023
Position : E: 597841, N: 4797701 (UTM 17T)
Elev. Datum : Geodetic

ROCK CORE LOG 101

File No. : 22-282 **Project** : 2072 Lakeshore Road, Burlington, ON **Client** : Trinity Point

Rock coring started at 3.3m below grade — elev. depth (m) 79.3

CLAYEY SILT, trace shale fragments, trace sand, trace gravel, hard, reddish brown, moist (GLACIAL TILL)
3.3 — Run R1 — TCR = **0%** SCR = **0%** RQD = **0%**
3.5

QUEENSTON FORMATION
Shale, reddish brown, thinly bedded to medium bedded, weak; joints are horizontal, closed to gapped, clean, calcareous

Run R2 — TCR = **98%** SCR = **92%** RQD = **80%**
77.6

... at 5.0 m (Elev. 77.6 m), transition to sound rock

5.0 — Run R3 — TCR = **100%** SCR = **98%** RQD = **74%**
76.1

6.5 — Run R4 — TCR = **90%** SCR = **80%** RQD = **73%**
74.6

8.0 — Run R5 — TCR = **98%** SCR = **95%** RQD = **86%**
73.1

9.5 — Run R6 — TCR = **98%** SCR = **98%** RQD = **93%**
71.6

11.0 — Run R7 — TCR = **98%** SCR = **87%** RQD = **62%**
70.1

12.5 — Run R8 — TCR = **98%** SCR = **89%** RQD = **83%**
68.6

14.0 — Run R9 — TCR = **100%** SCR = **100%** RQD = **97%**
67.0

15.6 — Run R10 — TCR = **100%** SCR = **95%** RQD = **81%**
65.5

17.1 — Run R11 — TCR = **100%** SCR = **90%** RQD = **82%**

elevation (m)	natural fracture frequency	notes and comments
79	core loss	**3.3 / 79.3 - 3.5 / 79.1m:** inferred caved materials and subsequent core loss
	4	**3.5 / 79.1m:** observed weathered bedrock, with 25mm of rubblized core
	3	**3.8 / 78.8m:** 75mm of rubblized core
	1	
78	1	
	0	
	2	
	1	
77	3	**5.7 / 76.9 - 5.9 / 76.7m:** JT SV PR SU CN 125mm
	1	
	2	
76	4	
	1	
	3	**7.3 / 75.3m:** 25mm of rubblized core
75	4	**7.4 / 75.2m:** IS CI 63mm
	0	
	1	
74	2	
	2	
	1	
73	4	
	1	
	3	
	1	
72	2	
	1	
	0	
	0	**11.5 / 71.1m:** 50mm of rubblized core
71	7	**11.6 / 71.0m:** IS CI 38mm
	4	
	1	**12.3 / 70.3m:** 25mm of rubblized core
70	4	**12.5 / 70.1m:** JT D PR SU CN
	7	**12.9 / 69.7m:** 25mm of rubblized core
	3	
69	0	
	0	
	0	
68	0	
	1	
	2	
	0	
67	0	
	0	
	0	
66	0	**16.8 / 65.8m:** JT D PR SU CN; , with 150mm of rubblized core
	4	**17.0 / 65.6m:** JT D PR SU CN
	5	
65	0	
	1	**17.9 / 64.7m:** 38mm of rubblized core
	2	**18.2 / 64.4m:** JT D PR SU CN

(continued next page)
Tech : CSH/MW | **PM** : NN | **Rev** : NN

file: 22-282 - gint.gpj

GROUNDED ENGINEERING

Date Started : Mar 7, 2023
Position : E: 597841, N: 4797701 (UTM 17T)
Elev. Datum : Geodetic

ROCK CORE LOG 101

File No. : 22-282 **Project** : 2072 Lakeshore Road, Burlington, ON **Client** : Trinity Point

depth (m)	graphic log	stratigraphy	Run / elev. depth (m)	recovery
		QUEENSTON FORMATION	79.3	
		Shale, reddish brown, thinly bedded to medium bedded, weak; joints are horizontal, closed to gapped, clean, calcareous	R11 63.9	
19			18.7 R12 62.4	TCR = **100**% SCR = **100**% RQD = **100**%
20			20.2 R13 60.9	TCR = **99**% SCR = **98**% RQD = **85**%
21			21.7 R14 59.3	TCR = **100**% SCR = **100**% RQD = **94**%
22			23.3 R15 57.8	TCR = **100**% SCR = **95**% RQD = **87**%
23			24.8 R16 56.3	TCR = **100**% SCR = **100**% RQD = **100**%
24			26.3 R17 54.8	TCR = **100**% SCR = **96**% RQD = **87**%
25			27.9m	
26		**END OF COREHOLE**		
27				

shale weathering zones: Z1 | Z2 | Z3 | Z4

UCS (MPa) ● — 5 25 50 100 250

estimated strength: R1 | R2 | R3 | R4 | R5 | R6

elevation (m)	natural fracture frequency	laboratory testing	notes and comments
64	2		
	7		
	0		
63	0		
	0		
	0	**El. 62.4m**: UCS = 25.9 MPa E = 3.60 GPa ϒ = 25.9 kN/m³	
62	0		
	0		
	1		**21.2 / 61.4m:** JT D PR SU CN
61	3		
	0		
	0		
60	0		
	0	**El. 59.7m**: UCS = 46.6 MPa E = 9.50 GPa ϒ = 25.9 kN/m³	
	1		**23.3 / 59.3m:** JT D PR SU CN
59	0		
	1		
	2		
58	0		
	0		
	2		
57	0		
	0		
	0		
	0		
56	0		
	0		**26.8 / 55.8m:** calcareous, green-grey band
	3		**26.8 / 55.8m:** JT D PR SU CN
	2		**27.3 / 55.3m:** JT D PR SU CN
55	2		

file: 22-282 - gint.gpj

Tech : CSH/MW | **PM** : NN | **Rev** : NN

GROUNDED ENGINEERING

Date Started : Mar 9, 2023
Position : E: 597865, N: 4797712 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 102

File No. : 22-282 **Project** : 2072 Lakeshore Road, Burlington, ON **Client** : Trinity Point

drill method : LC rig

elev depth (m)	description	graphic log	number	type	SPT N-value
82.4	**GROUND SURFACE**				
	50mm **ASPHALT**		1	SS	18
	FILL, sand, some gravel, trace to some silt, moderate petroleum hydrocarbon odour, compact, brown, moist				
	...at 0.4 m, trace asphalt fragments		2	SS	15
	...at 1.5 m, dense		3A	SS	33
80.3 / 2.1	**CLAYEY SILT**, some gravel, trace sand, moderate petroleum hydrocarbon odour, hard, reddish brown, moist (GLACIAL TILL)		3B		
	...at 2.6 m, layer of silt and sand glacail till, some gravel, some clay, dense, reddish brown, moist		4	SS	30
79.2 / 3.2	**QUEENSTON FORMATION** (See rock core log for details)		5	SS	50 / 125mm
			1	RUN	
			2	RUN	
			3	RUN	
			4	RUN	
			5	RUN	
			6	RUN	
			7	RUN	
			8	RUN	
			9	RUN	

hollow stem augers OD=215 mm

rock coring (HQ) OD=96 mm

depth scale (m): 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14

well details

elevation (m): 82 81 80 79 78 77 76 75 74 73 72 71 70 69 68

undrained shear strength (kPa)
○ unconfined + field vane
● pocket penetrometer ■ Lab Vane
40 80 120 160

SPT N-values (bpf)
× dynamic cone
10 20 30 40

headspace vapour (ppm)
× hexane □ isobutylene
⊠ methane
100 200 300

moisture / plasticity
PL MC LL
10 20 30

4.2 m (Elev. 78.2 m): transition to sound bedrock

unstabilized water level

lab data and comments

grain size distribution (%) (MIT)
GR SA SI CL

SS2: BTEX, PAHs, PHCs, VOCs

3A: EC/SAR, H-Ms, Metals, ORPs, pH

12 37 40 11

SS4: BTEX, EC/SAR, H-Ms, Metals, ORPs, PAHs, pH, PHCs, VOCs

3.0m: auger grinding

RUN7: BTEX, H-Ms, Metals, ORPs, PAHs, pH, PHCs, VOCs

file: 22-282 - gint.gpj

Tech : CSH/MW | **PM** : NN | **Rev** : NN

(continued next page)

GROUNDED ENGINEERING

Date Started : Mar 9, 2023
Position : E: 597865, N: 4797712 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 102

File No. : 22-282 **Project** : 2072 Lakeshore Road, Burlington, ON **Client** : Trinity Point

drill method : *LC rig*
rock coring (HQ) OD=96 mm

elev depth (m)	description	graphic log	samples: number	samples: type	samples: SPT N-value
	(continued)				
	QUEENSTON FORMATION (See rock core log for details) *(continued)*		9	RUN	
			10	RUN	
			11	RUN	
			12	RUN	
			13	RUN	
			14	RUN	
			15	RUN	
			16	RUN	
56.1 26.3	**END OF BOREHOLE**				

depth scale (m): 15 16 17 18 19 20 21 22 23 24 25 26

well details

elevation (m): 67 66 65 64 63 62 61 60 59 58 57

undrained shear strength (kPa)
○ unconfined + field vane
● pocket penetrometer ■ Lab Vane
40 80 120 160

SPT N-values (bpf)
× dynamic cone
10 20 30 40

headspace vapour (ppm)
× hexane □ isobutylene
▣ methane
100 200 300

moisture / plasticity
PL MC LL
10 20 30

unstabilized water level

lab data and comments

grain size distribution (%) (MIT)
GR SA SI CL

Contained drill water upon completion of drilling. Unstabilized water level and cave not measured.

50 mm dia. monitoring well installed.
No. 10 screen

GROUNDWATER LEVELS

date	depth (m)	elevation (m)
Mar 20, 2023	dry	n/a
Apr 3, 2023	dry	n/a
May 5, 2023	dry	n/a
Jun 9, 2023	dry	n/a

file: 22-282 - gint.gpj

Tech : CSH/MW | **PM** : NN | **Rev** : NN

GROUNDED ENGINEERING

Date Started : Mar 9, 2023
Position : E: 597865, N: 4797712 (UTM 17T)
Elev. Datum : Geodetic

ROCK CORE LOG 102

File No. : 22-282 **Project** : 2072 Lakeshore Road, Burlington, ON **Client** : Trinity Point

Rock coring started at 2.9m below grade

CLAYEY SILT, some gravel, trace sand, moderate petroleum hydrocarbon odour, hard, reddish brown, moist (GLACIAL TILL)

QUEENSTON FORMATION
Shale, reddish brown, thinly bedded to medium bedded, weak; joints are horizontal, closed to gapped, clean, calcareous
... at 4.2 m (Elev. 78.2 m), transition to sound rock

Run	elev. depth (m)	recovery
	79.5	
R1	2.9	TCR = **88%** SCR = **55%** RQD = **40%**
	3.5	
R2		TCR = **100%** SCR = **88%** RQD = **63%**
	77.4	
R3	5.0	TCR = **100%** SCR = **92%** RQD = **54%**
	75.9	
R4	6.5	TCR = **100%** SCR = **85%** RQD = **58%**
	74.4	
R5	8.0	TCR = **100%** SCR = **87%** RQD = **63%**
	72.9	
R6	9.5	TCR = **99%** SCR = **99%** RQD = **99%**
	71.4	
R7	11.0	TCR = **100%** SCR = **90%** RQD = **51%**
	69.9	
R8	12.5	TCR = **100%** SCR = **100%** RQD = **83%**
	68.3	
R9	14.1	TCR = **99%** SCR = **99%** RQD = **88%**
	66.8	
R10	15.6	TCR = **100%** SCR = **98%** RQD = **87%**
	65.3	
R11	17.1	TCR = **100%** SCR = **97%** RQD = **76%**

shale weathering zones: Z1 Z2 Z3 Z4
UCS (MPa) / estimated strength: 5 25 50 100 250; R1 R2 R3 R4 R5 R6
natural fracture frequency: n/a, 0, 3, 3, 1, 0, 3, 3, 1, 3, 3, 4, 2, 1, 3, 4, 3, 5, 1, 5, 0, 1, 1, 2, 0, 0, 0, 0, 4, 2, 7, 5, 7, 0, 1, 0, 0, 0, 3, 0, 0, 0, 0, 1, 2, 7, 0, 3, 2, 1

laboratory testing

notes and comments

2.9 / 79.5 - 3.2 / 79.2m: recovered caved materials and native soil
3.2 / 79.2m: observed weathered bedrock
3.7 / 78.7m: 25mm of rubblized core
3.9 / 78.4m: JT SV PR SU CN 88mm
4.9 / 77.5m: JT SV PR SU CN 25mm
6.3 / 76.0m: 50mm of rubblized core
7.3 / 75.1m: 63mm of rubblized core
7.4 / 75.0m: 25mm of rubblized core
8.1 / 74.3m: 50mm of rubblized core
8.2 / 74.1m: 50mm of rubblized core
8.4 / 74.0m: JT SV PR SU CN 75mm
8.6 / 73.7m: 50mm of rubblized core
12.2 / 70.1m: 13mm of rubblized core
12.4 / 70.0m: 38mm of rubblized core

(continued next page)
Tech : CSH/MW | **PM** : NN | **Rev** : NN

file: 22-282 - gint.gpj

GROUNDED ENGINEERING

Date Started : Mar 9, 2023
Position : E: 597865, N: 4797712 (UTM 17T)
Elev. Datum : Geodetic

ROCK CORE LOG 102

File No. : 22-282 **Project** : 2072 Lakeshore Road, Burlington, ON **Client** : Trinity Point

depth (m)	graphic log	stratigraphy	Run elev depth (m)	recovery	elevation (m)	shale weathering zones Z1 Z2 Z3 Z4	UCS (MPa) 5 25 50 100 250 / estimated strength R1 R2 R3 R4 R5 R6	natural fracture frequency	laboratory testing	notes and comments	elevation (m)
18		**QUEENSTON FORMATION** **Shale**, reddish brown, thinly bedded to medium bedded, weak; joints are horizontal, closed to gapped, clean, calcareous	**79.5** R11 63.8	TCR = **100**% SCR = **97**% RQD = **76**%	64			6			64
			18.6 R12 62.2	TCR = **100**% SCR = **100**% RQD = **98**%	63			0 0 0 0 0 0			63
19											
20			20.2 R13 60.7	TCR = **99**% SCR = **94**% RQD = **88**%	62			2 0 0 1 0		**20.2 / 62.1m:** calcareous, green-grey band **20.9 / 61.5m:** calcareous, green-grey band	62
21											
22			21.7 R14 59.2	TCR = **100**% SCR = **100**% RQD = **100**%	61			4 0 0 0			61
23			23.2 R15 57.7	TCR = **99**% SCR = **99**% RQD = **99**%	60			0 1 0 0 1	**El. 59.4m**: UCS = 27.9 MPa E = 5.40 GPa γ = 26.0 kN/m^3		60
24					59						59
25			24.7 R16 56.1	TCR = **100**% SCR = **100**% RQD = **100**%	58			0 0 0 1 0			58
26			**26.3m**		57			1	**El. 56.3m**: UCS = 32.4 MPa E = 6.80 GPa γ = 25.8 kN/m^3		57
		END OF COREHOLE									

file: 22-282 - gint.gpj

Tech : CSH/MW | **PM** : NN | **Rev** : NN

GROUNDED ENGINEERING

Date Started : Mar 15, 2023
Position : E: 597887, N: 4797709 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 103

