S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS

Functional Servicing & Stormwater Management Report

535-551 Brant Street

CITY OF BURLINGTON

RENIMMOB PROPERTIES LTD.

MARCH 2021

SLA File: 19010

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1.0 INTRODUCTION AND BACKGROUND

1.1 OVERVIEW

S. Llewellyn & Associates Limited has been retained by Renimmob Properties Ltd. to provide Consulting Engineering services for the proposed development at 535-551 Brant Street in the City of Burlington (see Figure 1.0 for location plan). This report will outline the functional servicing strategy for the proposed development.

The proposed development consists of demolishing a commercial plaza and constructing a 26-storey high-rise tower. The 26-storey building will contain a total of 248 residential units, 4 stories of underground parking and retail space.

This Functional Servicing and Stormwater Management Report will provide detailed information of the proposed servicing scheme for this development. Please refer to the site engineering plans prepared by S. Llewellyn and Associates Limited and the site plan prepared by Turner Fleischer 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 2004)

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

Ref. 4: Erosion & Sediment Control Guidelines for Urban Construction (December 2006)

Ref. 5: Hydrogeological Review Report, 535-551 Brant Street (Grounded Engineering Inc.)

Ref. 6: City of Burlington Stormwater Management Design Guidelines (May 2020)



Figure 1.0 – Location Plan

2.0 STORMWATER MANAGEMENT

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

Quantity Control
The stormwater discharge rates in the post-development condition for all storm events up to and including the 100-year event are to be controlled to the 5-year pre-development condition discharge rate. This criterion is consistent with the City of Burlington comments provided in the pre-consultation meeting held on November 27, 2019.

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

treatment). This criterion is consistent with the City of Burlington comments provided in the pre-consultation meeting held on November 27, 2019.

Erosion Control
Erosion and sediment control measures will be implemented in accordance with the standards of the City of Burlington.

2.1 PRE-DEVELOPMENT CONDITIONS

In the pre-development condition, the 0.28 ha site contains an existing commercial plaza with associated paved parking areas. The site is bound by Brant Street to the west, paved parking area to the north, John Street to the east and a commercial property to the south. There is an existing 825mmø storm sewer along Brant Street fronting the proposed development, which flows south and ultimately discharges to Rambo Creek. There is one existing double catch basin located along John Street to the east of the subject lands. The storm outlet for this double catch basin runs to the east and discharges directly to Rambo Creek. Runoff from the north and east of the existing site is captured by this double catch basin.

Two drainage areas have been identified in the pre-development condition. Catchment 101's drainage area represents runoff which outlets into the 825mmø storm sewer along Brant Street. Catchment 102's drainage area represents runoff that is captured by the existing double catch basin along John Street and discharges directly to Rambo Creek. See Table 2.1 below and the Pre-Development Storm Drainage Area Plan in Appendix A for details.

Table 2.1- Pre-Development Catchment Areas

Catchment ID	Description	Area (ha)	% Imp.	Runoff Coefficient
101	Drainage to Brant Street	0.180	100	0.94
102	Drainage to John Street	0.098	100	0.90

An analysis was performed on Catchment 101 and 102 using the SWMHYMO hydrologic modelling program developed by J.F. Sabourin & Associates for the 2-year to 100-year City of Burlington Design Storms. A summary of the results can be found in Table 2.2 below and the detailed SWMHYMO input/output information in Appendix B.

Table 2.2 - Pre-Development Condition Site Discharge		
Storm Event	Catchment 101 Discharge (m^3/s)	Catchment 102 Discharge (m^3/s)
2-Yr Event	0.039	0.021
5-Yr Event	0.050	0.027
10-Yr Event	0.058	0.031
25-Yr Event	0.067	0.037
50-Yr Event	0.074	0.040
100-Yr Event	0.081	0.044

2.2 POST-DEVELOPMENT CONDITIONS

It is proposed to service the site with a private storm sewer system, designed and constructed in accordance with the City of Burlington Standards. Three catchment areas have been identified in the post-development condition. Catchment 201's drainage area represents the controlled runoff from the rooftop of the proposed high-rise tower. Catchment 201 will be controlled via a 135mmø orifice pipe which will act as the outlet from the underground stormwater storage tank. Catchment 202 represents the uncontrolled runoff from the paved area to the west of the proposed building fronting Brant Street. Catchment 203's drainage area sheet drains uncontrolled to the municipal right-of-way to the east of the proposed site and is ultimately captured by the double catch basin on John Street. See Table 2.3 below and the Post-Development Storm Drainage Area Plan in Appendix A for details.

Table 2.3- Post-Development Catchment Areas				
Catchment ID	Description	Area (ha)	% Imp.	Runoff Coefficient
201	Controlled Roof Top Drainage	0.228	100	0.95
202	Uncontrolled Drainage to Brant Street	0.033	100	0.90
203	Uncontrolled Drainage to John Street	0.017	100	0.90

Short Term Dewatering Control

A hydrogeological review was recently completed by Grounded Engineering Inc. in order to determine short term construction dewatering discharge rates. See Appendix D for details.

During the construction phase, the short term discharge rate has been calculated to be 89,000 L/day (1.03L/s) under the 25mm Storm event and 259,000 L/day (3.00 L/s) under the 100-year Storm event. Based on the Grounded Engineering hydrogeological report dated February 26, 2021 (Appendix D) some groundwater quality parameters are exceeding the City of Burlington by-law No. 086-2002 for discharge to storm sewers. Under this scenario, any short-term dewatering would require pre-treatment prior to release to the storm sewer or dewatering could be collected and hauled off site using a licenced contractor.

Permanent Dewatering Control

It is required to provide a permanent subfloor drainage system, as it is proposed to construct four stories of underground parking. It has been proposed to install a sump pump system beneath the concrete slab of the level 4 underground parking garage (Refer to Site Servicing Plan). The sump pump unit will connect to the internal storm system within the building. A hydrogeological investigation (Ref. 5) was completed on-site to determine the ground water conditions and dewatering requirements. It was determined that a ground water taking of 0.255 L/s is possible. This flow rate will be accounted for in the discharge rate leaving the site. The additional stormwater storage volume required due to permanent dewatering was conservatively calculated using the maximum ground water taking of 0.255 L/s multiplied by the full design storm duration of 6-hrs. This will result in a maximum of 5.5m^3 of additional storage volume. It was also determined that the groundwater sample collected from the site exceeds the City of Burlington Storm Sewer Discharge Limits. As it is proposed to discharge groundwater takings to the municipal storm sewer, a groundwater treatment system will be proposed within the building to satisfy all necessary groundwater treatment standards. The hydrogeological investigation conducted by Grounded Engineering Inc. can be referenced in Appendix D.

Water Quantity Control

It is required to provide quantity control measures to prevent post-development discharge rates from exceeding the 5-year pre-development discharge rate during all storm events. To provide the required quantity control measures for the subject site, it has been proposed to install a 5.5m-135mmø orifice pipe at 0.6% grade. (Refer to Site Servicing Plan).

With the installation of the above noted orifice pipe, it will be required to provide stormwater storage during all storm events. It is proposed to install a stormwater storage vault within the level 1 underground parking garage. This storage vault will be cast into the foundation of the high-rise tower. A summary of the Stage-Storage-Discharge Calculations can be seen in Table 2.4 below.

Table 2.4 - Post-Development Condition Stage-Storage-Discharge (Catchment 201)

Elevation (m)	Vault Volume (m^3)	Discharge (m^3/s)
85.93 (orifice pipe invert/bottom of tank)	0	0
86.18 (0.25m deep)	15	0.0154
86.43 (0.50m deep)	30	0.0247
86.68 (0.75m deep)	45	0.0315
86.93 (1.00m deep)	60	0.0371
87.13 (top of tank)	72	0.0410

An analysis was performed on Catchments 201, 202 and 203 using the SWMHYMO hydrologic modelling program developed by J.F. Sabourin & Associates for the 2-year to 100-year City of Burlington Design Storms. A summary of the results can be found in Table 2.5 and Table 2.6 below. For additional information the detailed SWMHYMO input/output information can be found in Appendix B.

Table 2.5 - Post-Development Condition Site Discharge to Brant Street (Catchment 201 + 202)					
Storm Event	CA 201 Controlled Discharge (m^3/s)	CA 202 Uncontrolled Discharge (m^3/s)	Total Discharge To Brant Street (m^3/s)[A]	Allowable Discharge To Brant Street (m^3/s)[B]	Required Storage (m^3)
2-Yr Event	0.023	0.007	0.029	0.050	26.8
5-Yr Event	0.027	0.009	0.036	0.050	35.3
10-Yr Event	0.030	0.011	0.040	0.050	41.2
25-Yr Event	0.033	0.012	0.045	0.050	48.7
50-Yr Event	0.035	0.014	0.048	0.050	54.4
100-Yr Event	0.037	0.015	0.051	0.050	60.0
[A]= (Catchment 201 Controlled + Catchment 202 Uncontrolled) + Ground Water Discharge (0.255L/s)					
[B]= 5-Year Pre-Development Flow Rate (Catchment 101)					

Table 2.6 - Post-Development Condition Site Discharge to John Street (Catchment 203)		
Storm Event	CA 203 Discharge (m^3/s)	Allowable Discharge (m^3/s)[A]
2-Yr Event	0.004	0.027
5-Yr Event	0.005	0.027
10-Yr Event	0.005	0.027
25-Yr Event	0.006	0.027
50-Yr Event	0.007	0.027
100-Yr Event	0.008	0.027
[A]= 5-Year Pre-Development Flow Rate (Catchment 102)		

This analysis determined the following:

- Discharge rates in the post-development condition will only exceed the allowable discharge rate during the 100-year storm event by approximately 1 L/s through the use of a 5.5m-135mmø orifice pipe at 0.6%.

- Sufficient stormwater storage is provided on site. The proposed stormwater storage vault provides $72m^3$ of storage, whereas only $60m^3$ of storage is required during the 100-year event. The additional $12m^3$ is sufficient to accommodate any additional volume that may result from groundwater discharge.

Water Quality Control

Stormwater quality control measures will not be implemented on-site. Stormwater quality will not be adversely affected, as drainage from the subject lands will be generated from the roof top of the proposed high-rise tower 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 sediment control (silt sacks) in the nearby existing catch basins to ensure that no untreated runoff enters the existing conveyance system;

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 his contractor shall be responsible for any costs incurred during the remediation of problem areas.

3.0 SANITARY SEWER SERVICING

3.1 PRE-DEVELOPMENT CONDITIONS

There is an existing 525mmø sanitary trunk sewer along Brant Street fronting the proposed development which flows south. The existing development is currently serviced with a 125 mmø sanitary lateral which ties into the existing 525mmø sanitary trunk sewer along Brant Street. It has been specified by Halton Region that any lateral connections to the 525mmø sanitary sewer will require a special review and Regional permission to connect, and should be noted that permission is not always guaranteed.

3.2 SANITARY DEMAND

Sanitary discharge from the site was estimated in accordance with the Halton Region Water and Wastewater Linear Design Manual (Ref. 3). Table 3.1 summarizes the sanitary sewer discharge rate from the subject lands.

Table 3.1- Post-Development Sanitary Sewer Discharge (Residential Units)

Population [A]	Avg. Demand [B] (l/s)	Peaking Factor [C]	Infiltration [D] (l/s)	**Peak Flow [E] (l/s)**
730 persons	2.32	3.88	0.080	**9.08**

[A] Population = (136 x 1 bdr units x 2 cap/bdr) + (107 x 2 bdr units x 2 cap/bdr) + (5 x 3 bdr units x 2 cap/bdr) = 730 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 (0.28 hectares)

[E] Peak Flow = (Average Flow x Peaking Factor) + Infiltration

Table 3.2- Post-Development Sanitary Sewer Discharge (Retail Units)					
Retail Gross Floor Area [A] (ha)	Population [B]	Avg. Demand [C] (l/s)	Peaking Factor [D]	Infiltration [E] (l/s)	**Peak Flow [F] (l/s)**
0.11	10 persons	0.03	3.53	0.080	**0.19**

[A] GFA of retail units (1068m^2)
[B] Light Commercial Areas = 90 persons/hectare
[C] Average demand = 24.75 m^3/ha/day x total floor area
[D] Peaking Factor = 0.80(1+((14/(4+P$^{0.5}$))) with P expressed in thousands Min=2.0
[E] Infiltration flow based on 0.286 l/ha/sec infiltration rate x Site Area (0.28 hectares)
[F] Peak Flow = (Average Flow x Peaking Factor) + Infiltration

Total Sanitary Sewer Discharge = 9.08 l/s + 0.19 l/s
Total Sanitary Sewer Discharge = 9.27 l/s

3.3 POST-DEVELOPMENT SANITARY SERVICING AND CAPACITY ANALYSIS

The proposed high-rise tower will be serviced by a private 200mm⌀ sanitary sewer system, designed and constructed in accordance with the Halton Region standards. The proposed 200mm⌀ sanitary sewer will connect to the existing 525mm⌀ sanitary sewer along Brant Street.

The minimum grade of the proposed 200mm⌀ sanitary will be 2.0%. At this minimum grade, the proposed sanitary sewer will have a capacity of 0.046 m^3/s (46 l/s). Therefore, the proposed 200mm⌀ sanitary sewer at 2.0% grade is adequately sized to service the proposed development.

4.0 DOMESTIC AND FIRE WATER SUPPLY SERVICING

4.1 PRE-DEVELOPMENT CONDITIONS

The existing municipal water distribution system consists of a 300mm⌀ and 150mmø watermain along Brant Street. There are two existing fire hydrants within close proximity of the southern face of the proposed building which fronts onto Brant 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 (Ref.3). Table 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 (Residential Units)					
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)**
730 persons	2.32	2.25	4.00	**5.22**	**9.28**

[A] Population = (136 x 1 bdr units x 2 cap/bdr) + (107 x 2 bdr units x 2 cap/bdr) + (5 x 3 bdr units x 2 cap/bdr) = 730 persons
[B] Average Daily Demand = 275 l/cap/day x population
[C] Max. Daily Peaking Factor = 2.25 (refer to sentence 2.4.1 in Ref.3)
[D] Max. Hourly Peaking Factor = 4.00 (refer to Table 2-2 in Ref. 3)
[E] Max. Daily Demand = Average Daily Demand x Max. Daily Peaking Factor
[F] Max. Hourly Demand = Average Daily Demand x Max. Hourly Peaking Factor

Table 4.2 - Post-Development Domestic Water Demand (Retail Units)					
Total Gross Floor Area [A] (ha)	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)**
0.11	0.03	2.25	2.25	**0.068**	**0.068**

[A] GFA of retail units (1068m^2)
[B] Average Daily Demand = 24.75 m^3/ha/day x total floor area
[C] Max. Daily Peaking Factor = 2.25 (refer to sentence 2.4.1 in Ref.3)
[D] Max. Hourly Peaking Factor = 2.25 (refer to Table 2-2 in Ref. 3)
[E] Max. Daily Demand = Average Daily Demand x Max. Daily Peaking Factor
[F] Max. Hourly Demand = Average Daily Demand x Max. Hourly Peaking Factor

Total Max. Daily Demand = 5.22 l/s + 0.068 l/s
Total Max. Daily Demand = 5.29 l/s
Total Max. Hourly Demand = 9.28 l/s + 0.068 l/s
Total Max. Hourly Demand = 9.35 l/s

4.3 FIRE FLOW DEMAND

Fire flow demands for development are governed by a number of guidelines and criteria, such as the Water Supply for Public Fire Protection (Fire Underwriters Survey, 1999), Ontario Building Code (OBC), and various codes and standards published by the National Fire Protection Association (NFPA). Since the FUS criteria provides adjustment for sprinklered buildings (OBC does not), the FUS method was used to determine the fire flow demand for the proposed development.

The condominium building is anticipated to be constructed as a fire resistive building (C=0.6), with non-combustible occupancy (-25% correction) and sprinkler system (-50% correction). Exposure corrections are based on the following:
North Face: 0% correction (>45)

South Face: 25% correction (0m to 3m)
East Face: 10% correction (20.1m to 30m)
West Face: 10% correction (20.1m to 30m)

Based on the hydrant flow test conducted by Jackson Waterworks, the theoretical maximum available flow rate is **402 l/s**. It is estimated that the required fire flow for the proposed development will be **133 l/s**. Therefore, the water distribution system has adequate pressure and capacity to service the subject site. See Fire Flow Demand Requirements in Appendix C for calculations and details.

4.4 POST-DEVELOPMENT WATER SERVICING AND ANALYSIS

The proposed water servicing for the subject site consists of installing a 200mmø watermain which will be split at property line to provide a 100mmø domestic and 200mmø fire water service for the proposed development. Water services for the site are to be designed and constructed in accordance with the Halton Region standards.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the information provided herein, it is concluded that the proposed development at 535-551 Brant Street can be constructed to meet the requirements of the City of Burlington and Halton Region. Therefore, it is recommended that:

- The development be graded and serviced in accordance with the Grading and Erosion Control Plan and the Site Servicing Plan prepared by S.Llewellyn & Associates Limited.

- Install a 5.5m-135mmø orifice pipe at 0.6% as per the Site Servicing Plan and this report to provide adequate quantity control.

- No quality control measures will be implemented as the site is predominately covered by roof and is considered “clean runoff”.

- Erosion and sediment controls be installed as described in this report to meet City of Burlington requirements.

- The proposed sanitary and water servicing system be installed as per this report and Site Servicing Plan to adequately service the proposed development;

- Hydrovac investigations are premature at this point in time. Instead, it is recommended that the hydrovac investigations be completed at the Site Plan Application Stage when the details of the design have been confirmed.

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



S. DeGrow, Dipl.T.

S. Llewellyn, P.Eng.

APPENDIX A
STORMWATER MANAGEMENT INFORMATION

C:\Users\stevend\Desktop\WORKING FROM HOME\19010\CAD\19010\WORKING\CURRENT\19010-DAP.dwg

4/20/2020 8:16:52 AM - Steven DeGrow

JOHN STREET

BRANT STREET

EX. CENTRE LINE OF PAVEMENT

EX. PARKING

EX. CONCRETE

EX. PLAZA
No. 535-551

EX. 1 STOREY CONCRETE BUILDING WITH STONE FACE
NO. 531

EX. MH
T/G=87.72

EX. DCB
T/G=87.15

EX. CB
T/G=87.50
INV=85.83

EX. CB
T/G=87.64
INV=86.32

EX. CB
T/G=87.27
INV=86.02

EX. BMH
T/G=87.72

EX. BMH
T/G=87.70

EX. SAN MH
T/G=87.64
N.INV=84.56
S.INV=83.65

EX. HMH
T/G=87.54

EX. STM MH
T/G=87.31
N.INV=85.11
S.INV=84.95

EX. 825mmø STORM SEWER @ 0.50%

EX. 525mmø SANITARY SEWER @ 0.38%

EX. 300mmø PVC WATERMAIN

EX. 150mmø CAST IRON WATERMAIN

EX. UNDERGROUND BELL CABLES

EX. UNDERGROUND HYDRO CABLES

EX. UNKNOWN UNDERGROUND SERVICE

EX. CONCRETE SIDEWALK

EX. CURB STONES

EX. CURB

EX. APPROACH

EX. PIPE FENCE

EX. SANITARY SERVICE

EX. WATER SERVICE

EX. PAINTED

EX. PAINT

EX. SIGN BASE

EX. SIGN

EX. PIL

EX. LP

EX. GV

EX. WV

EX. HP

EX. VENT

EX. FH

EX. SIGN CONTROL

EX. MH

EX. CB

EX. CRW

EX. APP

EX. CURB

CCRB

CURB

94.63 Roof

DTREE

DS

101
0.180
100
0.94

102
0.098
100
0.90

PROJECT

LEGEND

PERVIOUS AREA

201 — DRAINAGE AREA I.D.
0.39 — DRAINAGE AREA (ha)
11 — PERCENT IMPERVIOUS
0.32 — RUNOFF COEFFICENT

DIRECTION OF SHEET FLOW

FIGURE 1.0
PRE-DEVELOPMENT STORM DRAINAGE AREA PLAN

SCALE: 1:300

PROJECT: 535-551 BRANT STREET, BURLINGTON, ON
PROJECT No.: 19010

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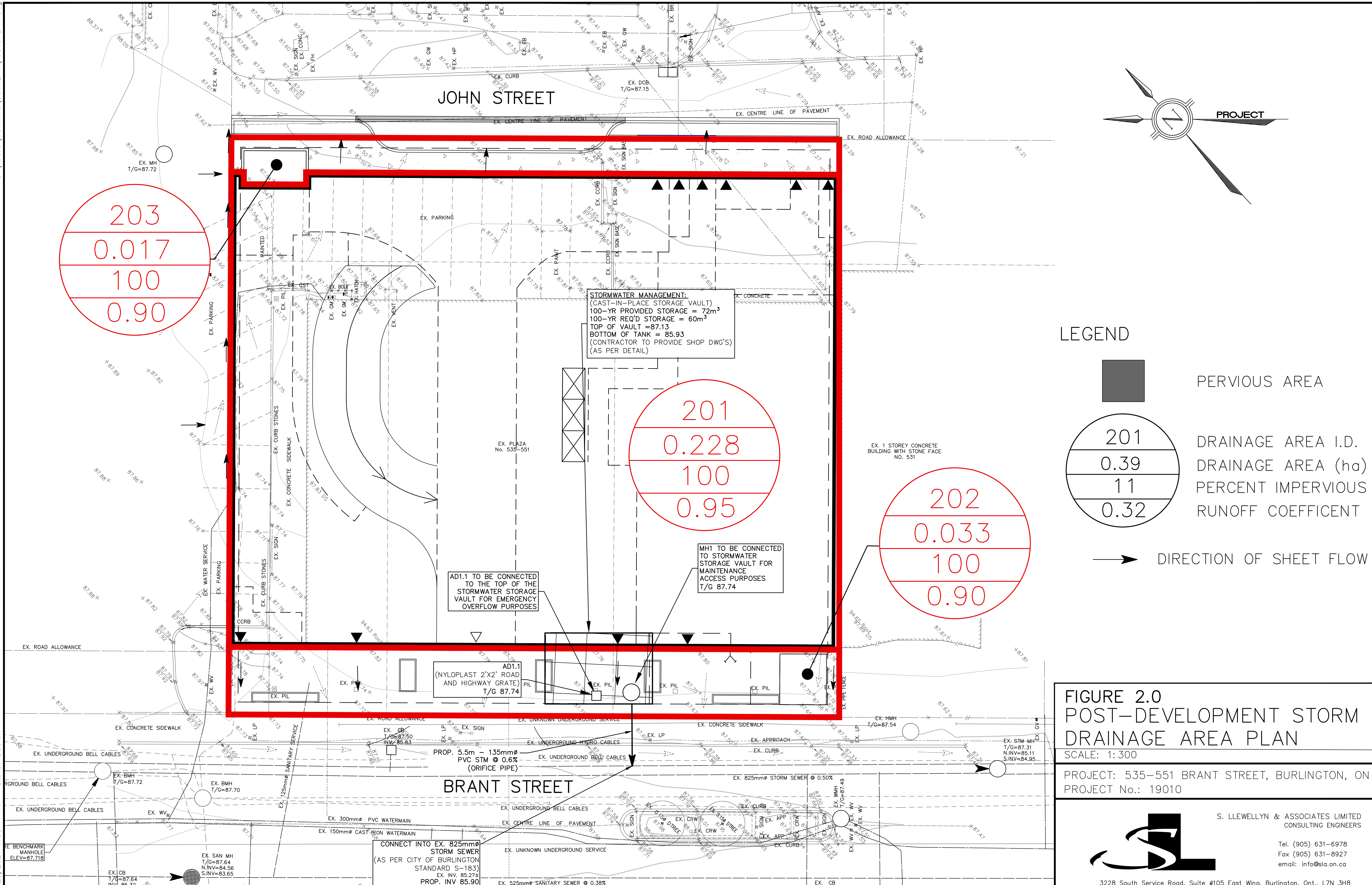


FIGURE 2.0
POST–DEVELOPMENT STORM DRAINAGE AREA PLAN
SCALE: 1:300

PROJECT: 535–551 BRANT STREET, BURLINGTON, ON
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Burlington, ON

S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS

RUNOFF COEFFICIENT CALCULATIONS

Pre

		C-Value
Drainage Area #:	101	
Roof/Building Area (m²):	1459.12	0.95
Asphalt/Conc. Area (m²):	339.82	0.90
Gravel	0	0.80
Grass Area - Pervious (m²):	0	0.25
Total Area (m²):	1798.94	0.94
Impervious	1798.94	**1.00**
Pervious	0	**0.00**
Site	1798.94	

Pre

		C-Value
Drainage Area #:	102	
Roof/Building Area (m²):	0	0.95
Asphalt/Conc. Area (m²):	980.36	0.90
Gravel	0	0.80
Grass Area - Pervious (m²):	0	0.25
Total Area (m²):	980.36	0.90
Impervious	980.36	**1.00**
Pervious	0	**0.00**
Site	980.36	

Post

		C-Value
Drainage Area #:	201	
Roof/Building Area (m²):	2279.78	0.95
Asphalt/Conc. Area (m²):	0	0.90
Grass Area - Pervious (m²):	0	0.25
Total Area (m²):	2279.78	0.95
Impervious	2279.78	**1.00**
Pervious	0	**0.00**
Site	2279.78	

Drainage Area #:	202	
Roof/Building Area (m²):	0	0.95
Asphalt/Conc. Area (m²):	325.72	0.90
Grass Area - Pervious (m²):	0	0.25
Total Area (m²):	325.72	0.90
Impervious	325.72	**1.00**
Pervious	0	**0.00**
Site	325.72	

Drainage Area #:	203	
Roof/Building Area (m²):	0	0.95
Asphalt/Conc. Area (m²):	173.8	0.90
Grass Area - Pervious (m²):	0	0.25
Total Area (m²):	173.8	0.90
Impervious	173.8	**1.00**
Pervious	0	**0.00**
Site	173.8	

535-551 Brant Street
Burlington, Ontario

S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS

STAGE-STORAGE-DISCHARGE CALCULATIONS

Outlet Device No. 1 (Quantity)

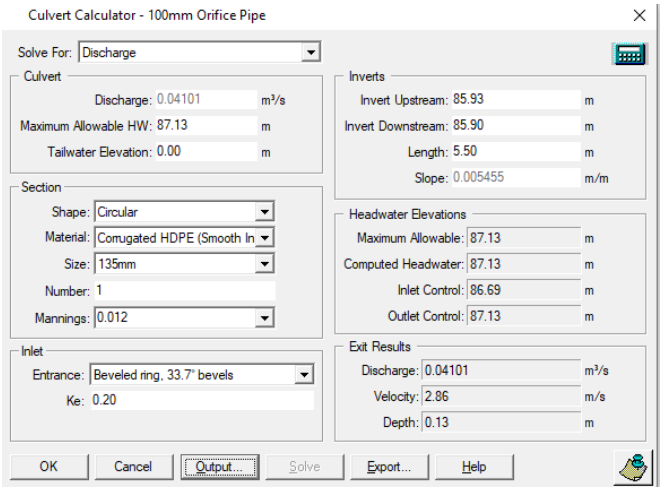
Type:	Circular Orifice
Diameter (mm)	**135**
Area (m^2)	0.01431
Invert Elev. (m)	85.93
C/L Elev. (m)	86.00
Disch. Coeff. (C_d)	0.8
Discharge (Q) =	$C_d A (2 g H)^{0.5}$
Number of Orifices:	1

		SWM Pond Volumes				Outlet No. 1	
	Elevation m	Area m^2	Tank Incremental Volume	Cumulative Volume m^3	Active Storage Volume m^3	H m	Discharge m^3/s
Orifice Invert	85.93	0	0	0	0	0.000	0.0000
Bottom of Tank	85.93	60	0	0	0	0.000	0.0000
0.25m Deep	86.18	60	15	15	15	0.250	0.0154
0.50m Deep	86.43	60	15	30	30	0.500	0.0247
0.75m Deep	86.68	60	15	45	45	0.750	0.0315
1.00m Deep	86.93	60	15	60	60	1.000	0.0371
Top of Tank	87.13	60	12	72	72	1.200	0.0410

Rating Table Report
100mm Orifice Pipe

Range Data:				
	Minimum	Maximum	Increment	
Allowable HW E	85.90	87.13	0.01	m

HW Elev. (m)	Discharge (m³/s)
85.90	0.00000
85.91	0.00000
85.92	0.00000
85.93	0.00000
85.94	0.00006
85.95	0.00025
85.96	0.00055
85.97	0.00096
85.98	0.00147
85.99	0.00207
86.00	0.00276
86.01	0.00353
86.02	0.00436
86.03	0.00525
86.04	0.00618
86.05	0.00713
86.06	0.00807
86.07	0.00901
86.08	0.00990
86.09	0.01070
86.10	0.01143
86.11	0.01197
86.12	0.01248
86.13	0.01298
86.14	0.01348
86.15	0.01396
86.16	0.01444
86.17	0.01491
86.18	0.01537
86.19	0.01582
86.20	0.01627
86.21	0.01670
86.22	0.01713
86.23	0.01755
86.24	0.01796
86.25	0.01837
86.26	0.01877
86.27	0.01916
86.28	0.01954
86.29	0.01992
86.30	0.02029
86.31	0.02066
86.32	0.02102
86.33	0.02138
86.34	0.02173
86.35	0.02207
86.36	0.02241
86.37	0.02275
86.38	0.02308
86.39	0.02341
86.40	0.02373



Rating Table Report
100mm Orifice Pipe

HW Elev. (m)	Discharge (m³/s)
86.41	0.02405
86.42	0.02436
86.43	0.02467
86.44	0.02498
86.45	0.02528
86.46	0.02558
86.47	0.02588
86.48	0.02617
86.49	0.02646
86.50	0.02675
86.51	0.02703
86.52	0.02732
86.53	0.02759
86.54	0.02787
86.55	0.02814
86.56	0.02841
86.57	0.02868
86.58	0.02895
86.59	0.02921
86.60	0.02947
86.61	0.02973
86.62	0.02999
86.63	0.03024
86.64	0.03050
86.65	0.03075
86.66	0.03099
86.67	0.03124
86.68	0.03148
86.69	0.03173
86.70	0.03197
86.71	0.03221
86.72	0.03244
86.73	0.03268
86.74	0.03292
86.75	0.03315
86.76	0.03338
86.77	0.03361
86.78	0.03384
86.79	0.03406
86.80	0.03429
86.81	0.03451
86.82	0.03473
86.83	0.03495
86.84	0.03517
86.85	0.03539
86.86	0.03561
86.87	0.03581
86.88	0.03602
86.89	0.03623
86.90	0.03644
86.91	0.03665
86.92	0.03686
86.93	0.03707
86.94	0.03729
86.95	0.03749

Rating Table Report
100mm Orifice Pipe

HW Elev. (m)	Discharge (m³/s)
86.96	0.03770
86.97	0.03790
86.98	0.03810
86.99	0.03830
87.00	0.03850
87.01	0.03869
87.02	0.03889
87.03	0.03909
87.04	0.03928
87.05	0.03948
87.06	0.03967
87.07	0.03986
87.08	0.04006
87.09	0.04025
87.10	0.04044
87.11	0.04063
87.12	0.04082
87.13	0.04101

