

GEI Consultants

BEA
Barrie · Essa · Ardagh

Consulting
Engineers and
Scientists

Servicing & Stormwater Management Report

Bea Towns

500 Ardagh Road

City of Barrie, Ontario

Submitted to:
Stateview Homes (Bea Towns) Inc.
410 Chrislea Road
Woodbridge, ON, L4L 8B5

Submitted by:
GEI Consultants Ltd.
75 Tiverton Court, Unit 100
Markham, ON L3R 4M8
1-800-810-3281

October 2022
Project No. 2104593



PREPARED BY:

GEI Consultants

Chaodong Sheng, M.Sc., P.Eng.
Senior Water Resources Engineer

Paul Chiocchio, M.Fin., EIT
Project Manager

CHECKED BY:

GEI Consultants



Torben Ruddock
2022.10.07
14:55:13-04'00'

Torben Ruddock, P.Eng.
Project Manager / Senior Water Resources Engineer

Peter Slama, P.Eng.
Senior Project Manager

Record of Revisions

Issues and Revisions Registry

Identification	Date	Description of issue and/or revision
Servicing & SWM Report	October 7, 2022	1st Site Plan Application

Statement of Conditions

This Report / Study (the “Work”) has been prepared at the request of, and for the exclusive use of, the Owner / Client, the City of Barrie, and its affiliates (the “Intended User”). No one other than the Intended User has the right to use and rely on the Work without first obtaining the written authorization of GEI Consultants Ltd. and its Owner. GEI Consultants Ltd. expressly excludes liability to any party except the Intended User for any use of, and/or reliance upon, the work.

Neither possession of the Work, nor a copy of it, carries the right of publication. All copyright in the Work is reserved to GEI Consultants Ltd. The Work shall not be disclosed, produced, or reproduced, quoted from, or referred to, in whole or in part, or published in any manner, without the express written consent of GEI Consultants Ltd., the City of Barrie, or the Owner.

Record of Revisions ii

Statement of Conditions ii

1. Introduction 1
1.1 Background Review 1
1.2 Existing Site Conditions 2
1.3 Proposed Development 2
1.4 Development Phasing 2
1.5 Proposed Grading 3

2. Stormwater Management (SWM) 4
2.1 Background 4
2.2 Stormwater Servicing 4
2.2.1 Existing Conditions/Stormwater Drainage 4
2.2.2 Pre-Development Drainage Conditions and modeling 5
2.2.3 Post-Development Drainage Conditions 6
2.2.4 Post-Development Hydrologic Model Scheme 7
2.2.5 Proposed SWM Controls 8
2.2.6 Dry Pond Design 9
2.2.7 Underground Storm Chambers 11
2.2.8 Proposed SWM Facilities Design 11
2.3 Stormwater Quality Control 11
2.4 Water Balance 12
2.5 Erosion Control 13

3. Sanitary Drainage System 14
3.1 Existing Sanitary Drainage System 14
3.2 Proposed Sanitary System 14

4. Water Supply System 15
4.1 Water Design Guidelines 15
4.2 Existing Water System 15
4.3 Proposed Water Distribution System 16

5. Conclusions 18

Tables

Table 2-1 Pre-Development VO Model Parameters 5
Table 2-2 Pre-Development Flows (m3/s) 5
Table 2-3 Post-Development Modelling Approach 6
Table 2-4 Infiltration Gallery Design Parameters 7
Table 2-5 Post-Development Catchment Parameters 7
Table 2-6 SWM Quantity Control Modeling and Calculation Results 9
Table 2-7 SWM Dry Pond Design Characteristics 9
Table 2-8 SWM Quantity Control Results for A2 Post and A3 Post 10
Table 2-9 Quality Control Requirements 12
Table 3-1 Proposed Sanitary Flow 14
Table 4-1 Water Demand Calculation Summary 16

Figures

Figure LOC-1	Location Plan	Appendix A
Figure DAP-1	Pre-Development Storm Drainage Area Plan	Appendix B
Figure DAP-2	Post-Development Storm Drainage Area Plan	Appendix B

Appendices

A. Background Information

B. Stormwater Management

C. Sanitary

D. Watermain

E. Engineering Drawings

1. Introduction

1.1 Background Review

GEI Consultants Ltd. (GEI) was retained by Stateview Homes (BEA Towns) Inc. (the "Client") to prepare a Servicing & Stormwater Management Report (SSWMR) in support of development approvals under the Planning Act for a 4.5 hectare residential development at Summerset Drive and Ardagh Road in the City of Barrie, Ontario (the "Site").

The purpose of this report is to demonstrate that the detailed design is in conformance with the various standards and guidelines (as applicable) from the City of Barrie (City), Nottawasaga Valley Conservation Authority (NVCA), Ministry of Environment, Climate and Parks (MECP), the Ardagh Secondary Plan and the Ardagh West Master Servicing Plan.

This site is defined as Part Lot 2 Concession 14, Geographic township of Innisfil and all of Block 76 Plan 51M-1167, City of Barrie, County of Simcoe. The site is bounded by Summerset Drive to the north and west, Ardagh Road to the south and Bear Creek to the east. The Bear Creek Wetland is on the north side of Summerset Drive and classified as Environmental Protection Area (EPA) – Level 1 according to Official Plan Map 3 Natural Heritage Protection Overlays (February 2022). The Site zoning is identified as "RM2 – Residential Multiple Dwelling Second Density according to the City's Zoning By-Law 2009-141, Office Consolidation January 2022. See **Figure LOC-1** in **Appendix A** for conceptual location details.

Below are documents that assisted in guiding this Servicing and Stormwater Management Report:

- City of Barrie Site Plan Pre-Consultation Review Comments, File: D28-020-2022, provided by the City and received May 26, 2022;
- As-built Plan and Profile Drawings of Summerset Drive and Ardagh Road vicinity, provided by the City, received March 03, 2022;
- Master Servicing Plan, The Ardagh West Secondary Planning Area, City of Barrie P/N 93-1168, dated January 1998;
- City of Barrie Wastewater Collection Master Plan Update Final Master Plan Report, prepared by Cole Engineering, dated April 5, 2019;
- City of Barrie Water Supply Master Plan Update – Final Report, prepared by WSP, dated July 2019;
- Meadows of Bear Creek City of Barrie, Ontario Detailed Stormwater Management Report, DUI-15187(70), prepared by the Jones Consulting Group, dated July 2018;
- Bear Creek Village Functional Servicing Report Ardagh/Summerset Drive, City of Barrie (19-11476B – rev. 0), prepared by Pinestone Engineering Ltd., dated January 29th, 2021;

- Geotechnical/Hydrogeological Investigation Proposed Residential Development Ardagh Road and Summerset Drive, Barrie Ontario (Ref: 21BF003 Report 1), for Wynstar Bear Creek LP, prepared by PETO MacCALLUM Ltd., dated March 2021;
- Groundwater Level Monitoring Proposed Residential Development Ardagh Road and Summerset Drive, Barrie Ontario (Ref: 21BF003 Report 2), for Wynstar Bear Creek LP, prepared by PETO MacCALLUM Ltd., dated September 24, 2021;
- Supplemental Hydrogeological Investigation BEA Towns, 500 Ardagh Road, Barrie, Ontario, prepared by GEI Consultants Inc., dated August 2022;
- Topographic Survey, prepared by Schaeffer Dzaldov Purcell Ltd., dated September 20 2022;
- BEA Condominium Development Ardagh Road, Barrie, Ontario Architectural Drawings prepared by Onespace Unlimited Inc., dated August 17, 2022;

1.2 Existing Site Conditions

The existing 4.5 ha site is currently forested, and generally slopes from south (242.9m) to north (237.3m), as per the topographic survey prepared by Schaeffer Dzaldov Bennett Limited, dated March 25, 2022.

1.3 Proposed Development

A residential development is proposed for the parcel of land between Ardagh Road and the meandering Summerset Drive in Barrie. A six-story condominium building is currently proposed, and two levels of underground parking are being considered. Approximately 154 back-to-back, stacked and 66 rear lane town houses are proposed without basements (slab-on-grade). Full municipal servicing is proposed along with a network of internal, private paved roads. A stormwater management (SWM) facility is proposed for the northeast corner of the site. It is understood grades will likely be raised 1.0 to 2.0 m. The preliminary Site Plan, dated January 10, 2022, is included for reference in **Appendix A**.

1.4 Development Phasing

The residential development is intended to be phased with the eastern portion of the site containing townhouse blocks advanced ahead of the mid-rise condominium building. Townhouse blocks 1 & 10, adjacent to the mid-rise condominium building, will be frozen in the first phase of development and constructed within the second phase along with the condominium development as illustrated in **Appendix A**. This phasing strategy would require interim grading and direct the site's south-west corner to drain towards Ardagh Road. Additionally, in order to ensure the watermain is looped in the interim condition, two alternative alignments include routing between the amenity area & Block 5 or utilizing the space allocated within the amenity area outside of Street 2 right-of-way. In the latter alternative, the water main alignment can be designed for both the interim or ultimate condition. This alternative, routed alongside Street 2 in the amenity area, avoids overall construction disturbance for future Block 5 residents given it is suitable for the ultimate condition. Servicing alignments proposed within

Street 2's adjacency with the condominium block will be terminated at temporary turnaround circles with radii compatible with all proposed fire access routes. Lastly, the mid-rise condominium building's shoring and excavation works will be limited by the interim grading condition mentioned above as illustrated in **Appendix A**.

Interim grading details & ESC (Erosion and Sediment Control) measures, interim or ultimate watermain & other servicing realignments, and temporary turnaround circles in the vicinity of the phasing interface are anticipated to be advanced following this submission's agency review. A separate ESC & interim grading plan will be prepared to support this phasing strategy.

1.5 Proposed Grading

The proposed site grading design has been provided in the form of a Site Grading Plan in **Appendix E** of the report. Detailed grading has been provided along the perimeter property lines to demonstrate that the site conforms with the existing boundary conditions. Retaining walls, in conjunction with maximum 3:1 transition slopes, are proposed to match the existing grades along the Summerset Drive right-of-way. The proposed retaining wall along Summerset Drive is approximately 1.0m in height and 1.5m along the interface of the condominium block & Ardagh Road to match existing grades. A trench drain will be installed along the top of wall to direct minor drainage from sidewalks along Blocks 1 through 4 frontages.

The proposed storm sewer network on site is designed to capture all storms up to the 100-year event, and stormwater will not escape the site during lesser events. Overland flow relief is provided in the form of a 3.0m wide emergency spillway located within the pond directed to the Bear Creek corridor for ultimate discharge.

2. Stormwater Management (SWM)

2.1 Background

The site is located within the Middle Nottawasaga River Watershed and all storm discharge is tributary to Bear Creek located approximately 40 m east of the site.

This development will be designed in accordance with the Nottawasaga Valley Conservation Authority (NVCA), City of Barrie's Stormwater management (SWM) Guidelines, and the MECP Planning and Design Manual (MECP, 2003). The SWM criteria applied guiding the SWM design are listed below:

- The "enhanced" level of protection in accordance with the MECP Stormwater Management Planning and Design Manual (MECP, 2003);
- Peak flow attenuation for the post-development flows to match pre-development levels for the 2-year through the 100-year storms as per the City Standard and NVCA requirements;
- Hydrologic modeling method using Visual OTTHYMO model, will be applied for peak flow simulation using both 4-hour Chicago and 24-hour SCS Type II storm as per the City Standard;
- Safe conveyance of the Regulatory flows through the site to a sufficient outlet is required. The Regulatory flows are taken as the greater of the uncontrolled 100-year or the Regional flows through the development; and
- Maintain or enhance average annual water balance upon development via on-site retention and infiltration.

Refer to **Appendix B** for relevant excerpts from background review related to stormwater management.

2.2 Stormwater Servicing

2.2.1 Existing Conditions/Stormwater Drainage

The existing area (4.49 ha) consists of vacant forested land. Elevations of the site range approximately from 237.3 m to 242.9 m, and the site generally slopes northwest to southeast towards Bear Creek. The existing drainage patterns are illustrated on **Drawing DAP-01** provided in **Appendix B**.

Based on the Soil Surveys for Ontario York Region Report (1955), the dominant soil type in the site area is Tioga Sandy Loam with a Hydrologic Soil Group (HSG) of A, as per Ministry of Transportation Drainage Management Manual (1993) Chart 1.08. This soil type (sandy soil) was also confirmed by geotechnical investigation completed by Peto MacCallum Ltd (PML Report March 2021).

2.2.2 *Pre-Development Drainage Conditions and modeling*

Under the existing conditions, the site is mainly open space and runoff is conveying southwest to northeast and discharging into Bear Creek as sheet flow in general (see **Figure DAP-1**). A Visual OTTHYMO 6 (VO Model) hydrologic model was developed to simulate the pre-development flows which were set as the flow targets for sizing required SWM storage under post-development conditions. Since the existing site is comprised mainly of open space, NASHYD command was used in the VO model to represent the existing drainage characteristics.

The Soil Conservation Service (SCS) Curve Number (CN) for pervious areas was determined based on the existing land use and soil type. Soil on the subject site is classified as Hydrological Soil Group (HSG) A based on the Sandy Loams classification and the land cover and land use were categorized as “woods” based on the current satellite image. The CN number under the pre-development conditions was determined as 32 based on the land use of "woods" as per the Table 10.1 of the “NVCA Stormwater Technical Guide” (page 32). CN* method was not applied in VO model.

Time of Concentration (T_c) was calculated using the Airport Method with the longest overland flow length, and the average land slope within Area A1 Time to Peak (T_p) is calculated as two thirds of Tc. Initial Abstraction, i.e., I_a, was coded using Table 10.1 of the “NVCA Stormwater Technical Guide” based on land use of “woods”. Other parameters are not sensitive in the nature of this project and were kept as the VO model default value. Refer to **Appendix B** for the detailed VO model parameter calculations under the pre-development conditions. **Table 2-1** summarizes the main parameters applied for the pre-development VO model.

Table 2-1 Pre-Development VO Model Parameters

DAP-1 ID	Discharge Location	Area (ha)	Land Use Type	CN	Ia	Tp (hr)
A1 Pre	Bear Creek	4.49	Woods	32	10	0.62

As per the VO model excises, the predevelopment flows under 4-hour Chicago and 24-hour SCS storms are summarized in **Table 2-2**. The VO model schematic and details outputs under the existing conditions are provided in **Appendix B**.

Table 2-2 Pre-Development Flows (m3/s)

Storm	2-year	5-year	10-year	25-year	50-year	100-year
4-hour Chicago	0.007	0.016	0.024	0.036	0.046	0.058
24-hr SCS	0.010	0.025	0.037	0.055	0.072	0.092

2.2.3 Post-Development Drainage Conditions

The proposed development will consist of a six-story condominium building, and approximately 220 town homes, parking spaces, amenity areas and a SWM facility. The post-development drainage pattern and areas is illustrated on **Figure DAP-02** in **Appendix B**. As per **Figure DAP-2**, the proposed post-development drainage pattern is summarized below:

Runoff from drainage area A1 Post, will be discharged into the dry SWM pond located in the northeastern portion of the site. A2 Post will drain into the storm chambers located at the west amenity area. As per the grading constraints, A3 Post, as an individual condo site, can be self-contained using a separate SWM control system, including an underground storage tank and an infiltration gallery. Over-flow path will be provided to let the condo site discharge into the storm sewer under emergency conditions. Based on the proposed grading, there will be two uncontrolled areas, UNC-1 and UNC-2, which will drain directly to the surrounding areas, and eventually Bear Creek, uncontrolled. As mentioned previously, a post-to-pre peak flow attention up to 100-year storm will be provided for the entire site, therefore, an over control will be provided for Area A1 Post and A2 Post to compensate the uncontrolled UNC-1 and UNC-2 areas. **Table 2-3** provides a summary of the post-development drainage scheme.

Table 2-3 Post-Development Modelling Approach

DAP-2 ID	Area (ha)	Controls	Outlet	Sizing Method
A1 Post	1.22	SWM Pond	Infiltration + Bear Creek	VO Model
A2 Post	2.75	Underground SWM Chambers	Infiltration Only	VO Model
A3 Post	0.37	Underground Tank + SWM Chambers	Infiltration Only	Rational Method
UNC-1/UNC-2	0.15	Uncontrolled	Overland Spills	VO Model

Based on the Geotechnical investigation completed by PML in 2021 and the Supplemental Hydrogeological Investigation prepared by GEI Consultants (2022), we understand that the site soil percolation rate is very high. Therefore, a 30 cm depth of infiltration gallery filled with 50 mm clear stone will be installed at the bottom of the proposed storages, i.e., the underground storage under the west amenity area and the proposed dry pond, to promote the infiltration as the main portion of the SWM storage outlets. **Table 2-4** provides the summary of the infiltration gallery design.

Table 2-4 Infiltration Gallery Design Parameters

Drainage ID	SWM Facility	Bottom Area (m^2)	Percolation Rate (mm/hr)	Percolation Rate with 2.5 Factor (mm/hr)	Outlet Capacity (L/s)
A1 Post	Dry Pond	940	76.57	30.6	20
A2 Post	Underground Chamber	1,500	74.30	29.7	31

2.2.4 Post-Development Hydrologic Model Scheme

A VO model was developed to simulate the post-development drainage flows under proposed conditions. As per the City and the NVCA requirements, the 4-hour Chicago storms and 24-hour SCS storms were applied for the VO model simulations. Under the post-development conditions, A1 Post and A2 Post were modelled using a STANDHYD command as the imperviousness is over 0.70. The uncontrolled areas are assumed as Pasture/Lawn under fair conditions (CN = 49), therefore, are still modelled using the NASHYD command. A summary of the post-development parameters is provided in **Table 2-5** below. Refer to **Appendix B** for the detailed post-development input parameters.

Table 2-5 Post-Development Catchment Parameters

Drainage ID	Discharge Point	Area (ha)	Land Use Type	IA (mm)	TIMP	XIMP
A1 Post	Dry Pond	1.22	Residential Townhouses + Roads and Driveways	2 (Impervious portion)	0.77	0.77
A2 Post and A3 Post	West Amenity Area (Infiltration Gallery)	2.75	Residential Townhouses + Roads and Driveways	5 (Pervious portion)	0.75	0.75
UNC-1 and UNC-2	Bear Creek	0.15	Landscape	5	NASHYD for Pasture/Lawn	

The site overall imperviousness values were calculated as per the current site plan. Since most of the site is impervious, e.g., building roofs and parking spaces, the total impervious areas are primarily all directly connected to storm outlets. Please note that it is conservative in the VO model to set the XIMP to equal the TIMP, meaning no overland flow path on pervious areas was considered for runoff calculations. Refer to **Appendix B** for supporting VO model parameter calculations.

As mentioned previously, the A3 Post, i.e., the 0.37 ha independent Condo area, will be self-contained using the underground SWM tank installed in the budling block. The SWM tank will be sized using the Rational Method described in **Section 2.2.5**. The outlet of the SWM tank will be connected to the site storm sewer system and discharged into the infiltration gallery under West Amenity Area sized for A2 Area. To be conservative, in the VO modeling, this area was included in the infiltration gallery sizing modeling under West Amenity Area.

A2 Post will be captured and drained to the infiltration gallery under West Amenity Area. The required storage was sized to allow all the runoff volume to be infiltrated via the infiltration gallery at the bottom of chambers without regular outlet structure installed. Emergency relief pipes will be installed at the top of the SWM chambers to connect with the site storm system. These pipes will only function under emergency situations when the SWM chambers exceed capacity.

A1 Post will be captured and discharged into the proposed SWM pond. Similar to the infiltration gallery under West Amenity Area, there will be a 300 mm depth of infiltration gallery installed at the bottom of the SWM pond. The infiltration gallery will function as the SWM pond outlet from elevation 238.55 m to elevation 238.85 m. A 5.0 m of spillway will be installed at pond berm elevation of 264.75 m to let runoff spill out the SWM pond into the Bear Creek valley as the SWM pond reaches the 100-year elevation (see **Table 2-6**) as per the VO model simulation results.

With the SWM scheme proposed, the actual flow discharged into Bear Creek should the SWM Pond spills + peak flows from the UNC-1 and UNC-2 and should be less than the flows under pre-development conditions as per the SWM quantity control requirements outlined in Section 2.1.

An VO model for post-development scenario was completed to reflect the proposed SWM servicing scheme and size the SWM facilities and demonstrate the post-to-pre controls are achieved. The VO model schematic and outputs under the proposed conditions are provided in **Appendix B**.

2.2.5 Proposed SWM Controls

Based on the VO model simulations, as a 665 m^3 storage volume are provided within the dry pond and a 2,929 m^3 storage volume are provided using underground storage chamber under the West Amenity Area, the post-to-pre SWM quantity control required will be achieved.

A1 Post + Uncontrolled Area

As mentioned above, only the dry pond + uncontrolled areas will discharge flow to Bear Creek while the infiltration gallery installed with the west amenity area will capture and retain all the runoff volume on site for infiltration for both A1 Post and A3 Post. Therefore, the site SWM quantity control can be achieved to compare the pre-development flow for the site and the SWM discharge rates + peak flow from the uncontrolled areas. The 665 m^3 storage volume consists of 440 m^3 surface storage + 225 m^3 volume from infiltration basin (1,875 m^2 with 0.3 m depth and 0.4 void space). **Table 2-6** provides the summary of the SWM Control modeling

and calculations results. The detailed VO model outputs and Rational calculations sheets are provided in **Appendix B**.

Table 2-6 SWM Quantity Control Modeling and Calculation Results

Return Period	Pre-Dev Flow to Bear Creek (m^3/s)	SWM Pond Outlet (m^3/s)	Infiltration Capacity (m^3/s)	Control Flow to Bear Creek (m^3/s)	Note
2-year	0.010	0.018	0.020	0	No spill
5-year	0.025	0.019	0.020	0	No spill
10-year	0.037	0.019	0.020	0	No spill
25 Year	0.055	0.020	0.020	0	No spill
50-Year	0.072	0.020	0.020	0	No spill
100-year	0.092	0.063	0.020	0.043	Spill

2.2.6 Dry Pond Design

The SWM Pond has been designed to provide post-to-pre controls using infiltration and broad crest wear. As per the VO modeling results, the SCS 24-hour Storms resulted in a higher peak flow and higher pond storage volume than the 4-hour Chicago Storms, therefore, the SWM pond design was completed based on SCS storms.

Table 2-7 SWM Dry Pond Design Characteristics

Storm Event	Elevation	24-Hour SCS Release Rate (m^3/s)	Total Area to SWM Pond (ha)	Required SCS Storage Volume (m^3)	Water Level (m)	Provided Storage Volume (m^3/s)
Bottom of Stone	238.55	-	1.22	-		225
Top of Stone	238.85	-		-		
2 year	239.00	0.018		214		
Bottom of Pond	239.00	-		-	263.85	665
5 year	239.56	0.019		323	264.00	
10 year	239.81	0.019		397	264.20	
25 year	240.07	0.020		498	264.40	
50 year	240.25	0.020		581	264.55	
100 year	240.30	0.063		605	264.75	

The dry pond design was summarized in **Table 2-7**, while the VO6 model outputs using both 4-hour Chicago and 24-hour SCS storm events are provided in **Appendix B.** As shown above in **Table 2-7**, the post-development discharge from the pond is controlled to the target flow rates. The maximum required storage volume occurs during the 100-year storm event is satisfied with the 665 m^3 of volume provided.

A2 Post + A3 Post

As mentioned above, A2 Post will be totally captured and retained on site, i.e., west amenity area, for infiltration. A 2,929 m^3 storage volume of storm chambers is proposed. The stone base for the chambers are included in the chamber volume calculations. A relief pipe will be installed connecting to the dry pond functioned as an emergency spill way.

A 60 m3 tank and individual infiltration basin (800 m^2) is proposed for the Condo Block, i.e., A3 Post. A post-to-pre flow attenuation will be achieved using the SMW Tank and infiltration basin for the Condo Block. The A3 Post is relatively small, therefore, the post-to-pre flow attenuation and SWM tank sizing calculations are completed using the Modified Ration Method. The outlet of this Condo Block, which has been controlled to the pre-development levels, will be conveyed into the storm sewer system, and then into the infiltration gallery under the west amenity area, combined with A2 Post. To be conservative in VO modeling exercises, it is assumed the A3 Post will combine with A2 Post and discharge into the infiltration gallery directly.

The control level for A2 Post and A3 Post are summarized in **Table 2-8**. The VO model results, and Rational calculations are provided in **Appendix B**.

Table 2-8 SWM Quantity Control Results for A2 Post and A3 Post

Return Period	A2 Post		A3 Post		
	Storage Required (m^3)	Outflow to Bear Creek (m^3/s)	Storage Required (m^3)	Outflow to Underground Storage (L/s)	Outflow to Bear Creek (m^3/s)
2-year	810	0	26	37.9	0
5-year	1,175	0	37	44.5	0
10-year	1,418	0	44	49.0	0
25 Year	1,739	0	51	58.4	0
50-Year	1,991	0	55	67.2	0
100-year	2,255	0	60	74.4	0

The provided storage for A2 Post and A3 Post are 2,929 m^3 and 60 m^3, respectively. Therefore, the storage provided meets the requirements. The detailed VO model outputs and Rational calculations sheets are provided in **Appendix B**.

2.2.7 Underground Storm Chambers

The underground storage system under the West amenity Area was proposed using 807 section of 3-layer GreenStorm-ST chambers (or approved equivalent). The total storage capacity volume is 2,929 m³ as per the supplier. The base elevation of the system is set as 237.8m and takes up an area of 1,541 m^2.

An isolator row, with a bottom area of 22 m^2, is provided to have further water quality treatment after the Jellyfish OGS (Oil Grit Separator) JF10-11-3 unit installed. The isolate row will be wrapped using impermeable non-woven fabric to prevent infiltration.

The rest of GreenStorm chambers, with a bottom area of 1,519 m^2 will only capture “clean” water and infiltrate. Based on our VO modeling, a 1,500 m^2 was applied to estimate the infiltration capacity.

A 300 mm pipe is proposed to provide over-flow for the system when the chambers exceed its capacity under emergency conditions. The over-flow pipe will convey the flow to the dry pond and spill into Bear Creek.

The GreenStorm-ST chambers shop drawing and sizing report, as well as other supporting documents including Operation and Maintenance Manual, were included in **Appendix B.** However, as specified by the supplier, the chamber shop drawings and design shall be reviewed and approved by the landscape architect on file to confirm GreenStorm-ST chambers design will not impact the proposed plating plan in a long run.

2.2.8 Proposed SWM Facilities Design

The SWM storm system and dry pond drawings, including plan and cross sections, and storm pipes, are provided in **Appendix E**. The shop drawings of infiltration gallery under the west amenity area are provided in **Appendix B**. The SWM Tank and the infiltration basin for the Condo Block will be provided separately in the next design stage.

2.3 Stormwater Quality Control

Infiltration plays a critical role in providing SWM controls for this site. Therefore, water quality pretreatment will be installed before infiltration. The stormwater quality treatment should meet Enhanced Level 1 Protection criteria as defined by the MOECC SWM Planning & Design Manual (2003) to achieve 80% TSS (Total Suspended Solids) removal. A treatment train approach was also applied.

A1 Post

A Jellyfish OGS JF6-5-1 unit (or approved equivalent) is installed before discharging runoff into the SWM Pond. The Jellyfish OGS unit is sized to provide 89% TSS removal. A 15 cm of filter media will be installed on top of 30 cm depth of stone basin to provide further treatment before infiltration.

A2 and A3 Post

The required SWM quality treatment train method For A1 Post and A2 Post consist of a Jellyfish OGS unit and the isolated row of the storm chambers to treat the impervious asphalt areas.

The stormwater runoff from drainage area A2 and A3 Post is conveyed through a Jellyfish OGS JF10-11-3 unit (or approved equivalent), followed by an isolator row of the quantity control storm chamber which is wrapped with non-woven fabric.

UNC-1 and UNC-2

A Jellyfish OGS JF6-5-1 unit (or approved equivalent) is proposed for UNC-1 area to achieve 80% TSS removal rate. The Catchment UNC-2 consists of only landscape area; hence, runoff can be considered as “clean”.

The quality control results are summarized below in **Table 2-9**, and detailed calculations, the Jellyfish OGS sizing report is provided in **Appendix B**. The isolated chamber shop drawings are provided in **Appendix B**.

Table 2-9 Quality Control Requirements

Drainage Area	Area (ha)	Effective TSS Removal	Quality Control Measures	Overall TSS Removal
A1 Post	1.22	80%	OGS Jellyfish JF6-5-1 + Filter Media	21.7%
A2 & A3 Post	3.12	80%	OGS Jellyfish JF10-11-3 + Isolated Row	55.6%
UNC-1	0.13	80%	OGS Jellyfish JF6-5-1	2.3%
UNC-2	0.02	100%	Inherently Clean	0.4%
Total	4.49			80.0%

2.4 Water Balance

As per the City, a post-to-pre annual infiltration capacity mitigation will be required for the Water Balance. Based on the supplemental hydrogeological report completed by GEI under separate cover, a monthly pre and post infiltration capacity without mitigation were calculated. The conclusion is approximately 80% of surplus will be infiltrated on site under pre-development conditions.

Based on the site SWM service scheme described above, a total of 3,565 m^3 storage are provided and theoretically this volume will be eventually infiltrated via infiltration galleries (under dry pond and under west amenity area) on site. This volume is equivalent to a total runoff volume of an 88.2 mm (between a 24-hour 5-yr to 10-yr storm depth) over this 4.49 ha area with 0.9 runoff coefficient. It is safe to conclude that 100% of the surplus will be infiltrated

on site. Hence, the post-to-pre water balance requirement will be satisfied using this proposed SWM scheme.

2.5 Erosion Control

During construction, erosion and sediment control will be implemented on site. This will be achieved through methods such as installation of silt fence around the perimeter of the site, placement of mud mats at site access points to municipal roadways and the use of sediment control barriers at catch basins located in proximity to the site. All erosion and sediment control will be designed, maintained, and constructed in accordance with all Town and Region guidelines. For more details, refer to erosion and sediment control drawings in **Appendix E.**

3. Sanitary Drainage System

3.1 Existing Sanitary Drainage System

The subject site is currently vacant. The proposed sanitary network for the condo block will be connected to the existing 250mm diameter municipal sanitary sewer system with a new 1200mm maintenance hole on Ardagh Road between maintenance holes SAP3 & SAP4 located approximately 15 m south of property line. In addition, the proposed sanitary network for the townhouses will be connected to existing 525mm sanitary pipe along Summerset Drive from proposed Street 1 with a new 1200mm maintenance manhole which is downstream of the existing maintenance manhole SAI17286. Refer to as-built drawings in **Appendix A.**

The existing sewers convey sewage easterly to the City of Barrie Wastewater Treatment Facility Pumping Station (Barrie WWTF PS10) located on Bradford Street. Based on the downstream sanitary analysis conducted by Cole Engineering as part of the City of Barrie's Wastewater Collection Master Plan (2019), indicated there were no capacity issue and no surcharging (freeboard greater than 1.8m) predicted based on 2019 conditions during a 25-year storm event.

3.2 Proposed Sanitary System

The subject site consists of a six (6) story multi-level residential building and 220 townhouse units. The proposed sanitary flow has been calculated in **Table 3-1** in accordance with the City of Barrie Sanitary Sewage Collection System Policies and Design Guideline Section 3.4.1 (2021).

Table 3-1 Proposed Sanitary Flow

Site Component	Density (units/ha)	Total Population	Unit Sewage Flow (L/day/person)	Peaking Factor	Domestic Flow (L/s)	Infiltration Rate (L/ha/s)	Infiltration Flow (L/s)	Total Flow (L/s)
Condo	575	154	225	7.272	2.91	0.100	0.016	2.926
Towns	59	515	225	5.710	7.67	0.100	0.372	8.027

The maximum anticipated sanitary flow from the subject site's townhouses & condominium is 2.926 L/s & 8.027 L/s respectively, which is less than the full flow capacity of 46.384 L/s from the proposed 200mm connections on Summerset Drive & Ardagh Road, respectively.

Refer to engineering drawings in **Appendix E** for a depiction of the proposed sanitary sewer alignment and depth within the site and proposed connection to existing sanitary sewer.

4. Water Supply System

4.1 Water Design Guidelines

As per City of Barrie's Water Transmission & Distribution Policies & Design Standard (February 2022) and MECP guidelines, the system design pressure and demand requirements for the residential development are summarized as follows:

- Daily Average Domestic Demand: 225 L/capita/day (Residential); 28m3/ha/day (Commercial); and 35m3/ha/day (Industrial)
- Residential Densities: 3.25 ppu (Low-Density); 2.57 ppu (Medium Density); and 1.67 ppu (High-Density)
- Demand Peaking Factor: Based on MECP Design Guidelines for Drinking Water Systems (2008), Table 3-1: Minimum Hour = 0.4 Maximum Day = 2.75; Peak Hour = 4.13 (based on a 500-1000 population)
- Fire Flow: In accordance with the "Water Supply for Public Fire Protection" by the Fire Underwriters Survey (FUS);
- System Pressure, in accordance with MECP:
    - Minimum Pressure = 140 kPa (20 psi) during maximum Day + fire flow;
    - Maximum Pressure = 700 kPa (100 psi) then a pressure reducing valve is required;
    - Operation Pressure = 350 kPa to 485 kPa (50 to 70 psi) and not less than 275kPa (40 psi) under maximum daily flow
- Hazen-William "C" Factors: C=100 for 150mm diameter pipe; C=110 for 200-250mm diameter pipe and C=120 for 300-600mm.

4.2 Existing Water System

There is an existing municipal 300mm diameter PVC watermain located approximately 25 m south of the property line on Ardagh Road and existing 300mm diameter PVC watermain located approximately 22 m north & west of the property line. A hydrant flow test was conducted on September 22, 2020 from existing hydrants located nearest to Ardagh Road & Summerset Drive intersection, and the results indicate that the static pressure is approximately 627 kPa (91 psi) in the existing 300mm diameter watermain. The hydrant test can be found in **Appendix D.** As this submission exceeds the 2 years expiry period set by City of Barrie Standard (Section 4.3.3), a new test has been requested to verify the calculations presented in **Appendix D**. Further, this test report includes the City of Barrie Fire Flow Testing Calculator completed with September 22, 2020 test results.

4.3 Proposed Water Distribution System

The watermain servicing the subject site's condo development will be 200mm diameter in size for firefighting use and 150mm diameter for domestic use connected to an existing 300mm watermain on Ardagh Road. The watermain servicing for the subject site's townhouses will be 250mm diameter in size for firefighting and domestic use connected to an existing 300mm on Summerset Drive. The site servicing schematic can be seen on the Site Servicing Plan in **Appendix E**.

Based on the City's design criteria and the Fire Underwriters' Survey – Water Supply for Public Fire Protection (2020), the required flow during a maximum day plus fire flow event is 151.1 L/s for the condo and 154.0 L/s for the townhouses. The calculated water demands for the subject development are summarized below in **Table 4-1**. Fire flow and water demand calculations can be found in **Appendix D**.

Table 4-1 Water Demand Calculation Summary

Site Component	Units	Total Population	Demand (L/s)			
			Average Day	Max Hour	Max Day	Fire Flow*
Condo	92	154	0.40	1.65	1.10	150
Cluster Towns	64	165	0.43	1.77	1.18	150
Back-to-Back Towns	156	401	1.04	4.31	2.87	117

**Calculated Fire Flow based on Fire Underwriter's Survey (FUS) Water Supply for Public Fire Protection*

Head loss calculations for the proposed 200mm watermain were completed from the condominium's mechanical room to the connection point nearest to the intersection of Summerset Drive & Ardagh Road. As such, the head loss results under the maximum hour demand for the proposed domestic 150mm watermain for the condominium is calculated to have a residual pressure of 576.70 kPa (83.6 psi), and under the maximum day plus fire flow demand, the proposed 200mm firefighting watermain is calculated to have a residual pressure of 539.48 kPa (78.2 psi). Based on City of Barrie Standards, the minimum fire flow required for condominiums is 200 L/s which exceeds the calculated FUS flow of 150 L/s. In order to meet the minimum fire flow requirements, the residual pressure is revised to 513.49 (74.5 psi) under maximum day plus fire flow demand.

Head loss calculations for the proposed 250mm watermain were completed from the furthest hydrant on Street 2 adjacent to Block 5 to the connection point at the intersection of proposed Street 1 and Summerset Drive as illustrated in **Appendix D**. It is assumed for this submission that the static pressure of 91 psi is suitable to apply to this connection point given its proximity testing location at Ardagh Road and Summerset Drive. Additional hydrant tests are currently scheduled to validate the static pressure at this connection point. As such, the head loss results under the maximum hour demand for townhomes, the proposed 250mm watermain is

calculated under maximum hour demand to have a residual pressure of 537.45 kPa (78.0 psi), and under the maximum day plus fire flow demand, the proposed 250mm watermain is calculated to have a residual pressure of 440.04 kPa (63.8 psi). Based on City of Barrie Standards, the minimum fire flow required for townhouses is 155 L/s which exceeds the calculated FUS flow of 150 L/s for the most restrictive townhouse block among both street town and back-to-back units. In order to meet the minimum fire flow requirements, the residual pressure is revised to 432.82 (62.8 psi) under maximum day plus fire flow demand.

The head loss calculations for the proposed watermain to service the furthest proposed hydrant have been included in **Appendix D**. The representative townhouse blocks for FUS calculations as well as preliminary proposed firewall locations recommended by Onespace Unlimited Inc. are detailed in **Appendix D**.

The proposed 200mm diameter watermain for the condominium will satisfy the City's normal operations criteria under all normal demand conditions. The pressure of 513.49 (74.5 psi) during the maximum day plus fire flow demand scenario also satisfies the City's minimum operating pressure requirement during firefighting events of 140 kPa (20 psi).

The proposed 250mm diameter watermain for the townhouse blocks will satisfy the City's normal operations criteria under all normal demand conditions. The pressure of 432.82 (62.8 psi) during the maximum day plus fire flow demand scenario also satisfies the City's minimum operating pressure requirement during firefighting events of 140 kPa (20 psi).

Based on the hydrant test by VIPOND, the projected flow rate of 209 L/s using the pressure under fire suppression (20 psi) exceeded the minimum fire flow requirement for both the condominium (200 L/s) and townhouse (155 L/s) is calculated in **Appendix D**.

5. Conclusions

GEI Consultants Ltd. (GEI) was retained by Stateview Homes (BEA Towns) Inc. (the "Client") to prepare a Servicing & Stormwater Management Report (SSWMR) in support of development approvals under the Planning Act for a 4.5 hectare residential development at Summerset Drive and Ardagh Road in the City of Barrie, Ontario (the "Site").

This report has demonstrated that the detailed design is in conformance with the various standards and guidelines (as applicable) from the City of Barrie (City), Nottawasaga Valley Conservation Authority (NVCA), Ministry of Environment, Climate and Parks (MECP), the Ardagh Secondary Plan and the Ardagh West Master Servicing Plan, as summarized below.

Stormwater Management

- The site is located within the Middle Nottawasaga River Watershed and all storm discharge is tributary to Bear Creek located approximately 40 m east of the site.
- Enhanced Protection (80% TSS Removal) is provided by the infiltration galleries and water quality filtration units.
- All post-development peak flows are less than pre-development levels for the 2 year through 100 year return periods, using the critical storm.
- Safe conveyance of regional flow is provided via the end-of-pipe dry SWM facility to the tributary of Bear Creek.
- Water balance is improved upon post-development by providing 3,565 m^3 of infiltration capacity, equivalent to approximately 88.2 mm of rainfall across the site.
- During construction, erosion and sediment control will be effectively implemented based on the enclosed erosion and sediment control plans.

Sanitary System

- Proposed sanitary network for the mid-rise block will be connected to the existing 250mm diameter municipal sanitary sewer system with a new 1200mm maintenance hole on Ardagh Road between maintenance holes SAP3 & SAP4 located approximately 15 m south of property line.
- Proposed sanitary network for the townhouses will be connected to existing 525mm sanitary pipe along Summerset Drive from proposed Street 1 with a new 1200mm maintenance manhole which is downstream of the existing maintenance manhole SAI17286.

- The maximum anticipated sanitary flow from the townhouses is 3 L/s, which is less than design capacity of the 200 mm service connection.

- The maximum anticipated sanitary flow from the mid-rise block is 8 L/s, which is less than the design capacity of the proposed service connection.

Water Supply System

- Existing municipal 300mm diameter PVC watermain located approximately 25 m south of the property line on Ardagh Road.

- Existing 300mm diameter PVC watermain located approximately 22 m north & west of the property line on Summerset Drive

- Current design is based on hydrant flow tests completed in September 2020 which are now considered to be out-of-date, technically, but not materially different. Notwithstanding, new hydrant tests have been commissioned for October 2022 and will be reflected in subsequent design submissions.

- The watermain servicing the mid-rise block will be 200mm fire supply and 150mm domestic, connected to the existing 300mm watermain on Ardagh Road.

  The proposed 200mm diameter watermain for the condominium will satisfy the City's normal operations criteria under all normal demand conditions. The pressure of 513.49 (74.5 psi) during the maximum day plus fire flow demand scenario also satisfies the City's minimum operating pressure requirement during firefighting events of 140 kPa (20 psi).

- The watermain servicing for the townhouses will be a single 250mm for fire supply and domestic, connected to the existing 300mm watermain on Summerset Dr.

- The proposed 250mm diameter watermain for the townhouse blocks will satisfy the City's normal operations criteria under all normal demand conditions. The pressure of 432.82 (62.8 psi) during the maximum day plus fire flow demand scenario also satisfies the City's minimum operating pressure requirement during firefighting events of 140 kPa (20 psi).

Appendix A

Background Information



Note: Site Location is conceptually displayed

189 Summerset Drive Barrie, ON	GEI Consultants	Location Plan
Stateview Homes (BEA Towns) Inc. Vaughan, ON	Project 2104593	October 2022 LOC-1

onespace
one team. one vision.

onespace unlimited inc.
architecture + interior design
3700 STEELES AVE WEST. SUITE 305.
VAUGHAN,
ONTARIO L4L 9R9 TEL: (416)
848-1245 FAX: (416)
848-1246
WWW.ONESPACEUNLIMITED.COM

SUMMERSET DRIVE

SUBJEC T

BLOCK 1

AMENITY AREA
1544 M2

S.W.M. AREA
1205.9 M2

AMENITY AREA
2536 M2

PIN 58763-1249

LOT 2 CONCESSION 14

(ROAD ALLOWANCE BETWEEN CONCESSIONS 13 AND 14)

ARDA

OPEN SPACE

BLOCK 01 — 3 STOREY, 16 UNITS
BLOCK 02 — 3 STOREY, 12 UNITS
BLOCK 03 — 3 STOREY, 10 UNITS
BLOCK 04 — 3 STOREY, 12 UNITS
BLOCK 05 — 3 STOREY, 14 UNITS
BLOCK 06 — 3 STOREY, 6 UNITS
BLOCK 07 — 3 STOREY, 7 UNITS
BLOCK 08 — 3 STOREY, 7 UNITS
BLOCK 09 — 3 STOREY, 7 UNITS
BLOCK 10 — 3 STOREY, 16 UNITS
BLOCK 11 — 3 STOREY, 16 UNITS
BLOCK 12 — 3 STOREY, 16 UNITS
BLOCK 13 — 3 STOREY, 10 UNITS
BLOCK 14 — 3 STOREY, 6 UNITS
BLOCK 15 — 3 STOREY, 6 UNITS
BLOCK 16 — 3 STOREY, 8 UNITS
BLOCK 17 — 3 STOREY, 6 UNITS
BLOCK 18 — 3 STOREY, 6 UNITS
BLOCK 19 — 3 STOREY, 7 UNITS
BLOCK 20 — 3 STOREY, 12 UNITS
BLOCK 21 — 3 STOREY, 12 UNITS
BLOCK 22 — 3 STOREY, 10 UNITS

6 STOREY TERRACE — LINE OF PARKING GARAGE BELOW
5 STOREY TERRACE
STAIR
ELEVATOR
MPH
EXHAUST
SNOW STORAGE
PICK UP/ DROP OFF
OUTDOOR AMENITY @ MPH
OUTDOOR AMENITY @ GRADE
TERRACE
CANOPY
INTAKE
FIRE ROUTE
PROPERTY LINE

R 7500 — R 12000 — R 300 — R 1500

S86°14'40"W 88.74
N84°35'30"E 23.88
N5°45'50"W 8.17
N84°47'10"E 7.62
N80°49'40"E 8.01
N53°37'00"W 2.24
N77°10'50"E 8.18
N5°45'50"W 15.91
N84°47'10"E 20.58
N5°45'50"W 15.91
S84°47'10"W 20.58
S5°45'50"E 15.91
S84°47'10"W 88.74
N5°45'50"W 15.91
S84°47'10"W 15.91
N5°45'50"W 15.91
S84°47'10"W 15.91
N5°45'50"W 15.91
S84°47'10"W 15.91

METRIC: DISTANCES AND ELEVATIONS SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

NOTES

CB	■ DENOTES CATCH BASIN
MH	● DENOTES MANHOLE
UP (SAN)	● DENOTES UTILITY MANHOLE
HP	● DENOTES HYDRO POLE
HW	■ DENOTES HAND WELL
WV	⊗ DENOTES WATER VALVE
D/T 0.10	DENOTES DECIDUOUS TREE 0.10m dia.
C/T 0.10	DENOTES CONIFEROUS TREE 0.10m dia.
☼	DENOTES LIGHT
TP	DENOTES TELEPHONE
OW	DENOTES OVERHEAD WIRES
FH	DENOTES FIRE HYDRANT
GUY	—○— DENOTES GUY WIRE/POLE

BENCHMARK

ELEVATIONS SHOWN HEREON ARE GEODETIC AND ARE REFERRED TO ONTARIO MINISTRY OF NATRYAL RESOURCES AND FORESTRY MONUMENT No. 03120030026 HAVING A PUBLISHED ELEVATION OF 244.262 METRES

CONTOUR INTERVAL 0.50m

CAUTION

THIS IS NOT A PLAN OF SURVEY OF THE BOUNDARY AND SHALL NOT BE USED EXCEPT FOR THE PURPOSE INDICATED IN THE TITLE BLOCK. ALL BOUNDARY AND PLAN INFORMATION SHOWN ON THIS TOPOGRAPHIC PLAN HAVE BEEN COMPILED FROM REGISTRY OFFICE RECORDS.

TOPOGRAPHIC PLAN OF
BLOCK 76
REGISTERED PLAN 51M-1167
CITY OF BARRIE
COUNTY OF SIMCOE
SCALE 1:300

5 0 5 10 15 20 METRES

SCHAEFFER DZALDOV PURCELL LTD.

© COPYRIGHT

LOT 2, CONCESSION 14
PART 1, PLAN 51R-33917
PIN 58763-1686

LOT 23

LOT 22

LOT 1, CONCESSION 14

SUMMERSET DRIVE
(DEDICATED BY REGISTERED PLAN 51M-1167)
PIN 58763-1772

PART 1, PLAN 51R-33917
(SUBJECT TO EASEMENT AS IN INST. No. SC172709)

BLOCK 79
PIN 58763-1767

BLOCK 76
PIN 58763-1764

REGISTERED PLAN 51M - 1167

BLOCK 80 (5.0 ROAD WIDENING) PIN 58763-1768

ARDAGH ROAD
(ROAD ALLOWANCE BETWEEN CONCESSIONS 13 AND 14)
PIN 58763-0002

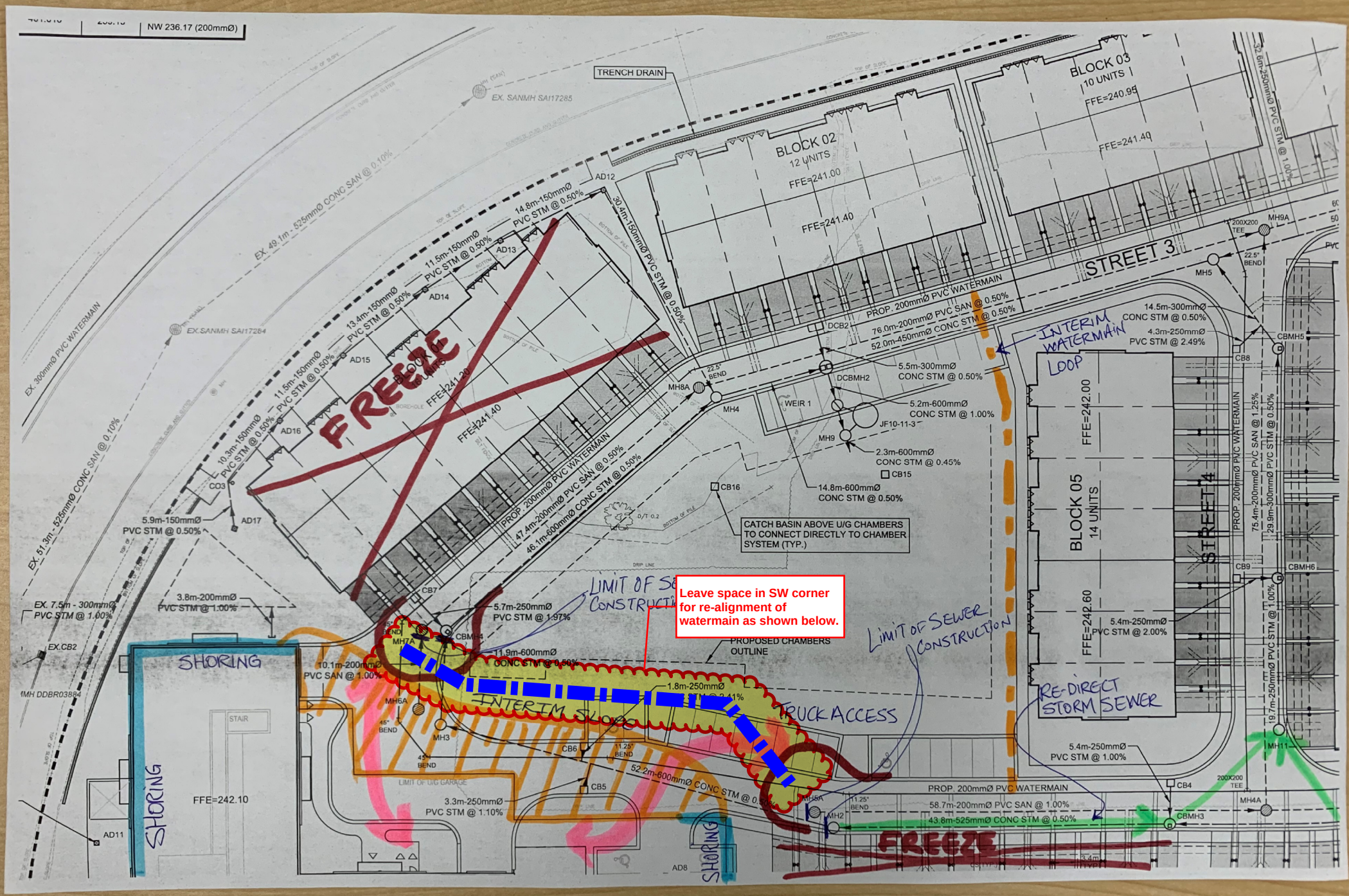
SURVEYOR'S CERTIFICATE

I CERTIFY THAT:
THE FIELD SURVEY REPRESENTED ON THIS TOPOGRAPHIC PLAN WAS COMPLETED ON THE 6TH DAY OF JULY, 2022.

DATE: SEPTEMBER 20, 2022.

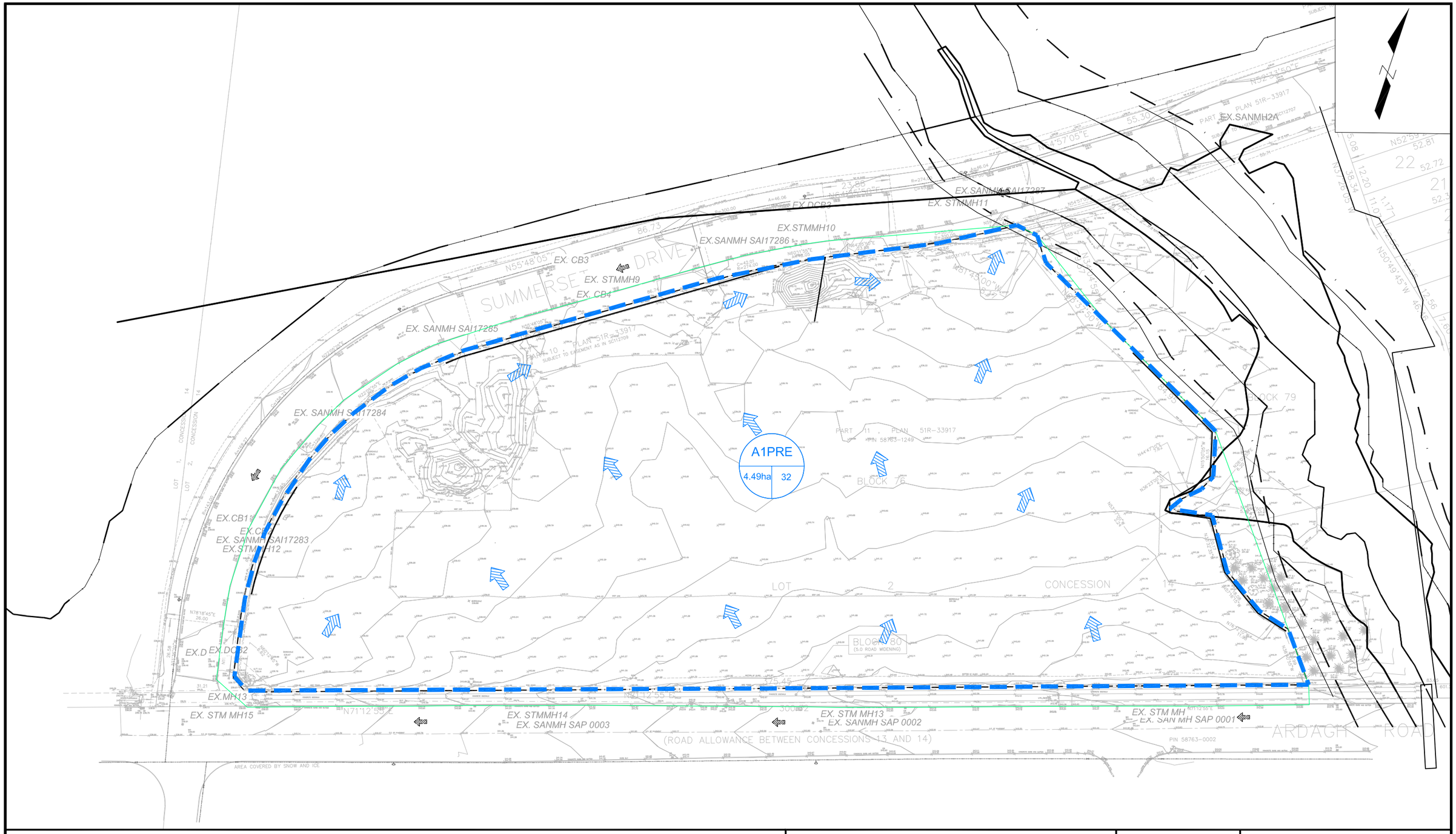
NIKOLAI N. DZALDOV
ONTARIO LAND SURVEYOR

SCHAEFFER DZALDOV PURCELL LTD.
ONTARIO LAND SURVEYORS
54 JARDIN DRIVE CONCORD, ONTARIO L4K 3P3 TEL:(416)-987-0101
DRAWN: SAM/LW CHECKED SCALE 1 : 300 JOB No. 20-400-01


NW 236.17 (200mmØ)
TRENCH DRAIN
EX. SANMH SAI17285
EX. 49.1m - 525mmØ CONC SAN @ 0.10%
EX. 300mmØ PVC WATERMAIN
EX.SANMH SAI17284
EX. 51.3m - 525mmØ CONC SAN @ 0.10%
BLOCK 02
12 UNITS
FFE=241.00
FFE=241.40
BLOCK 03
10 UNITS
FFE=240.95
FFE=241.40
FREEZE
FFE=241.20
FFE=241.40
AD12
AD13
AD14
AD15
AD16
AD17
CO3
14.8m-150mmØ PVC STM @ 0.50%
11.5m-150mmØ PVC STM @ 0.50%
13.4m-150mmØ PVC STM @ 0.50%
11.5m-150mmØ PVC STM @ 0.50%
10.3m-150mmØ PVC STM @ 0.50%
30.4m-150mmØ PVC STM @ 0.50%
5.9m-150mmØ PVC STM @ 0.50%
PROP. 200mmØ PVC WATERMAIN
47.4m-200mmØ PVC SAN @ 0.50%
46.1m-600mmØ CONC STM @ 0.50%
PROP. 200mmØ PVC WATERMAIN
76.0m-200mmØ PVC SAN @ 0.50%
52.0m-450mmØ CONC STM @ 0.50%
DCB2
DCBMH2
MH8A
MH4
WEIR 1
JF10-11-3
MH9
5.5m-300mmØ CONC STM @ 0.50%
5.2m-600mmØ CONC STM @ 1.00%
2.3m-600mmØ CONC STM @ 0.45%
CB15
CB16
14.8m-600mmØ CONC STM @ 0.50%
22.5° BEND
CATCH BASIN ABOVE U/G CHAMBERS TO CONNECT DIRECTLY TO CHAMBER SYSTEM (TYP.)
STREET 3
MH5
200X200 TEE
MH9A
22.5° BEND
14.5m-300mmØ CONC STM @ 0.50%
4.3m-250mmØ PVC STM @ 2.49%
CBMH5
CB8
INTERIM WATERMAIN LOOP
BLOCK 05
14 UNITS
FFE=242.00
FFE=242.60
STREET 4
PROP. 200mmØ PVC WATERMAIN
75.4m-200mmØ PVC SAN @ 1.25%
29.9m-300mmØ PVC STM @ 0.50%
19.7m-250mmØ PVC STM @ 1.00%
CB9
CBMH6
5.4m-250mmØ PVC STM @ 2.00%
MH11
5.4m-250mmØ PVC STM @ 1.00%
RE-DIRECT STORM SEWER
3.8m-200mmØ PVC STM @ 1.00%
EX. 7.5m - 300mmØ PVC STM @ 1.00%
EX.CB2
MH DDBR03884
5.7m-250mmØ PVC STM @ 1.97%
CBMH4
MH7A
11.9m-600mmØ CONC STM @ 0.50%
PROPOSED CHAMBERS OUTLINE
10.1m-200mmØ PVC SAN @ 1.00%
1.8m-250mmØ
LIMIT OF SEWER CONSTRUCTION
TRUCK ACCESS
SHORING
STAIR
MH6A
MH3
45° BEND
CB6
11.25° BEND
52.2m-600mmØ CONC STM @ 0.50%
LIMIT OF U/G GARAGE
CB5
3.3m-250mmØ PVC STM @ 1.10%
FFE=242.10
AD11
AD8
SHORING
MH6A
MH2
11.25° BEND
PROP. 200mmØ PVC WATERMAIN
58.7m-200mmØ PVC SAN @ 1.00%
43.8m-525mmØ CONC STM @ 0.50%
CB4
CBMH3
200X200 TEE
MH4A
FREEZE
Leave space in SW corner for re-alignment of watermain as shown below.