File No. : 22-282 **Project** : 2072 Lakeshore Road, Burlington, ON **Client** : Trinity Point

drill method : LC rig

hollow stem augers OD=215 mm

rock coring (HQ) OD=96 mm

elev depth (m)	description	graphic log	number	type	SPT N-value
82.3	**GROUND SURFACE**				
82.1 / 0.2	150mm **TOPSOIL**				
	FILL, sand, trace silt, trace rock fragments, trace rootlets, loose, blackish brown, moist		1	SS	5
81.5 / 0.8	**SAND**, some silt, trace gravel, loose to compact, brown, moist to wet		2	SS	6
80.3 / 2.0	**CLAYEY SILT**, trace sand, trace gravel, very stiff, reddish brown, moist (GLACIAL TILL)		3A	SS	11
			3B		
			4	SS	20
	...at 3.0 m, layer of sandy silt glacial till, some clay, some gravel, some shale fragments, hard, reddish brown, moist		5	SS	66 / 175mm
78.9 / 3.4			1	RUN	
	QUEENSTON FORMATION (See rock core log for details)		2	RUN	
			3	RUN	
			4	RUN	
			5	RUN	
			6	RUN	
			7	RUN	
			8	RUN	
			9	RUN	

depth scale (m): 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14

well details

elevation (m): 82 81 80 79 78 77 76 75 74 73 72 71 70 69 68

undrained shear strength (kPa)
○ unconfined + field vane
● pocket penetrometer ■ Lab Vane
40 80 120 160

SPT N-values (bpf)
× dynamic cone
10 20 30 40

headspace vapour (ppm)
× hexane □ isobutylene
⊠ methane
100 200 300

moisture / plasticity
PL MC LL
10 20 30

3.9 m (Elev. 78.4 m): transition to sound bedrock

unstabilized water level

lab data and comments

grain size distribution (%) (MIT)
GR SA SI CL

SS2: BTEX, PAHs, PHCs, VOCs

3A: EC/SAR, H-Ms, Metals, ORPs, pH

10 26 45 19

SS4: BTEX, EC/SAR, H-Ms, Metals, ORPs, PAHs, pH, PHCs, VOCs

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Tech : CSH | **PM** : NN | **Rev** : NN

file: 22-282 - gint.gpj

GROUNDED ENGINEERING

Date Started : Mar 15, 2023
Position : E: 597887, N: 4797709 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 103

File No. : 22-282 **Project** : 2072 Lakeshore Road, Burlington, ON **Client** : Trinity Point

drill method : LC rig

rock coring (HQ) OD=96 mm

elev depth (m)	description (continued)	graphic log	number	type	SPT N-value
	QUEENSTON FORMATION (See rock core log for details) *(continued)*		9	RUN	
			10	RUN	
			11	RUN	
			12	RUN	
			13	RUN	
			14	RUN	
			15	RUN	
			16	RUN	
			17	RUN	
54.4					
27.9	**END OF BOREHOLE**				

depth scale (m): 15 16 17 18 19 20 21 22 23 24 25 26 27

well details

elevation (m): 67 66 65 64 63 62 61 60 59 58 57 56 55

undrained shear strength (kPa)
○ unconfined + field vane
● pocket penetrometer ■ Lab Vane
40 80 120 160

SPT N-values (bpf)
× dynamic cone
10 20 30 40

headspace vapour (ppm)
× hexane □ isobutylene
▣ methane
100 200 300

moisture / plasticity
PL MC LL
10 20 30

unstabilized water level

lab data and comments

grain size distribution (%) (MIT)
GR SA SI CL

RUN12: BTEX, EC/SAR, H-Ms, Metals, ORPs, PAHs, pH, PHCs, VOCs

Borehole was filled with drill water upon completion of drilling.

50 mm dia. monitoring well installed.
No. 10 screen

GROUNDWATER LEVELS

date	depth (m)	elevation (m)
Mar 20, 2023	10.4	71.9
Apr 3, 2023	10.1	72.2
May 5, 2023	9.0	73.3
Jun 9, 2023	9.2	73.1

file: 22-282 - gint.gpj

Tech : CSH | **PM** : NN | **Rev** : NN

GROUNDED ENGINEERING

Date Started : Mar 15, 2023
Position : E: 597887, N: 4797709 (UTM 17T)
Elev. Datum : Geodetic

ROCK CORE LOG 103

File No. : 22-282 **Project** : 2072 Lakeshore Road, Burlington, ON **Client** : Trinity Point

Rock coring started at 3.0m below grade

CLAYEY SILT, trace sand, trace gravel, very stiff, reddish brown, moist
(GLACIAL TILL)

QUEENSTON FORMATION
Shale, reddish brown, thinly bedded to medium bedded, weak; joints are horizontal, closed to gapped, clean, calcareous
... at 3.9 m (Elev. 78.4 m), transition to sound rock

Run	elev. depth (m)	recovery
	79.3	
R1	3.0 – 3.6	TCR = **100%** SCR = **70%** RQD = **25%**
R2	3.6 – 77.2	TCR = **100%** SCR = **90%** RQD = **45%**
R3	5.1 – 75.7	TCR = **100%** SCR = **88%** RQD = **74%**
R4	6.6 – 74.2	TCR = **100%** SCR = **74%** RQD = **61%**
R5	8.1 – 72.6	TCR = **100%** SCR = **78%** RQD = **71%**
R6	9.7 – 71.0	TCR = **100%** SCR = **95%** RQD = **77%**
R7	11.3 – 69.6	TCR = **100%** SCR = **93%** RQD = **54%**
R8	12.7 – 68.1	TCR = **100%** SCR = **95%** RQD = **82%**
R9	14.2 – 66.6	TCR = **100%** SCR = **98%** RQD = **95%**
R10	15.7 – 65.1	TCR = **100%** SCR = **95%** RQD = **83%**
R11	17.2	TCR = **100%** SCR = **97%** RQD = **62%**

natural fracture frequency	notes and comments
core loss	**3.0 / 79.3 - 3.2 / 79.1m:** inferred caved materials and subsequent core loss
>10	**3.2 / 79.1 - 3.4 / 78.9m:** observed native soil
3	**3.4 / 78.9m:** observed weathered bedrock
2	
2	**4.1 / 78.2m:** JT SV UN R GA CN 50mm
2	**4.2 / 78.2m:** JT SV UN R GA CN 38mm
1	**4.7 / 77.6m:** JT SV UN R GA CN 88mm
3	**5.2 / 77.1m:** JT SV UN R GA CN 50mm
2	**5.3 / 77.1m:** JT SV IR R GA CN 25mm
1	
1	
5	**6.2 / 76.1m:** 38mm of rubblized core
5	**6.6 / 75.8m:** JT SV CU R T CN
9	**6.7 / 75.7m:** 113mm of rubblized core
4	**7.1 / 75.3m:** 50mm of rubblized core
>10	**7.4 / 74.9m:** 25mm of rubblized core
1	**7.9 / 74.4m:** 38mm of rubblized core
3	**8.1 / 74.2 - 8.3 / 74.0m:** IS CI 175mm; , with 25mm of rubblized core
3	**8.5 / 73.9m:** 75mm of rubblized core
6	**8.7 / 73.6m:** 50mm of rubblized core
3	
2	
4	**9.8 / 72.5m:** IS CI 50mm
1	
0	
4	
1	
0	
5	**11.6 / 70.7m:** 50mm of rubblized core
3	**11.7 / 70.7m:** JT D UN R GA CN
8	**11.8 / 70.5m:** JT D UN R GA CN
4	
7	
3	
0	
0	
0	
0	
3	
0	**14.8 / 67.5m:** JT SV ST R GA CN
0	
0	
1	
0	
1	
5	
1	
2	
4	**17.8 / 64.6m:** JT D UN R GA CN
1	

(continued next page)

Tech : CSH | **PM** : NN | **Rev** : NN

file: 22-282 - gint.gpj

GROUNDED ENGINEERING

Date Started : Mar 15, 2023
Position : E: 597887, N: 4797709 (UTM 17T)
Elev. Datum : Geodetic

ROCK CORE LOG 103

File No. : 22-282 **Project** : 2072 Lakeshore Road, Burlington, ON **Client** : Trinity Point

depth (m)	graphic log	stratigraphy	Run	elev depth (m)	recovery	elevation (m)	shale weathering zones	UCS (MPa) / estimated strength	natural fracture frequency	laboratory testing	notes and comments	elevation (m)
				79.3			Z1 Z2 Z3 Z4	5 25 50 100 250 R1 R2 R3 R4 R5 R6				
		QUEENSTON FORMATION **Shale**, reddish brown, thinly bedded to medium bedded, weak; joints are horizontal, closed to gapped, clean, calcareous	R11	63.5	TCR = **100**% SCR = **97**% RQD = **62**%	64			3			64
19				18.8					0			
			R12	62.0	TCR = **100**% SCR = **100**% RQD = **93**%	63			0 0 2 0 0			63
20				20.3		62			0 0		**20.4 / 61.9m:** calcareous, green-grey band	62
21			R13	60.6	TCR = **100**% SCR = **96**% RQD = **84**%				5		**21.0 / 61.3m:** 63mm of rubblized core	
				21.7		61			0 0 0			61
22			R14	59.0	TCR = **100**% SCR = **98**% RQD = **97**%	60			2 0 0			60
23				23.3		59			1 2			59
24			R15	57.5	TCR = **100**% SCR = **97**% RQD = **93**%	58			0 0 0 3			58
25				24.8		57			3 0			57
			R16	55.9	TCR = **100**% SCR = **100**% RQD = **100**%				0 0 0			
26				26.4		56			0 1	**El. 55.5m**: UCS = 28.6 MPa E = 6.60 GPa γ = 25.9 kN/m^3	**26.7 / 55.7m:** calcareous, green-grey band **26.7 / 55.6m:** JT D PR R GA CN	56
27			R17	54.4	TCR = **100**% SCR = **100**% RQD = **88**%	55			0 0 0			55
				27.9m								
		END OF COREHOLE										

file: 22-282 - gint.gpj

Tech : CSH | **PM** : NN | **Rev** : NN

BOREHOLE LOG 104

Date Started : Mar 6, 2023
Position : E: 597872, N: 4797741 (UTM 17T)
Elev. Datum : Geodetic

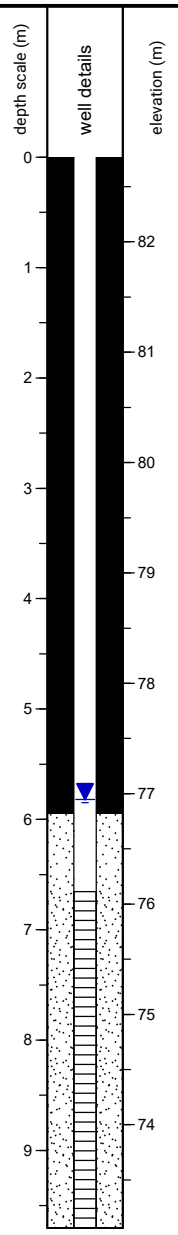
File No. : 22-282 **Project** : 2072 Lakeshore Road, Burlington, ON **Client** : Trinity Point

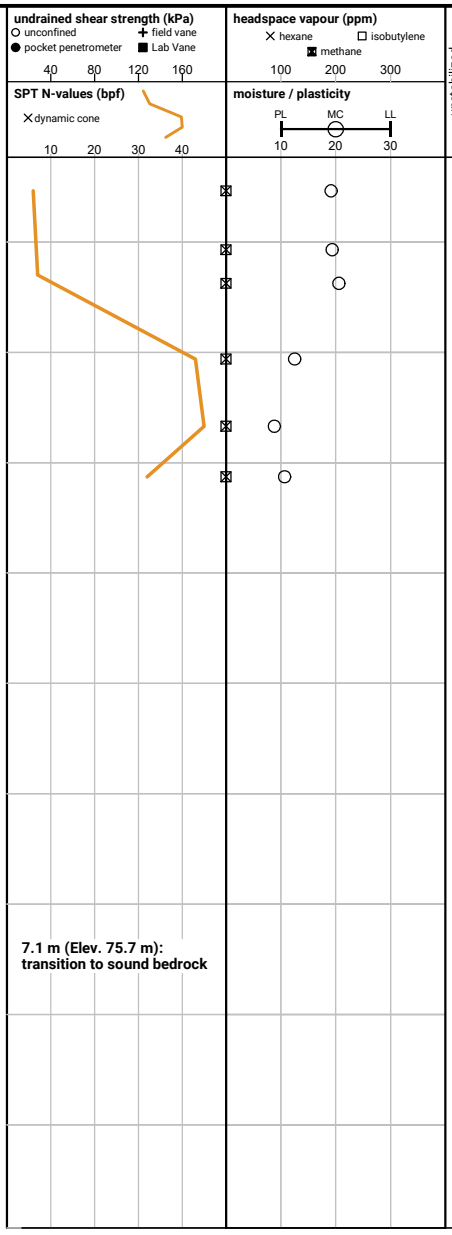
drill method : LC rig

elev depth (m)	description	graphic log	samples: number	samples: type	samples: SPT N-value
82.8	**GROUND SURFACE**				
	FILL, silt, some sand, some gravel, some rootlets, trace clay, trace topsoil inclusions, loose, brownish black, moist		1	SS	6
	...at 0.2 m, sand fill, some gravel, trace silt, brown with oxidation staining, moist to wet		2A		
	...at 0.9 m, no topsoil inclusions, mottled brownish grey		2B	SS	7
81.3					
1.5	**CLAYEY SILT**, sandy, trace gravel, hard, reddish brown, moist (GLACIAL TILL)		3	SS	43
			4	SS	45
			5	SS	32
	...at 3.0 m, sandy silt, clayey, trace gravel, trace shale fragments		1	RUN	
78.9					
3.9	**QUEENSTON FORMATION** (See rock core log for details)		2	RUN	
			3	RUN	
			4	RUN	
			5	RUN	
73.1					
9.7	**END OF BOREHOLE**				

hollow stem augers OD=215 mm

rock coring (HQ) OD=96 mm





unstabilized water level

lab data and comments

grain size distribution (%) (MIT)
GR SA SI CL

SS1: BTEX, EC/SAR, H-Ms, Metals, ORPs, PAHs, pH, PHCs, VOCs

SS3: BTEX, PAHs, PHCs, VOCs
1.8m: auger grinding
5 27 48 20

SS4: EC/SAR, H-Ms, Metals, ORPs, pH
2.6m: auger grinding with refusal, and Run 1 encountered inferred caved materials overlapping with the SS4 and SS5 intervals

Contained drill water upon completion of drilling. Unstabilized water level and cave not measured.