APPENDIX B
SWMHYMO INPUT/OUTPUT INFORMATION

```
2     Metric units
*#**************************************************************************|
*#  Project Name: 535-551 BRANT STREET
*#               BURLINGTON, ONTARIO
*#  JOB NUMBER  : 19010
*#       Date   : JAN 2021
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 19010.DAT
*#**************************************************************************|
*
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[002]
                    BUR6_002.stm
*
READ STORM          STORM_FILENAME "STORM.001"
*
*#**************************************************************************|
*#
*#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ==============================================
*#
**#**************************************************************************|
*# CATCHMENT 101 - Existing Condition Outlet to 825mm Storm Sewer on Brant Stree
*
CALIB STANDHYD      ID=[1], NHYD=["101"], DT=[1](min), AREA=[0.180](ha),
                    XIMP=[0.99], TIMP=[0.99], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[80],
                    Pervious   surfaces: IAper=[6.35](mm), SLPP=[2.0](%),
                                         LGP=[5.0](m), MNP=[0.250], SCP=[0](min)
                    Impervious surfaces: IAimp=[1.0](mm), SLPI=[1.4](%),
                                         LGI=[3.0](m), MNI=[0.013], SCI=[0](min)
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
**#**************************************************************************|
*# CATCHMENT 102 - Existing Condition Outlet to Ex. CB on John Street
*
CALIB STANDHYD      ID=[2], NHYD=["102"], DT=[1](min), AREA=[0.098](ha),
                    XIMP=[0.99], TIMP=[0.99], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[80],
                    Pervious   surfaces: IAper=[6.35](mm), SLPP=[2.0](%),
                                         LGP=[5.0](m), MNP=[0.250], SCP=[0](min)
                    Impervious surfaces: IAimp=[1.0](mm), SLPI=[3.5](%),
                                         LGI=[7.0](m), MNI=[0.013], SCI=[0](min)
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
**#**************************************************************************|
*#
*#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ===============================================
*#
**#**************************************************************************|
*# CATCHMENT 201 - Proposed Condition Runoff From Roof
*
CALIB STANDHYD      ID=[1], NHYD=["201"], DT=[1](min), AREA=[0.228](ha),
                    XIMP=[0.99], TIMP=[0.99], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[80],
                    Pervious   surfaces: IAper=[6.35](mm), SLPP=[2.0](%),
                                         LGP=[5.0](m), MNP=[0.250], SCP=[0](min)
                    Impervious surfaces: IAimp=[1.0](mm), SLPI=[1.0](%),
                                         LGI=[5.0](m), MNI=[0.013], SCI=[0](min)
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
**#**************************************************************************|
*# ROUTE CATCHMENT 201 THROUGH 135mm ORIFICE PIPE
*
ROUTE RESERVOIR     IDout=[2],   NHYD=["SWM"],  IDin=[1],
                    RDT=[1](min),
                          TABLE of ( OUTFLOW-STORAGE ) values
                                     (cms) - (ha-m)
                                      0.0 ,  0.0
                                   0.0154 ,  0.0015
                                   0.0247 ,  0.0030
                                   0.0315 ,  0.0045
                                   0.0371 ,  0.0060
                                   0.0410 ,  0.0072
                                     -1   ,  -1     (max twenty pts)
                               IDovf=[3], NHYDovf=["OVF"]
**#**************************************************************************|
*# CATCHMENT 202 - Proposed Condition Uncontrolled Runoff to Brant Street
*#
*
CALIB STANDHYD      ID=[4], NHYD=["202"], DT=[1](min), AREA=[0.033](ha),
                    XIMP=[0.99], TIMP=[0.99], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[80],
                    Pervious   surfaces: IAper=[6.35](mm), SLPP=[2.0](%),
                                         LGP=[5.0](m), MNP=[0.250], SCP=[0](min)
                    Impervious surfaces: IAimp=[1.0](mm), SLPI=[2.1](%),
                                         LGI=[1.5](m), MNI=[0.013], SCI=[0](min)
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
**#**************************************************************************|
*# ADD CATCHMENT 201+202
*
ADD HYD             IDsum=[5], NHYD=["201+202"], IDs to add=[2,3,4]
**#**************************************************************************|
*# CATCHMENT 203 - Proposed Condition Runoff to John Street
*
CALIB STANDHYD      ID=[6], NHYD=["203"], DT=[1](min), AREA=[0.017](ha),
                    XIMP=[0.99], TIMP=[0.99], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[80],
                    Pervious   surfaces: IAper=[6.35](mm), SLPP=[2.0](%),
                                         LGP=[5.0](m), MNP=[0.250], SCP=[0](min)
                    Impervious surfaces: IAimp=[1.0](mm), SLPI=[2.7](%),
                                         LGI=[1.5](m), MNI=[0.013], SCI=[0](min)
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-------------------------------------------------------|

* RUN REMAINING DESIGN STORMS (CITY OF BURLINGTON 5 TO 100-YR)
*
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[005]
                    BUR6_005.stm
*
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[010]
                    BUR6_010.stm
*
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[025]
                    BUR6_025.stm
*
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[050]
                    BUR6_050.stm
*
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[100]
                    BUR6_100.stm
*
*%-----------------|-------------------------------------------------------|
FINISH
```

```
================================================================================

   SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO       999    999    =========
   S      W W W  MM MM  H   H   Y Y   MM MM  O   O     9   9  9   9
   SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
       S  W W W  M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
   SSSSS   W W   M   M  H   H    Y    M   M   OOO            9      9   =========
                                                         9   9  9   9   # 3902680
        StormWater Management HYdrologic Model           999    999    =========

 ********************************************************************************
 ***************************** SWMHYMO Ver/4.05  ********************************
 *********  A single event and continuous hydrologic simulation model  *********
 *********     based on the principles of HYMO and its successors      *********
 *********                 OTTHYMO-83 and OTTHYMO-89.                  *********
 ********************************************************************************
 ********* Distributed by:  J.F. Sabourin and Associates Inc.          *********
 *********                  Ottawa,  Ontario: (613) 836-3884           *********
 *********                  Gatineau, Quebec: (819) 243-6858           *********
 *********                  E-Mail: swmhymo@jfsa.com                   *********
 ********************************************************************************

 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++++ Licensed user: S. Llewellyn & Associates Ltd               +++++++++
 +++++++++                Burlington           SERIAL#:3902680       +++++++++
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ********************************************************************************
 *********          ++++++ PROGRAM ARRAY DIMENSIONS ++++++             *********
 *********          Maximum value for ID numbers  :     10            *********
 *********          Max. number of rainfall points: 105408            *********
 *********          Max. number of flow points    : 105408            *********
 ********************************************************************************


 *********************   D E T A I L E D   O U T P U T   **********************
 ********************************************************************************
 *         DATE: 2021-01-20     TIME: 18:59:35     RUN COUNTER: 000216          *
 ********************************************************************************
 * Input   filename: T:\PROJECTS\19010\SWMHYMO\19010.dat                        *
 * Output  filename: T:\PROJECTS\19010\SWMHYMO\19010.out                        *
 * Summary filename: T:\PROJECTS\19010\SWMHYMO\19010.sum                        *
 * User comments:                                                               *
 * 1:_____________________________________________________________________________*
 * 2:_____________________________________________________________________________*
 * 3:_____________________________________________________________________________*
 ********************************************************************************


--------------------------------------------------------------------------------
001:0001--------------------------------------------------------------------------
*#*****************************************************************************|
*#  Project Name: 535-551 BRANT STREET
*#               BURLINGTON, ONTARIO
*#  JOB NUMBER  : 19010
*#       Date   : JAN 2021
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 19010.DAT
*#*****************************************************************************|
*
  ** END OF RUN :   1

********************************************************************************




--------------------
| START            |  Project  dir.: T:\PROJECTS\19010\SWMHYMO\
--------------------  Rainfall dir.: T:\PROJECTS\19010\SWMHYMO\
    TZERO =   .00 hrs on      0
    METOUT=   2 (output = METRIC)
    NRUN  = 002
    NSTORM=   1
           #  1=BUR6_002.stm
--------------------------------------------------------------------------------
002:0002--------------------------------------------------------------------------
*#*****************************************************************************|
*#  Project Name: 535-551 BRANT STREET
*#               BURLINGTON, ONTARIO
*#  JOB NUMBER  : 19010
*#       Date   : JAN 2021
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 19010.DAT
*#*****************************************************************************|
*
--------------------------------------------------------------------------------
002:0002--------------------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: Burlington 2-yr 6hr NEW CHICAGO
| Ptotal=  40.93 mm|    Comments: Burlington 2-yr 6hr NEW CHICAGO
--------------------
            TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
             hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
              .17   1.715 |   1.67   8.325 |   3.17   4.467 |   4.67   2.213
              .33   1.858 |   1.83  19.646 |   3.33   3.978 |   4.83   2.105
              .50   2.032 |   2.00  78.391 |   3.50   3.595 |   5.00   2.008
              .67   2.247 |   2.17  25.776 |   3.67   3.286 |   5.17   1.920
              .83   2.522 |   2.33  13.777 |   3.83   3.030 |   5.33   1.841
             1.00   2.888 |   2.50   9.511 |   4.00   2.815 |   5.50   1.769
             1.17   3.399 |   2.67   7.331 |   4.17   2.632 |   5.67   1.703
             1.33   4.172 |   2.83   6.005 |   4.33   2.474 |   5.83   1.642
             1.50   5.492 |   3.00   5.111 |   4.50   2.335 |   6.00   1.586

--------------------------------------------------------------------------------
002:0003--------------------------------------------------------------------------
*
*#*****************************************************************************|
*#
*#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ==============================================
*#
**#****************************************************************************|
*# CATCHMENT 101 - Existing Condition Outlet to 825mm Storm Sewer on Brant Stree
*
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .18
| 01:101    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
----------------------
                                IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .18           .00
     Dep. Storage     (mm)=       1.00          6.35
     Average Slope     (%)=       1.40          2.00
     Length            (m)=       3.00          5.00
     Mannings n           =       .013          .250

     Max.eff.Inten.(mm/hr)=      78.39         24.53
               over (min)        1.00          4.00
     Storage Coeff.  (min)=        .31 (ii)    3.87 (ii)
     Unit Hyd. Tpeak (min)=       1.00          4.00
     Unit Hyd. peak  (cms)=       1.63           .29
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .04           .00          .039 (iii)
     TIME TO PEAK    (hrs)=       1.93          2.03         2.000
     RUNOFF VOLUME    (mm)=      39.93         12.19        39.655
     TOTAL RAINFALL   (mm)=      40.93         40.93        40.933
     RUNOFF COEFFICIENT   =        .98           .30          .969

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
002:0004--------------------------------------------------------------------------
**#****************************************************************************|
*# CATCHMENT 102 - Existing Condition Outlet to Ex. CB on John Street
*
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .10
| 02:102    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
----------------------
                                IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .10           .00
     Dep. Storage     (mm)=       1.00          6.35
     Average Slope     (%)=       3.50          2.00
     Length            (m)=       7.00          5.00
     Mannings n           =       .013          .250

     Max.eff.Inten.(mm/hr)=      78.39         24.53
               over (min)        1.00          4.00
     Storage Coeff.  (min)=        .39 (ii)    3.95 (ii)
     Unit Hyd. Tpeak (min)=       1.00          4.00
     Unit Hyd. peak  (cms)=       1.57           .29
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .02           .00          .021 (iii)
     TIME TO PEAK    (hrs)=       1.93          2.03         2.000
     RUNOFF VOLUME    (mm)=      39.93         12.19        39.655
     TOTAL RAINFALL   (mm)=      40.93         40.93        40.933
     RUNOFF COEFFICIENT   =        .98           .30          .969

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
002:0005--------------------------------------------------------------------------
**#****************************************************************************|
*#
*#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ===============================================
*#
**#****************************************************************************|
*# CATCHMENT 201 - Proposed Condition Runoff From Roof
*
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .23
| 01:201    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
----------------------
                                IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .23           .00
     Dep. Storage     (mm)=       1.00          6.35
     Average Slope     (%)=       1.00          2.00
     Length            (m)=       5.00          5.00
     Mannings n           =       .013          .250

     Max.eff.Inten.(mm/hr)=      78.39         24.53
               over (min)        1.00          4.00
     Storage Coeff.  (min)=        .47 (ii)    4.02 (ii)
     Unit Hyd. Tpeak (min)=       1.00          4.00
     Unit Hyd. peak  (cms)=       1.50           .28
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .05           .00          .049 (iii)
     TIME TO PEAK    (hrs)=       1.95          2.03         2.000
     RUNOFF VOLUME    (mm)=      39.93         12.19        39.655
     TOTAL RAINFALL   (mm)=      40.93         40.93        40.933
     RUNOFF COEFFICIENT   =        .98           .30          .969

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
002:0006--------------------------------------------------------------------------
**#****************************************************************************|
*# ROUTE CATCHMENT 201 THROUGH 135mm ORIFICE PIPE
*
--------------------
| ROUTE RESERVOIR  |    Requested routing time step =  1.0 min.
|  IN>01:(201   )  |
| OUT<02:(SWM   )  |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |     .032  .4500E-02
                           .015  .1500E-02   |     .037  .6000E-02
                           .025  .3000E-02   |     .041  .7200E-02

     ROUTING RESULTS           AREA     QPEAK     TPEAK       R.V.
     --------------------      (ha)     (cms)     (hrs)       (mm)
     INFLOW >01: (201   )       .23      .049     2.000     39.655
     OUTFLOW<02: (SWM   )       .23      .023     2.017     39.655
    OVERFLOW<03: (OVF   )       .00      .000      .000       .000
```

```
                TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                PERCENTAGE OF TIME OVERFLOWING    (%)=      .00


                PEAK   FLOW   REDUCTION [Qout/Qin](%)=   46.020
                TIME SHIFT OF PEAK FLOW         (min)=    1.00
                MAXIMUM  STORAGE   USED       (ha.m.)=.2680E-02

--------------------------------------------------------------------------------
002:0007----------------------------------------------------------------------
**#*********************************************************************|
*# CATCHMENT 202 - Proposed Condition Uncontrolled Runoff to Brant Street
*#
*
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .03
| 04:202    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
----------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .03          .00
     Dep. Storage     (mm)=      1.00         6.35
     Average Slope     (%)=      2.10         2.00
     Length            (m)=      1.50         5.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=     78.39        24.53
               over (min)        1.00         4.00
     Storage Coeff.  (min)=       .18 (ii)    3.74 (ii)
     Unit Hyd. Tpeak (min)=      1.00         4.00
     Unit Hyd. peak  (cms)=      1.69          .30
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .01          .00          .007 (iii)
     TIME TO PEAK    (hrs)=      1.92         2.03         2.000
     RUNOFF VOLUME    (mm)=     39.93        12.19        39.655
     TOTAL RAINFALL   (mm)=     40.93        40.93        40.933
     RUNOFF COEFFICIENT   =       .98          .30          .969

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
002:0008----------------------------------------------------------------------
**#*********************************************************************|
*# ADD CATCHMENT 201+202
*
------------------------
| ADD HYD (201+202   ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
                        ID1 02:SWM          .23     .023    2.02  39.66    .000
                       +ID2 03:OVF          .00     .000     .00    .00    .000
                       +ID3 04:202          .03     .007    2.00  39.66    .000
                        ========================================================
                        SUM 05:201+202      .26     .029    2.00  39.66    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
002:0009----------------------------------------------------------------------
**#*********************************************************************|
*# CATCHMENT 203 - Proposed Condition Runoff to John Street
*
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .02
| 06:203    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
----------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .02          .00
     Dep. Storage     (mm)=      1.00         6.35
     Average Slope     (%)=      2.70         2.00
     Length            (m)=      1.50         5.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=     78.39        24.53
               over (min)        1.00         4.00
     Storage Coeff.  (min)=       .17 (ii)    3.72 (ii)
     Unit Hyd. Tpeak (min)=      1.00         4.00
     Unit Hyd. peak  (cms)=      1.69          .30
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .00          .00          .004 (iii)
     TIME TO PEAK    (hrs)=      1.92         2.03         2.000
     RUNOFF VOLUME    (mm)=     39.93        12.19        39.655
     TOTAL RAINFALL   (mm)=     40.93        40.93        40.933
     RUNOFF COEFFICIENT   =       .98          .30          .969

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
002:0010----------------------------------------------------------------------
* RUN REMAINING DESIGN STORMS (CITY OF BURLINGTON 5 TO 100-YR)
*
  ** END OF RUN :   4

********************************************************************************




--------------------
| START            |  Project  dir.: T:\PROJECTS\19010\SWMHYMO\
--------------------  Rainfall dir.: T:\PROJECTS\19010\SWMHYMO\
    TZERO =    .00 hrs on      0
    METOUT=   2 (output = METRIC)
    NRUN  = 005
    NSTORM=   1
            #  1=BUR6_005.stm
--------------------------------------------------------------------------------
005:0002----------------------------------------------------------------------
*#*********************************************************************|
*#  Project Name: 535-551 BRANT STREET
*#               BURLINGTON, ONTARIO
*#  JOB NUMBER  : 19010
*#       Date   : JAN 2021
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 19010.DAT
*#*********************************************************************|
*
--------------------------------------------------------------------------------
005:0002----------------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: Burlington 5-yr 6hr NEW CHICAGO
| Ptotal=  53.05 mm|    Comments: Burlington 5-yr 6hr NEW CHICAGO
--------------------
            TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
             hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
             .17   2.348 |   1.67  10.690 |   3.17   5.897 |   4.67   3.004
             .33   2.537 |   1.83  24.479 |   3.33   5.279 |   4.83   2.862
             .50   2.766 |   2.00 101.312 |   3.50   4.790 |   5.00   2.734
             .67   3.048 |   2.17  31.941 |   3.67   4.394 |   5.17   2.619
             .83   3.407 |   2.33  17.333 |   3.83   4.065 |   5.33   2.514
            1.00   3.881 |   2.50  12.145 |   4.00   3.788 |   5.50   2.419
            1.17   4.539 |   2.67   9.469 |   4.17   3.550 |   5.67   2.331
            1.33   5.523 |   2.83   7.826 |   4.33   3.344 |   5.83   2.251
            1.50   7.185 |   3.00   6.709 |   4.50   3.164 |   6.00   2.176

--------------------------------------------------------------------------------
005:0003----------------------------------------------------------------------
*
*#*********************************************************************|
*#
*#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ==============================================
*#
**#*********************************************************************|
*# CATCHMENT 101 - Existing Condition Outlet to 825mm Storm Sewer on Brant Stree
*
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .18
| 01:101    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
----------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .18          .00
     Dep. Storage     (mm)=      1.00         6.35
     Average Slope     (%)=      1.40         2.00
     Length            (m)=      3.00         5.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=    101.31        42.29
               over (min)        1.00         3.00
     Storage Coeff.  (min)=       .28 (ii)    3.14 (ii)
     Unit Hyd. Tpeak (min)=      1.00         3.00
     Unit Hyd. peak  (cms)=      1.65          .36
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .05          .00          .050 (iii)
     TIME TO PEAK    (hrs)=      1.92         2.02         2.000
     RUNOFF VOLUME    (mm)=     52.05        19.79        51.730
     TOTAL RAINFALL   (mm)=     53.05        53.05        53.053
     RUNOFF COEFFICIENT   =       .98          .37          .975

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
005:0004----------------------------------------------------------------------
**#*********************************************************************|
*# CATCHMENT 102 - Existing Condition Outlet to Ex. CB on John Street
*
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .10
| 02:102    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
----------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .10          .00
     Dep. Storage     (mm)=      1.00         6.35
     Average Slope     (%)=      3.50         2.00
     Length            (m)=      7.00         5.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=    101.31        42.29
               over (min)        1.00         3.00
     Storage Coeff.  (min)=       .35 (ii)    3.21 (ii)
     Unit Hyd. Tpeak (min)=      1.00         3.00
     Unit Hyd. peak  (cms)=      1.60          .36
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .03          .00          .027 (iii)
     TIME TO PEAK    (hrs)=      1.92         2.02         2.000
     RUNOFF VOLUME    (mm)=     52.05        19.79        51.730
     TOTAL RAINFALL   (mm)=     53.05        53.05        53.053
     RUNOFF COEFFICIENT   =       .98          .37          .975

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
005:0005----------------------------------------------------------------------
**#*********************************************************************|
*#
*#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ===============================================
*#
**#*********************************************************************|
*# CATCHMENT 201 - Proposed Condition Runoff From Roof
*
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .23
| 01:201    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
----------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .23          .00
     Dep. Storage     (mm)=      1.00         6.35
     Average Slope     (%)=      1.00         2.00
     Length            (m)=      5.00         5.00
     Mannings n           =      .013         .250
```

```
     Max.eff.Inten.(mm/hr)=     101.31        42.29
               over (min)        1.00         3.00
     Storage Coeff.  (min)=       .42 (ii)    3.28 (ii)
     Unit Hyd. Tpeak (min)=      1.00         3.00
     Unit Hyd. peak  (cms)=      1.54          .35
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .06          .00          .064 (iii)
     TIME TO PEAK    (hrs)=      1.95         2.02         2.000
     RUNOFF VOLUME    (mm)=     52.05        19.79        51.730
     TOTAL RAINFALL   (mm)=     53.05        53.05        53.053
     RUNOFF COEFFICIENT   =       .98          .37          .975

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
005:0006----------------------------------------------------------------------
**#*********************************************************************|
*# ROUTE CATCHMENT 201 THROUGH 135mm ORIFICE PIPE
*
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>01:(201   )   |
| OUT<02:(SWM   )   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                          .000  .0000E+00    |     .032  .4500E-02
                          .015  .1500E-02    |     .037  .6000E-02
                          .025  .3000E-02    |     .041  .7200E-02

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     -------------------        (ha)     (cms)     (hrs)       (mm)
     INFLOW >01: (201   )         .23      .064     2.000     51.730
     OUTFLOW<02: (SWM   )         .23      .027     2.017     51.730
    OVERFLOW<03: (OVF   )         .00      .000      .000      .000

                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                    CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                    PERCENTAGE OF TIME OVERFLOWING    (%)=      .00


                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=   42.481
                    TIME SHIFT OF PEAK FLOW         (min)=    1.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=.3533E-02

-------------------------------------------------------------------------------
005:0007----------------------------------------------------------------------
**#*********************************************************************|
*# CATCHMENT 202 - Proposed Condition Uncontrolled Runoff to Brant Street
*#
*
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .03
| 04:202    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
----------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .03          .00
     Dep. Storage     (mm)=      1.00         6.35
     Average Slope     (%)=      2.10         2.00
     Length            (m)=      1.50         5.00
     Mannings n            =      .013         .250

     Max.eff.Inten.(mm/hr)=     101.31        42.29
               over (min)        1.00         3.00
     Storage Coeff.  (min)=       .16 (ii)    3.02 (ii)
     Unit Hyd. Tpeak (min)=      1.00         3.00
     Unit Hyd. peak  (cms)=      1.70          .38
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .01          .00          .009 (iii)
     TIME TO PEAK    (hrs)=      1.88         2.02         2.000
     RUNOFF VOLUME    (mm)=     52.05        19.79        51.730
     TOTAL RAINFALL   (mm)=     53.05        53.05        53.053
     RUNOFF COEFFICIENT   =       .98          .37          .975

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
005:0008----------------------------------------------------------------------
**#*********************************************************************|
*# ADD CATCHMENT 201+202
*
----------------------
| ADD HYD (201+202   ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
----------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
                        ID1 02:SWM          .23      .027    2.02  51.73    .000
                       +ID2 03:OVF          .00      .000     .00    .00    .000
                       +ID3 04:202          .03      .009    2.00  51.73    .000
                        ==========================================================
                        SUM 05:201+202      .26      .036    2.00  51.73    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
005:0009----------------------------------------------------------------------
**#*********************************************************************|
*# CATCHMENT 203 - Proposed Condition Runoff to John Street
*
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .02
| 06:203    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
----------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .02          .00
     Dep. Storage     (mm)=      1.00         6.35
     Average Slope     (%)=      2.70         2.00
     Length            (m)=      1.50         5.00
     Mannings n            =      .013         .250

     Max.eff.Inten.(mm/hr)=     101.31        42.29
               over (min)        1.00         3.00
     Storage Coeff.  (min)=       .15 (ii)    3.01 (ii)
     Unit Hyd. Tpeak (min)=      1.00         3.00
     Unit Hyd. peak  (cms)=      1.70          .38
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .00          .00          .005 (iii)
     TIME TO PEAK    (hrs)=      1.88         2.02         2.000
     RUNOFF VOLUME    (mm)=     52.05        19.79        51.730
     TOTAL RAINFALL   (mm)=     53.05        53.05        53.053
     RUNOFF COEFFICIENT   =       .98          .37          .975

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
005:0010----------------------------------------------------------------------
* RUN REMAINING DESIGN STORMS (CITY OF BURLINGTON 5 TO 100-YR)
*
-------------------------------------------------------------------------------
005:0002----------------------------------------------------------------------
*
  ** END OF RUN :   9

********************************************************************************




--------------------
| START            |  Project  dir.: T:\PROJECTS\19010\SWMHYMO\
--------------------  Rainfall dir.: T:\PROJECTS\19010\SWMHYMO\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 010
    NSTORM=   1
          #  1=BUR6_010.stm
-------------------------------------------------------------------------------
010:0002----------------------------------------------------------------------
*#*********************************************************************|
*#  Project Name: 535-551 BRANT STREET
*#               BURLINGTON, ONTARIO
*#  JOB NUMBER  : 19010
*#       Date   : JAN 2021
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 19010.DAT
*#*********************************************************************|
*
-------------------------------------------------------------------------------
010:0002----------------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: Burlington 10-yr 6hr NEW CHICAGO
| Ptotal=  61.10 mm|    Comments: Burlington 10-yr 6hr NEW CHICAGO
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .17   2.714 |   1.67  12.326 |   3.17   6.808 |   4.67   3.472
               .33   2.933 |   1.83  28.176 |   3.33   6.095 |   4.83   3.308
               .50   3.197 |   2.00 116.310 |   3.50   5.532 |   5.00   3.161
               .67   3.523 |   2.17  36.748 |   3.67   5.075 |   5.17   3.027
               .83   3.937 |   2.33  19.967 |   3.83   4.696 |   5.33   2.907
              1.00   4.483 |   2.50  14.001 |   4.00   4.376 |   5.50   2.796
              1.17   5.242 |   2.67  10.921 |   4.17   4.102 |   5.67   2.695
              1.33   6.377 |   2.83   9.030 |   4.33   3.864 |   5.83   2.602
              1.50   8.291 |   3.00   7.743 |   4.50   3.656 |   6.00   2.516

-------------------------------------------------------------------------------
010:0003----------------------------------------------------------------------
*
*#*********************************************************************|
*#
*#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ==============================================
*#
**#*********************************************************************|
*# CATCHMENT 101 - Existing Condition Outlet to 825mm Storm Sewer on Brant Stree
*
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .18
| 01:101    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
----------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .18          .00
     Dep. Storage     (mm)=      1.00         6.35
     Average Slope     (%)=      1.40         2.00
     Length            (m)=      3.00         5.00
     Mannings n            =      .013         .250

     Max.eff.Inten.(mm/hr)=     116.31        54.51
               over (min)        1.00         3.00
     Storage Coeff.  (min)=       .27 (ii)    2.85 (ii)
     Unit Hyd. Tpeak (min)=      1.00         3.00
     Unit Hyd. peak  (cms)=      1.66          .39
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .06          .00          .058 (iii)
     TIME TO PEAK    (hrs)=      1.92         2.02         2.000
     RUNOFF VOLUME    (mm)=     60.10        25.35        59.754
     TOTAL RAINFALL   (mm)=     61.10        61.10        61.101
     RUNOFF COEFFICIENT   =       .98          .41          .978

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

-------------------------------------------------------------------------------
010:0004----------------------------------------------------------------------
**#*********************************************************************|
*# CATCHMENT 102 - Existing Condition Outlet to Ex. CB on John Street
*
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .10
| 02:102    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
----------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .10          .00
     Dep. Storage     (mm)=      1.00         6.35
```

```
     Average Slope     (%)=       3.50         2.00
     Length            (m)=       7.00         5.00
     Mannings n            =       .013         .250

     Max.eff.Inten.(mm/hr)=     116.31        54.51
               over (min)        1.00         3.00
     Storage Coeff.  (min)=        .33 (ii)    2.92 (ii)
     Unit Hyd. Tpeak (min)=       1.00         3.00
     Unit Hyd. peak  (cms)=       1.61          .38
                                                    *TOTALS*
     PEAK FLOW       (cms)=        .03          .00          .031 (iii)
     TIME TO PEAK    (hrs)=       1.92         2.02         2.000
     RUNOFF VOLUME    (mm)=      60.10        25.35        59.754
     TOTAL RAINFALL   (mm)=      61.10        61.10        61.101
     RUNOFF COEFFICIENT   =        .98          .41          .978

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.


------------------------------------------------------------------------------
010:0005----------------------------------------------------------------------
**#*************************************************************************|
*#
*#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ===============================================
*#
**#*************************************************************************|
*# CATCHMENT 201 - Proposed Condition Runoff From Roof
*
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .23
| 01:201    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
---------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .23          .00
     Dep. Storage     (mm)=       1.00         6.35
     Average Slope     (%)=       1.00         2.00
     Length            (m)=       5.00         5.00
     Mannings n            =       .013         .250

     Max.eff.Inten.(mm/hr)=     116.31        54.51
               over (min)        1.00         3.00
     Storage Coeff.  (min)=        .40 (ii)    2.98 (ii)
     Unit Hyd. Tpeak (min)=       1.00         3.00
     Unit Hyd. peak  (cms)=       1.56          .38
                                                    *TOTALS*
     PEAK FLOW       (cms)=        .07          .00          .073 (iii)
     TIME TO PEAK    (hrs)=       1.93         2.02         2.000
     RUNOFF VOLUME    (mm)=      60.10        25.35        59.754
     TOTAL RAINFALL   (mm)=      61.10        61.10        61.101
     RUNOFF COEFFICIENT   =        .98          .41          .978

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.


------------------------------------------------------------------------------
010:0006----------------------------------------------------------------------
**#*************************************************************************|
*# ROUTE CATCHMENT 201 THROUGH 135mm ORIFICE PIPE
*
--------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>01:(201   )   |
| OUT<02:(SWM   )   |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                          .000  .0000E+00    |     .032  .4500E-02
                          .015  .1500E-02    |     .037  .6000E-02
                          .025  .3000E-02    |     .041  .7200E-02

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     -------------------        (ha)     (cms)     (hrs)       (mm)
     INFLOW >01: (201   )        .23      .073     2.000     59.754
     OUTFLOW<02: (SWM   )        .23      .030     2.017     59.754
    OVERFLOW<03: (OVF   )        .00      .000      .000      .000

                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                    CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                    PERCENTAGE OF TIME OVERFLOWING    (%)=      .00


                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=   40.612
                    TIME SHIFT OF PEAK FLOW         (min)=     1.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=.4118E-02


------------------------------------------------------------------------------
010:0007----------------------------------------------------------------------
**#*************************************************************************|
*# CATCHMENT 202 - Proposed Condition Uncontrolled Runoff to Brant Street
*#
*
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .03
| 04:202    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
---------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .03          .00
     Dep. Storage     (mm)=       1.00         6.35
     Average Slope     (%)=       2.10         2.00
     Length            (m)=       1.50         5.00
     Mannings n            =       .013         .250

     Max.eff.Inten.(mm/hr)=     116.31        54.51
               over (min)        1.00         3.00
     Storage Coeff.  (min)=        .15 (ii)    2.74 (ii)
     Unit Hyd. Tpeak (min)=       1.00         3.00
     Unit Hyd. peak  (cms)=       1.70          .40
                                                    *TOTALS*
     PEAK FLOW       (cms)=        .01          .00          .011 (iii)
     TIME TO PEAK    (hrs)=       1.88         2.02         2.000
     RUNOFF VOLUME    (mm)=      60.10        25.35        59.754
     TOTAL RAINFALL   (mm)=      61.10        61.10        61.101
     RUNOFF COEFFICIENT   =        .98          .41          .978

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.


------------------------------------------------------------------------------
010:0008----------------------------------------------------------------------
**#*************************************************************************|
*# ADD CATCHMENT 201+202
*
------------------------
| ADD HYD (201+202   ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
                       ID1 02:SWM           .23     .030    2.02  59.75    .000
                      +ID2 03:OVF           .00     .000     .00    .00    .000
                      +ID3 04:202           .03     .011    2.00  59.75    .000
                       ==========================================================
                       SUM 05:201+202       .26     .040    2.00  59.75    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.


------------------------------------------------------------------------------
010:0009----------------------------------------------------------------------
**#*************************************************************************|
*# CATCHMENT 203 - Proposed Condition Runoff to John Street
*
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .02
| 06:203    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
---------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .02          .00
     Dep. Storage     (mm)=       1.00         6.35
     Average Slope     (%)=       2.70         2.00
     Length            (m)=       1.50         5.00
     Mannings n            =       .013         .250

     Max.eff.Inten.(mm/hr)=     116.31        54.51
               over (min)        1.00         3.00
     Storage Coeff.  (min)=        .14 (ii)    2.73 (ii)
     Unit Hyd. Tpeak (min)=       1.00         3.00
     Unit Hyd. peak  (cms)=       1.70          .40
                                                    *TOTALS*
     PEAK FLOW       (cms)=        .01          .00          .005 (iii)
     TIME TO PEAK    (hrs)=       1.88         2.02         2.000
     RUNOFF VOLUME    (mm)=      60.10        25.35        59.754
     TOTAL RAINFALL   (mm)=      61.10        61.10        61.101
     RUNOFF COEFFICIENT   =        .98          .41          .978

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.


------------------------------------------------------------------------------
010:0010----------------------------------------------------------------------
* RUN REMAINING DESIGN STORMS (CITY OF BURLINGTON 5 TO 100-YR)
*
------------------------------------------------------------------------------
010:0002----------------------------------------------------------------------
*
------------------------------------------------------------------------------
010:0002----------------------------------------------------------------------
*
  ** END OF RUN :  24

********************************************************************************




--------------------
| START            |  Project  dir.: T:\PROJECTS\19010\SWMHYMO\
--------------------  Rainfall dir.: T:\PROJECTS\19010\SWMHYMO\
    TZERO =   .00 hrs on      0
    METOUT=  2 (output = METRIC)
    NRUN  = 025
    NSTORM=   1
            #  1=BUR6_025.stm
------------------------------------------------------------------------------
025:0002----------------------------------------------------------------------
*#*************************************************************************|
*#  Project Name: 535-551 BRANT STREET
*#               BURLINGTON, ONTARIO
*#  JOB NUMBER  : 19010
*#       Date   : JAN 2021
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 19010.DAT
*#*************************************************************************|
*
------------------------------------------------------------------------------
025:0002----------------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: Burlington 25-yr 6hr NEW CHICAGO
| Ptotal=  71.35 mm|    Comments: Burlington 25-yr 6hr NEW CHICAGO
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .17   3.182 |   1.67  14.410 |   3.17   7.968 |   4.67   4.068
               .33   3.437 |   1.83  32.881 |   3.33   7.135 |   4.83   3.876
               .50   3.746 |   2.00 135.380 |   3.50   6.477 |   5.00   3.704
               .67   4.128 |   2.17  42.866 |   3.67   5.943 |   5.17   3.548
               .83   4.612 |   2.33  23.321 |   3.83   5.499 |   5.33   3.407
              1.00   5.251 |   2.50  16.365 |   4.00   5.125 |   5.50   3.278
              1.17   6.138 |   2.67  12.771 |   4.17   4.805 |   5.67   3.160
              1.33   7.465 |   2.83  10.563 |   4.33   4.527 |   5.83   3.051
              1.50   9.700 |   3.00   9.061 |   4.50   4.284 |   6.00   2.950

------------------------------------------------------------------------------
025:0003----------------------------------------------------------------------
*
*#*************************************************************************|
*#
*#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ==============================================
```

```
*#
**#************************************************************************|
*# CATCHMENT 101 - Existing Condition Outlet to 825mm Storm Sewer on Brant Stree
*
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .18
| 01:101    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
---------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .18          .00
     Dep. Storage     (mm)=      1.00         6.35
     Average Slope     (%)=      1.40         2.00
     Length            (m)=      3.00         5.00
     Mannings n            =      .013         .250

     Max.eff.Inten.(mm/hr)=    135.38       71.01
               over (min)        1.00         3.00
     Storage Coeff.  (min)=       .25 (ii)    2.57 (ii)
     Unit Hyd. Tpeak (min)=      1.00         3.00
     Unit Hyd. peak  (cms)=      1.67          .41
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .07          .00          .067 (iii)
     TIME TO PEAK    (hrs)=      1.92         2.00         2.000
     RUNOFF VOLUME    (mm)=     70.35        32.88        69.972
     TOTAL RAINFALL   (mm)=     71.35        71.35        71.347
     RUNOFF COEFFICIENT   =       .99          .46          .981

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
025:0004----------------------------------------------------------------------
**#************************************************************************|
*# CATCHMENT 102 - Existing Condition Outlet to Ex. CB on John Street
*
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .10
| 02:102    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
---------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .10          .00
     Dep. Storage     (mm)=      1.00         6.35
     Average Slope     (%)=      3.50         2.00
     Length            (m)=      7.00         5.00
     Mannings n            =      .013         .250

     Max.eff.Inten.(mm/hr)=    135.38       71.01
               over (min)        1.00         3.00
     Storage Coeff.  (min)=       .32 (ii)    2.64 (ii)
     Unit Hyd. Tpeak (min)=      1.00         3.00
     Unit Hyd. peak  (cms)=      1.63          .41
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .04          .00          .037 (iii)
     TIME TO PEAK    (hrs)=      1.92         2.00         2.000
     RUNOFF VOLUME    (mm)=     70.35        32.88        69.972
     TOTAL RAINFALL   (mm)=     71.35        71.35        71.347
     RUNOFF COEFFICIENT   =       .99          .46          .981

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
025:0005----------------------------------------------------------------------
**#************************************************************************|
*#
*#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ===============================================
*#
**#************************************************************************|
*# CATCHMENT 201 - Proposed Condition Runoff From Roof
*
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .23
| 01:201    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
---------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .23          .00
     Dep. Storage     (mm)=      1.00         6.35
     Average Slope     (%)=      1.00         2.00
     Length            (m)=      5.00         5.00
     Mannings n            =      .013         .250

     Max.eff.Inten.(mm/hr)=    135.38       71.01
               over (min)        1.00         3.00
     Storage Coeff.  (min)=       .38 (ii)    2.70 (ii)
     Unit Hyd. Tpeak (min)=      1.00         3.00
     Unit Hyd. peak  (cms)=      1.58          .40
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .08          .00          .085 (iii)
     TIME TO PEAK    (hrs)=      1.93         2.00         2.000
     RUNOFF VOLUME    (mm)=     70.35        32.88        69.972
     TOTAL RAINFALL   (mm)=     71.35        71.35        71.347
     RUNOFF COEFFICIENT   =       .99          .46          .981

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
025:0006----------------------------------------------------------------------
**#************************************************************************|
*# ROUTE CATCHMENT 201 THROUGH 135mm ORIFICE PIPE
*
---------------------
| ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
|  IN>01:(201   )    |
| OUT<02:(SWM   )    |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00    |     .032  .4500E-02
                           .015  .1500E-02    |     .037  .6000E-02
                           .025  .3000E-02    |     .041  .7200E-02

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     -------------------        (ha)     (cms)     (hrs)       (mm)
     INFLOW >01: (201   )        .23      .085     2.000     69.972
     OUTFLOW<02: (SWM   )        .23      .033     2.017     69.972
    OVERFLOW<03: (OVF   )        .00      .000      .000       .000

                   TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                   CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                   PERCENTAGE OF TIME OVERFLOWING    (%)=      .00


                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   38.552
                   TIME SHIFT OF PEAK FLOW         (min)=    1.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.4873E-02

------------------------------------------------------------------------------
025:0007----------------------------------------------------------------------
**#************************************************************************|
*# CATCHMENT 202 - Proposed Condition Uncontrolled Runoff to Brant Street
*#
*
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .03
| 04:202    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
---------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .03          .00
     Dep. Storage     (mm)=      1.00         6.35
     Average Slope     (%)=      2.10         2.00
     Length            (m)=      1.50         5.00
     Mannings n            =      .013         .250

     Max.eff.Inten.(mm/hr)=    135.38       72.61
               over (min)        1.00         2.00
     Storage Coeff.  (min)=       .15 (ii)    2.45 (ii)
     Unit Hyd. Tpeak (min)=      1.00         2.00
     Unit Hyd. peak  (cms)=      1.70          .49
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .01          .00          .012 (iii)
     TIME TO PEAK    (hrs)=      1.88         2.00         2.000
     RUNOFF VOLUME    (mm)=     70.35        32.88        69.972
     TOTAL RAINFALL   (mm)=     71.35        71.35        71.347
     RUNOFF COEFFICIENT   =       .99          .46          .981

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
025:0008----------------------------------------------------------------------
**#************************************************************************|
*# ADD CATCHMENT 201+202
*
----------------------
| ADD HYD (201+202   ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
----------------------                    (ha)     (cms)   (hrs)   (mm)   (cms)
                        ID1 02:SWM          .23     .033    2.02  69.97    .000
                       +ID2 03:OVF          .00     .000     .00    .00    .000
                       +ID3 04:202          .03     .012    2.00  69.97    .000
                        ==========================================================
                        SUM 05:201+202      .26     .045    2.00  69.97    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------
025:0009----------------------------------------------------------------------
**#************************************************************************|
*# CATCHMENT 203 - Proposed Condition Runoff to John Street
*
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .02
| 06:203    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
---------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .02          .00
     Dep. Storage     (mm)=      1.00         6.35
     Average Slope     (%)=      2.70         2.00
     Length            (m)=      1.50         5.00
     Mannings n            =      .013         .250

     Max.eff.Inten.(mm/hr)=    135.38       72.61
               over (min)        1.00         2.00
     Storage Coeff.  (min)=       .14 (ii)    2.44 (ii)
     Unit Hyd. Tpeak (min)=      1.00         2.00
     Unit Hyd. peak  (cms)=      1.70          .49
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .01          .00          .006 (iii)
     TIME TO PEAK    (hrs)=      1.88         2.00         2.000
     RUNOFF VOLUME    (mm)=     70.35        32.88        69.972
     TOTAL RAINFALL   (mm)=     71.35        71.35        71.347
     RUNOFF COEFFICIENT   =       .99          .46          .981

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
025:0010----------------------------------------------------------------------
* RUN REMAINING DESIGN STORMS (CITY OF BURLINGTON 5 TO 100-YR)
*
------------------------------------------------------------------------------
025:0002----------------------------------------------------------------------
*
------------------------------------------------------------------------------
025:0002----------------------------------------------------------------------
*
------------------------------------------------------------------------------
025:0002----------------------------------------------------------------------
*
  ** END OF RUN :  49

********************************************************************************
```

```
--------------------
| START            |  Project  dir.: T:\PROJECTS\19010\SWMHYMO\
--------------------  Rainfall dir.: T:\PROJECTS\19010\SWMHYMO\
    TZERO =   .00 hrs on      0
    METOUT=   2 (output = METRIC)
    NRUN  = 050
    NSTORM=   1
           #  1=BUR6_050.stm
--------------------------------------------------------------------------------
050:0002----------------------------------------------------------------------|
*#*****************************************************************************|
*#  Project Name: 535-551 BRANT STREET
*#               BURLINGTON, ONTARIO
*#  JOB NUMBER  : 19010
*#       Date   : JAN 2021
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 19010.DAT
*#*****************************************************************************|
*
--------------------------------------------------------------------------------
050:0002----------------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: Burlington 50-yr 6hr NEW CHICAGO
| Ptotal=  78.93 mm|    Comments: Burlington 50-yr 6hr NEW CHICAGO
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .17   3.533 |   1.67  15.961 |   3.17   8.836 |   4.67   4.516
               .33   3.817 |   1.83  36.356 |   3.33   7.913 |   4.83   4.304
               .50   4.160 |   2.00 149.296 |   3.50   7.185 |   5.00   4.113
               .67   4.582 |   2.17  47.374 |   3.67   6.593 |   5.17   3.940
               .83   5.119 |   2.33  25.806 |   3.83   6.102 |   5.33   3.783
              1.00   5.827 |   2.50  18.121 |   4.00   5.688 |   5.50   3.640
              1.17   6.809 |   2.67  14.149 |   4.17   5.333 |   5.67   3.509
              1.33   8.278 |   2.83  11.707 |   4.33   5.025 |   5.83   3.388
              1.50  10.753 |   3.00  10.045 |   4.50   4.755 |   6.00   3.277

--------------------------------------------------------------------------------
050:0003----------------------------------------------------------------------
*
*#*****************************************************************************|
*#
*#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ==============================================
*#
**#****************************************************************************|
*# CATCHMENT 101 - Existing Condition Outlet to 825mm Storm Sewer on Brant Stree
*
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .18
| 01:101    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
----------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .18          .00
     Dep. Storage     (mm)=      1.00         6.35
     Average Slope     (%)=      1.40         2.00
     Length            (m)=      3.00         5.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=    149.30        85.37
               over (min)        1.00         2.00
     Storage Coeff.  (min)=       .24 (ii)    2.40 (ii)
     Unit Hyd. Tpeak (min)=      1.00         2.00
     Unit Hyd. peak  (cms)=      1.67          .50
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .07          .00          .074 (iii)
     TIME TO PEAK    (hrs)=      1.90         2.00         2.000
     RUNOFF VOLUME    (mm)=     77.93        38.71        77.540
     TOTAL RAINFALL   (mm)=     78.93        78.93        78.932
     RUNOFF COEFFICIENT   =       .99          .49          .982

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
050:0004----------------------------------------------------------------------
**#****************************************************************************|
*# CATCHMENT 102 - Existing Condition Outlet to Ex. CB on John Street
*
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .10
| 02:102    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
----------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .10          .00
     Dep. Storage     (mm)=      1.00         6.35
     Average Slope     (%)=      3.50         2.00
     Length            (m)=      7.00         5.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=    149.30        85.37
               over (min)        1.00         2.00
     Storage Coeff.  (min)=       .30 (ii)    2.46 (ii)
     Unit Hyd. Tpeak (min)=      1.00         2.00
     Unit Hyd. peak  (cms)=      1.64          .49
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .04          .00          .040 (iii)
     TIME TO PEAK    (hrs)=      1.92         2.00         2.000
     RUNOFF VOLUME    (mm)=     77.93        38.71        77.540
     TOTAL RAINFALL   (mm)=     78.93        78.93        78.932
     RUNOFF COEFFICIENT   =       .99          .49          .982

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
050:0005----------------------------------------------------------------------
**#****************************************************************************|
*#
*#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ===============================================
*#
**#****************************************************************************|
*# CATCHMENT 201 - Proposed Condition Runoff From Roof
*
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .23
| 01:201    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
----------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .23          .00
     Dep. Storage     (mm)=      1.00         6.35
     Average Slope     (%)=      1.00         2.00
     Length            (m)=      5.00         5.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=    149.30        83.65
               over (min)        1.00         3.00
     Storage Coeff.  (min)=       .36 (ii)    2.54 (ii)
     Unit Hyd. Tpeak (min)=      1.00         3.00
     Unit Hyd. peak  (cms)=      1.59          .42
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .09          .00          .094 (iii)
     TIME TO PEAK    (hrs)=      1.93         2.00         2.000
     RUNOFF VOLUME    (mm)=     77.93        38.71        77.540
     TOTAL RAINFALL   (mm)=     78.93        78.93        78.932
     RUNOFF COEFFICIENT   =       .99          .49          .982

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
050:0006----------------------------------------------------------------------
**#****************************************************************************|
*# ROUTE CATCHMENT 201 THROUGH 135mm ORIFICE PIPE
*
--------------------
| ROUTE RESERVOIR  |    Requested routing time step =  1.0 min.
|  IN>01:(201   )  |
| OUT<02:(SWM   )  |    =========  OUTLFOW STORAGE TABLE  =========
--------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                          (cms)    (ha.m.)   |    (cms)    (ha.m.)
                           .000  .0000E+00   |     .032  .4500E-02
                           .015  .1500E-02   |     .037  .6000E-02
                           .025  .3000E-02   |     .041  .7200E-02

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >01: (201   )        .23      .094     2.000     77.540
     OUTFLOW<02: (SWM   )        .23      .035     2.017     77.540
    OVERFLOW<03: (OVF   )        .00      .000      .000       .000

                   TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                   CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                   PERCENTAGE OF TIME OVERFLOWING    (%)=      .00


                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   37.187
                   TIME SHIFT OF PEAK FLOW         (min)=     1.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.5436E-02

--------------------------------------------------------------------------------
050:0007----------------------------------------------------------------------
**#****************************************************************************|
*# CATCHMENT 202 - Proposed Condition Uncontrolled Runoff to Brant Street
*#
*
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .03
| 04:202    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
----------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .03          .00
     Dep. Storage     (mm)=      1.00         6.35
     Average Slope     (%)=      2.10         2.00
     Length            (m)=      1.50         5.00
     Mannings n           =      .013         .250

     Max.eff.Inten.(mm/hr)=    149.30        85.37
               over (min)        1.00         2.00
     Storage Coeff.  (min)=       .14 (ii)    2.30 (ii)
     Unit Hyd. Tpeak (min)=      1.00         2.00
     Unit Hyd. peak  (cms)=      1.70          .51
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .01          .00          .014 (iii)
     TIME TO PEAK    (hrs)=      1.88         2.00         2.000
     RUNOFF VOLUME    (mm)=     77.93        38.71        77.540
     TOTAL RAINFALL   (mm)=     78.93        78.93        78.932
     RUNOFF COEFFICIENT   =       .99          .49          .982

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
050:0008----------------------------------------------------------------------
**#****************************************************************************|
*# ADD CATCHMENT 201+202
*
------------------------
| ADD HYD (201+202   ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------ (ha)     (cms)   (hrs)   (mm)   (cms)
                      ID1 02:SWM            .23     .035    2.02  77.54    .000
                     +ID2 03:OVF            .00     .000     .00    .00    .000
                     +ID3 04:202            .03     .014    2.00  77.54    .000
                      ==========================================================
                      SUM 05:201+202        .26     .048    2.00  77.54    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
050:0009----------------------------------------------------------------------
**#****************************************************************************|
*# CATCHMENT 203 - Proposed Condition Runoff to John Street
*
```

```
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .02
| 06:203    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
---------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .02         .00
     Dep. Storage     (mm)=      1.00        6.35
     Average Slope     (%)=      2.70        2.00
     Length            (m)=      1.50        5.00
     Mannings n           =      .013        .250

     Max.eff.Inten.(mm/hr)=    149.30       85.37
               over (min)        1.00        2.00
     Storage Coeff.  (min)=       .13 (ii)    2.29 (ii)
     Unit Hyd. Tpeak (min)=      1.00        2.00
     Unit Hyd. peak  (cms)=      1.70         .51
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .01         .00          .007 (iii)
     TIME TO PEAK    (hrs)=      1.88        2.00         2.000
     RUNOFF VOLUME    (mm)=     77.93       38.71        77.540
     TOTAL RAINFALL   (mm)=     78.93       78.93        78.932
     RUNOFF COEFFICIENT   =       .99         .49          .982

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
050:0010----------------------------------------------------------------------
* RUN REMAINING DESIGN STORMS (CITY OF BURLINGTON 5 TO 100-YR)
*
------------------------------------------------------------------------------
050:0002----------------------------------------------------------------------
*
------------------------------------------------------------------------------
050:0002----------------------------------------------------------------------
*
------------------------------------------------------------------------------
050:0002----------------------------------------------------------------------
*
------------------------------------------------------------------------------
050:0002----------------------------------------------------------------------
*
  ** END OF RUN :  99

********************************************************************************




--------------------
| START            |  Project  dir.: T:\PROJECTS\19010\SWMHYMO\
--------------------  Rainfall dir.: T:\PROJECTS\19010\SWMHYMO\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 100
    NSTORM=   1
           #  1=BUR6_100.stm
------------------------------------------------------------------------------
100:0002----------------------------------------------------------------------
*#*****************************************************************************|
*#  Project Name: 535-551 BRANT STREET
*#               BURLINGTON, ONTARIO
*#  JOB NUMBER  : 19010
*#       Date   : JAN 2021
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 19010.DAT
*#*****************************************************************************|
*
------------------------------------------------------------------------------
100:0002----------------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: Burlington 100-yr 6hr NEW CHICAGO
| Ptotal=  86.27 mm|    Comments: Burlington 100-yr 6hr NEW CHICAGO
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .17   3.862 |   1.67  17.445 |   3.17   9.657 |   4.67   4.936
               .33   4.172 |   1.83  39.736 |   3.33   8.649 |   4.83   4.704
               .50   4.546 |   2.00 163.177 |   3.50   7.853 |   5.00   4.495
               .67   5.008 |   2.17  51.779 |   3.67   7.206 |   5.17   4.306
               .83   5.595 |   2.33  28.205 |   3.83   6.670 |   5.33   4.135
              1.00   6.369 |   2.50  19.806 |   4.00   6.217 |   5.50   3.979
              1.17   7.443 |   2.67  15.465 |   4.17   5.829 |   5.67   3.835
              1.33   9.048 |   2.83  12.795 |   4.33   5.492 |   5.83   3.703
              1.50  11.752 |   3.00  10.979 |   4.50   5.197 |   6.00   3.581

------------------------------------------------------------------------------
100:0003----------------------------------------------------------------------
*
*#*****************************************************************************|
*#
*#        PRE-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ==============================================
*#
**#*****************************************************************************|
*# CATCHMENT 101 - Existing Condition Outlet to 825mm Storm Sewer on Brant Stree
*
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .18
| 01:101    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
---------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .18         .00
     Dep. Storage     (mm)=      1.00        6.35
     Average Slope     (%)=      1.40        2.00
     Length            (m)=      3.00        5.00
     Mannings n           =      .013        .250

     Max.eff.Inten.(mm/hr)=    163.18       98.36
               over (min)        1.00        2.00
     Storage Coeff.  (min)=       .23 (ii)    2.27 (ii)
     Unit Hyd. Tpeak (min)=      1.00        2.00
     Unit Hyd. peak  (cms)=      1.68         .51
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .08         .00          .081 (iii)
     TIME TO PEAK    (hrs)=      1.90        2.00         2.000
     RUNOFF VOLUME    (mm)=     85.27       44.54        84.864
     TOTAL RAINFALL   (mm)=     86.27       86.27        86.271
     RUNOFF COEFFICIENT   =       .99         .52          .984

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
100:0004----------------------------------------------------------------------
**#*****************************************************************************|
*# CATCHMENT 102 - Existing Condition Outlet to Ex. CB on John Street
*
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .10
| 02:102    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
---------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .10         .00
     Dep. Storage     (mm)=      1.00        6.35
     Average Slope     (%)=      3.50        2.00
     Length            (m)=      7.00        5.00
     Mannings n           =      .013        .250

     Max.eff.Inten.(mm/hr)=    163.18       98.36
               over (min)        1.00        2.00
     Storage Coeff.  (min)=       .29 (ii)    2.33 (ii)
     Unit Hyd. Tpeak (min)=      1.00        2.00
     Unit Hyd. peak  (cms)=      1.64         .50
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .04         .00          .044 (iii)
     TIME TO PEAK    (hrs)=      1.92        2.00         2.000
     RUNOFF VOLUME    (mm)=     85.27       44.54        84.864
     TOTAL RAINFALL   (mm)=     86.27       86.27        86.271
     RUNOFF COEFFICIENT   =       .99         .52          .984

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
100:0005----------------------------------------------------------------------
**#*****************************************************************************|
*#
*#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ===============================================
*#
**#*****************************************************************************|
*# CATCHMENT 201 - Proposed Condition Runoff From Roof
*
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .23
| 01:201    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
---------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .23         .00
     Dep. Storage     (mm)=      1.00        6.35
     Average Slope     (%)=      1.00        2.00
     Length            (m)=      5.00        5.00
     Mannings n           =      .013        .250

     Max.eff.Inten.(mm/hr)=    163.18       98.36
               over (min)        1.00        2.00
     Storage Coeff.  (min)=       .35 (ii)    2.39 (ii)
     Unit Hyd. Tpeak (min)=      1.00        2.00
     Unit Hyd. peak  (cms)=      1.60         .50
                                                    *TOTALS*
     PEAK FLOW       (cms)=       .10         .00          .103 (iii)
     TIME TO PEAK    (hrs)=      1.93        2.00         2.000
     RUNOFF VOLUME    (mm)=     85.27       44.54        84.864
     TOTAL RAINFALL   (mm)=     86.27       86.27        86.271
     RUNOFF COEFFICIENT   =       .99         .52          .984

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

------------------------------------------------------------------------------
100:0006----------------------------------------------------------------------
**#*****************************************************************************|
*# ROUTE CATCHMENT 201 THROUGH 135mm ORIFICE PIPE
*
---------------------
| ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
|  IN>01:(201    )   |
| OUT<02:(SWM    )   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |     .032  .4500E-02
                            .015  .1500E-02   |     .037  .6000E-02
                            .025  .3000E-02   |     .041  .7200E-02

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     -------------------        (ha)     (cms)     (hrs)       (mm)
     INFLOW >01: (201   )        .23      .103     2.000     84.864
     OUTFLOW<02: (SWM   )        .23      .037     2.017     84.864
    OVERFLOW<03: (OVF   )        .00      .000      .000       .000

                  TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                  CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                  PERCENTAGE OF TIME OVERFLOWING    (%)=      .00


                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=   36.065
                  TIME SHIFT OF PEAK FLOW         (min)=    1.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.6001E-02

------------------------------------------------------------------------------
100:0007----------------------------------------------------------------------
**#*****************************************************************************|
*# CATCHMENT 202 - Proposed Condition Uncontrolled Runoff to Brant Street
*#
```

```
*
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .03
| 04:202    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
----------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .03          .00
     Dep. Storage     (mm)=       1.00         6.35
     Average Slope     (%)=       2.10         2.00
     Length            (m)=       1.50         5.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     163.18        98.36
               over (min)        1.00         2.00
     Storage Coeff.  (min)=        .14 (ii)    2.18 (ii)
     Unit Hyd. Tpeak (min)=       1.00         2.00
     Unit Hyd. peak  (cms)=       1.70          .53
                                                    *TOTALS*
     PEAK FLOW       (cms)=        .01          .00          .015 (iii)
     TIME TO PEAK    (hrs)=       1.88         2.00         2.000
     RUNOFF VOLUME    (mm)=      85.27        44.54        84.864
     TOTAL RAINFALL   (mm)=      86.27        86.27        86.271
     RUNOFF COEFFICIENT   =        .99          .52          .984

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
100:0008----------------------------------------------------------------------
**#*********************************************************************|
*# ADD CATCHMENT 201+202
*
------------------------
| ADD HYD (201+202   ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
                     ID1 02:SWM             .23     .037    2.02  84.86    .000
                    +ID2 03:OVF             .00     .000     .00    .00    .000
                    +ID3 04:202             .03     .015    2.00  84.86    .000
                     ==========================================================
                     SUM 05:201+202         .26     .051    2.00  84.86    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
100:0009----------------------------------------------------------------------
**#*********************************************************************|
*# CATCHMENT 203 - Proposed Condition Runoff to John Street
*
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .02
| 06:203    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
----------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .02          .00
     Dep. Storage     (mm)=       1.00         6.35
     Average Slope     (%)=       2.70         2.00
     Length            (m)=       1.50         5.00
     Mannings n           =       .013         .250

     Max.eff.Inten.(mm/hr)=     163.18        98.36
               over (min)        1.00         2.00
     Storage Coeff.  (min)=        .13 (ii)    2.17 (ii)
     Unit Hyd. Tpeak (min)=       1.00         2.00
     Unit Hyd. peak  (cms)=       1.70          .53
                                                    *TOTALS*
     PEAK FLOW       (cms)=        .01          .00          .008 (iii)
     TIME TO PEAK    (hrs)=       1.88         2.00         2.000
     RUNOFF VOLUME    (mm)=      85.27        44.54        84.864
     TOTAL RAINFALL   (mm)=      86.27        86.27        86.271
     RUNOFF COEFFICIENT   =        .99          .52          .984

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  80.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
100:0010----------------------------------------------------------------------
* RUN REMAINING DESIGN STORMS (CITY OF BURLINGTON 5 TO 100-YR)
*
--------------------------------------------------------------------------------
100:0002----------------------------------------------------------------------
*
--------------------------------------------------------------------------------
100:0002----------------------------------------------------------------------
*
--------------------------------------------------------------------------------
100:0002----------------------------------------------------------------------
*
--------------------------------------------------------------------------------
100:0002----------------------------------------------------------------------
*
--------------------------------------------------------------------------------
100:0002----------------------------------------------------------------------
*
      FINISH
--------------------------------------------------------------------------------
*******************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2021-01-20     at 18:59:37
===============================================================================
```