Appendix B

Stormwater Management Analysis



LEGEND:

- PROPERTY LINE
- EXISTING STORM DRAINAGE AREA BOUNDARY
- EXISTING OVERLAND FLOW DIRECTION

A1PRE
4.49ha 50

- STORM DRAINAGE AREA NUMBER
- DRAINAGE AREA IN HECTARES
- CURVE NUMBER

BEAR CREEK VILLAGE
BARRIE, ONTARIO

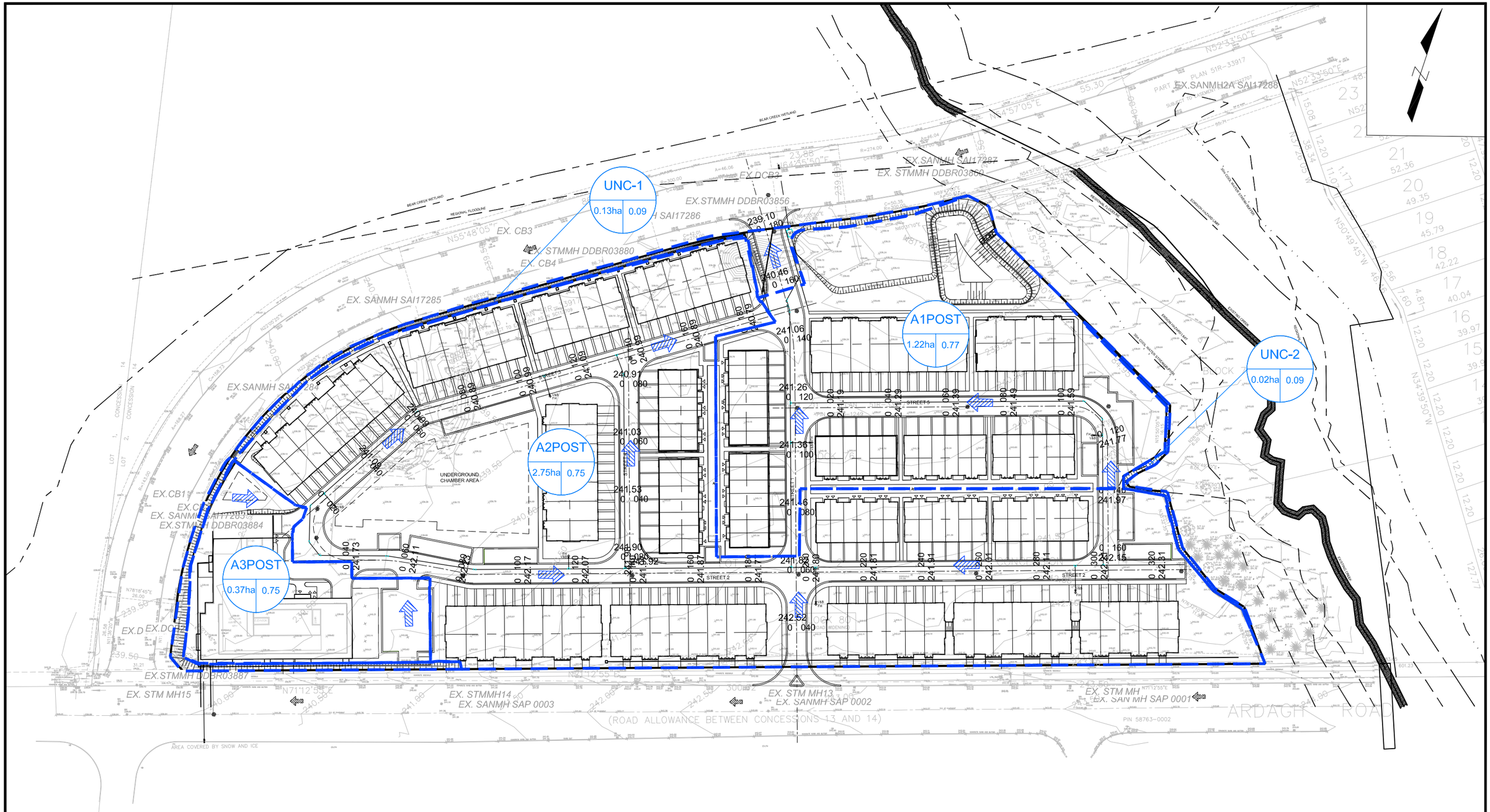
STATEVIEW HOMES

GEI Consultants

PRE-DEVELOPMENT DRAINAGE AREA PLAN

2104593 | **AUGUST 2022** | **DAP-1**

C:\ProgramData\Autodesk\ApplicationPlugins\Landproject22.bundle\Contents B:\Working\STATEVIEW HOMES\2104593 Bear Creek Village Barrie\00_CAD\Design\Figures\2104593 - DAP.dwg - 8/24/2022



LEGEND:

- PROPERTY LINE
- PROPOSED STORM DRAINAGE AREA BOUNDARY
- PROPOSED OVERLAND FLOW DIRECTION

A1POST (4.49ha | 0.50)

- DRAINAGE AREA IN HECTARES
- STORM DRAINAGE AREA NUMBER
- TOTAL IMPERVIOUS / DIRECT IMPERVIOUS VALUE

BEAR CREEK VILLAGE
500 ARDAGH ROAD
BARRIE, ONTARIO

STATEVIEW HOMES

GEI Consultants

2104593

POST-DEVELOPMENT DRAINAGE AREA PLAN

SEPTEMBER 2022 **DAP-2**

C:\ProgramData\Autodesk\ApplicationPlugins\Landproject22.bundle\Contents B:\Working\STATEVIEW HOMES\2104593 Bear Creek Village Barrie\00_CAD\Design\Figures\2104593 - DAP.dwg - 9/1/2022

GEI Consultants

Pre-Development Drainage Parameters

Project Name:	Bea Towns
Project No.:	2104593
Prepared By:	Whitney Trinh
Date:	September 2022

A101 -- NASHYD		
Area	ha	4.49
Land Use	Vacant Open Space	
C	Runoff coefficient obtained from NVCA Table 10.6 for Type A soil under category of "Woodland; Rolling 5-10% Slopes"	0.12
DT		5 min
DWF	Dry Weather Flow (Base Flow)	0.00
CN	Curve Number. Calculated using NVCA criteria for type A soil under category of "woods"	32
Ia		10 mm
Storm Index	Default Value	1
N	Default Value	3.0
Tp	Calculated using Airport Method fort Tc; Tp = 2/3 of Tc	0.62

L (m)	252.6
Highpoint	240.0
Lowpoint	238.2
Slope	0.743
Tc	56.01
Tp	0.62

(b) Airport Formula

$$T_c = \frac{3.26 * (1.1 - C) * L^{0.5}}{S_w^{0.33}}$$

where:

T_c = Time of concentration, min
L = Watershed length, m
S_w = Watershed slope, %
A = Watershed area, ha

GEI Consultants

Pre-Development Flows

Project Name:	Bea Towns
Project No.:	2104593
Prepared By:	Whitney Trinh
Date:	September 2022

	A1 Pre	
Return Period	4-hour Chicago (m^3/s)	24-hour SCS (m^3/s)
2-year	0.007	0.010
5-year	0.016	0.025
10-year	0.024	0.037
25-year	0.036	0.055
50-year	0.046	0.072
100-year	0.058	0.092

GEI Consultants

Post-Development Drainage Parameters

Project Name:	Bea Towns
Project No.:	2104593
Prepared By:	Chaodong Sheng
Date:	September 2022

A1Post -- STANDHYD		
Area	ha	1.22
Land Use	Residental Homes and Roads	
Runoff C		0.74
Imperviousness		0.77
VO ID		A201
VO Command	STANDHYD	
TIMP	Total Impervious Area	0.77
XIMP	Impervious Area (Direct Connection)	0.77
LGI	Overland Flow Length (Impervious)	90.2
DT	Time Step Increment	5 min
SLPI	Average Slope (Impervious)	1%
DWF	Dry Weather Flow (Base Flow)	0.00
LOSS	Rainfall Loss Method	*CN = 85, IA = 2.4
	*CN and IA calculated using NVCA criteria for type A soil under category of "Wetlands/lakes/SWMFs" and "Impervious Area"	
SLPP	Average Slope (Pervious)	2%
LGP	Overland Flow Length (Pervious)	40.00
MNP	Mannings Roughness Coefficient (Pervious)	0.25
DPSI	Depression Storage (Pervious)	2 mm
MNI	Manning's Roughness Coefficient (Impervious)	0.013

A2 and A3Post -- STANDHYD		
Area	ha	3.12
Land Use	Residental Homes and Roads	
Runoff C		0.72
Imperviousness		0.75
VO ID		202
VO Command	STANDHYD	
TIMP	Total Impervious Area	0.75
XIMP	Impervious Area (Direct Connection)	0.75
LGI	Overland Flow Length (Impervious)	144.2
DT	Time Step Increment	5 min
SLPI	Average Slope (Impervious)	1%
DWF	Dry Weather Flow (Base Flow)	0.00
LOSS	Rainfall Loss Method	*CN = 85, IA = 2.4
	*CN and IA calculated using NVCA criteria for type A soil under category of "Wetlands/lakes/SWMFs" and "Impervious Area"	
SLPP	Average Slope (Pervious)	2%
LGP	Overland Flow Length (Pervious)	40.00
MNP	Mannings Roughness Coefficient (Pervious)	0.25
DPSI	Depression Storage (Pervious)	1 mm
MNI	Manning's Roughness Coefficient (Impervious)	0.013

UNC-1 and UNC-2 -- NASHYD		
Area	ha	0.15
Land Use	Landscape	
C		0.24
Imperviousness		0.06
TIMP	Total Impervious Area	0.06
XIMP	Impervious Area (Direct Connection)	0.06
DT		5 min
DWF	Dry Weather Flow (Base Flow)	0.00
CN	Curve Number. Calculated using NVCA criteria for type A soil under category of "lawn"	49
Ia	Calculated using NVCA criteria for category of "lawn"	5 mm
Storm Index	Default Value	1
N	Default Value	3.0
Tp	Calculated using Airport Method fort Tc; Tp = 2/3 of Tc	0.16

L (m)	22.8
Highpoint	240.6
Lowpoint	239.6
Slope	0.743
Tc	14.76
Tp	0.16

(b) Airport Formula

$$T_c = \frac{3.26 * (1.1 - C) * L^{0.5}}{S_w^{0.33}}$$

where:

T_c = Time of concentration, min
L = Watershed length, m
S_w = Watershed slope, %
A = Watershed area, ha

GEI Consultants

Post-Development Flows and Storage Sizing

Project Name:	Bea Towns
Project No.:	2104593
Prepared By:	Chaodong Sheng
Date:	September 2022

Phase 2									
Return Period	Predevelopment Target Flow (m^3/s)	Controlled 4-hour Chicago Flow (m^3/s)	Controlled 24-hour Type II SCS Flow (m^3/s)	Chicago Storm Storm Chamber Storage Used (m^3) (VO ID: 0020)	SCS Storm Storage Chamber Storage Used (m^3) (VO ID: 0020)	Greenstorm Chamber Storage Provided (m^3)	Chicago Storm Storage Used (m^3) (VO ID: 0010)	SCS Storm Storage Used (m^3) (VO ID: 0010)	Pond Storage Provided (m^3)
2-year	0.010	0.019	0.020	770.0	810.0		220.0	214.0	
5-year	0.025	0.022	0.024	1082.0	1175.0		319.0	323.0	
10-year	0.037	0.023	0.026	1297.0	1418.0		394.0	397.0	
25-year	0.055	0.025	0.029	1571.0	1739.0		495.0	498.0	
50-year	0.072	0.027	0.031	1768.0	1991.0		569.0	581.0	
100-year	0.092	0.055	0.070	1965.0	2255.0	2929.4	605.0	605.0	440.0

Storage		Area (m^2)	Perculation Rate (mm/hr)	Discharge (L/s)			
SWM Pond	85	940	76.57	0.020			
Underground Storage		1500	74.30	0.031			
			Total	0.051	Equivalent to 25-year		

Total Site Area = 4.49 ha			24-hr Rainfall Depth		
Storage Volume Provided					
SWM Pond	440.0	m^3	5-year 24-hr Rainfall	86.8	mm
Underground Storage	2929.4	m^3	10-year 24-hr Rainfall	99.2	mm
Total	3369.4	m^3	Equivalent Rainfall Depth	83.4	mm

	5-year				10-year		
	a	853.608		3.62	975.865		4.13
	b	4.699			4.699		
	c	0.766			0.76		

Water Quality Calculations

GEI Consultants

Project Name:	Bea Towns
Project No.:	2104593
Prepared By:	Chaodong Sheng
Date:	September 2022

Surface	Area (ha)	% of Site Area	Effective TSS Removal	Overall TSS Removal
A1 Post	1.22	27.2%	80%	21.7%
A2 & A3 Post	3.12	69.5%	80%	55.6%
UNC-1	0.13	2.9%	80%	2.3%
UNC-2	0.02	0.4%	100%	0.4%
Total Area:	**4.49**	27.2%		**80%**

Peto MacCallum Ltd.
CONSULTING ENGINEERS

GEOTECHNICAL/HYRDOGEOLOGICAL INVESTIGATION
PROPOSED RESIDENTIAL DEVELOPMENT
ARDAGH ROAD AND SUMMERSET DRIVE
BARRIE, ONTARIO

for

WYNSTAR BEAR CREEK LP



PETO MacCALLUM LTD.
19 CHURCHILL DRIVE
BARRIE, ONTARIO
L4N 8Z5
PHONE: (705) 734-3900
FAX: (705) 734-9911
EMAIL: barrie@petomaccallum.com

Distribution:
1 cc: Wynstar Bear Creek LP (email only)
1 cc: PML Barrie

PML Ref.: 21BF003
Report: 1
March 2021

Peto MacCallum Ltd.
CONSULTING ENGINEERS

March 23, 2021

PML Ref.: 21BX003
Report: 1

Mr. David Seaman
Wynstar Bear Creek LP
100 New Park Place, Suite 820
Vaughan, Ontario
L4K 0H9

Dear Mr. Seaman

Geotechnical/Hydrogeological Investigation
Proposed Residential Development
Ardagh Road and Summerset Drive
Barrie, Ontario

Peto MacCallum Ltd. (PML) is pleased to present the results of the geotechnical/hydrogeological investigation recently completed at the above noted project site. Authorization for this work was provided by Mr. D. Seaman in an email dated January 12, 2021, with the provision of Purchase Order No. WBC-10013.

A residential development is proposed for the parcel of land between Ardagh Road and the meandering Summerset Drive in Barrie. A six-storey condominium building is currently proposed and two levels of underground parking are being considered. Approximately 220 back-to-back town homes are proposed without basements (slab-on-grade). Full municipal servicing is proposed along with a network of internal paved roads. A Storm Water Management (SWM) pond is proposed for the northeast corner of the site. It is understood grades will likely be raised 1.0 to 2.0 m. The preliminary concept plans for the property layout are shown on Drawing 1, appended.

A geotechnical/hydrogeological investigation has been requested to determine the general subsurface conditions at the site, and based on this information, provide geotechnical engineering recommendations for earthworks, building foundations and basements, site servicing, SWM pond and pavement design. Hydrogeological input will be provided for preliminary LID parameters, preliminary water quality assessment, ground water levels, gradient, and flow direction.

Geoenvironmental services (observations, recording, chemical testing or assessment of the environmental conditions of the soil and ground water) were not within the terms of reference for this assignment, and no work has been carried out in this regard. If excess excavated soils requiring transportation off-site are generated, a program of sampling and chemical testing will be needed to determine the chemical properties of the soil to evaluate appropriate receiving site options, in accordance with O.Reg. 406/19.

We trust the report is complete within our terms of reference and the information presented is sufficient for your present purposes. If you have any questions or when we may be of further service, please do not hesitate to call our office.

Sincerely

Peto MacCallum Ltd.

Geoffrey R. White, P.Eng.
Director
Manager, Geotechnical Services

AK/DP/GRW:tc

19 Churchill Drive, Barrie, Ontario L4N 8Z5
Tel: (705) 734-3900 Fax: (705) 734-9911
E-mail: barrie@petomaccallum.com

TABLE OF CONTENTS

1. INTRODUCTION 1

2. INVESTIGATION PROCEDURES 2

2.1 Borehole Drilling and Monitoring Well Installation 2

2.2 Borehole Permeability Testing 3

2.3 Ground Water Sampling 4

2.4 Ground Water Level Monitoring Program 5

3. SITE SETTING 5

3.1 Physiography and Topography 5

3.2 Drainage and Surface Water Flow 5

4. GEOLOGY AND SUBSURFACE CONDITIONS 6

4.1 Geology 6

4.2 Subsurface Conditions 6

4.3 Soil 6

4.4 Ground Water 7

5. GEOTECHNICAL ENGINEERING CONSIDERATIONS 8

5.1 Site Grading and Engineered Fill 8

5.2 Foundations 9

5.2.1 Seismic Design 10

5.3 Floor Slab-on-Grade 10

5.4 Basements 11

5.5 Site Servicing 12

5.5.1 Trench Excavation and Ground Water Control 12

5.5.2 Pipe Support, Pipe Bedding and Cover 12

5.5.3 Trench Backfill 12

5.6 Storm Water Management Pond 13

5.7 Excavation and Ground Water Control 14

5.8 Pavement Design and Construction 15

5.9 Geotechnical Review and Construction Inspection and Testing 16

6. HYDROGEOLOGICAL CONSIDERATIONS 17

6.1 Aquifers and Local Ground Water Use 17

6.2 Preliminary Infiltration Assessment 17

6.2.1 In-Situ Permeability Tests 18

6.2.2 Grain Size Distribution 18

6.3 Ground Water Sample Chemical Test Results 19

7. CLOSURE 21

Figure 1– Grain Size Distribution

Figure 2 – General Recommendations Regarding Drainage and Backfill Requirements for Basement Walls

List of Abbreviations

Log of Boreholes 1 to 13

Drawing No. 1 – Borehole/Monitoring Well Location Plan

Appendix A – Statement of Limitations

Appendix B – Borehole Permeability Testing

Appendix C – Certificates of Analyses for Groundwater Chemical Testing

Appendix D – Engineered Fill

Appendix E – MECP Water Well Records

1. INTRODUCTION

Peto MacCallum Ltd. (PML) is pleased to present the results of the geotechnical investigation recently completed at the above noted project site. Authorization for this work was provided by Mr. D. Seaman in the signed Engineering Services Agreement, dated January 12, 2021 with the provision of Purchase Order No. WBC-10013.

A residential development is proposed for the parcel of land between Ardagh Road and the meandering Summerset Drive in Barrie. A six-storey condominium building is currently proposed and two levels of underground parking are being considered. Approximately 220 back-to-back town homes are proposed without basements (slab-on-grade). Full municipal servicing is proposed along with a network of internal paved roads. A Storm Water Management (SWM) pond is proposed for the northeast corner of the site. It is understood grades will likely be raised 1.0 to 2.0 m. The preliminary concept plans for the property layout are shown on Drawing 1, appended.

A geotechnical/hydrogeological investigation has been requested to determine the general subsurface conditions at the site, and based on this information, provide geotechnical engineering recommendations for earthworks, building foundations and basements, site servicing, SWM pond and pavement design. Hydrogeological input will be provided for preliminary LID parameters, preliminary water quality assessment, ground water levels, gradient, and flow direction.

Geoenvironmental services (observations, recording, chemical testing or assessment of the environmental conditions of the soil and ground water) were not within the terms of reference for this assignment, and no work has been carried out in this regard. If excess excavated soils requiring transportation off-site are generated, a program of sampling and chemical testing will be needed to determine the chemical properties of the soil to evaluate appropriate receiving site options, in accordance with O.Reg. 406/19.

The comments and recommendations provided in this report are based on the site conditions at the time of the investigation, and are applicable only to the proposed works as addressed in the report. Any changes in the proposed plans will require review by PML to re-assess the validity of the report, and may require modified recommendations, additional investigation and/or analysis.

This report is subject to the Statement of Limitations in Appendix A and should be read in conjunction with the report.

2. INVESTIGATION PROCEDURES

2.1 Borehole Drilling and Monitoring Well Installation

The field work for the investigation was carried out February 8 and 9, 2021 and consisted of Boreholes 1 to 13. Two boreholes were advanced to 6.5 m and two boreholes were advanced to 8.0 m depth for the condominium building. Nine boreholes were advanced to 5.0 m depth across the remainder of the site. The borehole locations are shown on Drawing 1, appended.

PML laid out the boreholes in the field. The ground surface elevation at the borehole locations, with the exception of Boreholes 8 and 9, were obtained with a Sokkia SHC5000 GPS System equipped with a GCX3 (network RTK rover) Global Navigation Satellite System (GNSS) Receiver. Vertical and horizontal accuracy of the GPS unit are 0.1 m and 0.5 m, respectively.

Surface elevations for Boreholes 8 and 9, were established relative to a Temporary Bench Mark (TBM), described as follows:

TBM: Temporary Bench Mark
Borehole 10
Elevation 238.50 (metric, geodetic)

All borehole elevations in this report are geodetic and expressed in metres.

Co-ordination for clearances of underground utilities was provided by PML. The boreholes were advanced cognizant of the underground utilities.

The boreholes were advanced using continuous flight solid stem augers, powered by a track mounted CME-55 drill rig, equipped with an automatic hammer, supplied and operated by a specialist drilling contractor, working under the full-time supervision of a member of PML's engineering staff.

The thickness of the topsoil unit, where encountered at borehole locations, was measured in hand dug divots.

Representative samples of the overburden were recovered at frequent depth intervals for identification purposes using a conventional 51 mm OD split spoon sampler. The sampler excludes particles larger than 38 mm. Standard penetration tests were carried out simultaneously with the sampling operations to assess the strength characteristics of the subsoil. The ground water conditions in the boreholes were assessed during drilling by visual examination of the soil samples, the sampler, and drill rods as the samples were retrieved, and measurement of the water level in the open boreholes, if any.

Monitoring wells, comprised of 50 mm diameter pipe, filter sand, bentonite seal, and stick-up protection casing, were installed in six boreholes. The details of the monitoring well installation are shown on the applicable Log of Borehole Sheets. It should be noted that the wells become the property of the Owner and will have to be decommissioned by the Owner when no longer required. PML would be pleased to assist, if requested.

Boreholes without wells were backfilled in accordance with O.Reg. 903.

All recovered samples were returned to our laboratory for detailed examination and moisture content determinations. Grain size analyses were carried out on seven representative samples of the major soil unit. The results are provided on Figure 1, appended.

Geotechnical engineering considerations are provided in Section 5.

2.2 Borehole Permeability Testing

In order to estimate the hydraulic conductivity of the soils surrounding the well screens, borehole permeability testing was conducted in the monitoring wells in Boreholes 1, 4, 10, 12, and 13, on March 10, 2021.

The field permeability testing was conducted by using the rising head method, in which periodic water level measurements were recorded manually, as well as using an electronic data recorder

or transducer, as the water level recovered inside the monitoring wells after rapid removal of a volume of water. The field permeability testing was completed after well development, which consisted of removing an equivalent of about ten times the well volume.

After purging the monitoring well, the rising head data was recorded at intervals of one second using a datalogger until the water level returned to the equilibrium condition or until a steady state was attained.

Aqtesolv, which is a specialized software designed to interpret aquifer tests, was utilized in the interpretation of the field permeability results. The results are included in Appendix B and further discussed in Section 6.0.

2.3 Ground Water Sampling

On March 10, 2021, a ground water sample was obtained from the monitoring well in Borehole 12 for chemical analyses. Following well development and the borehole permeability testing the ground water sample was collected and submitted for chemical testing as described below. The ground water sample was kept cool with ice in a cooler until delivery to the laboratory for analysis.

The ground water sample was delivered to Caduceon Environmental Laboratories (Caduceon) for chemical analyses. Caduceon Laboratories is accredited by The Standards Council of Canada (SCC) and CALA.

To address the potential in-construction ground water dewatering discharge quality issues, the ground water sample was analyzed for the City of Barrie Storm and Sanitary Sewer Use Criteria and Provincial Water Quality Objectives (PWQO) metals.

The Chain-of-Custody Record and the laboratory certificates of analyses are included in Appendix C.

2.4 Ground Water Level Monitoring Program

An six month ground water level monitoring program is currently on-going and results will be provided under a separate cover when completed. Ground water levels recorded to date are provided in this report.

Hydrogeological considerations are presented in Section 6.

3. SITE SETTING

The site is located in the northeast quadrant of Ardagh Road and Summerset Drive intersection and is about 4.5 ha in size.

The site is undeveloped and treed, within a predominately residential area.

3.1 Physiography and Topography

The site is located within the physiographic region known as the Simcoe Lowlands comprising sand plains (Chapman and Putnam, 1984). To the south of the site the land is characterized as till plains of the Peterborough Drumlin Field.

The Ontario Department of Agriculture Soil Report notes the near surface soils are part of the Tioga Series consisting of sand loam (good drainage) with smooth gently to steeply sloping topography.

The borehole elevations indicate about 3.5 m of relief across the site, ranging from elevation 238.5 to elevation 242.0.

3.2 Drainage and Surface Water Flow

A creek is located immediately to the east and the Bear Creek Wetland lies to the north of the site. Surface drainage on the site is expected to follow the topography towards the north to the Bear Creek wetland.

4. GEOLOGY AND SUBSURFACE CONDITIONS

4.1 Geology

Bedrock below the overburden is mapped as limestone, dolostone, shale, arkose, and sand stone of the Simcoe Group from the Middle Ordovian period of the Paleozoic era of the Phanerzoic eon. Bedrock is typically over 120 m in the area based on the Ontario Division of Mines Map P-980 Drift Thickness Series for the Barrie Area.

4.2 Subsurface Conditions

Reference is made to the appended Log of Borehole sheets for details of the subsurface conditions, including soil classifications, existing topsoil thicknesses, inferred stratigraphy and thicknesses, Standard Penetration test N Values (N Values, blows per 300 mm penetration of the split spoon sampler), ground water observations and well installation details, and the results of laboratory moisture content determinations.

Due to the soil sampling procedures and the limited size of samples, the depth/elevation demarcations on the borehole logs must be viewed as “transitional” zones and cannot be construed as exact geologic boundaries between layers. PML should be retained to assist in defining the geological boundaries in the field during construction, if required.

The site is characterized by topsoil over gravelly sand/sand. A description of the distribution and characteristics of the soil units and ground water observations encountered in the boreholes is presented below.

4.3 Soil

Topsoil was encountered at the surface of all boreholes, ranging in thickness from 50 to 250 mm.

A major sand deposit was encountered in all boreholes beneath the topsoil, extending to the 5.0 to 8.0 m depth of exploration. The deposit comprised sand with trace to some silt and gravel, locally gravelly sand with trace silt. Seven samples of the material were submitted for grain size

analysis and the results are presented on Figure 1, appended. Cobbles were noted during drilling in some boreholes. The unit was very loose to very dense, with N Values of 2 to greater than 50, typically compact to dense. Moisture contents ranged from 3 to 19%, being moist in the upper portion becoming wet below about 2.0 to 4.0 m depth.

4.4 Ground Water

The first ground water strike during drilling, the water level in the boreholes upon completion, and measured in the wells about two weeks after installation are provided below.

BOREHOLE	FIRST STRIKE DURING DRILLING DEPTH (m) / ELEVATION	UPON COMPLETION OF AUGERING DEPTH (m) / ELEVATION	WATER LEVEL IN WELL DEPTH (m) / ELEVATION	
			2021-03-05	2021-03-10
1	2.9 / 236.0	3.0 / 235.9	2.5 / 236.4	2.6 / 236.3
2	4.0 / 235.2	3.2 / 236.0	--	--
3	4.0 / 235.9	4.0 / 235.9	--	--
4	4.0 / 235.6	4.0 / 235.6	3.1 / 236.5	3.1 / 236.5
5	No Water	4.3 / 236.6	--	--
6	4.0 / 237.5	4.4 / 237.1	Dry	Dry
7	No Water	4.4 / 237.6	--	--
8	4.0 / 237.1	3.7 / 237.4	--	--
9	4.3 / 236.6	4.4 / 236.5	--	--
10	2.9 / 235.6	2.4 / 236.1	2.3 / 236.2	2.4 / 236.1
11	3.4 / 236.1	3.2 / 236.3	--	--
12	2.9 / 236.0	3.0 / 235.9	2.2 / 236.7	2.3 / 236.6
13	4.0 / 236.0	3.8 / 236.2	3.0 / 237.0	3.0 / 237.0

The regional ground water table is believed to be below the depth of exploration. The shallow ground water encountered in the sand unit stabilized at 2.3 to 3.1 m below existing grade, corresponding to elevation 236.1 to 237.0.

The shallow ground water flow direction is towards the northwest, with a gradient of 0.2 to 0.3% towards the Bear Creek wetland.

Ground water levels are subject to seasonal variation and will fluctuate in response to precipitation.

5. GEOTECHNICAL ENGINEERING CONSIDERATIONS

5.1 Site Grading and Engineered Fill

In general, it is understood the site grade will be raised about 1.0 to 2.0 m. Upfill in building and road/servicing areas need to be constructed as engineered fill. Topsoil, very loose to loose soils, or otherwise deleterious material will need to be removed prior to placement of engineered fill due to potential for gross and differential settlement.

General guidelines for engineered fill construction are provided in Appendix D. Highlights are as follows:

- Sub-excavate the existing topsoil, very loose to loose native soil (upper 0.5 to 1.0 m depth), and deleterious material to competent native soil. The soil should be separated during excavation for reuse or disposal, based on geotechnical review during construction;
- Proofroll exposed subgrade using a heavy vibrating roller to targeted 100% Standard Proctor maximum dry density (SPmdd) for the building, and 95% SPmdd under paved/servicing areas, subject to geotechnical review;
- Following geotechnical subgrade approval, the site can be raised up to the design levels using engineered fill. The engineered fill material must be spread in maximum 200 mm thick loose lifts and uniformly compacted to 100% SPmdd in building areas and 95% SPmdd in paved areas;
- The excavated inorganic native soils are generally suitable for reuse as engineered fill, subject to geotechnical approval. Imported material will be required, and shall comprise OPSS Select Subgrade Material (SSM) or OPSS Granular B. It is recommended that imported fill be utilized under building and site soil be used under pavement/servicing areas;

- The engineered fill pad must extend at least 1 m beyond the structures to be supported, then outwards and downwards at no steeper than 45° to the horizontal to meet the underlying approved subgrade. In this regard, strict survey control and detailed documentation of the lateral and vertical extent of the engineered fill limits should be carried out to ensure that the engineered fill pad fully incorporates the structure to be supported;

- Engineered fill construction must be carried out under full-time field review by PML, to approve sub-excavation and subgrade preparation, backfill materials, placement and compaction procedures, and to verify that the specified compaction standards are achieved throughout.

5.2 Foundations

Floor elevations were not provided at the time of this report. Based on the intended grade raise, it is assumed that floor slab-on-grade elevations will be 1.0 to 2.0 m above existing grade. Based on the boreholes and grading discussion earlier, footings for slab-on-grade structures can be founded on native soil or engineered fill where a net geotechnical bearing resistance of 150 kPa at Serviceability Limit State (SLS) and a factored bearing resistance of 225 kPa at Ultimate Limit State (ULS) may be adopted for design.

The condominium building (Boreholes 1 to 4) is to have an underground paring level (possibly two levels). Based on the ground water levels noted to date, the lowest footings are recommended at elevation 237.0, 0.5 m above the ground water level. At this elevation, footings will be founded on native soil and can be designed for a geotechnical bearing resistance of 200 kPa at SLS and a factored bearing resistance of 300 kPa at ULS.

The geotechnical bearing resistance at SLS is based on 25 mm or settlement in the bearing stratum with differential settlement not exceeding 75% of the value.

Footings subject to frost action must be provided with a minimum 1.2 m of earth cover or equivalent insulation.

Prior to placement of structural concrete, all founding surfaces shall be reviewed by PML to verify the design bearing capacity is available, or to reassess the design parameters based on the actual conditions revealed in the excavation.

5.2.1 Seismic Design

Based on the soil profile revealed in the boreholes, Site Classification D is applicable for Seismic Site Response as set out in Table 4.1.8.4.A of the Ontario Building Code (2012). Based on the type and relative density of the soil cover at the site there is a low potential for liquefaction of soils to occur.

5.3 Floor Slab-on-Grade

Floor slab-on-grade construction is feasible on native soil or engineered fill, constructed as discussed earlier.

A minimum 200 mm thick base layer of crushed stone (nominal 20 mm size) is recommended directly beneath the floor slab. A polyethylene sheeting or similar means shall be incorporated as a vapour barrier. An underfloor drainage system is not considered necessary.

Exterior grades must be established to promote surface drainage away from the building.

5.4 Basements

Underground parking level(s) are proposed for the condominium. The lowest recommended floor slab is at elevation 237.5 (minimum 1.0 m above highest ground water level). Perimeter walls must be designed to resist the unbalanced horizontal earth pressure imposed by the backfill adjacent to the walls. The lateral earth pressure, P, may be computed using the following equation and assuming a triangular pressure distribution:

$$P = K(\gamma h + q) + C_p$$

Where
- P = lateral pressure at depth h (m) below ground surface (kPa)
- K = lateral earth pressure coefficient of granular backfill = 0.5
- h = depth below grade (m) at which lateral pressure is calculated
- γ = unit weight of compacted granular backfill = 21.0 kN/m^3
- q = surcharge loads (kPa)
- C_p = compaction pressure

The above equation assumes that drainage measures will be incorporated to prevent the buildup of hydrostatic pressure. In this regard, foundation wall backfill should comprise free draining granular material conforming to OPSS Granular B in conjunction with a weeping tile system. The weeping tiles should be protected by a properly designed granular filter or geotextile to prevent migration of fines into the system. The drainage pipe should be placed on a positive grade and lead to a frost-free outlet. The basement walls should be damp proofed. Alternatively, the native sand can be utilized with a proprietary drainage board product.

Basement wall backfill should be placed in thin lifts compacted to a minimum 95% SPmdd. Over compaction close to the walls should be avoided as this could generate excessive pressure on the walls.

Basement floor slab construction is feasible on native soils as discussed above. A minimum 200 mm thick base layer of crushed stone (nominal 19 mm size) is recommended directly under the slab. Underfloor drains are not considered necessary, provided floor slabs are a minimum 1.0 m above the ground water level (elevation 237.5 or higher, as noted above). A polyethylene sheet vapour barrier is recommended as a vapour barrier. Exterior grades should be established to promote surface drainage away from the buildings.

Reference is made to appended Figure 2, for general recommendations regarding drainage and backfill requirements for basement walls and floor slabs.

5.5 Site Servicing

At the time of this report, design inverts were not established. Services are anticipated to be as much as 3.0 m below proposed grades, corresponding to as much as 2.0 m below proposed grades based on the grade raise.

5.5.1 Trench Excavation and Ground Water Control

Trench excavation and ground water control are described later in the report under Excavation and Ground Water Control.

5.5.2 Pipe Support, Pipe Bedding and Cover

Native soil or engineered fill are generally expected at invert levels, which is considered satisfactory for pipe support. Where existing fill or other deleterious material is encountered at the design invert level, such material should be sub-excavated and replaced with an increased thickness of bedding material, subject to geotechnical field review and approval.

OPSS bedding and cover thickness and compaction standards are recommended. Bedding and cover material should comprise OPSS Granular A.

5.5.3 Trench Backfill

Backfill in trenches shall comprise select inorganic soil, placed in maximum 200 mm thick loose lifts and compacted to at least 95% SPmdd to minimize post construction settlement in the backfill. Topsoil, organic, excessively wet, frozen oversized (greater than 150 mm in diameter), or otherwise deleterious material must not be incorporated as trench backfill. The moisture content of the trench backfill shall be within 2% of the optimum moisture content in order to achieve the specified compaction and be close to optimum moisture content in the upper 1 m to prevent subgrade instability issues. Ideally the backfill shall comprise excavated site soil, in order to minimize differential frost heave.

The excavated soil will comprise topsoil and native sand. The excavated inorganic native soils will generally be acceptable for reuse as trench backfill subject to geotechnical review during construction for moisture content and general composition acceptance.

Earthworks operations must be inspected by PML to verify subgrade preparation, backfill materials, placement and compaction efforts and ensure the specified degree of compaction is achieved throughout.

5.6 Storm Water Management Pond

A SWM pond is proposed in northeast corner of the site. The design concepts were not established at the time of this report. The following preliminary recommendations are provided, and should be reviewed by PML when further details are finalized.

Borehole 12 and 13 were advanced within the footprint of SWM Pond. Below the topsoil, a sand unit was present to the 5.0 m depth of exploration. Ground water was encountered about 2 to 3 m below existing grade, corresponding to elevation 236.6 to 237.0.

Cognizant of the subsurface conditions, the following geotechnical comments and recommendations are provided for your consideration:

1. Berms, where required, should be constructed as engineered fill, using select material, compacted to minimum 95% SPmdd, and be a minimum of 3 m in width;

2. Interior pond side slopes should be no steeper than five horizontal to one vertical (5H:1V) and protected with erosion control blankets or other vegetation. Rip rap will be required in areas of moving water;

3. Exterior pond side slopes and ditch/berm side slopes should be no steeper than 3H:1V;

4. If a wet pond is desired, a clay or synthetic liner is required;

5. If the pond is to be used for infiltration purposes, the bottom of the pond should be a minimum 1.0 m above high ground water table (currently the lowest proposed bottom would be elevation 238.0). The sand unit has a permeability on the order of 10^{-4} to 10^{-5} m/s.

5.7 Excavation and Ground Water Control

Excavation for services is anticipated to extend about as much as 2.0 m below existing grades. Excavation for engineered fill is anticipated to extend to about 1.0 m below existing grades. Excavation for the condominium basement is expected to extend as much as 2.0 to 3.0 m below existing grade.

All construction work must be carried out in accordance with the Occupational Health and Safety Act (OHSA). The site soils are classified as Type 3 soils requiring excavation/trench slopes to be cut back at 1H:1V from the base of the excavation, subject to appropriate groundwater control.

Excavation side slopes will need to be continuously examined and reviewed for evidence of instability, particularly following periods of heavy rain or thawing. When required, remedial action must be taken to ensure the continued stability of the excavation slope and the safety of the workers.

Stabilized water depth varies between 2.0 to 3.0 m below grade corresponding to elevation 236 to 237, roughly following the site topography. Based on the anticipated excavation depths, excavation will generally be above, or slightly below the ground water table where conventional sump pumping should suffice. Excavation much below the ground water table will require dewatering.

Excavation is recommended during the dry time of the year when the ground water is at its lowest, thus aiding in reducing ground water control requirements.

Water taking in Ontario is governed by the Ontario Water Resources Act (OWRA) and the Water Taking and Transfer Regulation O.Reg. 387/040, Section 34 of the OWRA requires any one taking more than 50,000 L/d to notify the Ministry of Environment, Conservation and Parks (MECP). This requirement applies to all withdrawals, whether for consumption, temporary construction dewatering or permanent drainage improvements. Projects assessed to be taking more than 50,000 L/d but less than 400,000 L/d of ground water can obtain a permit/permission online via the Environmental Activity and Sector Registry (EASR) system. If it is assessed that more than 400,000 L/d is required, then a Category 3 Permit-to-Take-Water (PTTW) will be required.

Based on the excavation as described above, registry on the EASR is may be required as a minimum, and once further design details are finalized, PML should be contacted to confirm the requirements and/or a site specific hydrogeological assessment in support of a PTTW or registry on the EASR system.

5.8 Pavement Design and Construction

As discussed earlier, grading has not been finalized, however given the site grade raise, the pavement subgrade is anticipated to comprise engineered fill. The following designs must be reviewed when the subgrade soil has been confirmed.

	MEDIUM DUTY	HEAVY DUTY
Asphalt (mm)	80	110
Granular A Base Course (mm)	150	150
Granular B Subbase Course (mm)	300	450

Subgrade is expected to comprise engineered fill. Further, preparation of subgrade can be provided once grading has been finalized.

Imported material for the granular base and subbase shall conform to OPSS gradation specifications for Granular A and Granular B, and must be compacted to 100% SPmdd. Asphalt shall be compacted in accordance with OPSS 310.

For the pavement to function properly, it is essential that provisions be made for water to drain out of and not collect in the base material. The incorporation of subdrains is not considered mandatory due to the drainage properties of the native sand. If considered, subdrains shall be installed at least 300 mm below the subgrade level. Refer to OPSD 216 Series for details regarding pipe, filter fabric or filter sock, bedding and cover material. Maintenance hole/catchbasins shall be backfilled with free draining material with frost tapers and stub drains extending out from structures. The above measures will help drain the pavement structure as well as alleviate the problems of differential frost movement between the catchbasins and pavement.

5.9 Geotechnical Review and Construction Inspection and Testing

It is recommended that the project design drawings be submitted to PML for geotechnical review for compatibility with site subsurface conditions and the recommendations contained in this report.

Earthworks operations shall be carried out with field review by PML to approve subgrade preparation, backfill materials, placement and compaction procedures and check the specified degree of compaction is achieved throughout.

Prior to placement of structural concrete, all founding surfaces must be inspected by PML to verify the design bearing capacity is available, or to reassess the design parameters based on the actual conditions

The comments and recommendations provided in the report are based on the information revealed in all of the boreholes/test pits. Conditions away from and between boreholes/test pits may vary, which may necessitate modifications to the recommendations contained in the report and are subject to geotechnical review by PML during construction.

6. HYDROGEOLOGICAL CONSIDERATIONS

A hydrogeological investigation has also been requested for the site. The hydrogeological component includes a preliminary water quality assessment, preliminary assessment for permeability for infiltration features, ground water levels, gradient, and flow direction.

6.1 Aquifers and Local Ground Water Use

The Water Well Records (WWRs) held by the MECP within a 500 m study area are tabulated in Appendix E. A total of 10 WWRs were identified. Six records indicated the wells were for domestic use, two records were for test holes/montioring wells, one was listed as “other”, and one was listed “not in use”. Bedrock was not encoutnered in any of the WWRs.

The water supply wells ranged in depth from 22 to 27 m below the ground surface at the time of drilling, with fresh water typically encountered in the well.

It should be noted that municipal water is available in the area and the site is located within a Well Head Protection Area (WHPA), specially a WHPA Zone E. The site is located approximately 1.4 km southwest of the municipal water supply Well No. 19 and has a vulnerability score of 2.

6.2 Preliminary Infiltration Assessment

A preliminary assessment for permeability for infiltration features has been requested. In-situ borehole permeability testing was completed in all five wells, and grain size analyses testing was carried out on seven samples of the native site soils.

6.2.1 In-Situ Permeability Tests

The hydraulic conductivity (K-value, m/s), was estimated by performing slug tests in the wells. The permeability testing results were inputted into Aqtesolv where the Hvorslev (1951) expression was applied. Borehole permeability test plots are provided in Appendix B and summarized below:

BH/MW	DEPTH (m)	MATERIAL TYPE	ESTIMATED HYDRAULIC CONDUCTIVITY, K (m/sec)
1	5.7 to 7.2	Sand	7.0×10^{-5}
4	5.7 to 7.2	Sand	6.7×10^{-5}
10	3.0 to 4.5	Sand	3.5×10^{-5}
12	3.0 to 4.5	Sand	2.7×10^{-5}
13	3.0 to 4.5	Sand	3.0×10^{-5}

6.2.2 Grain Size Distribution

In addition to in-situ testing, the hydraulic conductivity of selected soil samples was estimated using the grain size distribution determined by laboratory testing and an established empirical formula by Vukovic and Soro (1992).

The results of field permeability tests as well as the estimated K-values from particle size distribution test results are summarized below:

BH/MW	SAMPLE	DEPTH (m)	MATERIAL TYPE	ESTIMATED HYDRAULIC CONDUCTIVITY FROM GRAIN SIZE DISTRIBUTION, K (m/sec)
1	4	2.3 to 2.8	Sand Trace to Some Gravel and Silt	10^{-4} to 10^{-5}
4	2	0.7 to 1.2	Gravelly Sand Trace Silt	10^{-4} to 10^{-5}
6	3	1.5 to 2.0	Sand Trace to Some Gravel and Silt	10^{-4} to 10^{-5}
10	2	0.7 to 1.2	Sand Trace to Some Gravel and Silt	10^{-4} to 10^{-5}
11	3	1.5 to 2.0	Sand Trace to Some Gravel and Silt	10^{-4} to 10^{-5}
12	3	1.5 to 2.0	Sand Trace to Some Gravel and Silt	10^{-4} to 10^{-5}
13	2	0.7 to 1.2	Sand Trace to Some Gravel and Silt	10^{-4} to 10^{-5}

6.3 Ground Water Sample Chemical Test Results

The laboratory certificate of chemical analyses for the analysis carried out by Caduceon on an unfiltered ground water sample from Borehole 12 in accordance with the chain-of-custody records and the protocols described in Section 2.3, are in included in Appendix C.

The unfiltered ground water sample was analyzed for the City of Barrie Storm and Sanitary Sewer Use Criteria and PWQO metals. As per the PWQO guidelines select metal parameters require field filtering and as such PML submitted one filtered metals bottle and one unfiltered metals bottle to satisfy the PWQO requirements.

The chemical test results complied with the City of Barrie Sewer Use Guidelines and PWQO standards for the parameters tested with the exception of the parameters listed below:

PARAMETER	UNITS	CITY OF BARRIE SANITARY SEWER USE GUIDELINE	CITY OF BARRIE STORM SEWER USE GUIDELINE	PWQO	MEASURED CONCENTRATION
Total Suspended Solids (TSS)	**mg/L**	350	15	--	885
Cobalt	**µg/L**	--	--	0.9	2.8
Copper	**µg/L**	--	--	5	8.9
Iron	**µg/L**	--	--	300	6,280
Vanadium	**µg/L**	--	--	6	9
Zinc	**µg/L**	--	--	4	5

The unfiltered ground water sample test results indicate that the discharge water, if untreated, is expected to exceed the Storm and Sanitary Sewer Use Bylaw Criteria for TSS and PWQO for cobalt, copper, iron, vanadium and zinc.

Based on the above, it is recommended, as a minimum, that during construction dewatering, the pumped water be treated with a form of filtration/sediment control treatment system comprising a sediment tank and silt bag, prior to being discharged to surface.

Treatment of the dewatering discharge water by filtration or sedimentation to reduce the concentration of suspended solids, is anticipated to reduce the concentrations of non-dissolved metals, however, other treatment methods may be necessary to reduce the concentration of dissolved analytes.

7. CLOSURE

We trust this report is complete within our terms of reference, and the information presented is sufficient for your present purposes. If you have any questions, or when we may be of further assistance, please do not hesitate to call our office.

Sincerely

Peto MacCallum Ltd.

Davin Power, E.I.T.
Project Supervisor, Geotechnical Services

PROFESSIONAL GEOSCIENTIST
ALICIA KIMBERLEY
PRACTISING MEMBER
2949
Mar 23, 2021
ONTARIO

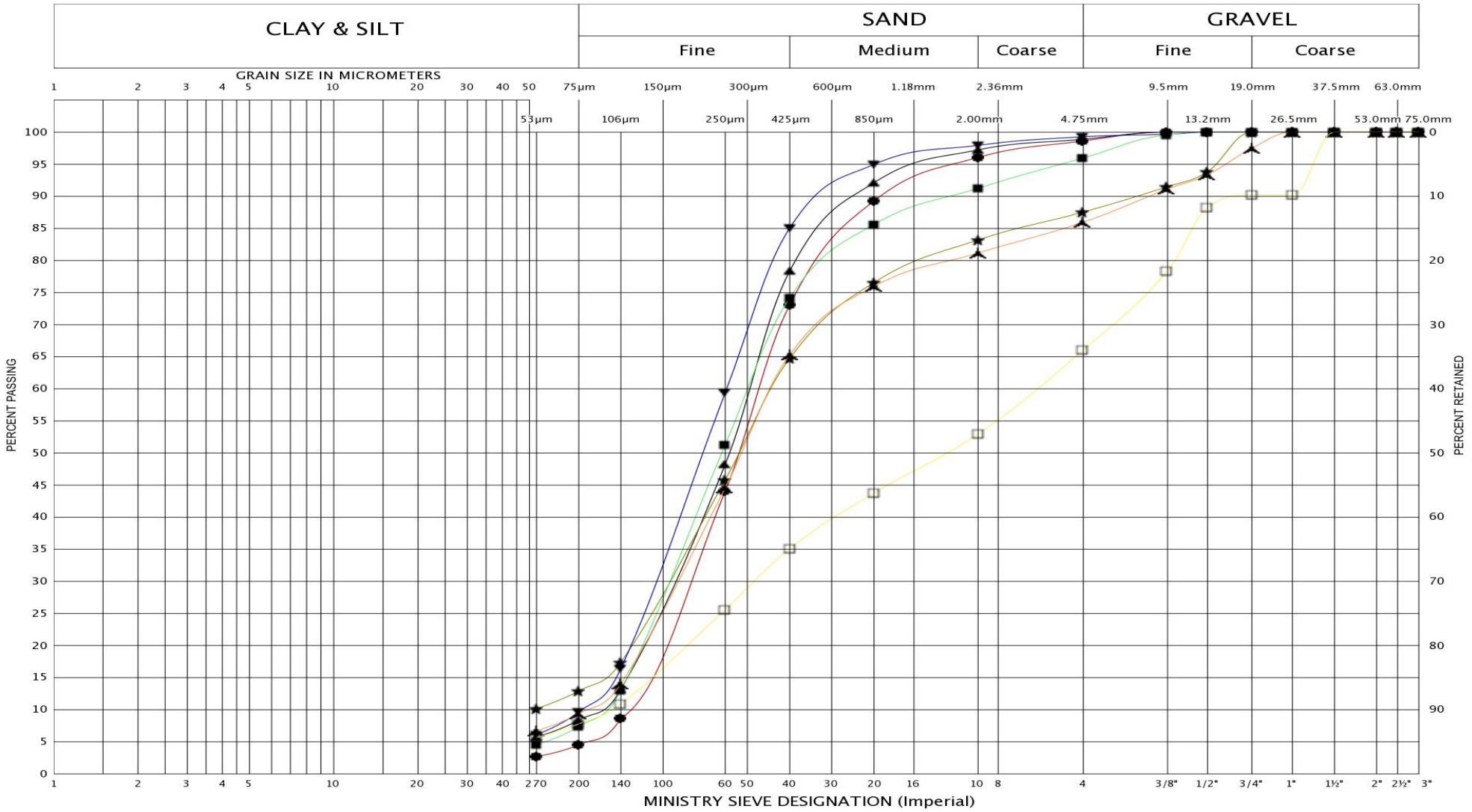
Alicia Kimberley, MSc., P.Geo.
Associate
Manager, Geoenvironmental and Hydrogeological Services

LICENSED PROFESSIONAL ENGINEER
G. R. WHITE
MARCH 23 2021
PROVINCE OF ONTARIO

Geoffrey R. White, P.Eng.
Director
Manager, Geotechnical Services

DP/AK/GRW:tc

UNIFIED SOIL CLASSIFICATION SYSTEM



LEGEND	BH	1	4	6	10	11	12	13
	SAMPLE	4	2	3	2	3	3	2
	SYMBOL	●	□	⅄	▲	★	▼	■

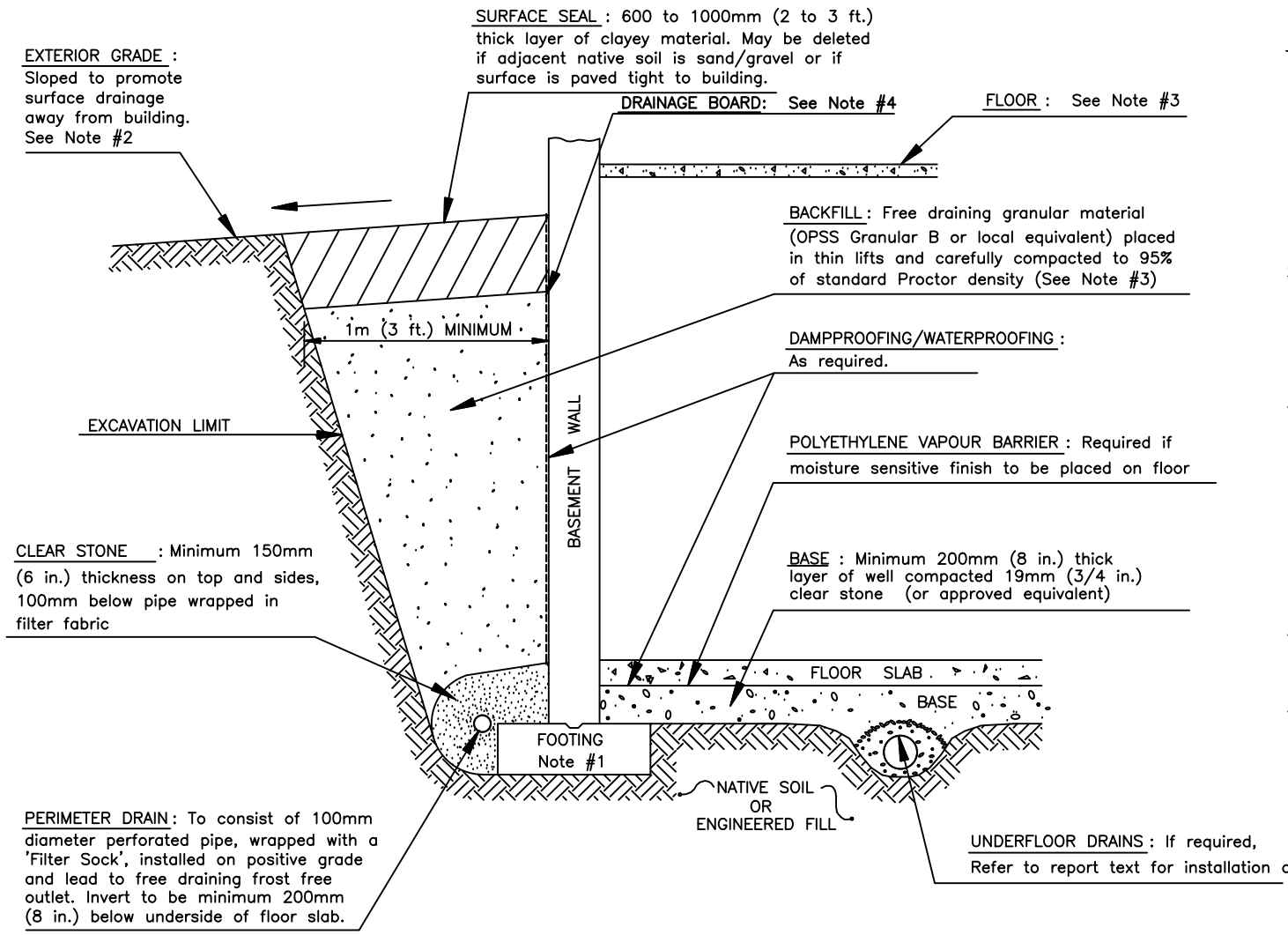
Peto MacCallum Ltd.
CONSULTING ENGINEERS

GRAIN SIZE DISTRIBUTION

GRAVELLY SAND, Trace Silt, TO SAND, Trace to Some Gravel, Trace to Some Silt

FIG No.: 1

Project No.: 21BF003



NOTES

1. Footing may be constructed by placement of structural concrete neat against natural soil. Drain to be installed in a similar manner immediately above footing maintaining 200mm (8 in.) distance between top of drain and underside of floor slab.
2. Exterior grade to be minimum 300mm (12 in.) below interior floor slab, or other means established to prevent entry of surface water into building through building openings.
3. Basement wall to be supported by floor system or interior bracing prior to commencement of backfill placement. Heavy construction equipment should not be permited within a distance from the foundation wall equivalent to half the wall height. Overcompaction of backfill to be avoided as excessive lateral earth pressure may result.
4. A proprietary drainage board product may be used with compacted native soil as backfill against the wall.
5. Refer to text for details regarding founding levels, competent bearing material and construction details specific to particular site.

STANDARD DRAWING

GENERAL RECOMMENDATIONS REGARDING DRAINAGE AND BACKFILL REQUIREMENTS FOR BASEMENT WALL AND FLOOR SLAB CONSTRUCTION

PML Peto MacCallum Ltd.
CONSULTING ENGINEERS

DRAWN:	N/A	DATE	SCALE	JOB NO.	FIGURE NO.
CHECKED:	GW	MAR 2021	N.T.S.	21BF003	2
APPROVED:	GW				

LIST OF ABBREVIATIONS

PENETRATION RESISTANCE

Standard Penetration Resistance N: - The number of blows required to advance a standard split spoon sampler 0.3 m into the subsoil. Driven by means of a 63.5 kg hammer falling freely a distance of 0.76 m.

Dynamic Penetration Resistance: - The number of blows required to advance a 51 mm, 60 degree cone, fitted to the end of drill rods, 0.3 m into the subsoil. The driving energy being 475 J per blow.