50 mm dia. monitoring well installed.
No. 10 screen

GROUNDWATER LEVELS

date	depth (m)	elevation (m)
Mar 20, 2023	5.4	77.4
Apr 3, 2023	5.5	77.3
May 5, 2023	5.7	77.1
Jun 9, 2023	5.8	77.0

file: 22-282 - gint.gpj

Tech : CSH/MW | **PM** : NN | **Rev** : NN

GROUNDED ENGINEERING

Date Started : Mar 6, 2023
Position : E: 597872, N: 4797741 (UTM 17T)
Elev. Datum : Geodetic

ROCK CORE LOG 104

File No. : 22-282 **Project** : 2072 Lakeshore Road, Burlington, ON **Client** : Trinity Point

depth (m)	stratigraphy	Run elev / depth (m)	recovery	elevation (m)	shale weathering zones (Z1 Z2 Z3 Z4)	UCS (MPa) 5 25 50 100 250 / estimated strength (R1 R2 R3 R4 R5 R6)	natural fracture frequency	laboratory testing	notes and comments	elevation (m)
	Rock coring started at 2.5m below grade	**80.3**								
3	**CLAYEY SILT**, sandy, trace gravel, hard, reddish brown, moist (GLACIAL TILL)	2.5 R1 79.3	TCR = **69%** SCR = **0%** RQD = **0%**	80			n/a		**2.5 / 80.3 - 3.2 / 79.6m:** inferred caved materials	80
							n/a		**3.2 / 79.6 - 3.9 / 78.9m:** recovered native soil	
4	**QUEENSTON FORMATION** **Shale**, reddish brown, thinly bedded to medium bedded, weak; joints are horizontal, closed to gapped, clean, calcareous	3.5 R2 77.8	TCR = **98%** SCR = **64%** RQD = **8%**	79			n/a		**3.9 / 78.9m:** observed weathered bedrock	79
							>10		**4.2 / 78.6m:** 75mm of rubblized core	
							>10		**4.4 / 78.4m:** 50mm of rubblized core	
5		5.0 R3 76.2	TCR = **100%** SCR = **98%** RQD = **92%**	78			4			78
							6			
							4			
6							3		**5.5 / 77.3m:** JT SV PR R GA CN 50mm	
				77			3			77
							6			
7	**... at 7.1 m (Elev. 75.7 m), transition to sound rock**	6.6 R4 74.6	TCR = **100%** SCR = **95%** RQD = **52%**				5		**6.4 / 76.4m:** 75mm of rubblized core	
				76			4		**6.7 / 76.1m:** JT SV IR R T CN 25mm	76
							2		**6.7 / 76.0m:** 25mm of rubblized core	
							1			
8				75			3		**7.6 / 75.1m:** JT SV IR R T CN 25mm	75
							2			
		8.2 R5 73.1	TCR = **100%** SCR = **100%** RQD = **100%**				1			
9				74			1			74
							0			
							1			
							1			
							0			
		9.7m								
	END OF COREHOLE									

file: 22-282 - gint.gpj

Tech : CSH/MW | **PM** : NN | **Rev** : NN

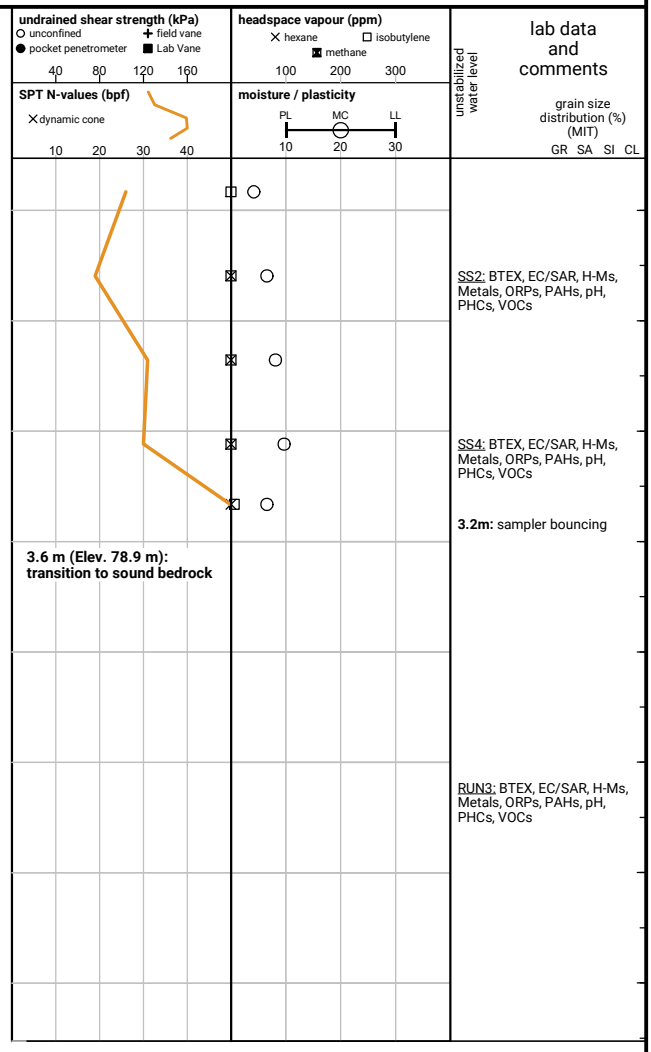
GROUNDED ENGINEERING

Date Started : Mar 14, 2023
Position : E: 597849, N: 4797707 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 105

File No. : 22-282 **Project** : 2072 Lakeshore Road, Burlington, ON **Client** : Trinity Point

drill method : LC rig	elev depth (m)	description	graphic log	samples: number	samples: type	samples: SPT N-value
	82.5	**GROUND SURFACE**				
hollow stem augers OD=215 mm		50mm **ASPHALT**		1	SS	26
		FILL, gravelly sand, trace to some silt, faint petroleum hydrocarbon odour, compact to dense, brownish grey, moist		2	SS	19
				3	SS	31
	80.2 2.3	**CLAYEY SILT**, some gravel, trace sand, hard, brownish red, moist (GLACIAL TILL)		4	SS	30
	79.3 3.2	...at 3.1 m, some shale fragments, faint petroleum hydrocarbon odour		5	SS	50 / 25mm
rock coring (HQ) OD=96 mm		**QUEENSTON FORMATION** (See rock core log for details)		1	RUN	
				2	RUN	
				3	RUN	
				4	RUN	
	74.5 8.0	**END OF BOREHOLE**				



Water level and cave not measured upon completion of drilling.

50 mm dia. monitoring well installed.
No. 10 screen

GROUNDWATER LEVELS

date	depth (m)	elevation (m)
Mar 20, 2023	dry	n/a
Apr 3, 2023	dry	n/a
May 5, 2023	dry	n/a
Jun 9, 2023	dry	n/a

file: 22-282 - gint.gpj

Tech : CSH/MW | **PM** : NN | **Rev** : NN

GROUNDED ENGINEERING

Date Started : Mar 14, 2023
Position : E: 597849, N: 4797707 (UTM 17T)
Elev. Datum : Geodetic

ROCK CORE LOG 105

File No. : 22-282 **Project** : 2072 Lakeshore Road, Burlington, ON **Client** : Trinity Point

depth (m)	graphic log	stratigraphy	Run elev depth (m)	recovery	elevation (m)	shale weathering zones Z1 Z2 Z3 Z4	UCS (MPa) 5 25 50 100 250 estimated strength R1 R2 R3 R4 R5 R6	natural fracture frequency	laboratory testing	notes and comments	elevation (m)
		Rock coring started at 3.2m below grade	**79.3**								
		QUEENSTON FORMATION **Shale**, reddish brown, thinly bedded to medium bedded, weak; joints are horizontal, closed to gapped, clean, calcareous **... at 3.6 m (Elev. 78.9 m), transition to sound rock**	3.2 R1 3.5	TCR = **100%** SCR = **100%** RQD = **63%**				2			
4			R2 77.6	TCR = **100%** SCR = **100%** RQD = **95%**	79			2 2 0 0		**3.6 / 78.9m:** JT D PR S GA CN	79
5			4.9 R3 76.0	TCR = **84%** SCR = **98%** RQD = **84%**	78			1 4 1 0		**4.7 / 77.8m:** JT SV PR S T CN 50mm	78
6			6.5 R4 74.5	TCR = **97%** SCR = **85%** RQD = **60%**	77			1 2 3 1		**6.3 / 76.2m:** JT SV PR R T CN 25mm	77
7					76			4 4 7		**7.3 / 75.1m:** JT SV IR R T CN 25mm **7.6 / 74.9m:** 38mm of rubblized core **7.8 / 74.7 - 7.9 / 74.6m:** 125mm of rubblized core	76
8		**END OF COREHOLE**	**8.0m**		75						75

file: 22-282 - gint.gpj

Tech : CSH/MW | **PM** : NN | **Rev** : NN

BOREHOLE LOG 106

Date Started : Mar 13, 2023
Position : E: 597852, N: 4797695 (UTM 17T)
Elev. Datum : Geodetic

File No. : 22-282 **Project** : 2072 Lakeshore Road, Burlington, ON **Client** : Trinity Point

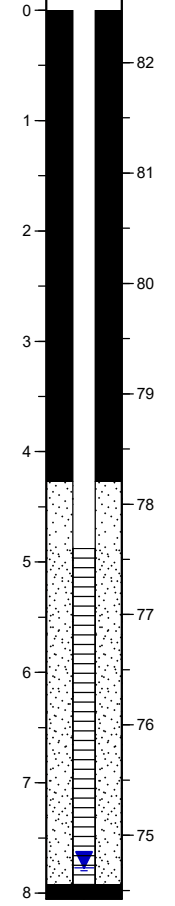
drill method : *LC rig*

elev depth (m)	description	graphic log	number	type	SPT N-value
82.5	**GROUND SURFACE**				
	40mm **ASPHALT**				
	FILL, sand, some gravel, trace to some silt, moderate petroleum hydrocarbon odour, compact to dense, brown, moist		1	SS	22
			2	SS	22
			3	SS	31
80.2 / 2.3	**CLAYEY SILT**, some gravel, trace sand, trace shale fragments, very stiff to hard, brownish red, moist (GLACIAL TILL)		4	SS	29
			5	SS	50 / 125mm
79.2 / 3.3	...at 3.2 m, layer of gravelly sand, trace silt, moderate petroleum hydrocarbon odour, very dense, grey, wet		1	RUN	
	QUEENSTON FORMATION (See rock core log for details)		2	RUN	
			3	RUN	
			4	RUN	
74.4 / 8.1	**END OF BOREHOLE**				

hollow stem augers OD=215 mm

rock coring (HQ) OD=96 mm

depth scale (m) / well details / elevation (m)

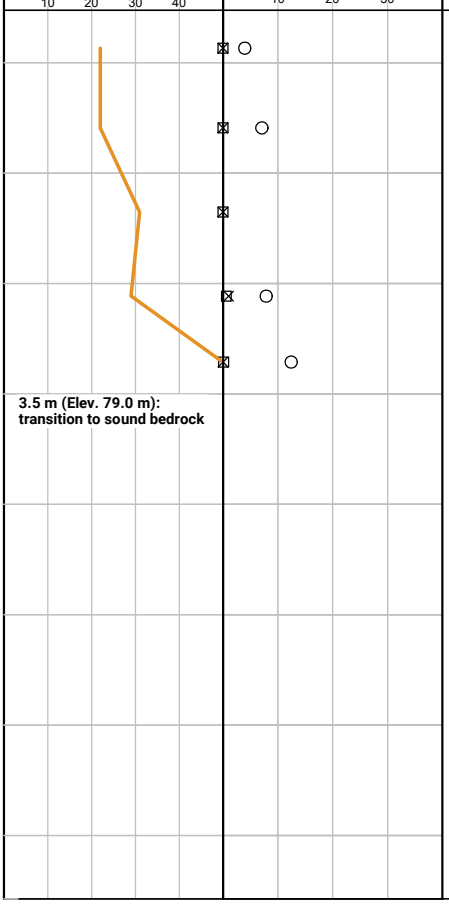


undrained shear strength (kPa)
○ unconfined + field vane
● pocket penetrometer ■ Lab Vane
40 80 120 160

SPT N-values (bpf)
× dynamic cone
10 20 30 40

headspace vapour (ppm)
× hexane □ isobutylene
⊠ methane
100 200 300

moisture / plasticity
PL MC LL
10 20 30



3.5 m (Elev. 79.0 m): transition to sound bedrock

unstabilized water level

lab data and comments

grain size distribution (%) (MIT)
GR SA SI CL

SS3: BTEX, EC/SAR, H-Ms, Metals, ORPs, PAHs, pH, PHCs, VOCs

2.4m: auger grinding

SS4: BTEX, EC/SAR, H-Ms, Metals, ORPs, PAHs, pH, PHCs, VOCs
2.9m: auger grinding
3.0m: Run 1 encountered inferred caved materials overlapping with the SS5 interval

Contained drill water upon completion of drilling. Unstabilized water level and cave not measured.

50 mm dia. monitoring well installed.
No. 10 screen

GROUNDWATER LEVELS

date	depth (m)	elevation (m)
Mar 20, 2023	7.8	74.7
Apr 3, 2023	7.8	74.7
May 5, 2023	7.8	74.7
Jun 9, 2023	7.8	74.7

file: 22-282 - gint.gpj

Tech : CSH/MW | **PM** : NN | **Rev** : NN

GROUNDED ENGINEERING

Date Started : Mar 13, 2023
Position : E: 597852, N: 4797695 (UTM 17T)
Elev. Datum : Geodetic

ROCK CORE LOG 106

File No. : 22-282 **Project** : 2072 Lakeshore Road, Burlington, ON **Client** : Trinity Point

depth (m)	graphic log	stratigraphy	Run / elev. depth (m)	recovery	elevation (m)	shale weathering zones (Z1 Z2 Z3 Z4)	UCS (MPa) 5 25 50 100 250 / estimated strength (R1 R2 R3 R4 R5 R6)	natural fracture frequency	laboratory testing	notes and comments	elevation (m)
		Rock coring started at 3.0m below grade	**79.5**								
		CLAYEY SILT, some gravel, trace sand, trace shale fragments, very stiff to hard, brownish red, moist (GLACIAL TILL)	3.0 R1	TCR = **100%** SCR = **16%** RQD = **0%**				n/a		**3.0 / 79.4 - 3.4 / 79.1m:** inferred caved materials	
			3.5		79			1		**3.4 / 79.1m:** observed weathered bedrock	79
4		**QUEENSTON FORMATION** **Shale**, reddish brown, thinly bedded to medium bedded, weak; joints are horizontal, closed to gapped, clean, calcareous **... at 3.5 m (Elev. 79.0 m), transition to sound rock**	R2	TCR = **100%** SCR = **100%** RQD = **58%**				1			
								4			
								4		**4.3 / 78.2m:** JT D PR R GA OX	
					78			2		**4.3 / 78.1m:** JT D PR R GA OX	78
			77.5					1			
5			5.0					0			
			R3	TCR = **100%** SCR = **97%** RQD = **85%**	77			1			77
								3			
6								0			
								2			
			76.0		76			4			76
			6.5					0			
7			R4	TCR = **100%** SCR = **88%** RQD = **70%**				2			
					75			4		**7.5 / 75.0m:** IS Cl 38mm	75
								>10		**7.5 / 74.9m:** 38mm of rubblized core	
8			74.4							**7.7 / 74.7m:** 50mm of rubblized core	
			8.1m							**7.9 / 74.6m:** JT SV IR R T CN	
		END OF COREHOLE									

file: 22-282 - gint.gpj

Tech : CSH/MW | **PM** : NN | **Rev** : NN

GROUNDED ENGINEERING

Date Started : Mar 13, 2023
Position : E: 597857, N: 4797703 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 107

File No. : 22-282 **Project** : 2072 Lakeshore Road, Burlington, ON **Client** : Trinity Point

drill method : *LC rig*

elev depth (m)	description	graphic log	samples: number	samples: type	samples: SPT N-value
82.3	**GROUND SURFACE**				
	65mm **ASPHALT**				
	FILL, sand, some gravel, trace silt, faint petroleum hydrocarbon odour, compact to dense, brown, moist		1	SS	28
			2	SS	19
			3	SS	33
80.0					
2.3	**CLAYEY SILT**, some gravel, trace sand, trace shale fragments, hard, reddish brown, moist (GLACIAL TILL)		4	SS	33
79.1			5	SS	50 / 150mm
3.2	**QUEENSTON FORMATION** (See rock core log for details)		1	RUN	
			2	RUN	
			3	RUN	
			4	RUN	
			5	RUN	
72.8					
9.5					

hollow stem augers OD=215 mm

rock coring (HQ) OD=96 mm

depth scale (m): 0 1 2 3 4 5 6 7 8 9

well details

elevation (m): 82 81 80 79 78 77 76 75 74 73

undrained shear strength (kPa)
○ unconfined + field vane
● pocket penetrometer ■ Lab Vane
40 80 120 160

SPT N-values (bpf)
× dynamic cone
10 20 30 40

headspace vapour (ppm)
× hexane □ isobutylene
▣ methane
100 200 300

moisture / plasticity
PL MC LL
10 20 30

3.6 m (Elev. 78.7 m): transition to sound bedrock

unstabilized water level

lab data and comments

grain size distribution (%) (MIT)
GR SA SI CL

SS3: BTEX, EC/SAR, H-Ms, Metals, ORPs, PAHs, pH, PHCs, VOCs

2.4m: auger grinding

SS4: BTEX, EC/SAR, H-Ms, Metals, ORPs, PAHs, pH, PHCs, VOCs
3.0m: sampler bouncing
3.1m: Run 1 encountered inferred caved materials overlapping with the SS5 interval

END OF BOREHOLE

Water level and cave not measured upon completion of drilling.