APPENDIX C
WATER ANALYSIS INFORMATION

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

Project Number: 19010
Project Name: 535-551 Brant Street
Date: Apr-20

Fire flow demands for the FUS method is based on information and guidance provided in "Water Supply for Public Protection" (Fire Underwriters Survey, 1999).

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

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

where:

F the required fire flow in litres per minute
C coefficient related to the type of construction
= 1.5 for wood frame construction (structure essentially all combustible).
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior)
= 0.8 for non-combustible construction (unprotected metal structural components, masonry or metal walls)
= 0.6 for fire-resistive construction (fully protected frame, floors, roof)
A Total 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)**
Condominium	**26**	**6406.6**	**0.6**	11000	183.3	**-25**	-2750.0	**8250.0**	**-50**	-4125.0	45	3712.5	**8000**	**133**

Total Area Calculation:

	Floor	Area	Cumm. Area
Two largest ajoining floors plus 50% of any floors immediately above them up to eight floors	1-2	3032	3032.0
	50% of 2-10	3374.55	6406.6

(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%.

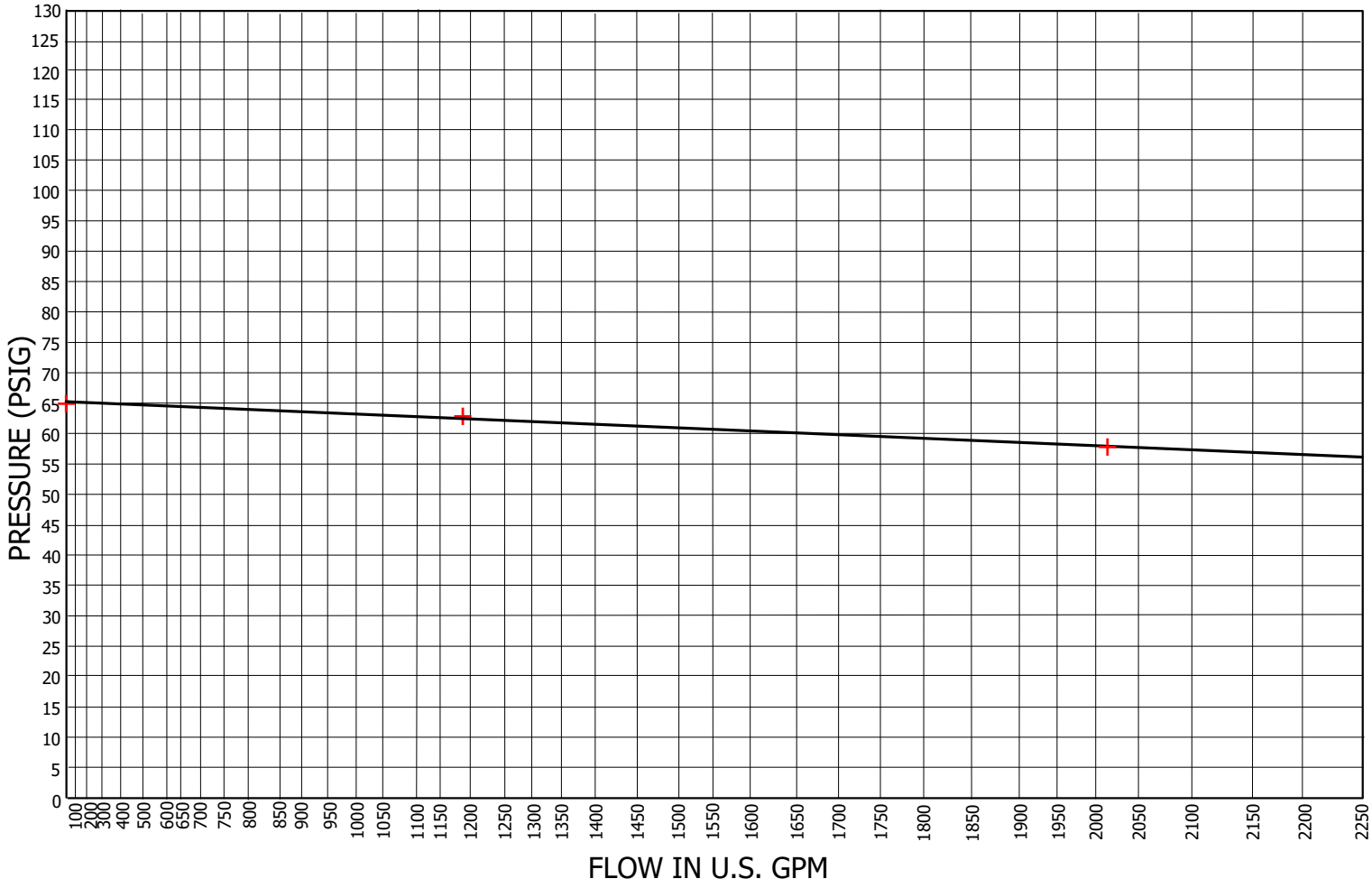
If the domestic and fire services are supplied by the same municipal water system, then take an additional 10%.

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%	Calculate for all sides. Maximum charge shall not exceed 75%
3.1 to 10m	20%	
10.1 to 20m	15%	
20.1 to 30m	10%	
30.1 to 45m	5%	

Side	Exposure (m)	Charge (%)
North =	**>45**	**0**
South =	**0 to 3**	**25**
East =	**20.1 to 30**	**10**
West =	**20.1 to 30**	**10**
Total Expoure =		***45***

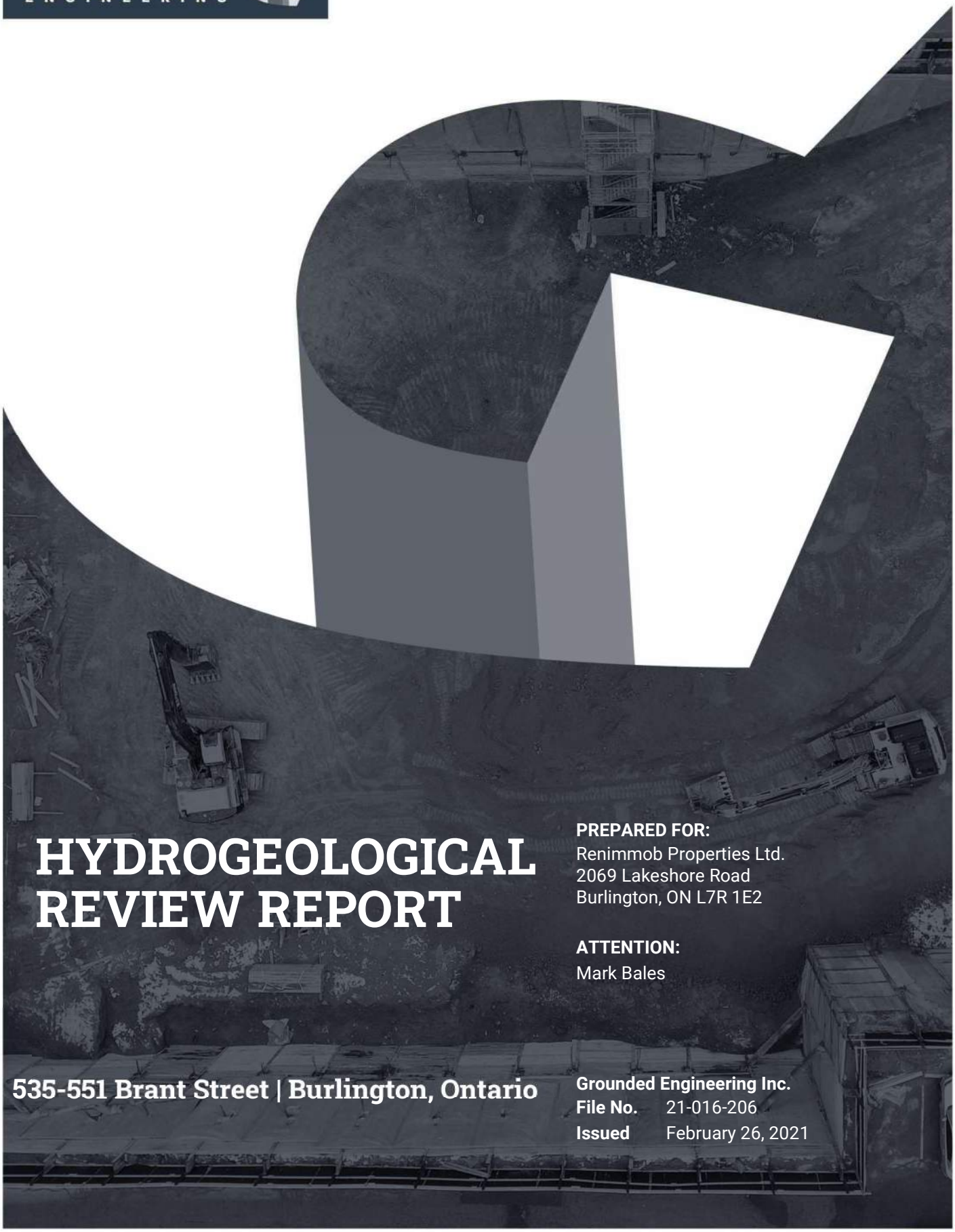


# of Ports	PORT DIA. (in/mm)	PITOT (psig)	FLOW (usgpm)	RESIDUAL (psig)
1	2.50/63	50	1186	63
2	2.50/63	36/36	2014	58
THEORETICAL FLOW @ 20psi			6374	

General Data	
Test Date	13 March 2020
Test Time	11:15am
Pipe Dia.	12"
Static	65

Site Information	
Site or Developer Name	Carriage Gate Homes
Site Address/Municipality	535 Brant Street, Burlington
Location of Test Hydrant	566 Brant Street
Location of Base Hydrant	518 Brant Street
Technician's Comments	No conversion factor used for flow calculation based on round and flush internal nozzle
	configuration. Flow testing has been conducted in accrodance with NFPA 291 guidelines
	wherever possible. Refer to attached report for further information.
	Verified By: Mark Schmidt

APPENDIX D
ADDITIONAL REPORTS



HYDROGEOLOGICAL REVIEW REPORT

PREPARED FOR:
Renimmob Properties Ltd.
2069 Lakeshore Road
Burlington, ON L7R 1E2

ATTENTION:
Mark Bales

535-551 Brant Street | Burlington, Ontario

Grounded Engineering Inc.
File No. 21-016-206
Issued February 26, 2021

Executive Summary

Grounded Engineering Inc. (Grounded) was retained by Renimmob Properties Ltd. to conduct a Hydrogeological Review for the proposed redevelopment of 535-551 Brant Street in Burlington, Ontario (site). The conclusions of the investigation are summarized as follows:

Development Information

Current Development

Development Phase	Above Grade Levels	Below Grade Levels			
		Level #	Lowest Finished Floor		Approximate Base of Footings (masl)
			Depth (m)	Elevation (masl)	
535 – 539 Brant Street	1	1	Unknown	Unknown	Unknown
541 – 551 Brant Street	2	1	Unknown	Unknown	Unknown

Proposed Development

Development Phase	Above Grade Levels	Below Grade Levels			
		Level #	Lowest Finished Floor		Approximate Base of Footings (masl)
			Depth (m)	Elevation (masl)	
1	26	4	12.2	75.4	74.9

Site Conditions

Site Stratigraphy

Stratum/Formation	Aquifer or Aquitard	Depth Range (mbgs)	Elevation Range (masl)	Hydraulic Conductivity (m/s)
Earth Fill	Aquifer	0.0 – 2.3	87.3 – 85.0	9.29×10^{-09}*
Silt Till (Halton Till)	Aquifer	1.5 – 3.3	85.8 – 84.4	1.3×10^{-08}*
Bedrock (Queenston Shale)	Aquifer	3.1 – 18.5	84.7 – 68.9	1.78×10^{-07}**

*Conductivity was approximated using grain size analysis.
**Bedrock conductivity is highest reported between Grounded & Terraprobe via slug test analysis (Appendix B).

Maximum Groundwater Elevation

Monitoring Well ID	Depth Below Grade (m)	Elevation (masl)
BH104	18.5	87.4
BH105	2.3	87.6
BH106	18.0	87.7
BH107	18.1	87.8
BH108	3.0	87.7

Groundwater Quality				
Sample ID	**Sample Date**	**Sample Expiry Date**	**City of Burlington Storm Sewer Limits**	**Halton Region Sanitary and Combined Sewer Limits**
SW-UF-BH107	February 4, 2021	February 6, 2021	Exceeds	Meets

Groundwater Control

Stored Groundwater (pre-excavation/dewatering)			
Volume of Excavation (m^3)	**Volume of Excavation Below Water Table (m^3)**	**Volume of Storage Groundwater (m^3)**	**Volume of Storage Groundwater (L)**
35,527	25,612	8,675	8,675,100

Short Term (Construction) Groundwater Quantity – Safety Factor of 1.5 Used					
Groundwater Seepage		**Design Rainfall Event (25mm)**		**Total Daily Water Takings**	
L/day	**L/min**	**L/day**	**L/min**	**L/day**	**L/min**
20,000	13.9	69,000	47.9	89,000	61.8

Long Term (Permanent) Groundwater Quantity – Safety Factor of 1.5 Used					
Groundwater Seepage		**Infiltration Design Rainfall Event (25mm)**		**Total Daily Water Takings**	
L/day	**L/min**	**L/day**	**L/min**	**L/day**	**L/min**
20,000	13.9	2,000	1.4	22,000	15.3

Zone of Influence	
Zone of Influence	**Potential Settlement**
13 m	1 mm

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 Region of Halton or City of Burlington	Required
Long Term Discharge Agreement Region of Halton or City of Burlington	Required

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1 Introduction

Renimmob Properties Ltd. has retained Grounded Engineering Inc. ("Grounded") to provide hydrogeological engineering design advice for their proposed development at 535-551 Brant Street, in Burlington, Ontario.

Property Information	
Location of Property	535-551 Brant Street
Ownership of Property	Renimmob Properties Ltd.
Property Dimensions (m)	Approx. 51 m EW x 54 m NS
Property Area (m^2)	2,779

Existing Development	
Number of Building Structures	Two (2)
Number of Above Grade Levels	535 – 539 Brant Street: One (1) 541 – 551 Brant Street: Two (2)
Number of Underground Levels	One (1)
Sub-Grade Depth of Development (m)	Unknown
Sub-Grade Area (m^2)	Unknown
Land Use Classification	Commercial

Proposed Development	
Number of Building Structures	One (1): One high-rise tower on a mixed-use podium
Number of Above Grade Levels	Twenty-six (26)
Number of Underground Levels	Four (4) – P4 Level
Sub-Grade Depth of Development (m)	12.4
Sub-Grade Area (m^2)	2,779
Land Use Classification	Mixed Use – Residential and Commercial

Qualified Person and Hydrogeological Review Information	
Qualified Person	Matthew Bielaski, P.Eng.
Consulting Firm	Grounded Engineering Inc.
Date of Hydrogeological Review	February 26, 2021
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 ▪ Review of previous Hydrogeological Report by others ▪ Completion of slug tests in accessible monitoring wells ▪ Groundwater sampling and analysis to the City of Burlington and Halton Region 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	
Property Topography	The site has an approximate ground surface elevation of 87.4 to 87.8 masl.
Local Physiographic Features	The site is composed of clayey to sandy silt fill underlain by a native silt till (Halton Till) with bedrock directly below (Queenston Shale)
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.
Surface Drainage	Surface water is expected to flow to the municipal roads located on adjacent of the site. Catch basins are located on Brant Street to the south and John Street to the north.