DESCRIPTION OF SOIL

The consistency of cohesive soils and the relative density or denseness of cohesionless soils are described in the following terms:

CONSISTENCY	N (blows/0.3 m)	c (kPa)	DENSENESS	N (blows/0.3 m)
Very Soft	0 - 2	0 - 12	Very Loose	0 - 4
Soft	2 - 4	12 - 25	Loose	4 - 10
Firm	4 - 8	25 - 50	Compact	10 - 30
Stiff	8 - 15	50 - 100	Dense	30 - 50
Very Stiff	15 - 30	100 - 200	Very Dense	> 50
Hard	> 30	> 200		

WTLL	Wetter Than Liquid Limit
WTPL	Wetter Than Plastic Limit
APL	About Plastic Limit
DTPL	Drier Than Plastic Limit

TYPE OF SAMPLE

SS	Split Spoon	ST	Slotted Tube Sample
WS	Washed Sample	TW	Thinwall Open
SB	Scraper Bucket Sample	TP	Thinwall Piston
AS	Auger Sample	OS	Oesterberg Sample
CS	Chunk Sample	FS	Foil Sample
GS	Grab Sample	RC	Rock Core

PH	Sample Advanced Hydraulically
PM	Sample Advanced Manually

SOIL TESTS

Qu	Unconfined Compression	LV	Laboratory Vane
Q	Undrained Triaxial	FV	Field Vane
Qcu	Consolidated Undrained Triaxial	C	Consolidation
Qd	Drained Triaxial		

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE/MONITORING WELL NO. 1

17T 600878E 4911617N

PROJECT Proposed Residential Development — **PML REF.** 21BF003

LOCATION Ardagh Road and Summerset Drive, Barrie, Ontario — **BORING DATE** February 9, 2020 — **ENGINEER** GW

BORING METHOD Continuous Flight Hollow Stem Augers — **TECHNICIAN** NG

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES
	SURFACE ELEVATION 238.90				
0.25 / 238.65	TOPSOIL: Dark brown, silty sand, some organics, frozen to moist		1	SS	6
	SAND: Loose to dense, light brown to brown, sand, trace to some gravel and silt, moist to wet		2	SS	4
			3	SS	50/145mm
			4	SS	18
			5	SS	19
			6	SS	21
			7	SS	11
8.0 / 230.9	BOREHOLE TERMINATED AT 8.0 m		8	SS	37

ELEVATION SCALE: 238, 237, 236, 235, 234, 233, 232, 231

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

GAS READINGS ppm

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL



Upon completion of augering
Water at 3.0 m
No cave
Water Level Readings:

Date	Depth	Elev.
2021-03-05	2.5	236.4
2021-03-10	2.6	236.3

NOTES

Peto MacCallum Ltd
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 2

17T 600898E 4911645N

PROJECT Proposed Residential Development
PML REF. 21BF003
LOCATION Ardagh Road and Summerset Drive, Barrie, Ontario
BORING DATE February 9, 2020
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN NG

DEPTH (metres)	ELEV	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	GAS READINGS (ppm)	GROUND WATER OBSERVATIONS AND REMARKS
		SURFACE ELEVATION 239.15							
0.0	239.15						239		
0.20	238.95	TOPSOIL: Dark brown, silty sand, some organics, frozen to moist		1	SS	4			
		SAND: Loose to very dense, light brown to brown, sand, trace gravel to gravelly, trace silt, cobbles, moist to wet		2	SS	26	238		
1.0									
				3	SS	43			
2.0							237		
				4	SS	21			
3.0									
				5	SS	17	236		
4.0									First water strike at 4.0 m
							235		
				6	SS	66			
5.0							234		
6.0									
6.5	232.7	BOREHOLE TERMINATED AT 6.5 m		7	SS	11	233		
7.0									Upon completion of augering Wet cave at 3.2 m
8.0									
9.0									
10.0									
11.0									
12.0									
13.0									
14.0									
15.0									

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 3

17T 600917E 4911627N

PROJECT Proposed Residential Development
PML REF. 21BF003
LOCATION Ardagh Road and Summerset Drive, Barrie, Ontario
BORING DATE February 8, 2020
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN NG

DEPTH (metres)	ELEV	DESCRIPTION	STRAT PLOT	SAMPLE NUMBER	SAMPLE TYPE	"N" VALUES	ELEVATION SCALE	SHEAR STRENGTH (kPa) / DYNAMIC CONE PENETRATION	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT / WATER CONTENT (%)	GAS READINGS (ppm)	GROUND WATER OBSERVATIONS AND REMARKS / GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL
		SURFACE ELEVATION 239.90									
0.0	0.15 239.75	TOPSOIL: Dark brown, silty sand, some organics, frozen to moist		1	SS	4					
		SAND: Loose to dense, brown, sand, trace to some gravel and silt, moist to wet		2	SS	28	239				
1.0											
				3	SS	27	238				
2.0											
				4	SS	32	237				
3.0											
				5	SS	22	236				First water strike at 4.0 m
4.0											
				6	SS	18	235				
5.0											
							234				
6.0	6.5			7	SS	24					
	233.4	BOREHOLE TERMINATED AT 6.5 m									Upon completion of augering Wet cave at 4.0 m
7.0											
8.0											
9.0											
10.0											
11.0											
12.0											
13.0											
14.0											
15.0											

SHEAR STRENGTH (kPa): + FIELD VANE △ TORVANE ○ Qu ▲ POCKET PENETROMETER ○ Q; 50 100 150 200; DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST ●; 20 40 60 80

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L; WATER CONTENT (%): 10 20 30 40

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE/MONITORING WELL NO. 4

17T 600933E 4911657N

PROJECT Proposed Residential Development
PML REF. 21BF003
LOCATION Ardagh Road and Summerset Drive, Barrie, Ontario
BORING DATE February 9, 2020
ENGINEER GW
BORING METHOD Continuous Flight Hollow Stem Augers
TECHNICIAN NG

DEPTH (metres)	ELEV	DESCRIPTION	NUMBER	TYPE	"N" VALUES
		SURFACE ELEVATION 239.55			
0.25	239.30	TOPSOIL: Dark brown, silty sand, some organics, frozen to moist	1	SS	5
		SAND: Loose to dense, brown, gravelly sand, trace silt, moist to wet	2	SS	26
			3	SS	29
			4	SS	22
			5	SS	42
			6	SS	23
			7	SS	24
			8	SS	10
8.0	231.6	BOREHOLE TERMINATED AT 8.0 m			

SHEAR STRENGTH (kPa)
+ FIELD VANE △ TORVANE ○ Qu
▲ POCKET PENETROMETER ● Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

GAS READINGS ppm

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

Stick-up casing
Concrete
Bentonite seal
First water strike at 4.0 m
50 mm slotted pipe
Filter sand

Upon completion of augering
Water at 4.0 m
No cave
Water Level Readings:

Date	Depth	Elev.
2021-03-05	3.1	236.5
2021-03-10	3.1	236.5

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 5

17T 601001E 4911680N

PROJECT Proposed Residential Development
PML REF. 21BF003
LOCATION Ardagh Road and Summerset Drive, Barrie, Ontario
BORING DATE February 8, 2020
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN NG

DEPTH (metres)	ELEV	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	ELEVATION SCALE
0.05	240.85	SURFACE ELEVATION 240.90 TOPSOIL: Dark brown, silty sand, some organics, frozen to moist		1	SS	6	240
		SAND: Loose to dense, light brown to brown, sand, trace to some gravel and silt, cobbles, moist to wet		2	SS	7	
				3	SS	27	239
				4	SS	38	
				5	SS	43	238
							237
5.0	235.9			6	SS	34	236
		BOREHOLE TERMINATED AT 5.0 m					

SHEAR STRENGTH (kPa)
+ FIELD VANE △ TORVANE ○ Qu
▲ POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

GAS READINGS ppm

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

Upon completion of augering
Water at 4.3 m
No cave

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE/MONITORING WELL NO. 6

17T 601098E 4911712N

PROJECT Proposed Residential Development
LOCATION Ardagh Road and Summerset Drive, Barrie, Ontario
BORING METHOD Continuous Flight Solid Stem Augers
BORING DATE February 8, 2020
PML REF. 21BF003
ENGINEER GW
TECHNICIAN NG

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	ELEVATION SCALE
	SURFACE ELEVATION 241.50					
0.0 / 0.10 / 241.40	TOPSOIL: Dark brown, silty sand, some organics, frozen to moist		1	SS	4	241
	SAND: Loose to very dense, brown, sand, trace to some gravel and silt, cobbles, moist to wet		2	SS	14	
1.0						240
			3	SS	31	
2.0						239
			4	SS	53	
3.0						238
			5	SS	37	
4.0						237
5.0 / 5.0 / 236.5	BOREHOLE TERMINATED AT 5.0 m		6	SS	19	

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

GAS READINGS ppm

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

Stick-up casing
Concrete
Bentonite seal
50 mm slotted pipe
Filter sand
First water strike at 4.0 m

Upon completion of augering
Wet cave at 4.4 m

Water Level Readings:

Date	Depth	Elev.
2021-03-05	Dry	
2021-03-10	Dry	

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 7

17T 601145E 4911727N

PROJECT Proposed Residential Development
PML REF. 21BF003
LOCATION Ardagh Road and Summerset Drive, Barrie, Ontario
BORING DATE February 8, 2020
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN NG

DEPTH (metres)	ELEV	DESCRIPTION	STRAT PLOT	SAMPLE NUMBER	SAMPLE TYPE	"N" VALUES
	242.00	SURFACE ELEVATION 242.00				
0.0						
0.15	241.85	TOPSOIL: Dark brown, silty sand, some organics, frozen to moist		1	SS	6
		SAND: Loose to dense, brown, sand, trace to some gravel and silt, moist to wet		2	SS	7
1.0				3	SS	27
2.0				4	SS	38
3.0				5	SS	43
4.0				6	SS	34
5.0	237.0	BOREHOLE TERMINATED AT 5.0 m				
6.0						
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						
13.0						
14.0						
15.0						

ELEVATION SCALE: 241, 240, 239, 238, 237

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ● Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

GAS READINGS ppm

GROUND WATER OBSERVATIONS AND REMARKS

GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

Upon completion of augering
Wet cave at 4.4 m

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 8

PROJECT Proposed Residential Development
PML REF. 21BF003
LOCATION Ardagh Road and Summerset Drive, Barrie, Ontario
BORING DATE February 8, 2020
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN NG

DEPTH (metres)	ELEV	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	ELEVATION SCALE	SHEAR STRENGTH (kPa) / DYNAMIC CONE PENETRATION	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	GAS READINGS (ppm)	GROUND WATER OBSERVATIONS AND REMARKS / GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL
		SURFACE ELEVATION 241.05									
0.20	240.85	TOPSOIL: Dark brown, silty sand, some organics, frozen to moist		1	SS	2					
		SAND: Very loose to dense, light brown to brown, sand, trace to some gravel and silt, moist to wet		2	SS	9	240				
				3	SS	35	239				
				4	SS	30					
				5	SS	33	238				
							237				First water strike at 4.0 m
5.0	236.1	BOREHOLE TERMINATED AT 5.0 m		6	SS	35					Upon completion of augering Water at 3.7 m Cave at 3.8 m

SHEAR STRENGTH (kPa): +FIELD VANE △TORVANE ○ Qu ▲POCKET PENETROMETER O Q; 50 100 150 200
DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST ●; 20 40 60 80
PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT; WATER CONTENT (%): 10 20 30 40

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 9

PROJECT Proposed Residential Development
PML REF. 21BF003
LOCATION Ardagh Road and Summerset Drive, Barrie, Ontario
BORING DATE February 9, 2020
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN NG

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	ELEVATION SCALE	SHEAR STRENGTH (kPa) / DYNAMIC CONE PENETRATION / STANDARD PENETRATION TEST	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT / WATER CONTENT (%)	GAS READINGS (ppm)	GROUND WATER OBSERVATIONS AND REMARKS / GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL
	SURFACE ELEVATION 240.90									
0.20 240.70	TOPSOIL: Dark brown, silty sand, some organics, frozen to moist		1	SS	8					
	SAND: Very loose to very dense, light brown to brown, sand, trace gravel to gravelly, trace silt, moist to wet		2	SS	3	240				
			3	SS	23	239				
			4	SS	61	238				
			5	SS	37	237				First water strike at 4.3 m
5.0 235.9	BOREHOLE TERMINATED AT 5.0 m		6	SS	36	236				Upon completion of augering Water at 4.4 m No cave

SHEAR STRENGTH (kPa): + FIELD VANE △ TORVANE ○ Qu ▲ POCKET PENETROMETER ○ Q; 50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80
PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%): 10 20 30 40

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE/MONITORING WELL NO. 10

17T 600882E 4911695N

PROJECT Proposed Residential Development — **PML REF.** 21BF003

LOCATION Ardagh Road and Summerset Drive, Barrie, Ontario — **BORING DATE** February 9, 2020 — **ENGINEER** GW

BORING METHOD Continuous Flight Solid Stem Augers — **TECHNICIAN** NG

DEPTH (metres)	ELEV	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES
		SURFACE ELEVATION 238.50				
0.0	238.30	TOPSOIL: Dark brown, silty sand, some organics, frozen to moist		1	SS	5
		SAND: Loose to dense, light brown to brown, sand, trace to some gravel and silt, cobbles, moist to wet		2	SS	6
				3	SS	33
				4	SS	30
				5	SS	23
5.0	233.5			6	SS	36
		BOREHOLE TERMINATED AT 5.0 m				

ELEVATION SCALE: 238, 237, 236, 235, 234

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ● Q
50 100 150 200

DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L

WATER CONTENT (%)
10 20 30 40

GAS READINGS (ppm)

GROUND WATER OBSERVATIONS AND REMARKS

GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

Stick-up casing
Concrete

Bentonite seal

First water strike at 2.9 m

50 mm slotted pipe
Filter sand

Upon completion of augering
Wet cave at 2.4 m

Water Level Readings:

Date	Depth	Elev.
2021-03-05	2.3	236.2
2021-03-10	2.4	236.1

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 11

17T 600969E 3911770N

PROJECT Proposed Residential Development
PML REF. 21BF003
LOCATION Ardagh Road and Summerset Drive, Barrie, Ontario
BORING DATE February 8, 2020
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN NG

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	ELEVATION SCALE
	SURFACE ELEVATION 239.50					
0.10 239.40	TOPSOIL: Dark brown, silty sand, some organics, frozen to moist		1	SS	4	239
	SAND: Loose to very dense, light brown to brown, sand, trace gravel to gravelly, trace silt, cobbles, moist to wet		2	SS	5	
			3	AS	-	238
			4	SS	77	237
			5	SS	23	236
5.0 234.5	BOREHOLE TERMINATED AT 5.0 m		6	SS	26	235

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

GAS READINGS ppm

GROUND WATER OBSERVATIONS AND REMARKS

First water strike at 3.4 m

Upon completion of augering
Water at 3.2 m
Cave at 3.4 m

GRAIN SIZE DISTRIBUTION (%)
GR SA SI&CL

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE/MONITORING WELL NO. 12

17T 601036E 4911802N

PROJECT Proposed Residential Development
PML REF. 21BF003
LOCATION Ardagh Road and Summerset Drive, Barrie, Ontario
BORING DATE February 8, 2020
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN NG

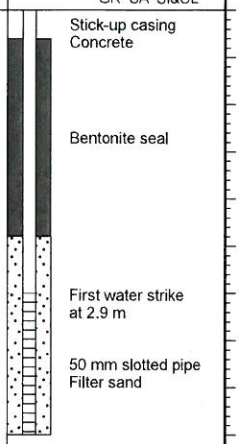
DEPTH (metres)	ELEV	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	ELEVATION SCALE
0.0	238.85	SURFACE ELEVATION 238.85					
0.08	238.77	TOPSOIL: Dark brown, silty sand, some organics, frozen to moist		1	SS	3	
		SAND: Very loose to dense, brown, sand, trace to some gravel and silt, moist to wet		2	SS	10	238
				3	SS	20	237
				4	SS	15	236
				5	SS	32	235
5.0	233.9	BOREHOLE TERMINATED AT 5.0 m		6	SS	27	234

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

GAS READINGS ppm

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL



Upon completion of augering
Wet cave at 3.0 m

Water Level Readings:

Date	Depth	Elev.
2021-03-05	2.2	236.7
2021-03-10	2.3	236.6

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE/MONITORING WELL NO. 13

17T 601132E 4911793N

PROJECT Proposed Residential Development
PML REF. 21BF003
LOCATION Ardagh Road and Summerset Drive, Barrie, Ontario
BORING DATE February 8, 2020
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN NG

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	ELEVATION SCALE
	SURFACE ELEVATION 240.00					
0.15 239.85	TOPSOIL: Dark brown, silty sand, some organics, frozen to moist		1	SS	3	
	SAND: Very loose to dense, brown, sand, trace to some gravel and silt, moist to wet		2	SS	18	239
			3	SS	26	238
			4	SS	20	
			5	SS	28	237
						236
5.0 235.0	BOREHOLE TERMINATED AT 5.0 m		6	SS	32	235

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ● Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

GAS READINGS ppm

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

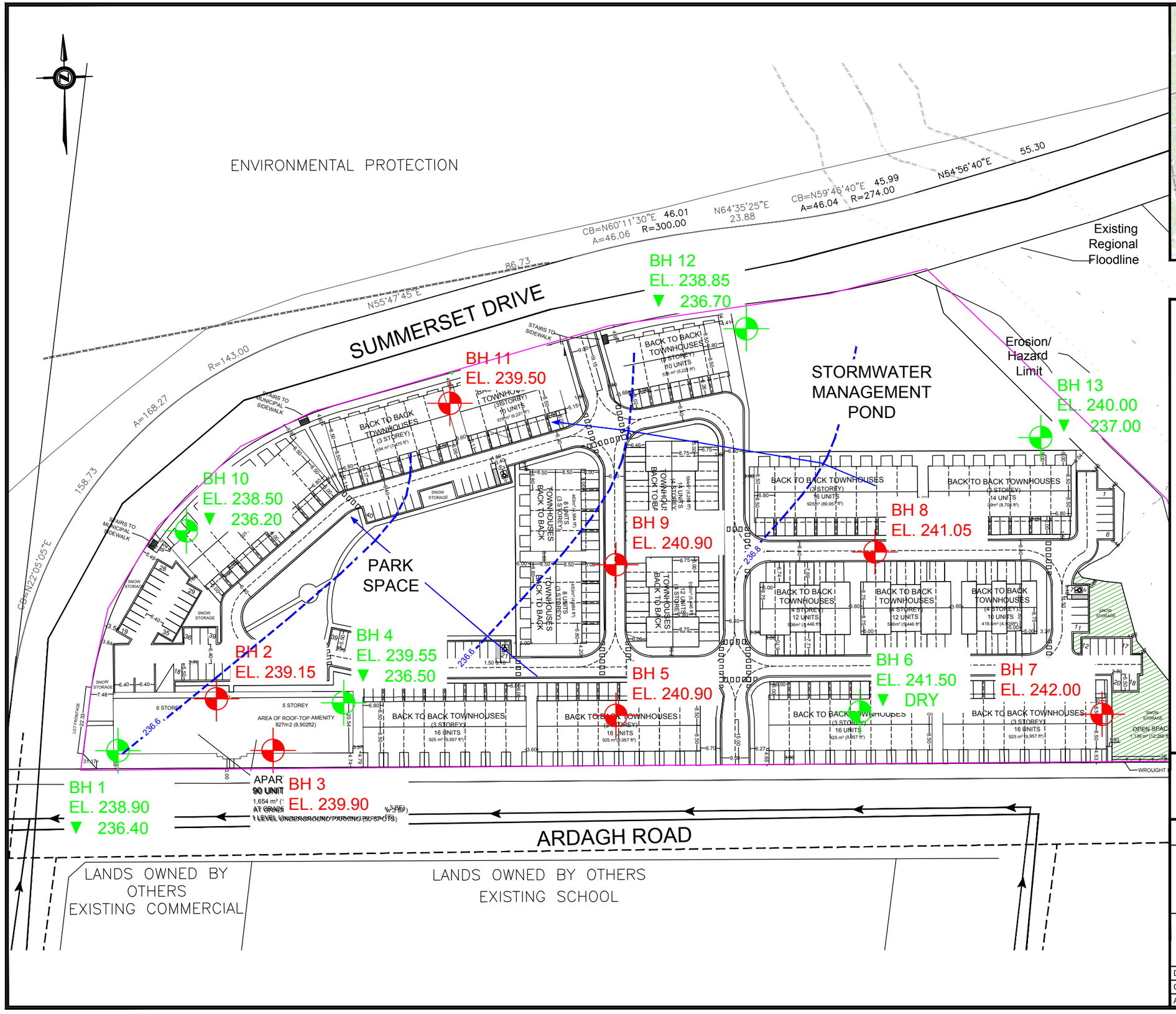
Stick-up casing
Concrete
Bentonite seal
50 mm slotted pipe
Filter sand
First water strike at 4.0 m

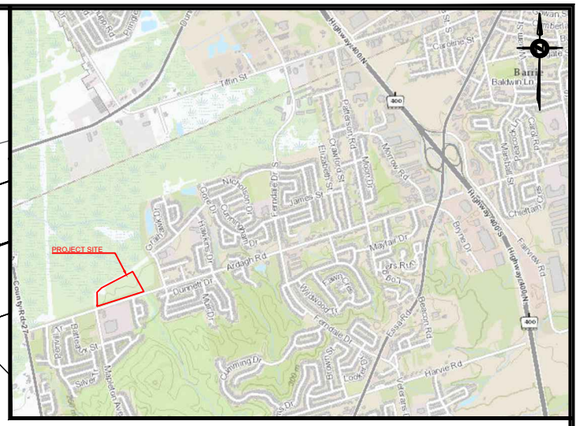
Upon completion of augering
Wet cave at 3.8 m

Water Level Readings:

Date	Depth	Elev.
2021-03-05	3.0	237.0
2021-03-10	3.0	237.0

NOTES





KEY PLAN
BARRIE, ONTARIO

LEGEND:

BH 1
EL. 238.90
▼ 236.40
BOREHOLE/MONITORING WELL LOCATION
SURFACE ELEVATION
WATER ELEVATION (2021-03-05)

BH 2
EL. 239.15
BOREHOLE LOCATION
SURFACE ELEVATION

INTERPRETED GROUND WATER CONTOURS

INFERRED GROUND WATER FLOW DIRECTION

APPROXIMATE SITE LIMITS

REFERENCE:

BASE PLAN PROVIDED BY THE CLIENT.

0m 15 30 45 60 75
SCALE

BOREHOLE/MONITORING WELL LOCATION PLAN

PROPOSED RESIDENTIAL DEVELOPMENT
ARDAGH ROAD AND SUMMERSET DRIVE
BARRIE, ONTARIO

Peto MacCallum Ltd.
CONSULTING ENGINEERS

DRAWN	NG	DATE	SCALE	PML REF.	DRAWING NO.
CHECKED	AK	MAR. 2021	AS SHOWN	21BF003	1
APPROVED	GW				

APPENDIX A

Statement of Limitations

STATEMENT OF LIMITATIONS

This report is prepared for and made available for the sole use of the client named. Peto MacCallum Ltd. (PML) hereby disclaims any liability or responsibility to any person or entity, other than those for whom this report is specifically issued, for any loss, damage, expenses, or penalties that may arise or result from the use of any information or recommendations contained in this report. The contents of this report may not be used or relied upon by any other person without the express written consent and authorization of PML.

This report shall not be relied upon for any purpose other than as agreed with the client named without the written consent of PML. It shall not be used to express or imply warranty as to the fitness of the property for a particular purpose. A portion of this report may not be used as a separate entity: that is to say the report is to be read in its entirety at all times.

The report is based solely on the scope of services which are specifically referred to in this report. No physical or intrusive testing has been performed, except as specifically referenced in this report. This report is not a certification of compliance with past or present regulations, codes, guidelines and policies.

The scope of services carried out by PML is based on details of the proposed development and land use to address certain issues, purposes and objectives with respect to the specific site as identified by the client. Services not expressly set forth in writing are expressly excluded from the services provided by PML. In other words, PML has not performed any observations, investigations, study analysis, engineering evaluation or testing that is not specifically listed in the scope of services in this report. PML assumes no responsibility or duty to the client for any such services and shall not be liable for failing to discover any condition, whose discovery would require the performance of services not specifically referred to in this report.

STATEMENT OF LIMITATIONS
(continued)

The findings and comments made by PML in this report are based on the conditions observed at the time of PML's site reconnaissance. No assurances can be made and no assurances are given with respect to any potential changes in site conditions following the time of completion of PML's field work. Furthermore, regulations, codes and guidelines may change at any time subsequent to the date of this report and these changes may effect the validity of the findings and recommendations given in this report.

The results and conclusions with respect to site conditions are therefore in no way intended to be taken as a guarantee or representation, expressed or implied, that the site is free from any contaminants from past or current land use activities or that the conditions in all areas of the site and beneath or within structures are the same as those areas specifically sampled.

Any investigation, examination, measurements or sampling explorations at a particular location may not be representative of conditions between sampled locations. Soil, ground water, surface water, or building material conditions between and beyond the sampled locations may differ from those encountered at the sampling locations and conditions may become apparent during construction which could not be detected or anticipated at the time of the intrusive sampling investigation.

Budget estimates contained in this report are to be viewed as an engineering estimate of probable costs and provided solely for the purposes of assisting the client in its budgeting process. It is understood and agreed that PML will not in any way be held liable as a result of any budget figures provided by it.

The Client expressly waives its right to withhold PML's fees, either in whole or in part, or to make any claim or commence an action or bring any other proceedings, whether in contract, tort, or otherwise against PML in anyway connected with advice or information given by PML relating to the cost estimate or Environmental Remediation/Cleanup and Restoration or Soil and Ground Water Management Plan Cost Estimate.

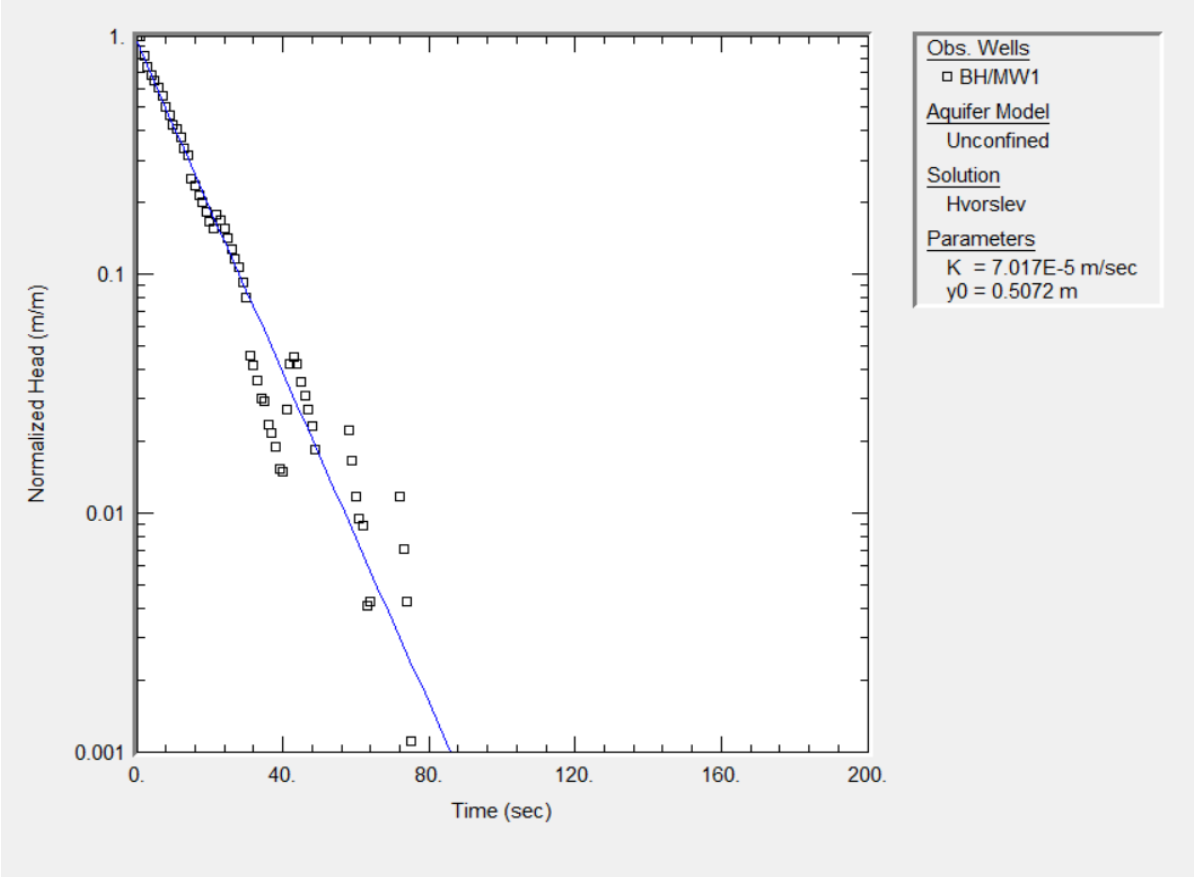
APPENDIX B

Borehole Permeability Testing

Estimation of K by Slug Test, based on Hvorslev equation

Date:	March 10, 2021
Conducted by:	S. Griffith

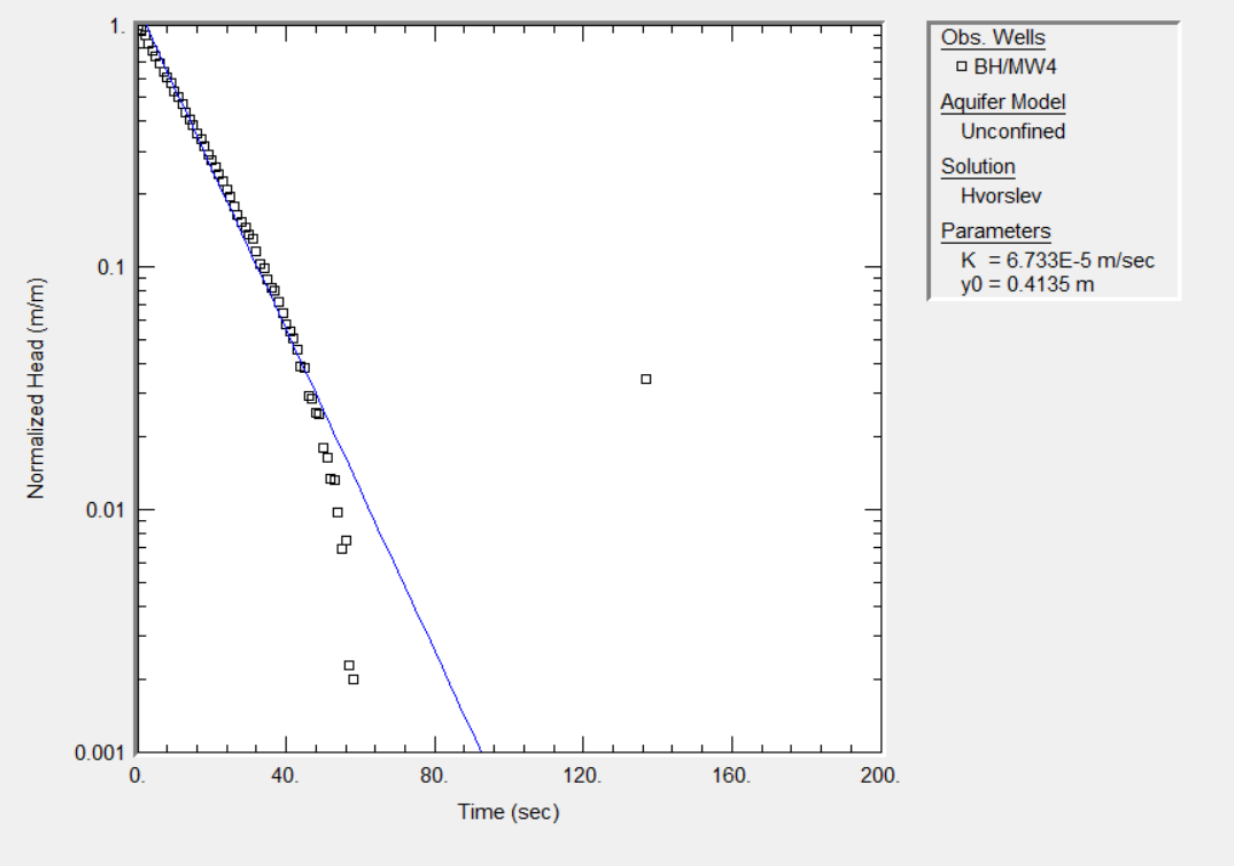
Well Number:	BH/MW1	
Well Screen Bottom:	7.20	mbgs
Top of Pipe:	0.85	mags
Well Casing Diameter:	5.08	cm
Well Elevation:	238.90	masl
Static Water Level:	2.60	mbgs
$K = r^2 \ln(L/R)/(2LTo) =$	**7.0×10^{-5}**	m/s



Estimation of K by Slug Test, based on Hvorslev equation

Date:	March 10, 2021
Conducted by:	S. Griffith

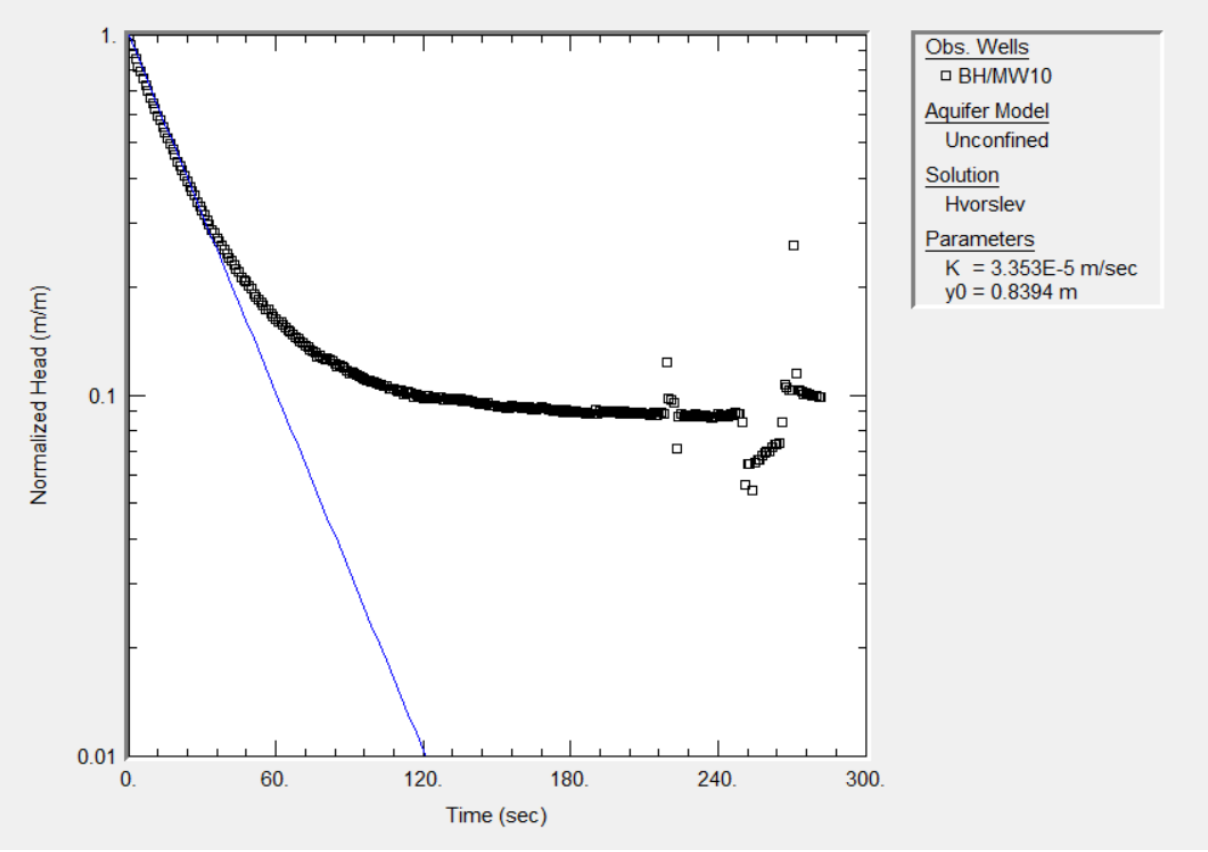
Well Number:	BH/MW4	
Well Screen Bottom:	7.20	mbgs
Top of Pipe:	0.90	mags
Well Casing Diameter:	5.08	cm
Well Elevation:	239.55	masl
Static Water Level:	3.10	mbgs
$K = r^2 \ln(L/R)/(2LTo) =$	**6.7×10^{-5}**	m/s



Estimation of K by Slug Test, based on Hvorslev equation

Date:	March 10, 2021
Conducted by:	S. Griffith

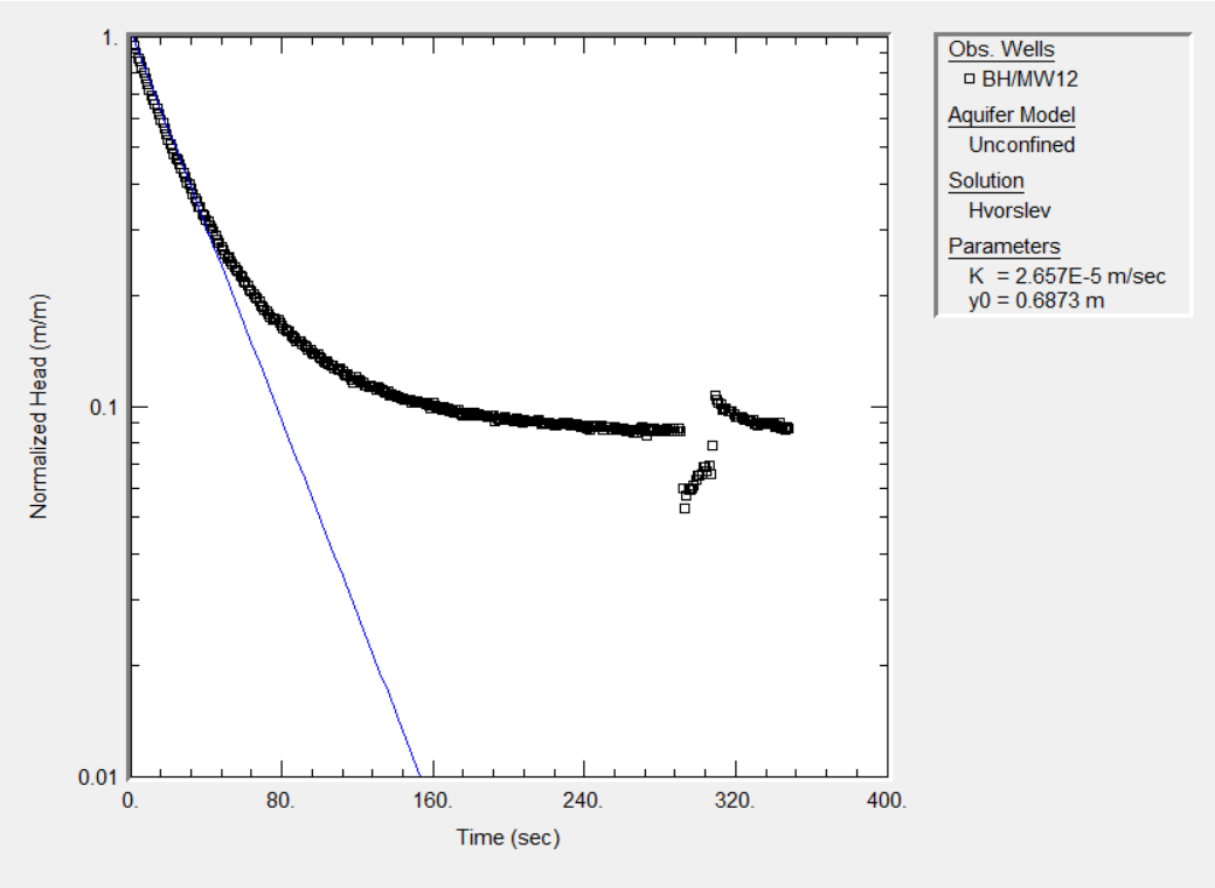
Well Number:	BH/MW10	
Well Screen Bottom:	4.50	mbgs
Top of Pipe:	0.89	mags
Well Casing Diameter:	5.08	cm
Well Elevation:	238.50	masl
Static Water Level:	2.40	mbgs
$K = r^2 \ln(L/R)/(2LTo) =$	**3.5×10^{-5}**	m/s



Estimation of K by Slug Test, based on Hvorslev equation

Date:	March 10, 2021
Conducted by:	S. Griffith

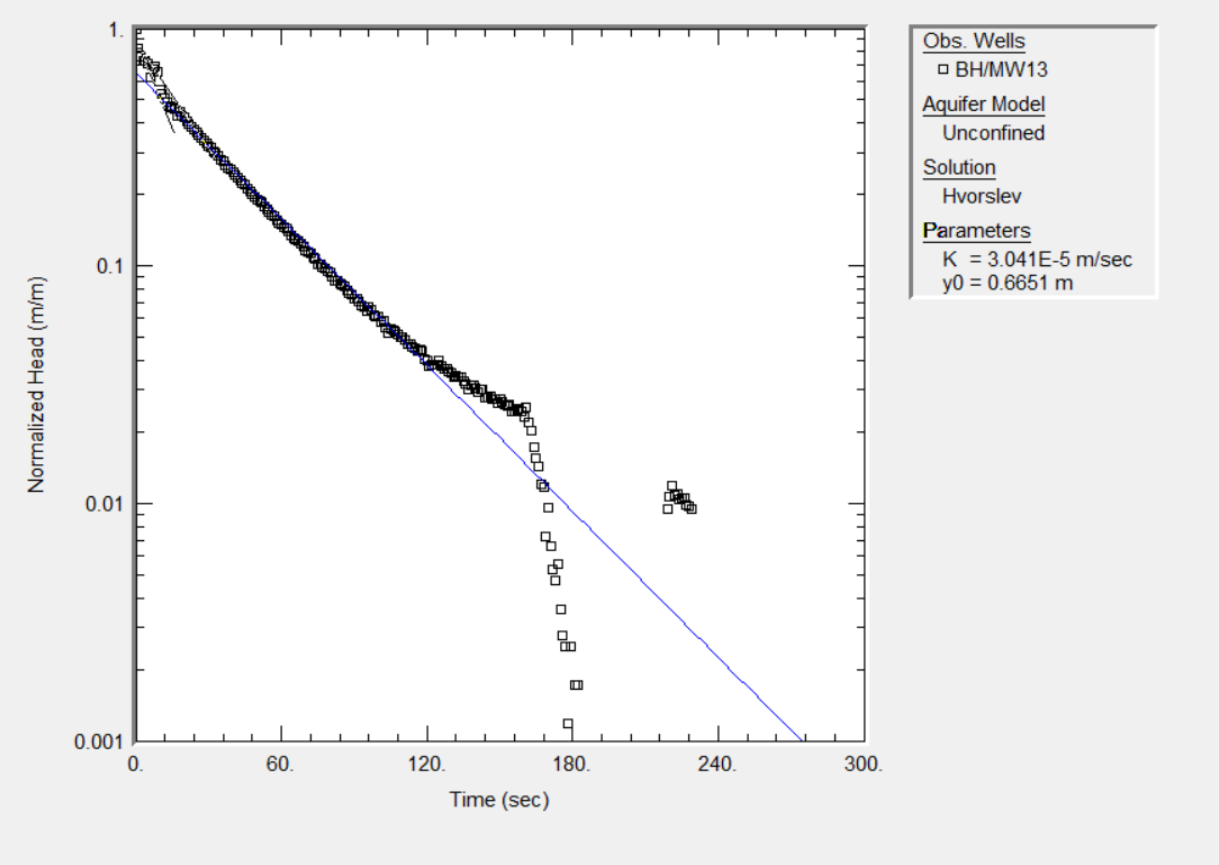
Well Number:	BH/MW12	
Well Screen Bottom:	4.50	mbgs
Top of Pipe:	0.68	mags
Well Casing Diameter:	5.08	cm
Well Elevation:	238.85	masl
Static Water Level:	2.30	mbgs
$K = r^2 \ln(L/R)/(2LTo) =$	**2.7×10^{-5}**	m/s



Estimation of K by Slug Test, based on Hvorslev equation

Date:	March 10, 2021
Conducted by:	S. Griffith

Well Number:	BH/MW13	
Well Screen Bottom:	4.50	mbgs
Top of Pipe:	0.89	mags
Well Casing Diameter:	5.08	cm
Well Elevation:	240.00	masl
Static Water Level:	3.00	mbgs
$K = r^2\ln(L/R)/(2LTo)$ =	**$3.0x10^{-5}$**	m/s



APPENDIX C

Certificates of Analyses for Groundwater Chemical Testing

CADUCEON™ ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: GH0155 **REPORT No. B21-06872**

Report To:

Peto MacCallum Ltd
19 Churchill Drive,
Barrie ON L4N 8Z5
Attention: Alicia Kimberley

Caduceon Environmental Laboratories
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 10-Mar-21
DATE REPORTED: 18-Mar-21
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:

P.O. NUMBER: 21BF003
WATERWORKS NO.

Parameter	Qty	Site Analyzed	Analyst Initials	Date Analyzed	Lab Method	Reference Method
Cyanide	1	Kingston	US	12-Mar-21	A-CN-001 (k)	SM 4500CN
A - Wet Chem	1	Kingston	TK	16-Mar-21	A-COD K	SM5220C
Anions	1	Holly Lane	VK	16-Mar-21	A-IC-01 (o)	SM4110C
pH	1	Holly Lane	SYL	12-Mar-21	A-PH-01 (o)	SM 4500H
Sulphide	1	Kingston	TK	12-Mar-21	A-S2	SM4500-S2
A - Wet Chem	1	Kingston	KD	12-Mar-21	A-TPTKN-001 (N)(k)	E3199A.1
A - Wet Chem	1	Kingston	KD	12-Mar-21	A-TPTKN-001 (P)(k)	E3199A.1
Total Suspended Solids	1	Kingston	TK	12-Mar-21	A-TSS-001 (k)	SM2540D
BOD	1	Kingston	JWF	12-Mar-21	C-BOD-001 (k)	SM 5210B
SVOC	1	Kingston	sge	15-Mar-21	C-NAB-W-001 (k)	EPA 8270
Oil & Grease	1	Kingston	KPR	17-Mar-21	C-O&G-001 (k)	SM 5520
Phenolics (4-aap)	1	Kingston	TK	16-Mar-21	C-PHEN-01 (k)	MOEE 3179
VOC's	1	Richmond Hill	JE	12-Mar-21	C-VOC-02 (rh)	EPA 8260
Chromium (VI)	1	Holly Lane	LMG	16-Mar-21	D-CRVI-01 (o)	MOE E3056
Mercury	1	Holly Lane	PBK	15-Mar-21	D-HG-02 (o)	SM 3112 B
Metals - ICP-OES	1	Holly Lane	AHM	15-Mar-21	D-ICP-01 (o)	SM 3120
Metals-ICP-MS	1	Holly Lane	TPR	15-Mar-21	D-ICPMS Dissolved 7800	EPA 200.8
Metals - ICP-MS	1	Holly Lane	TPR	16-Mar-21	D-ICPMS-01 (o)	EPA 200.8

Barrie Sanitary - Barrie Sanitary & Combined and Storm
Barrie-Sanitary/Combined - Sanitary/Combined Sewer Guidelines
Barrie-Storm Sewer - Storm Sewer Guidelines



Christine Burke
Lab Manager

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

The analytical results reported herein refer to the samples as received. Reproduction of this analytical report in full or in part is prohibited without prior consent from Caduceon Environmental Laboratories.

CADUCEON ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: GH0155 **REPORT No. B21-06872**

Report To:

Peto MacCallum Ltd
19 Churchill Drive,
Barrie ON L4N 8Z5
Attention: Alicia Kimberley

Caduceon Environmental Laboratories
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 10-Mar-21
DATE REPORTED: 18-Mar-21
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:
P.O. NUMBER: 21BF003
WATERWORKS NO.

	Client I.D.		BH/MW 12				Barrie Sanitary	
	Sample I.D.		B21-06872-1				Barrie-Sanitary/Combined	Barrie-Storm Sewer
	Date Collected							
Parameter	**Units**	**R.L.**						
pH @25°C	pH Units		8.05				9.5	9.5
BOD(5 day)	mg/L	3	< 3				300	15
COD	mg/L	5	5				600	
Total Kjeldahl Nitrogen	mg/L	0.1	0.2				100	
Total Suspended Solids	mg/L	3	**885**				350	15
Oil and Grease-Mineral	mg/L	1.0	< 1.0				15	
Oil and Grease-Anim/Veg.	mg/L	1.0	< 1.0				150	
Phosphorus-Total	mg/L	0.01	0.30				10	
Cyanide (Total)	mg/L	0.005	< 0.005				1.2	
Chloride	mg/L	0.5	6.1				1500	
Fluoride	mg/L	0.1	< 0.1				10	
Sulphate	mg/L	1	7				1500	
Aluminum	mg/L	0.01	0.07				50	
Aluminum (total)	mg/L	0.01	4.65				50	
Antimony	mg/L	0.0001	0.0004				5.0	
Arsenic	mg/L	0.0001	0.0008				1.0	
Barium	mg/L	0.001	0.063				5.0	
Beryllium	mg/L	0.002	< 0.002					
Boron	mg/L	0.005	0.012					
Benzene	mg/L	0.0005	< 0.0005				0.01	
Bismuth	mg/L	0.02	< 0.02				5.0	
Cadmium	mg/L	0.000015	0.000047				0.7	0.001
Chromium	mg/L	0.001	0.004				2.0	0.08
Chromium (VI)	mg/L	0.001	< 0.001					

Barrie Sanitary - Barrie Sanitary & Combined and Storm
Barrie-Sanitary/Combined - Sanitary/Combined Sewer Guidelines
Barrie-Storm Sewer - Storm Sewer Guidelines



Christine Burke
Lab Manager

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

The analytical results reported herein refer to the samples as received. Reproduction of this analytical report in full or in part is prohibited without prior consent from Caduceon Environmental Laboratories.

CADUCEON ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: GH0155 **REPORT No. B21-06872**

Report To:

Peto MacCallum Ltd
19 Churchill Drive,
Barrie ON L4N 8Z5
Attention: Alicia Kimberley

Caduceon Environmental Laboratories
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 10-Mar-21
DATE REPORTED: 18-Mar-21
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:
P.O. NUMBER: 21BF003
WATERWORKS NO.

	Client I.D.		BH/MW 12				Barrie Sanitary	
	Sample I.D.		B21-06872-1				Barrie-Sanitary/Combined	Barrie-Storm Sewer
	Date Collected							
Parameter	**Units**	**R.L.**						
Cobalt	mg/L	0.0001	0.0028				5.0	
Copper	mg/L	0.0001	0.0089				2.0	0.01
Dichlorobenzene,1,2-	mg/L	0.0005	< 0.0005				0.05	
Dichlorobenzene,1,4-	mg/L	0.0005	< 0.0005				0.08	
Ethylbenzene	mg/L	0.0005	< 0.0005				0.06	
Gold	mg/L	0.0007	< 0.0007				5.0	
Hexachlorobenzene	mg/L	0.0001	< 0.0001				0.0001	
Iron	mg/L	0.005	6.28				50	
Lead	mg/L	0.00002	0.00276				0.7	0.05
Manganese (Total)	mg/L	0.001	0.311				5.0	
Dichloromethane (Methylene Chloride)	mg/L	0.005	< 0.005				0.09	
Mercury	mg/L	0.00002	< 0.00002				0.01	
Molybdenum	mg/L	0.01	< 0.01				5.0	
Nickel	mg/L	0.0002	0.0049				2.0	0.05
Total PAH	mg/L	0.0001	< 0.0001				0.005	
Acenaphthene	µg/L	0.05	< 0.05					
Acenaphthylene	µg/L	0.05	< 0.05					
Anthracene	µg/L	0.05	< 0.05					
Benzo(a)anthracene	µg/L	0.05	< 0.06					
Benzo(a)pyrene	µg/L	0.01	< 0.01					
Benzo(b+k)fluoranthene	µg/L	0.1	< 0.1					
Benzo(g,h,i)perylene	µg/L	0.05	< 0.05					
Dibenzo(a,h)anthracene	µg/L	0.05	< 0.05					

Barrie Sanitary - Barrie Sanitary & Combined and Storm
Barrie-Sanitary/Combined - Sanitary/Combined Sewer Guidelines
Barrie-Storm Sewer - Storm Sewer Guidelines



Christine Burke
Lab Manager

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

The analytical results reported herein refer to the samples as received. Reproduction of this analytical report in full or in part is prohibited without prior consent from Caduceon Environmental Laboratories.

CADUCEON ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: GH0155 **REPORT No. B21-06872**

Report To:

Peto MacCallum Ltd
19 Churchill Drive,
Barrie ON L4N 8Z5
Attention: Alicia Kimberley

Caduceon Environmental Laboratories
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 10-Mar-21
DATE REPORTED: 18-Mar-21
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:
P.O. NUMBER: 21BF003
WATERWORKS NO.

	Client I.D.		BH/MW 12				Barrie Sanitary	
	Sample I.D.		B21-06872-1				Barrie-Sanitary/Combined	Barrie-Storm Sewer
	Date Collected							
Parameter	**Units**	**R.L.**						
Chrysene	µg/L	0.05	< 0.05					
Fluoranthene	µg/L	0.05	< 0.05					
Fluorene	µg/L	0.05	< 0.05					
Indeno(1,2,3,-cd)pyrene	µg/L	0.05	< 0.05					
Methylnaphthalene,1-	µg/L	0.05	< 0.05					
Methylnaphthalene,2-	µg/L	0.05	< 0.05					
Naphthalene	µg/L	0.05	< 0.06					
Phenanthrene	µg/L	0.05	< 0.05					
Pyrene	µg/L	0.05	< 0.05					
Phenolics	mg/L	0.002	< 0.002				0.1	
Platinum	mg/L	0.00004	< 0.00004				5.0	
Rhodium	mg/L	0.00002	< 0.00002				5.0	
Selenium	mg/L	0.001	< 0.001				1.0	
Silver	mg/L	0.0001	< 0.0001				0.4	
Strontium	mg/L	0.001	0.251					
Sulphide	mg/L	0.01	< 0.1				1.0	
Tetrachloroethane,1,1,2,2-	mg/L	0.0005	< 0.0005				0.06	
Tetrachloroethylene	mg/L	0.0005	< 0.0005				0.06	
Toluene	mg/L	0.0005	< 0.0005				0.02	
Trichloroethylene	mg/L	0.0005	< 0.0005				0.05	
Xylene, m,p,o-	mg/L	0.0011	< 0.0011				0.3	
Thallium	mg/L	0.00005	0.00008					
Tin	mg/L	0.05	< 0.05				5.0	

Barrie Sanitary - Barrie Sanitary & Combined and Storm
Barrie-Sanitary/Combined - Sanitary/Combined Sewer Guidelines
Barrie-Storm Sewer - Storm Sewer Guidelines



Christine Burke
Lab Manager

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

The analytical results reported herein refer to the samples as received. Reproduction of this analytical report in full or in part is prohibited without prior consent from Caduceon Environmental Laboratories.

CADUCEON ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: GH0155 **REPORT No. B21-06872**

Report To:

Peto MacCallum Ltd
19 Churchill Drive,
Barrie ON L4N 8Z5
Attention: Alicia Kimberley

Caduceon Environmental Laboratories
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 10-Mar-21
DATE REPORTED: 18-Mar-21
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:
P.O. NUMBER: 21BF003
WATERWORKS NO.

	Client I.D. / Sample I.D. / Date Collected		BH/MW 12 B21-06872-1				Barrie Sanitary	
							Barrie-Sanitary/Combined	Barrie-Storm Sewer
Parameter	**Units**	**R.L.**						
Titanium	mg/L	0.005	0.277					
Tungsten	mg/L	0.01	< 0.01					
Uranium	mg/L	0.00005	0.00026					
Vanadium	mg/L	0.005	0.009				5.0	
Zinc	mg/L	0.005	0.026				2.0	0.04
Zirconium	mg/L	0.003	0.005					

1 Elevated RL due to sample matrix interference

Barrie Sanitary - Barrie Sanitary & Combined and Storm
Barrie-Sanitary/Combined - Sanitary/Combined Sewer Guidelines
Barrie-Storm Sewer - Storm Sewer Guidelines

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

Christine Burke
Lab Manager

The analytical results reported herein refer to the samples as received. Reproduction of this analytical report in full or in part is prohibited without prior consent from Caduceon Environmental Laboratories.

CADUCEON™ ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: GH0155 **REPORT No. B21-06872**

Report To:

Peto MacCallum Ltd
19 Churchill Drive,
Barrie ON L4N 8Z5
Attention: Alicia Kimberley

Caduceon Environmental Laboratories
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 10-Mar-21
DATE REPORTED: 18-Mar-21
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:
P.O. NUMBER: 21BF003
WATERWORKS NO.

Summary of Exceedances

Sanitary/Combined Sewer Guidelines

BH/MW 12	Found Value	Limit
Total Suspended Solids (mg/L)	885	350

Storm Sewer Guidelines

BH/MW 12	Found Value	Limit
Total Suspended Solids (mg/L)	885	15

Barrie Sanitary - Barrie Sanitary & Combined and Storm
Barrie-Sanitary/Combined - Sanitary/Combined Sewer Guidelines
Barrie-Storm Sewer - Storm Sewer Guidelines



Christine Burke
Lab Manager

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

The analytical results reported herein refer to the samples as received. Reproduction of this analytical report in full or in part is prohibited without prior consent from Caduceon Environmental Laboratories.

CADUCEON™ ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: GH0155

REPORT No. B21-06872 (i)

Rev. 1

Report To:

Peto MacCallum Ltd
19 Churchill Drive,
Barrie ON L4N 8Z5
Attention: Alicia Kimberley

Caduceon Environmental Laboratories
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 10-Mar-21
DATE REPORTED: 18-Mar-21
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:
P.O. NUMBER: 21BF003
WATERWORKS NO.

Parameter	Qty	Site Analyzed	Analyst Initials	Date Analyzed	Lab Method	Reference Method
Chromium (VI)	1	Holly Lane	LMG	16-Mar-21	D-CRVI-01 (o)	MOE E3056
Mercury	1	Holly Lane	PBK	15-Mar-21	D-HG-02 (o)	SM 3112 B
Metals - ICP-OES	1	Holly Lane	AHM	15-Mar-21	D-ICP-01 (o)	SM 3120
Metals - ICP-MS	1	Holly Lane	TPR	16-Mar-21	D-ICPMS-01 (o)	EPA 200.8

PWQO - Provincial Water Quality Objectives
Interim PWQO - Interim PWQO
PWQO - Provincial Water Quality Objectives

Christine Burke
Lab Manager

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

The analytical results reported herein refer to the samples as received. Reproduction of this analytical report in full or in part is prohibited without prior consent from Caduceon Environmental Laboratories.

CADUCEON ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: GH0155

REPORT No. B21-06872 (i)

Rev. 1

Report To:

Peto MacCallum Ltd
19 Churchill Drive,
Barrie ON L4N 8Z5
Attention: Alicia Kimberley

Caduceon Environmental Laboratories
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 10-Mar-21
DATE REPORTED: 18-Mar-21
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:
P.O. NUMBER: 21BF003
WATERWORKS NO.

	Client I.D.		BH/MW 12				PWQO	
	Sample I.D.		B21-06872-1				Interim PWQO	PWQO
	Date Collected							
Parameter	**Units**	**R.L.**						
Aluminum	µg/L	10	70				75	75
Aluminum (total)	µg/L	10	4650					
Antimony	µg/L	0.1	0.4					20
Arsenic	µg/L	0.1	0.8				100	5
Barium	µg/L	1	63					
Beryllium	µg/L	2	< 2					11
Boron	µg/L	5	12				200	
Bismuth	µg/L	20	< 20					
Cadmium	µg/L	0.015	0.047				0.1	0.2
Chromium	µg/L	1	4					
Chromium (VI)	µg/L	1	< 1					1
Cobalt	µg/L	0.1	**2.8**					0.9
Copper	µg/L	0.1	**8.9**					5
Iron	µg/L	5	**6280**					300
Lead	µg/L	0.02	**2.76**				1	5
Manganese (Total)	µg/L	1	311					
Mercury	µg/L	0.02	< 0.02					0.2
Molybdenum	µg/L	10	< 10					40
Nickel	µg/L	0.2	4.9					25
Selenium	µg/L	1	< 1					100
Silver	µg/L	0.1	< 0.1					0.1
Strontium	µg/L	1	251					
Thallium	µg/L	0.05	0.08					0.3
Tin	µg/L	50	< 50					

PWQO - Provincial Water Quality Objectives
Interim PWQO - Interim PWQO
PWQO - Provincial Water Quality Objectives



Christine Burke
Lab Manager

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

The analytical results reported herein refer to the samples as received. Reproduction of this analytical report in full or in part is prohibited without prior consent from Caduceon Environmental Laboratories.

CADUCEON ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: GH0155

REPORT No. B21-06872 (i)

Rev. 1

Report To:

Peto MacCallum Ltd
19 Churchill Drive,
Barrie ON L4N 8Z5
Attention: Alicia Kimberley

Caduceon Environmental Laboratories
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 10-Mar-21
DATE REPORTED: 18-Mar-21
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:
P.O. NUMBER: 21BF003
WATERWORKS NO.

	Client I.D.		BH/MW 12				PWQO	
	Sample I.D.		B21-06872-1				Interim PWQO	PWQO
	Date Collected							
Parameter	**Units**	**R.L.**						
Titanium	µg/L	5	277					
Tungsten	µg/L	10	< 10					30
Uranium	µg/L	0.05	0.26					5
Vanadium	µg/L	5	**9**					6
Zinc	µg/L	5	**26**				20	30
Zirconium	µg/L	3	**5**					4

PWQO - Provincial Water Quality Objectives
Interim PWQO - Interim PWQO
PWQO - Provincial Water Quality Objectives

Christine Burke
Lab Manager

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

The analytical results reported herein refer to the samples as received. Reproduction of this analytical report in full or in part is prohibited without prior consent from Caduceon Environmental Laboratories.

CADUCEON ENVIRONMENTAL LABORATORIES
Client committed. Quality assured.

CERTIFICATE OF ANALYSIS

Final Report

C.O.C.: GH0155

REPORT No. B21-06872 (i)

Rev. 1

Report To:

Peto MacCallum Ltd
19 Churchill Drive,
Barrie ON L4N 8Z5
Attention: Alicia Kimberley

Caduceon Environmental Laboratories
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 10-Mar-21
DATE REPORTED: 18-Mar-21
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:
P.O. NUMBER: 21BF003
WATERWORKS NO.

Summary of Exceedances

Interim PWQO		
BH/MW 12	Found Value	Limit
Zinc (µg/L)	26	20
Lead (µg/L)	2.76	1

Provincial Water Quality Objectives		
BH/MW 12	Found Value	Limit
Zirconium (µg/L)	5	4
Vanadium (µg/L)	9	6
Iron (µg/L)	6280	300
Copper (µg/L)	8.9	5
Cobalt (µg/L)	2.8	0.9

PWQO - Provincial Water Quality Objectives
Interim PWQO - Interim PWQO
PWQO - Provincial Water Quality Objectives



Christine Burke
Lab Manager

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

The analytical results reported herein refer to the samples as received. Reproduction of this analytical report in full or in part is prohibited without prior consent from Caduceon Environmental Laboratories.

GENERAL SAMPLE SUBMISSION FORM

CADUCEON ENVIRONMENTAL LABORATORIES

SAMPLES SUBMITTED TO: Kingston [ ] Ottawa [ ] Richmond Hill [ ] Barrie [X] London [ ] Windsor [ ]

TESTING REQUIREMENTS: [X] O'Reg 153/04 [ ] O'Reg 406/19 [ ] RPI [ ] Coarse [ ] MISA [ ] Other: | [1] Table (1 - 9) [ ] Table (1 - 9.1) [ ] ICC [ ] Medium/Fine [ ] PWQO | [ ] Record of Site [ ] SPLP Table (1 - 9.1) [ ] Agricultural [ ] O'Reg 558 TCLP [ ] Landfill Monitoring

REPORT NUMBER (Lab Use): B21-06872

Are any samples to be submitted intended for Human Consumption under any Drinking Water Regulations? [ ] Yes [X] No (If yes, submit all Drinking Water Samples on a Drinking Water Chain of Custody)

Organization: Peto Maccallum Ltd.	Address: 19 Churchill Drive, Barrie, ON L4N 8Z5, barrie@petomaccallum.com	Invoicing Address (if different):
Contact: A. Kimberley		
Tel: 705-734-3900 / Fax: 705-734-9911		
Email: akimberley@petomaccallum.com	Quote #: YD2019	Project Name/#: 21BF003
Additional Info (email, cell, etc): gwhite@petomaccallum.com	P.O. #:	Additional Info:

ANALYSES REQUESTED: PWQO Metals; Barrie Storm & Storm; SANITARY (as per Mun sm); Suspected Highly Contaminated

TURNAROUND SERVICE REQUESTED (see back page) *Must be arranged in advance

[ ]	Platinum*	200% Surcharge
[ ]	Gold*	100% Surcharge
[ ]	Silver	50% Surcharge
[ ]	Bronze	25% Surcharge
[X]	Standard	5-7 days
[ ]	Specific Date:	

* Sample Matrix Legend: WW=Waste Water, SW=Surface Water, GW=Groundwater, LS=Liquid Sludge, SS=Solid Sludge, S=Soil, Sed=Sediment, PC=Paint Chips, F=Filter, Oil = Oil

Lab No.	Sample Source and/or Sample Identification	S.P.L.	Sample Matrix *	Date Collected (yy-mm-dd)	Time Collected	Indicate Test For Each Sample By Using A Check Mark In The Box Provided	X	Field pH	Field Temp.	# Bottles/ Sample	Field Filtered Y/N
1	BH/MW 12		GW	21-03-10	4:00:00 PM	X X				13	N
	~~Cr (VI)~~ PM										
	Cyanide → K										
	O+G → K										
	1L amber → K										
	VOC → RH										
	Gen Chem; nut → K										
	Gen chem; metals → O (+ Filtered metals)										
	Pheinol → K										
	Hg → O										
	S^{2-} → K										
	Chromium → O										

SAMPLE SUBMISSION INFORMATION

	Sampled by:	Submitted by:
Print:	S Griffith	S Griffith
Sign:		
	21-03-10	21-03-10
	Date (yy-mm-dd)/Time:	Date (yy-mm-dd)/Time:

SHIPPING INFORMATION: Courier (Client account) [ ]; Courier (Caduceon account) [ ]; Drop Off [X]; Caduceon (Pick-up) [ ]; Invoice; # of Pieces

REPORTING / INVOICING: Report by Fax [ ]; Report by Email [X]; Invoice by Email [X]; Invoice by Mail [ ]

SAMPLE RECEIVING INFORMATION (LABORATORY USE ONLY)

Received By (print):	Elle	Signature:	ES
Date Received (yy-mm-dd):	21-03-10	Time Received:	16:45
Laboratory Prepared Bottles:	[X] Yes	[ ] No	
Sample Temperature °C:	7.0°C	Labeled by:	AM

Comments:

APPENDIX D

Engineered Fill

ENGINEERED FILL

The information presented in this appendix is intended for general guidance only. Site specific conditions and prevailing weather may require modification of compaction standards, backfill type or procedures. Each site must be discussed, and procedures agreed with Peto MacCallum Ltd. prior to the start of the earthworks and must be subject to ongoing review during construction. This appendix is not intended to apply to embankments. Steeply sloping ravine residential lots require special consideration.

For fill to be classified as engineered fill suitable for supporting structural loads, a number of conditions must be satisfied, including but not necessarily limited to the following:

6. Purpose

The site specific purpose of the engineered fill must be recognized. In advance of construction, all parties should discuss the project and its requirements and agree on an appropriate set of standards and procedures.

7. Minimum Extent

The engineered fill envelope must extend beyond the footprint of the structure to be supported. The minimum extent of the envelope should be defined from a geotechnical perspective by:

- at founding level, extend a minimum 1.0 m beyond the outer edge of the foundations, greater if adequate layout has not yet been completed as noted below; and
- extend downward and outward at a slope no greater than 45° to meet the subgrade

All fill within the envelope established above must meet the requirements of engineered fill in order to support the structure safely. Other considerations such as survey control, or construction methods may require an envelope that is larger, as noted in the following sections.

Once the minimum envelope has been established, structures must not be moved or extended without consultation with Peto MacCallum Ltd. Similarly, Peto MacCallum Ltd. should be consulted prior to any excavation within the minimum envelope.