50 mm dia. monitoring well installed.
No. 10 screen

GROUNDWATER LEVELS

date	depth (m)	elevation (m)
Mar 20, 2023	8.9	73.4
Apr 3, 2023	8.7	73.6
May 5, 2023	8.6	73.7
Jun 9, 2023	8.7	73.6

file: 22-282 - gint.gpj

Tech : CSH/MW | **PM** : NN | **Rev** : NN

GROUNDED ENGINEERING

Date Started : Mar 13, 2023
Position : E: 597857, N: 4797703 (UTM 17T)
Elev. Datum : Geodetic

ROCK CORE LOG 107

File No. : 22-282 **Project** : 2072 Lakeshore Road, Burlington, ON **Client** : Trinity Point

Rock coring started at 3.1m below grade

depth (m)	stratigraphy	Run	elev depth (m)	recovery	elevation (m)	shale weathering zones	UCS (MPa) / estimated strength	natural fracture frequency	laboratory testing	notes and comments	elevation (m)
			79.2								
	CLAYEY SILT, some gravel, trace sand, trace shale fragments, hard, reddish brown, moist (GLACIAL TILL)	R1	3.1	TCR = **100**% SCR = **100**% RQD = **71**%				n/a		**3.1 / 79.2 - 3.2 / 79.1m:** inferred caved materials	
			3.5		79			7		**3.2 / 79.1m:** observed weathered bedrock	79
	QUEENSTON FORMATION **Shale**, reddish brown, thinly bedded to medium bedded, weak; joints are horizontal, closed to gapped, clean, calcareous **... at 3.6 m (Elev. 78.7 m), transition to sound rock**	R2		TCR = **100**% SCR = **93**% RQD = **67**%				4			
4								5		**3.9 / 78.4m:** 25mm of rubblized core	
					78			3			78
								2			
			77.3					1		**4.7 / 77.6m:** JT SV UN R GA OX 38mm	
5			5.0					1			
					77			2			77
		R3		TCR = **100**% SCR = **93**% RQD = **85**%				1			
								3		**6.0 / 76.3m:** 50mm of rubblized core	
6			75.8		76			2		**6.3 / 76.0 - 6.4 / 75.9m:** JT SV PR R T CN 100mm	76
			6.5					4		**6.6 / 75.8m:** JT D PR R T CN	
								1			
		R4		TCR = **100**% SCR = **90**% RQD = **47**%				3			
7					75			7		**7.3 / 75.1 - 7.4 / 74.9m:** 125mm of rubblized core	75
								5		**7.5 / 74.8m:** 63mm of rubblized core	
			74.3					0			
8			8.0					6			
					74			1		**8.4 / 73.9m:** JT SV UN R T CN 50mm	74
		R5		TCR = **100**% SCR = **92**% RQD = **80**%				6		**8.5 / 73.9m:** 25mm of rubblized core	
								1		**8.9 / 73.5m:** IS Cl; , with 12mm of rubblized core	
9			72.8		73			0			73
			9.5m								

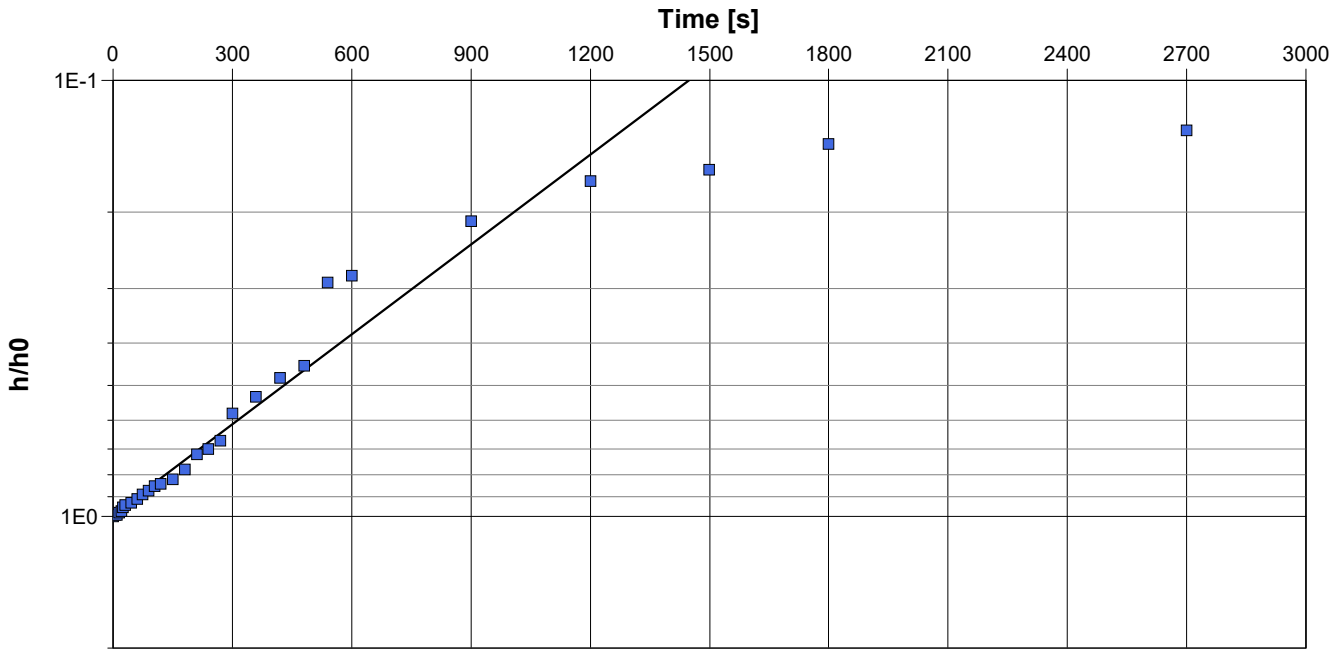
END OF COREHOLE

APPENDIX B



GROUNDED ENGINEERING	**Slug Test Analysis Report**
	Project: 22-282
	Number: 2072 Lakeshore Road
	Client: Trinity Point

Location: Burlington, Ontario	Slug Test: BH101 - RHT1	Test Well: BH101 (Sound Bedrock)
Test Conducted by: MW		Test Date: 2023-04-03
Analysis Performed by: NN	Bouwer & Rice	Analysis Date: 2023-04-10
Aquifer Thickness: 30.00 m		

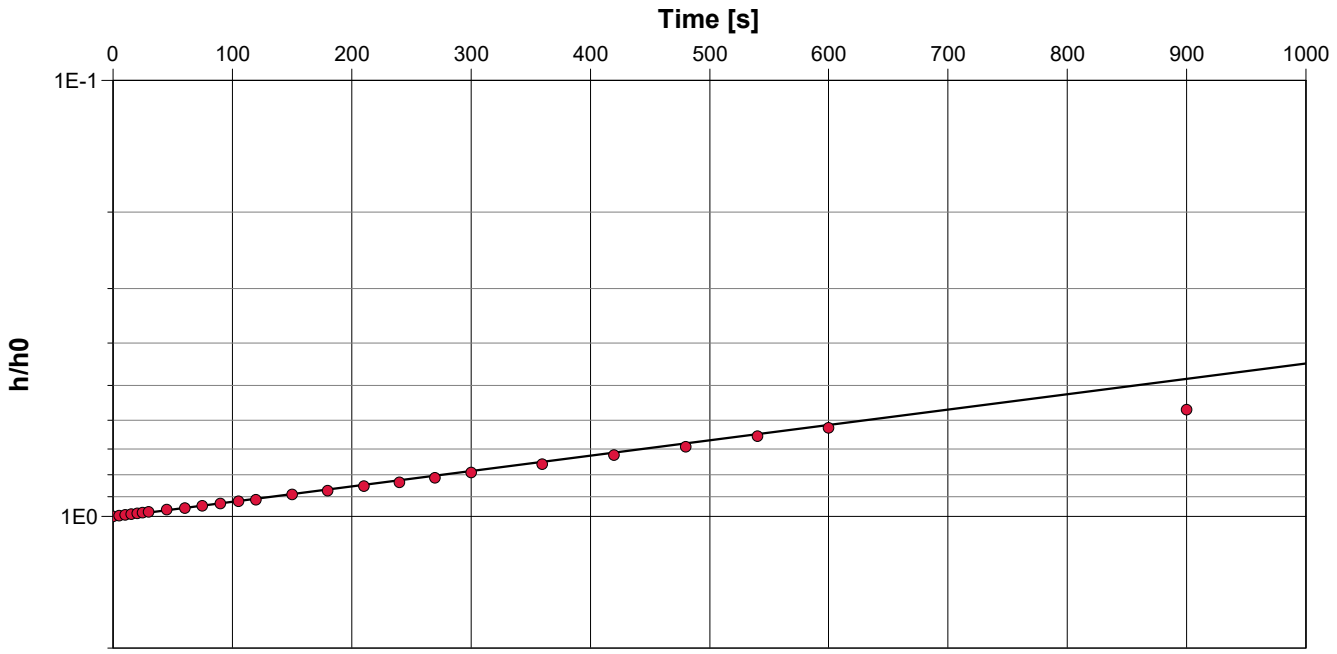


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH101 (Sound Bedrock)	7.00×10^{-7}	

GROUNDED ENGINEERING	**Slug Test Analysis Report**
	Project: 22-282
	Number: 2072 Lakeshore Road
	Client: Trinity Point

Location: Burlington, Ontario	Slug Test: BH102 - FHT1	Test Well: BH102 (Sound Bedrock)
Test Conducted by: MW		Test Date: 2023-04-04
Analysis Performed by: NN	Bouwer & Rice	Analysis Date: 2023-04-10
Aquifer Thickness: 30.00 m		

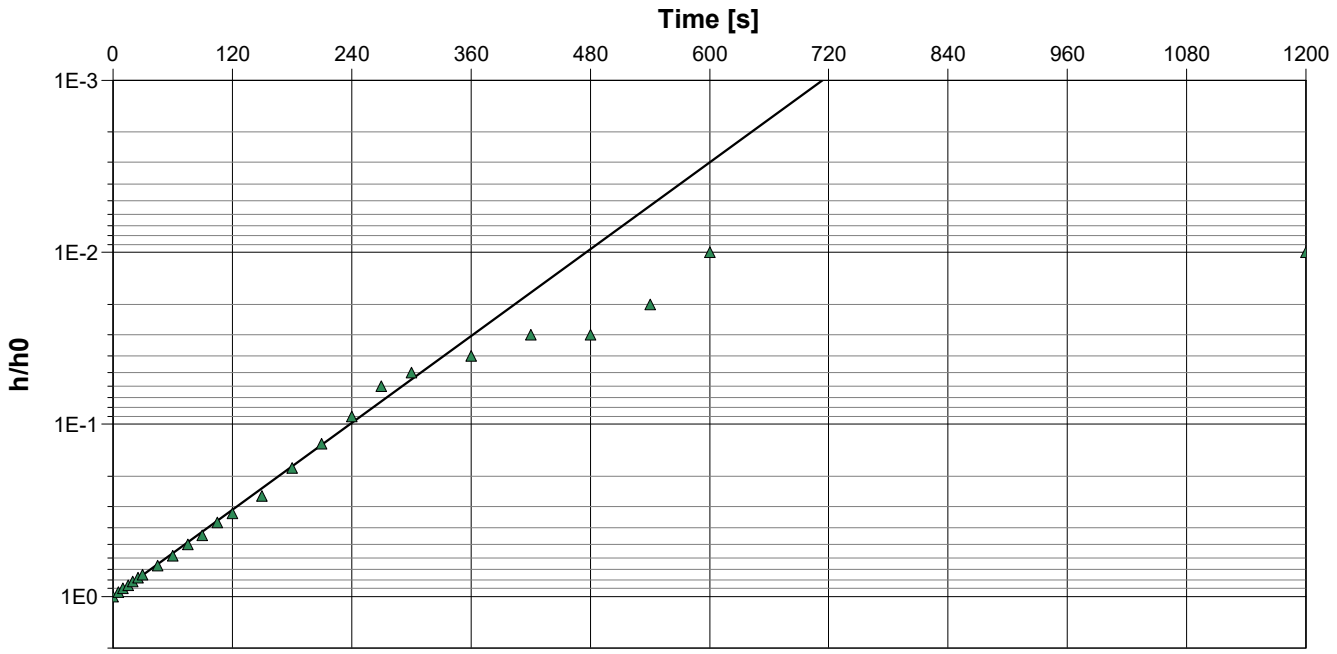


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH102 (Sound Bedrock)	3.00×10^{-7}	

GROUNDED ENGINEERING	**Slug Test Analysis Report**
	Project: 22-282
	Number: 2072 Lakeshore Road
	Client: Trinity Point

Location: Burlington, Ontario	Slug Test: BH103 - RHT1	Test Well: BH103 (Sound Bedrock)
Test Conducted by: MW		Test Date: 2023-03-21
Analysis Performed by: NN	Bouwer & Rice	Analysis Date: 2023-04-10
Aquifer Thickness: 30.00 m		

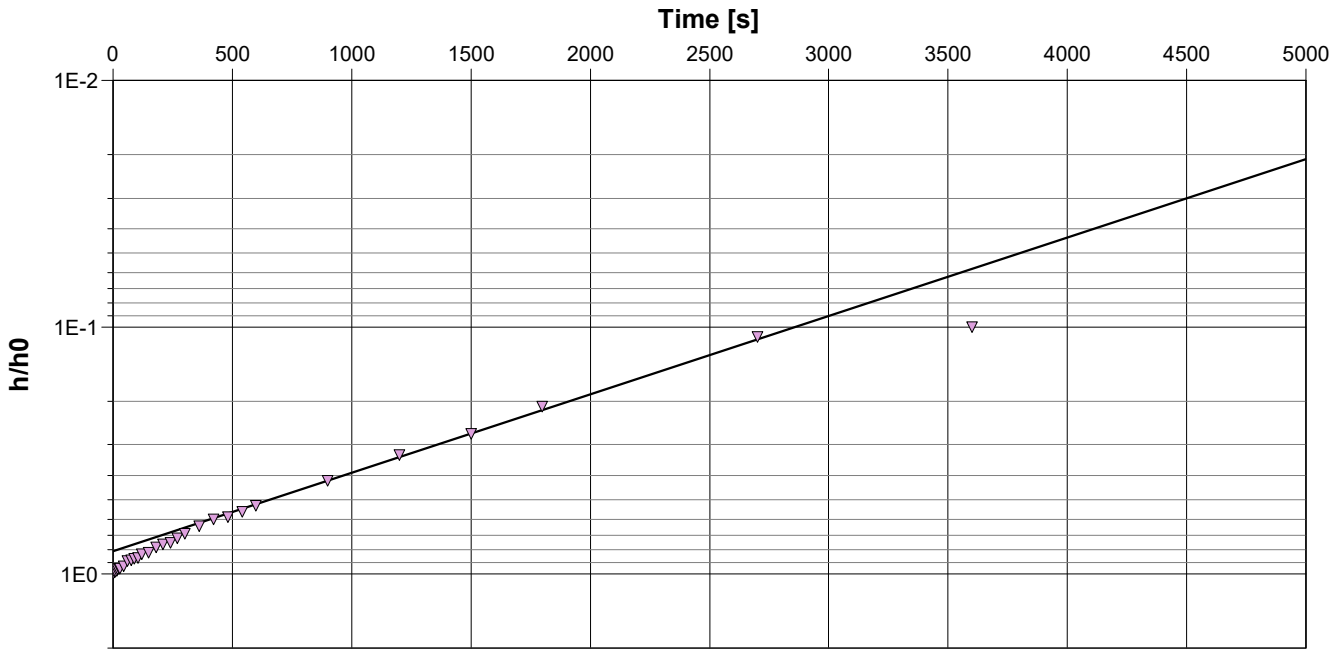


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH103 (Sound Bedrock)	4.30×10^{-6}	