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 property boundaries of the Site
- 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 are as follows:

Site Stratigraphy				
Stratum/Formation	**Aquifer or Aquitard**	**Depth Range (mbgs)**	**Elevation Range (masl)**	**Hydraulic Conductivity (m/s)**
Earth Fill	Aquifer	0.0 – 2.3	87.3 –85.0	9.29×10^{-09}
Silt Till (Halton Till)	Aquifer	1.5 – 3.3	85.8 – 84.4	1.3×10^{-08}
Bedrock (Queenston Shale)	Aquifer	3.1 – 18.5	84.7 – 68.9	1.78×10^{-07}*

*Indicates conductivity was estimated using grain size analysis
***Indicates conductivity was highest reported value between Grounded and Terraprobe

Bedrock			
Stratum	**Depth Range (mbgs)**	**Elevation Range (masl)**	**Hydraulic Conductivity (m/s)**
Weathered	3.1 – 6.8	84.7 – 80.6	1.78×10^{-07}*
Sound	6.4 – 18.0	81.3 - 69.7	1.78×10^{-07}*

*Bedrock conductivity is highest reported between Grounded & Terraprobe via slug test analysis (Appendix B).

Surface Water		
Surface Water Body	**Distance from site (m)**	**Hydraulically Connected to Property (yes/no)**
Lake Ontario	712	No

4 Monitoring Well Information

Well ID	Well Diameter (mm)	Ground Surface (masl)	Top of Screen (masl)	Bottom of Screen (masl)	Screened Geological Unit
BH104	50	87.4	71.9	68.9	Bedrock
BH105	50	87.6	86.8	85.3	Earth Fill to Silt Till
BH106	50	87.7	66.7	69.7	Bedrock
BH107	50	87.8	66.7	69.7	Bedrock
BH108	50	87.7	83.2	84.7	Earth Fill to Silt Till

5 Groundwater Elevations

Well ID	Groundwater Elevation (masl)					
	19-Feb-08	19-Feb-21	19-Mar-15	19-Mar-22	19-Apr-14	21-Feb-04
BH104	84.0	83.8	84.1	84.2	84.2	-
BH105	Dry	Dry	Dry	Dry	Dry	Dry
BH106	76.3	82.8	83.2	83.2	83.3	82.9
BH107	83.5	-	83.5	83.7	83.6	82.1
BH108	Dry	-	Dry	85.1	85.1	85.0

"-" Well inaccessible at time of visit

For design purposes the stabilized water level at the site is assumed to be 84.2 masl within the Bedrock unit, the groundwater within the overlying overburden material is likely part of a perched water table at approximately Elev. 85.1 masl. 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 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)
BH106	66.7 - 69.7	Bedrock	2.74×10^{-09}*

*Conductivity was much lower than reported values from the previous Terraprobe report, the highest reported conductivity will be used instead.

6.2 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)
BH104-SS4B	Silt Till	Alyamani and Sen, Barr, Sauerbrei	3.7×10^{-09}
BH105-SS1	Earth Fill	Alyamani and Sen, Barr, Sauerbrei	9.2×10^{-09}
BH105-SS4	Silt Till	Alyamani and Sen, Barr, Sauerbrei	8.5×10^{-09}
BH106-SS4	Silt Till	Alyamani and Sen, Barr, Sauerbrei	6.0×10^{-09}
BH108-SS4	Silt Till	Alyamani and Sen, Barr, Sauerbrei	1.3×10^{-08}

The results of the analyses are presented in Appendix D.

6.3 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^{-05} to 10^{-09}
Silt Till (Glacial Tills)	10^{-05} to 10^{-09}
Bedrock (Queenston Shale)	10^{-07} to 10^{-09}

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 BH107 (SW-UF-BH107) on February 4, 2021. The sample was analyzed for the following parameters:

- The City of Burlington Storm Sewer Discharge By-Law 86-2002
- Regional Municipality of Halton By-Law No. 2-03 Section 4 Table 1 – Limits for Sanitary Sewers and Combined Sewers Discharge

The groundwater sample exceeded the City of Burlington Storm Sewer Discharge Limits and will require treatment prior to discharge into the storm sewer. 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

The proposed shoring at the site is unknown at the time of writing this report. However, it is assumed that conventional solider pile and lagging will be utilized except where adjacent structures exist.

9 Private Water Drainage System (PWDS)

If the proposed development is designed as a leak tight 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.

If the proposed development is not a leak tight structure, then a private water drainage system will be required. The total sub floor drain area will be approximately 2,575 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.

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 F.

The groundwater seepage estimates, which have been provided, represent the steady state groundwater seepage. There will 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 estimate initial volume of stored groundwater which will require removal before steady state is reached has been provided below.

Please note that if excavation is exposed to the elements, storm water 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 storm water from a 100-year storm. The additional volume that will be generated in the occurrence of a 100-year storm event is approximately 259,000 L.

Stored Groundwater (pre-excavation/dewatering)			
Volume of Excavation (m^3)	**Volume of Excavation Below Water Table (m^3)**	**Volume of Storage Groundwater (m^3)**	**Volume of Storage Groundwater (L)**
35,527	25,612	8,675	8,675,100

Short Term (Construction) Groundwater Quantity – Safety Factor of 1.5 Used					
Groundwater Seepage		**Design Rainfall Event (25mm)**		**Total Daily Water Takings**	
L/day	**L/min**	**L/day**	**L/min**	**L/day**	**L/min**
20,000	13.9	69,000	47.9	89,000	61.8

Long Term (Permanent) Groundwater Quantity – Safety Factor of 1.5 Used					
Groundwater Seepage		**Infiltration Design Rainfall Event (25mm)**		**Total Daily Water Takings**	
L/day	**L/min**	**L/day**	**L/min**	**L/day**	**L/min**
20,000	13.9	2,000	1.4	22,000	15.3

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 Region of Halton or City of Burlington	Required
Long Term Discharge Agreement Region of Halton or City of Burlington	Required

Please note:

- The native bedrock must be dewatered a minimum of 1 m below the footing elevation prior to excavation to preserve the in-situ integrity of the bedrock during construction dewatering activities. It is anticipated that the groundwater elevation will rise to the elevation of the subfloor drainage in the event of a drained structure or the waterproofing in the event of a leak tight 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.
- Leak tight structure (structure that has not included a private water drainage system) has not been considered as part of the proposed development at this time.
- On-site containment (infiltration gallery/dry well etc.) 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 Property.

The ZOI was calculated using the Sichardt equation below.

Equation: $R_0 = 3000*dH*K^{0.5}$

Where:

dH is the dewatering thickness (m)

K is the hydraulic conductivity (m/s)

Calculation:

The ZOI with respect to groundwater seepage at the site is:

$R_0 = 3000*10.5\ m*(1.78 \times 10^{-07})^{0.5}\ m/s$

$R_0 = \pm 13\ m$

11.2 Land Stability

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

- The proposed dewatering at the subject site locally lowers the groundwater table within the ZOI by a maximum of 13 m. This has the potential increase of effective stress of approximately 86.3 kPa in the native soils.
- Due to the groundwater table being within the bedrock strata, subsequent dewatering of the bedrock will induce minimal amounts of settlement within the zone of influence.
- Based on the change in effective stress and the compressibility of the soil subjected to that change, the proposed dewatering activities will induce a maximum 1 mm of additional settlement in the adjacent soils.
- The maximum induced settlement occurs directly adjacent to the proposed excavation and decreases in a nonlinear fashion with distance away from the excavation.
- For the structures within the public realm adjacent to the site, the dewatering-induced settlement is calculated to be 1 mm or less (depending on the depth of the structure).

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 previous Sections. As noted in that section the groundwater sample exceeded the Limits for Storm Sewer Discharge and met the Limits for Sanitary and Combined Sewer Discharge.

As such additional treatment will be required before the water can be discharge 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 cause by groundwater quality.

11.4 Natural Environment

There are no natural waterbodies within the ZOI that will be caused 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 water body. 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 commercial and some residential areas. There are possible land uses which could be a source of potential contamination that should be further investigated. Evaluation of the environmental condition of the site has been completed under a separate cover.

12 Proposed Mitigation Measures and Monitoring Plan

The extent of the negative impact identified in previous sections will be limited to the ZOI caused by the groundwater taking at the site.

As a result of dewatering and draining the bedrock, changes in groundwater level have the potential to cause settlement based on the change in the effective stresses within the ZOI.

If adjacent buildings or municipal infrastructure are within the ZOI and will undergo settlement that may be considered unacceptable as identified the Land Stability Section, consideration should be given to implement a monitoring and mitigation program during dewatering activities.

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.

13.1 Report Use

The authorized users of this report are Renimmob Properties Ltd. 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 City of Burlington may also make use of and rely upon this report, subject to the limitations as stated.

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

Jason Ngo, B.Sc

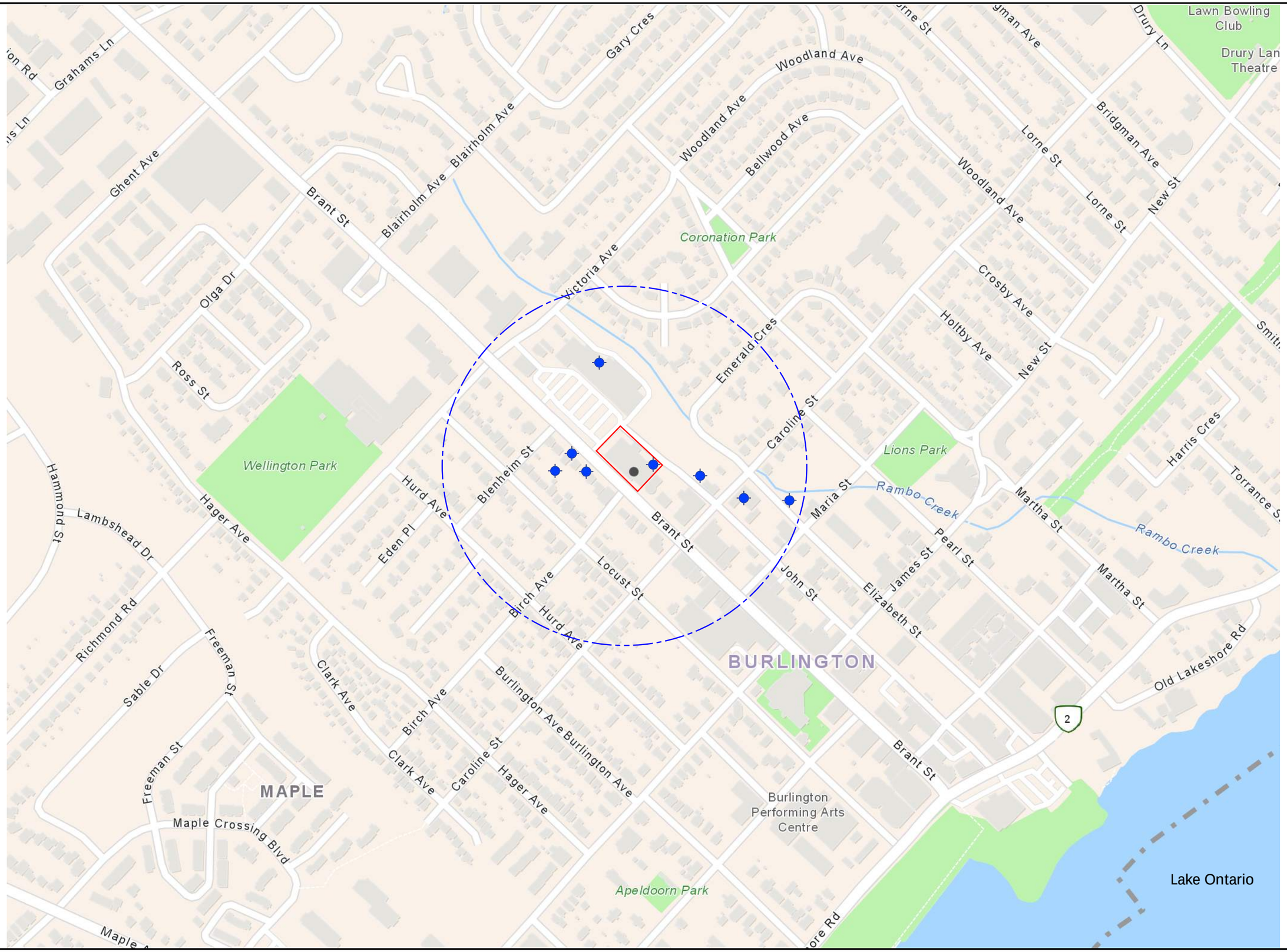
Jeremy Bobro, M$_{ENVM}$
Senior Consultant



Matthew Bielaski, P.Eng., QP$_{ESA-RA}$
Principal

FIGURES





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www.groundedeng.ca

LEGEND

- PROPERTY BOUNDARY
- STUDY AREA (250m)
- MECP WELL RECORD

Note

Study area is 250m around propterty

Reference

ArcGIS 2021, MECP Well Record Database 2021

Project

535-551 BRANT STREET BURLINGTON, ONTARIO

Figure Title

STUDY AREA MAP

North

TRUE
PROJECT

Date

FEBRUARY 9, 2021

Scale

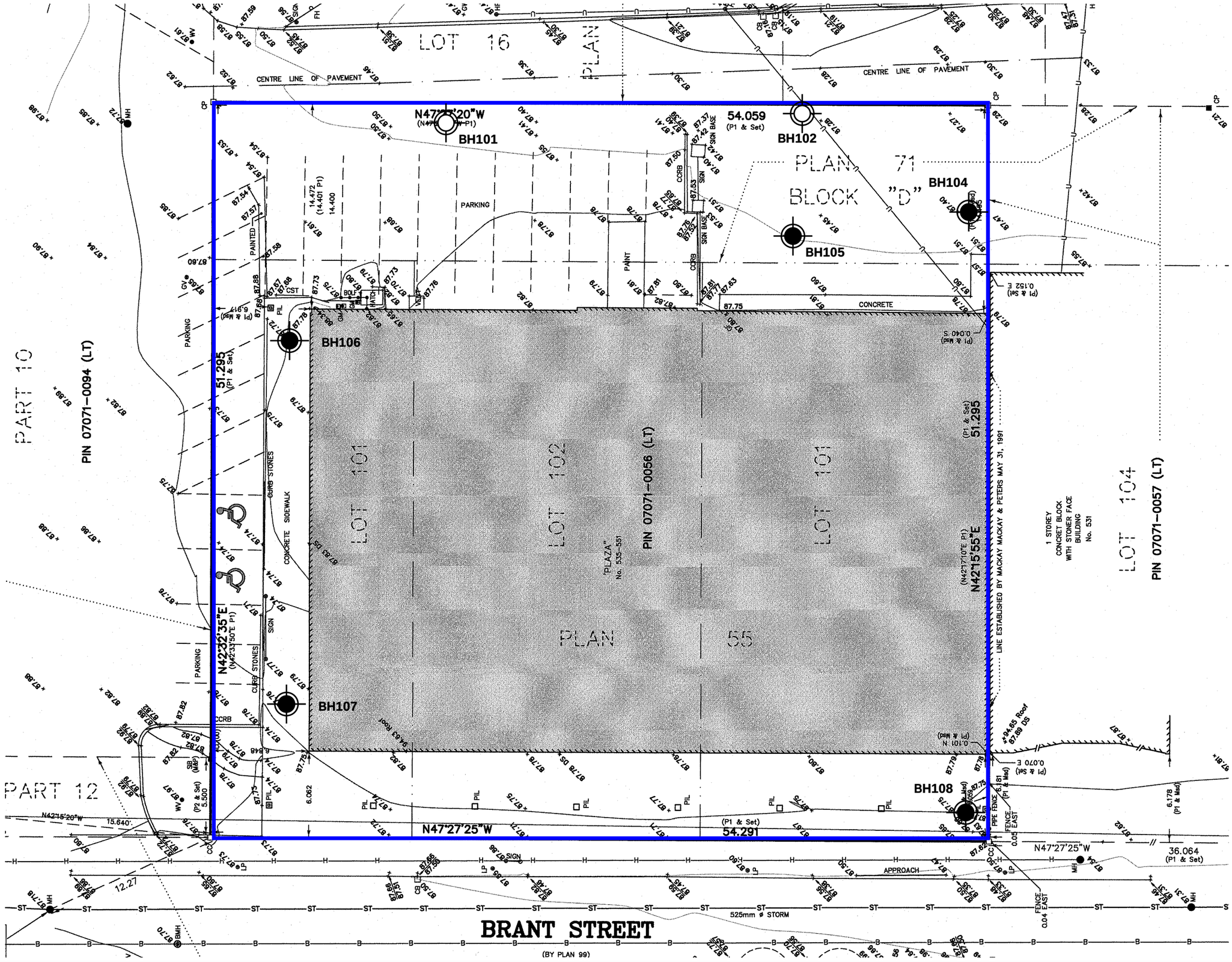
NOT TO SCALE

Job No

21-016

Figure No

FIGURE 1



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LEGEND

- PROPERTY BOUNDARY
- MONITORING WELL (TERRAPROBE 2019)
- BOREHOLE (TERRAPROBE 2019)

Note

Reference

Topographic Survey, A.T. McLaren Limited, Dec 2018 (Drawing #35815)

Project

535-551 BRANT STREET BURLINGTON, ONTARIO

Figure Title

BOREHOLE LOCATION PLAN (EXISTING CONDITION)

North

TRUE
PROJECT

Date

FEBRUARY 9, 2021

Scale

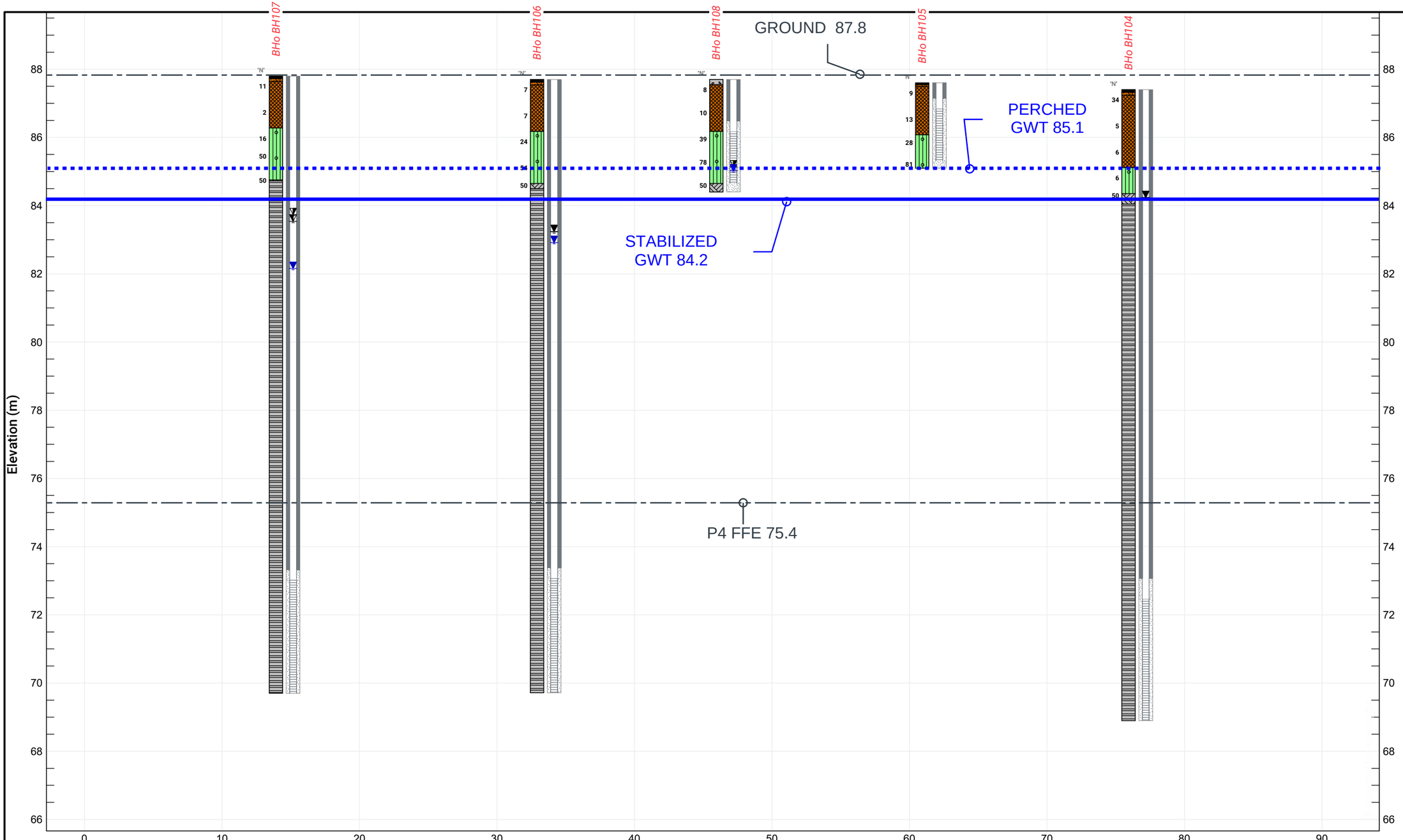
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21-016

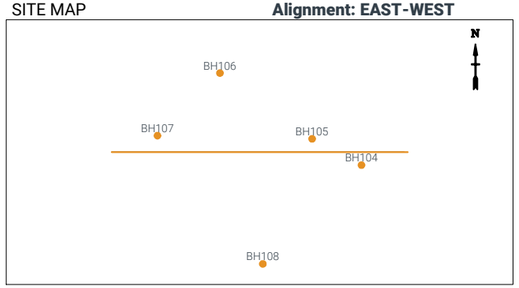
Figure No

FIGURE 2



SITE MAP

Alignment: EAST-WEST



LITHOLOGY GRAPHIC LEGEND

- Asphalt
- Aggregate
- Fill
- Silty Till
- Bedrock (inferred)
- Bedrock (cored)
- Concrete

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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 SOILS

- water level, unstabilized
- water level, stabilized

Project

535-551 BRANT STREET BURLINGTON, ONTARIO

Figure Title

SUBSURFACE CROSS-SECTION

EAST-WEST

Date: FEBRUARY 2021

Scale: AS INDICATED

Job No: 21-016

Figure No: **FIGURE 3**

APPENDIX A



LOG OF BOREHOLE 101

Terraprobe

Project No. : 1-18-0718	Client : Carriage Gate Homes	Originated by : TG
Date started : November 26, 2018	Project : 535-551 Brant Street	Compiled by : JK
Sheet No. : 1 of 1	Location : Burlington, ON	Checked by : MD

Position : E: 597162, N: 4798043 (UTM 17T) Elevation Datum : Geodetic

Rig type : Truck-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)	Penetration Test Values (Blows / 0.3m) / Undrained Shear Strength (kPa)	Moisture / Plasticity	Headspace Vapour (ppm)	Instrument Details	Lab Data and Comments
0	**87.5**	**GROUND SURFACE**										
	87.2	115mm **ASPHALTIC CONCRETE**										
	0.3	150mm **AGGREGATE**		1	SS	15						SS1 Analysis: M&I
1		**FILL**, clayey silt, trace sand, trace gravel, trace asphalt, stiff, red with black pockets, moist		2	SS	12	87					SS2 Analysis: PAH
	86.0											
	1.5	**SILT**, some clay, trace sand, trace gravel, hard, reddish brown, moist (HALTON TILL)		3	SS	92 / 275mm	86					SS3 Analysis: PHC
	85.5											
	2.0	**END OF BOREHOLE**										

Penetration Test Values (Blows / 0.3m): × Dynamic Cone; 10 20 30 40

Undrained Shear Strength (kPa): ○ Unconfined + Field Vane ● Pocket Penetrometer ■ Lab Vane; 40 80 120 160

Moisture / Plasticity: Plastic Limit (PL) Natural Water Content (MC) Liquid Limit (LL); 10 20 30

Unstabilized Water Level

Lab Data and Comments: GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL

Borehole was dry and open upon completion of drilling.

file: 1-18-0718 bh logs.gpj

LOG OF BOREHOLE 102

Terraprobe

Project No. : 1-18-0718	Client : Carriage Gate Homes	Originated by : TG
Date started : November 26, 2018	Project : 535-551 Brant Street	Compiled by : JK
Sheet No. : 1 of 1	Location : Burlington, ON	Checked by : MD

Position : E: 597181, N: 4798028 (UTM 17T) Elevation Datum : Geodetic

Rig type : Truck-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)	Penetration Test Values (Blows / 0.3m) / Undrained Shear Strength (kPa)	Moisture / Plasticity	Headspace Vapour (ppm)	Instrument Details	Lab Data and Comments
0	87.3	**GROUND SURFACE**					87	Dynamic Cone: 10 20 30 40; Unconfined / Pocket Penetrometer / Field Vane / Lab Vane: 40 80 120 160	Plastic Limit / Natural Water Content / Liquid Limit: PL MC LL; 10 20 30			Unstabilized Water Level; GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL
		120mm **ASPHALTIC CONCRETE**										
	86.9	260mm **AGGREGATE**										
	0.4	**FILL**, clayey silt, some sand, trace to some gravel, trace asphalt, trace rock fragments, firm to stiff, dark brown, moist		1	SS	7						SS1 Analysis: PAH
1		...at 0.6 m, red, stiff		2	SS	13						SS2 Analysis: VOC, PHC
	85.8						86					
	1.5	**SILT**, some silt, trace sand, trace gravel, hard, reddish brown, moist		3	SS	59						SS3 Analysis: M&I
	85.3	(HALTON TILL)										
	2.0											

END OF BOREHOLE

Unstabilized water level measured at 0.3 m below ground surface; borehole caved to 0.9 m below ground surface upon completion of drilling.

LOG OF BOREHOLE 103

Terraprobe

Project No. : 1-18-0718	Client : Carriage Gate Homes	Originated by : TG
Date started : November 26, 2018	Project : 535-551 Brant Street	Compiled by : JK
Sheet No. : 1 of 1	Location : Burlington, ON	Checked by : MD

Position : E: 597202, N: 4798017 (UTM 17T) Elevation Datum : Geodetic

Rig type : Truck-mounted Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)	Penetration Test Values (Blows / 0.3m) / Undrained Shear Strength (kPa)	Moisture / Plasticity	Headspace Vapour (ppm)	Instrument Details	Unstabilized Water Level	Lab Data and Comments
0	87.3	**GROUND SURFACE**					87	Dynamic Cone 10 20 30 40; Unconfined, Pocket Penetrometer, Field Vane, Lab Vane 40 80 120 160	Plastic Limit, Natural Water Content, Liquid Limit PL MC LL 10 20 30				GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL
	87.0	95mm **ASPHALTIC CONCRETE**											
	0.3	240mm **AGGREGATE**											
		FILL, clayey silt, some sand, trace to some gravel, trace asphalt, trace rock fragments, stilff to very stiff, red with black pockets, moist		1	SS	26							SS1 Analysis: VOC, PHC
1				2	SS	12							SS2 Analysis: M&I
	85.8						86						
	1.5	**SILT**, some clay, trace sand, trace gravel, very stiff, reddish brown, moist (HALTON TILL)		3	SS	17							SS3 Analysis: PAH
	85.3												
	2.0	**END OF BOREHOLE**											

Borehole was dry and open upon completion of drilling.

LOG OF BOREHOLE 104

Terraprobe

Project No. : 1-18-0718	Client : Carriage Gate Homes	Originated by : TG
Date started : January 22, 2019	Project : 535-551 Brant Street	Compiled by : JK
Sheet No. : 1 of 2	Location : Burlington, ON	Checked by : MD

Position : E: 597190, N: 4798010 (UTM 17T) | Elevation Datum : Geodetic | Core Diameter : **HQ**, OD=96mm, ID=64mm

Rig type : Truck-mounted | Drilling Method : Hollow stem augers, HQ rock coring

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
0	87.4	**GROUND SURFACE**				
	87.2	80mm **ASPHALTIC CONCRETE**				
	0.2	80mm **AGGREGATE**				
		FILL, clayey silt, trace to some gravel, trace sand, trace asphalt, hard, red with grey and black pockets, moist		1	SS	34
1		...at 0.8 m, some sand, trace concrete, dark brown to black, firm		2	SS	5
		...at 1.5 m, brown with red staining		3	SS	6
2	85.1					
	2.3	**SILT**, some clay, trace sand, trace gravel, firm, reddish brown, moist (HALTON TILL)		4A	SS	6
		...at 2.6 m, silty clay, trace shale fragments		4B		
3	84.4					
	3.0			5	SS	50 / 125mm
	84.1	**INFERRED BEDROCK**, shale, red				
	3.3	**QUEENSTON FORMATION** (See rock core log for details)		1	RUN	
4		...at 3.5 m, transition to sound bedrock		2	RUN	
5				3	RUN	
6				4	RUN	
7				5	RUN	
8						
9				6	RUN	
10						
11				7	RUN	

Elevation Scale (m): 87, 86, 85, 84, 83, 82, 81, 80, 79, 78, 77, 76

Penetration Test Values (Blows / 0.3m): Dynamic Cone 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane — 40 80 120 160

Moisture / Plasticity: Plastic Limit (PL) | Natural Water Content (MC) | Liquid Limit (LL) — 10 20 30

Headspace Vapour (ppm): PID: <5 | PID: 5 | PID: 10 | PID: <5 | PID: <5 | PID: <5

Instrument Details: Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT) — GR SA SI CL

SS1 Analysis: M&I

SS2 Analysis: PAH

SS3 Analysis: VOC, PHC

17 11 47 25

4B Analysis: M&I, PAH, VOC, PHC

(continued next page)

LOG OF BOREHOLE 104

Terraprobe

Project No. : 1-18-0718	Client : Carriage Gate Homes	Originated by : TG
Date started : January 22, 2019	Project : 535-551 Brant Street	Compiled by : JK
Sheet No. : 2 of 2	Location : Burlington, ON	Checked by : MD

Position : E: 597190, N: 4798010 (UTM 17T) | Elevation Datum : Geodetic | Core Diameter : **HQ**, OD=96mm, ID=64mm

Rig type : Truck-mounted | Drilling Method : Hollow stem augers, HQ rock coring

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
12		*(continued)*				
		QUEENSTON FORMATION (See rock core log for details) *(continued)*		7	RUN	
13						
				8	RUN	
14						
				9	RUN	
15						
				10	RUN	
16						
				11	RUN	
17						
18	68.9					
	18.5	**END OF BOREHOLE**				

Elevation Scale (m): 75, 74, 73, 72, 71, 70, 69

Penetration Test Values (Blows / 0.3m) — Dynamic Cone: 10, 20, 30, 40

Undrained Shear Strength (kPa) — Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40, 80, 120, 160

Moisture / Plasticity — Plastic Limit (PL), Natural Water Content (MC), Liquid Limit (LL): 10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT) — GR SA SI CL

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

50 mm dia. monitoring well installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Mar 15, 2019	3.3	84.2
Mar 22, 2019	3.2	84.2

file: 1-18-0718 bh logs.gpj

ROCK CORE LOG 104

Terraprobe

Project No. : 1-18-0718 | Client : Carriage Gate Homes | Originated by : TG

Date started : January 22, 2019 | Project : 535-551 Brant Street | Compiled by : JK

Sheet No. : 1 of 1 | Location : Burlington, ON | Checked by : MD

Position : E: 597190, N: 4798010 (UTM 17T) | Elevation Datum : Geodetic | Core Diameter : **HQ**, OD=96mm, ID=64mm

Rig type : Truck-mounted | Drilling Method : Hollow stem augers, HQ rock coring

Depth (m)	Graphic Log	GENERAL DESCRIPTION	Run / Elev Depth (m)	Recovery	Elevation (m)	Shale Weathering Zones	UCS (MPa) / Estimated Strength	Natural Fractures: Frequency	Natural Fractures: Spacing	Laboratory Testing	Comments	Elevation (m)
		Rock coring started at 3.3m below grade	**84.1**			Z1 Z2 Z3 Z4	R1 R2 R3 R4 R5 R6					
4		**QUEENSTON FORMATION** **calcareous Shale**, red, medium bedded, weak; joints are horizontal, closed to gapped, clean;	3.3 R1 83.3	TCR = **103%** SCR = **87%** RQD = **45%**	84			5 2			**3.3m:** *highly weathered* **3.8m:** *dipping joint, closed, clean, smooth, planar*	84
5		interbedded with **limestone**, grey, thinly bedded, medium strong ...at 3.5m, transition to sound bedrock	4.1 R2 81.8	TCR = **100%** SCR = **97%** RQD = **83%**	83			6 2 2 1 2 2			**4.1m:** *vertilcal joint, closed, clean, smooth, planar*	83
6		*Run 1 : 0% limestone 100% shale*	5.6 R3 80.2	TCR = **100%** SCR = **93%** RQD = **68%**	82			WZ 3 1 0			**5.6-5.7m:** *50mm rubblized*	82
7		*Run 2 : 10% limestone 90% shale* *Run 3 : 7% limestone 93% shale*	7.2 R4 78.7	TCR = **98%** SCR = **98%** RQD = **95%**	81			1 1 1 0 1 1				81
8					80							80
9		*Run 4 : 16% limestone 84% shale*	8.7 R5 77.2	TCR = **93%** SCR = **88%** RQD = **60%**	79			>10 3 1			**8.8-8.8m:** *rubble* **8.9m:** *dipping joint, clean, smooth, closed, planar*	79
10		*Run 5 : 29% limestone 71% shale*	10.2 R6 75.7	TCR = **100%** SCR = **97%** RQD = **85%**	78			5 2 1 0 1 1			**9.6-9.7m:** *horizontal joint, clay infilled, gapped, smooth, planar* **10.3m:** *dipping joint, closed, smooth, planar, clean*	78
11		*Run 6 : 17% limestone 83% shale*	11.7 R7 74.3	TCR = **98%** SCR = **98%** RQD = **98%**	77			0 0 1 0 0 0				77
12					76							76
13		*Run 7 : 8% limestone 92% shale*	13.1 R8 72.7	TCR = **100%** SCR = **100%** RQD = **100%**	75			0 1 1 1 0 0			**13.0m:** *cacium deposits*	75
14		*Run 8 : 9% limestone 91% shale*	14.7 R9 71.2	TCR = **97%** SCR = **97%** RQD = **97%**	74			0 0 0 0 1 0				74
15					73							73
16		*Run 9 : 9% limestone 91% shale*	16.2 R10 69.6	TCR = **95%** SCR = **94%** RQD = **87%**	72			2 0 0 0 2 0			**16.5m:** *vertical joint, clean, closed, smooth, undulating*	72
17		*Run 10 : 6% limestone 94% shale*	17.8 R11 68.9	TCR = **100%** SCR = **96%** RQD = **96%**	71			0 0 0				71
18		*Run 11 : 4% limestone 96% shale*	**18.5m**		70							70
		END OF COREHOLE			69							69

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LOG OF BOREHOLE 105

Terraprobe

Project No. : 1-18-0718	Client : Carriage Gate Homes	Originated by : TG
Date started : January 25, 2019	Project : 535-551 Brant Street	Compiled by : JK
Sheet No. : 1 of 1	Location : Burlington, ON	Checked by : MD

Position : E: 597175, N: 4798018 (UTM 17T) Elevation Datum : Geodetic

Rig type : Big Beaver Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)	Penetration Test Values (Blows / 0.3m) / Undrained Shear Strength (kPa)	Moisture / Plasticity	Headspace Vapour (ppm)	Instrument Details	Unstabilized Water Level	Lab Data and Comments / GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL
0	87.6	**GROUND SURFACE**											
		50mm **ASPHALTIC CONCRETE**											
		50mm **AGGREGATE**											
		FILL, clayey silt, trace to some sand, trace to some gravel, trace asphalt, trace wood fragments, trace rock fragments, stiff, reddish brown, moist		1	SS	9				PID: <5			14 22 46 18 SS1 Analysis: M&I
1				2	SS	13	87			PID: <5			SS2 Analysis: PAH, VOC, PHC
	86.1												
	1.5	**SILT**, some clay, trace sand, trace gravel, very stiff, reddish brown, moist (HALTON TILL)		3	SS	28	86			PID: <5			SS3 Analysis: M&I, PAH, VOC, PHC
2		...at 2.3 m, trace shale fragments, hard, grey with red		4	SS	81 / 200mm				PID: <5			21 18 41 20
	85.0						85						
	2.6	**END OF BOREHOLE**											

Penetration Test Values (Blows / 0.3m): × Dynamic Cone; 10 20 30 40

Undrained Shear Strength (kPa): ○ Unconfined + Field Vane ● Pocket Penetrometer ■ Lab Vane; 40 80 120 160

Moisture / Plasticity: Plastic Limit PL — Natural Water Content MC — Liquid Limit LL; 10 20 30

Borehole was dry and open upon completion of drilling.