8. Survey Control

Accurate survey control is essential to the success of an engineered fill project. The boundaries of the engineered fill must be laid out by a surveyor in consultation with engineering staff from Peto MacCallum Ltd. Careful consideration of the maximum building envelope is required.

During construction it is necessary to have a qualified surveyor provide total station control on the three dimensional extent of filling.

9. Subsurface Preparation

Prior to placement of fill, the subgrade must be prepared to the satisfaction of Peto MacCallum Ltd. All deleterious material must be removed and in some cases, excavation of native mineral soils may be required.

Particular attention must be paid to wet subgrades and possible additional measures required to achieve sufficient compaction. Where fill is placed against a slope, benching may be necessary and natural drainage paths must not be blocked.

10. Suitable Fill Materials

All material to be used as fill must be approved by Peto MacCallum Ltd. Such approval will be influenced by many factors and must be site and project specific. External fill sources must be sampled, tested and approved prior to material being hauled to site.

11. Test Section

In advance of the start of construction of the engineered fill pad, the Contractor should conduct a test section. The compaction criterion will be assessed in consultation with Peto MacCallum Ltd. for the various fill material types using different lift thicknesses and number of passes for the compaction equipment proposed by the Contractor.

Additional test sections may be required throughout the course of the project to reflect changes in fill sources, natural moisture content of the material and weather conditions.

The Contractor should be particularly aware of changes in the moisture content of fill material. Site review by Peto MacCallum Ltd. is required to ensure the desired lift thickness is maintained and that each lift is systematically compacted, tested and approved before a subsequent lift is commenced.

12. Inspection and Testing

Uniform, thorough compaction is crucial to the performance of the engineered fill and the supported structure. Hence, all subgrade preparation, filling and compacting must be carried out under the full time inspection by Peto MacCallum Ltd.

All founding surfaces for all buildings and residential dwellings or any part thereof (including but not limited to footings and floor slabs) on structural fill or native soils must be inspected and approved by PML engineering personnel prior to placement of the base/subbase granular material and/or concrete. The purpose of the inspection is to ensure the subgrade soils are capable of supporting the building/house foundation and floor slab loads and to confirm the building/house envelope does not extend beyond the limits of any structural fill pads.

13. Protection of Fill

Fill is generally more susceptible to the effects of weather than natural soil. Fill placed and approved to the level at which structural support is required must be protected from excessive wetting, drying, erosion or freezing. Where adequate protection has not been provided, it may be necessary to provide deeper footings or to strip and recompact some of the fill.

14. Construction Delay Time Considerations

The integrity of the fill pad can deteriorate due to the harsh effects of our Canadian weather. Hence, particular care must be taken if the fill pad is constructed over a long time period.

It is necessary therefore, that all fill sources are tested to ensure the material compactability prior to the soil arriving at site. When there has been a lengthy delay between construction periods of the fill pad, it is necessary to conduct subgrade proof rolling, test pits or boreholes to verify the adequacy of the exposed subgrade to accept new fill material.

When the fill pad will be constructed over a lengthy period of time, a field survey should be completed at the end of each construction season to verify the areal extent and the level at which the compacted fill has been brought up to, tested and approved.

In the following spring, subexcavation may be necessary if the fill pad has been softened attributable to ponded surface water or freeze/thaw cycles.

A new survey is required at the beginning of the next construction season to verify that random dumping and/or spreading of fill has not been carried out at the site.

15. Approved Fill Pad Surveillance

It should be appreciated that once the fill pad has been brought to final grade and documented by field survey, there must be ongoing surveillance to ensure that the integrity of the fill pad is not threatened.

Grading operations adjacent to fill pads can often take place several months or years after completion of the fill pad.

It is imperative that all site management and supervision staff, the staff of Contractors and earthwork operators be fully aware of the boundaries of all approved engineered fill pads.

Excavation into an approved engineered fill pad should never be contemplated without the full knowledge, approval and documentation by the geotechnical consultant.

If the fill pad is knowingly built several years in advance of ultimate construction, the areal limits of the fill pad should be substantially overbuilt laterally to allow for changes in possible structure location and elevation and other earthwork operations and competing interests on the site. The overbuilt distance required is project and/or site specified.

Iron bars should be placed at the corner/intermediate points of the fill pad as a permanent record of the approved limits of the work for record keeping purposes.

16. Unusual Working Conditions

Construction of fill pads may at times take place at night and/or during periods of freezing weather conditions because of the requirements of the project schedule. It should be appreciated therefore, that both situations present more difficult working conditions. The Owner, Contractor, Design Consultant and Geotechnical Engineer must be willing to work together to revise site construction procedures, enhance field testing and surveillance, and incorporate design modifications as necessary to suit site conditions.

When working at night there must be sufficient artificial light to properly illuminate the fill pad and borrow areas.

Placement of material to form an engineered fill pad during winter and freezing temperatures has its own special conditions that must be addressed. It is imperative that each day prior to placement of new fill, the exposed subgrade must be inspected and any overnight snow or frozen material removed. Particular attention should be given to the borrow source inspection to ensure only nonfrozen fill is brought to the site.

The Contractor must continually assess the work program and have the necessary spreading and compacting equipment to ensure that densification of the fill material takes place in a minimum amount of time. Changes may be required to the spreading methods, lift thickness, and compaction techniques to ensure the desired compaction is achieved uniformly throughout each fill lift.

The Contractor should adequately protect the subgrade at the end of each shift to minimize frost penetration overnight. Since water cannot be added to the fill material to facilitate compaction, it is imperative that densification of the fill be achieved by additional compaction effort and an appropriate reduced lift thickness. Once the fill pad has been completed, it must be properly protected from freezing temperatures and ponding of water during the spring thaw period.

If the pad is unusually thick or if the fill thickness varies dramatically across the width or length of the fill pad, Peto MacCallum Ltd. should be consulted for additional recommendations. In this case, alternative special provisions may be recommended, such as providing a surcharge preload for a limited time or increase the degree of compaction of the fill.

APPENDIX E

MECP Water Well Records

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
INNISFIL TOWNSHIP CON 14 003	17 601514 4911873 W	1972/11 4608	30	FR 0017	16/20/2/ 0:30	DO		5709611 ()	BRWN SAND 0023
INNISFIL TOWNSHIP CON 14 003	17 601564 4911923 W	1973/08 4608	30	FR 0015	10//45/0: 30	DO		5710470 ()	BRWN CLAY 0010 GREY CLAY 0025
INNISFIL TOWNSHIP CON 14 003	17 601464 4911823 W	1984/08 1467	5	FR 0075	32/55/5/ 1:0	DO	0085 4	5719410 ()	GREY FILL STNS 0004 BRWN GRVL SAND 0029 BRWN CLAY SAND 0039 GREY CLAY 0055 GREY SAND SLTY 0062 GREY CLAY 0075 BRWN FSND 0089
INNISFIL TOWNSHIP CON 14 003	17 601714 4911923 W	1985/01 1467	5	FR 0084	30/53/5/ 3:0	DO	0084 4	5719579 ()	BLCK LOAM 0001 BRWN SAND 0026 BRWN SAND CLAY 0069 GREY CLAY GRVL 0084 BRWN SAND STNS 0088 GREY CLAY GRVL 0088
INNISFIL TOWNSHIP CON 14 003	17 601569 4911932 W	1992/03 3602	6	FR 0080	32/70/15 /1:0	DO	0082 3	5728987 (111289)	BRWN SAND 0015 BRWN CLAY STNS STNY 0019 BRWN CLAY SAND SNDY 0080 BRWN SAND WBRG 0085
INNISFIL TOWNSHIP CON 14 003	17 601534 4912006 W	1994/12 3602	6	FR 0066	33/50/20 /2:15	DO	0069 3	5731300 (148244)	BRWN SAND GRVL STNS 0021 GREY CLAY SOFT 0040 GREY CLAY STNS HPAN 0055 GREY SAND CLAY SNDY 0066 BRWN SAND CLN WBRG 0072
BARRIE CITY	17 601474 4911829 W	2010/07 7219	5		39///:	NU		7149889 (Z111899) A097054 A	
INNISFIL TOWNSHIP	17 601351 4911927 W	2017/11 7241	2			TH MO	0010 5	7303756 (Z274175) A217625	BRWN SAND 0016
BARRIE CITY (VESPRA)	17 601273 4912108 W	2017/11 7241	2			TH MO	0010 5	7303914 (Z274174) A217647	BLCK PEAT 0004 BRWN SAND 0015
INNISFIL TOWNSHIP	17 601085 4911856 W	2019/04 7314	5	FR 0001		OT	0006 2	7333788 (Z265166) A139489	BRWN LOAM WBRG 0000 BRWN FILL SLTY SNDY 0002 BRWN SAND FILL SILT 0005 BRWN SAND SILT WBRG 0006 BRWN SAND GRVL WBRG 0008

Peto MacCallum Ltd.
CONSULTING ENGINEERS

September 24 , 2021

PML Ref.: 21BF003
Report: 2

Mr. David Seaman
Wynstar Bear Creek LP
100 New Park Place, Suite 820
Vaughan, Ontario
L4K 0H9

Dear Mr. Seaman

Ground Water Level Monitoring
Proposed Residential Development
Ardagh Road and Summerset Drive
Barrie, Ontario

Peto MacCallum Ltd. (PML) herein provides our report for the ground water level monitoring program for the above noted project. Authorization for this assignment was provided by Mr. David Seaman, in an email dated January 12, 2021.

In accordance with the Terms of Reference the ground water levels within the six 50 mm diameter monitoring wells, installed during the geotechnical/hydrogeological investigated, were measured monthly for six months (March 2021 to August 2021) following installation.

The water level monitoring data is included in Table 2-1.

Typically, the highest ground water levels to date were measured in April 2021 ranging from 2.0 to 4.2 m below existing grade (elevation 236.2 to 237.3).

We trust this report is complete within our Terms of Reference. Please do not hesitate to call if you have any questions.

Sincerely

Peto MacCallum Ltd.

Geoffrey White, P.Eng.
Director
Manager, Geotechnical Services

FR/GW:tc

Enclosure(s):
Table 2-1 – Ground Water Level Measurements

Distribution:
1 cc: Mr. D. Seaman, Wynstar Bear Creek LP (email only)
1 cc: PML Barrie

19 Churchill Drive, Barrie.Ontario, L4N 8Z5
Tel: (705) 734-3900 Fax: (705) 734-9911
E-mail: barrie@petomaccallum.com
BARRIE, COLLINGWOOD, HAMILTON, KITCHENER, LONDON, TORONTO

TABLE 2-1

GROUND WATER LEVEL MEASUREMENTS

Borehole / Monitoring Well	Borehole Ground Surface Elevation	Depth of Water Below Surface (m) / Elevation					
		Date					
		2021-03-05	2021-04-06	2021-05-10	2021-06-09	2021-07-12	2021-08-10
BH/MW1	238.90	2.5 / 236.4	2.4 / 236.5	2.5 / 236.4	2.7 / 236.2	2.6 / 236.3	2.5 / 236.4
BH/MW4	239.55	3.1 / 236.5	3.1 / 236.5	3.1 / 236.5	3.3 / 236.3	3.1 / 236.5	4.0 / 235.6
BH/MW6	241.50	Dry	4.2 / 237.3	4.2 / 237.3	4.3 / 237.2	4.3 / 237.2	4.3 / 237.2
BH/MW10	238.50	2.3 / 236.2	2.3 / 236.2	2.3 / 236.2	2.5 / 236.0	2.2 / 236.3	2.4 / 236.1
BH/MW12	238.85	2.2 / 236.7	2.0 / 236.9	2.1 / 236.8	0.9 / 238.0	2.2 / 236.7	1.5 / 237.4
BH/MW13	240.00	3.0 / 237.0	2.7 / 237.3	2.7 / 237.3	1.3 / 238.7	2.8 / 237.2	1.9 / 238.1

August 29, 2022

StateView Homes Inc.
16-410 Chrislea Road
Woodbridge, Ontario
L4L 8B5

Attn: Nicole Sampogna, MCIP, RPP

RE: Supplemental Hydrogeological Investigation
BEA Towns
500 Ardagh Road, Barrie, Ontario
Project No. 2104593

GEI Consultants (GEI) was retained by StateView Homes Inc. (the Client), to complete a supplemental hydrogeological investigation and report for the proposed development at 500 Ardagh Road in the City of Barrie, Ontario (the Site). A site location plan is enclosed as Enclosure 1.

This supplemental letter provides the results of the in-situ infiltration testing and groundwater level monitoring to date, conducted at the site in support of Draft Site Plan Approval, and to provide site-specific infiltration parameters for the site for design purposes.

The Site is irregular in shape with a total site area of 4.5 hectares. The Site is located on the north side of Ardagh Road, to the west of Bear Creek and to the east and south of the Summerset Drive extension. The Site is currently vacant, and tree covered.

GEI Consultants (GEI) was provided with the following documents for review in preparation of this letter:

- *"Geotechnical/Hydrogeological Investigation – Proposed Residential Development Ardagh Road and Summerset Drive, Barrie, Ontario", dated March 2021, by Peto MacCallum Ltd.*
- *"Ground Water Level Monitoring – Proposed Residential Development Ardagh Road and Summerset Drive, Barrie, Ontario", dated September 2021, by Peto MacCallum Ltd.*
- *"Full Site Plan – BEA Condominium 500 Ardagh Road, Barrie, ON, L4N 3Y9", dated May 2022 by onespace unlimited inc.*

It is understood that the scope of the proposed subdivision will include residential dwellings (town houses and apartments), two (2) amenity areas, a Storm Water Management (SWM) facility, and associated internal roadways and servicing.

As part of the previous geotechnical and hydrogeological investigations a borehole drilling and monitoring well installation program, borehole permeabilities testing, groundwater level

monitoring, and groundwater quality testing was carried out. Details pertaining to the previous geotechnical and hydrogeological investigations are included in reports completed by others, however, the borehole and monitoring well locations are shown on Figure 1 within Enclosure 1. In general, the boreholes encountered sand to gravelly sand deposits with groundwater levels ranging from 0.9 to 4.3 m below existing grade (Elevation 235.6 to 238.1 m asl).

A supplemental hydrogeological investigation as requested to assess the site specifical infiltration parameters in the vicinity of the proposed SWM facilities, and to complete a pre- and post-construction water balance for the site.

1. SCOPE OF WORK

On August 8, 2022, a representative of our technical staff visited the site to observe the existing soil and groundwater conditions within four (4) test pit excavations, advanced using an excavator retained by GEI, and also to carry out Guelph Permeameter testing to determine in-situ infiltration rates within those test pits. The approximate test pit locations are shown on Figure 1 within Enclosure 1.

1.2 Test Pitting Observations

A detailed breakdown of the subsurface conditions in each test pit is provided in the table below. Photographs of each test pit are also provided in Enclosure 2.

Table 1:

		Test Pit #1	Test Pit #2	Test Pit #3	Test Pit #4
Surface Elevation		239.3 m asl	239.4 m asl	242.5 m asl	239.0 m asl
GPS Coordinates		North: 4911677 East: 600935	North: 4911798 East: 601039	North: 4911712 East: 601162	North: 4911637 East: 600877
Relative Location on the Property		Southwestern portion of the site.	Northcentral portion of the site.	Southeastern corner of the site.	Southwestern corner of the site.
Stratigraphy Encountered (below ground surface)	Sandy Topsoil	0.0 to 0.3 m	0.0 to 0.2 m	0.0 to 0.2 m	0.0 to 0.2 m
	Native: Fine Sand, Trace Silt, Trace to Some Gravel, Brown, Moist	0.3 to 3.0 m	0.3 to 3.0 m	0.3 to 3.0 m	0.3 to 3.0 m
Ground Water and Caving Conditions		Groundwater seepage was observed at 3.0 m	Groundwater seepage was observed at 3.0 m	No appreciable caving of excavation sidewalls or groundwater seepage was observed.	Groundwater seepage was observed at 3.0 m
Guelph Permeameter Test Depth		1.7 m	1.5 m	1.7 m	1.5 m

Representative soil samples were taken and analyzed for particle size distribution as per applicable Ontario Laboratory standards in reference to ASTM D6913 and D7928 to ensure proper identification of the soil. The soil samples were taken to corroborate the results of the infiltration testing and the lab results are provided in Enclosure 3.

Further, groundwater level measurements were collected utilizing the monitoring wells installed by others. Reference is made to the *"Groundwater Level Monitoring, Proposed Development, Ardagh Road and Summerset Drive, Barrie, Ontario"* by Peto MacCallum Ltd. Report 2 dated September 2021 for previous groundwater levels measured between March and August of 2021. Below is a summary of the two groundwater level measurement visits completed by GEI in 2022 as well as the interpreted seasonally high groundwater level considering all groundwater level measurements obtained to date:

Monitoring Well	Well Screen Location		Strata Screened	Groundwater Level Depth / Elev. (m)		Interpreted Seasonally High Groundwater Level Depth / Elev. (m)
	Depth (m)	Local Elev. (m)		Jun. 24, 2022	Aug. 8, 2022	
BH/MW1	5.7 to 7.2	233.2 to 231.7	Sand	2.5 / 236.4	2.6 / 236.3	2.4 / 236.5
BH/MW4	5.7 to 7.2	233.9 to 232.4	Sand	3.2 / 236.4	3.3 / 236.3	3.1 / 236.5
BH/MW6	3.0 to 4.5	238.5 to 237.0	Sand	4.3 / 237.2	4.5 / 237.0	4.2 / 237.2
BH/MW10	3.0 to 4.5	235.5 to 234.0	Sand	2.4 / 236.1	2.4 / 236.1	2.2 / 236.3
BH/MW12	3.0 to 4.5	235.9 to 234.4	Sand	2.2 / 236.6	2.3 / 236.6	0.9 / 238.0
BH/MW 13	3.0 to 4.5	237.0 to 235.5	Sand	2.8 / 237.2	3.0 / 237.0	1.3 / 238.7

Groundwater levels are expected to show seasonal fluctuations and vary in response to prevailing climate conditions.

1.3 Infiltration Testing

The infiltration testing conducted conformed to the requirements laid out in the Nottawasaga Valley Conservation Authority (NVCA) Stormwater Technical Guide, dated December 2013. The method used on site is summarized below:

- GEI conducted infiltration testing using a Guelph Permeameter to determine the saturated hydraulic conductivity in the vertical direction. An infiltration test was conducted in each test pit on site. Guelph Permeameter testing was carried out at depths of 1.5 to 1.7 m below existing grade.
- The testing did not occur during a precipitation event nor within 24 hours of a significant rainfall event, and the temperature was above freezing.

- The saturated hydraulic conductivity was converted to infiltration rate using the approximate relationships provided within Table 7.1 of the guideline and applying the appropriate factor of safety based on Table 7.

Measurement of the field-saturated hydraulic conductivity (K_{fs}) was carried out in all four (4) excavated test pits using a Guelph Permeameter apparatus (Model 2800K1) on August 8, 2022. The test locations are shown on Figure 1 within Enclosure 1. The test pit excavations were supervised by a representative of our technical staff.

In discussion with the civil engineer, final stormwater management infiltration elevations were unknown, so based on the stratigraphy and groundwater conditions encountered during the borehole drilling program the test pit excavations were carried out such that the Guelph Permeameter tests were completed in unsaturated native soils.

1.3.1 Analysis Methods

The field-saturated hydraulic conductivity of the soil was calculated using the one-head method which is calculated as follows:

$$K_{fs} = \frac{C_1 Q_1}{2H_1^2 + \pi a^2 C_1 + 2\pi \frac{H_1}{a^*}}$$

Where: C_1 = shape factor
Q = flow rate (cm^3/s)
H_1 = water column height (cm)
a = well radius (cm)
α^* = alpha factor (0.01 to 0.36 cm^{-1})

In accordance with the NVCA guidelines, the infiltration rate was determined as per the relationship with the field-saturated hydraulic conductivity provided within the document, “Ministry of Municipal Affairs and Housing (MMAH) Supplementary Guidelines SB-6, Percolation Time and Soil Descriptions, September 14, 2012”, which is summarized below.

Hydraulic Conductivity, K_{fs} (cm/s)	Percolation Time, T (min/cm)	Infiltration Rate, I (mm/hr)
0.1	2	300
0.01	4	150
0.001	8	75
0.0001	12	50
0.00001	20	30
0.000001	50	12

Infiltration rate is the inverse of percolation time. The approximate relationship (as provided in Figure C1 of the CVC guideline) in which the infiltration rate can be directly calculated from saturated hydraulic conductivity is as follows:

$$K_{fs} = 6 * 10^{-11}(I)^{3.7363}$$

A factor of safety is then applied to the calculated infiltration rate to account for soil variability, gradual accumulation of fine soil sediments during the lifespan of the facility, and compaction during construction. A higher factor of safety is applied if a soil with a lower infiltration rate is encountered within 1.5 metres of the base of the infiltration measure.

1.3.2 Results of Infiltration Testing

The results of the infiltration tests and particle size distribution analysis are included in Enclosures 4 and 2, respectively, and are summarized below.

Test Pit	Test Pit Depth (m)	Tested Soil Type	Field-Saturated Hydraulic Conductivity (cm/sec)	Unfactored Infiltration Rate (mm/hr)	Factor of Safety	Factored Infiltration Rate for Design (mm/hr)
1	3.0	Sand, Trace Silt, Trace Gravel	1.8×10^{-2}	186	2.5	74
2	3.0	Sand, Trace Silt	2.0×10^{-2}	191	2.5	76
3	3.0	Sand, Some Silt	1.9×10^{-2}	189	2.5	76
4	3.0	Sand, Trace Silt, Trace Gravel	1.4×10^{-2}	174	2.5	69

The recommended factor of safety is 2.5 as it is assumed that the sand extends an additional 1.5 m below the infiltration elevation and will have the same infiltration rate.

It is not recommended to design stormwater management measures to infiltrate into the earth fill zones due to variable soil consistency and the possibility for lower-permeability zones such as the buried topsoil layers. Infiltration cannot occur below the groundwater table. It is typical for the base of infiltration features to be kept at least 1 m above the seasonally high groundwater level.

The factored infiltration rate of the lower sand deposits across the site is 69 to 76 mm/hr, based onto eh testing above. It is recommended to use the lower factored infiltration of 69 mm/hr across the site to account for variability in soil conditions, as well as the exact details of the proposed stormwater management designs have not yet been finalized but is expected to include the entire site.

2. WATER BALANCE

2.1 Water Balance Components

A water balance is an accounting of the water resources within a given area. The water balance equates the precipitation (P) over a given area to the summation of the change in ground water storage (S), evapotranspiration/evaporation (ET), surface water runoff (R) and infiltration (I) using the following equation:

$$\mathrm{P} = S + I + ET + R$$

The components of the water balance vary in space and time and depend on climatic conditions as well as the soil and land cover conditions (i.e., rainfall intensity, land slope, soil hydraulic conductivity and vegetation). For example, runoff occurs at a higher percentage during periods of snowmelt when the ground is frozen or during intense rainfall events.

Precise measurement of the water balance components is difficult, and as such, approximations and simplifications are made to characterize the water balance of a property. Field observations of the drainage conditions, land cover and soil types, groundwater levels and local climatic records are important inputs to the water balance calculations.

- Precipitation (P): For the purposes of approximating the annual precipitation at this site, the monthly rainfall between 1981 and 2010 was used based on Environment Canada historical weather data for the Barrie WPCC weather station (Climate ID 6110557, Latitude 44.38 N, Longitude 79.7 W, Elevation 221 metres), which is located about 4.3 km northeast of the site.
- Storage (S): Although there are groundwater storage gains and losses on a short-term basis, the net change in groundwater storage on a long-term basis is assumed to be zero.
- Evapotranspiration/Evaporation (PET): The evapotranspiration and evaporation components vary based on the characteristics of the land surface cover (i.e., type of vegetation, soil moisture conditions, perviousness of surfaces, etc.). Potential evapotranspiration refers to the water loss from a vegetated surface to the atmosphere under conditions of an unlimited water supply. Evaporation occurs from a hard surface (such as flat rooftops, asphalt, gravel parking areas, etc.).
- Water Surplus (R + I): The difference between the mean precipitation and evapotranspiration is referred to as the water surplus. The water surplus is divided into two parts: as surface or overland runoff (R) and the infiltration into the surficial soil (I). The infiltration is comprised of two end member components: one component that moves vertically downward to underlying aquifers (referred to as percolation, deep infiltration or net recharge) and a second component that moves laterally through the near surface soil profile or shallow soils as interflow that re-emerges locally to surface (i.e., as runoff) at some short distance and time following precipitation.

2.2 Approach And Methodology

The analytical approach to calculate the water balance involves monthly soil-moisture balance calculations to determine the pre-development infiltration volumes. The detailed water balance calculation is provided in Enclosure 5, which is summarized in this and subsequent sections of the report. The following assumptions were used as part of the soil-moisture balance calculations:

- A soil moisture balance approach assumes that soils do not release water as potential recharge while a soil moisture deficit exists.
- During wetter periods, any excess of precipitation over evapotranspiration first goes to restore soil moisture. Considering the nature of the near surface soils (sand) and current tree cover, a soil moisture storage capacity of 250 mm was used for the pre-development. However, for post-construction permeable areas will have a reduced soil moisture storage capacity and 75 mm was utilized.
- Once the soil moisture deficit is overcome, any further excess water can then pass through the soil as infiltration and either become interflow (indirect runoff) or recharge (deep infiltration).

Monthly potential evapotranspiration calculations accounting for latitude, climate and the actual evapotranspiration and water surplus components of the water balance based on the monthly precipitation and soil moisture conditions was calculated. The *MECP SWM Planning and Design Manual* (2003) methodology for calculating total infiltration based on topography, soil type and land cover was used, and a corresponding infiltration factor was calculated for pre- and post-development conditions. The water surplus was multiplied by the infiltration factor to determine both the pre-existing and post-condition annual volumes for run-off and infiltration for the property.

The pre-development scenario was estimated based on 0% of the site comprising impermeable components. The post-development water balance scenario was estimated based on the assumption that 85% of the 4.5-hectare lands would comprise impermeable components (e.g., the internal roadways, townhouses, and apartments). The water balance must be updated following final site configuration to reflect the final site plans.

It is noted that the infiltration and runoff values presented in Enclosure 5 are estimates only. Single values are used for the water balance calculations, but it is important to understand that infiltration rates are dependent upon the hydraulic conductivity of the surficial soils which may vary over several orders of magnitude. As such, the margins of error for the calculated infiltration and runoff component values are potentially quite large. These margins of error are recognized, but for the purposes of this assessment, the numbers used in the water balance calculations are considered reasonable estimates based on the site-specific conditions and useful for comparison of pre- to post-development conditions.

2.3 Pre And Post Development Water Balance

The detailed water balance calculations are included in Enclosure 5. The pre- and post-development calculations are summarized in this section are preliminary only and must be updated once site plans are finalized.

The table below summarizes the pre- and post-construction water balance as per the proposed site development plans.

Condition	Permeable Areas	Impermeable Areas	Average Annual Runoff Volume (m^3/year)	Average Annual Infiltration Volume (m^3/year)
Pre-Development Land Use	100% (Woodland)	0% (Undeveloped)	1,521.6	13,694.0
Post-Development Land Use (Preliminary Plan)	15% (Amenity Areas, Stormwater Management Area, and Open Space)	85% (Internal Roadways, Townhouses, and Apartments)	30,853.1	2,088.8

These calculations suggest that, without additional stormwater management designs and mitigation such as LID measures, the proposed development will decrease average infiltration by about 11,605.2 m^3/year (85% decrease). The proposed development will increase runoff by about 29,331.5 m^3/year (1,928% increase). This means about 11,605.3 m^3/year of infiltration is required to maintain the water balance. The potential impacts of these changes and recommended mitigation measures are discussed below.

2.4 Recommended Mitigation Measures

The three broad categories which typically need to be mitigated and accounted for are:

- Reducing the volume and speed in which additional surface water runoff occurs;
- Increasing the amount of infiltration to match pre-development conditions; and
- Ensuring that the quality of existing surface water features and groundwater will not be adversely impacted.

2.5 Runoff Quantity

Urban development of an area affects the natural water balance. The most significant difference is the addition of impervious surfaces as a type of surface cover (e.g., roads, parking lots, driveways, rooftops). Impervious surfaces prevent infiltration of water into the underlying soils and the removal of the vegetation reduces the evapotranspiration component of the natural water balance. The evaporation component from impervious surfaces is relatively minor (estimated to be 15% of precipitation) compared to the evapotranspiration component that occurs with vegetation in this area (up to two thirds of precipitation). So, the net effect of the urbanization of the site is that most of the precipitation that falls onto impervious surfaces increases the surplus water resulting in more direct runoff from developed areas and reduced natural infiltration.

In conjunction with increased runoff, there is a reduction in infiltration to the shallow groundwater system. A reduction in infiltration can potentially lead to a lowering of the local water table and reduce the potential for this seasonal water table intersection and discharge.

Methods which do not necessarily increase infiltration rate, but decrease the volume and concentration of surface water runoff can be considered at this site include (but are not limited to):

- Increasing the topsoil thickness by about two times the normal thickness (up to 30 cm) to retain more water in storage; and
- Implementation of rainwater harvesting which intercepts, diverts and stores roof runoff (i.e., cisterns) for future use.

2.6 Mitigation Measures for Maintaining Infiltration

The increases in surface water runoff that will occur with urban development and mitigation of the potential impacts to the local water table due to reduction of infiltration may be minimized by using appropriate stormwater management and using LID measures to promote infiltration. These measures can be implemented on-site.

The basic premise for LID is to try to minimize changes to runoff and infiltration. As outlined in the *MECP SWMP Design Manual* (2003) and *Low Impact Development Stormwater Management Planning and Design Guide* published by the Credit Valley Conservation (CVC) and TRCA (2010), there are a suite of techniques that may be considered to promote infiltration and reduce runoff.

In order to maintain ground water function at the site the following typical LID measures can be considered as part of typical site developments (can depend on land use):

- Collection of runoff from the building rooftops and redirection to grass areas and overland flow. If feasible, it is recommended that there be a minimum five (5) metre flow path over pervious areas to allow this mitigation method to be fully effective;
- Provision of gentle slopes in open areas or along grass swales in order to allow time for water infiltration;
- Construction of engineered infiltration measures such as soakaway pits, infiltration galleries or bioswales. Subsurface infiltration methods can only be considered in areas where there is sufficient soil permeability and depth to water table to accommodate the systems within the unsaturated zone (typically the infiltration elevation must be kept 1 m or more above the seasonal high groundwater level).
- Construction of grass channels or filter strips which allow infiltration, discharge at a lower rate and direct roof runoff to overland flow.

Implementation of LID measures will not only allow for infiltration of the surface water into the near-surface groundwater regime but will also allow for increase in natural filtration of surficial runoff, prevent sedimentation transport and potential erosion, and help reduce flooding by increasing the transit time for water on the site. These types of LID techniques promote natural infiltration by providing additional water volumes in the pervious areas. This is particularly

effective in the summer months when natural infiltration would not generally occur because the additional water overcomes the natural soil moisture deficit.

Details and designs for LID measures will be provided in a supplemental stormwater management report for the site. This includes demonstrating through plans and sections (including all dimensions, materials used and including the seasonal high groundwater level) how this infiltration deficit will be mitigated.

As it is typically a requirement of maintaining the same levels of infiltration post construction, no appreciable change in the groundwater table elevation should occur over the long-term condition.

2.7 Groundwater Quality

Depending on land use, runoff from urban developments may contain a variety of dilute contaminants such as suspended solids, chloride from road salt, oil and grease, metals, pesticide residues, phosphorous, bacteria and viruses. For groundwater, generally except for the dissolved constituents such as nitrogen and salt, most contaminants are attenuated by filtration during groundwater flow through the soils.

LID measures or end treatments such as oil/grit separators or wet ponds also help to remove suspended solids and other contaminants in runoff prior to infiltration or conveying the flows off the site, especially when a treatment train approach is taken for stormwater management. The stormwater management facilities (to be designed by others) must be designed such that the water quality is maintained or improved prior to discharging water from the site or infiltrating water into the ground.

Runoff from residential developments (e.g., rooftops, landscaped areas) are typically considered “clean” and can be collected an infiltrated where possible. Further, infiltration-based practices would likely be permitted for impervious areas such as roads and driveways for the low-density residential development.

Since only clean or pre-treated runoff will be infiltrated, the groundwater quality will not be degraded and will not impact nearby domestic wells, the watercourse or other nearby environmental features. The surficial aquitard present across the site also limits the amount of water infiltrating deeper below grade as recharge.

3. CLOSURE

We trust this information is sufficient for your present purposes. Should you have any questions concerning the above, or can be of any further assistance, please do not hesitate to contact the undersigned.

Yours truly,
GEI Consultants



Sarah Griffith, G.I.T.
Hydrogeologist-in-Training



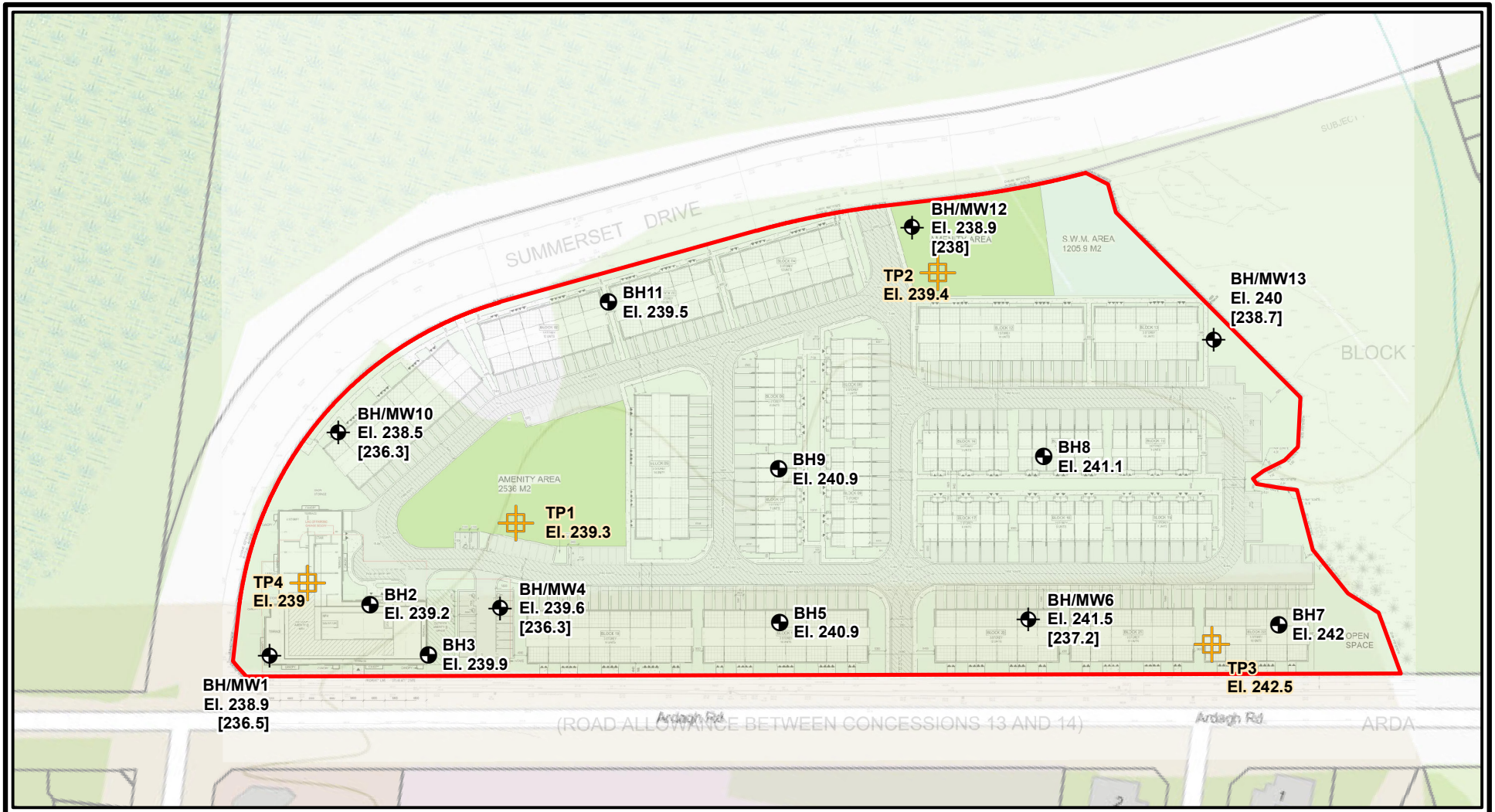
Alicia Kimberley, MSc., P.Geo.
Geoenvironmental and Hydrogeological
Practice Lead

Enclosures (5)

Site Plan
Geotechnical Laboratory Data
Test Pit Photographs
Guelph Permeameter Analysis Results
Preliminary Water Balance

ENCLOSURE 1

Site Plan



Legend

- Site Location
- Test Pit
- Approximate Borehole Location
- Approximate Borehole/Monitoring Well Location
- El. Surface Elevation (m asl)
- [xx.x] Highest Groundwater Level (m asl)

NOTES:

1. Coordinate System: NAD 1983 UTM Zone 17N.
2. Base image from Simcoe County Interactive Maps (opengis.simcoe.ca): © The Corporation of the County of Simcoe, Produced (in part) under license from:© Queens Printer, Ontario Ministry of Natural Resources and Forestry. All rights reserved.;© Her Majesty the Queen in Right of Canada, Department of Natural Resources. All rights reserved.;© Teranet Inc. and its suppliers all rights reserved.;© Municipal Property Assessment Corporation and its suppliers all rights reserved;© Members of the Ontario Geospatial Data Exchange. All rights reserved.
4. Site Plan: '22013 - BEA Condo, Barrie_2022-05-31 Site Plan',

0 10 20 m

1:1,900

N

Bear Creek Subdivision
Fill Management Plan

StateView Homes (Bea Towns) Inc.

GEI Consultants

Project 2104593

SITE PLAN

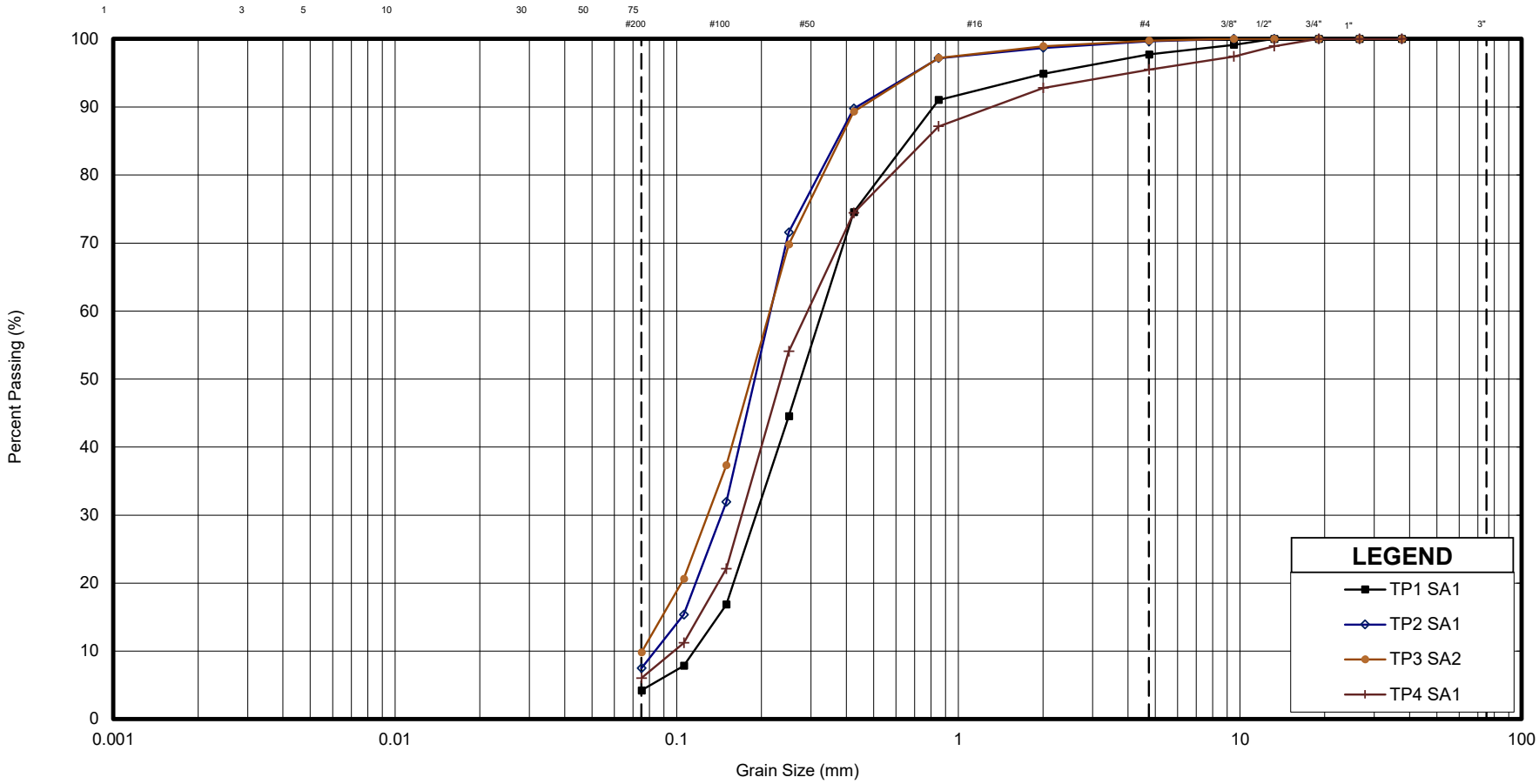
August 2022 Fig. 1

ENCLOSURE 2

Geotechnical Laboratory Data

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse



Sample	Description	Gr.	Sa.	Si.	Cl.	D_{10}	D_{30}	D_{60}	C_u	C_c
TP1 SA1	SAND, Trace Silt, Trace Gravel	2	94	4	-	0.115	0.191	0.329	2.861	0.964
TP2 SA1	SAND, Trace Silt	-	92	8	-	0.084	0.014	0.215	2.56	0.011
TP3 SA2	SAND, Some Silt	-	90	10	-	0.075	0.129	0.021	0.285	10.37
TP4 SA1	SAND, Trace Silt, Trace Gravel	5	89	6	-	0.098	0.170	0.292	2.98	1.01

GEI Consultants

GRAIN SIZE DISTRIBUTION - Bear Creek Village

FIGURE No.

REF. No. 2104593

DATE August 2022

ENCLOSURE 3

Test Pit Photographs



Photograph 1
(GEI 2022)
Description: Detailed view of Test Pit #1



Photograph 2
(GEI 2022)
Description: Detailed view of Test Pit #2



Photograph 3
(GEI 2022)
Description: Detailed view of Test Pit #3



Photograph 4
(GEI 2022)
Description: Detailed view of Test Pit #4

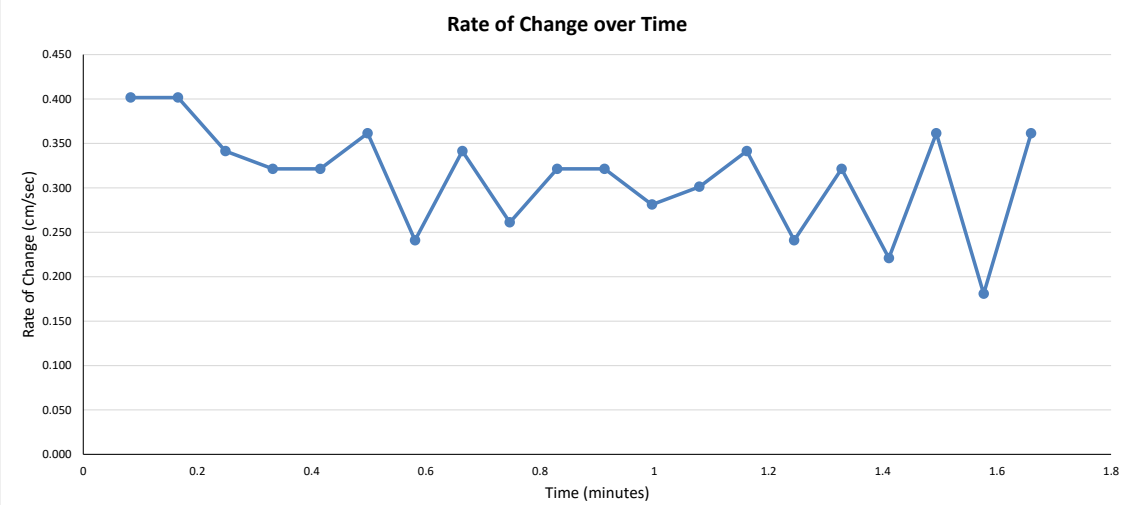
ENCLOSURE 4

Guelph Permeameter Analysis Results

Guelph Permeameter
Infiltration Rate Determination

GEI Consultants

Test Location: Test Pit 1



INPUT PARAMETERS

α* =	0.12	cm^{-1}
H =	5	cm
a =	3	cm
X =	35.22	cm^2
R =	0.281	cm/sec

SHAPE FACTOR

Shape Factor (1, 2 or 3) =	1
Shape Factor Value (cm^{-1}) =	0.803

CALCULATED PARAMETERS

H_a =	1.67	unitless
Q_1 =	9.901204819	cm^3/sec

CALCULATED DESIGN VALUES

k_{fs}=	1.80E-02	cm/sec
Φ_m=	1.50E-01	cm^2/s
Infiltration:	185.74	mm/hr
FOS:	2.50	unitless
Design Infiltration:	74.30	mm/hr

Variable Glossary

α* **1)** is the ratio of gravity to capillarity forces during infiltration or drainage
2) determined from table 1 on page 47 of the manual (or the adjacent table)

H **1)** is the water head in the BH
2) determined by the height that the inner tube is pulled up during field operation

a **1)** is the radius of the borehole
2) determine by the size of the auger

X **1)** is the resevoir constant
2) determined by the reservoir knob at the top of the unit
- if the knob is up X = 35.22 (outer and inner reservoir)
- if the knob is down X = 2.16 (inner reservoir)

R **1)** is the steady state rate of flow per minute
2) is determined by timing the drop of water in the Guelph Permeameter

Equation Glossary

Ha is the ratio of head to borehole radius

Q1 is the flow rate

$C_{(1, 2 or 3)}$ is the shape factor which accounts for the saturated area of the soil
- Select C_1 if α* is ≥ 0.12 cm^{-1}
- Select C_2 if α* = 0.04 cm^{-1}
- Select C_3 if α* = 0.01 cm^{-1}

k_{fs} is the field saturated hydraulic conductivity of the soil

Φ_m is an indicator of the capillary pull exerted by the unsaturated soil on the water

Table 1. Soil texture-structure categories for site-estimation of α* (adapted from Elrick et al., 1989)

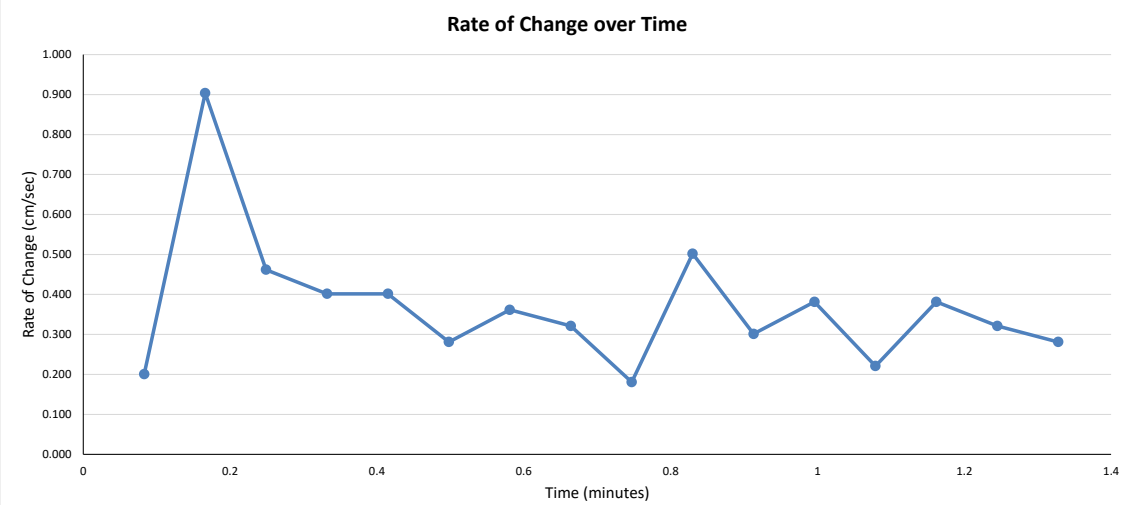
Soil Texture - Structure Category	α* (cm^{-1})
Compacted, structureless, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.	0.01
Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.	0.04
Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.	0.12
Coarse and gravelly sands; may also include some highly structured soils with large and/or numerous cracks, macropores, etc.	0.36

647 Welham Road, Unit 14
Barrie, Ontario

Guelph Permeameter
Infiltration Rate Determination

GEI Consultants

Test Location: Test Pit 2



INPUT PARAMETERS

α* =	0.12	cm^{-1}
H =	5	cm
a =	3	cm
X =	35.22	cm^2
R =	0.315	cm/sec

SHAPE FACTOR

Shape Factor (1, 2 or 3) =	1
Shape Factor Value (cm^{-1}) =	0.803

CALCULATED PARAMETERS

H_a =	1.67	unitless
Q_1 =	11.07991968	cm^3/sec

CALCULATED DESIGN VALUES

k_{fs}=	2.02E-02	cm/sec
Φ_m=	1.68E-01	cm^2/s
Infiltration:	191.42	mm/hr
FOS:	2.50	unitless
Design Infiltration:	76.57	mm/hr

Variable Glossary

α* **1)** is the ratio of gravity to capillarity forces during infiltration or drainage
2) determined from table 1 on page 47 of the manual (or the adjacent table)

H **1)** is the water head in the BH
2) determined by the height that the inner tube is pulled up during field operation

a **1)** is the radius of the borehole
2) determine by the size of the auger

X **1)** is the resevoir constant
2) determined by the reservoir knob at the top of the unit
- if the knob is up X = 35.22 (outer and inner reservoir)
- if the knob is down X = 2.16 (inner reservoir)

R **1)** is the steady state rate of flow per minute
2) is determined by timing the drop of water in the Guelph Permeameter

Equation Glossary

Ha is the ratio of head to borehole radius

Q1 is the flow rate

$C_{(1, 2 or 3)}$ is the shape factor which accounts for the saturated area of the soil
- Select C_1 if α* is ≥ 0.12 cm^{-1}
- Select C_2 if α* = 0.04 cm^{-1}
- Select C_3 if α* = 0.01 cm^{-1}

k_{fs} is the field saturated hydraulic conductivity of the soil

Φ_m is an indicator of the capillary pull exerted by the unsaturated soil on the water

Table 1. Soil texture-structure categories for site-estimation of α* (adapted from Elrick et al., 1989)

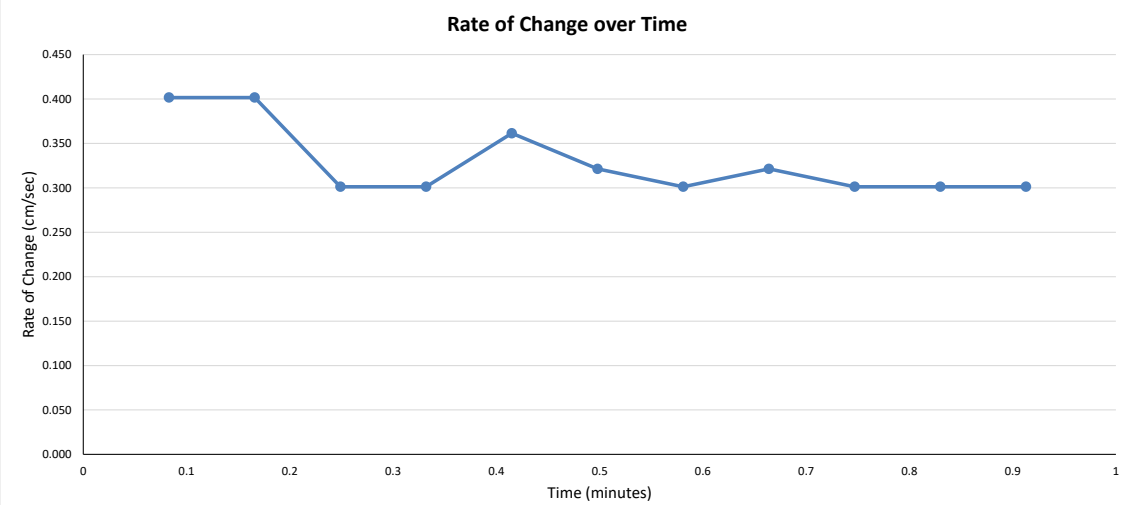
Soil Texture - Structure Category	α* (cm^{-1})
Compacted, structureless, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.	0.01
Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.	0.04
Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.	0.12
Coarse and gravelly sands; may also include some highly structured soils with large and/or numerous cracks, macropores, etc.	0.36

647 Welham Road, Unit 14
Barrie, Ontario

Guelph Permeameter
Infiltration Rate Determination

GEI Consultants

Test Location: Test Pit 3



INPUT PARAMETERS

α* =	0.12	cm^{-1}
H =	5	cm
a =	3	cm
X =	35.22	cm^2
R =	0.301	cm/sec

SHAPE FACTOR

Shape Factor (1, 2 or 3) =	1
Shape Factor Value (cm^{-1}) =	0.803

CALCULATED PARAMETERS

H_a =	1.67	unitless
Q_1 =	10.60122	cm^3/sec

CALCULATED DESIGN VALUES

k_{fs}=	1.93E-02	cm/sec
Φ_m=	1.61E-01	cm^2/s
Infiltration:	189.17	mm/hr
FOS:	2.50	unitless
Design Infiltration:	75.67	mm/hr

Variable Glossary

α* **1)** is the ratio of gravity to capillarity forces during infiltration or drainage
2) determined from table 1 on page 47 of the manual (or the adjacent table)

H **1)** is the water head in the BH
2) determined by the height that the inner tube is pulled up during field operation

a **1)** is the radius of the borehole
2) determine by the size of the auger

X **1)** is the resevoir constant
2) determined by the reservoir knob at the top of the unit
- if the knob is up X = 35.22 (outer and inner reservoir)
- if the knob is down X = 2.16 (inner reservoir)

R **1)** is the steady state rate of flow per minute
2) is determined by timing the drop of water in the Guelph Permeameter

Equation Glossary

Ha is the ratio of head to borehole radius

Q1 is the flow rate

$C_{(1, 2 or 3)}$ is the shape factor which accounts for the saturated area of the soil
- Select C_1 if α* is ≥ 0.12 cm^{-1}
- Select C_2 if α* = 0.04 cm^{-1}
- Select C_3 if α* = 0.01 cm^{-1}

k_{fs} is the field saturated hydraulic conductivity of the soil

Φ_m is an indicator of the capillary pull exerted by the unsaturated soil on the water

Table 1. Soil texture-structure categories for site-estimation of α* (adapted from Elrick et al., 1989)

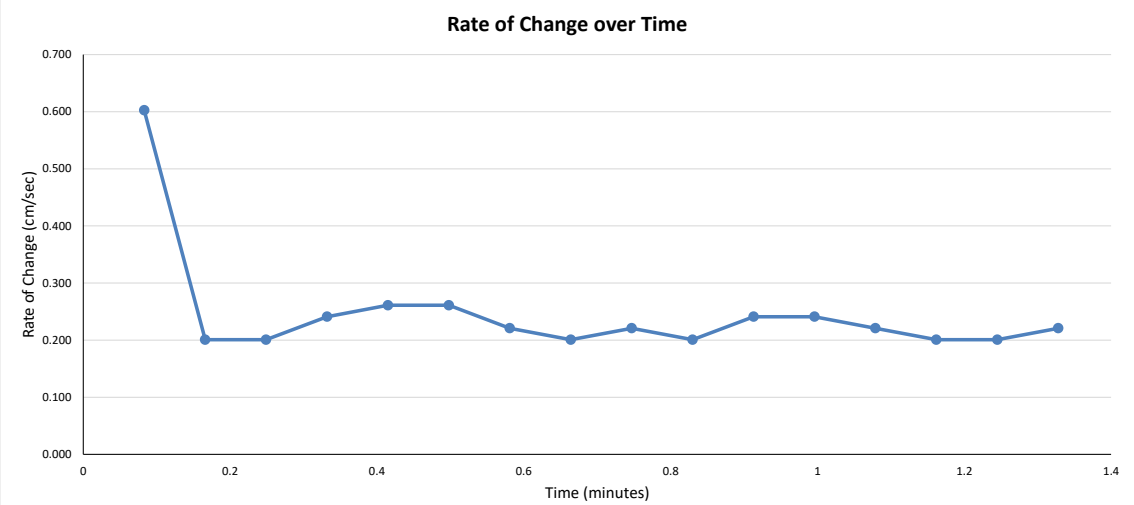
Soil Texture - Structure Category	α* (cm^{-1})
Compacted, structureless, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.	0.01
Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.	0.04
Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.	0.12
Coarse and gravelly sands; may also include some highly structured soils with large and/or numerous cracks, macropores, etc.	0.36

647 Welham Road, Unit 14
Barrie, Ontario

Guelph Permeameter
Infiltration Rate Determination

GEI Consultants

Test Location: Test Pit 4



INPUT PARAMETERS

α* =	0.12	cm^{-1}
H =	5	cm
a =	3	cm
X =	35.22	cm^2
R =	0.22	cm/sec

SHAPE FACTOR

Shape Factor (1, 2 or 3) =	1
Shape Factor Value (cm^{-1}) =	0.803

CALCULATED PARAMETERS

H_a =	1.67	unitless
Q_1 =	7.7484	cm^3/sec

CALCULATED DESIGN VALUES

k_{fs}=	1.41E-02	cm/sec
Φ_m=	1.17E-01	cm^2/s
Infiltration:	173.94	mm/hr
FOS:	2.50	unitless
Design Infiltration:	69.58	mm/hr

Variable Glossary

α* **1)** is the ratio of gravity to capillarity forces during infiltration or drainage
2) determined from table 1 on page 47 of the manual (or the adjacent table)

H **1)** is the water head in the BH
2) determined by the height that the inner tube is pulled up during field operation

a **1)** is the radius of the borehole
2) determine by the size of the auger

X **1)** is the resevoir constant
2) determined by the reservoir knob at the top of the unit
- if the knob is up X = 35.22 (outer and inner reservoir)
- if the knob is down X = 2.16 (inner reservoir)

R **1)** is the steady state rate of flow per minute
2) is determined by timing the drop of water in the Guelph Permeameter

Equation Glossary

Ha is the ratio of head to borehole radius

Q1 is the flow rate

$C_{(1, 2 or 3)}$ is the shape factor which accounts for the saturated area of the soil
- Select C_1 if α* is ≥ 0.12 cm^{-1}
- Select C_2 if α* = 0.04 cm^{-1}
- Select C_3 if α* = 0.01 cm^{-1}

k_{fs} is the field saturated hydraulic conductivity of the soil

Φ_m is an indicator of the capillary pull exerted by the unsaturated soil on the water

Table 1. Soil texture-structure categories for site-estimation of α* (adapted from Elrick et al., 1989)

Soil Texture - Structure Category	α* (cm^{-1})
Compacted, structureless, clayey or silty materials such as landfill caps and liners, lacustrine or marine sediments, etc.	0.01
Soils which are both fine textured (clayey or silty) and unstructured; may also include some fine sands.	0.04
Most structured soils from clays through loams; also includes unstructured medium and fine sands. The category most frequently applicable for agricultural soils.	0.12
Coarse and gravelly sands; may also include some highly structured soils with large and/or numerous cracks, macropores, etc.	0.36

647 Welham Road, Unit 14
Barrie, Ontario

ENCLOSURE 5

Pre- and Post-Development Water Balance

Water Balance - Bear Creek Subdivision (Pre-Development)

MONTHLY AND YEARLY WATER BALANCE COMPONENTS														
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
Potential Evapotranspiration Calculation	Average Temperature: T (^{o}C)	-7.7	-6.6	-2.1	5.6	12.3	17.9	20.8	19.7	15.3	8.7	2.7	-3.5	6.9
	Heat Index: $i=(T/5)^{1.514}$	0.00	0.00	0.00	1.19	3.91	6.90	8.66	7.97	5.44	2.31	0.39	0.00	36.8
	Unadjusted Daily Potential Evapotranspiration: U (mm)	0.0	0.0	0.0	25.2	59.0	88.5	104.1	98.1	74.7	40.6	11.5	0.0	501.7
	Adjusting Factor for U (Latitude 44^{o})	0.81	0.81	1.02	1.13	1.27	1.28	1.30	1.20	1.04	0.94	0.80	0.76	-
	Adjusted Potential Evapotranspiration - PET (mm)	0.0	0.0	0.0	28.5	74.9	113.3	135.3	117.8	77.7	38.1	9.2	0.0	594.8
Pervious Components	Precipitation: P (mm)	82.5	61.8	58.1	62.2	82.4	84.8	77.2	89.9	94	77.5	88.9	73.6	932.9
	Adjusted Potential Evapotranspiration: PET (mm)	0.0	0.0	0.0	28.5	74.9	113.3	135.3	117.8	77.7	38.1	9.2	0.0	594.8
	P - PET	82.5	61.8	58.1	33.7	7.5	-28.5	-58.1	-27.9	16.3	39.4	79.7	73.6	338.1
	Change in Soil Moisture Storage (mm)	0.0	0.0	0.0	0.0	0.0	-28.5	-58.1	-27.9	16.3	39.4	0.0	0.0	-
	Water Holding Capacity (max. 250 mm)	250.0	250.0	250.0	250.0	250.0	221.5	163.4	135.5	151.9	191.2	250.0	250.0	-
	Water Surplus Available for Infiltration or Runoff	82.5	61.8	58.1	33.7	7.5	0.0	0.0	0.0	0.0	0.0	20.9	73.6	338.1
	Potential Infiltration based on MECP Infiltration Factor (mm)	74.3	55.6	52.3	30.3	6.7	0.0	0.0	0.0	0.0	0.0	18.9	66.2	304.3
	Potential Surface Water Runoff (mm)	8.3	6.2	5.8	3.4	0.7	0.0	0.0	0.0	0.0	0.0	2.1	7.4	33.8
Impervious Components	Precipitation: P (mm)	-												932.9
	Potential Evaporation: PE (mm), Assume 15%	-												139.9
	Potential Surface Water Runoff: P - PE (mm)	-												793.0