GROUNDED ENGINEERING	**Slug Test Analysis Report**
	Project: 22-282
	Number: 2072 Lakeshore Road
	Client: Trinity Point

Location: Burlington, Ontario	Slug Test: BH104 - RHT1	Test Well: BH104 (Sound Bedrock)
Test Conducted by: MW		Test Date: 2023-04-03
Analysis Performed by: NN	Bouwer & Rice	Analysis Date: 2023-04-10
Aquifer Thickness: 30.00 m		

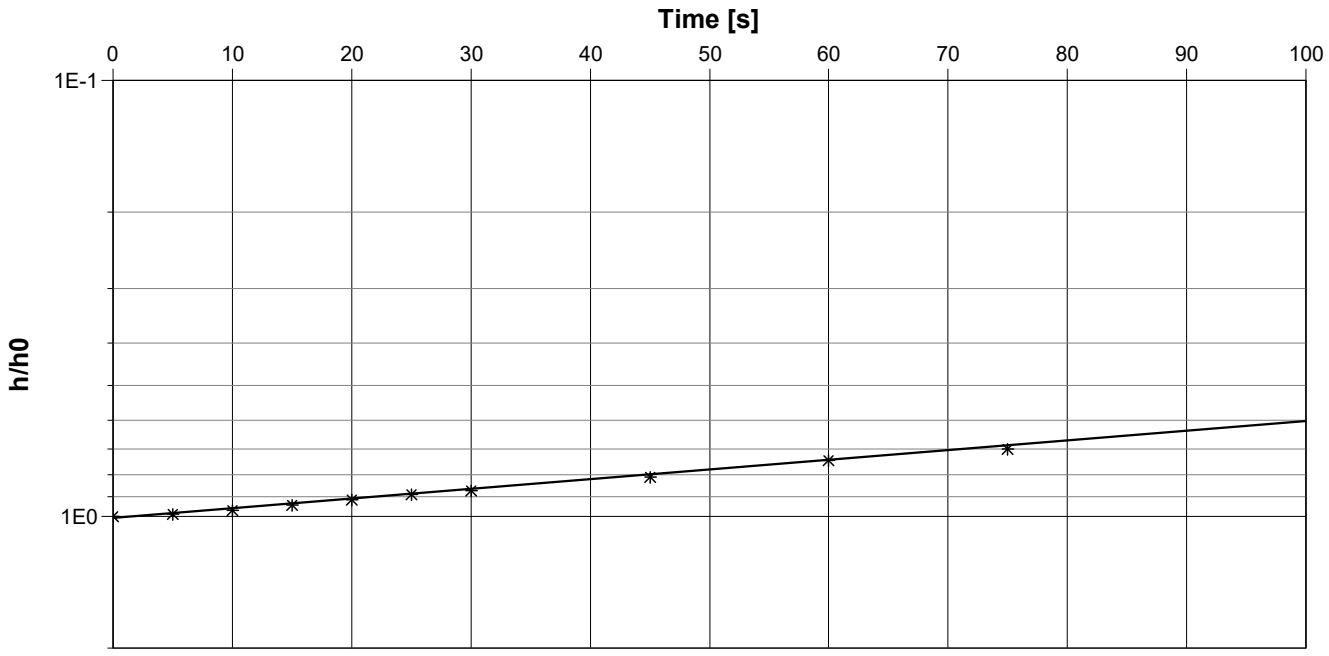


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH104 (Sound Bedrock)	2.80×10^{-7}	

GROUNDED ENGINEERING	**Slug Test Analysis Report**
	Project: 22-282
	Number: 2072 Lakeshore Road
	Client: Trinity Point

Location: Burlington, Ontario	Slug Test: BH105 - FHT1	Test Well: BH105 (Sound Bedrock)
Test Conducted by: MW		Test Date: 2023-04-04
Analysis Performed by: NN	Bouwer & Rice	Analysis Date: 2023-04-10
Aquifer Thickness: 30.00 m		

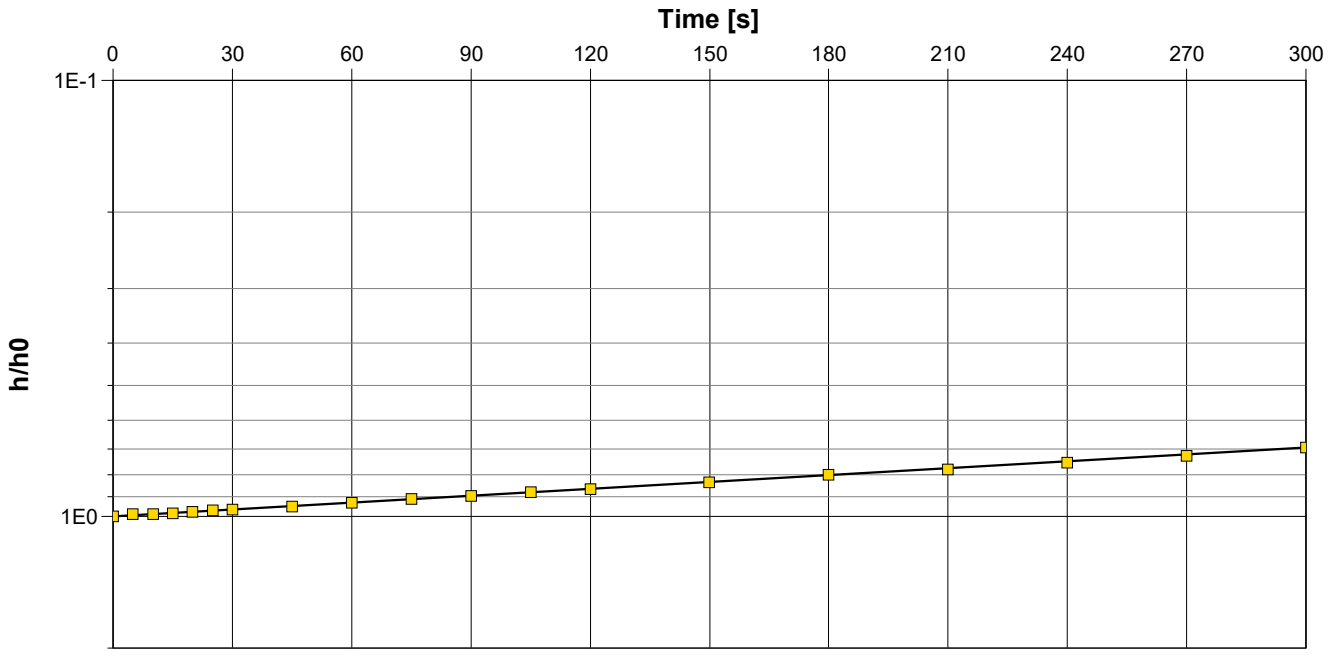


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH105 (Sound Bedrock)	1.90×10^{-6}	

GROUNDED ENGINEERING	**Slug Test Analysis Report**
	Project: 22-282
	Number: 2072 Lakeshore Road
	Client: Trinity Point

Location: Burlington, Ontario	Slug Test: BH106 - FHT1	Test Well: BH106 (Sound Bedrock)
Test Conducted by: MW		Test Date: 2023-04-04
Analysis Performed by: NN	Bouwer & Rice	Analysis Date: 2023-04-10
Aquifer Thickness: 30.00 m		

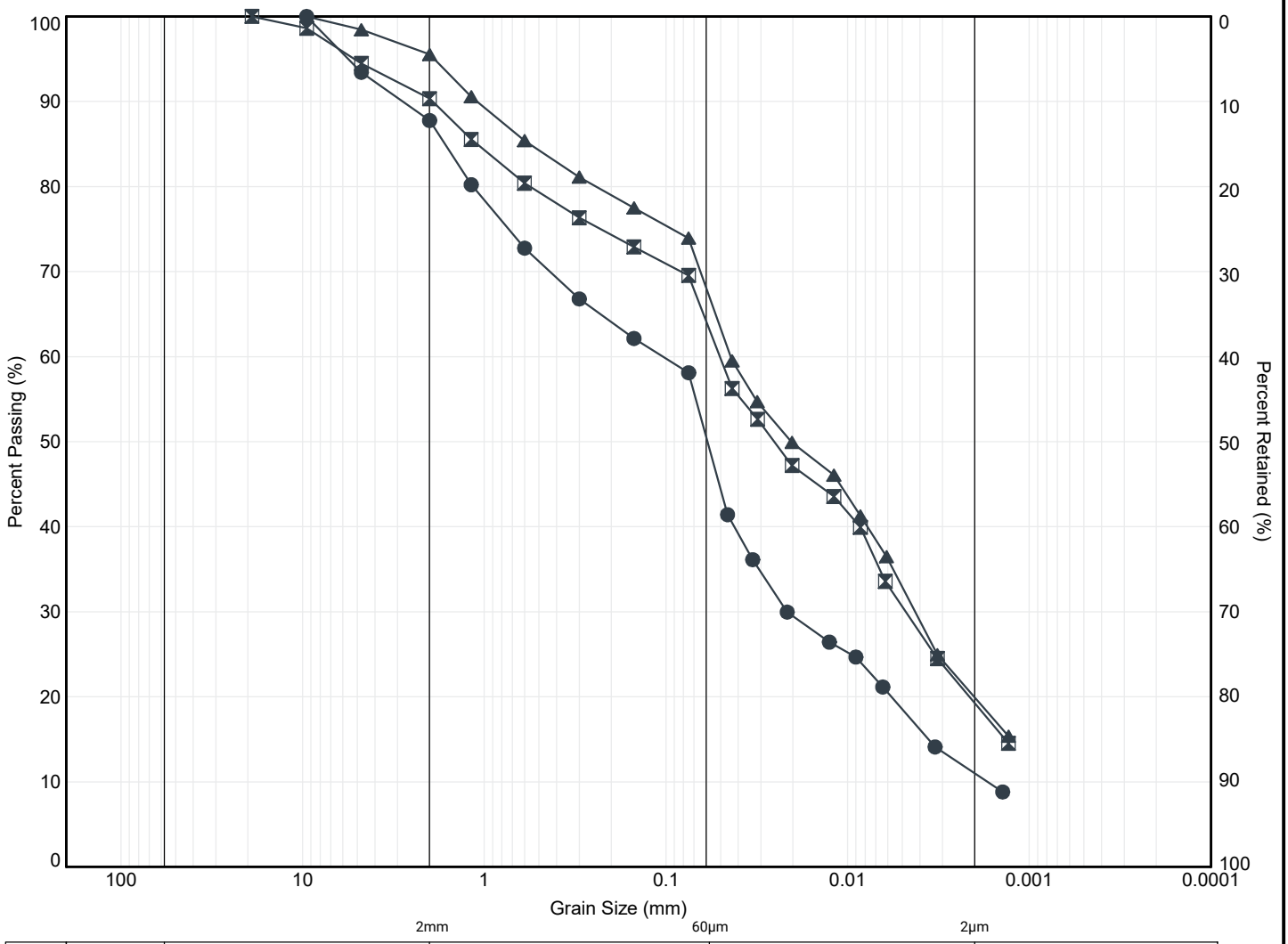


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH106 (Sound Bedrock)	4.50×10^{-7}	

APPENDIX C





MIT SYSTEM	COBBLES	GRAVEL			SAND			SILT	CLAY
		COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE		

MIT SYSTEM

	Borehole	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
●	**102**	SS4	2.6	79.8	12	37	40	11
⊠	**103**	SS4	2.6	79.8	10	26	45	19
▲	**104**	SS4	2.6	80.2	5	27	48	20

GROUNDED ENGINEERING

Title: **GRAIN SIZE DISTRIBUTION GLACIAL TILL**

File No.: **22-282**

file: 22-282 - gint.gpj

APPENDIX D



K from Grain Size Analysis Report

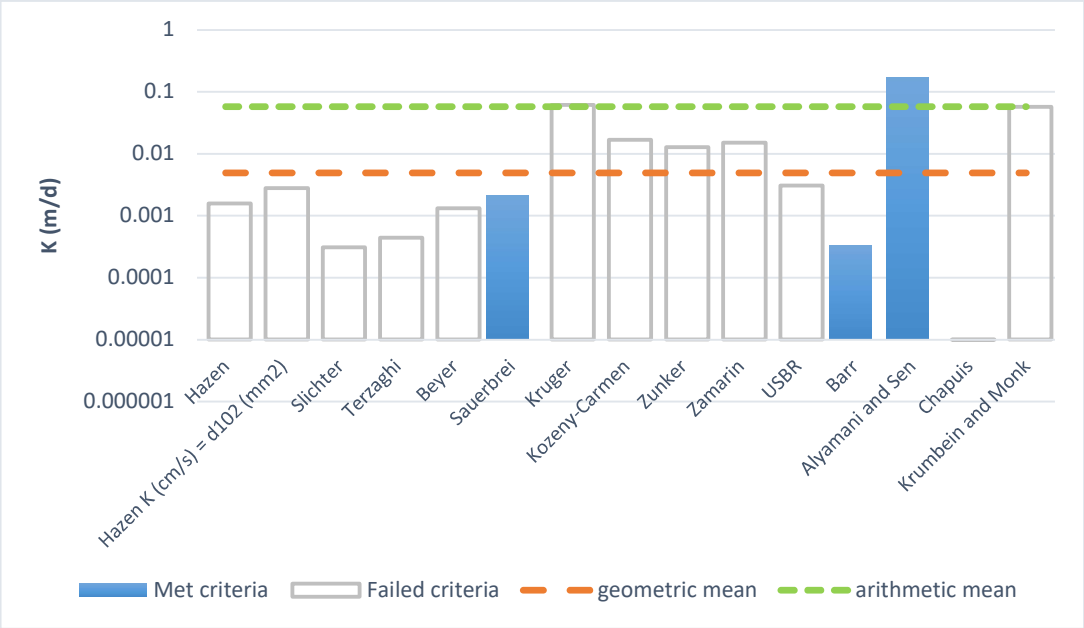
Date: 26-Jun-23

Sample Name: BH102 SS4

Mass Sample (g): 100

T (oC) 20

Poorly sorted sandy gravelly silt with fines



Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	1.8E-06	1.8E-08	0.00	
Hazen K (cm/s) = d_{10} (mm)	3.2E-06	3.2E-08	0.00	
Slichter	3.6E-07	3.6E-09	0.00	
Terzaghi	5.1E-07	5.1E-09	0.00	
Beyer	1.5E-06	1.5E-08	0.00	
Sauerbrei	2.5E-06	2.5E-08	0.00	
Kruger	7.1E-05	7.1E-07	0.06	
Kozeny-Carmen	1.9E-05	1.9E-07	0.02	
Zunker	1.5E-05	1.5E-07	0.01	
Zamarin	1.8E-05	1.8E-07	0.02	
USBR	3.6E-06	3.6E-08	0.00	
Barr	3.8E-07	3.8E-09	0.00	
Alyamani and Sen	2.0E-04	2.0E-06	0.17	
Chapuis	1.2E-08	1.2E-10	0.00	
Krumbein and Monk	6.7E-05	6.7E-07	0.06	
geometric mean	5.7E-06	5.7E-08	0.00	
arithmetic mean	6.7E-05	6.7E-07	0.06	