50 mm dia. monitoring well installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Mar 15, 2019	dry	n/a
Mar 22, 2019	dry	n/a

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LOG OF BOREHOLE 106

Terraprobe

Project No. : 1-18-0718	Client : Carriage Gate Homes	Originated by : TG
Date started : January 23, 2019	Project : 535-551 Brant Street	Compiled by : JK
Sheet No. : 1 of 2	Location : Burlington, ON	Checked by : MD

Position : E: 597147, N: 4798038 (UTM 17T) | Elevation Datum : Geodetic | Core Diameter : **HQ**, OD=96mm, ID=64mm

Rig type : Truck-mounted | Drilling Method : Hollow stem augers, HQ rock coring

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	87.7	**GROUND SURFACE**				
	87.5	80mm **ASPHALTIC CONCRETE**				
	0.2	80mm **AGGREGATE**		1	SS	7
		FILL, sandy silt, trace gravel, trace asphalt, loose, brown to dark brown, moist		2	SS	7
	86.2					
	1.5	**SILT**, some clay, trace sand, trace gravel, very stiff to hard, reddish brown, moist (HALTON TILL)		3	SS	24
				4	SS	54
	84.7					
	3.0	**INFERRED BEDROCK**, shale, red		5	SS	50 / 125mm
	84.5	**QUEENSTON FORMATION** (See rock core log for details)		1	RUN	
	3.2	..at 3.2 m, transition to sound bedrock		2	RUN	
				3	RUN	
				4	RUN	
				5	RUN	
				6	RUN	
				7	RUN	

Elevation Scale (m): 87, 86, 85, 84, 83, 82, 81, 80, 79, 78, 77, 76

Penetration Test Values (Blows / 0.3m): × Dynamic Cone; 10 20 30 40

Undrained Shear Strength (kPa): ○ Unconfined ● Pocket Penetrometer + Field Vane ■ Lab Vane; 40 80 120 160

Moisture / Plasticity: Plastic Limit | Natural Water Content | Liquid Limit; PL MC LL; 10 20 30

Headspace Vapour (ppm): PID: <5 (SS1); PID: <5 (SS2); PID: <5 (SS3); PID: <5 (SS4); PID: <5 (SS5)

Instrument Details: Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)

GR SA SI CL

SS1 Analysis: PAH

SS2 Analysis: M&I, VOC, PHC

SS3 Analysis: M&I, PAH

0 10 74 16

SS4 Analysis: VOC, PHC

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LOG OF BOREHOLE 106

Terraprobe

Project No. : 1-18-0718	Client : Carriage Gate Homes	Originated by : TG
Date started : January 23, 2019	Project : 535-551 Brant Street	Compiled by : JK
Sheet No. : 2 of 2	Location : Burlington, ON	Checked by : MD

Position : E: 597147, N: 4798038 (UTM 17T) | Elevation Datum : Geodetic | Core Diameter : **HQ**, OD=96mm, ID=64mm

Rig type : Truck-mounted | Drilling Method : Hollow stem augers, HQ rock coring

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)
12		*(continued)*					
		QUEENSTON FORMATION (See rock core log for details) *(continued)*		7	RUN		75
13							
				8	RUN		74
14							
				9	RUN		73
15							
							72
16				10	RUN		
							71
17							
	69.7 18.0						70

Penetration Test Values (Blows / 0.3m): × Dynamic Cone; 10 20 30 40

Undrained Shear Strength (kPa): ○ Unconfined ● Pocket Penetrometer + Field Vane ■ Lab Vane; 40 80 120 160

Moisture / Plasticity: Plastic Limit | Natural Water Content | Liquid Limit; PL MC LL; 10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT): GR SA SI CL

END OF BOREHOLE

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

50 mm dia. monitoring well installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Mar 15, 2019	4.5	83.2
Mar 22, 2019	4.5	83.3

file: 1-18-0718 bh logs.gpj

ROCK CORE LOG 106

Terraprobe

Project No. : 1-18-0718 | Client : Carriage Gate Homes | Originated by : TG

Date started : January 23, 2019 | Project : 535-551 Brant Street | Compiled by : JK

Sheet No. : 1 of 1 | Location : Burlington, ON | Checked by : MD

Position : E: 597147, N: 4798038 (UTM 17T) | Elevation Datum : Geodetic | Core Diameter : **HQ**, OD=96mm, ID=64mm

Rig type : Truck-mounted | Drilling Method : Hollow stem augers, HQ rock coring

Depth (m)	Graphic Log	GENERAL DESCRIPTION	Run / Elev Depth (m)	Recovery	Elevation (m)	Shale Weathering Zones	UCS (MPa) / Estimated Strength	Natural Fractures: Frequency	Natural Fractures: Spacing	Laboratory Testing	Comments	Elevation (m)
		Rock coring started at 3.2m below grade	**84.5**			Z1 Z2 Z3 Z4	R1 R2 R3 R4 R5 R6					
		QUEENSTON FORMATION **calcareous Shale**, red, medium bedded, weak; joints are horizontal, closed to gapped, clean;	3.2 R1 83.4	TCR = **98%** SCR = **88%** RQD = **77%**	84			4 0 1 1			**3.4m:** *dipping joint, clean, smooth, planar, closed*	84
4		interbedded with **limestone**, grey, thinly bedded, medium strong ...at 3.2m, transition to sound bedrock	4.3 R2 81.9	TCR = **95%** SCR = **93%** RQD = **92%**	83			2 2 1				83
5		*Run 1 : 16% limestone* *84% shale*	5.8 R3 80.4	TCR = **100%** SCR = **95%** RQD = **92%**	82			2 0 >10 1 1			**5.8m:** *approx. 75mm core loss* **6.1-6.2m:** *approx. 25mm rubblized* **6.2m:** *orange colour in joint (oxidation)*	82
6		*Run 2 : 16% limestone* *84% shale*										
7		*Run 3 : 21% limestone* *79% shale*			81			0 1 1				81
8		*Run 4 : 32% limestone* *68% shale*	7.3 R4 78.9	TCR = **100%** SCR = **100%** RQD = **100%**	80			1 1 1 1				80
9		*Run 5 : 17% limestone* *83% shale*	8.8 R5 77.3	TCR = **97%** SCR = **90%** RQD = **62%**	79			0 5 4 2 3				79
10		*Run 6 : 3% limestone* *97% shale*	10.4 R6 75.8	TCR = **95%** SCR = **95%** RQD = **95%**	78			0 0 0 1 0				78
11		*Run 7 : 18% limestone* *82% shale*	11.9 R7 74.3	TCR = **100%** SCR = **98%** RQD = **94%**	77			0 0 0 2 0				77
12		*Run 8 : 8% limestone* *92% shale*	13.4 R8 72.8	TCR = **100%** SCR = **100%** RQD = **87%**	76			0 0 0 0 4 1 3			**14.2-14.3m:** *approx. 25mm dipping joint, clean*	76
13					75			0 0 0 0				75
14					74							74
15		*Run 9 : 17% limestone* *83% shale*	14.9 R9 71.2	TCR = **100%** SCR = **100%** RQD = **100%**	73			0 0 0 1 0				73
16					72							72
17		*Run 10 : 5% limestone* *95% shale*	16.5 R10 69.7	TCR = **98%** SCR = **98%** RQD = **98%**	71			0 0 1 0 0				71
			18.0m		70							70
		END OF COREHOLE										

file: 1-18-0718 bh logs.gpj

LOG OF BOREHOLE 107

Terraprobe

Project No. : 1-18-0718	Client : Carriage Gate Homes	Originated by : TG
Date started : January 24, 2019	Project : 535-551 Brant Street	Compiled by : JK
Sheet No. : 1 of 2	Location : Burlington, ON	Checked by : MD

Position : E: 597128, N: 4798019 (UTM 17T) | Elevation Datum : Geodetic | Core Diameter : **HQ**, OD=96mm, ID=64mm

Rig type : Truck-mounted | Drilling Method : Hollow stem augers, HQ rock coring

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
0	87.8	**GROUND SURFACE**				
	87.6	75mm **ASPHALTIC CONCRETE**				
	0.2	75mm **AGGREGATE**		1	SS	11
		FILL, clayey silt, sandy, trace to some gravel, trace asphalt, trace concrete fragments, trace brick, very loose/very soft to stiff/compact, black to dark brown, moist		2	SS	2
	86.3					
2	1.5	**SILT**, some clay, trace sand, trace gravel, very stiff to hard, reddish brown, moist (HALTON TILL)		3	SS	16
				4	SS	50 / 125mm
	84.8					
3	3.0	**INFERRED BEDROCK**, shale, red		5	SS	50 / 25mm
	84.7	**QUEENSTON FORMATION**		1	RUN	
	3.1	(See rock core log for details) ...at 3.6 m, transition to sound bedrock		2	RUN	
5				3	RUN	
6				4	RUN	
8				5	RUN	
9				6	RUN	
10				7	RUN	
11						

Elevation Scale (m): 87, 86, 85, 84, 83, 82, 81, 80, 79, 78, 77, 76

Penetration Test Values (Blows / 0.3m): × Dynamic Cone (10, 20, 30, 40)

Undrained Shear Strength (kPa): ○ Unconfined, ● Pocket Penetrometer, + Field Vane, ■ Lab Vane (40, 80, 120, 160)

Moisture / Plasticity: Plastic Limit (PL) | Natural Water Content (MC) | Liquid Limit (LL) (10, 20, 30)

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT) — GR SA SI CL

SS1 Analysis: M&I, PAH

SS2 Analysis: VOC, PHC

SS3 Analysis: M&I, PAH

SS4 Analysis: VOC, PHC

(continued next page)

LOG OF BOREHOLE 107

Terraprobe

Project No. : 1-18-0718	Client : Carriage Gate Homes	Originated by : TG
Date started : January 24, 2019	Project : 535-551 Brant Street	Compiled by : JK
Sheet No. : 2 of 2	Location : Burlington, ON	Checked by : MD

Position : E: 597128, N: 4798019 (UTM 17T) | Elevation Datum : Geodetic | Core Diameter : **HQ**, OD=96mm, ID=64mm

Rig type : Truck-mounted | Drilling Method : Hollow stem augers, HQ rock coring

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
12		*(continued)*				
		QUEENSTON FORMATION (See rock core log for details) *(continued)*		7	RUN	
13				8	RUN	
14						
15				9	RUN	
16				10	RUN	
17						
18	69.7			11	RUN	
	18.1	**END OF BOREHOLE**				

Elevation Scale (m): 75, 74, 73, 72, 71, 70

Penetration Test Values (Blows / 0.3m): × Dynamic Cone; 10 20 30 40

Undrained Shear Strength (kPa): ○ Unconfined ● Pocket Penetrometer + Field Vane ■ Lab Vane; 40 80 120 160

Moisture / Plasticity: Plastic Limit | Natural Water Content | Liquid Limit; PL MC LL; 10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT): GR SA SI CL

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

50 mm dia. monitoring well installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Mar 15, 2019	4.3	83.5
Mar 22, 2019	4.1	83.7

file: 1-18-0718 bh logs.gpj

ROCK CORE LOG 107

Terraprobe

Project No. : 1-18-0718 | Client : Carriage Gate Homes | Originated by : TG

Date started : January 24, 2019 | Project : 535-551 Brant Street | Compiled by : JK

Sheet No. : 1 of 1 | Location : Burlington, ON | Checked by : MD

Position : E: 597128, N: 4798019 (UTM 17T) | Elevation Datum : Geodetic | Core Diameter : **HQ**, OD=96mm, ID=64mm

Rig type : Truck-mounted | Drilling Method : Hollow stem augers, HQ rock coring

Rock coring started at 3.1m below grade

QUEENSTON FORMATION

calcareous Shale, red, medium bedded, weak; joints are horizontal, closed to gapped, clean;

interbedded with **limestone**, grey, thinly bedded, medium strong

...at 3.6m, transition to sound bedrock

Run 1 : 9% limestone, 91% shale

Run 2 : 33% limestone, 67% shale

Run 3 : 10% limestone, 90% shale

Run 4 : 19% limestone, 81% shale

Run 5 : 30% limestone, 70% shale

Run 6 : 28% limestone, 72% shale

Run 7 : 25% limestone, 75% shale

Run 8 : 9% limestone, 91% shale

Run 9 : 19% limestone, 81% shale

Run 10 : 0% limestone, 100% shale

Run 11 : 8% limestone, 92% shale

END OF COREHOLE

Run	Elev Depth (m)	Recovery	Elevation (m)
	84.7		
R1	3.1 – 83.5	TCR = **100%** SCR = **72%** RQD = **43%**	84
R2	4.3 – 82.0	TCR = **97%** SCR = **92%** RQD = **68%**	83
R3	5.8 – 80.5	TCR = **100%** SCR = **98%** RQD = **97%**	82
R4	7.3 – 79.6	TCR = **100%** SCR = **89%** RQD = **78%**	81
R5	8.2 – 78.0	TCR = **100%** SCR = **97%** RQD = **93%**	80
R6	9.8 – 76.5	TCR = **95%** SCR = **95%** RQD = **90%**	79
R7	11.3 – 75.0	TCR = **95%** SCR = **95%** RQD = **92%**	78
R8	12.8 – 73.6	TCR = **100%** SCR = **100%** RQD = **100%**	77
R9	14.2 – 72.0	TCR = **98%** SCR = **98%** RQD = **81%**	76
R10	15.8 – 70.4	TCR = **100%** SCR = **100%** RQD = **100%**	75
R11	17.4 – 69.7	TCR = **100%** SCR = **100%** RQD = **100%**	74
	18.1m		73
			72
			71
			70

Shale Weathering Zones: Z1 Z2 Z3 Z4

UCS (MPa): 5 25 50 100 250

Estimated Strength: R1 R2 R3 R4 R5 R6

Natural Fractures: Frequency / Spacing

Depth (m)	Frequency
4	>10
5	>10
6	2
7	2
8	1
9	4
10	6
11	>10
12	2
13	0
14	12
15	3
16	2
17	1
18	>10
	1
	2
	1
	1
	1
	0
	4
	0
	2
	2
	1
	0
	0
	0
	0
	1
	2
	0
	0
	0
	1
	0
	0
	0
	3
	2
	1
	0
	0
	0
	0
	0
	0
	0
	0
	0

Laboratory Testing

Comments

- **3.1-3.3m:** *approx. 200mm rubble*
- **3.4-3.5m:** *approx. 25mm rubblized zone*
- **3.5m:** *vertical joint, clean, gapped, smooth, planar*
- **3.5-3.6m:** *approx. 100mm weathered zone, clay with angular blocks*
- **7.3-7.4m:** *approx. 100mm rubblized zone probably caved material*
- **12.5-12.6m:** *approx. 150mm calcium layer*
- **13.4m:** *calcium deposits*
- **15.0m:** *dipping joint, gapped, smooth, planar, clean*
- **15.1-15.1m:** *approx. 40mm dipping joint, smooth, undulating, open, clay infilled*

file: 1-18-0718 bh logs.gpj

LOG OF BOREHOLE 108

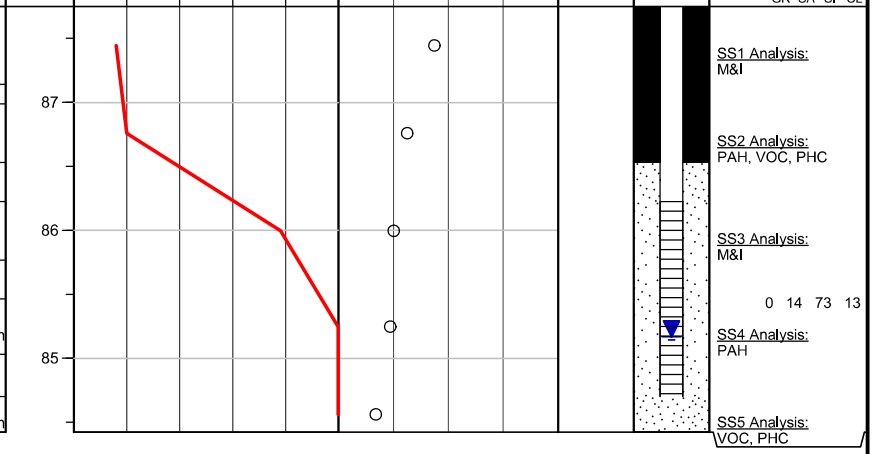
Terraprobe

Project No. : 1-18-0718	Client : Carriage Gate Homes	Originated by : TG
Date started : January 25, 2019	Project : 535-551 Brant Street	Compiled by : JK
Sheet No. : 1 of 1	Location : Burlington, ON	Checked by : MD

Position : E: 597160, N: 4797980 (UTM 17T) Elevation Datum : Geodetic

Rig type : Big Beaver Drilling Method : Solid stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
	87.7	**GROUND SURFACE**				
0	87.5	150mm **PC CONCRETE**				
	0.2	**FILL**, sandy silt, trace gravel, trace rock fragments, loose to compact, dark brown, moist		1	SS	8
1				2	SS	10
	86.2					
	1.5	**SILT**, some clay, trace sand, trace gravel, hard, reddish brown, moist (HALTON TILL)		3	SS	39
2				4	SS	78 / 275mm
	84.7					
3	3.0	**INFERRED BEDROCK**, shale, red		5	SS	50 / 125mm
	84.4					
	3.3	**END OF BOREHOLE**				



Borehole was dry and open upon completion of drilling.

50 mm dia. monitoring well installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Mar 15, 2019	dry	n/a
Mar 22, 2019	2.6	85.2

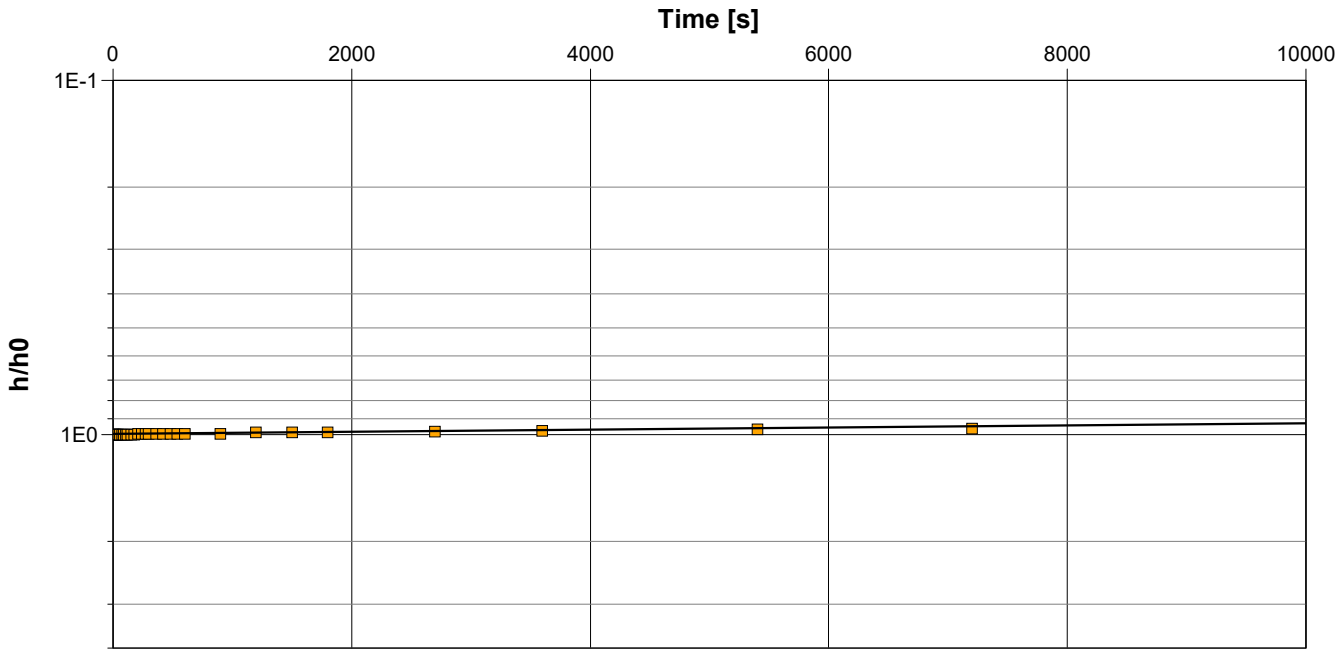
file: 1-18-0718 bh logs.gpj

APPENDIX B



GROUNDED ENGINEERING	**Slug Test Analysis Report**
	Project: 535-551 Brant Street
	Number: 20-016
	Client: Carriage Gate

Location: Burlington, Ontario	Slug Test: BH106	Test Well: BH106
Test Conducted by: LJ		Test Date: 2021-02-04
Analysis Performed by: JN	BH106	Analysis Date: 2021-02-09
Aquifer Thickness: 18.00 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH106	2.74×10^{-9}	

Terraprobe
Consulting Geotechnical & Environmental Engineering
Construction Materials Engineering, Inspection & Testing

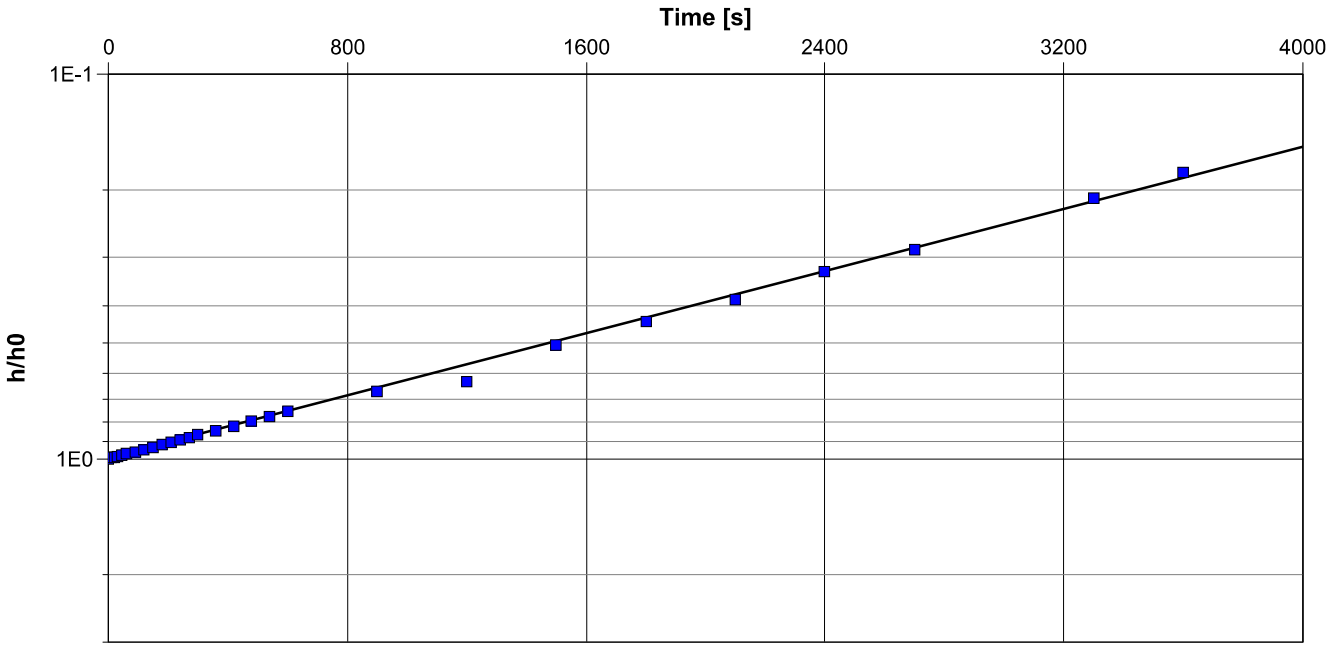
Slug Test Analysis Report

Project: 535 - 551 Brant Street

Number: 1-18-0718-46

Client: Carriage Gate Homes

Location: Burlington	Slug Test: Rising Head Test - BH104	Test Well: BH104
Test Conducted by: TG		Test Date: 2/8/2019
Analysis Performed by: AA	Rising Head Test - BH104	Analysis Date: 4/15/2019
Aquifer Thickness: 18.51 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH104	1.78×10^{-7}	

Terraprobe
Consulting Geotechnical & Environmental Engineering
Construction Materials Engineering, Inspection & Testing

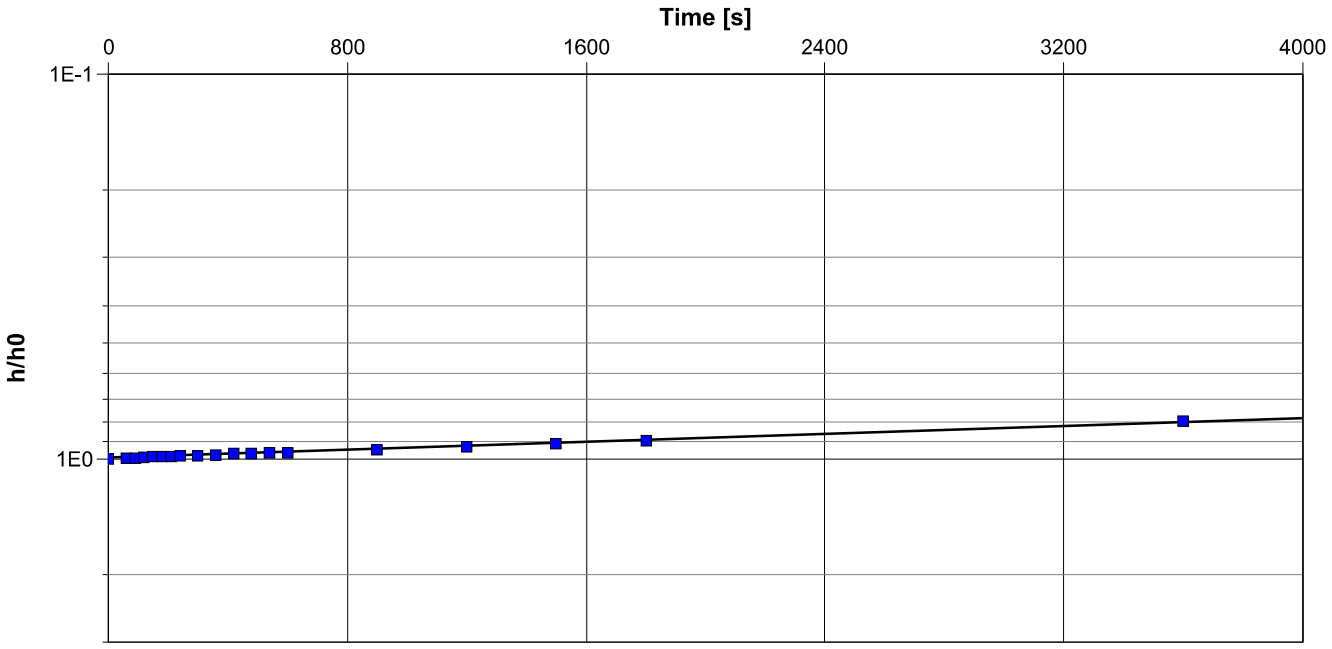
Slug Test Analysis Report

Project: 535 - 551 Brant Street

Number: 1-18-0718-46

Client: Carriage Gate Homes

Location: Burlington	Slug Test: Rising Head Test - BH106	Test Well: BH106
Test Conducted by: TG		Test Date: 2/8/2019
Analysis Performed by: AA	Rising Head Test - BH106	Analysis Date: 4/15/2019
Aquifer Thickness: 18.01 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH106	2.28×10^{-8}	

Terraprobe
Consulting Geotechnical & Environmental Engineering
Construction Materials Engineering, Inspection & Testing

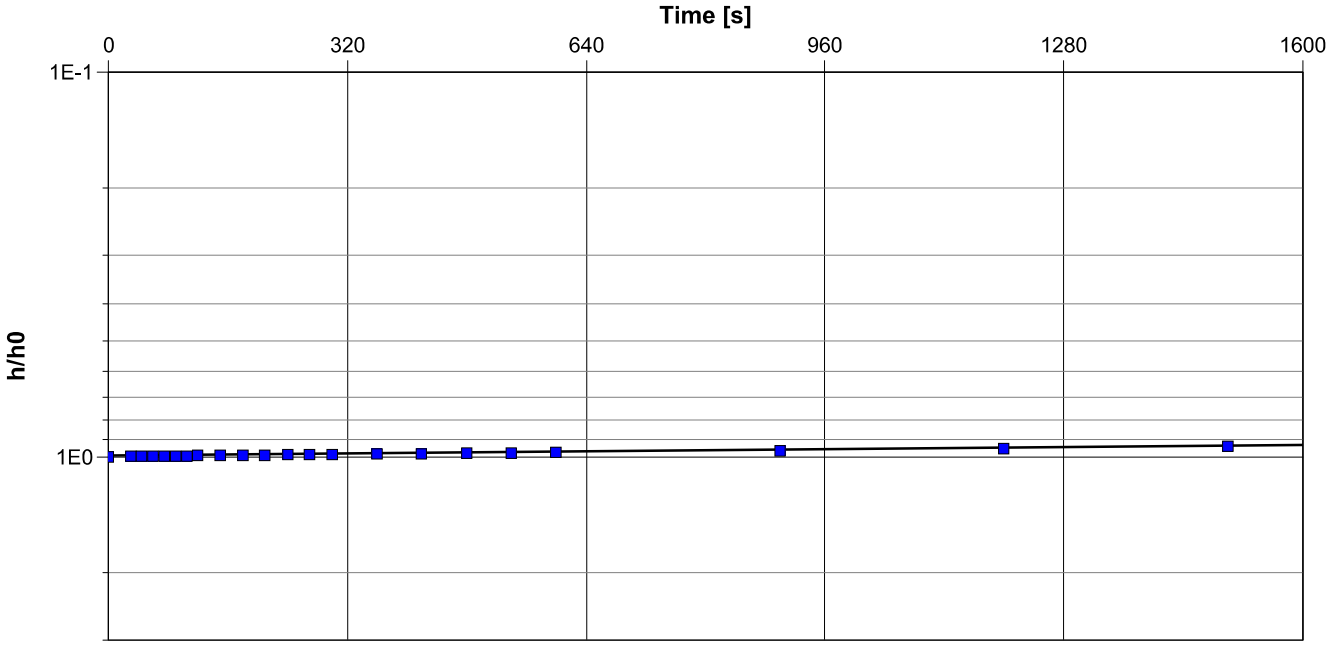
Slug Test Analysis Report

Project: 535 - 551 Brant Street

Number: 1-18-0718-46

Client: Carriage Gate Homes

Location: Burlington	Slug Test: Rising Head Test - BH107	Test Well: BH107
Test Conducted by: TG		Test Date: 2/8/2019
Analysis Performed by: AA	Rising Head Test - BH107	Analysis Date: 4/15/2019
Aquifer Thickness: 18.11 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH107	1.56×10^{-8}	

APPENDIX C



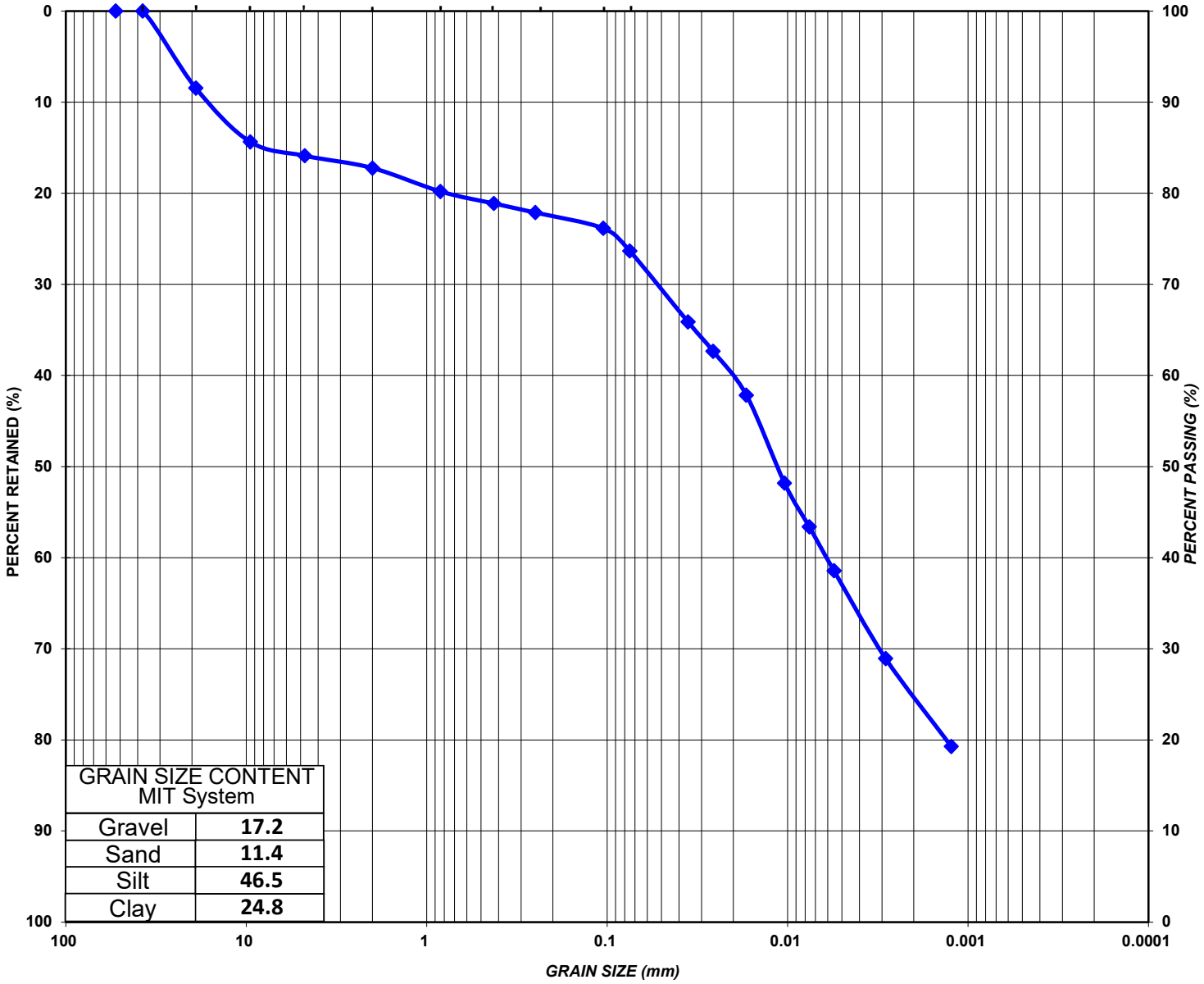
Terraprobe

SIEVE AND HYDROMETER ANALYSIS TEST REPORT

PROJECT: **535 - 551 Brant Street, Burlington, Ontario**
LOCATION: **Burlington, ON**
CLIENT: **Carriage Gate Homes**
BOREHOLE: **104**
SAMPLE NUMBER: **4B**
SAMPLE DEPTH:
SAMPLE DESCRIPTION: **CLAYEY SILT, some gravel, some sand**

FILE NO.: **1-18-0718**
LAB NO.: **1070A**
SAMPLE DATE:
SAMPLED BY:

GRAIN SIZE DISTRIBUTION ANALYSIS



GRAIN SIZE CONTENT MIT System	
Gravel	17.2
Sand	11.4
Silt	46.5
Clay	24.8

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

UNIFIED SYSTEM ASTM D2487	GRAVEL: COARSE	GRAVEL: FINE	SAND: COARSE	SAND: MEDIUM	SAND: FINE	SILT AND CLAY

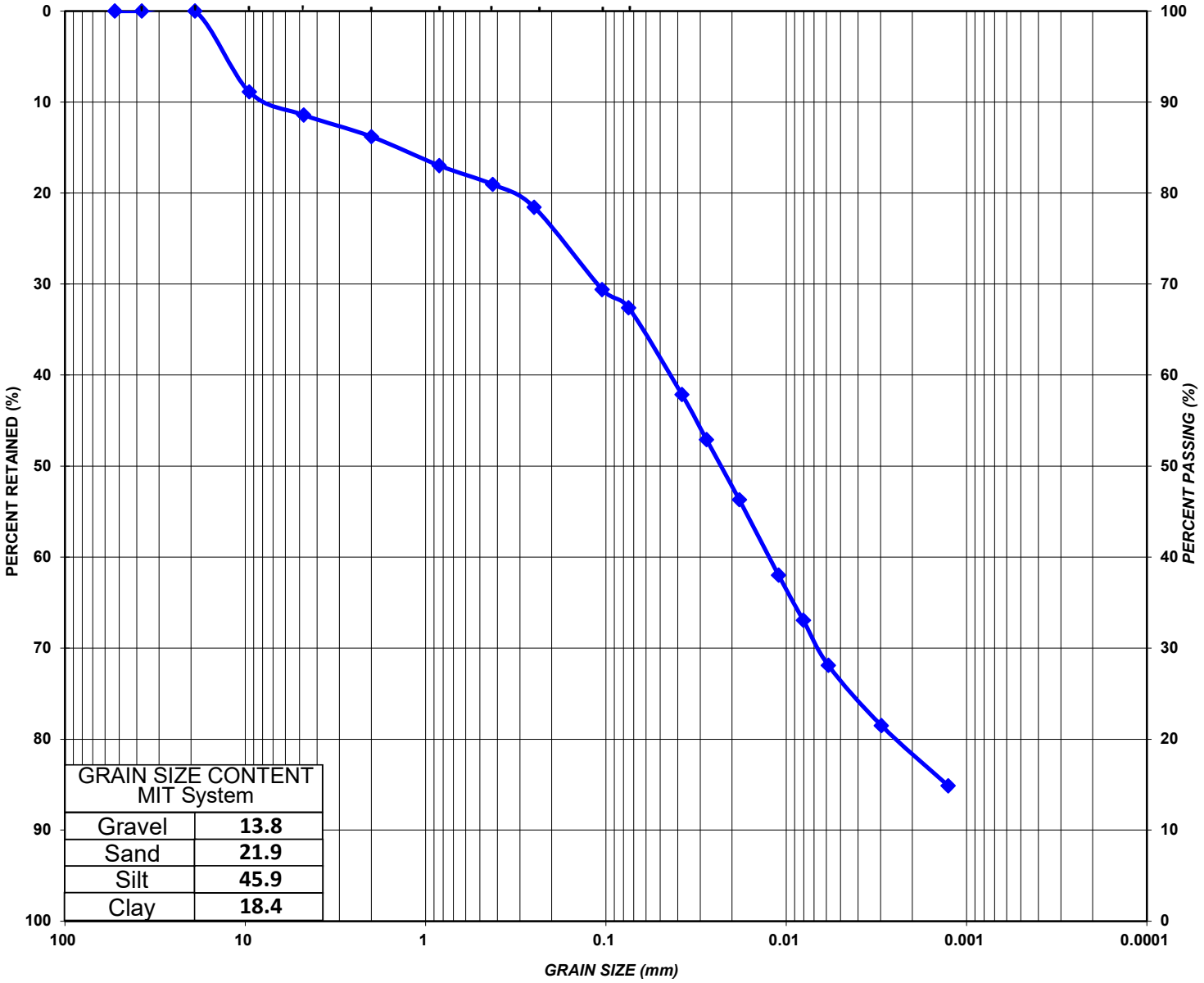
Terraprobe

SIEVE AND HYDROMETER ANALYSIS TEST REPORT

PROJECT: **535 - 551 Brant Street, Burlington, Ontario**
LOCATION: **Burlington, ON**
CLIENT: **Carriage Gate Homes**
BOREHOLE: **105**
SAMPLE NUMBER: **1**
SAMPLE DEPTH:
SAMPLE DESCRIPTION: **SANDY SILT, some clay, some gravel**

FILE NO.: **1-18-0718**
LAB NO.: **1070B**
SAMPLE DATE:
SAMPLED BY:

GRAIN SIZE DISTRIBUTION ANALYSIS



GRAIN SIZE CONTENT MIT System	
Gravel	13.8
Sand	21.9
Silt	45.9
Clay	18.4

MIT SYSTEM	GRAVEL		COARSE	MEDIUM	FINE	SILT	CLAY
			SAND				

UNIFIED SYSTEM ASTM D2487	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY
	GRAVEL		SAND			

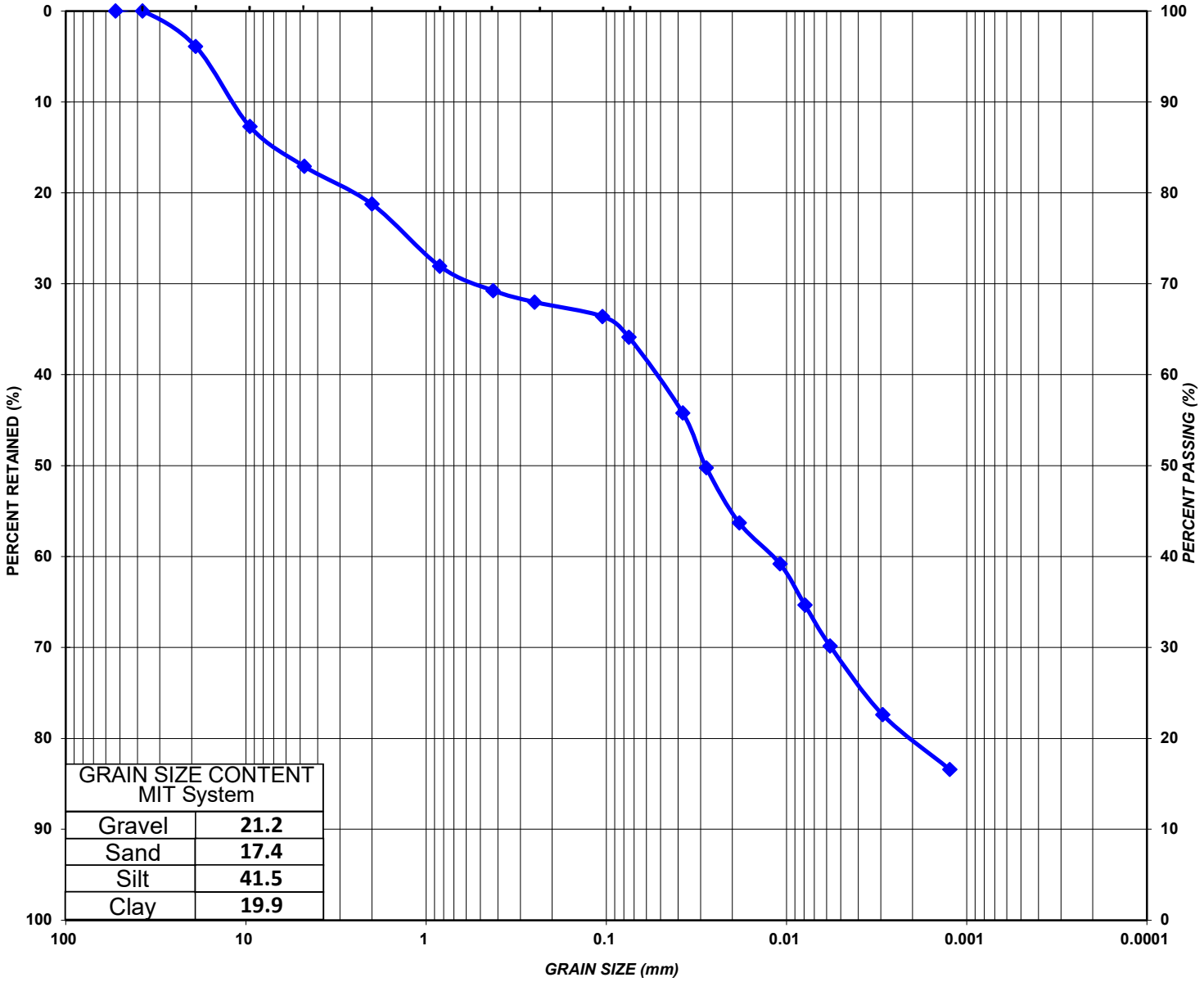
Terraprobe

SIEVE AND HYDROMETER ANALYSIS TEST REPORT

PROJECT: **535 - 551 Brant Street, Burlington, Ontario**
LOCATION: **Burlington, ON**
CLIENT: **Carriage Gate Homes**
BOREHOLE: **105**
SAMPLE NUMBER: **4**
SAMPLE DEPTH:
SAMPLE DESCRIPTION: **GRAVELLY SILT, some clay, some sand**

FILE NO.: **1-18-0718**
LAB NO.: **1070C**
SAMPLE DATE:
SAMPLED BY:

GRAIN SIZE DISTRIBUTION ANALYSIS



GRAIN SIZE CONTENT MIT System	
Gravel	21.2
Sand	17.4
Silt	41.5
Clay	19.9

MIT SYSTEM	GRAVEL		COARSE	MEDIUM	FINE	SILT	CLAY
			SAND				

UNIFIED SYSTEM ASTM D2487	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY
	GRAVEL		SAND			

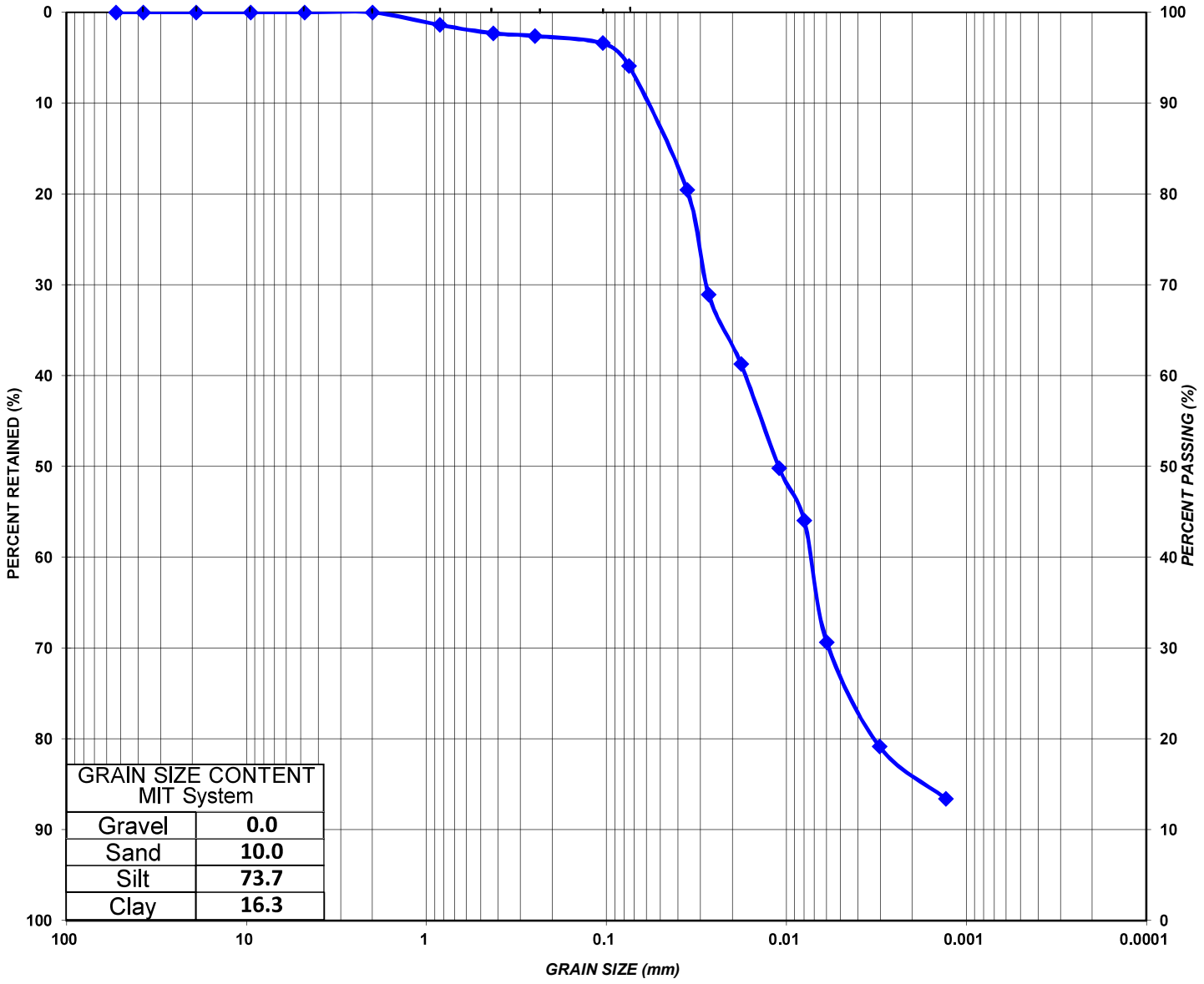
Terraprobe

SIEVE AND HYDROMETER ANALYSIS TEST REPORT

PROJECT: **535 - 551 Brant Street, Burlington, Ontario**
LOCATION: **Burlington, On.**
CLIENT: **Carriage Gate Homes**
BOREHOLE: **106**
SAMPLE NUMBER: **4**
SAMPLE DEPTH: **7'**
SAMPLE DESCRIPTION: **SILT, some clay, trace sand**

FILE NO.: **1-18-0718**
LAB NO.: **1057**
SAMPLE DATE: **Jan 27, 2019**
SAMPLED BY: **TG**

GRAIN SIZE DISTRIBUTION



GRAIN SIZE CONTENT MIT System	
Gravel	**0.0**
Sand	**10.0**
Silt	**73.7**
Clay	**16.3**

MIT SYSTEM	GRAVEL		COARSE	MEDIUM	FINE	SILT	CLAY
			SAND				

UNIFIED SYSTEM ASTM D2487	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY
	GRAVEL		SAND			

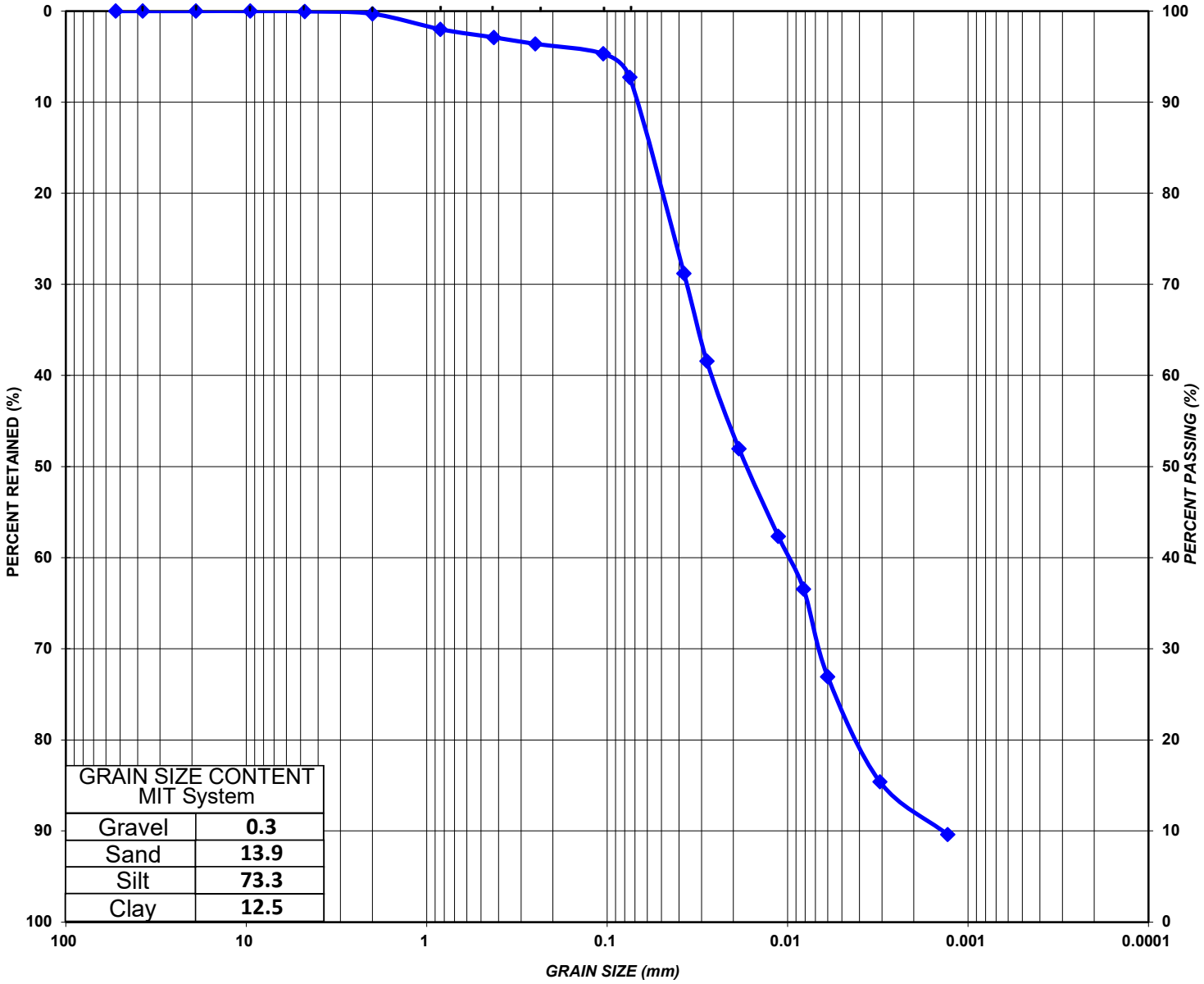
Terraprobe

SIEVE AND HYDROMETER ANALYSIS TEST REPORT

PROJECT: **535 - 551 Brant Street, Burlington, Ontario**
LOCATION: **Burlington, ON**
CLIENT: **Carriage Gate Homes**
BOREHOLE: **108**
SAMPLE NUMBER: **4**
SAMPLE DEPTH:
SAMPLE DESCRIPTION: **SILT, some sand, some clay, trace gravel**

FILE NO.: **1-18-0718**
LAB NO.: **1070D**
SAMPLE DATE:
SAMPLED BY:

GRAIN SIZE DISTRIBUTION ANALYSIS



GRAIN SIZE CONTENT MIT System	
Gravel	0.3
Sand	13.9
Silt	73.3
Clay	12.5

MIT SYSTEM	GRAVEL		COARSE	MEDIUM	FINE	SILT	CLAY
			SAND				
UNIFIED SYSTEM ASTM D2487	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY	
	GRAVEL		SAND				

APPENDIX D



K from Grain Size Analysis Report

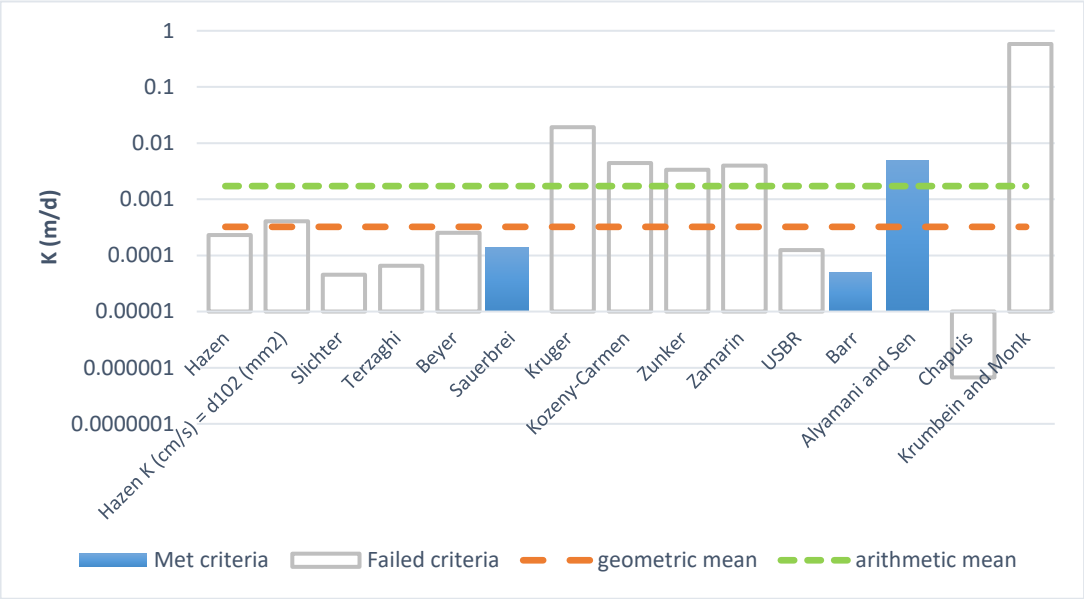
Date: 10-Feb-21

Sample Name: BH104-SS4B

Mass Sample (g): 100

T (oC) 20

Poorly sorted clay low in fines



Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	2.7E-07	2.7E-09	0.00	
Hazen K (cm/s) = d_{10} (mm)	4.7E-07	4.7E-09	0.00	
Slichter	5.3E-08	5.3E-10	0.00	
Terzaghi	7.5E-08	7.5E-10	0.00	
Beyer	2.9E-07	2.9E-09	0.00	
Sauerbrei	1.6E-07	1.6E-09	0.00	
Kruger	2.2E-05	2.2E-07	0.02	
Kozeny-Carmen	5.1E-06	5.1E-08	0.00	
Zunker	3.9E-06	3.9E-08	0.00	
Zamarin	4.6E-06	4.6E-08	0.00	
USBR	1.4E-07	1.4E-09	0.00	
Barr	5.7E-08	5.7E-10	0.00	
Alyamani and Sen	5.7E-06	5.7E-08	0.00	
Chapuis	7.8E-10	7.8E-12	0.00	
Krumbein and Monk	6.7E-04	6.7E-06	0.58	
geometric mean	3.7E-07	3.7E-09	0.00	
arithmetic mean	2.0E-06	2.0E-08	0.00	

K from Grain Size Analysis Report

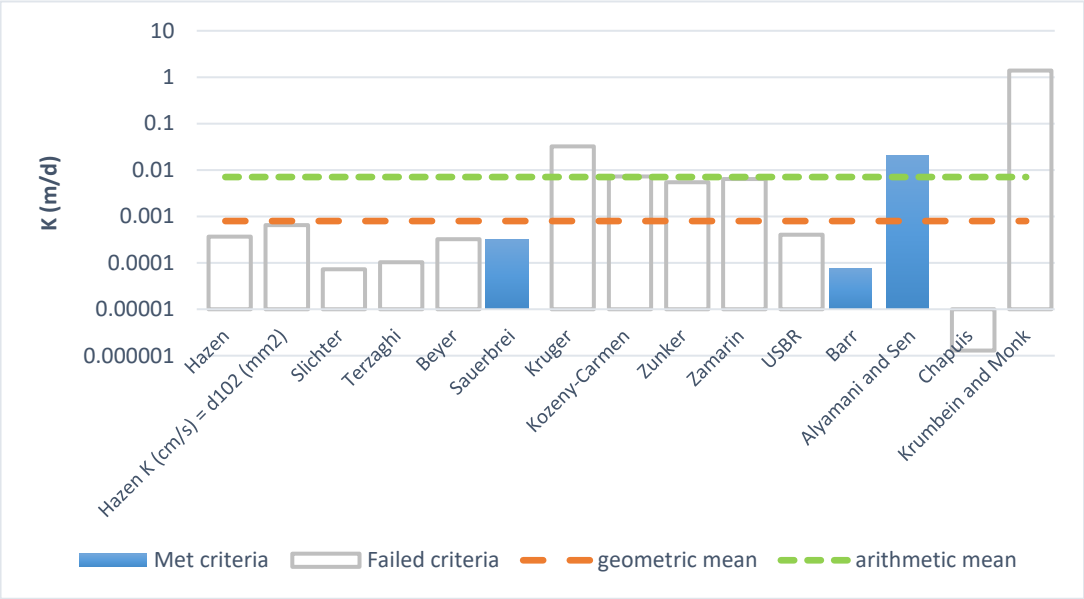
Date: 10-Feb-21

Sample Name: BH105-SS1

Mass Sample (g): 100

T (oC) 20

Poorly sorted silt low in 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)	7.5E-07	7.5E-09	0.00	
Slichter	8.4E-08	8.4E-10	0.00	
Terzaghi	1.2E-07	1.2E-09	0.00	
Beyer	3.7E-07	3.7E-09	0.00	
Sauerbrei	3.6E-07	3.6E-09	0.00	
Kruger	3.7E-05	3.7E-07	0.03	
Kozeny-Carmen	8.4E-06	8.4E-08	0.01	
Zunker	6.4E-06	6.4E-08	0.01	
Zamarin	7.5E-06	7.5E-08	0.01	
USBR	4.7E-07	4.7E-09	0.00	
Barr	9.0E-08	9.0E-10	0.00	
Alyamani and Sen	2.4E-05	2.4E-07	0.02	
Chapuis	1.5E-09	1.5E-11	0.00	
Krumbein and Monk	1.6E-03	1.6E-05	1.40	
geometric mean	9.2E-07	9.2E-09	0.00	
arithmetic mean	8.2E-06	8.2E-08	0.01	

K from Grain Size Analysis Report

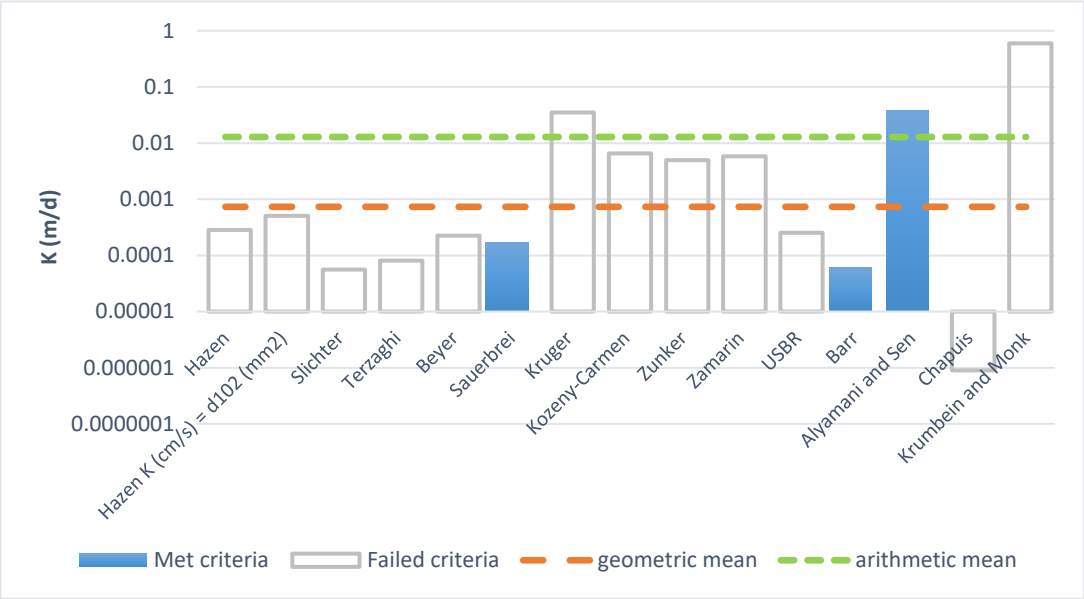
Date: 10-Feb-21

Sample Name: BH105-SS4

Mass Sample (g): 100

T (oC) 20

Poorly sorted silt low in fines



Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	3.3E-07	3.3E-09	0.00	
Hazen K (cm/s) = d_{10} (mm)	5.8E-07	5.8E-09	0.00	
Slichter	6.5E-08	6.5E-10	0.00	
Terzaghi	9.3E-08	9.3E-10	0.00	
Beyer	2.6E-07	2.6E-09	0.00	
Sauerbrei	2.0E-07	2.0E-09	0.00	
Kruger	4.1E-05	4.1E-07	0.04	
Kozeny-Carmen	7.6E-06	7.6E-08	0.01	
Zunker	5.7E-06	5.7E-08	0.00	
Zamarin	6.7E-06	6.7E-08	0.01	
USBR	2.9E-07	2.9E-09	0.00	
Barr	7.0E-08	7.0E-10	0.00	
Alyamani and Sen	4.4E-05	4.4E-07	0.04	
Chapuis	1.0E-09	1.0E-11	0.00	
Krumbein and Monk	6.9E-04	6.9E-06	0.60	
geometric mean	8.5E-07	8.5E-09	0.00	
arithmetic mean	1.5E-05	1.5E-07	0.01	

K from Grain Size Analysis Report

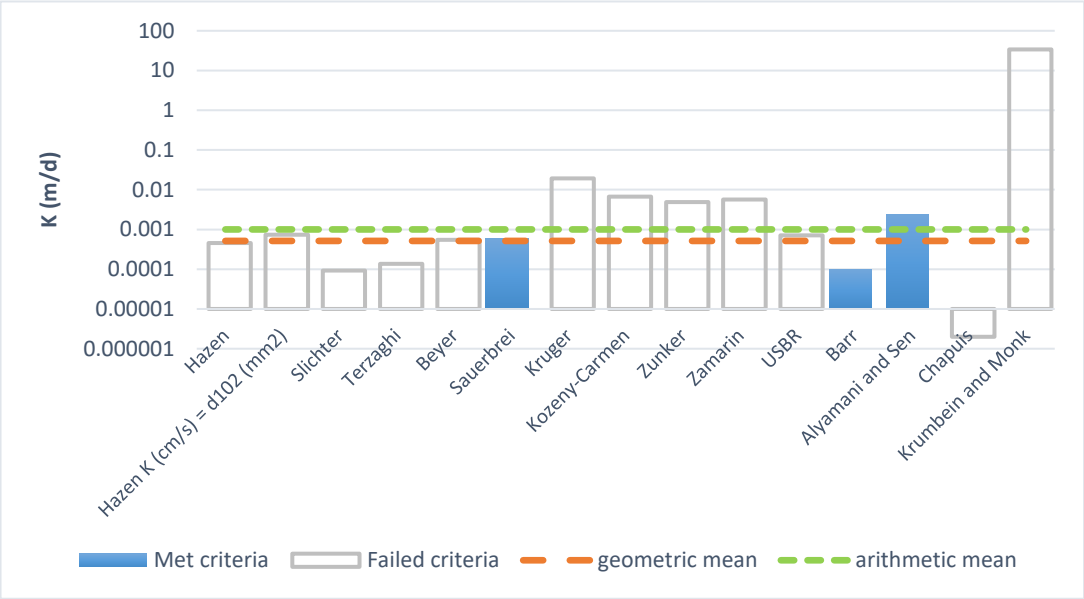
Date: 10-Feb-21

Sample Name: BH106-SS4

Mass Sample (g): 100

T (oC) 20

Poorly sorted clay low in fines



Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	5.3E-07	5.3E-09	0.00	
Hazen K (cm/s) = d_{10} (mm)	8.6E-07	8.6E-09	0.00	
Slichter	1.1E-07	1.1E-09	0.00	
Terzaghi	1.6E-07	1.6E-09	0.00	
Beyer	6.4E-07	6.4E-09	0.00	
Sauerbrei	6.8E-07	6.8E-09	0.00	
Kruger	2.2E-05	2.2E-07	0.02	
Kozeny-Carmen	7.7E-06	7.7E-08	0.01	
Zunker	5.6E-06	5.6E-08	0.00	
Zamarin	6.6E-06	6.6E-08	0.01	
USBR	8.2E-07	8.2E-09	0.00	
Barr	1.2E-07	1.2E-09	0.00	
Alyamani and Sen	2.7E-06	2.7E-08	0.00	
Chapuis	2.3E-09	2.3E-11	0.00	
Krumbein and Monk	4.0E-02	4.0E-04	34.21	
geometric mean	6.0E-07	6.0E-09	0.00	
arithmetic mean	1.2E-06	1.2E-08	0.00	

K from Grain Size Analysis Report

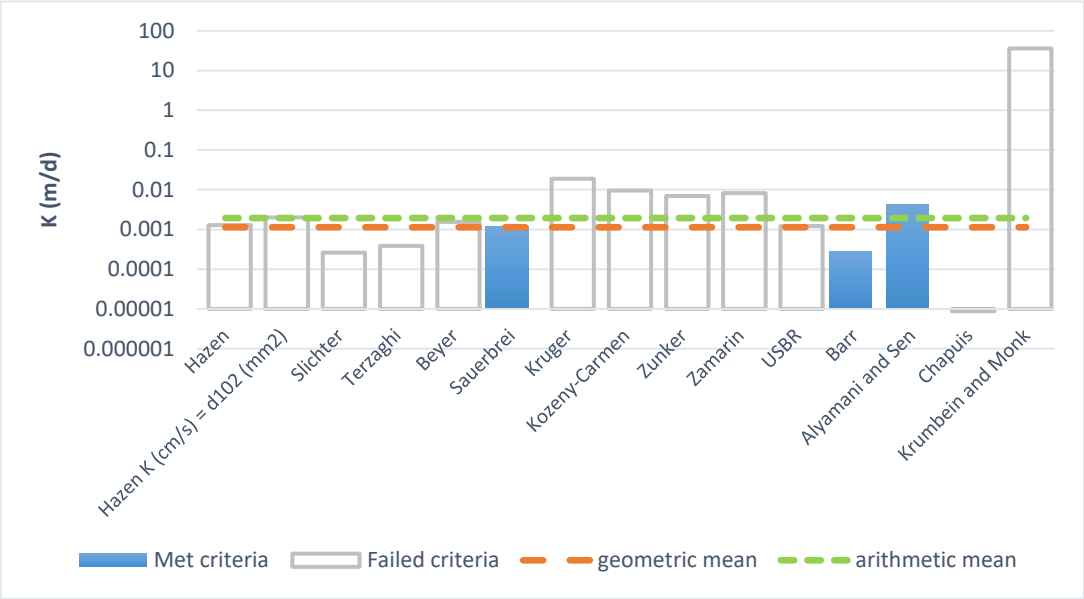
Date: 10-Feb-21

Sample Name: BH108-SS4

Mass Sample (g): 100

T (oC) 20

Poorly sorted silt low in fines



Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	1.5E-06	1.5E-08	0.00	
Hazen K (cm/s) = d_{10} (mm)	2.3E-06	2.3E-08	0.00	
Slichter	3.0E-07	3.0E-09	0.00	
Terzaghi	4.5E-07	4.5E-09	0.00	
Beyer	1.8E-06	1.8E-08	0.00	
Sauerbrei	1.4E-06	1.4E-08	0.00	
Kruger	2.2E-05	2.2E-07	0.02	
Kozeny-Carmen	1.1E-05	1.1E-07	0.01	
Zunker	8.1E-06	8.1E-08	0.01	
Zamarin	9.6E-06	9.6E-08	0.01	
USBR	1.4E-06	1.4E-08	0.00	
Barr	3.3E-07	3.3E-09	0.00	
Alyamani and Sen	5.0E-06	5.0E-08	0.00	
Chapuis	1.0E-08	1.0E-10	0.00	
Krumbein and Monk	4.2E-02	4.2E-04	36.07	
geometric mean	1.3E-06	1.3E-08	0.00	
arithmetic mean	2.2E-06	2.2E-08	0.00	

Adopting the equation form presented in Vukovic and Soro (1992),

$$K = \frac{\rho g}{\mu} N \varphi(n) d_e^2$$

the following values and equations aresubstituted into the appropriate terms to evalute the models listed in the table below. The values of d_e to be entered should be in cm units. The values of K calculated have the units cm/s, except for the Alyamani and Sen model (see footnote).