PRE- AND POST-DEVELOPMENT WATER BALANCE (NO LOW IMPACT DEVELOPMENT MEASURES IN PLACE)							
		Total Land Area (m^2)	Est. Fraction of Land	Est. Land Area (m^2)	Runoff (m^3/annum)	Infiltration (m^3/annum)	**Runoff Increase Pre to Post**
Existing Land Use (Pre-Development)	Pervious Area	45000.0	100%	45000.0	1521.6	13694.0	See Page 2
	Impervious Area (school, parking, track, sidewalks)		0%	0.0	0.0	0.0	**Infiltration Decrease Pre to Post**
	TOTAL	-	100%	45000.0	1521.6	13694.0	See Page 2
Proposed Land Use (Post-Development)	Pervious Area	45000.0	See Page 2				**Infiltration Required to Meet Pre-Development Conditions (m^3)**
	Impervious Area (school, parking, track, sidewalks, proposed portables and fire route)						
	TOTAL	-					See Page 2

Notes

1. Both potential infiltration and surface water runoff are independent of temperature
2. Assumption is in January maximum soil moisture storage value is present (75mm)
3. Water Holding Capacity & Infiltration Factors taken from Table 3.1 of MOE SWMPDM, 2003
4. Average Temp. and Precip. taken from Environment Canada station "Bardford Muck Research" between 1981 and 2010
5. Adjusting Factor for U based on Lorente, 1961

Infiltration Criteria	Site Description	Infiltration Factor
Topography	Flat Land - Average Slope Less Than 0.6 m/km	0.3
Soils	Open Sandy Loam	0.4
Cover	Woodland	0.2
	Sum of Infiltration Factors	**0.9**

Water Balance - Bear Creek Subdivision (Post Development)

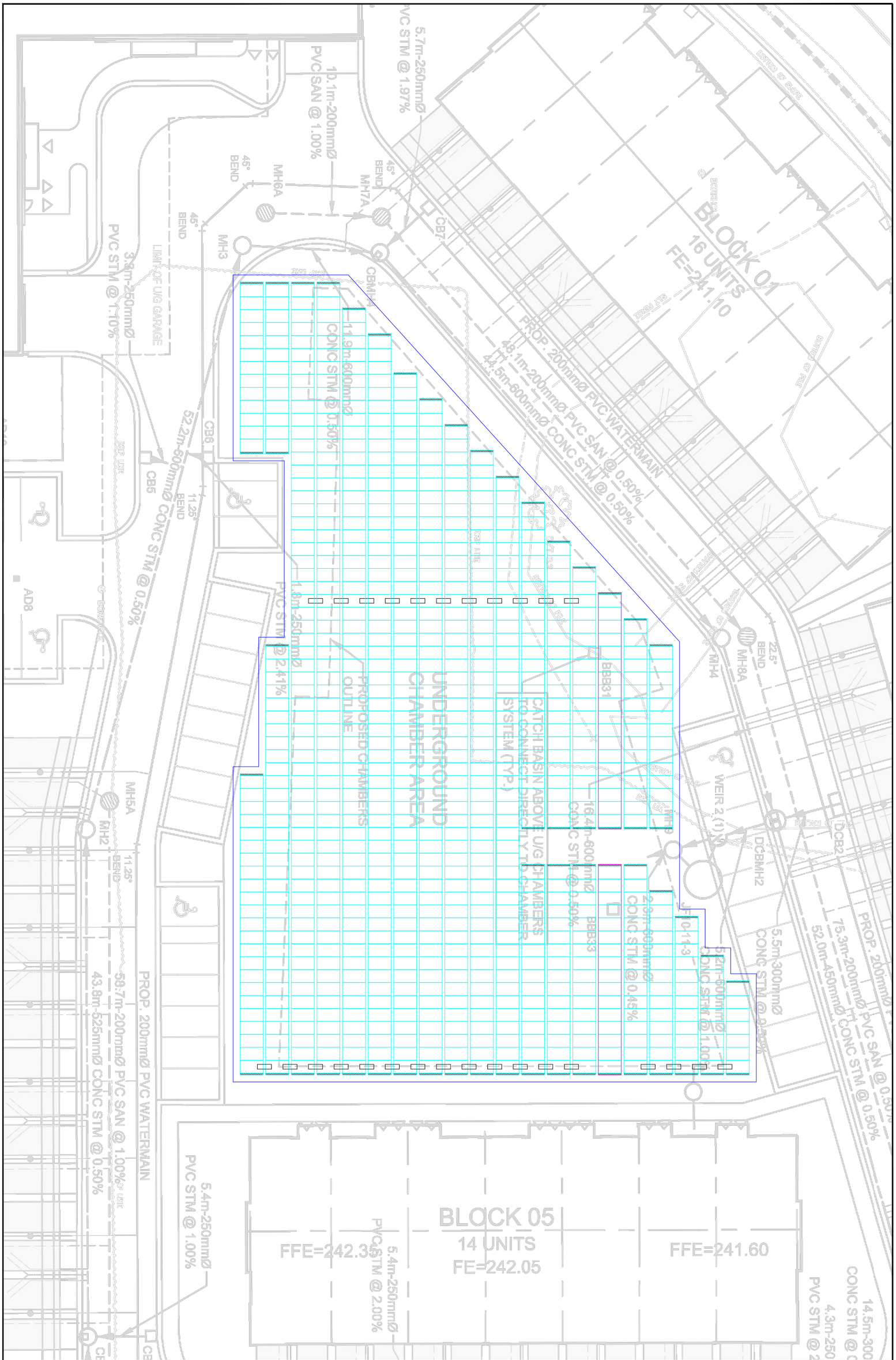
MONTHLY AND YEARLY WATER BALANCE COMPONENTS														
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
Potential Evapotranspiration Calculation	Average Temperature: T (^{o}C)	-7.7	-6.6	-2.1	5.6	12.3	17.9	20.8	19.7	15.3	8.7	2.7	-3.5	6.9
	Heat Index: $i=(T/5)^{1.514}$	0.00	0.00	0.00	1.19	3.91	6.90	8.66	7.97	5.44	2.31	0.39	0.00	36.8
	Unadjusted Daily Potential Evapotranspiration: U (mm)	0.0	0.0	0.0	25.2	59.0	88.5	104.1	98.1	74.7	40.6	11.5	0.0	501.7
	Adjusting Factor for U (Latitude 44^{o})	0.81	0.81	1.02	1.13	1.27	1.28	1.30	1.20	1.04	0.94	0.80	0.76	-
	Adjusted Potential Evapotranspiration - PET (mm)	0.0	0.0	0.0	28.5	74.9	113.3	135.3	117.8	77.7	38.1	9.2	0.0	594.8
Pervious Components	Precipitation: P (mm)	82.5	61.8	58.1	62.2	82.4	84.8	77.2	89.9	94	77.5	88.9	73.6	932.9
	Adjusted Potential Evapotranspiration: PET (mm)	0.0	0.0	0.0	28.5	74.9	113.3	135.3	117.8	77.7	38.1	9.2	0.0	594.8
	P - PET	82.5	61.8	58.1	33.7	7.5	-28.5	-58.1	-27.9	16.3	39.4	79.7	73.6	338.1
	Change in Soil Moisture Storage (mm)	0.0	0.0	0.0	0.0	0.0	-28.5	-58.1	-27.9	16.3	39.4	0.0	0.0	-
	Water Holding Capacity (max. 75 mm)	75.0	75.0	75.0	75.0	75.0	46.5	0.0	0.0	16.3	55.7	75.0	75.0	-
	Water Surplus Available for Infiltration or Runoff	82.5	61.8	58.1	33.7	7.5	0.0	0.0	0.0	0.0	0.0	60.4	73.6	377.6
	Potential Infiltration based on MECP Infiltration Factor (mm)	66.0	49.4	46.5	27.0	6.0	0.0	0.0	0.0	0.0	0.0	48.3	58.9	302.1
	Potential Surface Water Runoff (mm)	16.5	12.4	11.6	6.7	1.5	0.0	0.0	0.0	0.0	0.0	12.1	14.7	75.5
Impervious Components	Precipitation: P (mm)	-												932.9
	Potential Evaporation: PE (mm), Assume 15%	-												139.9
	Potential Surface Water Runoff: P - PE (mm)	-												793.0

PRE- AND POST-DEVELOPMENT WATER BALANCE (NO LOW IMPACT DEVELOPMENT MEASURES IN PLACE)							
		Total Land Area (m^2)	Est. Fraction of Land	Est. Land Area (m^2)	Runoff (m^3/annum)	Infiltration (m^3/annum)	**Runoff Increase Pre to Post**
Existing Land Use (Pre-Development)	Pervious Area	45000.0	See Page 1				1928%
	Impervious Area						**Infiltration Decrease Pre to Post**
	TOTAL	-					-85%
Proposed Land Use (Post-Development)	Pervious Area	45000.0	15%	6914.9	522.2	2088.8	**Infiltration Required to Meet Pre-Development Conditions (m^3)**
	Impervious Area (school, parking, track, sidewalks, proposed portables and fire route)		85%	38250.0	30330.9	0.0	
	TOTAL	-	100%	45164.9	30853.1	2088.8	11605.3

Notes

1. Both potential infiltration and surface water runoff are independent of temperature
2. Assumption is in January maximum soil moisture storage value is present (75mm)
3. Water Holding Capacity & Infiltration Factors taken from Table 3.1 of MOE SWMPDM, 2003
4. Average Temp. and Precip. taken from Environment Canada station "Bardford Muck Research" between 1981 and 2010
5. Adjusting Factor for U based on Lorente, 1961

Infiltration Criteria	Site Description	Infiltration Factor
Topography	Flat Land - Average Slope Less Than 0.6 m/km	0.3
Soils	Open Sandy Loam	0.4
Cover	Cultivated Land	0.1
	Sum of Infiltration Factors	**0.8**



CULTEC, Inc.
Subsurface Stormwater Management Systems
P.O. Box 280
878 Federal Road
Brookfield, CT 06804
www.cultec.com
PH: (203) 775-4416
PH: (800) 4-CULTEC
FX: (203) 775-1462
tech@cultec.com

THIS DRAWING HAS BEEN PREPARED TO SUPPORT THE PROJECT ENGINEER OF RECORD FOR THE PROPOSED SYSTEM. THIS DRAWING HAS BEEN PREPARED BASED ON INFORMATION PROVIDED TO CULTEC UNDER THE DIRECTION OF THE PROJECT ENGINEER OF RECORD OR OTHER PROJECT REPRESENTATIVE. IT IS ULTIMATE RESPONSIBILITY OF THE PROJECT ENGINEER OF RECORD TO ENSURE THAT THE CULTEC SYSTEM'S DESIGN IS IN FULL COMPLIANCE WITH ALL APPLICABLE LAWS, REGULATIONS AND MANUFACTURER REQUIREMENTS.

1.02

BEA TOWNS RESIDENTIAL DEVELOPMENT

SUMMERSET DRIVE

BARRIE, ON

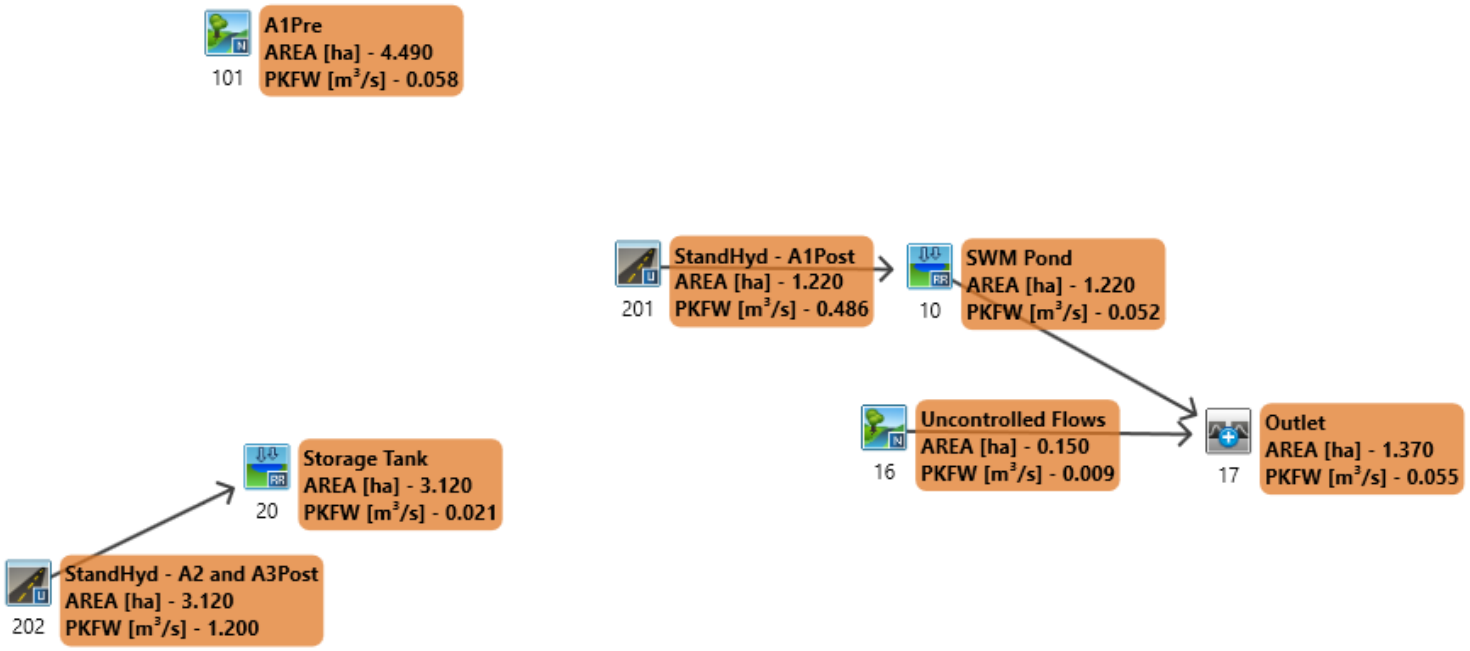
SYSTEM OVERLAY SHEET

CULTEC STORMWATER CHAMBER

PROJECT NO:	22-1450.00	**DATE:**	9/27/22
DESIGNED BY:	TNB	**CHECKED BY:**	TNB
SCALE:	N.T.S.	**SHEET NO:**	4 OF -

Project No.: 2104593
Stateview Homes (Bea Towns) Inc.
Bea Towns
2, 5, 10, 25, 50 & 100-Year 4 Hour Chicago Storm
Proposed Condition Model Output
September 2022

VO6 Model Schematic



GEI Consultants

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

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2003)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M M M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2020 Smart City Water Inc
All rights reserved.

                    *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
  Output  filename: C:\Users\wtrinh\AppData\Local\Civica\VH5\a922815c-9855-455d-abla-
2baf3f2ff9e0\84ac7ca5-e935-4e3a-a849-8c1a83209376\scena
  Summary filename: C:\Users\wtrinh\AppData\Local\Civica\VH5\a922815c-9855-455d-abla-
2baf3f2ff9e0\84ac7ca5-e935-4e3a-a849-8c1a83209376\scena


DATE: 09/23/2022                          TIME: 11:43:23

USER:


COMMENTS: _____________________________________________________

--------------------------------------------------------------------------------------------------------------
------
  ************************************************
  ** SIMULATION : 2 year Chicago                **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 678.085
| Ptotal= 36.96 mm |                          B=   4.699
--------------------                          C=   0.781
                       used in:   INTENSITY =  A / (t + B)^C

                       Duration of storm  =  4.00 hrs
                       Storm time step    = 10.00 min
                       Time to peak ratio =  0.33

                  TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                  0.17    2.47 |  1.17   18.78 |   2.17    5.73 |  3.17    2.92
                  0.33    2.82 |  1.33   83.11 |   2.33    4.89 |  3.33    2.72
                  0.50    3.31 |  1.50   24.57 |   2.50    4.28 |  3.50    2.55
                  0.67    4.05 |  1.67   13.01 |   2.67    3.82 |  3.67    2.39
                  0.83    5.30 |  1.83    9.01 |   2.83    3.46 |  3.83    2.26
                  1.00    7.98 |  2.00    6.97 |   3.00    3.17 |  4.00    2.15


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0101)|   Area     (ha)=   4.49   Curve Number    (CN)= 32.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.62

        NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                          ---- TRANSFORMED HYETOGRAPH ----
                  TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                  0.083   2.47 | 1.083   18.78 | 2.083   5.73 |  3.08    2.92
                  0.167   2.47 | 1.167   18.78 | 2.167   5.73 |  3.17    2.92
                  0.250   2.82 | 1.250   83.11 | 2.250   4.89 |  3.25    2.72
                  0.333   2.82 | 1.333   83.11 | 2.333   4.89 |  3.33    2.72
                  0.417   3.31 | 1.417   24.57 | 2.417   4.28 |  3.42    2.55
                  0.500   3.31 | 1.500   24.57 | 2.500   4.28 |  3.50    2.55
                  0.583   4.05 | 1.583   13.01 | 2.583   3.82 |  3.58    2.39
                  0.667   4.05 | 1.667   13.01 | 2.667   3.82 |  3.67    2.39
                  0.750   5.30 | 1.750    9.01 | 2.750   3.46 |  3.75    2.26
                  0.833   5.30 | 1.833    9.01 | 2.833   3.46 |  3.83    2.26
                  0.917   7.98 | 1.917    6.97 | 2.917   3.17 |  3.92    2.15
                  1.000   7.98 | 2.000    6.97 | 3.000   3.17 |  4.00    2.15

     Unit Hyd Qpeak  (cms)=   0.277

     PEAK FLOW       (cms)=   0.007 (i)
     TIME TO PEAK    (hrs)=   2.250
     RUNOFF VOLUME    (mm)=   1.282
     TOTAL RAINFALL   (mm)=  36.955
     RUNOFF COEFFICIENT   =   0.035

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0202)|   Area     (ha)=   3.12
|ID= 1 DT= 5.0 min |   Total Imp(%)=  75.00   Dir. Conn.(%)=  75.00
--------------------

                                IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       2.34          0.78
     Dep. Storage     (mm)=       2.00          5.00
     Average Slope     (%)=       1.00          2.00
     Length            (m)=     144.22         40.00
     Mannings n           =      0.013         0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                          ---- TRANSFORMED HYETOGRAPH ----
                  TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                  0.083   2.47 | 1.083   18.78 | 2.083   5.73 |  3.08    2.92
                  0.167   2.47 | 1.167   18.78 | 2.167   5.73 |  3.17    2.92
                  0.250   2.82 | 1.250   83.11 | 2.250   4.89 |  3.25    2.72
                  0.333   2.82 | 1.333   83.11 | 2.333   4.89 |  3.33    2.72
                  0.417   3.31 | 1.417   24.57 | 2.417   4.28 |  3.42    2.55
                  0.500   3.31 | 1.500   24.57 | 2.500   4.28 |  3.50    2.55
                  0.583   4.05 | 1.583   13.01 | 2.583   3.82 |  3.58    2.39
                  0.667   4.05 | 1.667   13.01 | 2.667   3.82 |  3.67    2.39
                  0.750   5.30 | 1.750    9.01 | 2.750   3.46 |  3.75    2.26
                  0.833   5.30 | 1.833    9.01 | 2.833   3.46 |  3.83    2.26
                  0.917   7.98 | 1.917    6.97 | 2.917   3.17 |  3.92    2.15
                  1.000   7.98 | 2.000    6.97 | 3.000   3.17 |  4.00    2.15

     Max.Eff.Inten.(mm/hr)=      83.11          5.55
               over (min)        5.00         10.00
     Storage Coeff.  (min)=      3.43 (ii)     8.32 (ii)
     Unit Hyd. Tpeak (min)=      5.00         10.00
     Unit Hyd. peak  (cms)=      0.26          0.13
                                                        *TOTALS*
     PEAK FLOW       (cms)=      0.52          0.01        0.523 (iii)
     TIME TO PEAK    (hrs)=      1.33          1.42         1.33
     RUNOFF VOLUME    (mm)=     34.96          3.45        27.08
     TOTAL RAINFALL   (mm)=     36.96         36.96        36.96
     RUNOFF COEFFICIENT   =      0.95          0.09         0.73

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  49.0    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.

--------------------------------------------------------------------------------
```

GEI Consultants

```
--------------------
| RESERVOIR(  0020)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE    |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)    |   (cms)     (ha.m.)
                         0.0000     0.0000     |  1.2100     0.2910
                         0.0310     0.2900     |  0.0000     0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0202)      3.120     0.523      1.33      27.08
   OUTFLOW: ID= 1 (  0020)      3.120     0.008      4.08      26.31

                PEAK   FLOW   REDUCTION [Qout/Qin](%)=  1.57
                TIME SHIFT OF PEAK FLOW          (min)=165.00
                MAXIMUM  STORAGE   USED        (ha.m.)=  0.0770
```

```
--------------------
| CALIB            |
| NASHYD   (  0016)|   Area     (ha)=   0.15   Curve Number    (CN)= 49.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.16
```

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.47	1.083	18.78	2.083	5.73	3.08	2.92
0.167	2.47	1.167	18.78	2.167	5.73	3.17	2.92
0.250	2.82	1.250	83.11	2.250	4.89	3.25	2.72
0.333	2.82	1.333	83.11	2.333	4.89	3.33	2.72
0.417	3.31	1.417	24.57	2.417	4.28	3.42	2.55
0.500	3.31	1.500	24.57	2.500	4.28	3.50	2.55
0.583	4.05	1.583	13.01	2.583	3.82	3.58	2.39
0.667	4.05	1.667	13.01	2.667	3.82	3.67	2.39
0.750	5.30	1.750	9.01	2.750	3.46	3.75	2.26
0.833	5.30	1.833	9.01	2.833	3.46	3.83	2.26
0.917	7.98	1.917	6.97	2.917	3.17	3.92	2.15
1.000	7.98	2.000	6.97	3.000	3.17	4.00	2.15

```
Unit Hyd Qpeak  (cms)=   0.036

PEAK FLOW       (cms)=   0.002 (i)
TIME TO PEAK    (hrs)=   1.500
RUNOFF VOLUME    (mm)=   3.428
TOTAL RAINFALL   (mm)=  36.955
RUNOFF COEFFICIENT   =   0.093
```

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area     (ha)=   1.22
|ID= 1 DT= 5.0 min |   Total Imp(%)=  77.00   Dir. Conn.(%)=  77.00
--------------------

                         IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.94          0.28
     Dep. Storage     (mm)=       2.00          5.00
     Average Slope     (%)=       1.00          2.00
     Length            (m)=      90.18         40.00
     Mannings n           =      0.013         0.250
```

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.47	1.083	18.78	2.083	5.73	3.08	2.92
0.167	2.47	1.167	18.78	2.167	5.73	3.17	2.92
0.250	2.82	1.250	83.11	2.250	4.89	3.25	2.72
0.333	2.82	1.333	83.11	2.333	4.89	3.33	2.72
0.417	3.31	1.417	24.57	2.417	4.28	3.42	2.55
0.500	3.31	1.500	24.57	2.500	4.28	3.50	2.55
0.583	4.05	1.583	13.01	2.583	3.82	3.58	2.39
0.667	4.05	1.667	13.01	2.667	3.82	3.67	2.39
0.750	5.30	1.750	9.01	2.750	3.46	3.75	2.26
0.833	5.30	1.833	9.01	2.833	3.46	3.83	2.26
0.917	7.98	1.917	6.97	2.917	3.17	3.92	2.15
1.000	7.98	2.000	6.97	3.000	3.17	4.00	2.15

```
Max.Eff.Inten.(mm/hr)=      83.11          5.55
          over (min)        5.00         10.00
Storage Coeff.  (min)=      2.59 (ii)     7.27 (ii)
Unit Hyd. Tpeak (min)=      5.00         10.00
Unit Hyd. peak  (cms)=      0.29          0.14
                                                  *TOTALS*
PEAK FLOW       (cms)=      0.21          0.00      0.216 (iii)
TIME TO PEAK    (hrs)=      1.33          1.42       1.33
RUNOFF VOLUME    (mm)=     34.96          3.45      27.70
TOTAL RAINFALL   (mm)=     36.96         36.96      36.96
RUNOFF COEFFICIENT   =      0.95          0.09       0.75
```

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 49.0 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.

```
--------------------
| RESERVOIR(  0010)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE    |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)    |   (cms)     (ha.m.)
                         0.0000     0.0000     |  0.0200     0.0600
                         0.0190     0.0225     |  0.7500     0.0660

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0201)      1.220     0.216      1.33      27.70
   OUTFLOW: ID= 1 (  0010)      1.220     0.019      2.00      27.46

                PEAK   FLOW   REDUCTION [Qout/Qin](%)=  8.61
                TIME SHIFT OF PEAK FLOW          (min)= 40.00
                MAXIMUM  STORAGE   USED        (ha.m.)=  0.0220
```

```
--------------------
| ADD HYD  (  0017)|
|   1 +  2 =  3    |          AREA     QPEAK     TPEAK      R.V.
--------------------          (ha)     (cms)     (hrs)      (mm)
       ID1= 1 (  0010):      1.22     0.019      2.00     27.46
     + ID2= 2 (  0016):      0.15     0.002      1.50      3.43
       ================================================
       ID = 3 (  0017):      1.37     0.019      1.83     24.83
```

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

```
      V    V   I    SSSSS  U   U    A    L              (v 6.2.2003)
      V    V   I    SS     U   U   A A   L
       V  V    I     SS    U   U  AAAAA  L
       V  V    I      SS   U   U  A   A  L
        VV     I    SSSSS  UUUUU  A   A  LLLLL

       OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
      O   O    T      T    H   H   Y Y   MM MM  O   O
      O   O    T      T    H   H    Y    M M M  O   O
       OOO     T      T    H   H    Y    M   M   OOO
```

Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2020 Smart City Water Inc
All rights reserved.

GEI Consultants

***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
Output filename: C:\Users\wtrinh\AppData\Local\Civica\VH5\a922815c-9855-455d-ab1a-2baf3f2ff9e0\d616c4b6-45b0-4dde-9799-5baf1d056ecc\scena
Summary filename: C:\Users\wtrinh\AppData\Local\Civica\VH5\a922815c-9855-455d-ab1a-2baf3f2ff9e0\d616c4b6-45b0-4dde-9799-5baf1d056ecc\scena

DATE: 09/23/2022 TIME: 11:43:23

USER:

COMMENTS: _____

****
** SIMULATION : 5 year Chicago **
****

| CHICAGO STORM | Ptotal= 50.52 mm |

IDF curve parameters: A= 853.608
B= 4.699
C= 0.766
used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.17	3.57	1.17	25.64	2.17	8.12	3.17	4.22
0.33	4.07	1.33	108.92	2.33	6.96	3.33	3.93
0.50	4.76	1.50	33.31	2.50	6.12	3.50	3.68
0.67	5.79	1.67	17.99	2.67	5.48	3.67	3.47
0.83	7.53	1.83	12.60	2.83	4.97	3.83	3.28
1.00	11.20	2.00	9.82	3.00	4.56	4.00	3.12

CALIB NASHYD (0101) ID= 1 DT= 5.0 min	Area (ha)= 4.49 Curve Number (CN)= 32.0 Ia (mm)= 10.00 # of Linear Res.(N)= 3.00 U.H. Tp(hrs)= 0.62

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	3.57	1.083	25.64	2.083	8.12	3.08	4.22
0.167	3.57	1.167	25.64	2.167	8.12	3.17	4.22
0.250	4.07	1.250	108.92	2.250	6.96	3.25	3.93
0.333	4.07	1.333	108.92	2.333	6.96	3.33	3.93
0.417	4.76	1.417	33.31	2.417	6.12	3.42	3.68
0.500	4.76	1.500	33.31	2.500	6.12	3.50	3.68
0.583	5.79	1.583	17.99	2.583	5.48	3.58	3.47
0.667	5.79	1.667	17.99	2.667	5.48	3.67	3.47
0.750	7.53	1.750	12.60	2.750	4.97	3.75	3.28
0.833	7.53	1.833	12.60	2.833	4.97	3.83	3.28
0.917	11.20	1.917	9.82	2.917	4.56	3.92	3.12
1.000	11.20	2.000	9.82	3.000	4.56	4.00	3.12

Unit Hyd Qpeak (cms)= 0.277

PEAK FLOW (cms)= 0.016 (i)
TIME TO PEAK (hrs)= 2.250
RUNOFF VOLUME (mm)= 2.829
TOTAL RAINFALL (mm)= 50.521
RUNOFF COEFFICIENT = 0.056

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB STANDHYD (0202) ID= 1 DT= 5.0 min	Area (ha)= 3.12 Total Imp(%)= 75.00 Dir. Conn.(%)= 75.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	2.34	0.78
Dep. Storage	(mm)=	2.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	144.22	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	3.57	1.083	25.64	2.083	8.12	3.08	4.22
0.167	3.57	1.167	25.64	2.167	8.12	3.17	4.22
0.250	4.07	1.250	108.92	2.250	6.96	3.25	3.93
0.333	4.07	1.333	108.92	2.333	6.96	3.33	3.93
0.417	4.76	1.417	33.31	2.417	6.12	3.42	3.68
0.500	4.76	1.500	33.31	2.500	6.12	3.50	3.68
0.583	5.79	1.583	17.99	2.583	5.48	3.58	3.47
0.667	5.79	1.667	17.99	2.667	5.48	3.67	3.47
0.750	7.53	1.750	12.60	2.750	4.97	3.75	3.28
0.833	7.53	1.833	12.60	2.833	4.97	3.83	3.28
0.917	11.20	1.917	9.82	2.917	4.56	3.92	3.12
1.000	11.20	2.000	9.82	3.000	4.56	4.00	3.12

				TOTALS
Max.Eff.Inten.(mm/hr)=		108.92	10.93	
over (min)		5.00	10.00	
Storage Coeff. (min)=		3.08 (ii)	7.47 (ii)	
Unit Hyd. Tpeak (min)=		5.00	10.00	
Unit Hyd. peak (cms)=		0.27	0.13	
PEAK FLOW	(cms)=	0.69	0.02	0.700 (iii)
TIME TO PEAK	(hrs)=	1.33	1.42	1.33
RUNOFF VOLUME	(mm)=	48.52	6.69	38.06
TOTAL RAINFALL	(mm)=	50.52	50.52	50.52
RUNOFF COEFFICIENT	=	0.96	0.13	0.75

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 49.0 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.

RESERVOIR(0020) IN= 2---> OUT= 1 DT= 5.0 min	OVERFLOW IS OFF

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	1.2100	0.2910
0.0310	0.2900	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0202)	3.120	0.700	1.33	38.06
OUTFLOW: ID= 1 (0020)	3.120	0.012	4.08	37.30

PEAK FLOW REDUCTION [Qout/Qin](%)= 1.65
TIME SHIFT OF PEAK FLOW (min)=165.00
MAXIMUM STORAGE USED (ha.m.)= 0.1082

GEI Consultants

```
--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  0016)  |   Area     (ha)=   0.15   Curve Number    (CN)= 49.0
|ID= 1 DT= 5.0 min   |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.16

        NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.

                          ---- TRANSFORMED HYETOGRAPH ----
    TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
     hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
   0.083    3.57 | 1.083   25.64 | 2.083    8.12 |  3.08    4.22
   0.167    3.57 | 1.167   25.64 | 2.167    8.12 |  3.17    4.22
   0.250    4.07 | 1.250  108.92 | 2.250    6.96 |  3.25    3.93
   0.333    4.07 | 1.333  108.92 | 2.333    6.96 |  3.33    3.93
   0.417    4.76 | 1.417   33.31 | 2.417    6.12 |  3.42    3.68
   0.500    4.76 | 1.500   33.31 | 2.500    6.12 |  3.50    3.68
   0.583    5.79 | 1.583   17.99 | 2.583    5.48 |  3.58    3.47
   0.667    5.79 | 1.667   17.99 | 2.667    5.48 |  3.67    3.47
   0.750    7.53 | 1.750   12.60 | 2.750    4.97 |  3.75    3.28
   0.833    7.53 | 1.833   12.60 | 2.833    4.97 |  3.83    3.28
   0.917   11.20 | 1.917    9.82 | 2.917    4.56 |  3.92    3.12
   1.000   11.20 | 2.000    9.82 | 3.000    4.56 |  4.00    3.12

    Unit Hyd Qpeak  (cms)=   0.036

    PEAK FLOW       (cms)=   0.003 (i)
    TIME TO PEAK    (hrs)=   1.500
    RUNOFF VOLUME    (mm)=   6.655
    TOTAL RAINFALL   (mm)=  50.521
    RUNOFF COEFFICIENT   =   0.132

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  0201)  |   Area     (ha)=   1.22
|ID= 1 DT= 5.0 min   |   Total Imp(%)=  77.00   Dir. Conn.(%)=  77.00
--------------------

                        IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=      0.94          0.28
    Dep. Storage     (mm)=      2.00          5.00
    Average Slope     (%)=      1.00          2.00
    Length            (m)=     90.18         40.00
    Mannings n           =     0.013         0.250

        NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.

                          ---- TRANSFORMED HYETOGRAPH ----
    TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
     hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
   0.083    3.57 | 1.083   25.64 | 2.083    8.12 |  3.08    4.22
   0.167    3.57 | 1.167   25.64 | 2.167    8.12 |  3.17    4.22
   0.250    4.07 | 1.250  108.92 | 2.250    6.96 |  3.25    3.93
   0.333    4.07 | 1.333  108.92 | 2.333    6.96 |  3.33    3.93
   0.417    4.76 | 1.417   33.31 | 2.417    6.12 |  3.42    3.68
   0.500    4.76 | 1.500   33.31 | 2.500    6.12 |  3.50    3.68
   0.583    5.79 | 1.583   17.99 | 2.583    5.48 |  3.58    3.47
   0.667    5.79 | 1.667   17.99 | 2.667    5.48 |  3.67    3.47
   0.750    7.53 | 1.750   12.60 | 2.750    4.97 |  3.75    3.28
   0.833    7.53 | 1.833   12.60 | 2.833    4.97 |  3.83    3.28
   0.917   11.20 | 1.917    9.82 | 2.917    4.56 |  3.92    3.12
   1.000   11.20 | 2.000    9.82 | 3.000    4.56 |  4.00    3.12

    Max.Eff.Inten.(mm/hr)=    108.92        10.93
                over (min)        5.00        10.00
    Storage Coeff.  (min)=      2.32 (ii)    6.53 (ii)
    Unit Hyd. Tpeak (min)=      5.00        10.00
    Unit Hyd. peak  (cms)=      0.30         0.14
                                                    *TOTALS*
    PEAK FLOW       (cms)=      0.28         0.01         0.286 (iii)
    TIME TO PEAK    (hrs)=      1.33         1.42          1.33
    RUNOFF VOLUME    (mm)=     48.52         6.69         38.90
    TOTAL RAINFALL   (mm)=     50.52        50.52         50.52
    RUNOFF COEFFICIENT   =      0.96         0.13          0.77

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  49.0    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.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0010)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE    |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)    |   (cms)     (ha.m.)
                          0.0000     0.0000    |  0.0200      0.0600
                          0.0190     0.0225    |  0.7500      0.0660

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0201)       1.220     0.286      1.33      38.90
   OUTFLOW: ID= 1 (  0010)       1.220     0.019      2.33      38.65

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  6.72
                  TIME SHIFT OF PEAK FLOW          (min)= 60.00
                  MAXIMUM  STORAGE   USED        (ha.m.)=  0.0319

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0017)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK      R.V.
--------------------          (ha)     (cms)    (hrs)      (mm)
        ID1= 1 (  0010):     1.22     0.019     2.33     38.65
      + ID2= 2 (  0016):     0.15     0.003     1.50      6.65
        ================================================
        ID = 3 (  0017):     1.37     0.022     1.50     35.15

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

 FINISH
================================================================================================================
======

================================================================================================================
======

      V    V   I    SSSSS  U   U    A    L              (v 6.2.2003)
      V    V   I    SS     U   U   A A   L
       V  V    I     SS    U   U  AAAAA  L
       V  V    I      SS   U   U  A   A  L
        VV     I    SSSSS  UUUUU  A   A  LLLLL

       OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
      O   O    T      T    H   H   Y Y   MM MM  O   O
      O   O    T      T    H   H    Y    M   M  O   O
       OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2020 Smart City Water Inc
All rights reserved.


                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
  Output  filename: C:\Users\wtrinh\AppData\Local\Civica\VH5\a922815c-9855-455d-ab1a-
2baf3f2ff9e0\79ace5ef-f3b6-4919-b56c-fafbd64a38f1\scena
  Summary filename: C:\Users\wtrinh\AppData\Local\Civica\VH5\a922815c-9855-455d-ab1a-
2baf3f2ff9e0\79ace5ef-f3b6-4919-b56c-fafbd64a38f1\scena
```

GEI Consultants

DATE: 09/23/2022 TIME: 11:43:23

USER:

COMMENTS: _____

****
** SIMULATION : 10 year Chicago **
****

| CHICAGO STORM | Ptotal= 59.69 mm |

IDF curve parameters: A= 975.865
B= 4.699
C= 0.760
used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.17	4.32	1.17	30.27	2.17	9.72	3.17	5.09
0.33	4.91	1.33	126.55	2.33	8.35	3.33	4.74
0.50	5.73	1.50	39.22	2.50	7.35	3.50	4.45
0.67	6.96	1.67	21.35	2.67	6.59	3.67	4.19
0.83	9.03	1.83	15.01	2.83	5.99	3.83	3.97
1.00	13.36	2.00	11.74	3.00	5.50	4.00	3.77

CALIB NASHYD (0101) ID= 1 DT= 5.0 min	Area (ha)= 4.49 Curve Number (CN)= 32.0 Ia (mm)= 10.00 # of Linear Res.(N)= 3.00 U.H. Tp(hrs)= 0.62

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	4.32	1.083	30.27	2.083	9.72	3.08	5.09
0.167	4.32	1.167	30.27	2.167	9.72	3.17	5.09
0.250	4.91	1.250	126.55	2.250	8.35	3.25	4.74
0.333	4.91	1.333	126.55	2.333	8.35	3.33	4.74
0.417	5.73	1.417	39.22	2.417	7.35	3.42	4.45
0.500	5.73	1.500	39.22	2.500	7.35	3.50	4.45
0.583	6.96	1.583	21.35	2.583	6.59	3.58	4.19
0.667	6.96	1.667	21.35	2.667	6.59	3.67	4.19
0.750	9.03	1.750	15.01	2.750	5.99	3.75	3.97
0.833	9.03	1.833	15.01	2.833	5.99	3.83	3.97
0.917	13.36	1.917	11.74	2.917	5.50	3.92	3.77
1.000	13.36	2.000	11.74	3.000	5.50	4.00	3.77

Unit Hyd Qpeak (cms)= 0.277

PEAK FLOW (cms)= 0.024 (i)
TIME TO PEAK (hrs)= 2.167
RUNOFF VOLUME (mm)= 4.189
TOTAL RAINFALL (mm)= 59.695
RUNOFF COEFFICIENT = 0.070

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB STANDHYD (0202)	Area (ha)= 3.12

ID= 1 DT= 5.0 min	Total Imp(%)= 75.00 Dir. Conn.(%)= 75.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	2.34	0.78
Dep. Storage	(mm)=	2.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	144.22	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	4.32	1.083	30.27	2.083	9.72	3.08	5.09
0.167	4.32	1.167	30.27	2.167	9.72	3.17	5.09
0.250	4.91	1.250	126.55	2.250	8.35	3.25	4.74
0.333	4.91	1.333	126.55	2.333	8.35	3.33	4.74
0.417	5.73	1.417	39.22	2.417	7.35	3.42	4.45
0.500	5.73	1.500	39.22	2.500	7.35	3.50	4.45
0.583	6.96	1.583	21.35	2.583	6.59	3.58	4.19
0.667	6.96	1.667	21.35	2.667	6.59	3.67	4.19
0.750	9.03	1.750	15.01	2.750	5.99	3.75	3.97
0.833	9.03	1.833	15.01	2.833	5.99	3.83	3.97
0.917	13.36	1.917	11.74	2.917	5.50	3.92	3.77
1.000	13.36	2.000	11.74	3.000	5.50	4.00	3.77

Max.Eff.Inten.	(mm/hr)=	126.55	15.45	
over	(min)	5.00	10.00	
Storage Coeff.	(min)=	2.90 (ii)	7.04 (ii)	
Unit Hyd. Tpeak	(min)=	5.00	10.00	
Unit Hyd. peak	(cms)=	0.28	0.14	
				TOTALS
PEAK FLOW	(cms)=	0.80	0.03	0.822 (iii)
TIME TO PEAK	(hrs)=	1.33	1.42	1.33
RUNOFF VOLUME	(mm)=	57.69	9.38	45.61
TOTAL RAINFALL	(mm)=	59.69	59.69	59.69
RUNOFF COEFFICIENT	=	0.97	0.16	0.76

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 49.0 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.

RESERVOIR(0020) IN= 2---> OUT= 1 DT= 5.0 min	OVERFLOW IS OFF

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	1.2100	0.2910
0.0310	0.2900	0.0000	0.0000

		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0202)		3.120	0.822	1.33	45.61
OUTFLOW: ID= 1 (0020)		3.120	0.014	4.08	44.85

PEAK FLOW REDUCTION [Qout/Qin](%)= 1.69
TIME SHIFT OF PEAK FLOW (min)=165.00
MAXIMUM STORAGE USED (ha.m.)= 0.1297

CALIB NASHYD (0016) ID= 1 DT= 5.0 min	Area (ha)= 0.15 Curve Number (CN)= 49.0 Ia (mm)= 5.00 # of Linear Res.(N)= 3.00 U.H. Tp(hrs)= 0.16

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

GEI Consultants

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	4.32	1.083	30.27	2.083	9.72	3.08	5.09
0.167	4.32	1.167	30.27	2.167	9.72	3.17	5.09
0.250	4.91	1.250	126.55	2.250	8.35	3.25	4.74
0.333	4.91	1.333	126.55	2.333	8.35	3.33	4.74
0.417	5.73	1.417	39.22	2.417	7.35	3.42	4.45
0.500	5.73	1.500	39.22	2.500	7.35	3.50	4.45
0.583	6.96	1.583	21.35	2.583	6.59	3.58	4.19
0.667	6.96	1.667	21.35	2.667	6.59	3.67	4.19
0.750	9.03	1.750	15.01	2.750	5.99	3.75	3.97
0.833	9.03	1.833	15.01	2.833	5.99	3.83	3.97
0.917	13.36	1.917	11.74	2.917	5.50	3.92	3.77
1.000	13.36	2.000	11.74	3.000	5.50	4.00	3.77

Unit Hyd Qpeak (cms)= 0.036

PEAK FLOW (cms)= 0.004 (i)
TIME TO PEAK (hrs)= 1.500
RUNOFF VOLUME (mm)= 9.331
TOTAL RAINFALL (mm)= 59.695
RUNOFF COEFFICIENT = 0.156

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB STANDHYD (0201) ID= 1 DT= 5.0 min	Area (ha)= 1.22 Total Imp(%)= 77.00 Dir. Conn.(%)= 77.00

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.94	0.28
Dep. Storage (mm)=	2.00	5.00
Average Slope (%)=	1.00	2.00
Length (m)=	90.18	40.00
Mannings n =	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	4.32	1.083	30.27	2.083	9.72	3.08	5.09
0.167	4.32	1.167	30.27	2.167	9.72	3.17	5.09
0.250	4.91	1.250	126.55	2.250	8.35	3.25	4.74
0.333	4.91	1.333	126.55	2.333	8.35	3.33	4.74
0.417	5.73	1.417	39.22	2.417	7.35	3.42	4.45
0.500	5.73	1.500	39.22	2.500	7.35	3.50	4.45
0.583	6.96	1.583	21.35	2.583	6.59	3.58	4.19
0.667	6.96	1.667	21.35	2.667	6.59	3.67	4.19
0.750	9.03	1.750	15.01	2.750	5.99	3.75	3.97
0.833	9.03	1.833	15.01	2.833	5.99	3.83	3.97
0.917	13.36	1.917	11.74	2.917	5.50	3.92	3.77
1.000	13.36	2.000	11.74	3.000	5.50	4.00	3.77

Max.Eff.Inten.(mm/hr)=	126.55	15.45		
over (min)	5.00	10.00		
Storage Coeff. (min)=	2.19 (ii)	6.15 (ii)		
Unit Hyd. Tpeak (min)=	5.00	10.00		
Unit Hyd. peak (cms)=	0.31	0.15		
			TOTALS	
PEAK FLOW (cms)=	0.33	0.01	0.335 (iii)	
TIME TO PEAK (hrs)=	1.33	1.42	1.33	
RUNOFF VOLUME (mm)=	57.69	9.38	46.58	
TOTAL RAINFALL (mm)=	59.69	59.69	59.69	
RUNOFF COEFFICIENT =	0.97	0.16	0.78	

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 49.0 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.

RESERVOIR(0010) IN= 2---> OUT= 1 DT= 5.0 min	OVERFLOW IS OFF			
	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	0.0200	0.0600
	0.0190	0.0225	0.7500	0.0660

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0201)	1.220	0.335	1.33	46.58
OUTFLOW: ID= 1 (0010)	1.220	0.019	2.58	46.34

PEAK FLOW REDUCTION [Qout/Qin](%)= 5.81
TIME SHIFT OF PEAK FLOW (min)= 75.00
MAXIMUM STORAGE USED (ha.m.)= 0.0394

ADD HYD (0017) 1 + 2 = 3	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0010):	1.22	0.019	2.58	46.34
+ ID2= 2 (0016):	0.15	0.004	1.50	9.33
ID = 3 (0017):	1.37	0.023	1.50	42.29

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

V V I SSSSS U U A L (v 6.2.2003)
V V I SS U U A A L
V V I SS U U AAAAA L
V V I SS U U A A L
VV I SSSSS UUUUU A A LLLLL

OOO TTTTT TTTTT H H Y Y M M OOO TM
O O T T H H Y Y MM MM O O
O O T T H H Y M M O O
OOO T T H H Y M M OOO

Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2020 Smart City Water Inc
All rights reserved.

***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
Output filename: C:\Users\wtrinh\AppData\Local\Civica\VH5\a922815c-9855-455d-ab1a-2baf3f2ff9e0\4772e9e0-007b-40e1-967b-d9315cc9e183\scena
Summary filename: C:\Users\wtrinh\AppData\Local\Civica\VH5\a922815c-9855-455d-ab1a-2baf3f2ff9e0\4772e9e0-007b-40e1-967b-d9315cc9e183\scena

DATE: 09/23/2022 TIME: 11:43:23

USER:

COMMENTS: _____

****
** SIMULATION : 25 year Chicago **
****

GEI Consultants

```
--------------------
| CHICAGO STORM    |
| Ptotal= 71.24 mm |
--------------------
```

IDF curve parameters: A=1146.275
B= 4.922
C= 0.757
used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.17	5.22	1.17	36.37	2.17	11.74	3.17	6.15
0.33	5.94	1.33	148.15	2.33	10.09	3.33	5.74
0.50	6.93	1.50	47.06	2.50	8.89	3.50	5.38
0.67	8.42	1.67	25.72	2.67	7.96	3.67	5.08
0.83	10.91	1.83	18.11	2.83	7.24	3.83	4.80
1.00	16.13	2.00	14.17	3.00	6.65	4.00	4.57

```
--------------------
| CALIB            |
| NASHYD  (  0101) |   Area     (ha)=   4.49   Curve Number   (CN)= 32.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.62
```

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	5.22	1.083	36.37	2.083	11.74	3.08	6.15
0.167	5.22	1.167	36.37	2.167	11.74	3.17	6.15
0.250	5.94	1.250	148.15	2.250	10.09	3.25	5.74
0.333	5.94	1.333	148.15	2.333	10.09	3.33	5.74
0.417	6.93	1.417	47.06	2.417	8.89	3.42	5.38
0.500	6.93	1.500	47.06	2.500	8.89	3.50	5.38
0.583	8.42	1.583	25.72	2.583	7.96	3.58	5.08
0.667	8.42	1.667	25.72	2.667	7.96	3.67	5.08
0.750	10.91	1.750	18.11	2.750	7.24	3.75	4.80
0.833	10.91	1.833	18.11	2.833	7.24	3.83	4.80
0.917	16.13	1.917	14.17	2.917	6.65	3.92	4.57
1.000	16.13	2.000	14.17	3.000	6.65	4.00	4.57

Unit Hyd Qpeak (cms)= 0.277

PEAK FLOW (cms)= 0.036 (i)
TIME TO PEAK (hrs)= 2.167
RUNOFF VOLUME (mm)= 6.239
TOTAL RAINFALL (mm)= 71.236
RUNOFF COEFFICIENT = 0.088

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

```
--------------------
| CALIB            |
| STANDHYD (  0202)|   Area     (ha)=   3.12
|ID= 1 DT= 5.0 min |   Total Imp(%)=  75.00   Dir. Conn.(%)=  75.00
--------------------
```

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	2.34	0.78
Dep. Storage	(mm)=	2.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	144.22	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	5.22	1.083	36.37	2.083	11.74	3.08	6.15
0.167	5.22	1.167	36.37	2.167	11.74	3.17	6.15
0.250	5.94	1.250	148.15	2.250	10.09	3.25	5.74
0.333	5.94	1.333	148.15	2.333	10.09	3.33	5.74
0.417	6.93	1.417	47.06	2.417	8.89	3.42	5.38
0.500	6.93	1.500	47.06	2.500	8.89	3.50	5.38
0.583	8.42	1.583	25.72	2.583	7.96	3.58	5.08
0.667	8.42	1.667	25.72	2.667	7.96	3.67	5.08
0.750	10.91	1.750	18.11	2.750	7.24	3.75	4.80
0.833	10.91	1.833	18.11	2.833	7.24	3.83	4.80
0.917	16.13	1.917	14.17	2.917	6.65	3.92	4.57
1.000	16.13	2.000	14.17	3.000	6.65	4.00	4.57

Max.Eff.Inten.	(mm/hr)=	148.15	21.95		
	over (min)	5.00	10.00		
Storage Coeff.	(min)=	2.72 (ii)	6.61 (ii)		
Unit Hyd. Tpeak	(min)=	5.00	10.00		
Unit Hyd. peak	(cms)=	0.29	0.14		
				TOTALS	
PEAK FLOW	(cms)=	0.94	0.04	0.973 (iii)	
TIME TO PEAK	(hrs)=	1.33	1.42	1.33	
RUNOFF VOLUME	(mm)=	69.24	13.27	55.24	
TOTAL RAINFALL	(mm)=	71.24	71.24	71.24	
RUNOFF COEFFICIENT	=	0.97	0.19	0.78	

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 49.0 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.

```
--------------------
| RESERVOIR(  0020)|
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |
--------------------
```

OVERFLOW IS OFF

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	1.2100	0.2910
0.0310	0.2900	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0202)	3.120	0.973	1.33	55.24
OUTFLOW: ID= 1 (0020)	3.120	0.017	4.08	54.48

PEAK FLOW REDUCTION [Qout/Qin](%)= 1.72
TIME SHIFT OF PEAK FLOW (min)=165.00
MAXIMUM STORAGE USED (ha.m.)= 0.1571

```
--------------------
| CALIB            |
| NASHYD  (  0016) |   Area     (ha)=   0.15   Curve Number   (CN)= 49.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.16
```

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	5.22	1.083	36.37	2.083	11.74	3.08	6.15
0.167	5.22	1.167	36.37	2.167	11.74	3.17	6.15
0.250	5.94	1.250	148.15	2.250	10.09	3.25	5.74
0.333	5.94	1.333	148.15	2.333	10.09	3.33	5.74
0.417	6.93	1.417	47.06	2.417	8.89	3.42	5.38
0.500	6.93	1.500	47.06	2.500	8.89	3.50	5.38
0.583	8.42	1.583	25.72	2.583	7.96	3.58	5.08
0.667	8.42	1.667	25.72	2.667	7.96	3.67	5.08
0.750	10.91	1.750	18.11	2.750	7.24	3.75	4.80
0.833	10.91	1.833	18.11	2.833	7.24	3.83	4.80
0.917	16.13	1.917	14.17	2.917	6.65	3.92	4.57
1.000	16.13	2.000	14.17	3.000	6.65	4.00	4.57

GEI Consultants

Unit Hyd Qpeak (cms)= 0.036

PEAK FLOW (cms)= 0.006 (i)
TIME TO PEAK (hrs)= 1.500
RUNOFF VOLUME (mm)= 13.209
TOTAL RAINFALL (mm)= 71.236
RUNOFF COEFFICIENT = 0.185

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| CALIB | STANDHYD (0201) | ID= 1 DT= 5.0 min |

Area (ha)= 1.22
Total Imp(%)= 77.00 Dir. Conn.(%)= 77.00

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	0.94	0.28
Dep. Storage (mm)=	2.00	

5.00==========

V V I SSSSS U U A L (v 6.2.2003)
V V I SS U U A A L
V V I SS U U AAAAA L
V V I SS U U A A L
VV I SSSSS UUUUU A A LLLLL

OOO TTTTT TTTTT H H Y Y M M OOO TM
O O T T H H Y Y MM MM O O
O O T T H H Y M M O O
OOO T T H H Y M M OOO

Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2020 Smart City Water Inc
All rights reserved.

***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
Output filename: C:\Users\wtrinh\AppData\Local\Civica\VH5\a922815c-9855-455d-abla-2baf3f2ff9e0\ad442228-38ef-434c-b435-4a9290f19484\scena
Summary filename: C:\Users\wtrinh\AppData\Local\Civica\VH5\a922815c-9855-455d-abla-2baf3f2ff9e0\ad442228-38ef-434c-b435-4a9290f19484\scena

DATE: 09/23/2022 TIME: 11:43:23

USER:

COMMENTS: _____

** SIMULATION : 50 year Chicago **

| CHICAGO STORM | Ptotal= 79.45 mm |

IDF curve parameters: A=1236.152
B= 4.699
C= 0.751
used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.17	5.93	1.17	40.22	2.17	13.20	3.17	6.98
0.33	6.74	1.33	164.22	2.33	11.37	3.33	6.51
0.50	7.85	1.50	51.92	2.50	10.03	3.50	6.11
0.67	9.50	1.67	28.58	2.67	9.00	3.67	5.77
0.83	12.27	1.83	20.23	2.83	8.19	3.83	5.46
1.00	18.04	2.00	15.88	3.00	7.53	4.00	5.19

| CALIB | NASHYD (0101) | ID= 1 DT= 5.0 min |

Area (ha)= 4.49 Curve Number (CN)= 32.0
Ia (mm)= 10.00 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= 0.62

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	5.93	1.083	40.22	2.083	13.20	3.08	6.98
0.167	5.93	1.167	40.22	2.167	13.20	3.17	6.98
0.250	6.74	1.250	164.22	2.250	11.37	3.25	6.51
0.333	6.74	1.333	164.22	2.333	11.37	3.33	6.51
0.417	7.85	1.417	51.92	2.417	10.03	3.42	6.11
0.500	7.85	1.500	51.92	2.500	10.03	3.50	6.11
0.583	9.50	1.583	28.58	2.583	9.00	3.58	5.77
0.667	9.50	1.667	28.58	2.667	9.00	3.67	5.77
0.750	12.27	1.750	20.23	2.750	8.19	3.75	5.46
0.833	12.27	1.833	20.23	2.833	8.19	3.83	5.46
0.917	18.04	1.917	15.88	2.917	7.53	3.92	5.19
1.000	18.04	2.000	15.88	3.000	7.53	4.00	5.19

Unit Hyd Qpeak (cms)= 0.277

PEAK FLOW (cms)= 0.046 (i)
TIME TO PEAK (hrs)= 2.167
RUNOFF VOLUME (mm)= 7.918
TOTAL RAINFALL (mm)= 79.453
RUNOFF COEFFICIENT = 0.100

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

| CALIB | STANDHYD (0202) | ID= 1 DT= 5.0 min |

Area (ha)= 3.12
Total Imp(%)= 75.00 Dir. Conn.(%)= 75.00

	IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=	2.34	0.78
Dep. Storage (mm)=	2.00	5.00
Average Slope (%)=	1.00	2.00
Length (m)=	144.22	40.00
Mannings n =	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	5.93	1.083	40.22	2.083	13.20	3.08	6.98
0.167	5.93	1.167	40.22	2.167	13.20	3.17	6.98
0.250	6.74	1.250	164.22	2.250	11.37	3.25	6.51
0.333	6.74	1.333	164.22	2.333	11.37	3.33	6.51
0.417	7.85	1.417	51.92	2.417	10.03	3.42	6.11
0.500	7.85	1.500	51.92	2.500	10.03	3.50	6.11
0.583	9.50	1.583	28.58	2.583	9.00	3.58	5.77
0.667	9.50	1.667	28.58	2.667	9.00	3.67	5.77
0.750	12.27	1.750	20.23	2.750	8.19	3.75	5.46
0.833	12.27	1.833	20.23	2.833	8.19	3.83	5.46
0.917	18.04	1.917	15.88	2.917	7.53	3.92	5.19
1.000	18.04	2.000	15.88	3.000	7.53	4.00	5.19

Max.Eff.Inten.(mm/hr)= 164.22 27.26
over (min) 5.00 10.00

Storage Coeff.	(min)=	2.61 (ii)	6.34 (ii)	
Unit Hyd. Tpeak	(min)=	5.00	10.00	
Unit Hyd. peak	(cms)=	0.29	0.15	
				TOTALS
PEAK FLOW	(cms)=	1.05	0.05	1.087 (iii)
TIME TO PEAK	(hrs)=	1.33	1.42	1.33
RUNOFF VOLUME	(mm)=	77.45	16.36	62.18
TOTAL RAINFALL	(mm)=	79.45	79.45	79.45
RUNOFF COEFFICIENT	=	0.97	0.21	0.78

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 49.0 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.

RESERVOIR(0020)	OVERFLOW IS OFF
IN= 2---> OUT= 1	
DT= 5.0 min	

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	1.2100	0.2910
0.0310	0.2900	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0202)	3.120	1.087	1.33	62.18
OUTFLOW: ID= 1 (0020)	3.120	0.019	4.08	61.42

PEAK FLOW REDUCTION [Qout/Qin](%)= 1.74
TIME SHIFT OF PEAK FLOW (min)=165.00
MAXIMUM STORAGE USED (ha.m.)= 0.1768

CALIB	
NASHYD (0016)	Area (ha)= 0.15 Curve Number (CN)= 49.0
ID= 1 DT= 5.0 min	Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
	U.H. Tp(hrs)= 0.16

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	5.93	1.083	40.22	2.083	13.20	3.08	6.98
0.167	5.93	1.167	40.22	2.167	13.20	3.17	6.98
0.250	6.74	1.250	164.22	2.250	11.37	3.25	6.51
0.333	6.74	1.333	164.22	2.333	11.37	3.33	6.51
0.417	7.85	1.417	51.92	2.417	10.03	3.42	6.11
0.500	7.85	1.500	51.92	2.500	10.03	3.50	6.11
0.583	9.50	1.583	28.58	2.583	9.00	3.58	5.77
0.667	9.50	1.667	28.58	2.667	9.00	3.67	5.77
0.750	12.27	1.750	20.23	2.750	8.19	3.75	5.46
0.833	12.27	1.833	20.23	2.833	8.19	3.83	5.46
0.917	18.04	1.917	15.88	2.917	7.53	3.92	5.19
1.000	18.04	2.000	15.88	3.000	7.53	4.00	5.19

Unit Hyd Qpeak	(cms)=	0.036
PEAK FLOW	(cms)=	0.007 (i)
TIME TO PEAK	(hrs)=	1.417
RUNOFF VOLUME	(mm)=	16.285
TOTAL RAINFALL	(mm)=	79.453
RUNOFF COEFFICIENT	=	0.205

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB	
STANDHYD (0201)	Area (ha)= 1.22
ID= 1 DT= 5.0 min	Total Imp(%)= 77.00 Dir. Conn.(%)= 77.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.94	0.28
Dep. Storage	(mm)=	2.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	90.18	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	5.93	1.083	40.22	2.083	13.20	3.08	6.98
0.167	5.93	1.167	40.22	2.167	13.20	3.17	6.98
0.250	6.74	1.250	164.22	2.250	11.37	3.25	6.51
0.333	6.74	1.333	164.22	2.333	11.37	3.33	6.51
0.417	7.85	1.417	51.92	2.417	10.03	3.42	6.11
0.500	7.85	1.500	51.92	2.500	10.03	3.50	6.11
0.583	9.50	1.583	28.58	2.583	9.00	3.58	5.77
0.667	9.50	1.667	28.58	2.667	9.00	3.67	5.77
0.750	12.27	1.750	20.23	2.750	8.19	3.75	5.46
0.833	12.27	1.833	20.23	2.833	8.19	3.83	5.46
0.917	18.04	1.917	15.88	2.917	7.53	3.92	5.19
1.000	18.04	2.000	15.88	3.000	7.53	4.00	5.19

Max.Eff.Inten.	(mm/hr)=	164.22	27.26	
over	(min)	5.00	10.00	
Storage Coeff.	(min)=	1.97 (ii)	5.54 (ii)	
Unit Hyd. Tpeak	(min)=	5.00	10.00	
Unit Hyd. peak	(cms)=	0.31	0.16	
				TOTALS
PEAK FLOW	(cms)=	0.43	0.02	0.441 (iii)
TIME TO PEAK	(hrs)=	1.33	1.42	1.33
RUNOFF VOLUME	(mm)=	77.45	16.36	63.40
TOTAL RAINFALL	(mm)=	79.45	79.45	79.45
RUNOFF COEFFICIENT	=	0.97	0.21	0.80

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 49.0 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.