K from Grain Size Analysis Report

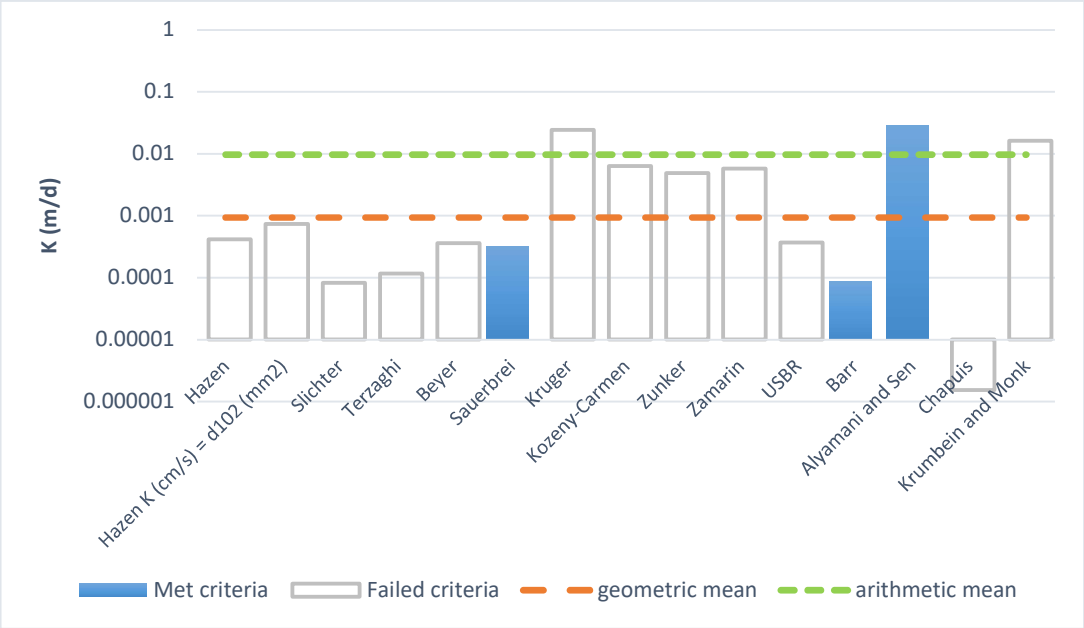
Date: 26-Jun-23

Sample Name: BH103 SS4

Mass Sample (g): 100

T (oC) 20

Poorly sorted sandy silt with fines



Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	4.8E-07	4.8E-09	0.00	
Hazen K (cm/s) = d_{10} (mm)	8.5E-07	8.5E-09	0.00	
Slichter	9.5E-08	9.5E-10	0.00	
Terzaghi	1.4E-07	1.4E-09	0.00	
Beyer	4.2E-07	4.2E-09	0.00	
Sauerbrei	3.8E-07	3.8E-09	0.00	
Kruger	2.8E-05	2.8E-07	0.02	
Kozeny-Carmen	7.4E-06	7.4E-08	0.01	
Zunker	5.6E-06	5.6E-08	0.00	
Zamarin	6.7E-06	6.7E-08	0.01	
USBR	4.3E-07	4.3E-09	0.00	
Barr	1.0E-07	1.0E-09	0.00	
Alyamani and Sen	3.3E-05	3.3E-07	0.03	
Chapuis	1.8E-09	1.8E-11	0.00	
Krumbein and Monk	1.9E-05	1.9E-07	0.02	
geometric mean	1.1E-06	1.1E-08	0.00	
arithmetic mean	1.1E-05	1.1E-07	0.01	

K from Grain Size Analysis Report

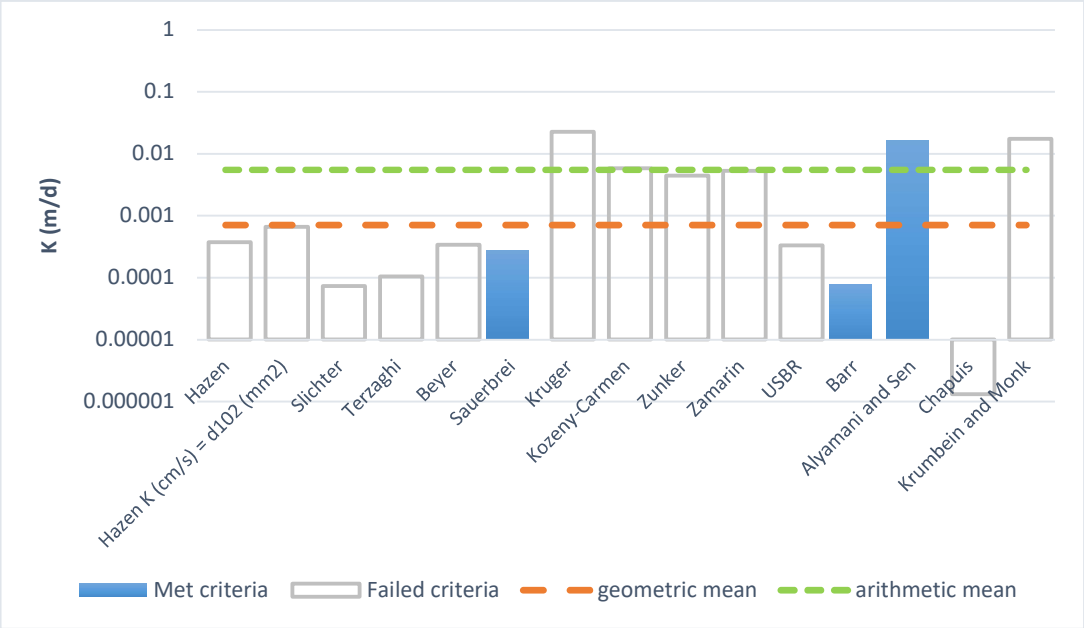
Date: 26-Jun-23

Sample Name: BH104 SS4

Mass Sample (g): 100

T (oC) 20

Poorly sorted sandy silt with fines



Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	4.3E-07	4.3E-09	0.00	
Hazen K (cm/s) = d_{10} (mm)	7.6E-07	7.6E-09	0.00	
Slichter	8.5E-08	8.5E-10	0.00	
Terzaghi	1.2E-07	1.2E-09	0.00	
Beyer	3.9E-07	3.9E-09	0.00	
Sauerbrei	3.2E-07	3.2E-09	0.00	
Kruger	2.6E-05	2.6E-07	0.02	
Kozeny-Carmen	6.7E-06	6.7E-08	0.01	
Zunker	5.2E-06	5.2E-08	0.00	
Zamarin	6.1E-06	6.1E-08	0.01	
USBR	3.8E-07	3.8E-09	0.00	
Barr	9.1E-08	9.1E-10	0.00	
Alyamani and Sen	1.9E-05	1.9E-07	0.02	
Chapuis	1.5E-09	1.5E-11	0.00	
Krumbein and Monk	2.0E-05	2.0E-07	0.02	
geometric mean	8.2E-07	8.2E-09	0.00	
arithmetic mean	6.4E-06	6.4E-08	0.01	

APPENDIX E



Your Project #: 22-282
Site Location: 2072 Lakeshore Road, Burlington, ON
Your C.O.C. #: 925895-02-01

Attention: Nick Ng

Grounded Engineering Inc.
1 Banigan Drive
Toronto, ON
CANADA M4H 1G3

Report Date: 2023/03/28
Report #: R7565045
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C379636
Received: 2023/03/21, 15:47

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Carbonaceous BOD	1	2023/03/22	2023/03/27	CAM SOP-00427	SM 23 5210B m
Total Cyanide	1	2023/03/22	2023/03/22	CAM SOP-00457	OMOE E3015 5 m
Fluoride	1	2023/03/22	2023/03/22	CAM SOP-00449	SM 23 4500-F C m
Mercury in Water by CVAA	1	2023/03/23	2023/03/23	CAM SOP-00453	EPA 7470A m
Total Metals Analysis by Axial ICP	1	2023/03/24	2023/03/24	CAM SOP-00408	EPA 6010D m
E.coli, (CFU/100mL)	1	N/A	2023/03/21	CAM SOP-00552	
Animal and Vegetable Oil and Grease	1	N/A	2023/03/24	CAM SOP-00326	EPA1664B m,SM5520B m
Total Oil and Grease	1	2023/03/24	2023/03/24	CAM SOP-00326	EPA1664B m,SM5520B m
PAH Compounds in Water by GC/MS (SIM)	1	2023/03/22	2023/03/23	CAM SOP-00318	EPA 8270E
pH	1	2023/03/22	2023/03/22	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	1	N/A	2023/03/22	CAM SOP-00444	OMOE E3179 m
Sulphate by Automated Turbidimetry	1	N/A	2023/03/23	CAM SOP-00464	SM 23 4500-SO42- E m
Total Kjeldahl Nitrogen in Water	1	2023/03/22	2023/03/27	CAM SOP-00938	OMOE E3516 m
Mineral/Synthetic O & G (TPH Heavy Oil) (1)	1	2023/03/24	2023/03/24	CAM SOP-00326	EPA1664B m,SM5520F m
Total Suspended Solids	1	2023/03/23	2023/03/24	CAM SOP-00428	SM 23 2540D m
Volatile Organic Compounds in Water	1	N/A	2023/03/23	CAM SOP-00228	EPA 8260D

Remarks:

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

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

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

Your Project #: 22-282
Site Location: 2072 Lakeshore Road, Burlington, ON
Your C.O.C. #: 925895-02-01

Attention: Nick Ng

Grounded Engineering Inc.
1 Banigan Drive
Toronto, ON
CANADA M4H 1G3

Report Date: 2023/03/28
Report #: R7565045
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C379636

Received: 2023/03/21, 15:47

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Note: TPH (Heavy Oil) is equivalent to Mineral / Synthetic Oil & Grease

Encryption Key

Please direct all questions regarding this Certificate of Analysis to:
Marijane Cruz, Senior Project Manager
Email: Marijane.Cruz@bureauveritas.com
Phone# (905)817-5756

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Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.

Bureau Veritas Job #: C379636
Report Date: 2023/03/28

Grounded Engineering Inc.
Client Project #: 22-282
Site Location: 2072 Lakeshore Road, Burlington, ON
Sampler Initials: CSH

HALTON SANITARY & COMBINED BYLAW (2-03)

Bureau Veritas ID			VIQ039			VIQ039		
Sampling Date			2023/03/21 12:00			2023/03/21 12:00		
COC Number			925895-02-01			925895-02-01		
	UNITS	Criteria	BH103 SEW	RDL	QC Batch	BH103 SEW Lab-Dup	RDL	QC Batch
Calculated Parameters								
Total Animal/Vegetable Oil and Greas	mg/L	150	<0.50	0.50	8564418			
Inorganics								
Total Carbonaceous BOD	mg/L	300	12	2	8566242			
Fluoride (F-)	mg/L	10	0.18	0.10	8567361			
Total Kjeldahl Nitrogen (TKN)	mg/L	100	1.2	0.50	8566600			
Phenols-4AAP	mg/L	1	<0.0010	0.0010	8566961			
Total Suspended Solids	mg/L	350	19	10	8568701			
Dissolved Sulphate (SO4)	mg/L	1500	250	1.0	8566937			
Total Cyanide (CN)	mg/L	2	<0.0050	0.0050	8566192			
Petroleum Hydrocarbons								
Total Oil & Grease	mg/L	-	1.1	0.50	8571861			
Total Oil & Grease Mineral/Synthetic	mg/L	-	1.0	0.50	8571869			
Metals								
Total Aluminum (Al)	mg/L	50	0.2	0.1	8570993	0.2	0.1	8570993
Total Antimony (Sb)	mg/L	5	<0.02	0.02	8570993	<0.02	0.02	8570993
Total Arsenic (As)	mg/L	1	<0.01	0.01	8570993	<0.01	0.01	8570993
Total Beryllium (Be)	mg/L	5	<0.0005	0.0005	8570993	<0.0005	0.0005	8570993
Total Cadmium (Cd)	mg/L	1	<0.002	0.002	8570993	<0.002	0.002	8570993
Total Chromium (Cr)	mg/L	3	<0.01	0.01	8570993	<0.01	0.01	8570993
Total Cobalt (Co)	mg/L	5	<0.002	0.002	8570993	<0.002	0.002	8570993
Total Copper (Cu)	mg/L	3	<0.01	0.01	8570993	<0.01	0.01	8570993
Total Iron (Fe)	mg/L	50	0.32	0.02	8570993	0.31	0.02	8570993
Total Lead (Pb)	mg/L	3	<0.01	0.01	8570993	<0.01	0.01	8570993
Total Manganese (Mn)	mg/L	5	0.19	0.001	8570993	0.19	0.001	8570993
Mercury (Hg)	mg/L	0.05	<0.00010	0.00010	8568511	<0.00010	0.00010	8568511
Total Molybdenum (Mo)	mg/L	5	0.007	0.005	8570993	0.007	0.005	8570993
Total Nickel (Ni)	mg/L	3	<0.005	0.005	8570993	<0.005	0.005	8570993
Total Phosphorus (P)	mg/L	10	0.14	0.05	8570993	0.14	0.05	8570993

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
Criteria: Halton Sanitary & Combined Sewer Bylaw (2-03)

Bureau Veritas 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvna.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

Bureau Veritas Job #: C379636
Report Date: 2023/03/28

Grounded Engineering Inc.
Client Project #: 22-282
Site Location: 2072 Lakeshore Road, Burlington, ON
Sampler Initials: CSH

HALTON SANITARY & COMBINED BYLAW (2-03)

Bureau Veritas ID			VIQ039			VIQ039		
Sampling Date			2023/03/21 12:00			2023/03/21 12:00		
COC Number			925895-02-01			925895-02-01		
	UNITS	**Criteria**	**BH103 SEW**	**RDL**	**QC Batch**	**BH103 SEW Lab-Dup**	**RDL**	**QC Batch**
Total Selenium (Se)	mg/L	5	<0.02	0.02	8570993	<0.02	0.02	8570993
Total Silver (Ag)	mg/L	5	<0.01	0.01	8570993	<0.01	0.01	8570993
Total Tin (Sn)	mg/L	5	<0.02	0.02	8570993	<0.02	0.02	8570993
Total Titanium (Ti)	mg/L	5	<0.005	0.005	8570993	<0.005	0.005	8570993
Total Zinc (Zn)	mg/L	3	0.015	0.005	8570993	0.015	0.005	8570993
Polyaromatic Hydrocarbons								
Naphthalene	mg/L	0.14	0.000059	0.000050	8566859			
Volatile Organics								
Benzene	mg/L	0.01	<0.00040	0.00040	8566810			
Chloroform	mg/L	0.04	<0.00040	0.00040	8566810			
1,4-Dichlorobenzene	mg/L	0.08	<0.00080	0.00080	8566810			
Ethylbenzene	mg/L	0.16	<0.00040	0.00040	8566810			
Methylene Chloride(Dichloromethane	mg/L	2.0	<0.0040	0.0040	8566810			
Tetrachloroethylene	mg/L	1.0	<0.00040	0.00040	8566810			
Toluene	mg/L	0.016	<0.00040	0.00040	8566810			
Trichloroethylene	mg/L	0.4	<0.00040	0.00040	8566810			
Surrogate Recovery (%)								
D10-Anthracene	%	-	101		8566859			
D14-Terphenyl (FS)	%	-	97		8566859			
D8-Acenaphthylene	%	-	104		8566859			
4-Bromofluorobenzene	%	-	101		8566810			
D4-1,2-Dichloroethane	%	-	110		8566810			
D8-Toluene	%	-	96		8566810			

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
Criteria: Halton Sanitary & Combined Sewer Bylaw (2-03)

Bureau Veritas 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvna.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

Bureau Veritas Job #: C379636
Report Date: 2023/03/28

Grounded Engineering Inc.
Client Project #: 22-282
Site Location: 2072 Lakeshore Road, Burlington, ON
Sampler Initials: CSH

HALTON STORM SEWER BYLAW (2-03)

Bureau Veritas ID				VIQ039		
Sampling Date				2023/03/21 12:00		
COC Number				925895-02-01		
	UNITS	Criteria	Criteria-2	BH103 SEW	RDL	QC Batch
Inorganics						
pH	pH	6.0:10.0	6.5:8.5	7.62		8567435
Microbiological						
Escherichia coli	CFU/100mL	-	200	<10	10	8565780

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: Halton Sanitary & Combined Sewer Bylaw (2-03)
Criteria-2: Halton Storm Sewer ByLaw

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Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

Bureau Veritas Job #: C379636
Report Date: 2023/03/28

Grounded Engineering Inc.
Client Project #: 22-282
Site Location: 2072 Lakeshore Road, Burlington, ON
Sampler Initials: CSH

TEST SUMMARY

Bureau Veritas ID: VIQ039
Sample ID: BH103 SEW
Matrix: Water

Collected: 2023/03/21
Shipped:
Received: 2023/03/21

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Carbonaceous BOD	DO	8566242	2023/03/22	2023/03/27	Gurjot Kaur
Total Cyanide	SKAL/CN	8566192	2023/03/22	2023/03/22	Kruti Jitesh Patel
Fluoride	ISE	8567361	2023/03/22	2023/03/22	Kien Tran
Mercury in Water by CVAA	CV/AA	8568511	2023/03/23	2023/03/23	Jaswinder Kaur
Total Metals Analysis by Axial ICP	ICPX	8570993	2023/03/24	2023/03/24	Jolly John
E.coli, (CFU/100mL)	PL	8565780	N/A	2023/03/21	Soham Patel
Animal and Vegetable Oil and Grease	BAL	8564418	N/A	2023/03/24	Automated Statchk
Total Oil and Grease	BAL	8571861	2023/03/24	2023/03/24	Rutvik Patel
PAH Compounds in Water by GC/MS (SIM)	GC/MS	8566859	2023/03/22	2023/03/23	Joe Paino
pH	AT	8567435	2023/03/22	2023/03/22	Kien Tran
Phenols (4AAP)	TECH/PHEN	8566961	N/A	2023/03/22	Mandeep Kaur
Sulphate by Automated Turbidimetry	KONE	8566937	N/A	2023/03/23	Alina Dobreanu
Total Kjeldahl Nitrogen in Water	SKAL	8566600	2023/03/22	2023/03/27	Jency Sara Johnson
Mineral/Synthetic O & G (TPH Heavy Oil)	BAL	8571869	2023/03/24	2023/03/24	Rutvik Patel
Total Suspended Solids	BAL	8568701	2023/03/23	2023/03/24	Shaneil Hall
Volatile Organic Compounds in Water	GC/MS	8566810	N/A	2023/03/23	Gladys Guerrero

Bureau Veritas ID: VIQ039 Dup
Sample ID: BH103 SEW
Matrix: Water

Collected: 2023/03/21
Shipped:
Received: 2023/03/21

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury in Water by CVAA	CV/AA	8568511	2023/03/23	2023/03/23	Jaswinder Kaur
Total Metals Analysis by Axial ICP	ICPX	8570993	2023/03/24	2023/03/24	Jolly John

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Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

GENERAL COMMENTS

Cooler custody seal present and intact.