Source	N	$\varphi(n)$	d_e	Applicable Conditions
Hazen simplified (Freeze and Cherry, 1979)	$10\frac{\mu}{\rho g}$	1	d_{10}	uniformly graded sand, n = 0.375 T = 10 °C
Hazen (1892)[a]	6×10^{-4}	$[1 + 10(n - 0.26)]$	d_{10}	0.01 cm < d_{10} < 0.3 cm U < 5
Slichter (1898)[a]	1×10^{-2}	$n^{3.287}$	d_{10}	0.01 cm < d_{10} < 0.5 cm
Terzaghi (1925)[a]	10.7×10^{-3} smooth grains 6.1×10^{-3} coarse grains	$\left(\frac{n - 0.13}{\sqrt[3]{1-n}}\right)^2$	d_{10}	sandy soil, coarse sand
Beyer (1964)[a]	$5.2 \times 10^{-4} \log\frac{500}{U}$	1	d_{10}	0.006 cm < d_{10} <0.06 cm $1 < U < 20$
Sauerbrei (1932)[a] (Vuković and Soro, 1992)	$(3.75 \times 10^{-5}) \times \tau$ $\tau \cong 1.093 \times 10^{-4} T^2 + 2.102 \times 10^{-2} T + 0.5889$	$\frac{n^3}{(1-n)^2}$	d_{17}	sand and sandy clay d_{17} < 0.05 cm
Krüger (1919)[a]	4.35×10^{-4}	$\frac{n}{(1-n)^2}$	$\frac{1}{\sum_{i=1}^{n} \frac{\Delta w_i}{d_i}}$	medium sand $U > 5$ T = 0 °C
Kozeny-Carmen (1953)[a]	8.3×10^{-3}	$\frac{n^3}{(1-n)^2}$	d_{10} or $\frac{1}{\frac{3}{2}\frac{\Delta w_1}{d_1} + \sum_{i=2}^{n} \Delta g_i \frac{d_i^g + d_i^d}{2 d_i^g d_i^d}}$ $d_1 = \frac{1}{\frac{1}{2}\left(\frac{1}{d_i^g} + \frac{1}{d_i^d}\right)}$	Coarse sand
Zunker (1930)[a]	0.7×10^{-3} for nonuniform, clayey, angular grains 1.2×10^{-3} for nonuniform 1.4×10^{-3} for uniform, coarse grains 2.4×10^{-3} for uniform sand, well rounded grains	$\frac{n}{(1-n)}$	$\frac{1}{\sum_{i=1}^{n} \Delta g_i \frac{d_i^g - d_i^d}{d_i^g d_i^d ln\left(\frac{d_i^g}{d_i^d}\right)}}$	no fractions finer than d = 0.0025 mm
Zamarin (1928)[a]	8.65×10^{-3}	$\frac{n^3}{(1-n)^2} C_n$ $C_n = (1.275 - 1.5n)^2$	$\frac{1}{\sum_{i=1}^{n} \Delta g_i \frac{\ln\left(\frac{d_i^g}{d_i^d}\right)}{d_i^g - d_i^d}}$	Large grained sands with no fractions having d < 0.00025 mm
USBR (United States Bureau of Reclamation) (Bialas, 1966)[a]	$(4.8 \times 10^{-4})(10^{0.3})$	1.0	$d_{20}^{1.15}$	Medium grained sands with U < 5; derived for T = 15 °C
Barr (2001)	$\frac{1}{(36)5C_s^2}$ C_s^2 = 1 for spherical grains C_s^2 = 1.35 for angular grains	$\frac{n^3}{(1-n)^2}$	d_{10}	unspecified
Alyamani and Sen (1993)	1300	1.0	$[I_o + 0.025(d_{50} - d_{10})]$	unspecified
Chapuis (2004)	$\frac{\mu}{\rho g}$	$10^{1.291\xi - 0.6435}$ $\xi = \frac{n}{1-n}$	$d_{10}^{\left(\frac{10^{(0.5304 - 0.2937\xi)}}{2}\right)}$	$0.3 < n < 0.7$ $0.10 < d_{10} < 2.0$ mm $2 < U < 12$ $d_{10}/d_5 < 1.4$
Krumbein and Monk (1942)	7.501×10^{-6}	$e^{(-1.31 \times \sigma_\phi)}$ $\sigma_\phi = \frac{\frac{d_{84\phi} - d_{16\phi}}{4} + \frac{d_{95\phi} - d_{5\phi}}{6.6}}{2}$	$2^{\left(\frac{d_{16\phi} + d_{50\phi} + d_{84\phi}}{3}\right)}$	natural sands with lognormal grain size distribution

* indicates formulas were taken from Vuković and Soro, (1992)
N = constant dependent on characteristics of the porous medium
$\varphi(n)$ = function of porosity
T = water temp. (°C)
g = 980 cm s^{-2}
$\rho = 3.1 \times 10^{-8} T^3 - 7.0 \times 10^{-6} T^2 + 4.19 \times 10^{-5} T + 0.99985$
$\mu = -7.0 \times 10^{-8} T^3 + 1.002 \times 10^{-5} T^2 - 5.7 \times 10^{-4} T + 0.0178$
$\tau = 1.093 \times 10^{-4} T^2 + 2.102 \times 10^{-2} T + 0.5889$
n = porosity as fraction of aquifer volume
d_i^g = the maximum grain diameter in fraction i
d_i^d = the minimum grain diameter in fraction i
d_{10} = grain size (cm) corresponding to 10% by weight passing through the sieves
d_{20} = grain size (cm) corresponding to 20% by weight passing through the sieves
d_{50} = grain size (cm) corresponding to 50% by weight passing through the sieves
d_{60} = grain size (cm) corresponding to 60% by weight passing through the sieves
$U = d_{60}/d_{10}$
Δg_i = the fraction of mass that passes between sieves i and $i+1$ where i is the smaller sieve
Δw_i = fraction of total weight of sample with fraction identifier 'i'
d_i = mean grain diameter of the fraction i
$d_{i\phi}$ = mean grain diameter of the fraction i in phi units ($\phi = \log_2 (d_e/d_o)$, d_e in mm, d_o = 1 mm)
I_o = x-intercept (grain size) of a percent grain retention curve plotted on arithmetic axes and focussing on data below 50% retained

References

(1) Aguilar, J.R. 2013. Analysis of grain size distribution and hydraulic conductivity for a variety of sediment types with application to wadi sediments. M.B2:B19S. thesis submitted to King Abdullah University of Science and Technology, Thuwal, Kingdom of Saudi Arabia, 134 pp.

(2) Alyamani, M.S., Sen Z. 1993. Determination of hydraulic conductivity from complete grain-size distribution curves. Ground Water, v. 31, no. 4, 551-555.

(3) Barr, D.W. 2001. Coefficient of permeability determined by measurable parameters. Ground Water, v. 39, no. 3, 356-361.

(4) Barth, G.R., Hill, M.C., Illangasekare, T.H., Rajaram, H. 2001. Predictive modeling of flow and transport in a two-dimensional intermediate-scale, heterogeneous porous medium. Water Resources Research, v. 37, no. 10, 2503–2512.

(5) Beyer, W. 1964. "Zur Bestimmung der Wasserdurchlässigkeit von Kiesen und Sanden aus der Kornverteilungskurve." Wasserwirtschaft-Wassertechnik 14(6): 165-168.

(6) Białas, Z. (1966). O usrednianiu wspolczynnikow filtracji z zastosowaniem elektronicznej cyfrowej maszyny matematycznej (Averaging filter coefficients using digital electronic mathematical machines). Przedsiebiorstwo Geologiczne we Wroclawiu: 47-50.

(7) Chapuis, R.P. 2004. Predicting the saturated hydraulic conductivity of sand and gravel using effective diameter and void ratio. Canadian Geotechnical Journal, v. 41, 787–795.

(8) Devlin, J.F. (2015). HydrogeoSieveXL. Excel-based Visual Basic tool freely available at http://www.people.ku.edu/~jfdevlin/Publications.html. Cited 18 February, 2015.

(9) Dullien, F.A., 1991. Fluid Transport and Pore Structure. Academic Press, San Diego, CA.

(10) Freeze, R.A., Cherry, J.A. 1979. Groundwater. Prentice Hall, Englewood Cliffs, New Jersey.

(11) Fuchs, S. (2010) Deterministische kf-Wert-Schätzung nach petrographischer Bohrgutansprache (Deterministic kf value estimation from petrographic borehole records). Grundwasser – Zeitschrift der Fachsektion Hydrogeologie 15: 177–189.

(12) Hazen, A. 1892. Some physical properties of sands and gravels, with special reference to their use in filtration. Massachusetts State Board of Health, vol. 24th annual report, pp. 539-556.

(13) Kasenow, M., 2002, Determination of Hydraulic Conductivity from Grain Size Analysis: Water Resources Publications, LLC, Highlands Ranch, Colorado, 97p.

(14) Kozeny, J. (1953). Das Wasser im Boden. Grundwasserbewegung (The water in the ground. Groundwater flow). Hydraulik, Springer, p 380-445.

(15) Krüger, E., 1919. Die Grundwasserbewegung (Groundwater flow). Int. Mitt. Bodenk. 8, 105–122.

(16) Krumbein, W.C., Monk, G.D. 1942. Permeability as a function of the size parameters of unconsolidated sand. American Institute of Mining and Metallurgical Engineers, Transactions v. 151, 153-163.

(17) Moreau, J.P. Program to demonstrate the Akima spline fitting of Function SIN(X) in double precision. http://jean-pierre.moreau.pagesperso-orange.fr/Fortran/akima_f90.txt . Cited 30 January, 2015.

(18) Odong, J. 2013. Evaluation of empirical formulae for determination of hydraulic conductivity based on grain-size analysis. International Journal of Agriculture and Environment, v. 1, 1-8.

(19) Rosas, J., Lopez, O., Missimer, T.M., Coulibaly, K.M., Dehwah, A.H.A., Sesler, K., Lujan, L.R., Mantilla, D. 2014. Determination of hydraulic conductivity from grain-size distribution for different depositional environments. Groundwater, v. 52, no. 3, 399-413.

(20) Slichter, C.S., 1898, Theoretical investigations of the motion of ground waters: United States Geological Survey, 19 th Annual Report, p 295-384.

(21) Terzaghi, K., 1925, Principles of soil mechanics: Engineering News-Record, v. 95, p 832.

(22) Urumovic, K., Urumovic, K. Sr. 2106. The referential grain size and effective porosity in the Kozeny–Carman model. Hydrological Earth System Science, v. 20, 1669-1680.

(23) Vukovic, M., Soro, A. 1992. Determinatiion of hydraulic conductivity of porous media from grain-size composition. Miladinov, D., translator, Water Resources Publications, Littleton, Colorado, USA, 83 pp.

(24) Zamarin, J.A. 1928. Calculation of ground-water flow (in Russian). Trudey I.V.H. Taskeni.

(25) Zunker, F. (1930). Das Verhalten des Wassers zum Boden (The behavior of groundwater). Zeitschrift für Pflanzenernährung, Düngung und Bodenkunde. A25(1): 7.

APPENDIX E



Your Project #: 21-016
Site Location: 535-551 BRANT STREET
Your C.O.C. #: 812312-02-01

Attention: Jason Ngo

Grounded Engineering Inc.
12 Banigan Drive
Toronto, ON
CANADA M4H 1E9

Report Date: 2021/02/18
Report #: R6522954
Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

BV LABS JOB #: C131452
Received: 2021/02/04, 17:25

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Carbonaceous BOD	1	2021/02/05	2021/02/10	CAM SOP-00427	SM 23 5210B m
Total Cyanide	1	2021/02/05	2021/02/05	CAM SOP-00457	OMOE E3015 5 m
Fluoride	1	2021/02/05	2021/02/08	CAM SOP-00449	SM 23 4500-F C m
Mercury in Water by CVAA	1	2021/02/08	2021/02/08	CAM SOP-00453	EPA 7470A m
Total Metals Analysis by Axial ICP	1	2021/02/08	2021/02/08	CAM SOP-00408	EPA 6010D m
E.coli, (CFU/100mL)	1	N/A	2021/02/04	CAM SOP-00552	MOE LSB E3371
Animal and Vegetable Oil and Grease	1	N/A	2021/02/10	CAM SOP-00326	EPA1664B m,SM5520B m
Total Oil and Grease	1	2021/02/10	2021/02/10	CAM SOP-00326	EPA1664B m,SM5520B m
OC Pesticides (Selected) & PCB (1)	1	2021/02/12	2021/02/14	CAM SOP-00307	EPA 8081A/8082B m
OC Pesticides Summed Parameters	1	N/A	2021/02/05	CAM SOP-00307	EPA 8081A/8082B m
PAH Compounds in Water by GC/MS (SIM)	1	2021/02/09	2021/02/10	CAM SOP-00318	EPA 8270D m
pH	1	2021/02/05	2021/02/08	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	1	N/A	2021/02/05	CAM SOP-00444	OMOE E3179 m
Sulphate by Automated Colourimetry	1	N/A	2021/02/08	CAM SOP-00464	EPA 375.4 m
Total Kjeldahl Nitrogen in Water	1	2021/02/05	2021/02/09	CAM SOP-00938	OMOE E3516 m
Mineral/Synthetic O & G (TPH Heavy Oil) (2)	1	2021/02/10	2021/02/10	CAM SOP-00326	EPA1664B m,SM5520F m
Total Suspended Solids	1	2021/02/08	2021/02/08	CAM SOP-00428	SM 23 2540D m
Volatile Organic Compounds in Water	1	N/A	2021/02/06	CAM SOP-00228	EPA 8260C 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

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

Your Project #: 21-016
Site Location: 535-551 BRANT STREET
Your C.O.C. #: 812312-02-01

Attention: Jason Ngo

Grounded Engineering Inc.
12 Banigan Drive
Toronto, ON
CANADA M4H 1E9

Report Date: 2021/02/18
Report #: R6522954
Version: 2 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

BV LABS JOB #: C131452
Received: 2021/02/04, 17:25

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) Chlordane (Total) = Alpha Chlordane + Gamma Chlordane
(2) Note: TPH (Heavy Oil) is equivalent to Mineral / Synthetic Oil & Grease

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Marijane Cruz, Senior Project Manager
Email: Marijane.Cruz@bureauveritas.com
Phone# (905)817-5756
==========
BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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BV Labs Job #: C131452
Report Date: 2021/02/18

Grounded Engineering Inc.
Client Project #: 21-016
Site Location: 535-551 BRANT STREET
Sampler Initials: LJ

BURLINGTON STORM SEWER (WATER)

BV Labs ID		OTT576		
Sampling Date		2021/02/04 15:00		
COC Number		812312-02-01		
	UNITS	SW-UF-BH107	RDL	QC Batch
Microbiological				
Escherichia coli	CFU/100mL	<10	10	7186157

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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BV Labs Job #: C131452
Report Date: 2021/02/18

Grounded Engineering Inc.
Client Project #: 21-016
Site Location: 535-551 BRANT STREET
Sampler Initials: LJ

HALTON SANITARY & COMBINED SEWER (2-03)

BV Labs ID				OTT576		
Sampling Date				2021/02/04 15:00		
COC Number				812312-02-01		
	UNITS	Criteria	Criteria-2	SW-UF-BH107	RDL	QC Batch
Calculated Parameters						
Total Animal/Vegetable Oil and Grease	mg/L	150	-	0.90	0.50	7184589
Inorganics						
Total Carbonaceous BOD	mg/L	300	-	8	2	7186348
Fluoride (F-)	mg/L	10	-	0.26	0.10	7187178
Total Kjeldahl Nitrogen (TKN)	mg/L	100	-	17	0.50	7187910
pH	pH	6.0:10.0	6.5:8.5	7.11		7187190
Phenols-4AAP	mg/L	1	0.008	<0.0010	0.0010	7186836
Total Suspended Solids	mg/L	350	15	**98**	10	7189743
Dissolved Sulphate (SO4)	mg/L	1500	-	980	5.0	7187230
Total Cyanide (CN)	mg/L	2	0.02	<0.0050	0.0050	7187280
Petroleum Hydrocarbons						
Total Oil & Grease	mg/L	-	-	0.90	0.50	7193509
Total Oil & Grease Mineral/Synthetic	mg/L	-	-	<0.50	0.50	7193515
Metals						
Total Aluminum (Al)	mg/L	50	-	<1	1	7189582
Total Antimony (Sb)	mg/L	5	-	<0.2	0.2	7189582
Total Arsenic (As)	mg/L	1	0.02	**<0.1 (1)**	0.1	7189582
Total Beryllium (Be)	mg/L	5	-	<0.005	0.005	7189582
Total Cadmium (Cd)	mg/L	1	0.008	**<0.02 (1)**	0.02	7189582
Total Chromium (Cr)	mg/L	3	0.08	**<0.1 (1)**	0.1	7189582
Total Cobalt (Co)	mg/L	5	-	<0.02	0.02	7189582
Total Copper (Cu)	mg/L	3	0.04	**<0.1 (1)**	0.1	7189582
Total Iron (Fe)	mg/L	50	-	6.3	0.2	7189582
Total Lead (Pb)	mg/L	3	0.12	<0.1	0.1	7189582
Total Manganese (Mn)	mg/L	5	0.05	**1.8**	0.01	7189582
Mercury (Hg)	mg/L	0.05	0.0004	<0.00010	0.00010	7189828
Total Molybdenum (Mo)	mg/L	5	-	<0.05	0.05	7189582
Total Nickel (Ni)	mg/L	3	0.08	<0.05	0.05	7189582

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: SW-UF Sewer Unfiltered City of Burlington Storm Sewer Discharge
(1) RDL exceeds criteria

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

BV Labs Job #: C131452
Report Date: 2021/02/18

Grounded Engineering Inc.
Client Project #: 21-016
Site Location: 535-551 BRANT STREET
Sampler Initials: LJ

HALTON SANITARY & COMBINED SEWER (2-03)

BV Labs ID				OTT576		
Sampling Date				2021/02/04 15:00		
COC Number				812312-02-01		
	UNITS	Criteria	Criteria-2	SW-UF-BH107	RDL	QC Batch
Total Phosphorus (P)	mg/L	10	0.4	**<0.5 (1)**	0.5	7189582
Total Selenium (Se)	mg/L	5	0.02	**<0.2 (1)**	0.2	7189582
Total Silver (Ag)	mg/L	5	0.12	<0.1	0.1	7189582
Total Tin (Sn)	mg/L	5	-	<0.2	0.2	7189582
Total Titanium (Ti)	mg/L	5	-	<0.05	0.05	7189582
Total Zinc (Zn)	mg/L	3	0.04	**<0.05 (1)**	0.05	7189582
Polyaromatic Hydrocarbons						
Naphthalene	ug/L	140	-	<0.050	0.050	7193106
Volatile Organics						
Benzene	ug/L	10	2	<0.40	0.40	7184452
Chloroform	ug/L	40	2	0.83	0.40	7184452
1,2-Dichlorobenzene	ug/L	-	5.6	<0.80	0.80	7184452
1,4-Dichlorobenzene	ug/L	80	6.8	<0.80	0.80	7184452
cis-1,2-Dichloroethylene	ug/L	-	5.6	<1.0	1.0	7184452
trans-1,3-Dichloropropene	ug/L	-	5.6	<0.80	0.80	7184452
Ethylbenzene	ug/L	160	2	<0.40	0.40	7184452
Methylene Chloride(Dichloromethane)	ug/L	2000	5.2	<4.0	4.0	7184452
1,1,2,2-Tetrachloroethane	ug/L	-	17	<0.80	0.80	7184452
Tetrachloroethylene	ug/L	1000	4.4	<0.40	0.40	7184452
Toluene	ug/L	16	2	<0.40	0.40	7184452
Trichloroethylene	ug/L	400	7.6	<0.40	0.40	7184452
Surrogate Recovery (%)						
D10-Anthracene	%	-	-	107		7193106
D14-Terphenyl (FS)	%	-	-	91		7193106
D8-Acenaphthylene	%	-	-	94		7193106
4-Bromofluorobenzene	%	-	-	95		7184452
D4-1,2-Dichloroethane	%	-	-	112		7184452
D8-Toluene	%	-	-	95		7184452

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: SW-UF Sewer Unfiltered City of Burlington Storm Sewer Discharge
(1) RDL exceeds criteria

Bureau Veritas Laboratories 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

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

BV Labs Job #: C131452
Report Date: 2021/02/18

Grounded Engineering Inc.
Client Project #: 21-016
Site Location: 535-551 BRANT STREET
Sampler Initials: LJ

ORGANOCHLORINATED PESTICIDES BY GC-ECD (WATER)

BV Labs ID			OTT576		
Sampling Date			2021/02/04 15:00		
COC Number			812312-02-01		
	UNITS	Criteria	SW-UF-BH107	RDL	QC Batch
Calculated Parameters					
Aldrin + Dieldrin	ug/L	-	<0.005	0.005	7184287
Chlordane (Total)	ug/L	-	<0.005	0.005	7184287
DDT+ Metabolites	ug/L	-	<0.005	0.005	7184287
Heptachlor + Heptachlor epoxide	ug/L	-	<0.005	0.005	7184287
o,p-DDD + p,p-DDD	ug/L	-	<0.005	0.005	7184287
o,p-DDE + p,p-DDE	ug/L	-	<0.005	0.005	7184287
o,p-DDT + p,p-DDT	ug/L	-	<0.005	0.005	7184287
Total Endosulfan	ug/L	-	<0.005	0.005	7184287
Total PCB	ug/L	0.4	<0.05	0.05	7184287
Pesticides & Herbicides					
Aldrin	ug/L	-	<0.005	0.005	7199906
Dieldrin	ug/L	-	<0.005	0.005	7199906
a-Chlordane	ug/L	-	<0.005	0.005	7199906
g-Chlordane	ug/L	-	<0.005	0.005	7199906
o,p-DDD	ug/L	-	<0.005	0.005	7199906
p,p-DDD	ug/L	-	<0.005	0.005	7199906
o,p-DDE	ug/L	-	<0.005	0.005	7199906
p,p-DDE	ug/L	-	<0.005	0.005	7199906
o,p-DDT	ug/L	-	<0.005	0.005	7199906
p,p-DDT	ug/L	-	<0.005	0.005	7199906
Lindane	ug/L	-	<0.003	0.003	7199906
Endosulfan I (alpha)	ug/L	-	<0.005	0.005	7199906
Endosulfan II (beta)	ug/L	-	<0.005	0.005	7199906
Endrin	ug/L	-	<0.005	0.005	7199906
Heptachlor	ug/L	-	<0.005	0.005	7199906
Heptachlor epoxide	ug/L	-	<0.005	0.005	7199906
Hexachlorobenzene	ug/L	-	<0.005	0.005	7199906
Methoxychlor	ug/L	-	<0.01	0.01	7199906
Aroclor 1016	ug/L	-	<0.05	0.05	7199906

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: SW-UF Sewer Unfiltered City of Burlington Storm Sewer Discharge

Bureau Veritas Laboratories 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

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

BV Labs Job #: C131452
Report Date: 2021/02/18

Grounded Engineering Inc.
Client Project #: 21-016
Site Location: 535-551 BRANT STREET
Sampler Initials: LJ

ORGANOCHLORINATED PESTICIDES BY GC-ECD (WATER)

BV Labs ID			OTT576		
Sampling Date			2021/02/04 15:00		
COC Number			812312-02-01		
	UNITS	Criteria	SW-UF-BH107	RDL	QC Batch
Aroclor 1221	ug/L	-	<0.05	0.05	7199906
Aroclor 1232	ug/L	-	<0.05	0.05	7199906
Aroclor 1242	ug/L	-	<0.05	0.05	7199906
Aroclor 1248	ug/L	-	<0.05	0.05	7199906
Aroclor 1254	ug/L	-	<0.05	0.05	7199906
Aroclor 1260	ug/L	-	<0.05	0.05	7199906
alpha-BHC	ug/L	-	<0.005	0.005	7199906
beta-BHC	ug/L	-	<0.005	0.005	7199906
delta-BHC	ug/L	-	<0.005	0.005	7199906
Endosulfan sulfate	ug/L	-	<0.005	0.005	7199906
Endrin aldehyde	ug/L	-	<0.005	0.005	7199906
Endrin ketone	ug/L	-	<0.005	0.005	7199906
Mirex	ug/L	-	<0.005	0.005	7199906
Octachlorostyrene	ug/L	-	<0.005	0.005	7199906
Oxychlordane	ug/L	-	<0.005	0.005	7199906
Toxaphene	ug/L	-	<0.2	0.2	7199906
Surrogate Recovery (%)					
2,4,5,6-Tetrachloro-m-xylene	%	-	64		7199906
Decachlorobiphenyl	%	-	90		7199906

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: SW-UF Sewer Unfiltered City of Burlington Storm Sewer Discharge

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BV Labs Job #: C131452
Report Date: 2021/02/18

Grounded Engineering Inc.
Client Project #: 21-016
Site Location: 535-551 BRANT STREET
Sampler Initials: LJ

TEST SUMMARY

BV Labs ID: OTT576
Sample ID: SW-UF-BH107
Matrix: Water

Collected: 2021/02/04
Shipped:
Received: 2021/02/04

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Carbonaceous BOD	DO	7186348	2021/02/05	2021/02/10	Nusrat Naz
Total Cyanide	SKAL/CN	7187280	2021/02/05	2021/02/05	Aditiben Patel
Fluoride	ISE	7187178	2021/02/05	2021/02/08	Surinder Rai
Mercury in Water by CVAA	CV/AA	7189828	2021/02/08	2021/02/08	Prempal Bhatti
Total Metals Analysis by Axial ICP	ICPX	7189582	2021/02/08	2021/02/08	Archana Patel
E.coli, (CFU/100mL)	PL	7186157	N/A	2021/02/04	Sirimathie Aluthwala
Animal and Vegetable Oil and Grease	BAL	7184589	N/A	2021/02/10	Automated Statchk
Total Oil and Grease	BAL	7193509	2021/02/10	2021/02/10	Jay Tailor
OC Pesticides (Selected) & PCB	GC/ECD	7199906	2021/02/12	2021/02/14	Li Peng
OC Pesticides Summed Parameters	CALC	7184287	N/A	2021/02/05	Automated Statchk
PAH Compounds in Water by GC/MS (SIM)	GC/MS	7193106	2021/02/09	2021/02/10	Mitesh Raj
pH	AT	7187190	2021/02/05	2021/02/08	Surinder Rai
Phenols (4AAP)	TECH/PHEN	7186836	N/A	2021/02/05	Bramdeo Motiram
Sulphate by Automated Colourimetry	KONE	7187230	N/A	2021/02/08	Deonarine Ramnarine
Total Kjeldahl Nitrogen in Water	SKAL	7187910	2021/02/05	2021/02/09	Louise Harding
Mineral/Synthetic O & G (TPH Heavy Oil)	BAL	7193515	2021/02/10	2021/02/10	Jay Tailor
Total Suspended Solids	BAL	7189743	2021/02/08	2021/02/08	Massarat Jan
Volatile Organic Compounds in Water	GC/MS	7184452	N/A	2021/02/06	Juan Pangilinan

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Grounded Engineering Inc.
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GENERAL COMMENTS

Revised Report (2021/02/18) : SW-UF City of Burlington Storm Sewer Discharge limits included in the certificate of analysis per client request.

Sample OTT576 [SW-UF-BH107] : VOC Analysis: Due to the sample matrix, sample required dilution. Detection limits were adjusted accordingly.

Metals: Due to the sample matrix, sample required dilution. Detection limits were adjusted accordingly.

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.

BV Labs Job #: C131452
Report Date: 2021/02/18

QUALITY ASSURANCE REPORT

Grounded Engineering Inc.
Client Project #: 21-016
Site Location: 535-551 BRANT STREET
Sampler Initials: LJ

			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
7184452	4-Bromofluorobenzene	2021/02/06	101	70 - 130	102	70 - 130	99	%				
7184452	D4-1,2-Dichloroethane	2021/02/06	102	70 - 130	104	70 - 130	105	%				
7184452	D8-Toluene	2021/02/06	101	70 - 130	100	70 - 130	95	%				
7193106	D10-Anthracene	2021/02/10	107	50 - 130	114	50 - 130	112	%				
7193106	D14-Terphenyl (FS)	2021/02/10	101	50 - 130	108	50 - 130	104	%				
7193106	D8-Acenaphthylene	2021/02/10	100	50 - 130	104	50 - 130	93	%				
7199906	2,4,5,6-Tetrachloro-m-xylene	2021/02/13	80	50 - 130	64	50 - 130	59	%				
7199906	Decachlorobiphenyl	2021/02/13	111	50 - 130	110	50 - 130	103	%				
7184452	1,1,2,2-Tetrachloroethane	2021/02/06	97	70 - 130	100	70 - 130	<0.40	ug/L	NC	30		
7184452	1,2-Dichlorobenzene	2021/02/06	96	70 - 130	97	70 - 130	<0.40	ug/L	NC	30		
7184452	1,4-Dichlorobenzene	2021/02/06	112	70 - 130	112	70 - 130	<0.40	ug/L	NC	30		
7184452	Benzene	2021/02/06	93	70 - 130	95	70 - 130	<0.20	ug/L	NC	30		
7184452	Chloroform	2021/02/06	100	70 - 130	102	70 - 130	<0.20	ug/L	NC	30		
7184452	cis-1,2-Dichloroethylene	2021/02/06	102	70 - 130	105	70 - 130	<0.50	ug/L	NC	30		
7184452	Ethylbenzene	2021/02/06	92	70 - 130	93	70 - 130	<0.20	ug/L	NC	30		
7184452	Methylene Chloride(Dichloromethane)	2021/02/06	100	70 - 130	103	70 - 130	<2.0	ug/L	NC	30		
7184452	Tetrachloroethylene	2021/02/06	92	70 - 130	91	70 - 130	<0.20	ug/L	NC	30		
7184452	Toluene	2021/02/06	93	70 - 130	94	70 - 130	<0.20	ug/L	NC	30		
7184452	trans-1,3-Dichloropropene	2021/02/06	107	70 - 130	106	70 - 130	<0.40	ug/L	NC	30		
7184452	Trichloroethylene	2021/02/06	103	70 - 130	105	70 - 130	<0.20	ug/L	NC	30		
7186348	Total Carbonaceous BOD	2021/02/10					<2	mg/L	25	30	92	85 - 115
7186836	Phenols-4AAP	2021/02/05	104	80 - 120	96	80 - 120	<0.0010	mg/L	NC	20		
7187178	Fluoride (F-)	2021/02/08	108	80 - 120	103	80 - 120	<0.10	mg/L	1.4	20		
7187190	pH	2021/02/08			102	98 - 103			1.9	N/A		
7187230	Dissolved Sulphate (SO4)	2021/02/08	NC	75 - 125	100	80 - 120	<1.0	mg/L	3.0	20		
7187280	Total Cyanide (CN)	2021/02/05	96	80 - 120	100	80 - 120	<0.0050	mg/L	NC	20		
7187910	Total Kjeldahl Nitrogen (TKN)	2021/02/09	98	80 - 120	108	80 - 120	<0.10	mg/L	18	20	107	80 - 120
7189582	Total Aluminum (Al)	2021/02/08	108	80 - 120	106	80 - 120	<0.1	mg/L				
7189582	Total Antimony (Sb)	2021/02/08	106	80 - 120	105	80 - 120	<0.02	mg/L				
7189582	Total Arsenic (As)	2021/02/08	106	80 - 120	105	80 - 120	<0.01	mg/L				
7189582	Total Beryllium (Be)	2021/02/08	107	80 - 120	104	80 - 120	<0.0005	mg/L				

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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
7189582	Total Cadmium (Cd)	2021/02/08	107	80 - 120	106	80 - 120	<0.002	mg/L				
7189582	Total Chromium (Cr)	2021/02/08	110	80 - 120	107	80 - 120	<0.01	mg/L				
7189582	Total Cobalt (Co)	2021/02/08	102	80 - 120	102	80 - 120	<0.002	mg/L				
7189582	Total Copper (Cu)	2021/02/08	108	80 - 120	106	80 - 120	<0.01	mg/L				
7189582	Total Iron (Fe)	2021/02/08	106	80 - 120	107	80 - 120	<0.02	mg/L				
7189582	Total Lead (Pb)	2021/02/08	102	80 - 120	102	80 - 120	<0.01	mg/L				
7189582	Total Manganese (Mn)	2021/02/08	106	80 - 120	104	80 - 120	<0.001	mg/L				
7189582	Total Molybdenum (Mo)	2021/02/08	103	80 - 120	102	80 - 120	<0.005	mg/L				
7189582	Total Nickel (Ni)	2021/02/08	101	80 - 120	102	80 - 120	<0.005	mg/L				
7189582	Total Phosphorus (P)	2021/02/08	102	80 - 120	103	80 - 120	<0.05	mg/L				
7189582	Total Selenium (Se)	2021/02/08	108	80 - 120	106	80 - 120	<0.02	mg/L				
7189582	Total Silver (Ag)	2021/02/08	106	80 - 120	104	80 - 120	<0.01	mg/L				
7189582	Total Tin (Sn)	2021/02/08	103	80 - 120	103	80 - 120	<0.02	mg/L				
7189582	Total Titanium (Ti)	2021/02/08	103	80 - 120	101	80 - 120	<0.005	mg/L				
7189582	Total Zinc (Zn)	2021/02/08	103	80 - 120	103	80 - 120	<0.005	mg/L				
7189743	Total Suspended Solids	2021/02/08					<10	mg/L	0.31	25	95	85 - 115
7189828	Mercury (Hg)	2021/02/08	92	75 - 125	95	80 - 120	<0.00010	mg/L	NC	20		
7193106	Naphthalene	2021/02/10	91	50 - 130	85	50 - 130	<0.050	ug/L	NC	30		
7193509	Total Oil & Grease	2021/02/10			97	85 - 115	<0.50	mg/L	0.77	25		
7193515	Total Oil & Grease Mineral/Synthetic	2021/02/10			97	85 - 115	<0.50	mg/L	2.6	25		
7199906	a-Chlordane	2021/02/13	84	50 - 130	90	50 - 130	<0.005	ug/L	NC	30		
7199906	Aldrin	2021/02/13	68	50 - 130	66	50 - 130	<0.005	ug/L	NC	30		
7199906	alpha-BHC	2021/02/13	76	30 - 130	86	30 - 130	<0.005	ug/L	13	40		
7199906	Aroclor 1016	2021/02/13					<0.05	ug/L				
7199906	Aroclor 1221	2021/02/13					<0.05	ug/L				
7199906	Aroclor 1232	2021/02/13					<0.05	ug/L				
7199906	Aroclor 1242	2021/02/13					<0.05	ug/L				
7199906	Aroclor 1248	2021/02/13					<0.05	ug/L				
7199906	Aroclor 1254	2021/02/13					<0.05	ug/L				
7199906	Aroclor 1260	2021/02/13					<0.05	ug/L				
7199906	beta-BHC	2021/02/13	75	30 - 130	84	30 - 130	<0.005	ug/L	12	40		

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
7199906	delta-BHC	2021/02/13	84	30 - 130	89	30 - 130	<0.005	ug/L	11	40		
7199906	Dieldrin	2021/02/13	100	50 - 130	110	50 - 130	<0.005	ug/L	NC	30		
7199906	Endosulfan I (alpha)	2021/02/13	79	50 - 130	86	50 - 130	<0.005	ug/L	2.4	30		
7199906	Endosulfan II (beta)	2021/02/13	78	50 - 130	88	50 - 130	<0.005	ug/L	20	30		
7199906	Endosulfan sulfate	2021/02/13	107	30 - 130	114	30 - 130	<0.005	ug/L	10	40		
7199906	Endrin aldehyde	2021/02/13	89	30 - 130	96	30 - 130	<0.005	ug/L	13	40		
7199906	Endrin ketone	2021/02/13	96	30 - 130	101	30 - 130	<0.005	ug/L	12	40		
7199906	Endrin	2021/02/13	90	50 - 130	100	50 - 130	<0.005	ug/L	13	30		
7199906	g-Chlordane	2021/02/13	82	50 - 130	89	50 - 130	<0.005	ug/L	NC	30		
7199906	Heptachlor epoxide	2021/02/13	86	50 - 130	94	50 - 130	<0.005	ug/L	13	30		
7199906	Heptachlor	2021/02/13	69	50 - 130	67	50 - 130	<0.005	ug/L	11	30		
7199906	Hexachlorobenzene	2021/02/13	77	50 - 130	80	50 - 130	<0.005	ug/L	NC	30		
7199906	Lindane	2021/02/13	81	50 - 130	91	50 - 130	<0.003	ug/L	NC	30		
7199906	Methoxychlor	2021/02/13	93	50 - 130	98	50 - 130	<0.01	ug/L	11	30		
7199906	Mirex	2021/02/13	94	30 - 130	95	30 - 130	<0.005	ug/L	NC	40		
7199906	o,p-DDD	2021/02/13	102	50 - 130	112	50 - 130	<0.005	ug/L	NC	30		
7199906	o,p-DDE	2021/02/13	89	50 - 130	95	50 - 130	<0.005	ug/L	NC	30		
7199906	o,p-DDT	2021/02/13	86	50 - 130	92	50 - 130	<0.005	ug/L	NC	30		
7199906	Octachlorostyrene	2021/02/13	85	30 - 130	86	30 - 130	<0.005	ug/L	9.8	40		
7199906	Oxychlordane	2021/02/13	78	30 - 130	84	30 - 130	<0.005	ug/L	12	30		
7199906	p,p-DDD	2021/02/13	103	50 - 130	114	50 - 130	<0.005	ug/L	NC	30		
7199906	p,p-DDE	2021/02/13	98	50 - 130	100	50 - 130	<0.005	ug/L	NC	30		
7199906	p,p-DDT	2021/02/13	86	50 - 130	89	50 - 130	<0.005	ug/L	NC	30		

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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
7199906	Toxaphene	2021/02/13					<0.2	ug/L				

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).