RESERVOIR(0010)	OVERFLOW IS OFF
IN= 2---> OUT= 1	
DT= 5.0 min	

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	0.0200	0.0600
0.0190	0.0225	0.7500	0.0660

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0201)	1.220	0.441	1.33	63.40
OUTFLOW: ID= 1 (0010)	1.220	0.020	3.17	63.16

PEAK FLOW REDUCTION [Qout/Qin](%)= 4.52
TIME SHIFT OF PEAK FLOW (min)=110.00
MAXIMUM STORAGE USED (ha.m.)= 0.0569

ADD HYD (0017)					
1 + 2 = 3		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
	ID1= 1 (0010):	1.22	0.020	3.17	63.16
	+ ID2= 2 (0016):	0.15	0.007	1.42	16.28
	ID = 3 (0017):	1.37	0.027	1.50	58.03

GEI Consultants

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

Average Slope	(%)=	1.00	2.00
Length	(m)=	90.18	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	5.22	1.083	36.37	2.083	11.74	3.08	6.15
0.167	5.22	1.167	36.37	2.167	11.74	3.17	6.15
0.250	5.94	1.250	148.15	2.250	10.09	3.25	5.74
0.333	5.94	1.333	148.15	2.333	10.09	3.33	5.74
0.417	6.93	1.417	47.06	2.417	8.89	3.42	5.38
0.500	6.93	1.500	47.06	2.500	8.89	3.50	5.38
0.583	8.42	1.583	25.72	2.583	7.96	3.58	5.08
0.667	8.42	1.667	25.72	2.667	7.96	3.67	5.08
0.750	10.91	1.750	18.11	2.750	7.24	3.75	4.80
0.833	10.91	1.833	18.11	2.833	7.24	3.83	4.80
0.917	16.13	1.917	14.17	2.917	6.65	3.92	4.57
1.000	16.13	2.000	14.17	3.000	6.65	4.00	4.57

Max.Eff.Inten.(mm/hr)=		148.15	21.95	
over (min)		5.00	10.00	
Storage Coeff. (min)=		2.05 (ii)	5.77 (ii)	
Unit Hyd. Tpeak (min)=		5.00	10.00	
Unit Hyd. peak (cms)=		0.31	0.15	
				TOTALS
PEAK FLOW	(cms)=	0.38	0.01	0.395 (iii)
TIME TO PEAK	(hrs)=	1.33	1.42	1.33
RUNOFF VOLUME	(mm)=	69.24	13.27	56.36
TOTAL RAINFALL	(mm)=	71.24	71.24	71.24
RUNOFF COEFFICIENT	=	0.97	0.19	0.79

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 49.0 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.

RESERVOIR(0010) | OVERFLOW IS OFF
IN= 2---> OUT= 1
DT= 5.0 min

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	0.0200	0.0600
0.0190	0.0225	0.7500	0.0660

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0201)	1.220	0.395	1.33	56.36
OUTFLOW: ID= 1 (0010)	1.220	0.020	2.92	56.12

PEAK FLOW REDUCTION [Qout/Qin](%)= 4.99
TIME SHIFT OF PEAK FLOW (min)= 95.00
MAXIMUM STORAGE USED (ha.m.)= 0.0495

ADD HYD (0017)
1 + 2 = 3

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
ID1= 1 (0010):	1.22	0.020	2.92	56.12
+ ID2= 2 (0016):	0.15	0.006	1.50	13.21
ID = 3 (0017):	1.37	0.025	1.50	51.42

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

V V I SSSSS U U A L (v 6.2.2003)
V V I SS U U A A L
V V I SS U U AAAAA L
V V I SS U U A A L
VV I SSSSS UUUUU A A LLLLL

OOO TTTTT TTTTT H H Y Y M M OOO TM
O O T T H H Y Y MM MM O O
O O T T H H Y M M O O
OOO T T H H Y M M OOO

Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2020 Smart City Water Inc
All rights reserved.

***** D E T A I L E D O U T P U T *****

Input filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
Output filename: C:\Users\wtrinh\AppData\Local\Civica\VH5\a922815c-9855-455d-abla-2baf3f2ff9e0\597c9523-3910-4fee-8204-fb3f7ede9862\scena
Summary filename: C:\Users\wtrinh\AppData\Local\Civica\VH5\a922815c-9855-455d-abla-2baf3f2ff9e0\597c9523-3910-4fee-8204-fb3f7ede9862\scena

DATE: 09/23/2022 TIME: 11:43:23

USER:

COMMENTS: _____

** SIMULATION : 100 year Chicago **

CHICAGO STORM
Ptotal= 87.58 mm

IDF curve parameters: A=1426.408
B= 5.273
C= 0.759
used in: INTENSITY = A / (t + B)^C

Duration of storm = 4.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.17	6.41	1.17	45.22	2.17	14.50	3.17	7.56
0.33	7.29	1.33	180.15	2.33	12.44	3.33	7.04
0.50	8.52	1.50	58.54	2.50	10.94	3.50	6.60
0.67	10.36	1.67	31.96	2.67	9.80	3.67	6.22
0.83	13.45	1.83	22.45	2.83	8.90	3.83	5.89
1.00	19.96	2.00	17.52	3.00	8.16	4.00	5.59

CALIB
NASHYD (0101)
ID= 1 DT= 5.0 min

Area	(ha)= 4.49	Curve Number	(CN)= 32.0
Ia	(mm)= 10.00	# of Linear Res.	(N)= 3.00
U.H. Tp	(hrs)= 0.62		

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	6.41	1.083	45.22	2.083	14.50	3.08	7.56
0.167	6.41	1.167	45.22	2.167	14.50	3.17	7.56
0.250	7.29	1.250	180.15	2.250	12.44	3.25	7.04
0.333	7.29	1.333	180.15	2.333	12.44	3.33	7.04
0.417	8.52	1.417	58.54	2.417	10.94	3.42	6.60
0.500	8.52	1.500	58.54	2.500	10.94	3.50	6.60
0.583	10.36	1.583	31.96	2.583	9.80	3.58	6.22
0.667	10.36	1.667	31.96	2.667	9.80	3.67	6.22
0.750	13.45	1.750	22.45	2.750	8.90	3.75	5.89
0.833	13.45	1.833	22.45	2.833	8.90	3.83	5.89
0.917	19.96	1.917	17.52	2.917	8.16	3.92	5.59
1.000	19.96	2.000	17.52	3.000	8.16	4.00	5.59

Unit Hyd Qpeak (cms)= 0.277

PEAK FLOW (cms)= 0.058 (i)
TIME TO PEAK (hrs)= 2.167
RUNOFF VOLUME (mm)= 9.749
TOTAL RAINFALL (mm)= 87.580
RUNOFF COEFFICIENT = 0.111

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB
STANDHYD (0202)
ID= 1 DT= 5.0 min

Area (ha)= 3.12
Total Imp(%)= 75.00 Dir. Conn.(%)= 75.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	2.34	0.78
Dep. Storage	(mm)=	2.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	144.22	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	6.41	1.083	45.22	2.083	14.50	3.08	7.56
0.167	6.41	1.167	45.22	2.167	14.50	3.17	7.56
0.250	7.29	1.250	180.15	2.250	12.44	3.25	7.04
0.333	7.29	1.333	180.15	2.333	12.44	3.33	7.04
0.417	8.52	1.417	58.54	2.417	10.94	3.42	6.60
0.500	8.52	1.500	58.54	2.500	10.94	3.50	6.60
0.583	10.36	1.583	31.96	2.583	9.80	3.58	6.22
0.667	10.36	1.667	31.96	2.667	9.80	3.67	6.22
0.750	13.45	1.750	22.45	2.750	8.90	3.75	5.89
0.833	13.45	1.833	22.45	2.833	8.90	3.83	5.89
0.917	19.96	1.917	17.52	2.917	8.16	3.92	5.59
1.000	19.96	2.000	17.52	3.000	8.16	4.00	5.59

Max.Eff.Inten.(mm/hr)=		180.15	33.02	
over (min)		5.00	10.00	
Storage Coeff. (min)=		2.51 (ii)	6.11 (ii)	
Unit Hyd. Tpeak (min)=		5.00	10.00	
Unit Hyd. peak (cms)=		0.29	0.15	
				TOTALS
PEAK FLOW	(cms)=	1.15	0.06	1.200 (iii)
TIME TO PEAK	(hrs)=	1.33	1.42	1.33
RUNOFF VOLUME	(mm)=	85.58	19.66	69.10
TOTAL RAINFALL	(mm)=	87.58	87.58	87.58
RUNOFF COEFFICIENT	=	0.98	0.22	0.79

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 49.0 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.

RESERVOIR(0020)
IN= 2---> OUT= 1
DT= 5.0 min

OVERFLOW IS OFF

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	1.2100	0.2910
0.0310	0.2900	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0202)	3.120	1.200	1.33	69.10
OUTFLOW: ID= 1 (0020)	3.120	0.021	4.08	68.33

PEAK FLOW REDUCTION [Qout/Qin](%)= 1.75
TIME SHIFT OF PEAK FLOW (min)=165.00
MAXIMUM STORAGE USED (ha.m.)= 0.1965

CALIB
NASHYD (0016)
ID= 1 DT= 5.0 min

Area (ha)= 0.15 Curve Number (CN)= 49.0
Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= 0.16

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	6.41	1.083	45.22	2.083	14.50	3.08	7.56
0.167	6.41	1.167	45.22	2.167	14.50	3.17	7.56
0.250	7.29	1.250	180.15	2.250	12.44	3.25	7.04
0.333	7.29	1.333	180.15	2.333	12.44	3.33	7.04
0.417	8.52	1.417	58.54	2.417	10.94	3.42	6.60
0.500	8.52	1.500	58.54	2.500	10.94	3.50	6.60
0.583	10.36	1.583	31.96	2.583	9.80	3.58	6.22
0.667	10.36	1.667	31.96	2.667	9.80	3.67	6.22
0.750	13.45	1.750	22.45	2.750	8.90	3.75	5.89
0.833	13.45	1.833	22.45	2.833	8.90	3.83	5.89
0.917	19.96	1.917	17.52	2.917	8.16	3.92	5.59
1.000	19.96	2.000	17.52	3.000	8.16	4.00	5.59

Unit Hyd Qpeak (cms)= 0.036

PEAK FLOW (cms)= 0.009 (i)
TIME TO PEAK (hrs)= 1.417
RUNOFF VOLUME (mm)= 19.564
TOTAL RAINFALL (mm)= 87.580
RUNOFF COEFFICIENT = 0.223

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB
STANDHYD (0201)
ID= 1 DT= 5.0 min

Area (ha)= 1.22
Total Imp(%)= 77.00 Dir. Conn.(%)= 77.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.94	0.28
Dep. Storage	(mm)=	2.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	90.18	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	6.41	1.083	45.22	2.083	14.50	3.08	7.56
0.167	6.41	1.167	45.22	2.167	14.50	3.17	7.56

0.250	7.29	1.250	180.15	2.250	12.44	3.25	7.04
0.333	7.29	1.333	180.15	2.333	12.44	3.33	7.04
0.417	8.52	1.417	58.54	2.417	10.94	3.42	6.60
0.500	8.52	1.500	58.54	2.500	10.94	3.50	6.60
0.583	10.36	1.583	31.96	2.583	9.80	3.58	6.22
0.667	10.36	1.667	31.96	2.667	9.80	3.67	6.22
0.750	13.45	1.750	22.45	2.750	8.90	3.75	5.89
0.833	13.45	1.833	22.45	2.833	8.90	3.83	5.89
0.917	19.96	1.917	17.52	2.917	8.16	3.92	5.59
1.000	19.96	2.000	17.52	3.000	8.16	4.00	5.59

Max.Eff.Inten.(mm/hr)=	180.15	33.02	
over (min)	5.00	10.00	
Storage Coeff. (min)=	1.90 (ii)	5.34 (ii)	
Unit Hyd. Tpeak (min)=	5.00	10.00	
Unit Hyd. peak (cms)=	0.32	0.16	
			TOTALS
PEAK FLOW (cms)=	0.47	0.02	0.486 (iii)
TIME TO PEAK (hrs)=	1.33	1.42	1.33
RUNOFF VOLUME (mm)=	85.58	19.66	70.41
TOTAL RAINFALL (mm)=	87.58	87.58	87.58
RUNOFF COEFFICIENT =	0.98	0.22	0.80

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 49.0 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.

RESERVOIR(0010)	OVERFLOW IS OFF			
IN= 2---> OUT= 1				
DT= 5.0 min	OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
	0.0000	0.0000	0.0200	0.0600
	0.0190	0.0225	0.7500	0.0660

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0201)	1.220	0.486	1.33	70.41
OUTFLOW: ID= 1 (0010)	1.220	0.052	2.08	70.17

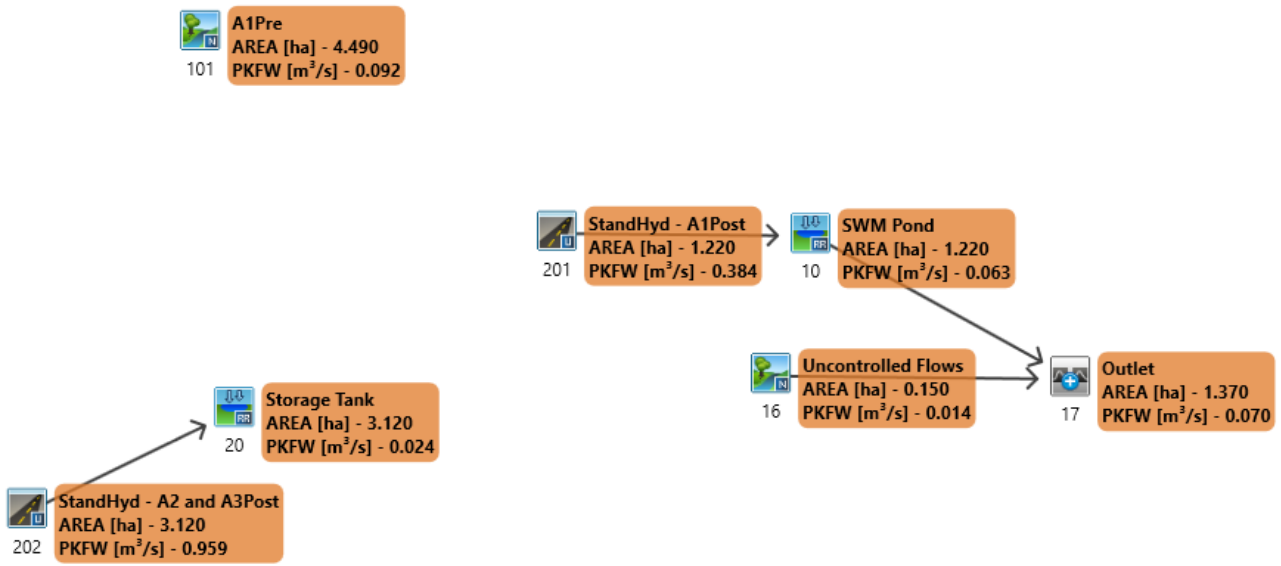
PEAK FLOW REDUCTION [Qout/Qin](%)= 10.81
TIME SHIFT OF PEAK FLOW (min)= 45.00
MAXIMUM STORAGE USED (ha.m.)= 0.0605

ADD HYD (0017)		AREA	QPEAK	TPEAK	R.V.
1 + 2 = 3		(ha)	(cms)	(hrs)	(mm)
	ID1= 1 (0010):	1.22	0.052	2.08	70.17
	+ ID2= 2 (0016):	0.15	0.009	1.42	19.56
	ID = 3 (0017):	1.37	0.055	2.08	64.63

NOTE: PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

Project No.: 2104593
Stateview Homes (Bea Towns) Inc.
Bea Towns
2, 5, 10, 25, 50 & 100-Year 24 Hour SCS
Proposed Condition Model Output
September 2022

VO6 Model Schematic



GEI Consultants

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

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2003)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2020 Smart City Water Inc
All rights reserved.

                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
  Output  filename: C:\Users\wtrinh\AppData\Local\Civica\VH5\a922815c-9855-455d-ab1a-
2baf3f2ff9e0\a920b364-fa76-4f13-8d7c-559efc4d417b\scena
  Summary filename: C:\Users\wtrinh\AppData\Local\Civica\VH5\a922815c-9855-455d-ab1a-
2baf3f2ff9e0\a920b364-fa76-4f13-8d7c-559efc4d417b\scena


DATE: 09/23/2022                          TIME: 11:39:44

USER:


COMMENTS: _____________________________________________________

--------------------------------------------------------------------------------------------------
------
  ************************************************
  ** SIMULATION : 2 yr SCS                      **
  ************************************************


--------------------
|    READ STORM    |    Filename: C:\Users\wtrinh\AppD
|                  |              ata\Local\Temp\
|                  |              96c01f6d-a685-460b-917c-658dc405f81d\4e827db1
| Ptotal= 47.50 mm |    Comments: 2 Year - 24 Hour SCS Type II
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.08	0.00	6.17	0.95	12.25	6.84	18.33	0.85
0.17	0.52	6.25	0.95	12.33	6.84	18.42	0.86
0.25	0.52	6.33	0.95	12.42	6.84	18.50	0.85
0.33	0.52	6.42	0.95	12.50	6.84	18.58	0.86
0.42	0.52	6.50	0.95	12.58	6.84	18.67	0.86
0.50	0.52	6.58	0.95	12.67	3.51	18.75	0.85
0.58	0.52	6.67	0.95	12.75	3.51	18.83	0.86
0.67	0.52	6.75	0.95	12.83	3.51	18.92	0.85
0.75	0.52	6.83	0.95	12.92	3.52	19.00	0.86
0.83	0.52	6.92	0.95	13.00	3.51	19.08	0.86
0.92	0.52	7.00	0.95	13.08	3.52	19.17	0.85
1.00	0.52	7.08	0.95	13.17	0.66	19.25	0.86
1.08	0.52	7.17	0.95	13.25	0.66	19.33	0.85
1.17	0.52	7.25	0.95	13.33	0.66	19.42	0.86
1.25	0.52	7.33	0.95	13.42	0.67	19.50	0.86
1.33	0.52	7.42	0.95	13.50	0.66	19.58	0.85
1.42	0.52	7.50	0.95	13.58	0.67	19.67	0.86
1.50	0.52	7.58	0.95	13.67	3.90	19.75	0.85
1.58	0.52	7.67	0.95	13.75	3.89	19.83	0.86
1.67	0.52	7.75	0.95	13.83	3.90	19.92	0.86
1.75	0.52	7.83	0.95	13.92	3.90	20.00	0.85
1.83	0.52	7.92	0.95	14.00	3.89	20.08	0.86
1.92	0.52	8.00	0.95	14.08	3.90	20.17	0.57
2.00	0.52	8.08	0.95	14.17	1.43	20.25	0.57
2.08	0.52	8.17	1.28	14.25	1.42	20.33	0.57
2.17	0.62	8.25	1.28	14.33	1.43	20.42	0.57
2.25	0.62	8.33	1.28	14.42	1.42	20.50	0.57
2.33	0.62	8.42	1.28	14.50	1.43	20.58	0.57
2.42	0.62	8.50	1.28	14.58	1.42	20.67	0.57
2.50	0.62	8.58	1.28	14.67	1.43	20.75	0.57
2.58	0.62	8.67	1.28	14.75	1.42	20.83	0.57
2.67	0.62	8.75	1.28	14.83	1.43	20.92	0.57
2.75	0.62	8.83	1.28	14.92	1.42	21.00	0.57
2.83	0.62	8.92	1.28	15.00	1.43	21.08	0.57
2.92	0.62	9.00	1.28	15.08	1.42	21.17	0.57
3.00	0.62	9.08	1.28	15.17	1.43	21.25	0.57
3.08	0.62	9.17	1.52	15.25	1.42	21.33	0.57
3.17	0.62	9.25	1.52	15.33	1.43	21.42	0.57
3.25	0.62	9.33	1.52	15.42	1.42	21.50	0.57
3.33	0.62	9.42	1.52	15.50	1.43	21.58	0.57
3.42	0.62	9.50	1.52	15.58	1.42	21.67	0.57
3.50	0.62	9.58	1.52	15.67	1.43	21.75	0.57
3.58	0.62	9.67	1.71	15.75	1.42	21.83	0.57
3.67	0.62	9.75	1.71	15.83	1.43	21.92	0.57
3.75	0.62	9.83	1.71	15.92	1.42	22.00	0.57
3.83	0.62	9.92	1.71	16.00	1.42	22.08	0.57
3.92	0.62	10.00	1.71	16.08	1.43	22.17	0.57
4.00	0.62	10.08	1.71	16.17	0.86	22.25	0.57
4.08	0.62	10.17	2.19	16.25	0.85	22.33	0.57
4.17	0.76	10.25	2.19	16.33	0.86	22.42	0.57
4.25	0.76	10.33	2.19	16.42	0.85	22.50	0.57
4.33	0.76	10.42	2.19	16.50	0.86	22.58	0.57
4.42	0.76	10.50	2.19	16.58	0.86	22.67	0.57
4.50	0.76	10.58	2.19	16.67	0.85	22.75	0.57
4.58	0.76	10.67	2.94	16.75	0.86	22.83	0.57
4.67	0.76	10.75	2.95	16.83	0.85	22.92	0.57
4.75	0.76	10.83	2.94	16.92	0.86	23.00	0.57
4.83	0.76	10.92	2.95	17.00	0.86	23.08	0.57
4.92	0.76	11.00	2.94	17.08	0.85	23.17	0.57
5.00	0.76	11.08	2.94	17.17	0.86	23.25	0.57
5.08	0.76	11.17	4.56	17.25	0.85	23.33	0.57
5.17	0.76	11.25	4.56	17.33	0.86	23.42	0.57
5.25	0.76	11.33	4.56	17.42	0.86	23.50	0.57
5.33	0.76	11.42	4.56	17.50	0.85	23.58	0.57
5.42	0.76	11.50	4.56	17.58	0.86	23.67	0.57
5.50	0.76	11.58	4.56	17.67	0.85	23.75	0.57
5.58	0.76	11.67	19.76	17.75	0.86	23.83	0.57
5.67	0.76	11.75	19.76	17.83	0.86	23.92	0.57
5.75	0.76	11.83	19.76	17.92	0.85	24.00	0.57
5.83	0.76	11.92	52.44	18.00	0.86	24.08	0.57
5.92	0.76	12.00	52.44	18.08	0.85		
6.00	0.76	12.08	52.44	18.17	0.86		
6.08	0.76	12.17	6.84	18.25	0.86		

```
--------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD  (  0101) |   Area     (ha)=   4.49   Curve Number    (CN)= 32.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.62

     Unit Hyd Qpeak  (cms)=   0.277

     PEAK FLOW       (cms)=   0.010 (i)
     TIME TO PEAK    (hrs)=  12.667
     RUNOFF VOLUME    (mm)=   2.436
     TOTAL RAINFALL   (mm)=  47.503
     RUNOFF COEFFICIENT   =   0.051

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0202)|   Area     (ha)=   3.12
|ID= 1 DT= 5.0 min |   Total Imp(%)=  75.00   Dir. Conn.(%)=  75.00
--------------------

                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       2.34          0.78
```

GEI Consultants

```
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     144.22        40.00
     Mannings n            =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      52.44         4.90
               over (min)        5.00        30.00
     Storage Coeff.  (min)=       4.12 (ii)   27.70 (ii)
     Unit Hyd. Tpeak (min)=       5.00        30.00
     Unit Hyd. peak  (cms)=       0.24         0.04
                                                      *TOTALS*
     PEAK FLOW       (cms)=       0.34         0.01      0.338 (iii)
     TIME TO PEAK    (hrs)=      12.08        12.42      12.08
     RUNOFF VOLUME    (mm)=      45.50         5.89      35.59
     TOTAL RAINFALL   (mm)=      47.50        47.50      47.50
     RUNOFF COEFFICIENT    =      0.96         0.12       0.75

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0020)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |  1.2100      0.2910
                          0.0310     0.2900   |  0.0000      0.0000

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0202)      3.120     0.338     12.08      35.59
   OUTFLOW: ID= 1 (  0020)      3.120     0.009     16.17      34.83

                PEAK   FLOW   REDUCTION [Qout/Qin](%)=  2.57
                TIME SHIFT OF PEAK FLOW          (min)=245.00
                MAXIMUM  STORAGE   USED        (ha.m.)=  0.0810

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0016)|   Area     (ha)=   0.15   Curve Number    (CN)= 49.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.16

     Unit Hyd Qpeak  (cms)=   0.036

     PEAK FLOW       (cms)=   0.002 (i)
     TIME TO PEAK    (hrs)=  12.083
     RUNOFF VOLUME    (mm)=   5.857
     TOTAL RAINFALL   (mm)=  47.503
     RUNOFF COEFFICIENT    =   0.123

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area     (ha)=   1.22
|ID= 1 DT= 5.0 min |   Total Imp(%)=  77.00   Dir. Conn.(%)=  77.00
--------------------

                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.94         0.28
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      90.18        40.00
     Mannings n            =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=      52.44         4.90
               over (min)        5.00        30.00
     Storage Coeff.  (min)=       3.11 (ii)   26.69 (ii)
     Unit Hyd. Tpeak (min)=       5.00        30.00
     Unit Hyd. peak  (cms)=       0.27         0.04
                                                      *TOTALS*
     PEAK FLOW       (cms)=       0.14         0.00      0.137 (iii)
     TIME TO PEAK    (hrs)=      12.08        12.42      12.08
     RUNOFF VOLUME    (mm)=      45.50         5.89      36.38
     TOTAL RAINFALL   (mm)=      47.50        47.50      47.50
     RUNOFF COEFFICIENT    =      0.96         0.12       0.77

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0010)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |  0.0200      0.0600
                          0.0190     0.0225   |  0.7500      0.0660

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0201)      1.220     0.137     12.08      36.38
   OUTFLOW: ID= 1 (  0010)      1.220     0.018     12.58      36.13

                PEAK   FLOW   REDUCTION [Qout/Qin](%)= 13.17
                TIME SHIFT OF PEAK FLOW          (min)= 30.00
                MAXIMUM  STORAGE   USED        (ha.m.)=  0.0214

--------------------------------------------------------------------------------
--------------------
| ADD HYD  (  0017)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)     (cms)    (hrs)     (mm)
       ID1= 1 (  0010):      1.22     0.018    12.58     36.13
     + ID2= 2 (  0016):      0.15     0.002    12.08      5.86
       ================================================
       ID = 3 (  0017):      1.37     0.020    12.17     32.82

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
================================================================================
======

      V    V   I    SSSSS  U   U    A    L              (v 6.2.2003)
      V    V   I    SS     U   U   A A   L
       V  V    I     SS    U   U  AAAAA  L
       V  V    I      SS   U   U  A   A  L
        VV     I    SSSSS  UUUUU  A   A  LLLLL

       OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
      O   O    T      T    H   H   Y Y   MM MM  O   O
      O   O    T      T    H   H    Y    M   M  O   O
       OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2020 Smart City Water Inc
All rights reserved.


                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
  Output  filename: C:\Users\wtrinh\AppData\Local\Civica\VH5\a922815c-9855-455d-ab1a-
2baf3f2ff9e0\f358551f-958a-4d0e-9818-0ac7e4c1a394\scena
  Summary filename: C:\Users\wtrinh\AppData\Local\Civica\VH5\a922815c-9855-455d-ab1a-
2baf3f2ff9e0\f358551f-958a-4d0e-9818-0ac7e4c1a394\scena
```

GEI Consultants

DATE: 09/23/2022 TIME: 11:39:44

USER:

COMMENTS: _____

** SIMULATION : 5 yr SCS **

READ STORM | Ptotal= 66.78 mm

Filename: C:\Users\wtrinh\AppData\Local\Temp\96c01f6d-a685-460b-917c-658dc405f81d\16f50994

Comments: 5 Year - 24 Hour SCS Type II

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.08	0.00	6.17	1.34	12.25	9.62	18.33	1.20
0.17	0.73	6.25	1.34	12.33	9.62	18.42	1.20
0.25	0.73	6.33	1.34	12.42	9.62	18.50	1.20
0.33	0.73	6.42	1.34	12.50	9.62	18.58	1.20
0.42	0.73	6.50	1.34	12.58	9.62	18.67	1.20
0.50	0.73	6.58	1.34	12.67	4.94	18.75	1.20
0.58	0.73	6.67	1.34	12.75	4.94	18.83	1.20
0.67	0.73	6.75	1.34	12.83	4.94	18.92	1.20
0.75	0.73	6.83	1.34	12.92	4.94	19.00	1.20
0.83	0.73	6.92	1.34	13.00	4.94	19.08	1.20
0.92	0.73	7.00	1.34	13.08	4.94	19.17	1.20
1.00	0.73	7.08	1.34	13.17	0.94	19.25	1.20
1.08	0.73	7.17	1.34	13.25	0.94	19.33	1.20
1.17	0.73	7.25	1.34	13.33	0.94	19.42	1.20
1.25	0.73	7.33	1.34	13.42	0.94	19.50	1.20
1.33	0.73	7.42	1.34	13.50	0.94	19.58	1.20
1.42	0.73	7.50	1.34	13.58	0.94	19.67	1.20
1.50	0.73	7.58	1.34	13.67	5.48	19.75	1.20
1.58	0.73	7.67	1.34	13.75	5.48	19.83	1.20
1.67	0.73	7.75	1.34	13.83	5.48	19.92	1.20
1.75	0.73	7.83	1.34	13.92	5.48	20.00	1.20
1.83	0.73	7.92	1.34	14.00	5.48	20.08	1.20
1.92	0.73	8.00	1.34	14.08	5.48	20.17	0.80
2.00	0.73	8.08	1.34	14.17	2.00	20.25	0.80
2.08	0.73	8.17	1.80	14.25	2.00	20.33	0.80
2.17	0.87	8.25	1.80	14.33	2.00	20.42	0.80
2.25	0.87	8.33	1.80	14.42	2.00	20.50	0.80
2.33	0.87	8.42	1.80	14.50	2.00	20.58	0.80
2.42	0.87	8.50	1.80	14.58	2.00	20.67	0.80
2.50	0.87	8.58	1.80	14.67	2.00	20.75	0.80
2.58	0.87	8.67	1.80	14.75	2.00	20.83	0.80
2.67	0.87	8.75	1.80	14.83	2.00	20.92	0.80
2.75	0.87	8.83	1.80	14.92	2.00	21.00	0.80
2.83	0.87	8.92	1.80	15.00	2.00	21.08	0.80
2.92	0.87	9.00	1.80	15.08	2.00	21.17	0.80
3.00	0.87	9.08	1.80	15.17	2.00	21.25	0.80
3.08	0.87	9.17	2.14	15.25	2.00	21.33	0.80
3.17	0.87	9.25	2.14	15.33	2.00	21.42	0.80
3.25	0.87	9.33	2.14	15.42	2.00	21.50	0.80
3.33	0.87	9.42	2.14	15.50	2.00	21.58	0.80
3.42	0.87	9.50	2.14	15.58	2.00	21.67	0.80
3.50	0.87	9.58	2.14	15.67	2.00	21.75	0.80
3.58	0.87	9.67	2.40	15.75	2.00	21.83	0.80
3.67	0.87	9.75	2.40	15.83	2.00	21.92	0.80
3.75	0.87	9.83	2.40	15.92	2.00	22.00	0.80
3.83	0.87	9.92	2.40	16.00	2.00	22.08	0.80
3.92	0.87	10.00	2.40	16.08	2.00	22.17	0.80
4.00	0.87	10.08	2.40	16.17	1.20	22.25	0.80
4.08	0.87	10.17	3.07	16.25	1.20	22.33	0.80
4.17	1.07	10.25	3.07	16.33	1.20	22.42	0.80
4.25	1.07	10.33	3.07	16.42	1.20	22.50	0.80
4.33	1.07	10.42	3.07	16.50	1.20	22.58	0.80
4.42	1.07	10.50	3.07	16.58	1.20	22.67	0.80
4.50	1.07	10.58	3.07	16.67	1.20	22.75	0.80
4.58	1.07	10.67	4.14	16.75	1.20	22.83	0.80
4.67	1.07	10.75	4.14	16.83	1.20	22.92	0.80
4.75	1.07	10.83	4.14	16.92	1.20	23.00	0.80
4.83	1.07	10.92	4.14	17.00	1.20	23.08	0.80
4.92	1.07	11.00	4.14	17.08	1.20	23.17	0.80
5.00	1.07	11.08	4.14	17.17	1.20	23.25	0.80
5.08	1.07	11.17	6.41	17.25	1.20	23.33	0.80
5.17	1.07	11.25	6.41	17.33	1.20	23.42	0.80
5.25	1.07	11.33	6.41	17.42	1.20	23.50	0.80
5.33	1.07	11.42	6.41	17.50	1.20	23.58	0.80
5.42	1.07	11.50	6.41	17.58	1.20	23.67	0.80
5.50	1.07	11.58	6.41	17.67	1.20	23.75	0.80
5.58	1.07	11.67	27.79	17.75	1.20	23.83	0.80
5.67	1.07	11.75	27.79	17.83	1.20	23.92	0.80
5.75	1.07	11.83	27.79	17.92	1.20	24.00	0.80
5.83	1.07	11.92	73.75	18.00	1.20	24.08	0.80
5.92	1.07	12.00	73.75	18.08	1.20		
6.00	1.07	12.08	73.75	18.17	1.20		
6.08	1.07	12.17	9.62	18.25	1.20		

CALIB | NASHYD (0101) | ID= 1 DT= 5.0 min

Area (ha)= 4.49 Curve Number (CN)= 32.0
Ia (mm)= 10.00 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= 0.62

Unit Hyd Qpeak (cms)= 0.277

PEAK FLOW (cms)= 0.025 (i)
TIME TO PEAK (hrs)= 12.667
RUNOFF VOLUME (mm)= 5.403
TOTAL RAINFALL (mm)= 66.775
RUNOFF COEFFICIENT = 0.081

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB | STANDHYD (0202) | ID= 1 DT= 5.0 min

Area (ha)= 3.12
Total Imp(%)= 75.00 Dir. Conn.(%)= 75.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	2.34	0.78	
Dep. Storage	(mm)=	2.00	5.00	
Average Slope	(%)=	1.00	2.00	
Length	(m)=	144.22	40.00	
Mannings n	=	0.013	0.250	
Max.Eff.Inten.	(mm/hr)=	73.75	11.61	
over	(min)	5.00	25.00	
Storage Coeff.	(min)=	3.59 (ii)	20.30 (ii)	
Unit Hyd. Tpeak	(min)=	5.00	25.00	
Unit Hyd. peak	(cms)=	0.26	0.05	
				TOTALS
PEAK FLOW	(cms)=	0.47	0.01	0.483 (iii)
TIME TO PEAK	(hrs)=	12.08	12.33	12.08
RUNOFF VOLUME	(mm)=	64.78	11.70	51.50
TOTAL RAINFALL	(mm)=	66.78	66.78	66.78
RUNOFF COEFFICIENT	=	0.97	0.18	0.77

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 49.0 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.

RESERVOIR(0020) | OVERFLOW IS OFF

GEI Consultants

```
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000    |  1.2100     0.2910
                         0.0310     0.2900    |  0.0000     0.0000

                              AREA     QPEAK     TPEAK       R.V.
                              (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0202)    3.120     0.483     12.08      51.50
   OUTFLOW: ID= 1 (  0020)    3.120     0.013     16.08      50.74

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=  2.59
                    TIME SHIFT OF PEAK FLOW          (min)=240.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.1175

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0016)|   Area     (ha)=   0.15   Curve Number   (CN)= 49.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.16

     Unit Hyd Qpeak  (cms)=   0.036

     PEAK FLOW       (cms)=   0.005 (i)
     TIME TO PEAK    (hrs)=  12.083
     RUNOFF VOLUME    (mm)=  11.645
     TOTAL RAINFALL   (mm)=  66.775
     RUNOFF COEFFICIENT   =   0.174

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0201)|   Area     (ha)=   1.22
|ID= 1 DT= 5.0 min |   Total Imp(%)=  77.00   Dir. Conn.(%)=  77.00
--------------------

                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      0.94         0.28
     Dep. Storage     (mm)=      2.00         5.00
     Average Slope     (%)=      1.00         2.00
     Length            (m)=     90.18        40.00
     Mannings n           =     0.013        0.250

     Max.Eff.Inten.(mm/hr)=     73.75        15.49
                 over (min)        5.00        10.00
     Storage Coeff.  (min)=     2.71 (ii)    7.63 (ii)
     Unit Hyd. Tpeak (min)=        5.00        10.00
     Unit Hyd. peak  (cms)=        0.29         0.13
                                                      *TOTALS*
     PEAK FLOW       (cms)=        0.19         0.01          0.201 (iii)
     TIME TO PEAK    (hrs)=       12.08        12.08           12.08
     RUNOFF VOLUME    (mm)=       64.78        11.70           52.57
     TOTAL RAINFALL   (mm)=       66.78        66.78           66.78
     RUNOFF COEFFICIENT   =        0.97         0.18            0.79

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0010)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                         0.0000     0.0000    |  0.0200     0.0600
                         0.0190     0.0225    |  0.7500     0.0660

                              AREA     QPEAK     TPEAK       R.V.
                              (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0201)    1.220     0.201     12.08      52.57
   OUTFLOW: ID= 1 (  0010)    1.220     0.019     12.67      52.32

                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=  9.57
                    TIME SHIFT OF PEAK FLOW          (min)= 35.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=  0.0323

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0017)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0010):     1.22    0.019    12.67    52.32
      + ID2= 2 (  0016):     0.15    0.005    12.08    11.65
        ================================================
        ID = 3 (  0017):     1.37    0.024    12.08    47.87

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

 FINISH
================================================================================================================
======

================================================================================================================
======

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2003)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO    TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O     T      T    H   H   Y Y   MM MM  O   O
       O   O     T      T    H   H    Y    M   M  O   O
        OOO      T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2020 Smart City Water Inc
All rights reserved.

                  *****  D E T A I L E D   O U T P U T *****

  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
  Output  filename: C:\Users\wtrinh\AppData\Local\Civica\VH5\a922815c-9855-455d-ab1a-
2baf3f2ff9e0\c6ee90e4-983e-4a65-9d1c-288dad71cfef\scena
  Summary filename: C:\Users\wtrinh\AppData\Local\Civica\VH5\a922815c-9855-455d-ab1a-
2baf3f2ff9e0\c6ee90e4-983e-4a65-9d1c-288dad71cfef\scena

DATE: 09/23/2022                          TIME: 11:39:44

USER:

COMMENTS: _____

--------------------------------------------------------------------------------------------------------------
------
  ************************************************
  ** SIMULATION : 10 yr SCS                     **
  ************************************************

--------------------
|    READ STORM    |    Filename: C:\Users\wtrinh\AppD
|                  |              ata\Local\Temp\
|                  |              96c01f6d-a685-460b-917c-658dc405f81d\b3d44b23
| Ptotal= 79.60 mm |    Comments: 10 Year - 24 Hour SCS Type II
--------------------
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
```

hrs	mm/hr	hrs	mm/hr	hrs	mm/hr	hrs	mm/hr
0.08	0.00	6.17	1.59	12.25	11.46	18.33	1.43
0.17	0.88	6.25	1.59	12.33	11.46	18.42	1.43
0.25	0.88	6.33	1.59	12.42	11.46	18.50	1.43
0.33	0.88	6.42	1.59	12.50	11.46	18.58	1.43
0.42	0.88	6.50	1.59	12.58	11.46	18.67	1.43
0.50	0.88	6.58	1.59	12.67	5.89	18.75	1.43
0.58	0.88	6.67	1.59	12.75	5.89	18.83	1.43
0.67	0.88	6.75	1.59	12.83	5.89	18.92	1.43
0.75	0.88	6.83	1.59	12.92	5.89	19.00	1.43
0.83	0.88	6.92	1.59	13.00	5.89	19.08	1.43
0.92	0.88	7.00	1.59	13.08	5.89	19.17	1.43
1.00	0.88	7.08	1.59	13.17	1.11	19.25	1.43
1.08	0.88	7.17	1.59	13.25	1.11	19.33	1.43
1.17	0.88	7.25	1.59	13.33	1.11	19.42	1.43
1.25	0.88	7.33	1.59	13.42	1.11	19.50	1.43
1.33	0.88	7.42	1.59	13.50	1.11	19.58	1.43
1.42	0.88	7.50	1.59	13.58	1.11	19.67	1.43
1.50	0.88	7.58	1.59	13.67	6.53	19.75	1.43
1.58	0.88	7.67	1.59	13.75	6.53	19.83	1.43
1.67	0.88	7.75	1.59	13.83	6.53	19.92	1.43
1.75	0.88	7.83	1.59	13.92	6.53	20.00	1.43
1.83	0.88	7.92	1.59	14.00	6.53	20.08	1.43
1.92	0.88	8.00	1.59	14.08	6.53	20.17	0.96
2.00	0.88	8.08	1.59	14.17	2.39	20.25	0.96
2.08	0.88	8.17	2.15	14.25	2.39	20.33	0.96
2.17	1.03	8.25	2.15	14.33	2.39	20.42	0.96
2.25	1.03	8.33	2.15	14.42	2.39	20.50	0.96
2.33	1.03	8.42	2.15	14.50	2.39	20.58	0.96
2.42	1.03	8.50	2.15	14.58	2.39	20.67	0.96
2.50	1.03	8.58	2.15	14.67	2.39	20.75	0.96
2.58	1.03	8.67	2.15	14.75	2.39	20.83	0.96
2.67	1.03	8.75	2.15	14.83	2.39	20.92	0.96
2.75	1.03	8.83	2.15	14.92	2.39	21.00	0.96
2.83	1.03	8.92	2.15	15.00	2.39	21.08	0.96
2.92	1.03	9.00	2.15	15.08	2.39	21.17	0.96
3.00	1.03	9.08	2.15	15.17	2.39	21.25	0.96
3.08	1.03	9.17	2.55	15.25	2.39	21.33	0.96
3.17	1.03	9.25	2.55	15.33	2.39	21.42	0.96
3.25	1.03	9.33	2.55	15.42	2.39	21.50	0.96
3.33	1.03	9.42	2.55	15.50	2.39	21.58	0.96
3.42	1.03	9.50	2.55	15.58	2.39	21.67	0.96
3.50	1.03	9.58	2.55	15.67	2.39	21.75	0.96
3.58	1.03	9.67	2.87	15.75	2.39	21.83	0.96
3.67	1.03	9.75	2.87	15.83	2.39	21.92	0.96
3.75	1.03	9.83	2.87	15.92	2.39	22.00	0.96
3.83	1.03	9.92	2.87	16.00	2.39	22.08	0.96
3.92	1.03	10.00	2.87	16.08	2.39	22.17	0.96
4.00	1.03	10.08	2.87	16.17	1.43	22.25	0.96
4.08	1.03	10.17	3.66	16.25	1.43	22.33	0.96
4.17	1.27	10.25	3.66	16.33	1.43	22.42	0.96
4.25	1.27	10.33	3.66	16.42	1.43	22.50	0.96
4.33	1.27	10.42	3.66	16.50	1.43	22.58	0.96
4.42	1.27	10.50	3.66	16.58	1.43	22.67	0.96
4.50	1.27	10.58	3.66	16.67	1.43	22.75	0.96
4.58	1.27	10.67	4.94	16.75	1.43	22.83	0.96
4.67	1.27	10.75	4.94	16.83	1.43	22.92	0.96
4.75	1.27	10.83	4.94	16.92	1.43	23.00	0.96
4.83	1.27	10.92	4.94	17.00	1.43	23.08	0.96
4.92	1.27	11.00	4.94	17.08	1.43	23.17	0.96
5.00	1.27	11.08	4.94	17.17	1.43	23.25	0.96
5.08	1.27	11.17	7.64	17.25	1.43	23.33	0.96
5.17	1.27	11.25	7.64	17.33	1.43	23.42	0.96
5.25	1.27	11.33	7.64	17.42	1.43	23.50	0.96
5.33	1.27	11.42	7.64	17.50	1.43	23.58	0.96
5.42	1.27	11.50	7.64	17.58	1.43	23.67	0.96
5.50	1.27	11.58	7.64	17.67	1.43	23.75	0.96
5.58	1.27	11.67	33.11	17.75	1.43	23.83	0.96
5.67	1.27	11.75	33.11	17.83	1.43	23.92	0.96
5.75	1.27	11.83	33.11	17.92	1.43	24.00	0.96
5.83	1.27	11.92	87.88	18.00	1.43	24.08	0.96
5.92	1.27	12.00	87.88	18.08	1.43		
6.00	1.27	12.08	87.88	18.17	1.43		
6.08	1.27	12.17	11.46	18.25	1.43		

```
--------------------
| CALIB            |
| NASHYD   (  0101)|   Area     (ha)=   4.49   Curve Number    (CN)= 32.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.62

     Unit Hyd Qpeak  (cms)=   0.277

     PEAK FLOW       (cms)=   0.037 (i)
     TIME TO PEAK    (hrs)=  12.667
     RUNOFF VOLUME    (mm)=   7.950
     TOTAL RAINFALL   (mm)=  79.602
     RUNOFF COEFFICIENT   =   0.100

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0202)|   Area     (ha)=   3.12
|ID= 1 DT= 5.0 min |   Total Imp(%)=  75.00   Dir. Conn.(%)=  75.00
--------------------

                                IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       2.34          0.78
     Dep. Storage     (mm)=       2.00          5.00
     Average Slope     (%)=       1.00          2.00
     Length            (m)=     144.22         40.00
     Mannings n           =      0.013         0.250

     Max.Eff.Inten.(mm/hr)=      87.88         21.74
               over (min)        5.00         10.00
     Storage Coeff.  (min)=      3.35 (ii)     8.14 (ii)
     Unit Hyd. Tpeak (min)=      5.00         10.00
     Unit Hyd. peak  (cms)=      0.26          0.13
                                                          *TOTALS*
     PEAK FLOW       (cms)=      0.57          0.04          0.602 (iii)
     TIME TO PEAK    (hrs)=     12.08         12.08         12.08
     RUNOFF VOLUME    (mm)=     77.60         16.42         62.31
     TOTAL RAINFALL   (mm)=     79.60         79.60         79.60
     RUNOFF COEFFICIENT   =      0.97          0.21          0.78

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  49.0    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.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0020)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE    |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |    (cms)     (ha.m.)
                           0.0000     0.0000    |   1.2100      0.2910
                           0.0310     0.2900    |   0.0000      0.0000

                                  AREA     QPEAK     TPEAK       R.V.
                                  (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0202)       3.120     0.602     12.08      62.31
   OUTFLOW: ID= 1 (  0020)       3.120     0.015     16.08      61.54

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  2.51
                  TIME SHIFT OF PEAK FLOW         (min)=240.00
                  MAXIMUM  STORAGE   USED        (ha.m.)=  0.1418

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0016)|   Area     (ha)=   0.15   Curve Number    (CN)= 49.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=   5.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.16

     Unit Hyd Qpeak  (cms)=   0.036
```

GEI Consultants

```
     PEAK FLOW       (cms)=   0.006 (i)
     TIME TO PEAK    (hrs)=  12.083
     RUNOFF VOLUME    (mm)=  16.343
     TOTAL RAINFALL   (mm)=  79.602
     RUNOFF COEFFICIENT   =   0.205

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-------------------
| CALIB             |
| STANDHYD (  0201) |   Area    (ha)=   1.22
|ID= 1 DT= 5.0 min  |   Total Imp(%)=  77.00   Dir. Conn.(%)=  77.00
-------------------

                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.94         0.28
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      90.18        40.00
     Mannings n             =    0.013        0.250

     Max.Eff.Inten.(mm/hr)=      87.88        21.74
               over (min)        5.00        10.00
     Storage Coeff.  (min)=       2.53 (ii)    7.11 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.29         0.14
                                                      *TOTALS*
     PEAK FLOW       (cms)=       0.23         0.01         0.242 (iii)
     TIME TO PEAK    (hrs)=      12.08        12.08         12.08
     RUNOFF VOLUME    (mm)=      77.60        16.42         63.53
     TOTAL RAINFALL   (mm)=      79.60        79.60         79.60
     RUNOFF COEFFICIENT   =       0.97         0.21          0.80

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  49.0    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.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0010) |     OVERFLOW IS OFF
| IN= 2---> OUT= 1  |
| DT=  5.0 min      |     OUTFLOW    STORAGE    |  OUTFLOW    STORAGE
--------------------      (cms)      (ha.m.)    |   (cms)      (ha.m.)
                          0.0000      0.0000    |   0.0200      0.0600
                          0.0190      0.0225    |   0.7500      0.0660

                               AREA     QPEAK     TPEAK       R.V.
                               (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0201)     1.220     0.242     12.08      63.53
   OUTFLOW: ID= 1 (  0010)     1.220     0.019     12.67      63.29

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  8.03
                  TIME SHIFT OF PEAK FLOW          (min)= 35.00
                  MAXIMUM  STORAGE   USED        (ha.m.)=  0.0397

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0017) |
|   1 +  2 =  3     |         AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)     (cms)    (hrs)      (mm)
       ID1= 1 (  0010):      1.22   0.019    12.67    63.29
     + ID2= 2 (  0016):      0.15   0.006    12.08    16.34
       ================================================
       ID = 3 (  0017):      1.37   0.026    12.08    58.15

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
================================================================================================================
======
```

```
       V    V   I    SSSSS  U   U    A    L              (v 6.2.2003)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO    TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O     T      T    H   H   Y Y   MM MM  O   O
       O   O     T      T    H   H    Y    M M M  O   O
        OOO      T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2020 Smart City Water Inc
All rights reserved.

                    *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
  Output  filename: C:\Users\wtrinh\AppData\Local\Civica\VH5\a922815c-9855-455d-ab1a-
2baf3f2ff9e0\903e7e14-8849-440b-bfe9-bec2e0f94885\scena
  Summary filename: C:\Users\wtrinh\AppData\Local\Civica\VH5\a922815c-9855-455d-ab1a-
2baf3f2ff9e0\903e7e14-8849-440b-bfe9-bec2e0f94885\scena


DATE: 09/23/2022                          TIME: 11:39:44

USER:


COMMENTS: _____________________________________________________

--------------------------------------------------------------------------------------------------------------
------
  ************************************************
  ** SIMULATION : 25 yr SCS                     **
  ************************************************


--------------------
|    READ STORM    |    Filename: C:\Users\wtrinh\AppD
|                  |              ata\Local\Temp\
|                  |              96c01f6d-a685-460b-917c-658dc405f81d\19a4c490
| Ptotal= 96.19 mm |    Comments: 25 Year - 24 Hour SCS Type II
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.08	0.00	6.17	1.92	12.25	13.85	18.33	1.73
0.17	1.06	6.25	1.92	12.33	13.85	18.42	1.73
0.25	1.06	6.33	1.92	12.42	13.85	18.50	1.73
0.33	1.06	6.42	1.92	12.50	13.85	18.58	1.73
0.42	1.06	6.50	1.92	12.58	13.85	18.67	1.73
0.50	1.06	6.58	1.92	12.67	7.12	18.75	1.73
0.58	1.06	6.67	1.92	12.75	7.12	18.83	1.73
0.67	1.06	6.75	1.92	12.83	7.12	18.92	1.73
0.75	1.06	6.83	1.92	12.92	7.12	19.00	1.73
0.83	1.06	6.92	1.92	13.00	7.12	19.08	1.73
0.92	1.06	7.00	1.92	13.08	7.12	19.17	1.73
1.00	1.06	7.08	1.92	13.17	1.35	19.25	1.73
1.08	1.06	7.17	1.92	13.25	1.35	19.33	1.73
1.17	1.06	7.25	1.92	13.33	1.35	19.42	1.73
1.25	1.06	7.33	1.92	13.42	1.35	19.50	1.73
1.33	1.06	7.42	1.92	13.50	1.35	19.58	1.73
1.42	1.06	7.50	1.92	13.58	1.35	19.67	1.73
1.50	1.06	7.58	1.92	13.67	7.89	19.75	1.73
1.58	1.06	7.67	1.92	13.75	7.89	19.83	1.73
1.67	1.06	7.75	1.92	13.83	7.89	19.92	1.73
1.75	1.06	7.83	1.92	13.92	7.89	20.00	1.73
1.83	1.06	7.92	1.92	14.00	7.89	20.08	1.73
1.92	1.06	8.00	1.92	14.08	7.89	20.17	1.15
2.00	1.06	8.08	1.92	14.17	2.89	20.25	1.15
2.08	1.06	8.17	2.60	14.25	2.89	20.33	1.15
2.17	1.25	8.25	2.60	14.33	2.89	20.42	1.15
2.25	1.25	8.33	2.60	14.42	2.89	20.50	1.15

2.33	1.25	8.42	2.60	14.50	2.89	20.58	1.15
2.42	1.25	8.50	2.60	14.58	2.89	20.67	1.15
2.50	1.25	8.58	2.60	14.67	2.89	20.75	1.15
2.58	1.25	8.67	2.60	14.75	2.89	20.83	1.15
2.67	1.25	8.75	2.60	14.83	2.89	20.92	1.15
2.75	1.25	8.83	2.60	14.92	2.89	21.00	1.15
2.83	1.25	8.92	2.60	15.00	2.89	21.08	1.15
2.92	1.25	9.00	2.60	15.08	2.89	21.17	1.15
3.00	1.25	9.08	2.60	15.17	2.89	21.25	1.15
3.08	1.25	9.17	3.08	15.25	2.89	21.33	1.15
3.17	1.25	9.25	3.08	15.33	2.89	21.42	1.15
3.25	1.25	9.33	3.08	15.42	2.89	21.50	1.15
3.33	1.25	9.42	3.08	15.50	2.89	21.58	1.15
3.42	1.25	9.50	3.08	15.58	2.89	21.67	1.15
3.50	1.25	9.58	3.08	15.67	2.89	21.75	1.15
3.58	1.25	9.67	3.46	15.75	2.89	21.83	1.15
3.67	1.25	9.75	3.46	15.83	2.89	21.92	1.15
3.75	1.25	9.83	3.46	15.92	2.89	22.00	1.15
3.83	1.25	9.92	3.46	16.00	2.89	22.08	1.15
3.92	1.25	10.00	3.46	16.08	2.89	22.17	1.15
4.00	1.25	10.08	3.46	16.17	1.73	22.25	1.15
4.08	1.25	10.17	4.43	16.25	1.73	22.33	1.15
4.17	1.54	10.25	4.43	16.33	1.73	22.42	1.15
4.25	1.54	10.33	4.43	16.42	1.73	22.50	1.15
4.33	1.54	10.42	4.43	16.50	1.73	22.58	1.15
4.42	1.54	10.50	4.43	16.58	1.73	22.67	1.15
4.50	1.54	10.58	4.43	16.67	1.73	22.75	1.15
4.58	1.54	10.67	5.96	16.75	1.73	22.83	1.15
4.67	1.54	10.75	5.96	16.83	1.73	22.92	1.15
4.75	1.54	10.83	5.96	16.92	1.73	23.00	1.15
4.83	1.54	10.92	5.96	17.00	1.73	23.08	1.15
4.92	1.54	11.00	5.96	17.08	1.73	23.17	1.15
5.00	1.54	11.08	5.96	17.17	1.73	23.25	1.15
5.08	1.54	11.17	9.24	17.25	1.73	23.33	1.15
5.17	1.54	11.25	9.24	17.33	1.73	23.42	1.15
5.25	1.54	11.33	9.24	17.42	1.73	23.50	1.15
5.33	1.54	11.42	9.24	17.50	1.73	23.58	1.15
5.42	1.54	11.50	9.24	17.58	1.73	23.67	1.15
5.50	1.54	11.58	9.24	17.67	1.73	23.75	1.15
5.58	1.54	11.67	40.02	17.75	1.73	23.83	1.15
5.67	1.54	11.75	40.02	17.83	1.73	23.92	1.15
5.75	1.54	11.83	40.02	17.92	1.73	24.00	1.15
5.83	1.54	11.92	106.20	18.00	1.73	24.08	1.15
5.92	1.54	12.00	106.20	18.08	1.73		
6.00	1.54	12.08	106.20	18.17	1.73		
6.08	1.54	12.17	13.85	18.25	1.73		

CALIB					
NASHYD (0101)	Area	(ha)=	4.49	Curve Number	(CN)= 32.0
ID= 1 DT= 5.0 min	Ia	(mm)=	10.00	# of Linear Res.	(N)= 3.00
	U.H. Tp	(hrs)=	0.62		

Unit Hyd Qpeak (cms)= 0.277

PEAK FLOW (cms)= 0.055 (i)
TIME TO PEAK (hrs)= 12.667
RUNOFF VOLUME (mm)= 11.866
TOTAL RAINFALL (mm)= 96.185
RUNOFF COEFFICIENT = 0.123

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB					
STANDHYD (0202)	Area	(ha)=	3.12		
ID= 1 DT= 5.0 min	Total Imp	(%)=	75.00	Dir. Conn.	(%)= 75.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	2.34	0.78
Dep. Storage	(mm)=	2.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	144.22	40.00
Mannings n	=	0.013	0.250
Max.Eff.Inten.	(mm/hr)=	106.20	31.00
over	(min)	5.00	10.00
Storage Coeff.	(min)=	3.11 (ii)	7.55 (ii)
Unit Hyd. Tpeak	(min)=	5.00	10.00
Unit Hyd. peak	(cms)=	0.27	0.13

		TOTALS
PEAK FLOW	(cms)=	0.69	0.05	0.739 (iii)
TIME TO PEAK	(hrs)=	12.08	12.08	12.08
RUNOFF VOLUME	(mm)=	94.18	23.39	76.48
TOTAL RAINFALL	(mm)=	96.19	96.19	96.19
RUNOFF COEFFICIENT	=	0.98	0.24	0.80

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 49.0 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.

RESERVOIR(0020)	OVERFLOW IS OFF
IN= 2---> OUT= 1	
DT= 5.0 min	

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	1.2100	0.2910
0.0310	0.2900	0.0000	0.0000

		AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (	0202)	3.120	0.739	12.08	76.48
OUTFLOW: ID= 1 (	0020)	3.120	0.019	16.08	75.72

PEAK FLOW REDUCTION [Qout/Qin](%)= 2.51
TIME SHIFT OF PEAK FLOW (min)=240.00
MAXIMUM STORAGE USED (ha.m.)= 0.1739

CALIB					
NASHYD (0016)	Area	(ha)=	0.15	Curve Number	(CN)= 49.0
ID= 1 DT= 5.0 min	Ia	(mm)=	5.00	# of Linear Res.	(N)= 3.00
	U.H. Tp	(hrs)=	0.16		

Unit Hyd Qpeak (cms)= 0.036

PEAK FLOW (cms)= 0.009 (i)
TIME TO PEAK (hrs)= 12.083
RUNOFF VOLUME (mm)= 23.277
TOTAL RAINFALL (mm)= 96.185
RUNOFF COEFFICIENT = 0.242

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB					
STANDHYD (0201)	Area	(ha)=	1.22		
ID= 1 DT= 5.0 min	Total Imp	(%)=	77.00	Dir. Conn.	(%)= 77.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.94	0.28
Dep. Storage	(mm)=	2.00	5.00
Average Slope	(%)=	1.00	2.00
Length	(m)=	90.18	40.00
Mannings n	=	0.013	0.250
Max.Eff.Inten.	(mm/hr)=	106.20	31.00
over	(min)	5.00	10.00
Storage Coeff.	(min)=	2.34 (ii)	6.59 (ii)
Unit Hyd. Tpeak	(min)=	5.00	10.00
Unit Hyd. peak	(cms)=	0.30	0.14

TOTALS

GEI Consultants

```
     PEAK FLOW       (cms)=       0.28         0.02          0.296 (iii)
     TIME TO PEAK    (hrs)=      12.08        12.08          12.08
     RUNOFF VOLUME    (mm)=      94.18        23.39          77.90
     TOTAL RAINFALL   (mm)=      96.19        96.19          96.19
     RUNOFF COEFFICIENT   =       0.98         0.24           0.81

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0     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.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0010)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE    |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)    |   (cms)     (ha.m.)
                          0.0000     0.0000    |  0.0200      0.0600
                          0.0190     0.0225    |  0.7500      0.0660

                               AREA     QPEAK     TPEAK       R.V.
                               (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0201)     1.220     0.296     12.08      77.90
   OUTFLOW: ID= 1 (  0010)     1.220     0.020     13.08      77.66

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  6.66
                  TIME SHIFT OF PEAK FLOW          (min)= 60.00
                  MAXIMUM  STORAGE   USED        (ha.m.)=  0.0498

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0017)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)     (cms)    (hrs)     (mm)
       ID1= 1 (  0010):     1.22   0.020    13.08    77.66
     + ID2= 2 (  0016):     0.15   0.009    12.08    23.28
       ================================================
       ID = 3 (  0017):     1.37   0.029    12.08    71.70

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
================================================================================
======

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2003)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2020 Smart City Water Inc
All rights reserved.