Sample VIQ039 [BH103 SEW] : VOC Analysis: Due sample matrix of target analytes, sample required dilution. Detection limits were adjusted accordingly. on Volatiles Batch: 8566810

Results relate only to the items tested.

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Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

Bureau Veritas Job #: C379636
Report Date: 2023/03/28

QUALITY ASSURANCE REPORT

Grounded Engineering Inc.
Client Project #: 22-282
Site Location: 2072 Lakeshore Road, Burlington, ON
Sampler Initials: CSH

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
8566810	4-Bromofluorobenzene	2023/03/23	101	70 - 130	99	70 - 130	102	%				
8566810	D4-1,2-Dichloroethane	2023/03/23	107	70 - 130	101	70 - 130	102	%				
8566810	D8-Toluene	2023/03/23	98	70 - 130	100	70 - 130	98	%				
8566859	D10-Anthracene	2023/03/23	103	50 - 130	99	50 - 130	103	%				
8566859	D14-Terphenyl (FS)	2023/03/23	103	50 - 130	97	50 - 130	100	%				
8566859	D8-Acenaphthylene	2023/03/23	103	50 - 130	100	50 - 130	103	%				
8566192	Total Cyanide (CN)	2023/03/22	97	80 - 120	96	80 - 120	<0.0050	mg/L	1.2	20		
8566242	Total Carbonaceous BOD	2023/03/27					<2	mg/L	0.34	30	99	85 - 115
8566600	Total Kjeldahl Nitrogen (TKN)	2023/03/28	NC	80 - 120	100	80 - 120	<0.10	mg/L	0.91	20	100	80 - 120
8566810	1,4-Dichlorobenzene	2023/03/23	110	70 - 130	109	70 - 130	<0.00040	mg/L	NC	30		
8566810	Benzene	2023/03/23	92	70 - 130	92	70 - 130	<0.00020	mg/L	NC	30		
8566810	Chloroform	2023/03/23	99	70 - 130	98	70 - 130	<0.00020	mg/L	4.2	30		
8566810	Ethylbenzene	2023/03/23	91	70 - 130	93	70 - 130	<0.00020	mg/L	NC	30		
8566810	Methylene Chloride(Dichloromethane)	2023/03/23	104	70 - 130	100	70 - 130	<0.0020	mg/L	NC	30		
8566810	Tetrachloroethylene	2023/03/23	88	70 - 130	88	70 - 130	<0.00020	mg/L	NC	30		
8566810	Toluene	2023/03/23	91	70 - 130	92	70 - 130	<0.00020	mg/L	NC	30		
8566810	Trichloroethylene	2023/03/23	102	70 - 130	101	70 - 130	<0.00020	mg/L	NC	30		
8566859	Naphthalene	2023/03/23	102	50 - 130	104	50 - 130	<0.000050	mg/L	NC	30		
8566937	Dissolved Sulphate (SO4)	2023/03/23	99	75 - 125	95	80 - 120	<1.0	mg/L	0.097	20		
8566961	Phenols-4AAP	2023/03/22	100	80 - 120	100	80 - 120	<0.0010	mg/L	4.9	20		
8567361	Fluoride (F-)	2023/03/22	101	80 - 120	107	80 - 120	<0.10	mg/L	4.8	20		
8567435	pH	2023/03/22			102	98 - 103			0.58	N/A		
8568511	Mercury (Hg)	2023/03/23	95	75 - 125	99	80 - 120	<0.00010	mg/L	NC	20		
8568701	Total Suspended Solids	2023/03/24					<10	mg/L	3.2	20	96	85 - 115
8570993	Total Aluminum (Al)	2023/03/24	131 (1)	80 - 120	101	80 - 120	<0.1	mg/L	7.2	20		
8570993	Total Antimony (Sb)	2023/03/24	102	80 - 120	100	80 - 120	<0.02	mg/L	NC	20		
8570993	Total Arsenic (As)	2023/03/24	108	80 - 120	102	80 - 120	<0.01	mg/L	NC	20		
8570993	Total Beryllium (Be)	2023/03/24	100	80 - 120	101	80 - 120	<0.0005	mg/L	NC	20		
8570993	Total Cadmium (Cd)	2023/03/24	103	80 - 120	101	80 - 120	<0.002	mg/L	NC	20		
8570993	Total Chromium (Cr)	2023/03/24	106	80 - 120	100	80 - 120	<0.01	mg/L	NC	20		
8570993	Total Cobalt (Co)	2023/03/24	97	80 - 120	100	80 - 120	<0.002	mg/L	NC	20		

Bureau Veritas 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvna.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

QUALITY ASSURANCE REPORT(CONT'D)

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
8570993	Total Copper (Cu)	2023/03/24	101	80 - 120	100	80 - 120	<0.01	mg/L	NC	20		
8570993	Total Iron (Fe)	2023/03/24	99	80 - 120	102	80 - 120	<0.02	mg/L	4.7	20		
8570993	Total Lead (Pb)	2023/03/24	95	80 - 120	100	80 - 120	<0.01	mg/L	NC	20		
8570993	Total Manganese (Mn)	2023/03/24	98	80 - 120	101	80 - 120	<0.001	mg/L	0.52	20		
8570993	Total Molybdenum (Mo)	2023/03/24	100	80 - 120	100	80 - 120	<0.005	mg/L	0	20		
8570993	Total Nickel (Ni)	2023/03/24	98	80 - 120	102	80 - 120	<0.005	mg/L	NC	20		
8570993	Total Phosphorus (P)	2023/03/24	108	80 - 120	100	80 - 120	<0.05	mg/L	2.7	20		
8570993	Total Selenium (Se)	2023/03/24	107	80 - 120	103	80 - 120	<0.02	mg/L	NC	20		
8570993	Total Silver (Ag)	2023/03/24	95	80 - 120	95	80 - 120	<0.01	mg/L	NC	20		
8570993	Total Tin (Sn)	2023/03/24	97	80 - 120	101	80 - 120	<0.02	mg/L	NC	20		
8570993	Total Titanium (Ti)	2023/03/24	99	80 - 120	100	80 - 120	<0.005	mg/L	NC	20		
8570993	Total Zinc (Zn)	2023/03/24	101	80 - 120	101	80 - 120	<0.005	mg/L	0	20		
8571861	Total Oil & Grease	2023/03/24			99	85 - 115	<0.50	mg/L	0.76	25		
8571869	Total Oil & Grease Mineral/Synthetic	2023/03/24			97	85 - 115	<0.50	mg/L	1.0	25		

N/A = Not Applicable

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

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

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

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

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

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

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

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

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

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Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

Bureau Veritas Job #: C379636
Report Date: 2023/03/28

Grounded Engineering Inc.
Client Project #: 22-282
Site Location: 2072 Lakeshore Road, Burlington, ON
Sampler Initials: CSH

VALIDATION SIGNATURE PAGE

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

Anastassia Hamanov, Scientific Specialist

Soham Patel, Senior Analyst

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by {0}, {1} responsible for {2} {3} laboratory operations.

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Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

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Page 1 of 1

CHAIN OF CUSTODY RECORD

INVOICE TO:	REPORT TO:	PROJECT INFORMATION:	Laboratory Use Only:
Company Name: #36876 Grounded Engineering Inc.	Company Name:	Quotation #: C20582	Bureau Veritas Job #: / Bottle Order #: 925895
Attention: ~~Lindsy Levesque~~ Nick Ng	Attention: ~~Lindsy Levesque~~ Nick Ng	P.O. #:	
Address: ~~1 Banigan Drive~~ 1 Banigan Dr, Toronto ON M4H 1G3	Address:	Project: 22-282	
Tel: (647) 361-5254 Fax:	Tel: (647) 361-5254 Fax:	Project Name:	COC #: C#925895-02-01 / Project Manager: Marijane Cruz
Email: ~~llevesque@groundedeng.ca~~ nng@groundedeng.ca	Email: ~~llevesque@groundedeng.ca~~ nng@groundedeng.ca	Site #: 2072 Lakeshore Road, Burlingto	
		Sampled By: CSH	

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE BUREAU VERITAS DRINKING WATER CHAIN OF CUSTODY

Regulation 153 (2011): ☐ Table 1 ☐ Res/Park ☐ Medium/Fine ☐ Table 2 ☐ Ind/Comm ☐ Coarse ☐ Table 3 ☐ Agr/Other ☐ For RSC ☐ Table ___

Other Regulations: ☐ CCME ☒ Sanitary Sewer Bylaw ☒ Storm Sewer Bylaw ☐ MISA Municipality Halton ☐ PWQO ☐ Reg 406 Table ☐ Other

Special Instructions:

Include Criteria on Certificate of Analysis (Y/N)? ____

ANALYSIS REQUESTED (PLEASE BE SPECIFIC):

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered (please circle): Metals / Hg / Cr VI	O Reg 153 Metals & Inorganics Pkg (WP)	O Reg 153 PAHs	O Reg 153 VOCs by HS & F1-F4	Halton Sanitary & Combined Bylaw (2-03)	Halton Storm Sewer Bylaw (2-03)	# of Bottles	Comments
1		BH 103 SEW	23-03-21	12:00	GW					X	X	13	
2													
3													
4													
5													
6													
7													
8													
9													
10													

Turnaround Time (TAT) Required:
Please provide advance notice for rush projects

Regular (Standard) TAT: ☒
(will be applied if Rush TAT is not specified)
Standard TAT = 5-7 Working days for most tests.
Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.

Job Specific Rush TAT (if applies to entire submission)
Date Required: ____ Time Required: ____ ☐
Rush Confirmation Number: ____ *(call lab for #)*

21-Mar-23 15:47
Marijane Cruz
C379636
RJM ENV-1390

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted
Christopher Hartley	23 03 21	13:00	ANERI	2023/03/21	1567	

Laboratory Use Only

Time Sensitive	Temperature (°C) on Recei	Custody Seal	Yes	No
	6 / 7 / 8	Present	✓	
		Intact	✓	

* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BUREAU VERITAS'S STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.BVNA.COM/ENVIRONMENTAL-LABORATORIES/RESOURCES/COC-TERMS-AND-CONDITIONS.

* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

** SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT WWW.BVNA.COM/ENVIRONMENTAL-LABORATORIES/RESOURCES/CHAIN-CUSTODY-FORMS-COCS.

SAMPLES MUST BE KEPT COOL (< 10° C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BUREAU VERITAS

White: Bureau Veritas Yellow: Client

Bureau Veritas Canada (2019) Inc.

Bureau Veritas Job #: C379636
Report Date: 2023/03/28

Grounded Engineering Inc.
Client Project #: 22-282
Site Location: 2072 Lakeshore Road, Burlington, ON
Sampler Initials: CSH

Exceedance Summary Table – Halton Sanitary Sewer

Result Exceedances

Sample ID	Bureau Veritas ID	Parameter	Criteria	Result	DL	UNITS
No Exceedances						

The exceedance summary table is for information purposes only and should not be considered a comprehensive listing or statement of conformance to applicable regulatory guidelines.

Exceedance Summary Table – Halton Storm Sewer

Result Exceedances

Sample ID	Bureau Veritas ID	Parameter	Criteria	Result	DL	UNITS
No Exceedances						

The exceedance summary table is for information purposes only and should not be considered a comprehensive listing or statement of conformance to applicable regulatory guidelines.

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APPENDIX F



STEADY STATE SEEPAGE ANALYSIS - SHORT TERM - P7 LEVEL

Excavation Dimensions: Equiv. 27± m (N-S) x 57± m (W-E)
Section Cut: W-E

P7 Level Finished Floor: Elev. 60± m
P7Level Base of Excavation: Elev. 59.5± m

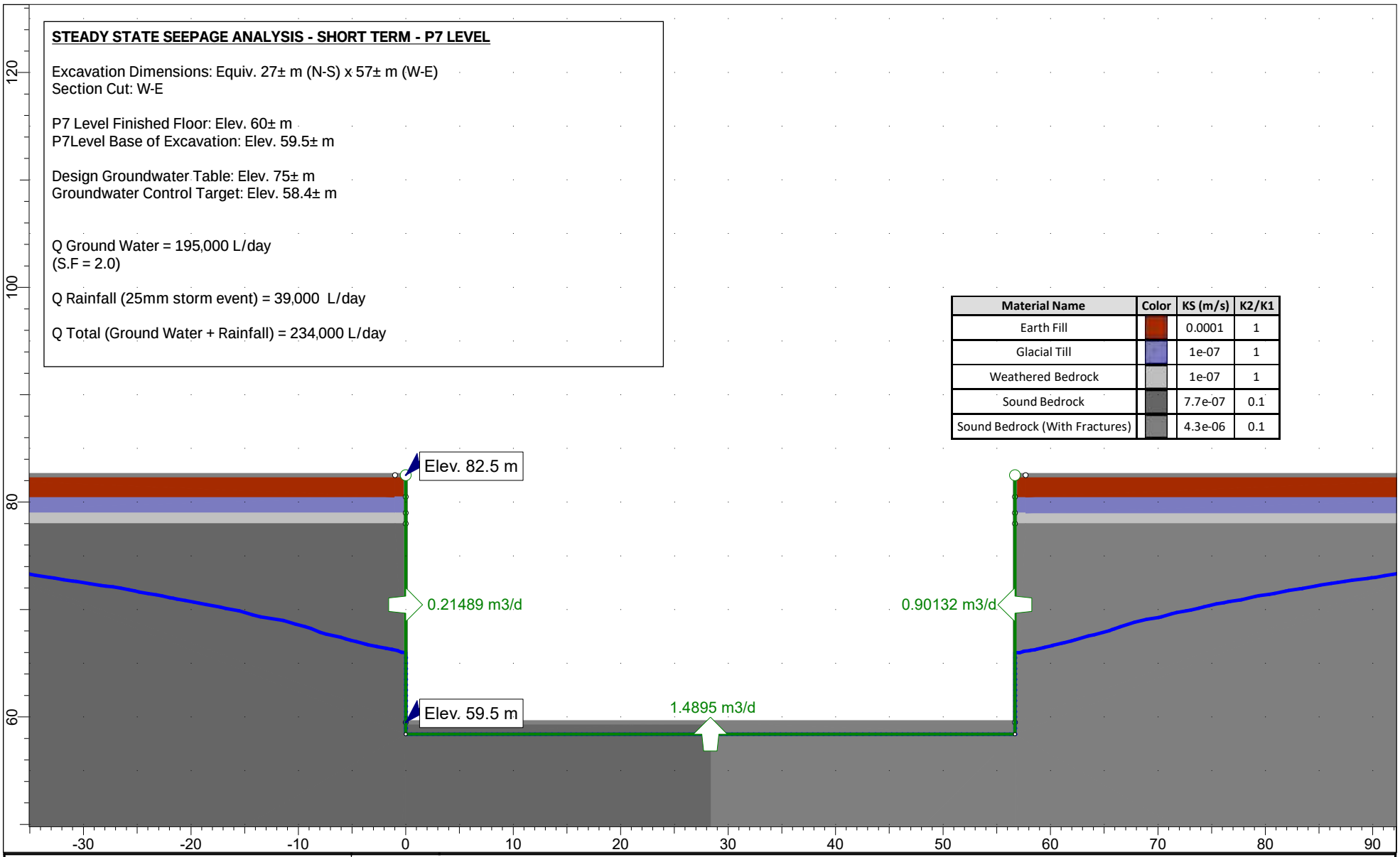
Design Groundwater Table: Elev. 75± m
Groundwater Control Target: Elev. 58.4± m