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BV Labs Job #: C131452
Report Date: 2021/02/18

Grounded Engineering Inc.
Client Project #: 21-016
Site Location: 535-551 BRANT STREET
Sampler Initials: LJ

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Anastassia Hamanov, Scientific Specialist

Ewa Pranjic, M.Sc., C.Chem, Scientific Specialist

Sirimathie Aluthwala, Campobello Micro

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

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[illegible] Road, Mississauga, Ontario Canada L5N 2L8 Tel (905) 817-5700 Toll-free 800-563-6266 Fax (905) 817-5777 www.bvlabs.com

MICRO

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 #:	C04975	BV Labs Job #:	Bottle Order #: 812312
Attention:	Accounts Payable	Attention:	Jason Ngo	P.O. #:			
Address:	12 Banigan Drive, Toronto ON M4H 1E9	Address:		Project:	21-016	COC #: C#812312-02-01	Project Manager: Marijane Cruz
Tel:	(647) 264-7909 Fax:	Tel:	Fax:	Project Name:	535-551 Brant St		
Email:	stavares@groundedeng.ca	Email:	jngo@groundedeng.ca	Site #:			
				Sampled By:	LJ/GM		

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

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

Other Regulations: ☐ CCME ☑ Sanitary Sewer Bylaw ☐ Reg 558 ☑ Storm Sewer Bylaw ☐ MISA Municipality Burlington Storm/Halton Sanitary ☐ PWQO ☐ Reg 406 Table ☐ Other

Special Instructions:

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

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 #)

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered (please circle): Metals / Hg / Cr VI	Halton Sanitary & Combined Sewer (2-03)	O Reg 153 PHCs, BTEX/F1-F4	E.coli (CFU/100mL)	OC Pesticides (Selected) & PCB	# of Bottles	Comments
1	B12312	SW-UF-BH107	21/02/04	3PM	GW	N	✓		✓	✓	17	
2												
3												
4												
5												
6												
7												
8												
9												
10												

04-Feb-21 17:25
Marijane Cruz
C131452

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted	Laboratory Use Only: Time Sensitive	Temperature (°C) on Rece: 12/10/10	Custody Seal: Present / Intact	Yes	No
Leland Johnston	21/02/04	4PM		04/02/04	17:25						
Leland Johnston	21/02/04	4PM									

* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BV LABS' 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.BVLABS.COM/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.BVLABS.COM/RESOURCES/CHAIN-OF-CUSTODY-FORMS.

SAMPLES MUST BE KEPT COOL (< 10° C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BV LABS

White: BV Labs Yellow: Client

Bureau Veritas Canada (2019) Inc.

* no ice

BV Labs Job #: C131452
Report Date: 2021/02/18

Grounded Engineering Inc.
Client Project #: 21-016
Site Location: 535-551 BRANT STREET
Sampler Initials: LJ

Exceedance Summary Table – Halton Sanitary Sewer

Result Exceedances

Sample ID	BV Labs 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 – SW-UF Burlington Storm

Result Exceedances

Sample ID	BV Labs ID	Parameter	Criteria	Result	DL	UNITS
SW-UF-BH107	OTT576-06	Total Manganese (Mn)	0.05	1.8	0.01	mg/L
SW-UF-BH107	OTT576-04	Total Suspended Solids	15	98	10	mg/L

Detection Limit Exceedances

Sample ID	BV Labs ID	Parameter	Criteria	Result	DL	UNITS
SW-UF-BH107	OTT576-06	Total Arsenic (As)	0.02	<0.1	0.1	mg/L
SW-UF-BH107	OTT576-06	Total Cadmium (Cd)	0.008	<0.02	0.02	mg/L
SW-UF-BH107	OTT576-06	Total Chromium (Cr)	0.08	<0.1	0.1	mg/L
SW-UF-BH107	OTT576-06	Total Copper (Cu)	0.04	<0.1	0.1	mg/L
SW-UF-BH107	OTT576-06	Total Phosphorus (P)	0.4	<0.5	0.5	mg/L
SW-UF-BH107	OTT576-06	Total Selenium (Se)	0.02	<0.2	0.2	mg/L
SW-UF-BH107	OTT576-06	Total Zinc (Zn)	0.04	<0.05	0.05	mg/L

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.

Bureau Veritas Laboratories 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvlabs.com

APPENDIX F

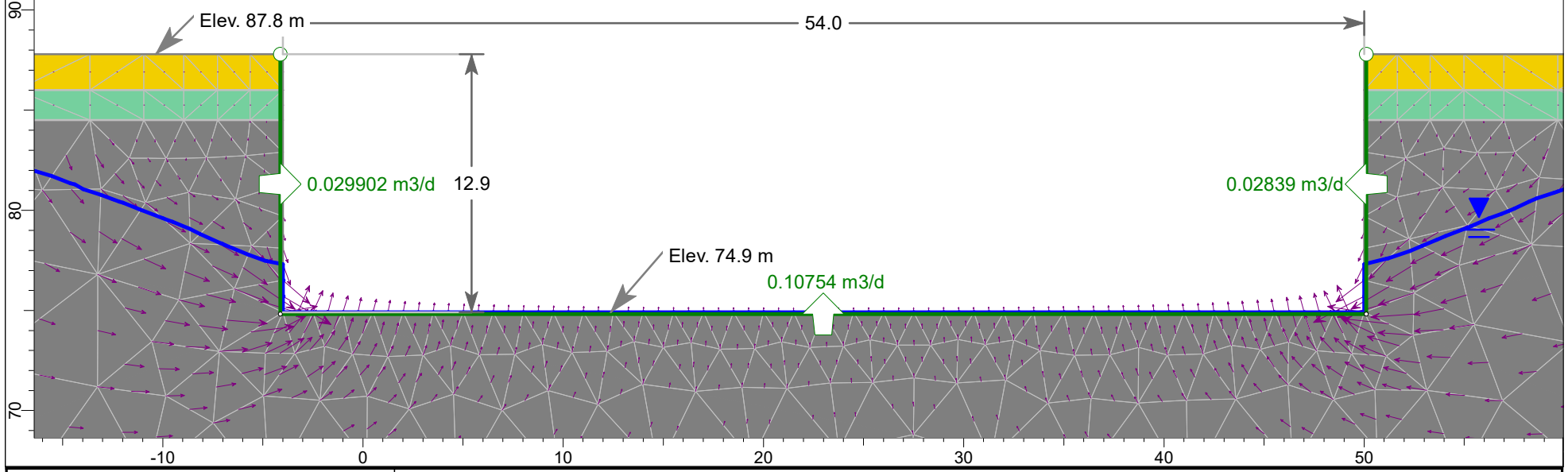


Excavation Dims (Equiv. Rectangle): 54 m by 51 m
Perimeter: 210 m
Equiv Area: 2,754 m2

Lowest FFE: 75.4 m
Dewatering Target: 74.9 m
Shoring: Lagging Wall
Scenario: Short Term Steady State

Total Groundwater Seepage (SF = 1.5): 20,000 ± L/day

Material Name	Color	KS (m/s)
Fill		9.29e-09
Native Till		1.3e-08
Queenston Shale		1.78e-07



GROUNDED ENGINEERING	Project: 21-016 | Brant St, Burlington		
	Analysis Description: Steady State FEM		Model: Group 1 | ST Dewatering
	Drawn By: MD	Scale: 1:300	Date: 2021-02-18
SLIDEINTERPRET 9.012	Source:		File Name: Brant St FEM (1).slmd

535-551 Brant Street
Burlington, Ontario
File No. 21-016

Dewatering Calculation Summary

SHORT TERM

Excavation Dimensions (m)	
N-S	54
E-W	51
Area (m2)	2754
Perimeter (m)	210

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		0.064528	51	3,291
Sides		0.037845	210	7,947
		0	0	-
Total				11,238
Factor of Safety	1.5			16,858

Storm Events	
2 Year [L/day]	100 Year [L/day]
68,850	259,000

Summary	L/day	L/min
Groundwater	20,000	13.9
Rainfall	69,000	47.9
Total	89,000	61.8

LONG TERM

Excavation Dimensions (m)	
N-S	54
E-W	51
Area (m2)	2754
Perimeter (m)	210

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		0.066954	51	3,415
Sides		0.035324	210	7,418
0		0	0	-
Total				10,833
Factor of Safety	1.5			16,249

Infiltration [L/day]
1575

Summary	L/day	L/min
Groundwater	20,000	13.9
Infiltration	2,000	1.4
Total	22,000	15.3

535-551 Brant Street
Burlington, Ontario
File No. 21-016

GROUNDED ENGINEERING

Groundwater Level Monitoring Summary

Well ID	Ground Surface Elevation (masl)	Screen Interval	Terraprobe				Grounded Engineering		Minimum Elev. (Lowest)		Maximum Elev. (Highest)		Seasonal Fluctuation
			15-Mar-19		22-Mar-19		4-Feb-21						
		(masl)	(mbgs)	(masl)	(mbgs)	(masl)	(mbgs)	(masl)	(mbgs)	(masl)	(mbgs)	(masl)	(±m)
BH104	87.4	65.8 to 68.9	3.3	84.1	3.2	84.2	N/A	-	3.3	84.1	3.2	84.2	0.0
BH105	87.6	83.5 to 85.0	Dry	-	Dry	-	Dry	-	0.0	0.0	0.0	0.0	0.0
BH106	87.7	66.6 to 69.7	4.5	83.2	4.5	83.2	4.8	82.9	4.8	82.9	4.5	83.2	0.2
BH107	87.8	66.6 to 69.7	4.3	83.5	4.1	83.7	5.7	82.1	5.7	82.1	4.1	83.7	0.8
BH108	87.7	82.9 to 84.4	Dry	-	2.6	85.1	2.7	85.0	2.7	85.0	2.6	85.1	0.1

mbgs = metres below existing ground surface
masl = metres above sea level
* = unstabilized groundwater level
N/A = damaged/inaccessible

APPENDIX E
ENGINEERING PLANS

DWG No.: —C101

S:\19010\WORKING\CURRENT\19010-Grading and Servicing Plan.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 TOWN 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. FOR ALL SEWERS AND WATERMAIN IN FILL SECTIONS, THE COMPACTION SHALL BE VERIFIED PRIOR TO LAYING OF PIPE.
6. NO SUBSTITUTIONS WILL BE ALLOWED WITHOUT WRITTEN APPROVAL FROM THE REGIONAL ENGINEER, CITY OF BURLINGTON OR THE ENGINEER.
7. ALL EXCAVATIONS TO BE BACKFILLED WITH SELECT NATIVE MATERIAL, APPROVED BY THE ENGINEER, TO 95% SPD.
8. THE CONTRACTOR IS RESPONSIBLE FOR INSTALLING AND MAINTAINING SILT CONTROL DEVICES AS SHOWN ON THE DRAWINGS AND AS DIRECTED BT THE ENGINEER.
9. TREE PROTECTION PROCEDURES TO BE IMPLEMENTED IN ACCORDANCE WITH CITY OF BURLINGTON STANDARDS.
10. THESE PLANS ARE NOT TO BE USED FOR CONSTRUCTION UNTIL SEALED BY THE ENGINEER AND INDICATED ISSUED FOR CONSTRUCTION ON THE DRAWING.
11. 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.
12. 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.
13. EXISTING TOPOGRAPHIC AND LEGAL INFORMATION TAKEN FROM PLANS PREPARED BY A. T. McLAREN LTD., DATED DEC. 6, 2018.
14. SITE PLAN INFORMATION TAKEN FROM PLANS PREPARED BY TURNER FLEISCHER ARCHITECTS INC., DATED MAR. 23, 2018.
15. THIS/THESE PLAN(S) TO BE READ IN CONJUNCTION WITH THE STORM WATER MANAGEMENT (SWM) REPORT PREPARED BY S. LLEWELLYN AND ASSOCIATES LIMITED, DATED APRIL 8, 2020.
16. THIS PLAN TO BE USED FOR SERVICING AND GRADING ONLY, FOR BUILDING LOCATION REFER TO TO THE SITE PLAN.
17. 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 CERTIFY THE LINE AND GRADE OF THE WORKS NOR RELIEVE THE CONTRACTOR OF CERTIFICATION OF ALL WORKS BY THE OWNER'S ENGINEER.
18. ALTERNATE MATERIALS MAY BE ACCEPTABLE PROVIDED WRITTEN APPROVAL HAS FIRST BEEN OBTAINED FROM THE CITY OF BURLINGTON AND THE THE ENGINEER.
19. 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
22. 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.
23. **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.**
24. 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.
25. 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.
26. ALL RESTORATIONS AND RECONSTRUCTIONS SHALL BE TO COMPLETED TO MATCH EXISTING CONDITIONS OR BETTER AND ARE TO BE PERFORMED TO THE SATISFACTION OF THE ENGINEER AND THE CITY OF BURLINGTON.
27. SERVICING CONTRACTOR TO MAINTAIN A "CONFINED TRENCH CONDITION" IN ALL SEWER AND WATERMAIN INSTALLATION TRENCHES.
28. THE SITE SERVICING CONTRACTOR SHALL TERMINATE ALL SERVICES 1.0m FROM THE BUILDING FACE.
29. NO BLASTING WILL BE PERMITTED.

ROADWORKS:

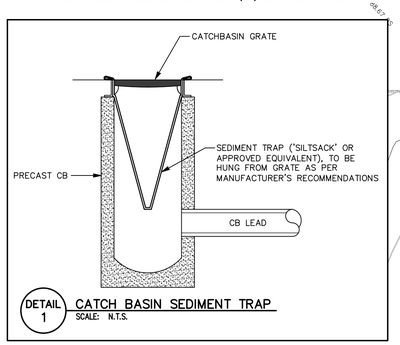
1. APPROVED FILL, FREE OF DELETERIOUS AND ORGANIC MATERIAL AND BOULDERS SHALL BE COMPACTED TO A DRY DENSITY NOT LESS THAN 95% THAN THE STANDARD PROCTOR DENSITY. AFTER COMPACTION, SOIL DENSITY TESTS SHALL BE CONDUCTED TO ENSURE ADEQUATE COMPACTION AND STABILITY OF THE FILL AND TEST RESULTS SHALL BE SUBMITTED 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. GEOTECH ENGINEER TO CONFIRM THE VOLUME OF THE UNSUITABLE MATERIALS.
3. ASPHALTIC CONCRETE TO BE COMPACTED TO 97% MARSHALL DENSITY.
4. PAVEMENT STRUCTURE FOR INTERNAL ROADS SHALL CONSIST OF COMPACTED THICKNESSES OF: 40mm HL3 SURFACE ASPHALT 60mm HL8 BASE BINDER ASPHALT 150mm GRANULAR "A" BASE COURSE 250mm GRANULAR "B" SUB-BASE COURSE
5. BOULEVARDS TO BE SODDED WITH #1 NURSERY SOD ON A MINIMUM 100mm OF SELECT TOPSOIL.
6. 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.
7. 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.
8. STANDARD PARKING SPACES SHALL BE 2.75mx6.0m. ACCESSIBLE PARKING SPACES SHALL BE 2.75mx6.0m AND SHALL HAVE AN ADJACENT ACCESS AISLE AT LEAST 2.0m WIDE, AS PER CITY OF BURLINGTON ACCESSIBILITY DESIGN STANDARDS (SECTION 4.3.12).

GRADING NOTES

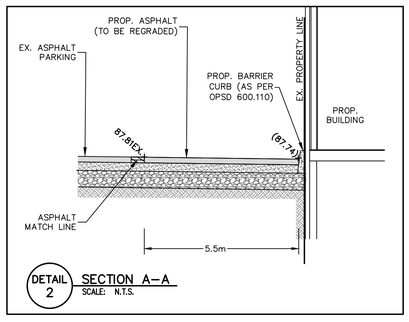
1. ALONG ADJOINING PROPERTIES GRADE TO MEET EXISTING OR PROPOSED ELEVATIONS WITH SODDED SLOPES (MIN. 3H TO 1V) AND/OR RETAINING WALLS AS SPECIFIED.
2. ALL RETAINING WALLS, WALKWAYS, CURBS, ETC., SHALL BE PLACED A MIN. OF 0.45m OFF THE PROPERTY LINE. ALL WALLS 1.0M OR HIGHER SHALL BE DESIGNED BY A P.ENG.
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.
11. ALL DRIVEWAYS FROM PROPERTY LINES FOR THE FIRST 7.5m SHALL BE WITHIN 5% MAXIMUM GRADE, THEREAFTER, ALL DRIVEWAYS SHALL BE WITHIN 10% MAXIMUM GRADES.

SILTATION AND EROSION CONTROL

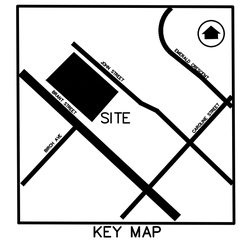
1. SILTATION CONTROL BARRIERS SHALL BE PLACED AS DETAILED.
2. ALL SILTATION CONTROL MEASURES SHALL BE CLEANED AND MAINTAINED AFTER EACH RAINFALL AS DIRECTED AND TO THE SATISFACTION OF THE CITY OF BURLINGTON AND/OR THE HALTON CONSERVATION AUTHORITY.
3. ADDITIONAL SILT CONTROL LOCATIONS MAY BE REQUIRED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



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



DETAIL 2 — SECTION A–A
SCALE: N.T.S.



KEY MAP
N.T.S.

LEGEND:

- 209.00 — EXISTING GROUND ELEVATION
- x(209.00) — PROPOSED GROUND ELEVATION
- x209.00EX — PROPOSED ELEVATION TO MATCH EXISTING
- 2.0% — PROPOSED DIRECTION OF SHEET FLOW
- EXISTING CATCHBASIN
- EXISTING STORM/SANITARY MANHOLE
- PROPOSED CATCHBASIN
- PROPOSED STORM/SANITARY MANHOLE
- PROPOSED CURB STOP/GATE VALVE
- EXISTING DIRECTION OF DRAINAGE
- PROPOSED DIRECTION OF SWALE FLOW
- PROPOSED OVERLAND FLOW ROUTE
- PROPOSED CONCRETE
- PROPOSED MAN DOOR
- PROPOSED OVERHEAD DOOR

BENCH MARK NOTE:

BURLINGTON BENCH MARK No. 301

BENCH MARK SET ON CITY PLATE SOUTHWEST CORNER, SOUTH SIDE OF CENTRAL PUBLIC SCHOOL FACING BALDWIN STREET.

ELEVATION: 90.583 metres

NO.	DATE	BY	REVISIONS
02	MAR 29,2021	SJD	REVISED AS PER CITY COMMENTS
01	NOV 23,2020	SJD	ISSUED FOR FIRST SUBMISSION

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.

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 UTILITIES AND 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	SJD	CHK'D	SL
DRAWN	SD	CHK'D	SL

DATE: MAR 30, 2020

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

APPROVALS

REGIONAL APPROVAL
REGION OF WATER &/OR WASTEWATER SERVICES APPROVED SUBJECT TO DETAIL CONSTRUCTION CONFORMING TO HALTON REGION'S STANDARDS & SPECIFICATIONS & LOCATION APPROVAL FROM AREA MUNICIPALITY.
SIGNED: _____ DATE: _____
INFRASTRUCTURE PLANNING & POLICY
The Applicant should be aware that the approval of the water system on private property is the responsibility of the Local Municipality. Regardless, the Applicant must ensure that the Region of Halton's standards and specifications are met. (the Water and Wastewater Linear Design Manual may be obtained from the Data Management Group at 905-825-6032,. Furthermore, all water quality tests must be completed to Halton Region's satisfaction, before the water supply can be turned on.

STAMP: LICENSED PROFESSIONAL ENGINEER — S. LLEWELLYN — 100300 — Mar 29/2021 — PROVINCE OF ONTARIO

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

CLIENT
RENIMMOB PROPERTIES LTD.
242 MAIN ST E, HAMILTON, ON

PROJECT NAME
535–551 BRANT STREET,
CITY OF BURLINGTON

TITLE
PRELIMINARY GRADING AND EROSION CONTROL PLAN

PROJECT No.	DRAWING No.
19010	C101

S:\19010\WORKING\CURRENT\19010-Grading and Servicing Plan.dwg
Plotted: March 29, 2021 3:35:43 PM By: Steven DeGrow

DWG No: —C102

S:\19010\WORKING\CURRENT\19010-Grading and Servicing Plan.dwg

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 401.01.
4. ALL PVC LATERALS TO BE SDR 28 AND SHALL BE ANY COLOUR EXCEPT WHITE. MINIMUM SLOPE OF LATERAL TO BE 2.0%.
5. SINGLE SERVICE CONNECTIONS TO BE MINIMUM 125mm DIA PIPE.
6. DOUBLE SERVICE CONNECTIONS TO BE MINIMUM 150mm DIA PIPE FROM THE MAIN TO THE WYE CONNECTION AND 125mm DIA THEREAFTER.
7. TAPPING AT EXISTING SANITARY SEWERS SHALL BE UNDERTAKEN IN ACCORDANCE WITH REGION OF HALTON REQUIREMENTS.
8. ALL SEWERS TO BE VIDEO INSPECTED.
9. ALL SEWERS TO BE FLUSHED PRIOR TO VIDEO INSPECTION.
10. 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:

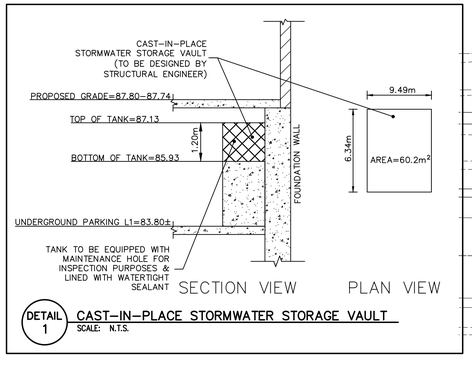
1. 300mm–450mm STORM SEWERS SHALL BE PVC, BELL AND SPIGOT AND SHALL COMPLY TO ASTM D-3034 WITH MINIMUM SDR 35 OR ULTRARIB.
2. MINIMUM BEDDING REQUIREMENTS FOR ALL SINGLE STORM SEWER MAINS AND ALL RELATED CONNECTIONS SHALL BE HIGH PERFORMANCE CLEAR STONE (HL-8 GRADED) AS PER CITY OF BURLINGTON STANDARD 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. DOUBLE CATCH BASINS SHALL BE IN ACCORDANCE WITH OPSD 705.020 WITH 250mm DIA. LEAD. FRAMES AND COVERS TO BE OPSD 400.11 (ROADS) AND CITY OF BURLINGTON STD. S-176 (REAR YARDS). LEADS TO BE PVC SDR 35.
6. 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.
7. 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.
8. INVERTS OF ALL SWALES TO BE SODDED TO A MINIMUM WIDTH OF 3.0m. ALL OTHER DISTURBED AREAS TO BE TOPSOILED AND SEEDED. SOD SHALL BE #1 NURSERY LAID ON A MINIMUM OF 100mm OF TOPSOIL.
9. ALL SEWERS TO BE VIDEO INSPECTED.
10. ALL SEWERS TO BE FLUSHED PRIOR TO VIDEO INSPECTION.
11. 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.

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 150mm OVER AND 500mm UNDER SEWERS AND ALL OTHER UTILITIES WHEN CROSSING.
12. WATER SERVICE CONNECTIONS (25mm & 20mm DIA. TYPE 'K' SOFT COPPER) AS PER OPSD 1104.01 AND OPSD 1104.02.

RESTORATIONS:

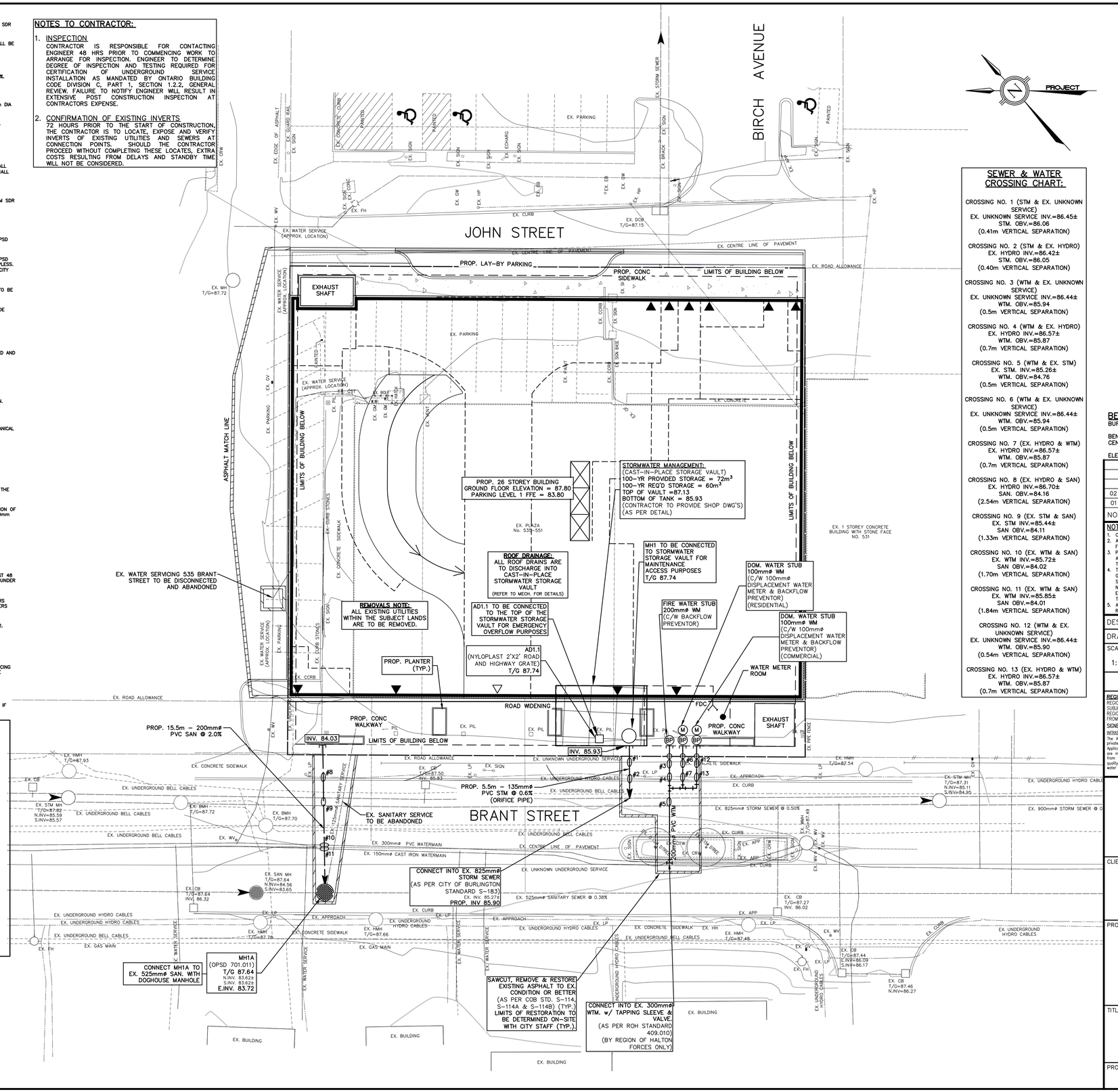
13. ALL TRENCH EXCAVATIONS WITHIN EXISTING ROAD ALLOWANCES SHALL BE AS BACKFILLED AS PER CITY OF BURLINGTON STANDARD DRAWING S-114 AND S-114A.
14. EXISTING PRIVATE FENCING IS TO BE MAINTAINED THROUGHOUT CONSTRUCTION. WHERE REMOVAL OR RELOCATION OF FENCING IS NECESSARY IT SHALL BE RESTORED OR REPLACED TO ORIGINAL CONDITIONS OR BETTER UNDER THE DIRECTION OF THE ENGINEER.
15. DAMAGED CURB, GUTTER AND SIDEWALK TO BE REPLACED WITH 28 MPa CONCRETE TO EXISTING CONDITIONS OR BETTER.
16. PAVEMENT SURFACE ON EXISTING BRANT STREET AND JOHN STREET TO BE REPAIRED BY CONTRACTOR AT THEIR EXPENSE IF DAMAGED BY CONSTRUCTION TRAFFIC.



DETAIL 1 — CAST-IN-PLACE STORMWATER STORAGE VAULT
SCALE: N.T.S.

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 UTILITIES AND SEWERS AT CONNECTION POINTS. SHOULD THE CONTRACTOR PROCEED WITHOUT COMPLETING THESE LOCATES, EXTRA COSTS RESULTING FROM DELAYS AND STANDBY TIME WILL NOT BE CONSIDERED.



SEWER & WATER CROSSING CHART:

CROSSING NO. 1 (STM & EX. UNKNOWN SERVICE)
EX. UNKNOWN SERVICE INV.=86.45±
STM. OBV.=86.06
(0.41m VERTICAL SEPARATION)

CROSSING NO. 2 (STM & EX. HYDRO)
EX. HYDRO INV.=86.42±
STM. OBV.=86.05
(0.40m VERTICAL SEPARATION)

CROSSING NO. 3 (WTM & EX. UNKNOWN SERVICE)
EX. UNKNOWN SERVICE INV.=86.44±
WTM. OBV.=85.94
(0.5m VERTICAL SEPARATION)

CROSSING NO. 4 (WTM & EX. HYDRO)
EX. HYDRO INV.=86.57±
WTM. OBV.=85.87
(0.7m VERTICAL SEPARATION)

CROSSING NO. 5 (WTM & EX. STM)
EX. STM. INV.=85.26±
WTM. OBV.=84.76
(0.5m VERTICAL SEPARATION)

CROSSING NO. 6 (WTM & EX. UNKNOWN SERVICE)
EX. UNKNOWN SERVICE INV.=86.44±
WTM. OBV.=85.94
(0.5m VERTICAL SEPARATION)

CROSSING NO. 7 (EX. HYDRO & WTM)
EX. HYDRO INV.=86.57±
WTM. OBV.=85.87
(0.7m VERTICAL SEPARATION)

CROSSING NO. 8 (EX. HYDRO & SAN)
EX. HYDRO INV.=86.70±
SAN. OBV.=84.16
(2.54m VERTICAL SEPARATION)

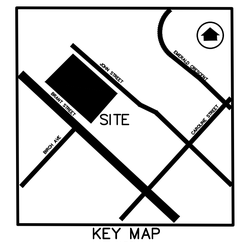
CROSSING NO. 9 (EX. STM & SAN)
EX. STM INV.=85.44±
SAN OBV.=84.11
(1.33m VERTICAL SEPARATION)

CROSSING NO. 10 (EX. WTM & SAN)
EX. WTM INV.=85.72±
SAN OBV.=84.02
(1.70m VERTICAL SEPARATION)

CROSSING NO. 11 (EX. WTM & SAN)
EX. WTM INV.=85.85±
SAN OBV.=84.01
(1.84m VERTICAL SEPARATION)

CROSSING NO. 12 (WTM & EX. UNKNOWN SERVICE)
EX. UNKNOWN SERVICE INV.=86.44±
WTM. OBV.=85.90
(0.54m VERTICAL SEPARATION)

CROSSING NO. 13 (EX. HYDRO & WTM)
EX. HYDRO INV.=86.57±
WTM. OBV.=85.87
(0.7m VERTICAL SEPARATION)



LEGEND:

- EXISTING CATCHBASIN
- EXISTING STORM/SANITARY MANHOLE
- PROPOSED DOUBLE CATCHBASIN
- PROPOSED CATCHBASIN
- PROPOSED STORM/SANITARY MANHOLE
- PROPOSED CATCHBASIN MANHOLE
- PROPOSED CURB STOP/GATE VALVE
- PROPOSED MAN DOOR
- PROPOSED OVERHEAD DOOR

BENCH MARK NOTE:
BURLINGTON BENCH MARK No. 301

BENCH MARK SET ON CITY PLATE SOUTHWEST CORNER, SOUTH SIDE OF CENTRAL PUBLIC SCHOOL FACING BALDWIN STREET.

ELEVATION: 90.583 metres

NO.	DATE	BY	REVISIONS
02	MAR 29,2021	SJD	REVISED AS PER CITY COMMENTS
01	NOV 23,2020	SJD	ISSUED FOR FIRST SUBMISSION

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	SJD	CHK'D	SL
DRAWN	SD	CHK'D	SL

DATE: MAR 30, 2020

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

APPROVALS

REGIONAL APPROVAL
REGION DESIGN OF WATER &/OR WASTEWATER SERVICES APPROVED SUBJECT TO DETAIL CONSTRUCTION CONFORMING TO HALTON REGION STANDARDS & SPECIFICATIONS & LOCATION APPROVAL FROM AREA MUNICIPALITY.
SIGNED: _____ DATED: _____
INFRASTRUCTURE PLANNING & POLICY
The Applicant should be aware that the approval of the water system on private property is the responsibility of the Local Municipality. Regardless, the Applicant must ensure that the Region of Halton's standards and specifications are met. (the Water and Wastewater Linear Design Manual may be obtained from the Data Management Group at 905-825-6032.. Furthermore, all water quality tests must be completed to Halton Region's satisfaction, before the water supply can be turned on.

STAMP: LICENSED PROFESSIONAL ENGINEER — S. LLEWELLYN — 100300 — Mar 29/2021 — PROVINCE OF ONTARIO

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

CLIENT
RENIMMOB PROPERTIES LTD.
242 MAIN ST E, HAMILTON, ON

PROJECT NAME
535–551 BRANT STREET,
CITY OF BURLINGTON

TITLE
PRELIMINARY SERVICING PLAN

PROJECT No. 19010
DRAWING No. C102

S:\19010\WORKING\CURRENT\19010-Grading and Servicing Plan.dwg
Plotted: March 29, 2021 3:36:06 PM By: Steven DeGrow