                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
  Output  filename: C:\Users\wtrinh\AppData\Local\Civica\VH5\a922815c-9855-455d-ab1a-
2baf3f2ff9e0\ca251c49-2e85-42e8-9735-f544bca61a2e\scena
  Summary filename: C:\Users\wtrinh\AppData\Local\Civica\VH5\a922815c-9855-455d-ab1a-
2baf3f2ff9e0\ca251c49-2e85-42e8-9735-f544bca61a2e\scena


DATE: 09/23/2022                          TIME: 11:39:44

USER:
```

COMMENTS: _____

```
  **********************************************
  ** SIMULATION : 50 yr SCS                   **
  **********************************************

--------------------
|    READ STORM    |    Filename: C:\Users\wtrinh\AppD
|                  |              ata\Local\Temp\
|                  |              96c01f6d-a685-460b-917c-658dc405f81d\93a33bf7
| Ptotal=109.09 mm |    Comments: 50 Year - 24 Hour SCS Type II
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.08	0.00	6.17	2.18	12.25	15.71	18.33	1.96
0.17	1.20	6.25	2.18	12.33	15.71	18.42	1.96
0.25	1.20	6.33	2.18	12.42	15.71	18.50	1.96
0.33	1.20	6.42	2.18	12.50	15.71	18.58	1.96
0.42	1.20	6.50	2.18	12.58	15.71	18.67	1.96
0.50	1.20	6.58	2.18	12.67	8.07	18.75	1.96
0.58	1.20	6.67	2.18	12.75	8.07	18.83	1.96
0.67	1.20	6.75	2.18	12.83	8.07	18.92	1.96
0.75	1.20	6.83	2.18	12.92	8.07	19.00	1.96
0.83	1.20	6.92	2.18	13.00	8.07	19.08	1.96
0.92	1.20	7.00	2.18	13.08	8.07	19.17	1.96
1.00	1.20	7.08	2.18	13.17	1.53	19.25	1.96
1.08	1.20	7.17	2.18	13.25	1.53	19.33	1.96
1.17	1.20	7.25	2.18	13.33	1.53	19.42	1.96
1.25	1.20	7.33	2.18	13.42	1.53	19.50	1.96
1.33	1.20	7.42	2.18	13.50	1.53	19.58	1.96
1.42	1.20	7.50	2.18	13.58	1.53	19.67	1.96
1.50	1.20	7.58	2.18	13.67	8.95	19.75	1.96
1.58	1.20	7.67	2.18	13.75	8.95	19.83	1.96
1.67	1.20	7.75	2.18	13.83	8.95	19.92	1.96
1.75	1.20	7.83	2.18	13.92	8.95	20.00	1.96
1.83	1.20	7.92	2.18	14.00	8.95	20.08	1.96
1.92	1.20	8.00	2.18	14.08	8.95	20.17	1.31
2.00	1.20	8.08	2.18	14.17	3.27	20.25	1.31
2.08	1.20	8.17	2.95	14.25	3.27	20.33	1.31
2.17	1.42	8.25	2.95	14.33	3.27	20.42	1.31
2.25	1.42	8.33	2.95	14.42	3.27	20.50	1.31
2.33	1.42	8.42	2.95	14.50	3.27	20.58	1.31
2.42	1.42	8.50	2.95	14.58	3.27	20.67	1.31
2.50	1.42	8.58	2.95	14.67	3.27	20.75	1.31
2.58	1.42	8.67	2.95	14.75	3.27	20.83	1.31
2.67	1.42	8.75	2.95	14.83	3.27	20.92	1.31
2.75	1.42	8.83	2.95	14.92	3.27	21.00	1.31
2.83	1.42	8.92	2.95	15.00	3.27	21.08	1.31
2.92	1.42	9.00	2.95	15.08	3.27	21.17	1.31
3.00	1.42	9.08	2.95	15.17	3.27	21.25	1.31
3.08	1.42	9.17	3.49	15.25	3.27	21.33	1.31
3.17	1.42	9.25	3.49	15.33	3.27	21.42	1.31
3.25	1.42	9.33	3.49	15.42	3.27	21.50	1.31
3.33	1.42	9.42	3.49	15.50	3.27	21.58	1.31
3.42	1.42	9.50	3.49	15.58	3.27	21.67	1.31
3.50	1.42	9.58	3.49	15.67	3.27	21.75	1.31
3.58	1.42	9.67	3.93	15.75	3.27	21.83	1.31
3.67	1.42	9.75	3.93	15.83	3.27	21.92	1.31
3.75	1.42	9.83	3.93	15.92	3.27	22.00	1.31
3.83	1.42	9.92	3.93	16.00	3.27	22.08	1.31
3.92	1.42	10.00	3.93	16.08	3.27	22.17	1.31
4.00	1.42	10.08	3.93	16.17	1.96	22.25	1.31
4.08	1.42	10.17	5.02	16.25	1.96	22.33	1.31
4.17	1.75	10.25	5.02	16.33	1.96	22.42	1.31
4.25	1.75	10.33	5.02	16.42	1.96	22.50	1.31
4.33	1.75	10.42	5.02	16.50	1.96	22.58	1.31
4.42	1.75	10.50	5.02	16.58	1.96	22.67	1.31
4.50	1.75	10.58	5.02	16.67	1.96	22.75	1.31
4.58	1.75	10.67	6.76	16.75	1.96	22.83	1.31

4.67	1.75	10.75	6.76	16.83	1.96	22.92	1.31
4.75	1.75	10.83	6.76	16.92	1.96	23.00	1.31
4.83	1.75	10.92	6.76	17.00	1.96	23.08	1.31
4.92	1.75	11.00	6.76	17.08	1.96	23.17	1.31
5.00	1.75	11.08	6.76	17.17	1.96	23.25	1.31
5.08	1.75	11.17	10.47	17.25	1.96	23.33	1.31
5.17	1.75	11.25	10.47	17.33	1.96	23.42	1.31
5.25	1.75	11.33	10.47	17.42	1.96	23.50	1.31
5.33	1.75	11.42	10.47	17.50	1.96	23.58	1.31
5.42	1.75	11.50	10.47	17.58	1.96	23.67	1.31
5.50	1.75	11.58	10.47	17.67	1.96	23.75	1.31
5.58	1.75	11.67	45.39	17.75	1.96	23.83	1.31
5.67	1.75	11.75	45.39	17.83	1.96	23.92	1.31
5.75	1.75	11.83	45.39	17.92	1.96	24.00	1.31
5.83	1.75	11.92	120.45	18.00	1.96	24.08	1.31
5.92	1.75	12.00	120.45	18.08	1.96		
6.00	1.75	12.08	120.45	18.17	1.96		
6.08	1.75	12.17	15.71	18.25	1.96		

CALIB
NASHYD (0101) ID= 1 DT= 5.0 min

Area (ha)= 4.49 Curve Number (CN)= 32.0
Ia (mm)= 10.00 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= 0.62

Unit Hyd Qpeak (cms)= 0.277

PEAK FLOW (cms)= 0.072 (i)
TIME TO PEAK (hrs)= 12.667
RUNOFF VOLUME (mm)= 15.371
TOTAL RAINFALL (mm)= 109.095
RUNOFF COEFFICIENT = 0.141

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB
STANDHYD (0202) ID= 1 DT= 5.0 min

Area (ha)= 3.12
Total Imp(%)= 75.00 Dir. Conn.(%)= 75.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	2.34	0.78	
Dep. Storage	(mm)=	2.00	5.00	
Average Slope	(%)=	1.00	2.00	
Length	(m)=	144.22	40.00	
Mannings n	=	0.013	0.250	
Max.Eff.Inten.(mm/hr)=		120.45	39.01	
over (min)		5.00	10.00	
Storage Coeff. (min)=		2.95 (ii)	7.18 (ii)	
Unit Hyd. Tpeak (min)=		5.00	10.00	
Unit Hyd. peak (cms)=		0.28	0.14	
				TOTALS
PEAK FLOW	(cms)=	0.78	0.07	0.847 (iii)
TIME TO PEAK	(hrs)=	12.08	12.08	12.08
RUNOFF VOLUME	(mm)=	107.09	29.41	87.67
TOTAL RAINFALL	(mm)=	109.09	109.09	109.09
RUNOFF COEFFICIENT	=	0.98	0.27	0.80

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 49.0 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.

RESERVOIR(0020) IN= 2---> OUT= 1 DT= 5.0 min

OVERFLOW IS OFF

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	1.2100	0.2910
0.0310	0.2900	0.0000	0.0000

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0202)	3.120	0.847	12.08	87.67
OUTFLOW: ID= 1 (0020)	3.120	0.021	16.08	86.91

PEAK FLOW REDUCTION [Qout/Qin](%)= 2.51
TIME SHIFT OF PEAK FLOW (min)=240.00
MAXIMUM STORAGE USED (ha.m.)= 0.1991

CALIB
NASHYD (0016) ID= 1 DT= 5.0 min

Area (ha)= 0.15 Curve Number (CN)= 49.0
Ia (mm)= 5.00 # of Linear Res.(N)= 3.00
U.H. Tp(hrs)= 0.16

Unit Hyd Qpeak (cms)= 0.036

PEAK FLOW (cms)= 0.012 (i)
TIME TO PEAK (hrs)= 12.083
RUNOFF VOLUME (mm)= 29.272
TOTAL RAINFALL (mm)= 109.095
RUNOFF COEFFICIENT = 0.268

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB
STANDHYD (0201) ID= 1 DT= 5.0 min

Area (ha)= 1.22
Total Imp(%)= 77.00 Dir. Conn.(%)= 77.00

		IMPERVIOUS	PERVIOUS (i)	
Surface Area	(ha)=	0.94	0.28	
Dep. Storage	(mm)=	2.00	5.00	
Average Slope	(%)=	1.00	2.00	
Length	(m)=	90.18	40.00	
Mannings n	=	0.013	0.250	
Max.Eff.Inten.(mm/hr)=		120.45	39.01	
over (min)		5.00	10.00	
Storage Coeff. (min)=		2.23 (ii)	6.27 (ii)	
Unit Hyd. Tpeak (min)=		5.00	10.00	
Unit Hyd. peak (cms)=		0.30	0.15	
				TOTALS
PEAK FLOW	(cms)=	0.31	0.03	0.339 (iii)
TIME TO PEAK	(hrs)=	12.08	12.08	12.08
RUNOFF VOLUME	(mm)=	107.09	29.41	89.22
TOTAL RAINFALL	(mm)=	109.09	109.09	109.09
RUNOFF COEFFICIENT	=	0.98	0.27	0.82

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 49.0 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.

RESERVOIR(0010) IN= 2---> OUT= 1 DT= 5.0 min

OVERFLOW IS OFF

OUTFLOW (cms)	STORAGE (ha.m.)	OUTFLOW (cms)	STORAGE (ha.m.)
0.0000	0.0000	0.0200	0.0600
0.0190	0.0225	0.7500	0.0660

	AREA (ha)	QPEAK (cms)	TPEAK (hrs)	R.V. (mm)
INFLOW : ID= 2 (0201)	1.220	0.339	12.08	89.22
OUTFLOW: ID= 1 (0010)	1.220	0.020	13.08	88.98

GEI Consultants

```
                PEAK   FLOW   REDUCTION [Qout/Qin](%)=  5.88
                TIME SHIFT OF PEAK FLOW          (min)= 60.00
                MAXIMUM  STORAGE   USED        (ha.m.)=  0.0581

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0017)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0010):     1.22   0.020    13.08    88.98
     + ID2= 2 (  0016):     0.15   0.012    12.08    29.27
       ====================================================
       ID = 3 (  0017):     1.37   0.031    12.08    82.44

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
================================================================================================================
======

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2003)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

       OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
      O   O    T      T    H   H   Y Y   MM MM  O   O
      O   O    T      T    H   H    Y    M   M  O   O
       OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
Copyright 2007 - 2020 Smart City Water Inc
All rights reserved.


                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
  Output  filename: C:\Users\wtrinh\AppData\Local\Civica\VH5\a922815c-9855-455d-ab1a-
2baf3f2ff9e0\904df38a-21ba-415f-aff7-e72b26785b9d\scena
  Summary filename: C:\Users\wtrinh\AppData\Local\Civica\VH5\a922815c-9855-455d-ab1a-
2baf3f2ff9e0\904df38a-21ba-415f-aff7-e72b26785b9d\scena


DATE: 09/23/2022                          TIME: 11:39:44

USER:


COMMENTS: _____________________________________________________


--------------------------------------------------------------------------------------------------------------
------
  ***********************************************
  ** SIMULATION : 100 yr SCS                   **
  ***********************************************


--------------------
|    READ STORM    |    Filename: C:\Users\wtrinh\AppD
|                  |              ata\Local\Temp\
|                  |              96c01f6d-a685-460b-917c-658dc405f81d\309a56cd
| Ptotal=122.40 mm |    Comments: 100 Year - 24 Hour SCS Type II
--------------------
                TIME    RAIN |  TIME    RAIN | '  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr | '   hrs   mm/hr |   hrs   mm/hr
                0.08    0.00 |  6.17    2.45 |  12.25   17.63 |  18.33    2.20
                0.17    1.35 |  6.25    2.45 |  12.33   17.63 |  18.42    2.20
                0.25    1.35 |  6.33    2.45 |  12.42   17.63 |  18.50    2.20
                0.33    1.35 |  6.42    2.45 |  12.50   17.63 |  18.58    2.20
                0.42    1.35 |  6.50    2.45 |  12.58   17.63 |  18.67    2.20
                0.50    1.35 |  6.58    2.45 |  12.67    9.06 |  18.75    2.20
                0.58    1.35 |  6.67    2.45 |  12.75    9.06 |  18.83    2.20
                0.67    1.35 |  6.75    2.45 |  12.83    9.06 |  18.92    2.20
                0.75    1.35 |  6.83    2.45 |  12.92    9.06 |  19.00    2.20
                0.83    1.35 |  6.92    2.45 |  13.00    9.06 |  19.08    2.20
                0.92    1.35 |  7.00    2.45 |  13.08    9.06 |  19.17    2.20
                1.00    1.35 |  7.08    2.45 |  13.17    1.71 |  19.25    2.20
                1.08    1.35 |  7.17    2.45 |  13.25    1.71 |  19.33    2.20
                1.17    1.35 |  7.25    2.45 |  13.33    1.71 |  19.42    2.20
                1.25    1.35 |  7.33    2.45 |  13.42    1.71 |  19.50    2.20
                1.33    1.35 |  7.42    2.45 |  13.50    1.71 |  19.58    2.20
                1.42    1.35 |  7.50    2.45 |  13.58    1.71 |  19.67    2.20
                1.50    1.35 |  7.58    2.45 |  13.67   10.04 |  19.75    2.20
                1.58    1.35 |  7.67    2.45 |  13.75   10.04 |  19.83    2.20
                1.67    1.35 |  7.75    2.45 |  13.83   10.04 |  19.92    2.20
                1.75    1.35 |  7.83    2.45 |  13.92   10.04 |  20.00    2.20
                1.83    1.35 |  7.92    2.45 |  14.00   10.04 |  20.08    2.20
                1.92    1.35 |  8.00    2.45 |  14.08   10.04 |  20.17    1.47
                2.00    1.35 |  8.08    2.45 |  14.17    3.67 |  20.25    1.47
                2.08    1.35 |  8.17    3.30 |  14.25    3.67 |  20.33    1.47
                2.17    1.59 |  8.25    3.30 |  14.33    3.67 |  20.42    1.47
                2.25    1.59 |  8.33    3.30 |  14.42    3.67 |  20.50    1.47
                2.33    1.59 |  8.42    3.30 |  14.50    3.67 |  20.58    1.47
                2.42    1.59 |  8.50    3.30 |  14.58    3.67 |  20.67    1.47
                2.50    1.59 |  8.58    3.30 |  14.67    3.67 |  20.75    1.47
                2.58    1.59 |  8.67    3.30 |  14.75    3.67 |  20.83    1.47
                2.67    1.59 |  8.75    3.30 |  14.83    3.67 |  20.92    1.47
                2.75    1.59 |  8.83    3.30 |  14.92    3.67 |  21.00    1.47
                2.83    1.59 |  8.92    3.30 |  15.00    3.67 |  21.08    1.47
                2.92    1.59 |  9.00    3.30 |  15.08    3.67 |  21.17    1.47
                3.00    1.59 |  9.08    3.30 |  15.17    3.67 |  21.25    1.47
                3.08    1.59 |  9.17    3.92 |  15.25    3.67 |  21.33    1.47
                3.17    1.59 |  9.25    3.92 |  15.33    3.67 |  21.42    1.47
                3.25    1.59 |  9.33    3.92 |  15.42    3.67 |  21.50    1.47
                3.33    1.59 |  9.42    3.92 |  15.50    3.67 |  21.58    1.47
                3.42    1.59 |  9.50    3.92 |  15.58    3.67 |  21.67    1.47
                3.50    1.59 |  9.58    3.92 |  15.67    3.67 |  21.75    1.47
                3.58    1.59 |  9.67    4.41 |  15.75    3.67 |  21.83    1.47
                3.67    1.59 |  9.75    4.41 |  15.83    3.67 |  21.92    1.47
                3.75    1.59 |  9.83    4.41 |  15.92    3.67 |  22.00    1.47
                3.83    1.59 |  9.92    4.41 |  16.00    3.67 |  22.08    1.47
                3.92    1.59 | 10.00    4.41 |  16.08    3.67 |  22.17    1.47
                4.00    1.59 | 10.08    4.41 |  16.17    2.20 |  22.25    1.47
                4.08    1.59 | 10.17    5.63 |  16.25    2.20 |  22.33    1.47
                4.17    1.96 | 10.25    5.63 |  16.33    2.20 |  22.42    1.47
                4.25    1.96 | 10.33    5.63 |  16.42    2.20 |  22.50    1.47
                4.33    1.96 | 10.42    5.63 |  16.50    2.20 |  22.58    1.47
                4.42    1.96 | 10.50    5.63 |  16.58    2.20 |  22.67    1.47
                4.50    1.96 | 10.58    5.63 |  16.67    2.20 |  22.75    1.47
                4.58    1.96 | 10.67    7.59 |  16.75    2.20 |  22.83    1.47
                4.67    1.96 | 10.75    7.59 |  16.83    2.20 |  22.92    1.47
                4.75    1.96 | 10.83    7.59 |  16.92    2.20 |  23.00    1.47
                4.83    1.96 | 10.92    7.59 |  17.00    2.20 |  23.08    1.47
                4.92    1.96 | 11.00    7.59 |  17.08    2.20 |  23.17    1.47
                5.00    1.96 | 11.08    7.59 |  17.17    2.20 |  23.25    1.47
                5.08    1.96 | 11.17   11.75 |  17.25    2.20 |  23.33    1.47
                5.17    1.96 | 11.25   11.75 |  17.33    2.20 |  23.42    1.47
                5.25    1.96 | 11.33   11.75 |  17.42    2.20 |  23.50    1.47
                5.33    1.96 | 11.42   11.75 |  17.50    2.20 |  23.58    1.47
                5.42    1.96 | 11.50   11.75 |  17.58    2.20 |  23.67    1.47
                5.50    1.96 | 11.58   11.75 |  17.67    2.20 |  23.75    1.47
                5.58    1.96 | 11.67   50.92 |  17.75    2.20 |  23.83    1.47
                5.67    1.96 | 11.75   50.92 |  17.83    2.20 |  23.92    1.47
                5.75    1.96 | 11.83   50.92 |  17.92    2.20 |  24.00    1.47
                5.83    1.96 | 11.92  135.13 |  18.00    2.20 |  24.08    1.47
                5.92    1.96 | 12.00  135.13 |  18.08    2.20 |
                6.00    1.96 | 12.08  135.13 |  18.17    2.20 |
                6.08    1.96 | 12.17   17.63 |  18.25    2.20 |

--------------------------------------------------------------------------------

--------------------
| CALIB            |
| NASHYD   (  0101)|   Area     (ha)=   4.49   Curve Number    (CN)= 32.0
|ID= 1 DT= 5.0 min |   Ia       (mm)=  10.00   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.62

     Unit Hyd Qpeak  (cms)=   0.277
```

```
     PEAK FLOW       (cms)=   0.092 (i)
     TIME TO PEAK    (hrs)=  12.667
     RUNOFF VOLUME    (mm)=  19.372
     TOTAL RAINFALL   (mm)= 122.402
     RUNOFF COEFFICIENT   =   0.158

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-------------------
| CALIB             |
| STANDHYD (  0202) |   Area    (ha)=   3.12
|ID= 1 DT= 5.0 min  |   Total Imp(%)=  75.00   Dir. Conn.(%)=  75.00
-------------------

                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       2.34         0.78
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=     144.22        40.00
     Mannings n            =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     135.13        47.92
               over (min)          5.00        10.00
     Storage Coeff.  (min)=       2.82 (ii)    6.85 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.28         0.14
                                                      *TOTALS*
     PEAK FLOW       (cms)=       0.88         0.08       0.959 (iii)
     TIME TO PEAK    (hrs)=      12.08        12.08       12.08
     RUNOFF VOLUME    (mm)=     120.40        36.10       99.33
     TOTAL RAINFALL   (mm)=     122.40       122.40      122.40
     RUNOFF COEFFICIENT   =       0.98         0.29        0.81

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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.

--------------------------------------------------------------------------------
-------------------
| RESERVOIR(  0020) |     OVERFLOW IS OFF
| IN= 2---> OUT= 1  |
| DT=  5.0 min      |     OUTFLOW    STORAGE    |  OUTFLOW    STORAGE
-------------------      (cms)      (ha.m.)    |   (cms)      (ha.m.)
                         0.0000      0.0000    |   1.2100      0.2910
                         0.0310      0.2900    |   0.0000      0.0000

                              AREA     QPEAK     TPEAK       R.V.
                              (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0202)     3.120     0.959     12.08      99.33
   OUTFLOW: ID= 1 (  0020)     3.120     0.024     16.08      98.56

                 PEAK   FLOW   REDUCTION [Qout/Qin](%)=  2.51
                 TIME SHIFT OF PEAK FLOW          (min)=240.00
                 MAXIMUM  STORAGE   USED        (ha.m.)=  0.2255

--------------------------------------------------------------------------------
-------------------
| CALIB             |
| NASHYD   (  0016) |   Area    (ha)=   0.15   Curve Number   (CN)= 49.0
|ID= 1 DT= 5.0 min  |   Ia      (mm)=   5.00   # of Linear Res.(N)= 3.00
-------------------   U.H. Tp(hrs)=   0.16

     Unit Hyd Qpeak  (cms)=   0.036

     PEAK FLOW       (cms)=   0.014 (i)
     TIME TO PEAK    (hrs)=  12.083
     RUNOFF VOLUME    (mm)=  35.939
     TOTAL RAINFALL   (mm)= 122.402
     RUNOFF COEFFICIENT   =   0.294

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
-------------------
| CALIB             |
| STANDHYD (  0201) |   Area    (ha)=   1.22
|ID= 1 DT= 5.0 min  |   Total Imp(%)=  77.00   Dir. Conn.(%)=  77.00
-------------------

                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.94         0.28
     Dep. Storage     (mm)=       2.00         5.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      90.18        40.00
     Mannings n            =      0.013        0.250

     Max.Eff.Inten.(mm/hr)=     135.13        47.92
               over (min)          5.00        10.00
     Storage Coeff.  (min)=       2.13 (ii)    5.99 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.31         0.15
                                                      *TOTALS*
     PEAK FLOW       (cms)=       0.35         0.03       0.384 (iii)
     TIME TO PEAK    (hrs)=      12.08        12.08       12.08
     RUNOFF VOLUME    (mm)=     120.40        36.10      101.01
     TOTAL RAINFALL   (mm)=     122.40       122.40      122.40
     RUNOFF COEFFICIENT   =       0.98         0.29        0.83

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  49.0    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.

--------------------------------------------------------------------------------
-------------------
| RESERVOIR(  0010) |     OVERFLOW IS OFF
| IN= 2---> OUT= 1  |
| DT=  5.0 min      |     OUTFLOW    STORAGE    |  OUTFLOW    STORAGE
-------------------      (cms)      (ha.m.)    |   (cms)      (ha.m.)
                         0.0000      0.0000    |   0.0200      0.0600
                         0.0190      0.0225    |   0.7500      0.0660

                              AREA     QPEAK     TPEAK       R.V.
                              (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0201)     1.220     0.384     12.08      101.01
   OUTFLOW: ID= 1 (  0010)     1.220     0.063     12.33      100.77

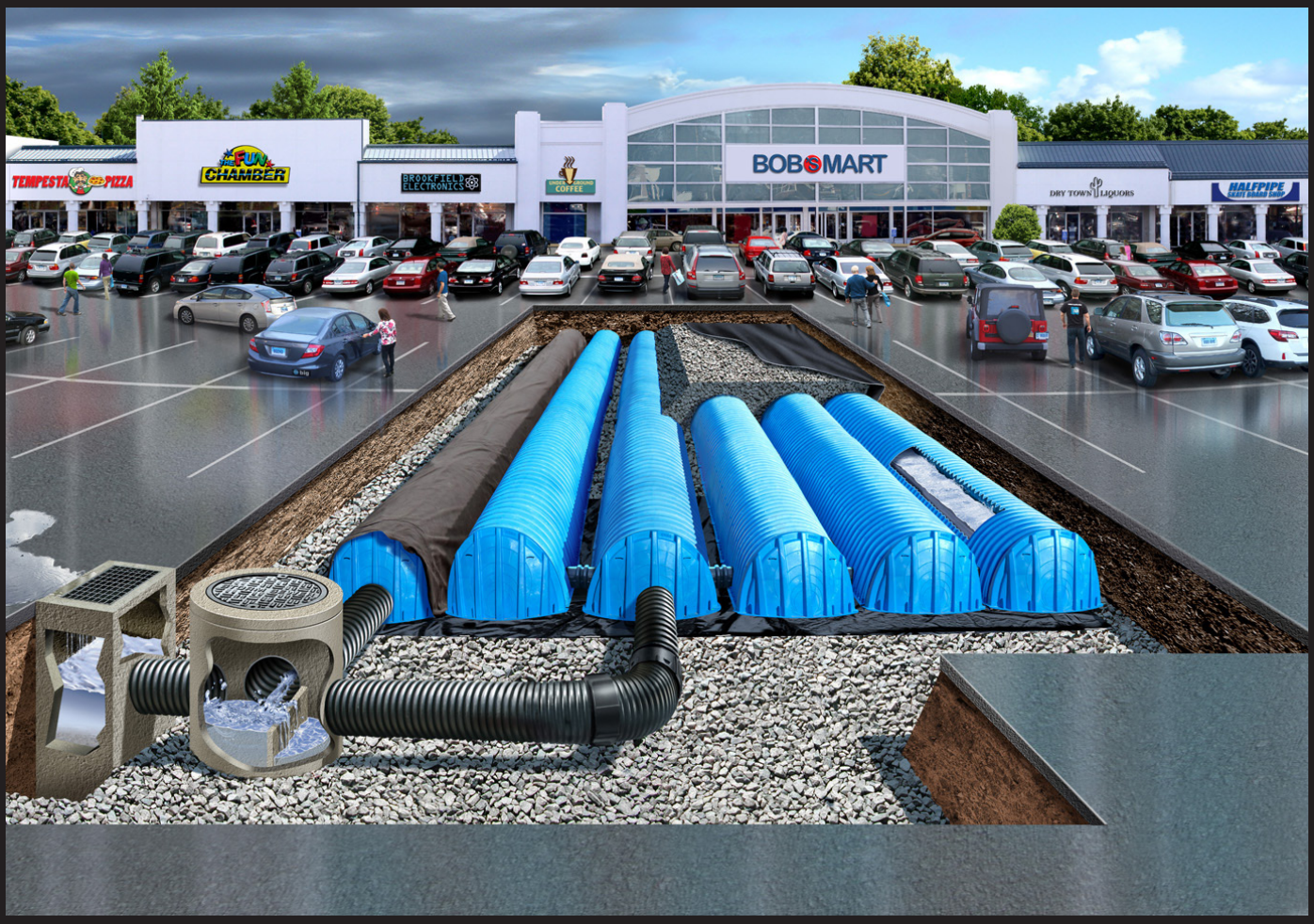
                 PEAK   FLOW   REDUCTION [Qout/Qin](%)= 16.32
                 TIME SHIFT OF PEAK FLOW          (min)= 15.00
                 MAXIMUM  STORAGE   USED        (ha.m.)=  0.0605

--------------------------------------------------------------------------------
-------------------
| ADD HYD  (  0017) |
|   1 +  2 =  3     |          AREA    QPEAK    TPEAK     R.V.
-------------------           (ha)     (cms)    (hrs)     (mm)
       ID1= 1 (  0010):     1.22    0.063    12.33   100.77
     + ID2= 2 (  0016):     0.15    0.014    12.08    35.94
       ==========================================================
       ID = 3 (  0017):     1.37    0.070    12.33    93.67

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
```

CULTEC SEPARATOR™ ROW

WATER QUALITY SYSTEM



OPERATION & MAINTENANCE GUIDE

FOR CULTEC STORMWATER MANAGEMENT SYSTEMS

GLOBE VERIFIED VÉRIFIÉ

STORMWATER MANAGEMENT SOLUTIONS

CULTEC®

Published by
CULTEC, Inc.
P.O. Box 280
878 Federal Road
Brookfield, Connecticut 06804 USA
www.cultec.com

Copyright Notice
© 2022 CULTEC, Inc. All rights reserved. Printed in the USA.
This document and any accompanying CULTEC products are copyrighted by CULTEC, Inc. Any reproduction and/or distribution without prior written consent from CULTEC, Inc. is strictly prohibited.

Disclaimers:
The drawings, photographs and illustrations shown in this document are for illustrative purposes only and are not necessarily to scale.
Actual designs may vary.

CULTEC reserves the right to make design and/or specification changes at any time without notice at CULTEC's sole discretion.

CULTEC is not responsible for typographical errors.

Protected by one or more of the following patents:
Protected by one or more of the following patents:
U.S. Patents 6,129,482; 6,322,288; 6,854,925; 7,226,241; 7,806,627; 8,366,346; 8,425,148; and others; U.S. Designs D613819; D638,095; D668,318 and others; Canadian Patent 2,591,255 and others; Community Designs 1092191; 1745209; and others.

CULTEC, the CULTEC logo, RECHARGER, CONTACTOR, HVLV, PAC, STORMFILTER, STORMGENIE and The Chamber with The Stripe are registered trademarks of CULTEC, Inc.
Chamber of Choice, 902, HD, 100, 125, 150, 150XL, 180, 280, 330, 330XL, 360, V8, 902, Field Drain Panel, C-1, C-2, C-3, C-4, EZ-24, Landscape Series are trademarks of CULTEC, Inc. All rights reserved.

Contact Information:
For general information on our other products and services, please contact our offices within the United States at (800)428-5832, (203)775-4416 ext. 202, or e-mail us at custservice@cultec.com.

For technical support, please call (203)775-4416 ext. 203 or e-mail tech@cultec.com.

Visit www.cultec.com/downloads.html for Product Downloads and CAD details.

Doc ID: CLT043 02-22
Feb 2022

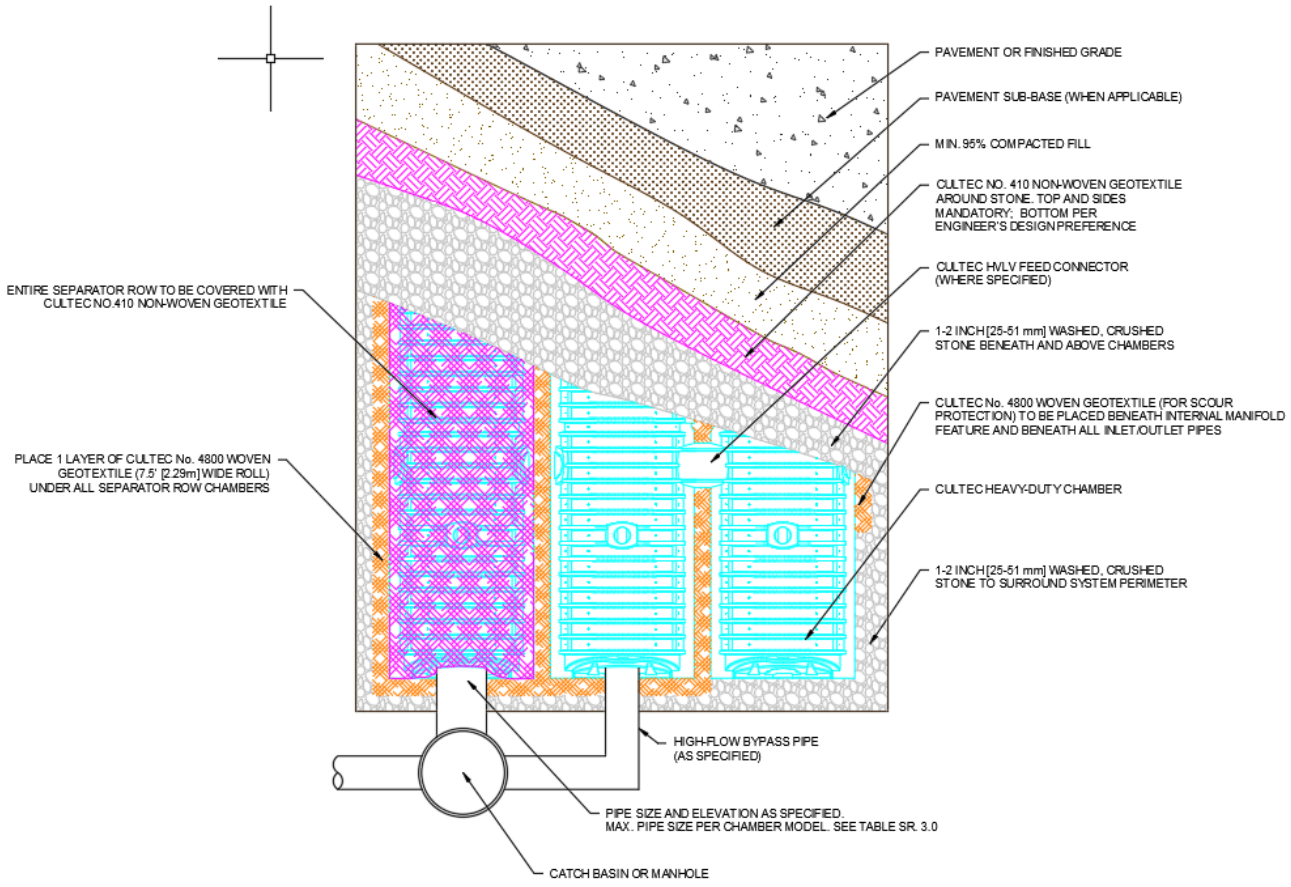
Introduction

CULTEC's Separator™ Row is an inexpensive means of removing Total Suspended Solids from the CULTEC chamber system, as well as providing easier access for inspection and maintenance. The Separator Row is designed to capture the First Flush of a rain event and is typically included as part of the "Treatment Train" for water quality.

The CULTEC Separator Row is a row of CULTEC Contactor or Recharger Chambers that are surrounded on all sides by filter fabric. One layer of CULTEC No. 4800™ Woven Geotextile are placed between the clean foundation stone and the chamber feet. The chambers are then completely wrapped with CULTEC No. 410™ non-woven geotextile. This configuration is designed to trap any sediment and/or debris that may pass through the upstream water-quality structures and into the chamber system.

A manhole is typically located adjacent to the separator row for ease of inspection and maintenance. This manhole is placed upstream of the system and can include a high-flow bypass pipe to pass peak-flows onto adjacent rows of chambers. The upstream manhole is designed with a sump to trap heavier sediment and allow for proper cleaning of the Separator Row. A JetVac process with a high pressure water nozzle is introduced down the Separator Row via the access manhole to clean all sediment and debris from the Separator Row. Captured pollutants are flushed into the sumped access manhole for vacuuming, and the process is repeated until the Separator Row is completely free of sediment and debris.

The Separator Row performance has been tested and verified to the protocols and procedures as defined by Environmental Technology Verification (ETV) Canada to achieve 80% TSS removal.



© CULTEC, Inc., Feb 2022 CLT043-02-22

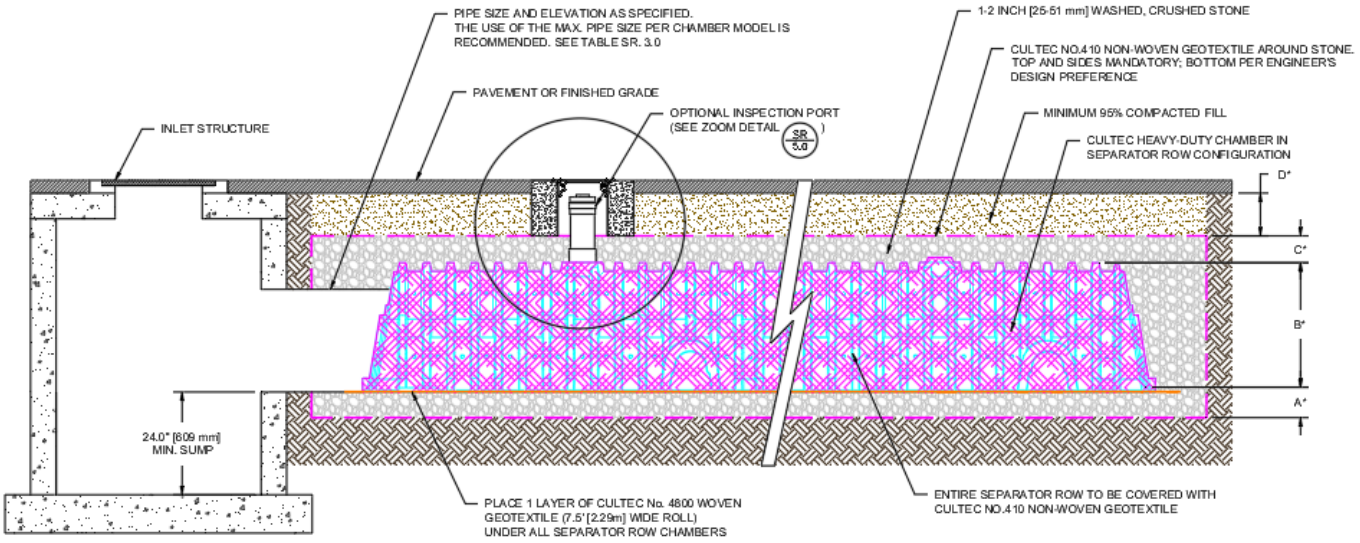
Design

There is no single design to achieve a high level of water quality. The CULTEC Separator Row should be designed as part of an overall best management practices water quality system. Pre-treatment devices such as sump catch basins, inlet baffles and proprietary oil-grit separators and filter systems can all be incorporated upstream of the CULTEC Separator Row. Sumped access/diversion manholes should be installed directly upstream of the Separator Row.

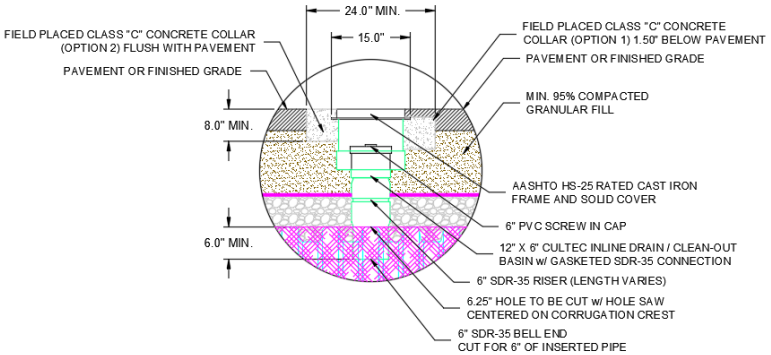
The following is a list of recommended design practices to ensure proper maintenance for the life of the system:

- Install sumped access/diversion manholes, including a minimum 24” (600 mm) sump, directly upstream of the Separator Row.
- Include a high-flow bypass pipe to divert peak flows that exceed the capacity of the Separator Row to adjacent rows.
- Connect the access manhole to the Separator Row with the largest diameter pipe allowable based on the CULTEC chamber model used.
- Maintain a minimum distance between the access manhole and the Separator Row to promote efficient maintenance.
- Include at least one inspection port per Separator Row for periodic inspection.

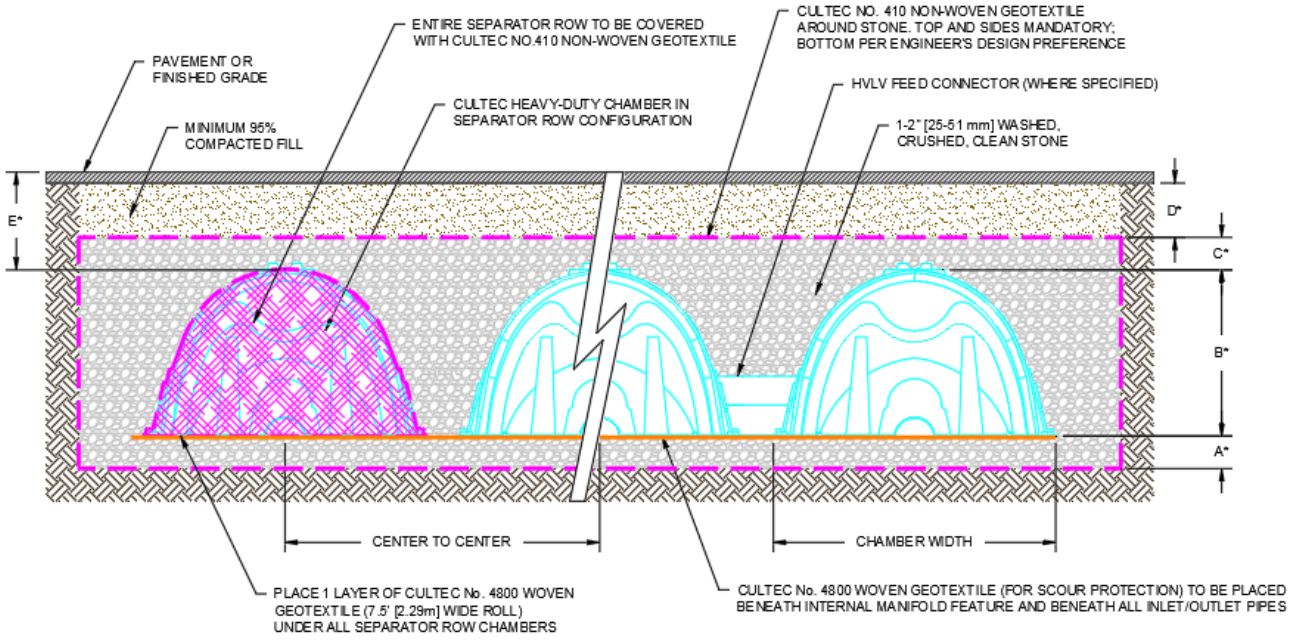
Note: Typical JetVac maintenance reels have a maximum of 400 feet (121.9 m) of available hose. Consider this when designing the length of the CULTEC Separator Rows.



*SEE SR 3.0 - CROSS SECTION TABLE REFERENCE



© CULTEC, Inc., Feb 2022 CLT043-02-22



*SEE SR 3.0 - CROSS SECTION TABLE REFERENCE

Table SR 3.0

	Description	Contactor 100HD	Recharger 150XLHD	Recharger 280HD	Recharger 330XLHD	Recharger 360HD	Recharger 902HD
A	Min. depth of stone base	6″ 152 mm	6″ 152 mm	6″ 152 mm	6″ 152 mm	6″ 152 mm	9″ 229 m
B	Chamber height	12.5″ 318 mm	18.5″ 470 mm	26.5″ 673 mm	30.5″ 775 mm	36″ 914 mm	48″ 1219 mm
C	Min. depth of stone required above units for traffic applications	6″ 152 mm	6″ 152 mm	6″ 152 mm	6″ 152 mm	6″ 152 mm	12″ 305 mm
D	Min. depth required of 95% compacted fill for paved traffic application	8″ 203 mm	8″ 203 mm	8″ 203 mm	10″ 254 mm	12″ 305 mm	12″ 305 mm
E	Max. depth of cover allowed above crown of chamber	12′ 3.65 m	12′ 3.65 m	12′ 3.65 m	12′ 3.65 m	12′ 3.65 m	8.5′ 2.59 m
	Max. allowable pipe size into chamber end wall/end cap	10″ 250 mm	12″ 300 mm	18″ 450 mm	24″ 600 mm	24″ 600 mm	24″ 600 mm

© CULTEC, Inc., Feb 2022 CLT043-02-22

Inspection and Maintenance

CULTEC recommends inspection of the Separator Row to be performed every six months for the first year of service. Future inspection frequency can be adjusted based upon previous inspection observations. However annual inspections are recommended. Inspection of the Separator Row can be achieved via an inspection port riser installed during construction. This inspection port riser will connect the top of the Separator Row chambers to finished grade with a removable lid. Alternatively the Separator Row may be inspected via the manhole(s) located at the end(s) of the Separator Row. However this method of inspection requires confined space entry. If entry into the manhole is required, all local and OSHA rules for confined space entries must be strictly followed.

To inspect:

- Remove the inspection port lid from the floor box frame.
- Remove the riser pipe cap.
- With a flashlight and stadia rod, measure the depth of sediment.
- Record results in a maintenance log.
- When depth of sediment exceeds 3” (76 mm), use the JetVac procedure described below.

The JetVac process utilizes a high pressure water nozzle controlled from the surface. The high pressure nozzle is introduced down the Separator Row via the access manhole(s). The high pressure water cleans all sediment and debris from the Separator Row as the nozzle is retrieved. Captured pollutants are flushed into the sumped access manhole for vacuuming. This process is repeated until the Separator Row is completely free of sediment and debris. A small diameter culvert cleaning nozzle is recommended for this procedure.



High pressure water nozzle



Cleaning Separator Row and pipes with high pressure water nozzle



SEPARATOR ROW: Separator Row prior to cleaning



ADJACENT ROW: When the Separator Row is working properly, the adjacent rows will not show signs of sediment.

© CULTEC, Inc., Feb 2022 CLT043-02-22

Inspection and Maintenance Record

Date	Mode of Access	Frequency	Depth of Sediment	Actions	Expenses	Inspector	Notes
Ex.	Inspection Port	Semi-annually	2”	Measure sediment depth with stadia rod. Visually inspect	$100	DPG	Depth of Sediment was measured via Northeast Inspection Port Adjacent to MH-1. Sediment depth was found to be 2”. No further action required at this time.
Ex.	Access Manhole	Annually					

© CULTEC, Inc., Feb 2022 CLT043-02-22



CULTEC, Inc.
878 Federal Road • P.O. Box 280 • Brookfield, CT 06804 USA
P: (203) 775-4416 • Toll Free: 1(800) 4-CULTEC • www.cultec.com

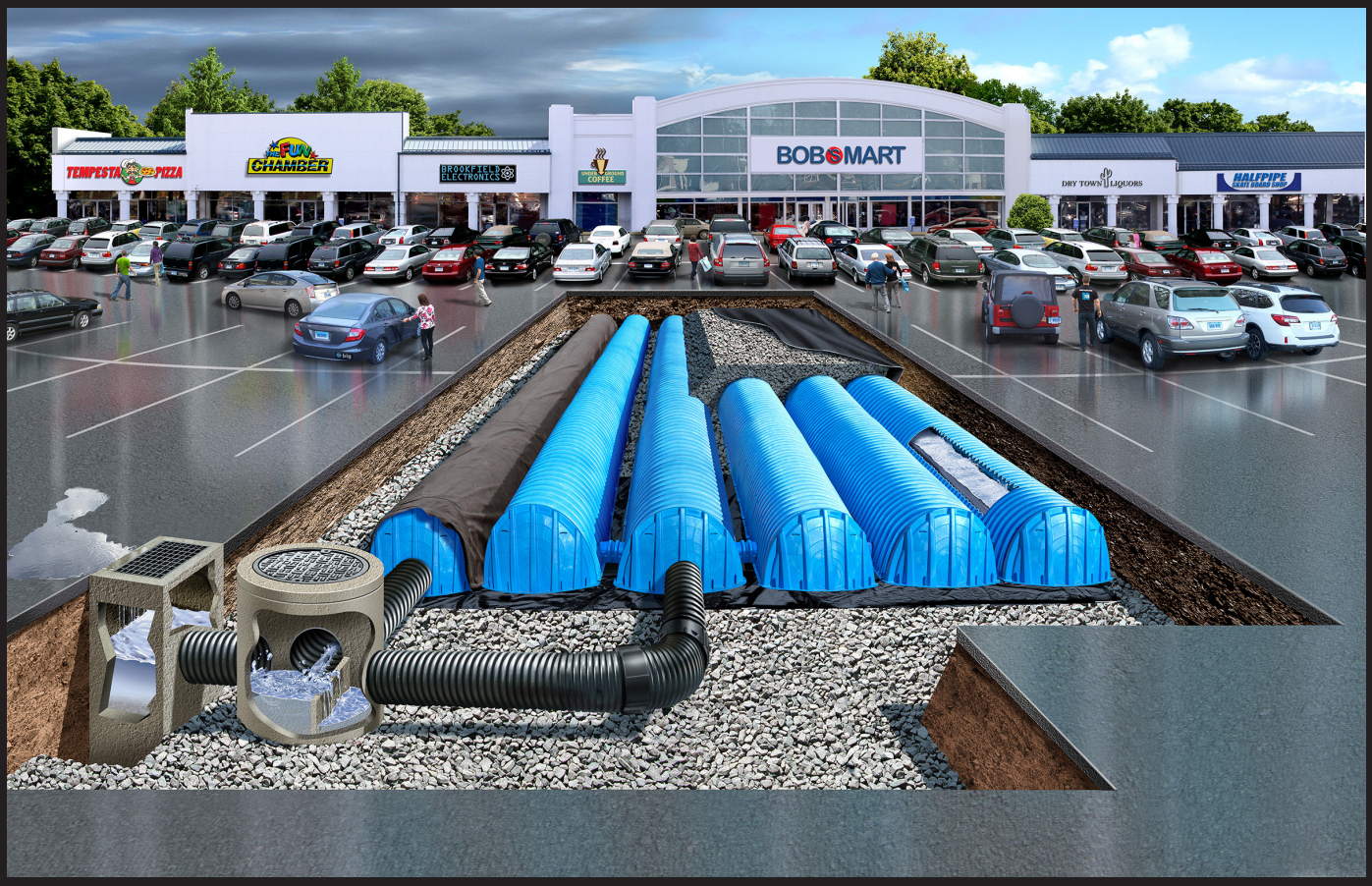


RETENTION • DETENTION • INFILTRATION • WATER QUALITY

©CULTEC, Inc. CLT043 03-22

CONTACTOR® & RECHARGER®

STORMWATER MANAGEMENT SOLUTIONS



OPERATION & MAINTENANCE GUIDELINES

FOR CULTEC STORMWATER MANAGEMENT SYSTEMS

CULTEC®

Published by
CULTEC, Inc.
P.O. Box 280
878 Federal Road
Brookfield, Connecticut 06804 USA
www.cultec.com

Copyright Notice
© 2019 CULTEC, Inc. All rights reserved. Printed in the USA.
This document and any accompanying CULTEC products are copyrighted by CULTEC, Inc. Any reproduction and/or distribution without prior written consent from CULTEC, Inc. is strictly prohibited.

Disclaimers:
The drawings, photographs and illustrations shown in this document are for illustrative purposes only and are not necessarily to scale.
Actual designs may vary.

CULTEC reserves the right to make design and/or specification changes at any time without notice at CULTEC's sole discretion.

CULTEC, the CULTEC logo, RECHARGER, CONTACTOR, HVLV, PAC, STORMFILTER, STORMGENIE and The Chamber with The Stripe are registered trademarks of CULTEC, Inc.
Chamber of Choice, HD, 100, 125, 150, 150XL, 180, 280, 330, 330XL, 360, V8, 902, Field Drain Panel, C-1, C-2, C-3, C-4, EZ-24, Landscape Series are trademarks of CULTEC, Inc. © Copyright on all drawings, illustrations, photos, charts - CULTEC, Inc. All rights reserved.

Protected by one or more of the following patents owned by Cultec, Inc.:
U.S. Patents 6,129,482; 6,322,288; 6,854,925; 7,226,241; 7,806,627; 8,366,346; 8,425,148; U.S. Designs D613,819; D638,095; D668,318; Canadian Patent 2,450,565; 2,591,255; Canadian Designs 129144; 135983; 159073; 160977; and/or other U.S. or Foreign Patent(s) or Patent(s) Pending.

Contact Information:
For general information on our other products and services, please contact our offices within the United States at (800)428-5832, (203)775-4416 ext. 202, or e-mail us at custservice@cultec.com.

For technical support, please call (203)775-4416 ext. 203 or e-mail tech@cultec.com.

Visit www.cultec.com/downloads.html for Product Downloads and CAD details.

Doc ID: CLT057 01-20
January 2020

These instructions are for single-layer traffic applications only. For multi-layer applications, contact CULTEC.
All illustrations and photos shown herein are examples of typical situations. Be sure to follow the engineer's drawings.
Actual designs may vary.

This manual contains guidelines recommended by CULTEC, Inc. and may be used in conjunction with, but not to supersede, local regulations or regulatory authorities. OSHA Guidelines must be followed when inspecting or cleaning any structure.

Introduction

The CULTEC Subsurface Stormwater Management System is a high-density polyethylene (HDPE) chamber system arranged in parallel rows surrounded by washed stone. The CULTEC chambers create arch-shaped voids within the washed stone to provide stormwater detention, retention, infiltration, and reclamation. Filter fabric is placed between the native soil and stone interface to prevent the intrusion of fines into the system. In order to minimize the amount of sediment which may enter the CULTEC system, a sediment collection device (stormwater pretreatment device) is recommended upstream from the CULTEC chamber system. Examples of pretreatment devices include, but are not limited to, an appropriately sized catch basin with sump, pretreatment catchment device, oil grit separator, or baffled distribution box. Manufactured pretreatment devices may also be used in accordance with CULTEC chambers. Installation, operation, and maintenance of these devices shall be in accordance with manufacturer's recommendations. Almost all of the sediment entering the stormwater management system will be collected within the pretreatment device.

Best Management Practices allow for the maintenance of the preliminary collection systems prior to feeding the CULTEC chambers. The pretreatment structures shall be inspected for any debris that will restrict inlet flow rates. Outfall structures, if any, such as outlet control must also be inspected for any obstructions that would restrict outlet flow rates. OSHA Guidelines must be followed when inspecting or cleaning any structure.

Operation and Maintenance Requirements

I. Operation

CULTEC stormwater management systems shall be operated to receive only stormwater run-off in accordance with applicable local regulations. CULTEC subsurface stormwater management chambers operate at peak performance when installed in series with pretreatment. Pretreatment of suspended solids is superior to treatment of solids once they have been introduced into the system. The use of pretreatment is adequate as long as the structure is maintained and the site remains stable with finished impervious surfaces such as parking lots, walkways, and pervious areas are properly maintained. If there is to be an unstable condition, such as improvements to buildings or parking areas, all proper silt control measures shall be implemented according to local regulations.

II. Inspection and Maintenance Options

A. The CULTEC system may be equipped with an inspection port located on the inlet row. The inspection port is a circular cast box placed in a rectangular concrete collar. When the lid is removed, a 6-inch (150 mm) pipe with a screw-in plug will be exposed. Remove the plug. This will provide access to the CULTEC Chamber row below. From the surface, through this access, the sediment may be measured at this location. A stadia rod may be used to measure the depth of sediment if any in this row. If the depth of sediment is in excess of 3 inches (76 mm), then this row should be cleaned with high pressure water through a culvert cleaning nozzle. This would be carried out through an upstream manhole or through the CULTEC StormFilter Unit (or other pretreatment device). CCTV inspection of this row can be deployed through this access port to deter mine if any sediment has accumulated in the inlet row.

B. If the CULTEC bed is not equipped with an inspection port, then access to the inlet row will be through an upstream manhole or the CULTEC StormFilter.

1. Manhole Access
This inspection should only be carried out by persons trained in confined space entry and sewer inspection services. After the manhole cover has been removed a gas detector must be lowered into the manhole to ensure that there are not high concentrations of toxic gases present. The inspector should be lowered into the manhole with the proper safety equipment as per OSHA requirements. The inspector may be able to observe sediment from this location. If this is not possible, the inspector will need to deploy a CCTV robot to permit viewing of the sediment.

© CULTEC, Inc. CLT057 01-20

2. StormFilter Access
Remove the manhole cover to allow access to the unit. Typically a 30-inch (750 mm) pipe is used as a riser from the StormFilter to the surface. As in the case with manhole access, this access point requires a technician trained in confined space entry with proper gas detection equipment. This individual must be equipped with the proper safety equipment for entry into the StormFilter. The technician will be lowered onto the StormFilter unit. The hatch on the unit must be removed. Inside the unit are two filters which may be removed according to StormFilter maintenance guidelines. Once these filters are removed the inspector can enter the StormFilter unit to launch the CCTV camera robot.

C. The inlet row of the CULTEC system is placed on a polyethylene liner to prevent scouring of the washed stone beneath this row. This also facilitates the flushing of this row with high pressure water through a culvert cleaning nozzle. The nozzle is deployed through a manhole or the StormFilter and extended to the end of the row. The water is turned on and the inlet row is back-flushed into the manhole or StormFilter. This water is to be removed from the manhole or StormFilter using a vacuum truck.

III. Maintenance Guidelines

The following guidelines shall be adhered to for the operation and maintenance of the CULTEC stormwater management system:

A. The owner shall keep a maintenance log which shall include details of any events which would have an effect on the system's operational capacity.

B. The operation and maintenance procedure shall be reviewed periodically and changed to meet site conditions.

C. Maintenance of the stormwater management system shall be performed by qualified workers and shall follow applicable occupational health and safety requirements.

D. Debris removed from the stormwater management system shall be disposed of in accordance with applicable laws and regulations.

IV. Suggested Maintenance Schedules

A. Minor Maintenance
The following suggested schedule shall be followed for routine maintenance during the regular operation of the stormwater system:

Frequency	Action
Monthly in first year	Check inlets and outlets for clogging and remove any debris, as required.
Spring and Fall	Check inlets and outlets for clogging and remove any debris, as required.
One year after commissioning and every third year following	Check inlets and outlets for clogging and remove any debris, as required.

B. Major Maintenance
The following suggested maintenance schedule shall be followed to maintain the performance of the CULTEC stormwater management chambers. Additional work may be necessary due to insufficient performance and other issues that might be found during the inspection of the stormwater management chambers. (See table on next page)

© CULTEC, Inc. CLT057 01-20

	Frequency	Action
Inlets and Outlets	Every 3 years	• Obtain documentation that the inlets, outlets and vents have been cleaned and will function as intended.
	Spring and Fall	• Check inlet and outlets for clogging and remove any debris as required.
CULTEC Stormwater Chambers	2 years after commissioning	• Inspect the interior of the stormwater management chambers through inspection port for deficiencies using CCTV or comparable technique. • Obtain documentation that the stormwater management chambers and feed connectors will function as anticipated.
	9 years after commissioning every 9 years following	• Clean stormwater management chambers and feed connectors of any debris. • Inspect the interior of the stormwater management structures for deficiencies using CCTV or comparable technique. • Obtain documentation that the stormwater management chambers and feed connectors have been cleaned and will function as intended.
	45 years after commissioning	• Clean stormwater management chambers and feed connectors of any debris. • Determine the remaining life expectancy of the stormwater management chambers and recommended schedule and actions to rehabilitate the stormwater management chambers as required. • Inspect the interior of the stormwater management chambers for deficiencies using CCTV or comparable technique. • Replace or restore the stormwater management chambers in accordance with the schedule determined at the 45-year inspection. • Attain the appropriate approvals as required. • Establish a new operation and maintenance schedule.
Surrounding Site	Monthly in 1st year	• Check for depressions in areas over and surrounding the stormwater management system.
	Spring and Fall	• Check for depressions in areas over and surrounding the stormwater management system.
	Yearly	• Confirm that no unauthorized modifications have been performed to the site.

For additional information concerning the maintenance of CULTEC Subsurface Stormwater Management Chambers, please contact CULTEC, Inc. at 1-800-428-5832.

© CULTEC, Inc. CLT057 01-20

WQMP
Operation & Maintenance (O&M) Plan

Project Name:_____

Prepared for:

Project Name: _____

Address:_____

City, State Zip:_____

Prepared on:

Date:_____

For more information, contact CULTEC at (203) 775-4416 or visit www.cultec.com.

© CULTEC, Inc. CLT057 01-20

This O&M Plan describes the designated responsible party for implementation of this WQMP, including: operation and maintenance of all the structural BMP(s), conducting the training/educational program and duties, and any other necessary activities. The O&M Plan includes detailed inspection and maintenance requirements for all structural BMPs, including copies of any maintenance contract agreements, manufacturer's maintenance requirements, permits, etc.

8.1.1 Project Information

Project name	
Address	
City, State Zip	
Site size	
List of structural BMPs, number of each	
Other notes	

8.1.2 Responsible Party

The responsible party for implementation of this WQMP is:

Name of Person or HOA Property Manager	
Address	
City, State Zip	
Phone number	
24-Hour Emergency Contact number	
Email	

8.1.3 Record Keeping

Parties responsible for the O&M plan shall retain records for at least 5 years.

All training and educational activities and BMP operation and maintenance shall be documented to verify compliance with this O&M Plan. A sample Training Log and Inspection and Maintenance Log are included in this document.

8.1.4 Electronic Data Submittal

This document along with the Site Plan and Attachments shall be provided in PDF format. AutoCAD files and/or GIS coordinates of BMPs shall also be submitted to the City.

© CULTEC, Inc. CLT057 01-20

Appendix ____

BMP SITE PLAN

Site plan is preferred on minimum 11” by 17” colored sheets, as long as legible.