Q Ground Water = 195,000 L/day
(S.F = 2.0)

Q Rainfall (25mm storm event) = 39,000 L/day

Q Total (Ground Water + Rainfall) = 234,000 L/day

Material Name	Color	KS (m/s)	K2/K1
Earth Fill		0.0001	1
Glacial Till		1e-07	1
Weathered Bedrock		1e-07	1
Sound Bedrock		7.7e-07	0.1
Sound Bedrock (With Fractures)		4.3e-06	0.1



GROUNDED ENGINEERING

File	22-282 - 2150 Lakeshore Rd, Burlington
Analysis	Steady State Seepage Analysis: W-E Section - Soldier Pile & Lagging Shoring - P7 Level, Short Term
Ref.	
RS2 File	22-282 - FEM.slmd
Scale	1:500
Eng	NN

SLIDEINTERPRET 9.028

STEADY STATE SEEPAGE ANALYSIS - LONG TERM - P7 LEVEL

Excavation Dimensions: Equiv. 27± m (N-S) x 57± m (W-E)
Section Cut: W-E

P7 Level Finished Floor: Elev. 60± m
P7Level Subfloor Drainage: Elev. 59.5± m

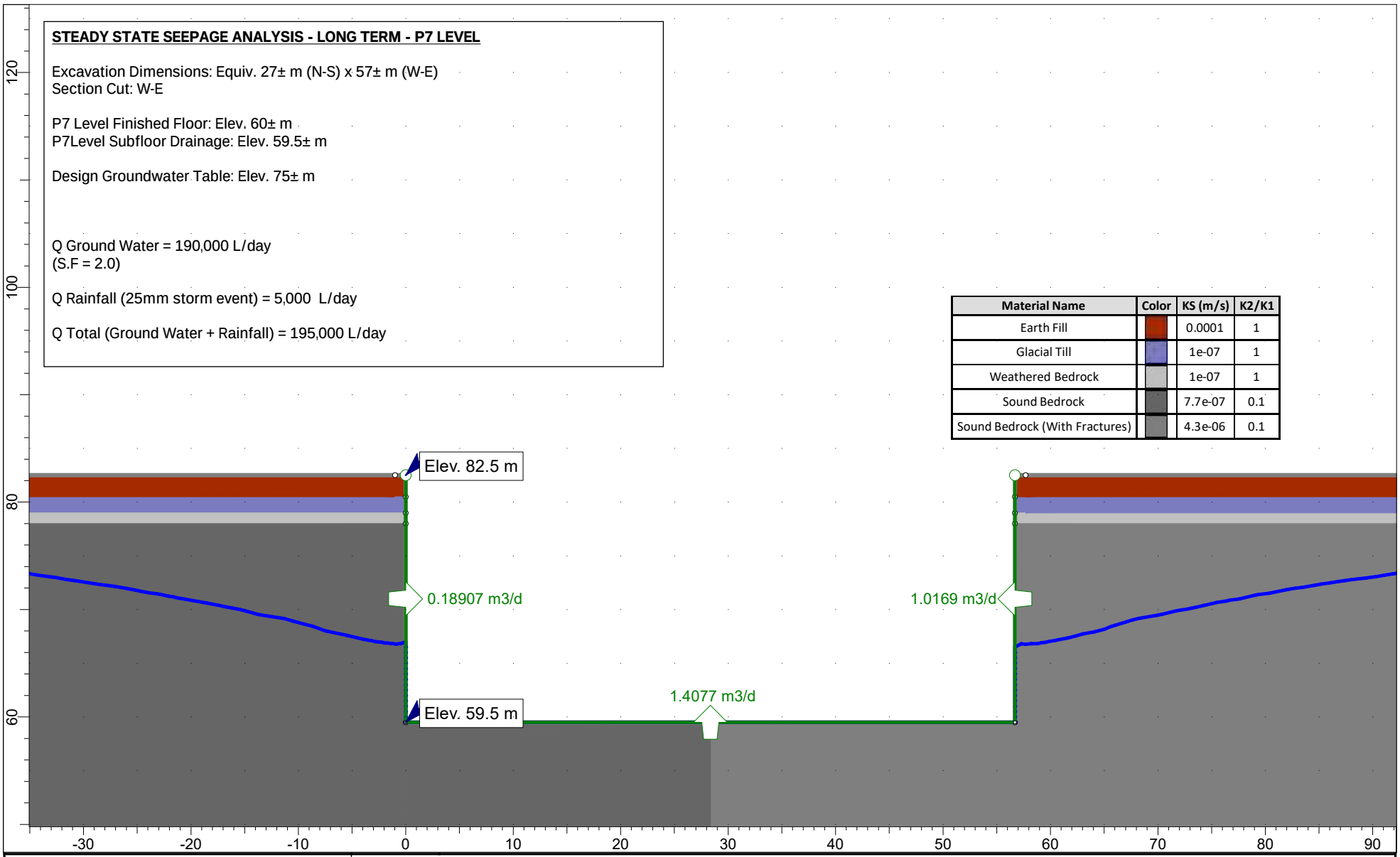
Design Groundwater Table: Elev. 75± m

Q Ground Water = 190,000 L/day
(S.F = 2.0)

Q Rainfall (25mm storm event) = 5,000 L/day

Q Total (Ground Water + Rainfall) = 195,000 L/day

Material Name	Color	KS (m/s)	K2/K1
Earth Fill		0.0001	1
Glacial Till		1e-07	1
Weathered Bedrock		1e-07	1
Sound Bedrock		7.7e-07	0.1
Sound Bedrock (With Fractures)		4.3e-06	0.1



GROUNDED ENGINEERING

File	22-282 - 2150 Lakeshore Rd, Burlington
Analysis	Steady State Seepage Analysis: W-E Section - Soldier Pile & Lagging Shoring - P7 Level, Long-Term
Ref.	
RS2 File	22-282 - FEM.slmd
Scale	1:500
Eng	NN

SLIDEINTERPRET 9.028

APPENDIX G



SHORT TERM - SOLDIER PILE & LAGGING - P7 EXCAVATION

Excavation Dimensions [m]	
N-S	27
E-W	57
Area (m2)	1536.57
Perimeter (m)	167.6

Rainfall Data		
Year	2	100
Hour	3	12
Depth (mm)	25	94
Depth (m)	0.025	0.094

Section		Flow [m3/day]	Length [m]	Volume [L/day]
Base		1.4691	27.1	39,813
Sides		0.19544	167.6	32,756
E side		0.90132	27	24,336
Total				96,904
Factor of Safety	2.0			193,808

Storm Events	
2 Year [L/day]	100 Year [L/day]
38,414	145,000

Summary	L/day	L/min
Groundwater	195,000	135.4
Rainfall	39,000	27.1
Total	234,000	162.5

LONG TERM - CONVENTIONAL DRAINAGE - P7 LEVEL

Excavation Dimensions [m]	
N-S	27
E-W	57
Area (m2)	1536.57
Perimeter (m)	167.6

Rainfall Data		
Year	2	100
Hour	3	12
Depth (mm)	25	94
Depth (m)	0.025	0.094

Section		Flow [m3/day]	Length [m]	Volume [L/day]
Base		1.3884	27.1	37,626
Sides		0.17196	167.6	28,820
E side		1.0169	27	27,456
Total				93,902
Factor of Safety	2.0			187,805

Infiltration [L/day]
628.5

Summary	L/day	L/min
Groundwater	190,000	131.9
Infiltration	5,000	3.5
Total	195,000	135.4

APPENDIX H





PINCHIN

PROJECT NAME: PHASE II ENVIRONMENTAL SITE ASSESSMENT			
CLIENT NAME: THE DAVID LANDRY FAMILY TRUST			
PROJECT LOCATION: 2072 LAKESHORE ROAD, BURLINGTON, ONTARIO			
FIGURE NAME: KEY MAP			FIGURE NO.: 1
APPROXIMATE SCALE: AS SHOWN	PROJECT NO.: 233963.001	DATE: FEB. 2019	



PINCHIN

PROJECT NAME: PHASE II ENVIRONMENTAL SITE ASSESSMENT			
CLIENT NAME: THE DAVID LANDRY FAMILY TRUST			
PROJECT LOCATION: 2072 LAKESHORE ROAD, BURLINGTON, ONTARIO			
FIGURE NAME: MONITORING WELL LOCATION PLAN			FIGURE NO.: 2
APPROXIMATE SCALE: AS SHOWN	PROJECT NO.: 233963.001	DATE: FEB. 2019	

Log of Borehole: MW01

Project #: 233963.001 **Logged By:** AH

Project: Phase II Environmental Site Assessment

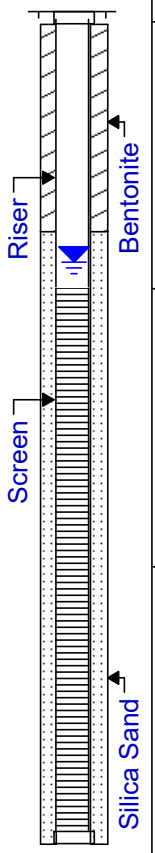
Client: The David Landry Family Trust

Location: 2072 Lakeshore Road, Burlington, Ontario

Drill Date: February 2, 2019

SUBSURFACE PROFILE

Depth (ft / m)	Description	Measured Depth (m)
0 / 0	Ground Surface	0.00
	Asphalt	
	Sand Brown, some gravel, damp.	
3 / 1	Wet below 1.52 mbgs.	
7 / 2		2.13
	Silt Red-brown to grey, trace weathered shale, damp.	
10 / 3	Sampler refusal at 3.05 mbgs. Augered to 4.57 mbgs for well installation.	3.05
	Silt Till / Weathered Shale Complex (Inferred) Red-brown to grey, damp.	
15 / 4		4.57
	End of Borehole	
18 / 5	Soil vapour concentrations measured using a RKI Eagle 2 equipped with a photoionization detector (PID) and a combustible gas indicator (CGI).	
20 / 6		



Water level measured at 1.38 mbgs on February 7, 2019.

SAMPLE

Recovery (%)	Sample ID	Soil Vapour Concentration (ppm) CGI/PID	Laboratory Analysis
30	MW01-1	0/0	PAHs
90	MW01-2	0/0	Grain Size, PHCs, VOCs
	MW01-3	0/0	pH

Contractor: Strata

Drilling Method: Direct Push & Solid Stem Auger

Well Casing Size: 5.1 cm

Grade Elevation: NM

Top of Casing Elevation: NM

Sheet: 1 of 1

Log of Borehole: MW02

Project #: 233963.001 ***Logged By:*** AH

Project: Phase II Environmental Site Assessment

Client: The David Landry Family Trust

Location: 2072 Lakeshore Road, Burlington, Ontario

Drill Date: February 2, 2019

SUBSURFACE PROFILE					SAMPLE			
Depth (ft / m)	Symbol	Description	Measured Depth (m)	Monitoring Well Details	Recovery (%)	Sample ID	Soil Vapour Concentration (ppm) CGI/PID	Laboratory Analysis
0 / 0		Ground Surface	0.00					
		Asphalt						
1		***Sand*** Brown, some gravel, damp.			60	MW02-1	0/0	
2 / 1						MW02-2	0/2	
3		Wet below 1.52 mbgs.						
4								
5								
6 / 2			2.13			MW02-3	0/2	PHCs, VOCs, Lead
7		***Silt*** Red-brown to grey, trace weathered shale, damp.			80			
8						MW02-4	0/0	
9								
10 / 3		Sampler refusal at 3.05 mbgs. Augered to 4.57 mbgs for well installation.	3.05					
11		***Silt Till / Weathered Shale Complex (Inferred)*** Red-brown to grey, damp.						
12								
13 / 4								
14								
15			4.57					
		End of Borehole						
16 / 5								
17								
18								
19								
20 / 6								

Riser, Bentonite, Screen, Silica Sand

Water level measured at 2.23 mbgs on February 7, 2019.

Soil vapour concentrations measured using a RKI Eagle 2 equipped with a photoionization detector (PID) and a combustible gas indicator (CGI).

Contractor: Strata

Grade Elevation: NM

Drilling Method: Direct Push & Solid Stem Auger

Top of Casing Elevation: NM

Well Casing Size: 5.1 cm

Sheet: 1 of 1

Log of Borehole: MW03

Project #: 233963.001 **Logged By:** AH

Project: Phase II Environmental Site Assessment

Client: The David Landry Family Trust

Location: 2072 Lakeshore Road, Burlington, Ontario

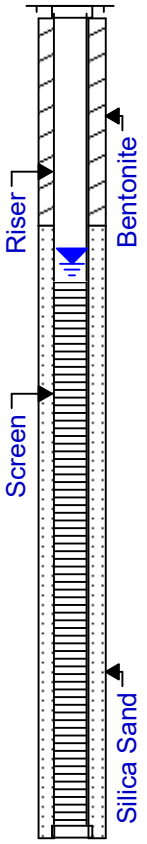
Drill Date: February 2, 2019

SUBSURFACE PROFILE

Depth (ft / m)	Description	Measured Depth (m)
0 / 0	Ground Surface	0.00
	Asphalt	
	Sand Brown, some gravel, damp.	
	Wet below 1.52 mbgs.	
7 / 2		2.13
	Silt Red-brown to grey, trace weathered shale, damp.	
	Sampler refusal at 3.05 mbgs. Augered to 4.57 mbgs for well installation.	3.05
	Silt Till / Weathered Shale Complex (Inferred) Red-brown to grey, damp.	
15 / 4.57		4.57
	End of Borehole	

Soil vapour concentrations measured using a RKI Eagle 2 equipped with a photoionization detector (PID) and a combustible gas indicator (CGI).

Monitoring Well Details



Water level measured at 1.42 mbgs on February 7, 2019.

SAMPLE

Recovery (%)	Sample ID	Soil Vapour Concentration (ppm) CGI/PID	Laboratory Analysis
60	MW03-1	0/0	
	MW03-2	0/0	pH
80	MW03-3	0/0	PHCs, VOCs, Lead
	MW03-4	0/0	

Contractor: Strata

Grade Elevation: NM

Drilling Method: Direct Push & Solid Stem Auger

Top of Casing Elevation: NM

Well Casing Size: 5.1 cm

Sheet: 1 of 1