For more information, contact CULTEC at (203) 775-4416 or visit www.cultec.com.
© CULTEC, Inc. CLT057 01-20

BMP OPERATION & MAINTENANCE LOG

Project Name: _____

Today's Date: _____

Name of Person Performing Activity (Printed): _____

Signature: _____

BMP Name (As Shown in O&M Plan)	Brief Description of Implementation, Maintenance, and Inspection Activity Performed

© CULTEC, Inc. CLT057 01-20

Minor Maintenance

Frequency		Action
Monthly in first year		Check inlets and outlets for clogging and remove any debris, as required.
		Notes
□ Month 1	Date:	
□ Month 2	Date:	
□ Month 3	Date:	
□ Month 4	Date	
□ Month 5	Date:	
□ Month 6	Date:	
□ Month 7	Date:	
□ Month 8	Date:	
□ Month 9	Date:	
□ Month 10	Date:	
□ Month 11	Date:	
□ Month 12	Date:	
Spring and Fall		Check inlets and outlets for clogging and remove any debris, as required.
		Notes
□ Spring	Date:	
□ Fall	Date:	
□ Spring	Date:	
□ Fall	Date:	
□ Spring	Date:	
□ Fall	Date:	
□ Spring	Date:	
□ Fall	Date:	
□ Spring	Date:	
□ Fall	Date:	
□ Spring	Date:	
□ Fall	Date:	
One year after commissioning and every third year following		Check inlets and outlets for clogging and remove any debris, as required.
		Notes
□ Year 1	Date:	
□ Year 4	Date:	
□ Year 7	Date:	
□ Year 10	Date:	
□ Year 13	Date:	
□ Year 16	Date:	
□ Year 19	Date:	
□ Year 22	Date:	

© CULTEC, Inc. CLT057 01-20

Major Maintenance

	Frequency		Action
Inlets and Outlets	**Every 3 years**		Obtain documentation that the inlets, outlets and vents have been cleaned and will function as intended.
			Notes
	□ Year 1	Date:	
	□ Year 4	Date:	
	□ Year 7	Date:	
	□ Year 10	Date:	
	□ Year 13	Date:	
	□ Year 16	Date:	
	□ Year 19	Date:	
	□ Year 22	Date:	
	Spring and Fall		Check inlet and outlets for clogging and remove any debris, as required.
			Notes
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
CULTEC Stormwater Chambers	**2 years after commissioning**		□ Inspect the interior of the stormwater management chambers through inspection port for deficiencies using CCTV or comparable technique. □ Obtain documentation that the stormwater management chambers and feed connectors will function as anticipated.
			Notes
	□ Year 2	Date:	

© CULTEC, Inc. CLT057 01-20

Major Maintenance

	Frequency		Action
CULTEC Stormwater Chambers	**9 years after commissioning every 9 years following**		□ Clean stormwater management chambers and feed connectors of any debris. □ Inspect the interior of the stormwater management structures for deficiencies using CCTV or comparable technique. □ Obtain documentation that the stormwater management chambers and feed connectors have been cleaned and will function as intended.
			Notes
	□ Year 9	Date:	
	□ Year 18	Date:	
	□ Year 27	Date:	
	□ Year 36	Date:	
	45 years after commissioning		□ Clean stormwater management chambers and feed connectors of any debris. □ Determine the remaining life expectancy of the stormwater management chambers and recommended schedule and actions to rehabilitate the stormwater management chambers as required. □ Inspect the interior of the stormwater management chambers for deficiencies using CCTV or comparable technique. □ Replace or restore the stormwater management chambers in accordance with the schedule determined at the 45-year inspection. □ Attain the appropriate approvals as required. □ Establish a new operation and maintenance schedule.
			Notes
	□ Year 45	Date:	

© CULTEC, Inc. CLT057 01-20

Major Maintenance

	Frequency		Action
Surrounding Site	**Monthly in 1st year**		□ Check for depressions in areas over and surrounding the stormwater management system.
			Notes
	□ Month 1	Date:	
	□ Month 2	Date:	
	□ Month 3	Date:	
	□ Month 4	Date:	
	□ Month 5	Date:	
	□ Month 6	Date:	
	□ Month 7	Date:	
	□ Month 8	Date:	
	□ Month 9	Date:	
	□ Month 10	Date:	
	□ Month 11	Date:	
	□ Month 12	Date:	
	Spring and Fall		□ Check for depressions in areas over and surrounding the stormwater management system.
			Notes
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	□ Spring	Date:	
	□ Fall	Date:	
	Yearly		□ Confirm that no unauthorized modifications have been performed to the site.
			Notes
	□ Year 1	Date:	
	□ Year 2	Date:	
	□ Year 3	Date:	
	□ Year 4	Date:	
	□ Year 5	Date:	
	□ Year 6	Date:	
	□ Year 7	Date:	

© CULTEC, Inc. CLT057 01-20

CULTEC, Inc.
878 Federal Road • P.O. Box 280 • Brookfield, CT 06804 USA
P: (203) 775-4416 • Toll Free: 1(800) 4-CULTEC • www.cultec.com



RETENTION • DETENTION • INFILTRATION • WATER QUALITY

©CULTEC, Inc. CLT057 01-20

Appendix C

Sanitary Calculations

SANITARY SEWER DESIGN

Land Use or Zoning Designation Basis (Residential)

DESIGN SHEET Issued for Site Alteration Permit (1st Submission)
FILE NO 2104593
CONTRACT / PROJECT Stateview Homes (BEA Towns) Inc.

n ≥ 0.013
M = 5/P^0.2 Babbit

Numbers in blue or text in red are equations
(Harmon or Babbitt peaking factor where; M ≥ 2), the greater of the two is used in the spreadsheet. Please refer to Section 3.3.1.1 of the Barrie Sanitary Design Guidelines for additional guidance on which peaking factor to use.

$Q_p = P*q*M/86400$ (Peak population flow where; q = 225 L/day/person; P = population) 225 litres/person/day.
$Q_i = I*A$ (Peak extraneous flow: I= 0.1L/s/ha over development area)
$Q_{tot} = Q_p + Q_i$ (Total peak flow as the sum of peak population flow and peak extraneous flow)

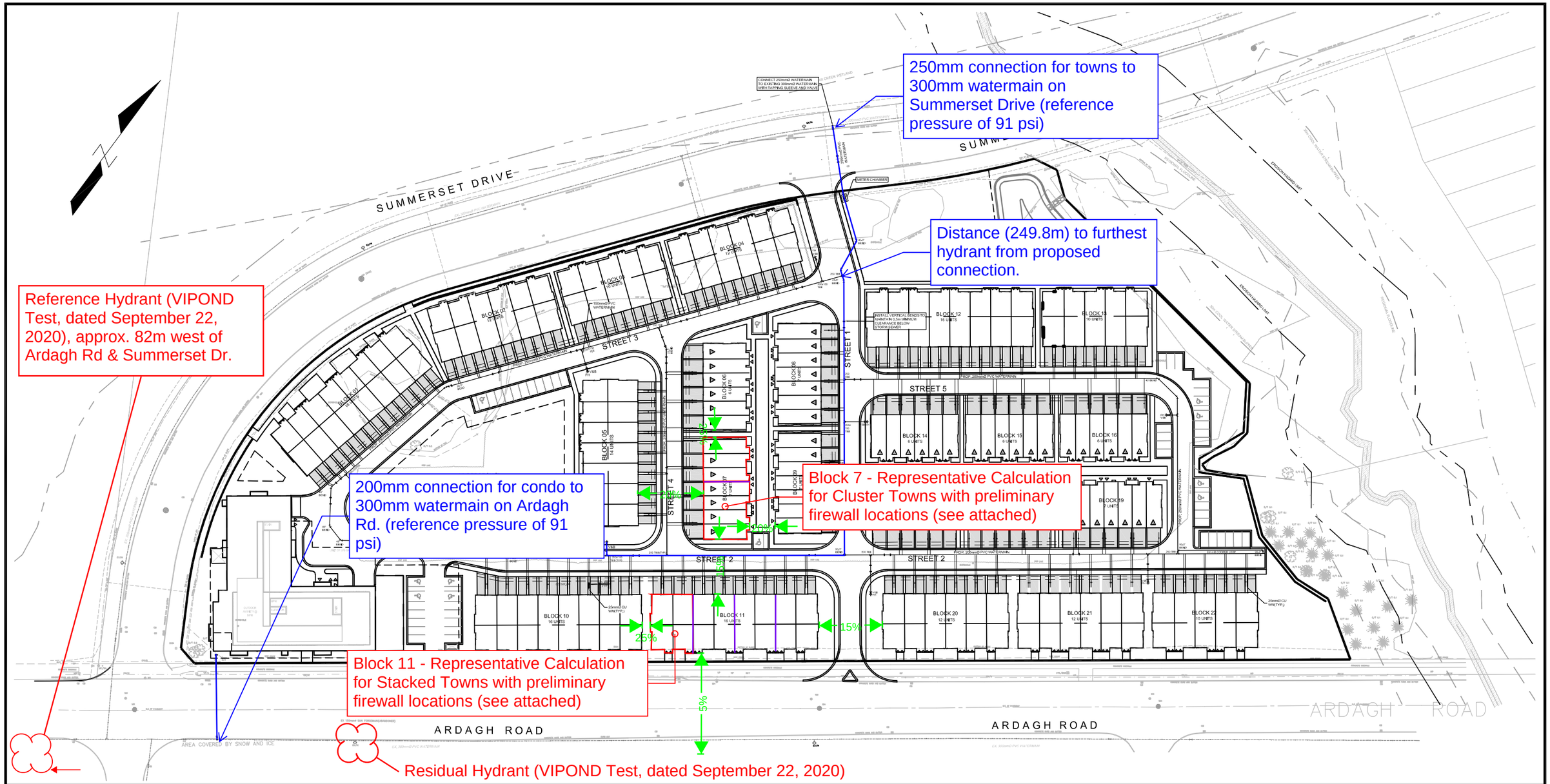
STREET / AREA	MAINTENANCE HOLE FROM	MAINTENANCE HOLE TO	Land Use	Density (units/ha)	Area (ha)	DENSITY P.P.U.	POP. (P)	POP. (ACC)	M PEAKING FACTOR BABBIT	M PEAKING FACTOR HARMON	Max PEAKING FACTOR	Q_p (l/s)	AREA (ACC) (ha)	Q_i (l/s)	Q_{tot} (l/s)	L (m)	D (mm)	S (%)	Qf FULL (l/s)	d/D[2]	d/D[3] >0.5 or >0.70	Velocity FULL (m/s)	Velocity Partial[1] (m/s)	Velocity[4] > 0.6 (m/s)
CONDO	SAN PLUG	SAP004-SAP003	R	575	0.16	1.67	154	154	7.272	4.188	7.272	2.910	0.16	0.016	2.926	16.3	200	2.00%	46.384	0.170	Ok	1.476	0.824	Ok
TOWNHOUSES	MH14A	MH15A	R	59	3.72	2.34	515	515	5.710	3.968	5.710	7.655	3.72	0.372	8.027	12.8	200	2.00%	46.384	0.281	Ok	1.476	1.105	Ok

DATE: October 6, 2022 CALCULATED BY: P. Chiocchio CHECKED BY:

Notes:
(1) without extraneous flow
(2) with extraneous flow
(3) d/D>0.5 for pipes 375 and less, d/D>0.70 for pipes greater than 375
(4) Velocity check based on the lesser of full flow or partial velocity

Appendix D

Water Demand Calculations



LEGEND

PROPERTY LINE		PROPOSED FIRE HYDRANT	FH	PROPOSED VALVE AND BOX	*EX.V&B*	PROPOSED DOMESTIC WATER METER	M
PROPOSED WATER		PROPOSED VALVE AND BOX	V&B	PROPOSED WATER LATERAL		PROPOSED BACKFLOW PREVENTER	B
EXISTING WATER		PROPOSED FIRE HYDRANT	*EX.FH*	CURB STOP			

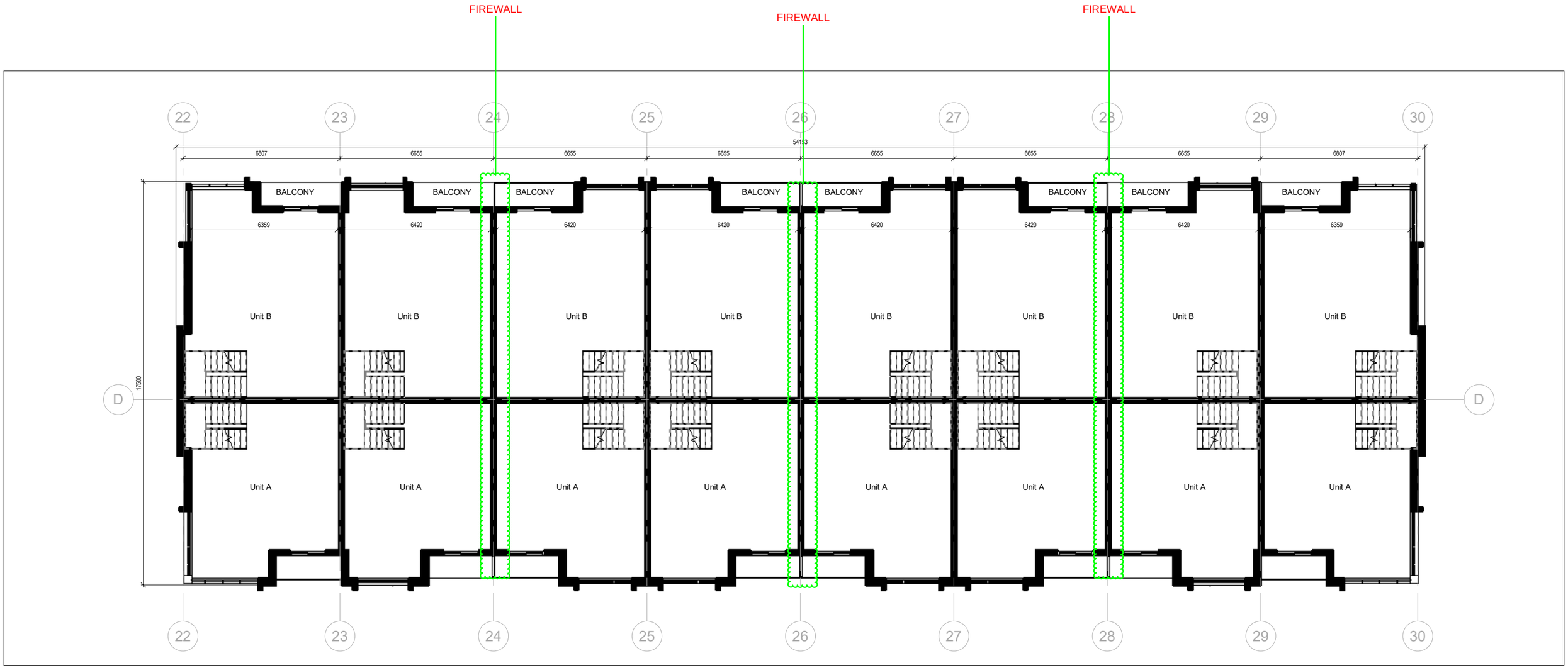
SOURCE

1. PLAN BASED ON TOPO PREPARED BY SCHAEFFER DZALDOV BENNETT LTD.

2104593(BEATOWNSINC)	WATERMAIN
STATEVIEWHOMES	PROJ_NO / SCALE: 1:1250

GEI Consultants

VIRTO GIRON, MARIA B:\Working\STATEVIEW HOMES\2104593 Bear Creek Village Barrie\00_CAD\Design\Sheets\2103462-SHT-SERV-01 - WM PAUL.dwg - 10/3/2022



3 Typical Level 3 Floor Plan (Block 1,10,11)

1 : 100

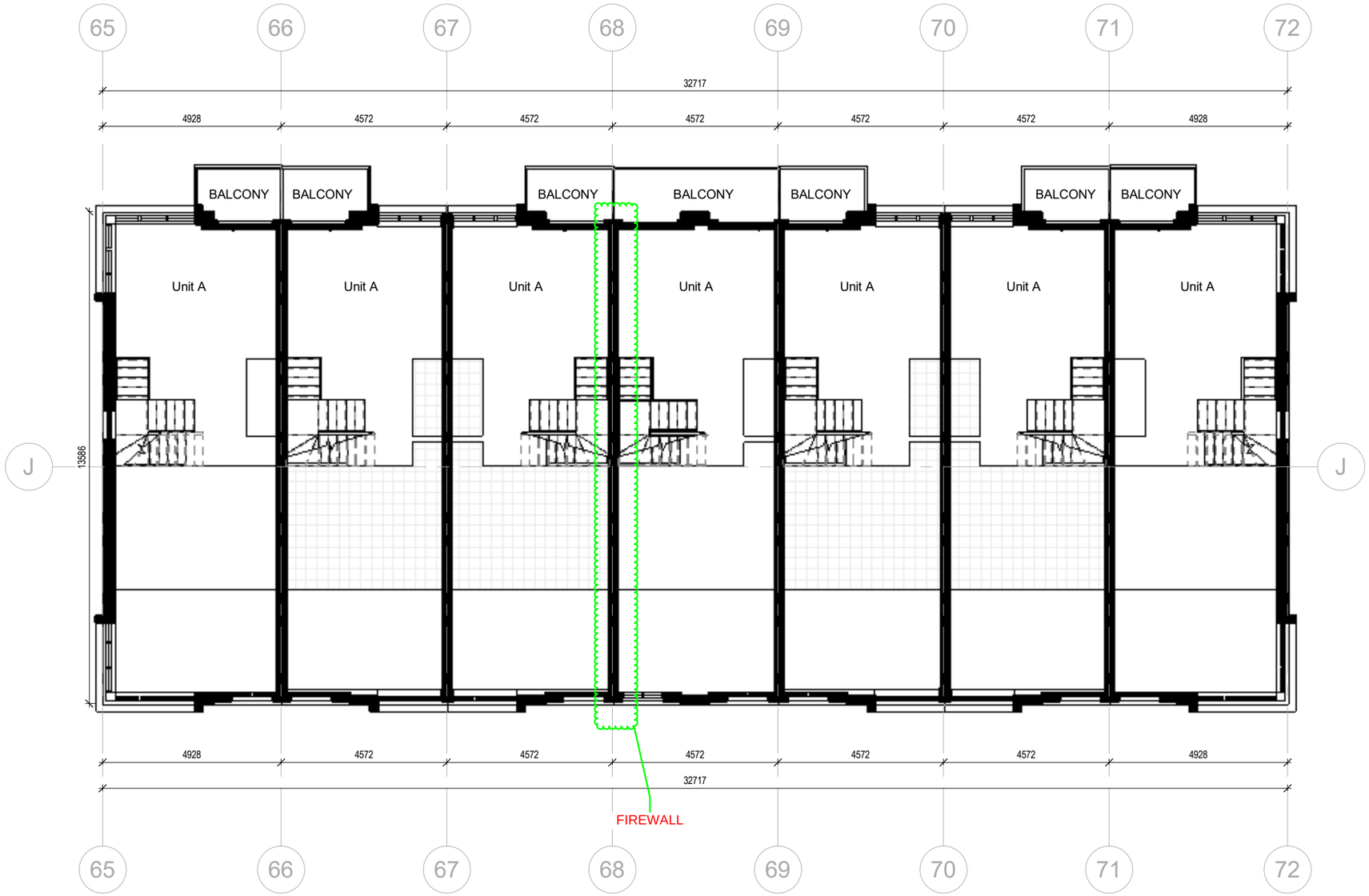
AS PER OBC SECTION 9.10.16.1 4(B) & 5

(4) In unsprinklered buildings of combustible construction, every concealed space created by a ceiling, roof space or unoccupied attic space shall be separated by fire blocksinto compartments of not more than 300 m^2 in area where such space contains exposed construction materials having a surface flame-spread rating greater than 25.

(5) No dimension of the concealed space described in Sentence (4) shall exceed 20 m.

PLEASE NOTE FIREWALL LOCATIONS ARE SUBJECT TO CHANGE AS THE PROJECT DEVELOPS. LOCATIONS ARE NOT FINALIZED.

Received from Onespace Unlimited Inc. by Elaina Poleto on October 3, 2022



4 Typical Level 2 Floor Plan (Block Block 7,8,9,19)

1 : 100

AS PER OBC SECTION 9.10.16.1 4(B) & 5
(4) In unsprinklered buildings of combustible construction, every concealed space created by a ceiling, roof space or unoccupied attic space shall be separated by fire blocksinto compartments of not more than 300 m^2 in area where such space contains exposed construction materials having a surface flame-spread rating greater than 25.

(5) No dimension of the concealed space described in Sentence (4) shall exceed 20 m.

PLEASE NOTE FIREWALL LOCATIONS ARE SUBJECT TO CHANGE AS THE PROJECT DEVELOPS. LOCATIONS ARE NOT FINALIZED.

Received from Onespace Unlimited Inc. by Elaina Poleto on October 3, 2022

DOMESTIC WATER DEMAND

GEI Consultants

Project Name:	Stateview Homes (BEA Towns) Inc.	Project No.	2104593
Prepared by:	Paul Chiocchio		
Date:	October 6, 2022		

Note:
Based on the City of Barrie Design Criteria

	Site Component	Condo	Cluster Towns	Back to Back Towns			
Residential Occupancy Data	Single/Semi Detached						
	People per unit						
	Townhouses		64	156			
	People per unit		*2.57*	*2.57*			
	Apartments	92					
	People per unit	*1.67*					
Commercial Occupancy Data							

Unit Quantity by Site Component	Water Demand	Units	Equivalent Population (persons)					
Residential Occupancies								
Apartments, Condominiums, Other Multi-family Dwellings	225	L/person/day	153.6	164.5	400.9	-	-	-
Not used	-	-	-	-	-	-	-	-
Not used	-	-	-	-	-	-	-	-
Other Occupancies			**Flow Rates (L/d)**					
Not used	-	-	-	-	-	-	-	-
Not used	-	-	-	-	-	-	-	-
Not used	-	-	-	-	-	-	-	-

Daily Flow Rate (L/d)								
Residential Occupancies								
Apartments, Condominiums, Other Multi-family Dwellings		161,784.00	34,569.00	37,008.00	90,207.00			
Not used								
Not used								
Other Occupancies								
Not used		0	0					
Not used		0	0					
Not used		0	0					
		Total Flow						
Average day (L/d)		**161,784**	34,569	37,008	90,207			
Average day (L/s)		**1.87**	0.40	0.43	1.04			
Max. day (L/d)		**444,906**	95,065	101,772	248,069			
Min. hour (L/hr)		**2,696**	576	617	1,503			
Peak hour (L/hr)		**27,840**	5,949	6,368	15,523			
Peak hour (L/s)		**7.73**	1.65	1.77	4.31			

Peaking Factors			
Land Use	Minimum Hour	Peak Hour	Maximum Day
Residential	0.4	4.13	2.75
Commercial / Retail			

FIRE FLOW CALCULATION

GEI Consultants

Project Name:	Stateview Homes (BEA Towns) Inc.	Project No.	2104593
Prepared by:	Paul Chiocchio		
Date:	October 6, 2022		

Fire Resistive Construction:	YES	Site Component:	Condo					
Note: Based on the City of Barrie Design Standards	Total Floor Area	Largest Floor Area (m2)	1682.14					
		Area Above (m2)	9190.22					
		Area Below (m2)	4836.52					
		Total Floor Area (m2)	5189					
	Flow (F)	C (dimensionless)	0.8					
$F = 220C\sqrt{A}$		A (m2)	5189					
		F (L/min)	13000					
F = Required fire flow L/min	Reduction Factor	F (L/min)	13000					
C = Coefficient related to construction		f_1 (dimensionless)	0.85					
A = Total area in m^2		F' = F x f_f (L/min)	11050					
		f_1 = occupancy factor; ie, Residential, f_1 = 0.85; for Retail or Commercial, f_1 = 1.00						
	Sprinkler and Exposure Increase or Decrease	f_2 (sprinkler factor)	50%					
		North Side	20%					
		East Side	5%					
		South Side	5%					
'Calculations, formulas and factors are as per Fire Underwriter's Survey (FUS) Water Supply for Public Fire Protection		West Side	0%					
		f_3	30%					
		f_3 = Exposure factor not to exceed 75%, determined as per FUS Guide Item 4, page 18)						

F' (L/min)	**11050**						
S = F' * f_2 *(L/min)*	**5525**						
E = F' * f_3 *(L/min)*	**3315**						

F''=F'-S+E (L/min) rounded to nearest 1,000	**9000**						
F''(L/s)	**150**						
F''(USGPM)	**2380**						
Max F'' + Dom (USGPM)	**2,420**						

Table 1

Sprinkler Reduction Factor (f_2)		
No Sprkinkler System	Sprinklered	Sprink. + Supervised
0%	30%	50%

Table 2

Construction Type "C" Factor			
Wood Frame	Ordinary Construction	Non-Combustible	Fire Resistive
1.5	1	0.80	0.60

Table 3

Occupancy Factor (f_1)				
Rapid Burning	Free Burning	Combustible	Limited Combustible	Non-Combust.
25%	15%	0%	-15%	-25%

Table 4

Exposure Charge					
0 to 3m	3.1 to 10m	10.1 to 20m	20.1 to 30m	30.1 to 45m	> 45m
25%	20%	15%	10%	5%	0

FIRE FLOW CALCULATION

GEI Consultants

Project Name:	Stateview Homes (BEA Towns) Inc.	Project No.	2104593
Prepared by:	Paul Chiocchio		
Date:	October 6, 2022		

Fire Resistive Construction:	NO	Site Component:	Cluster Towns (Blk. 7)	Back to Back Towns (Blk. 11)				
Note: Based on the City of Barrie Design Standards	Total Floor Area	Largest Floor Area (m2)	277.93	251.3				
		Area Above (m2)	277.93	251.3				
		Area Below (m2)	277.93	0.0				
		Total Floor Area (m2)	834	503				
	Flow (F)	C (dimensionless)	1.0	1.0				
$F = 220C\sqrt{A}$		A (m2)	834	503				
		F (L/min)	6000	5000				
F = Required fire flow L/min	Reduction Factor	F (L/min)	6000	5000				
C = Coefficient related to construction		f_1 (dimensionless)	0.85	0.85				
A = Total area in m^2		F' = F x f_f (L/min)	5100	4250				
		f_1 = occupancy factor; ie, Residential, f_1 = 0.85; for Retail or Commercial, f_1 = 1.00						
	Sprinkler and Exposure Increase or Decrease	f_2 (sprinkler factor)	0%	0%				
		North Side	25%	15%				
		East Side	20%	15%				
		South Side	15%	5%				
'Calculations, formulas and factors are as per Fire Underwriter's Survey (FUS) Water Supply for Public Fire Protection		West Side	15%	25%				
		f_3	75%	60%				
		f_3 = Exposure factor not to exceed 75%, determined as per FUS Guide Item 4, page 18)						

F' (L/min)	**5100**	**4250**				
S = F' * f_2 *(L/min)*	**0**	**0**				
E = F' * f_3 *(L/min)*	**3825**	**2550**				

F''=F'-S+E (L/min) rounded to nearest 1,000	**9000**	**7000**				
F''(L/s)	**150**	**117**				
F''(USGPM)	**2380**	**1850**				
Max F'' + Dom (USGPM)	**2,420**	**1,900**				

Table 1

Sprinkler Reduction Factor (f_2)		
No Sprkinkler System	Sprinklered	Sprink. + Supervised
0%	30%	50%

Table 2

Construction Type "C" Factor			
Wood Frame	Ordinary Construction	Non-Combustible	Fire Resistive
1.5	1	0.80	0.60

Table 3

Occupancy Factor (f_1)				
Rapid Burning	Free Burning	Combustible	Limited Combustible	Non-Combust.
25%	15%	0%	-15%	-25%

Table 4

Exposure Charge					
0 to 3m	3.1 to 10m	10.1 to 20m	20.1 to 30m	30.1 to 45m	> 45m
25%	20%	15%	10%	5%	0

GEI Consultants

Watermain Residual Pressure

FUS Fire Flow + Max. Daily Demand (Condo)

Project Name:	Stateview Homes (BEA Towns) Inc.
Project No.:	2104593
Prepared by:	P. Chiocchio
Date:	October 6, 2022

$$Q = 0.278 \times C \times D2.63 \times (\frac{Hf}{L})0.54$$

Specified Data		
L = length of pipe	27.5	m
C = Hazen-Williams roughness constant	110	
C=100 for 150 dia & smaller, C=110 for 200 & 250 dia and C=120 for 300 and larger)		
Q = Flow (Max Day plus Fire Flow)	151.1	L/s
D = Watermain Diameter	200	mm
V = Velocity	4.81	m/s

1.

Calculated Pressure Loss - Friction				
H_f = Friction Head loss (m of head per 100 m pipe)	13.80	m		
H_f = Friction Head loss (kPa per 100 m pipe)	135.43	kPa		
Head loss (m of head)	3.80	m		
Head loss (due to friction)	**37.24**	**kPa**	**5.40**	psi

2.

Pressure Loss - Water Meter & Backflow Preventer				
H_f = Head Loss (DCVA Performance Curve)	**27.58**	**kPa**	**4.00**	psi
H_f = Head Loss (Water Meter Performance Curve)	**17.24**	**kPa**	**2.50**	psi

3.

Pressure Loss - Connection				
K-Value for Entrance	1.00			
Head loss (m of head)[A]	**1.18**	**kPa**	**0.17**	psi

[A]Head Loss calculated by $KV^2/2g$

4.

Pressure Change Due to Elevation				
Ground Elevation at Existing Hydrant	240.75	m		
Ground Elevation at Water Connection Point	241.35	m		
Elevation Change	0.60	m		
Head loss (m H20)	0.60	m		
Head loss	**5.89**	kPa	**0.85**	psi
Static Pressure at Existing Hydrant	**627.42**	KPa	**91**	psi
Hydraulic head at Existing Hydrant	**304.82**	m		

3.

Residual Pressure at Furthest Hydrant for Max Day + Fire Flow				
Pressure at Water Connection Point	**539.48**	KPa	**78.2**	psi

GEI Consultants

Watermain Residual Pressure

Min. Fire Flow + Max. Daily Demand (Condo)

Project Name:	Stateview Homes (BEA Towns) Inc.
Project No.:	2104593
Prepared by:	P. Chiocchio
Date:	October 6, 2022

$$Q = 0.278 \times C \times D2.63 \times (\frac{Hf}{L})0.54$$

Specified Data		
L = length of pipe	27.5	m
C = Hazen-Williams roughness constant	110	
C=100 for 150 dia & smaller, C=110 for 200 & 250 dia and C=120 for 300 and larger)		
Q = Flow (Max Day plus Fire Flow)	201.1	L/s
D = Watermain Diameter	200	mm
V = Velocity	6.40	m/s

1.

Calculated Pressure Loss - Friction				
H_f = Friction Head loss (m of head per 100 m pipe)	23.44	m		
H_f = Friction Head loss (kPa per 100 m pipe)	229.94	kPa		
Head loss (m of head)	6.45	m		
Head loss (due to friction)	**63.23**	**kPa**	**9.17**	psi

2.

Pressure Loss - Water Meter & Backflow Preventer				
H_f = Head Loss (DCVA Performance Curve)	**27.58**	**kPa**	**4.00**	psi
H_f = Head Loss (Water Meter Performance Curve)	**17.24**	**kPa**	**2.50**	psi

3.

Pressure Loss - Connection				
K-Value for Entrance	1.00			
Head loss (m of head)[A]	**2.09**	**kPa**	**0.30**	psi

[A]Head Loss calculated by $KV^2/2g$

4.

Pressure Change Due to Elevation				
Ground Elevation at Existing Hydrant	240.75	m		
Ground Elevation at Water Connection Point	241.35	m		
Elevation Change	0.60	m		
Head loss (m H20)	0.60	m		
Head loss	**5.89**	kPa	**0.85**	psi
Static Pressure at Existing Hydrant	**627.42**	KPa	**91**	psi
Hydraulic head at Existing Hydrant	**304.82**	m		

3.

Residual Pressure at Furthest Hydrant for Max Day + Fire Flow				
Pressure at Water Connection Point	**513.49**	KPa	**74.5**	psi

GEI Consultants

Watermain Residual Pressure

Max. Hourly Demand (Condo)

Project Name:	Stateview Homes (BEA Towns) Inc.
Project No.:	2104593
Prepared by:	P. Chiocchio
Date:	October 6, 2022

$$Q = 0.278 \times C \times D2.63 \times (\frac{Hf}{L})0.54$$

Specified Data		
L = length of pipe	27.5	m
C = Hazen-Williams roughness constant	110	
C=100 for 150 dia & smaller, C=110 for 200 & 250 dia and C=120 for 300 and larger)		
Q = Flow (Max Hourly)	1.2	L/s
D = Watermain Diameter	150	mm
V = Velocity	0.07	m/s

1.

Calculated Pressure Loss - Friction				
H_f = Friction Head loss (m of head per 100 m pipe)	0.01	m		
H_f = Friction Head loss (kPa per 100 m pipe)	0.07	kPa		
Head loss (m of head)	0.00	m		
Head loss (due to friction)	**0.02**	**kPa**	**0.00**	psi

2.

Pressure Loss - Water Meter & Backflow Preventer				
H_f = Head Loss (DCVA Performance Curve)	**27.58**	**kPa**	**4.00**	psi
H_f = Head Loss (Water Meter Performance Curve)	**17.24**	**kPa**	**2.50**	psi

3.

Pressure Loss - Connection				
K-Value for Entrance	1.00			
Head loss (m of head)[A]	**0.00**	**kPa**	**0.00**	psi

[A]Head Loss calculated by $KV^2/2g$

4.

Pressure Change Due to Elevation				
Ground Elevation at Existing Hydrant	240.75	m		
Ground Elevation at Water Connection Point	241.35	m		
Elevation Change	0.60	m		
Head loss (m H20)	0.60	m		
Head loss	**5.89**	kPa	**0.85**	psi
Static Pressure at Existing Hydrant	**627.42**	KPa	**91**	psi
Hydraulic head at Existing Hydrant	**304.82**	m		

5.

Residual Pressure at Furthest Hydrant for Max Day + Fire Flow				
Pressure at Water Connection Point	**576.70**	KPa	**83.6**	psi

GEI Consultants

Watermain Residual Pressure

FUS Fire Flow + Max. Daily Demand (Town)

Project Name:	Stateview Homes (BEA Towns) Inc.
Project No.:	2104593
Prepared by:	P. Chiocchio
Date:	October 6, 2022

$$Q = 0.278 \times C \times D2.63 \times (\frac{Hf}{L})0.54$$

Specified Data		
L = length of pipe	249.8	m
C = Hazen-Williams roughness constant	110	
C=100 for 150 dia & smaller, C=110 for 200 & 250 dia and C=120 for 300 and larger)		
Q = Flow (Max Day plus Fire Flow)	154.049	L/s
D = Watermain Diameter	250	mm
V = Velocity	3.14	m/s

1.

Calculated Pressure Loss - Friction				
H_f = Friction Head loss (m of head per 100 m pipe)	4.83	m		
H_f = Friction Head loss (kPa per 100 m pipe)	47.40	kPa		
Head loss (m of head)	12.07	m		
Head loss (due to friction)	**118.39**	**kPa**	**17.17**	psi

2.

Pressure Loss - Water Meter & Backflow Preventer					
H_f = Head Loss (DCVA Performance Curve)		**44.82**	**kPa**	**6.50**	psi
H_f = Head Loss (Water Meter Performance Curve)	z	**10.34**	**kPa**	**1.50**	psi

3.

Pressure Loss - Connection				
K-Value for Entrance	1.00			
Head loss (m of head)[A]	**0.50**	**kPa**	**0.07**	psi

[A]Head Loss calculated by $KV^2/2g$

4.

Pressure Change Due to Elevation				
Ground Elevation at Existing Hydrant	240.75	m		
Ground Elevation at Water Connection Point	242.16	m		
Elevation Change	1.41	m		
Head loss (m H20)	1.41	m		
Head loss	**13.83**	kPa	**2.01**	psi
Static Pressure at Existing Hydrant	**627.42**	KPa	**91**	psi
Hydraulic head at Existing Hydrant	**304.82**	m		

3.

Residual Pressure at Furthest Hydrant for Max Day + Fire Flow				
Pressure at Water Connection Point	**440.04**	KPa	**63.8**	psi

GEI Consultants

Watermain Residual Pressure

Min. Fire Flow + Max. Daily Demand (Town)

Project Name:	Stateview Homes (BEA Towns) Inc.
Project No.:	2104593
Prepared by:	P. Chiocchio
Date:	October 6, 2022

$$Q = 0.278 \times C \times D2.63 \times (\frac{Hf}{L})0.54$$

Specified Data		
L = length of pipe	249.8	m
C = Hazen-Williams roughness constant	110	
C=100 for 150 dia & smaller, C=110 for 200 & 250 dia and C=120 for 300 and larger)		
Q = Flow (Max Day plus Fire Flow)	159.049	L/s
D = Watermain Diameter	250	mm
V = Velocity	3.24	m/s

1.

Calculated Pressure Loss - Friction				
H_f = Friction Head loss (m of head per 100 m pipe)	5.13	m		
H_f = Friction Head loss (kPa per 100 m pipe)	50.28	kPa		
Head loss (m of head)	12.80	m		
Head loss (due to friction)	**125.61**	**kPa**	**18.22**	psi

2.

Pressure Loss - Water Meter & Backflow Preventer					
H_f = Head Loss (DCVA Performance Curve)		**44.82**	**kPa**	**6.50**	psi
H_f = Head Loss (Water Meter Performance Curve)	z	**10.34**	**kPa**	**1.50**	psi

3.

Pressure Loss - Connection				
K-Value for Entrance	1.00			
Head loss (m of head)[A]	**0.54**	**kPa**	**0.08**	psi

[A]Head Loss calculated by $KV^2/2g$

4.

Pressure Change Due to Elevation				
Ground Elevation at Existing Hydrant	240.75	m		
Ground Elevation at Water Connection Point	242.16	m		
Elevation Change	1.41	m		
Head loss (m H20)	1.41	m		
Head loss	**13.83**	kPa	**2.01**	psi
Static Pressure at Existing Hydrant	**627.42**	KPa	**91**	psi
Hydraulic head at Existing Hydrant	**304.82**	m		

3.

Residual Pressure at Furthest Hydrant for Max Day + Fire Flow				
Pressure at Water Connection Point	**432.82**	KPa	**62.8**	psi

GEI Consultants

Watermain Residual Pressure

Max. Hourly Demand (Town)

Project Name:	Stateview Homes (BEA Towns) Inc.
Project No.:	2104593
Prepared by:	P. Chiocchio
Date:	October 6, 2022

$$Q = 0.278 \times C \times D2.63 \times (\frac{Hf}{L})0.54$$

Specified Data		
L = length of pipe	249.8	m
C = Hazen-Williams roughness constant	110	
C=100 for 150 dia & smaller, C=110 for 200 & 250 dia and C=120 for 300 and larger)		
Q = Flow (Max Hourly)	6.08	L/s
D = Watermain Diameter	250	mm
V = Velocity	0.12	m/s

1.

Calculated Pressure Loss - Friction				
H_f = Friction Head loss (m of head per 100 m pipe)	0.01	m		
H_f = Friction Head loss (kPa per 100 m pipe)	0.12	kPa		
Head loss (m of head)	0.03	m		
Head loss (due to friction)	**0.30**	**kPa**	**0.04**	psi

2.

Pressure Loss - Water Meter & Backflow Preventer				
H_f = Head Loss (DCVA Performance Curve)	**44.82**	**kPa**	**6.50**	psi
H_f = Head Loss (Water Meter Performance Curve)	**10.34**	**kPa**	**1.50**	psi

3.

Pressure Loss - Connection				
K-Value for Entrance	1.00			
Head loss (m of head)[A]	**0.00**	**kPa**	**0.00**	psi

[A]Head Loss calculated by $KV^2/2g$

4.

Pressure Change Due to Elevation				
Ground Elevation at Existing Hydrant	240.75	m		
Ground Elevation at Water Connection Point	242.16	m		
Elevation Change	1.41	m		
Head loss (m H20)	1.41	m		
Head loss	**13.83**	kPa	**2.01**	psi
Static Pressure at Existing Hydrant	**606.74**	KPa	**88**	psi
Hydraulic head at Existing Hydrant	**302.71**	m		

5.

Residual Pressure at Furthest Hydrant for Max Day + Fire Flow				
Pressure at Water Connection Point	**537.45**	KPa	**78.0**	psi

GEI Consultants

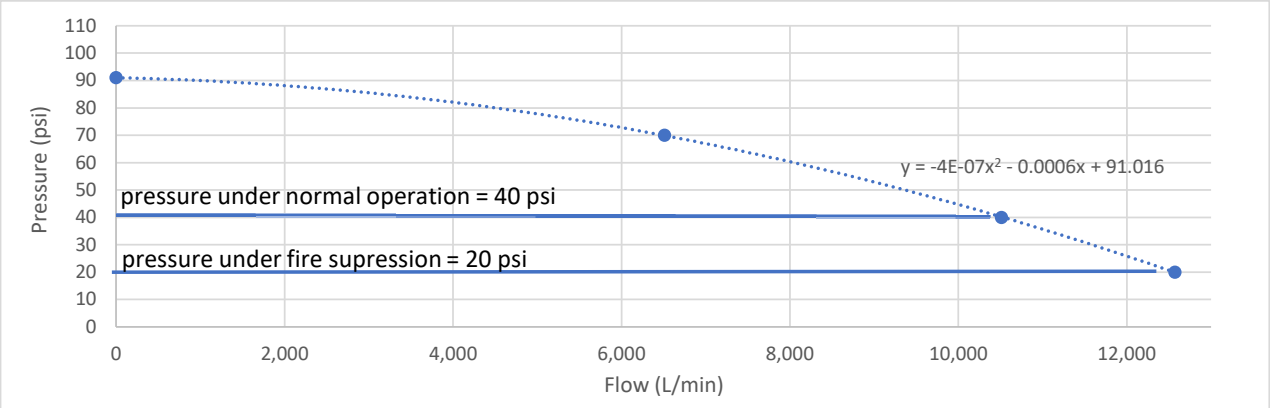
Water System Pressure Calculation Worksheet

Project Name:	Stateview Homes (BEA Towns) Inc.
Project No.:	2104593
Prepared by:	Paul Chiocchio
Date:	06-Oct-22

Hydrant Flow Test Results

Flow Test Location:	Ardagh Road & Mapleton Avenue, Barrie, ON
Residual Test Location:	Southwest of Ardagh Rd & Mapleton Avenue
Main Size:	300mm PVC
Test Date:	September 22, 2020
Tested By:	VIPOND Inc.

Number of Outlets & Orifice Size	Pitot Pressure (psi)	Flow (US GPM)	Flow (L/min)	Residual Pressure (psi)
1 x 1.75"	61	695	2,631	75
1 x 2.5"	32	954	3,611	80
2 x 2.5"	26	1,720	6,511	70



$$Q_R = \mathrm{Q_T}\left(\frac{\mathrm{P_S} - \mathrm{Pr}}{\mathrm{P_S} - \mathrm{Pt}}\right)\text{^}0.54$$

Where,

Q_r = Projected Flow Rate

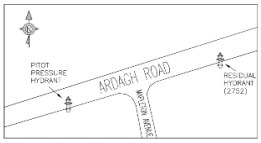
Q_t = Flow Rate from Flow Test = 6511 L/min

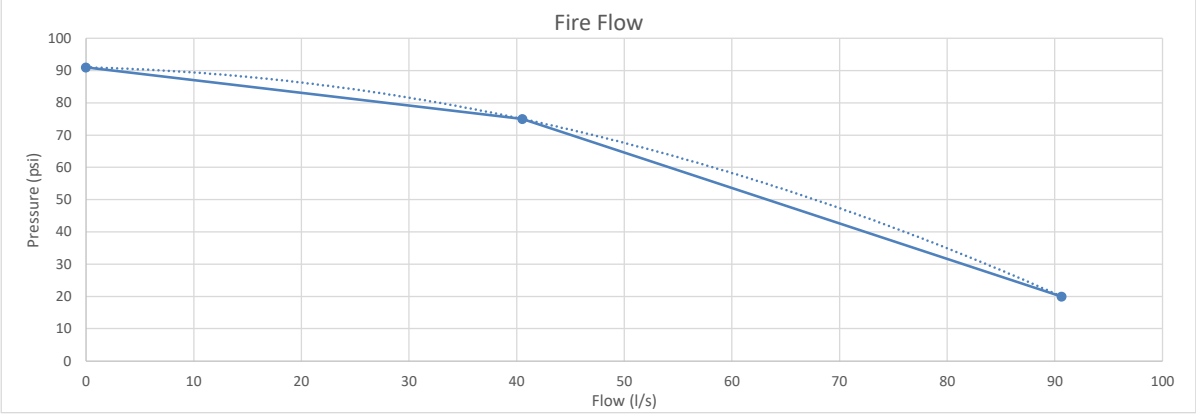
P_s = Static Pressure = 91 psi

P_r = Desired System Pressure

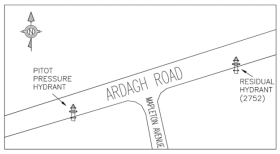
P_t = Residual Presure in Test = 70 psi

Static Pressure (P_s)	91	psi
Pressure Under Fire Suppression (P_{r1}) =	20.0	psi
Calculated Flow Rate (Q_{r1}) =	12,570	L/min
Calculated Flow Rate (Q_{r1}) =	209	L/s
Pressure Under Normal Operation (P_{r2}) =	40.0	psi
Calculated Flow Rate (Q_{r2}) =	10,513	L/min
Calculated Flow Rate (Q_{r1}) =	175	L/s

Fire Flow Test (v1.0) City of Barrie 6-Oct-2022		
Hydrant Number (Residual and Static Pressure)	2752	
Hydrant Number(s) (Flow)	Not provided by VIPOND Inc.	
Hydrant Street / Address (Residual and Static Pressure)	South East of Summerset Drive & Ardagh Road (refer to map by VIPOND)	
Hydrant Street / Address (Flow)	South West of Summerset Drive & Ardagh Road (refer to map by VIPOND)	
Hydrant Locations Figure (Residual/Static and Flow)		Figure by VIPOND Inc.
Date of Test (DD/MM/YYYY)	Tuesday September 22, 2020 (Test #1)	
Time (HH:MM AM or PM)	01:20:00 PM	
Time (HH:MM AM or PM)	Not provided by VIPOND Inc.	
Company Name	VIPOND Inc.	
Employee Name(s)	GUS A.	
City of Barrie Employee Name(s)	Not provided by VIPOND Inc.	
Static Pressure	91	psi
Residual Pressure	75	psi
Hydrant Elevation (Residual and Static Pressure)	240.75	m
Hydrant Elevation (Flow)	241	m
Elevation Difference (m)	-0.25	m
Pitot Pressure - Outlet 1	61	psi
Pitot Pressure - Outlet 2		psi
Outlet Size	1.75	inch
Outlet Coefficient	0.9	
Pressure Drop Check (NFPA 291)	17.58	% Minimum pressure drop of 25% is recommended, please consider opening other outlets or flowing additional hydrants
Pressure Drop Check (AWWA M17)	16.00	psi Meets minimum pressure drop recommendation of 10 psi
Q Hydrant Flow - Outlet 1	642.37	US gpm
Q Hydrant Flow - Outlet 2	0.00	US gpm
Q Total Flow	40.53	l/s
Pressure at Desired Fire Flow	20.00	psi
Q Outlet 1_R	1436.27	US gpm
Q Outlet 2_R	0.00	US gpm
Q $Total_R$	1436.27	US gpm
Q $Total_R$	90.61	l/s
Have any Cell formulas been changed? (Yes/No)	No	If Yes please indicate which ones and why
Hydrant Colour:	Green	
Boundary Conditions (ET, Reservoir, BPS, PRV, Wells etc): ??		
Other Considerations (flushing, fire, operational issues, outlet coefficient etc): ??		

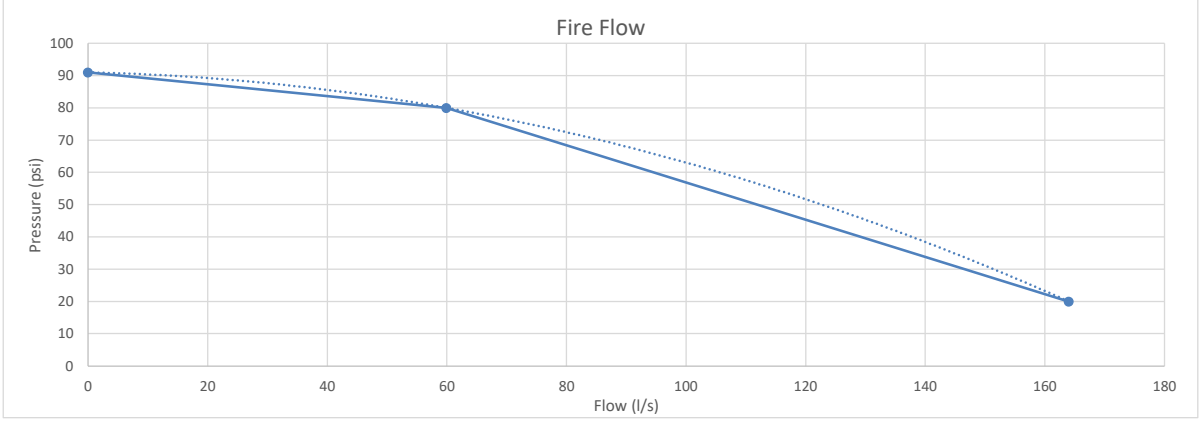


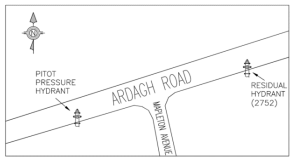
Fire Flow Test (v1.0)
City of Barrie
6-Oct-2022

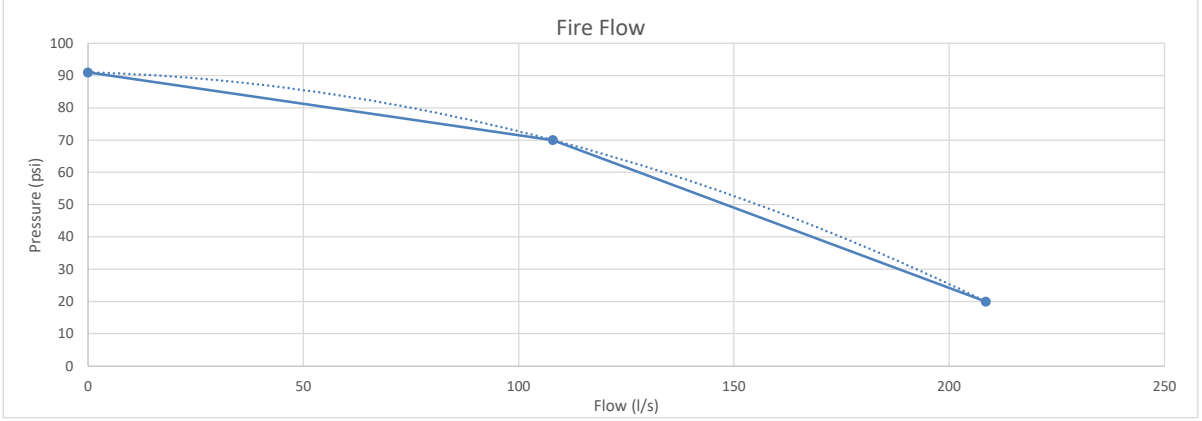
Hydrant Number (Residual and Static Pressure)	2752	
Hydrant Number(s) (Flow)	Not provided by VIPOND Inc.	
Hydrant Street / Address (Residual and Static Pressure)	South East of Summerset Drive & Ardagh Road (refer to map by VIPOND)	
Hydrant Street / Address (Flow)	South West of Summerset Drive & Ardagh Road (refer to map by VIPOND)	
Hydrant Locations Figure (Residual/Static and Flow)	 Figure by VIPOND Inc.	
Date of Test (DD/MM/YYYY)	Tuesday September 22, 2020 (Test #2)	
Time (HH:MM AM or PM)	01:20:00 PM	
Time (HH:MM AM or PM)	Not provided by VIPOND Inc.	
Company Name	VIPOND Inc.	
Employee Name(s)	GUS A.	
City of Barrie Employee Name(s)	Not provided by VIPOND Inc.	
Static Pressure	91	psi
Residual Pressure	80	psi
Hydrant Elevation (Residual and Static Pressure)	240.75	m
Hydrant Elevation (Flow)	241	m
Elevation Difference (m)	-0.25	m
Pitot Pressure - Outlet 1	32	psi
Pitot Pressure - Outlet 2		psi
Outlet Size	2.5	inch
Outlet Coefficient	0.9	
Pressure Drop Check (NFPA 291)	12.09	% Minimum pressure drop of 25% is recommended, please consider opening other outlets or flowing additional hydrants
Pressure Drop Check (AWWA M17)	11.00	psi Meets minimum pressure drop recommendation of 10 psi
Q Hydrant Flow - Outlet 1	949.50	US gpm
Q Hydrant Flow - Outlet 2	0.00	US gpm
Q Total Flow	59.90	l/s
Pressure at Desired Fire Flow	20.00	psi
Q Outlet 1_R	2599.10	US gpm
Q Outlet 2_R	0.00	US gpm
Q $Total_R$	2599.10	US gpm
Q $Total_R$	163.98	l/s
Have any Cell formulas been changed? (Yes/No)	No	If Yes please indicate which ones and why
Hydrant Colour:	Blue	

Boundary Conditions (ET, Reservoir, BPS, PRV, Wells etc):
??

Other Considerations (flushing, fire, operational issues, outlet coefficient etc):
??



Fire Flow Test (v1.0) City of Barrie 6-Oct-2022		
Hydrant Number (Residual and Static Pressure)	2752	
Hydrant Number(s) (Flow)	Not provided by VIPOND Inc.	
Hydrant Street / Address (Residual and Static Pressure)	South East of Summerset Drive & Ardagh Road (refer to map by VIPOND)	
Hydrant Street / Address (Flow)	South West of Summerset Drive & Ardagh Road (refer to map by VIPOND)	
Hydrant Locations Figure (Residual/Static and Flow)		Figure by VIPOND Inc.
Date of Test (DD/MM/YYYY)	Tuesday September 22, 2020 (**Test #3**)	
Time (HH:MM AM or PM)	01:20:00 PM	
Time (HH:MM AM or PM)	Not provided by VIPOND Inc.	
Company Name	VIPOND Inc.	
Employee Name(s)	GUS A.	
City of Barrie Employee Name(s)	Not provided by VIPOND Inc.	
Static Pressure	91	psi
Residual Pressure	70	psi
Hydrant Elevation (Residual and Static Pressure)	240.75	m
Hydrant Elevation (Flow)	241	m
Elevation Difference (m)	-0.25	m
Pitot Pressure - Outlet 1	26	psi
Pitot Pressure - Outlet 2	26	psi
Outlet Size	2.5	inch
Outlet Coefficient	0.9	
Pressure Drop Check (NFPA 291)	23.08	% Minimum pressure drop of 25% is recommended, please consider opening other outlets or flowing additional hydrants
Pressure Drop Check (AWWA M17)	21.00	psi Meets minimum pressure drop recommendation of 10 psi
Q Hydrant Flow - Outlet 1	855.87	US gpm
Q Hydrant Flow - Outlet 2	855.87	US gpm
Q Total Flow	107.99	l/s
Pressure at Desired Fire Flow	20.00	psi
Q Outlet 1_R	1652.30	US gpm
Q Outlet 2_R	1652.30	US gpm
Q $Total_R$	3304.60	US gpm
Q $Total_R$	208.49	l/s
Have any Cell formulas been changed? (Yes/No)	No	If Yes please indicate which ones and why
Hydrant Colour:	Blue	
Boundary Conditions (ET, Reservoir, BPS, PRV, Wells etc): ??		
Other Considerations (flushing, fire, operational issues, outlet coefficient etc): ??		



Model 350

Double Check Valve Assembly

Application

Designed for installation on potable water lines to protect against both backsiphonage and backpressure of polluted water into the potable water supply. The Model 350 shall provide protection where a potential health hazard does not exist. Ideal for use where lead-free* valves are required.

Standards Compliance : (Sizes 2 1/2"-10" Horiz. & Vert.)
(Size 12" horizontal)

- ASSE® Listed 1015
- CSA® Certified B64.5
- IAPMO® Listed
- AWWA Compliant C510, and C550
- UL® Classified
- C-UL® Classified
- FM® Approved (2 1/2" - 10")
- Approved by the Foundation for Cross Connection Control and Hydraulic Research at the University of Southern California
- NYC MEA 50-01-M (2 1/2" - 3")
- NYC MEA 297-98-M (4" - 6")
- NYC MEA 316-01-M (8" - 10")
- Meets the requirements of NSF/ANSI 61*

*(0.25% MAX. WEIGHTED AVERAGE LEAD CONTENT)



NSF/ANSI 61

Options

(Suffixes can be combined)

- ☐ - with NRS shut-off valves (standard)
- ☐ FSC - with epoxy coated wye type strainer (flanged only 2-1/2"-10")
- ☐ G - with groove end gate valves (2-1/2" - 10")
- ☐ GF - with grooved inlet connection and flanged outlet connection (2-1/2" - 10")
- ☐ FG - with flanged inlet connection and grooved outlet connection (2-1/2" - 10")
- ☐ L - less shut-off valves (flanged body connections)
- ☐ OSY - with OS & Y gate valves
- ☐ PI - Post Indicator gate valve
- ☐ BG - with grooved end butterfly valves with integral supervisory switches (2-1/2" - 10")
- ☐ –509 - with AWWA C509 gate valves

Accessories

- ☐ Repair kit (rubber only)
- ☐ Thermal expansion tank (Model XT)
- ☐ OS & Y Gate valve tamper switch (OSY-40)

Attention: Model 350 (flange body) and 350A (grooved body) have different lay lengths.

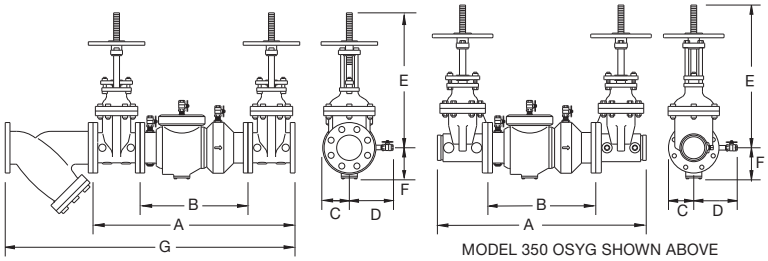
Materials

Main valve body	Ductile Iron ASTM A 536
Access covers	Ductile Iron ASTM A 536
Coatings	NSF Approved fusion epoxy finish
Internals	Stainless steel, 300 Series NORYL™
Fasteners	Stainless Steel, 300 Series
Seal ring	EPDM (FDA approved)
O-ring	Buna Nitrile (FDA approved)
Springs	Stainless Steel, 300 Series

Features

Sizes: 2 1/2", 3", 4", 6" , 8", 10" , 12"

Maximum working water pressure	175 PSI
Maximum working water temperature	140°F
Hydrostatic test pressure	350 PSI
End connections	
(Grooved for steel pipe)	AWWA C606
(Flanged)	ANSI B16.1 Class 125



MODEL 350 OSYG SHOWN ABOVE

Dimensions & Weights (do not include pkg.)

MODEL 350 SIZE		DIMENSION (approximate)																						WEIGHT											
		A		A WITH BUTTERFLY VALVES		B LESS GATE VALVES		C		D		E OS&Y OPEN		E OS&Y CLOSED		E NRS GATE		E WITH BUTTERFLY VALVES		F		G		LESS SHUTOFF VALVES		NRS GATE VALVES FLANGED		NRS GATE VALVES GROOVED		OSY GATE VALVES FLANGED		OS&Y GATE VALVES GROOVED		BUTTERFLY VALVES GROOVED	
in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	lbs.	kg	lbs.	kg	lbs.	kg	lbs.	kg	lbs.	kg	lbs.	kg
2 1/2	65	31	787	28	711	15 7/8	403	3 3/4	95	7 1/4	184	17 3/4	451	15 3/8	391	11 1/2	292	8 1/4	210	3 1/2	89	41 1/4	1048	53	24	155	70	137	62	163	74	145	66	125	57
3	80	32	813	28 1/2	724	15 7/8	403	3 3/4	95	7 1/4	184	20 1/4	514	17	432	12 3/4	324	8 1/2	216	3 1/2	89	42 3/4	1086	53	24	177	80	147	67	183	83	135	61	105	48
4	100	37 5/8	956	32 7/8	835	19 1/2	495	4 1/2	114	8	203	22 1/2	572	18 1/4	464	14 1/2	368	9	229	6	152	52 3/4	1340	91	41	271	123	253	115	281	127	267	121	175	79
6	150	44 3/4	1137	37 5/8	956	23 1/2	597	6	152	10	254	30 1/2	775	24 1/4	616	18	457	10 1/4	260	7	178	62 3/4	1594	165	75	449	204	421	191	465	211	439	199	283	129
8	200	60 3/4	1543	53 7/8	1369	37 3/4	959	10	254	11	279	37	940	28 1/2	724	21 1/8	537	12	305	8 1/2	216	85	2159	358	162	810	367	776	352	834	378	786	357	532	241
10	250	63 3/4	1619	57 7/8	1470	37 3/4	959	10	254	11	279	45 5/8	1159	34 3/4	883	24 3/4	629	13	330	8 1/2	216	93 1/4	2369	388	176	1148	521	1082	491	1206	547	1140	517	776	352
12	300	66 1/4	1683	n/a	n/a	38	965	10	254	12	305	53	1346	40 1/2	1029	28	711	n/a	n/a	9	229	100	2539	447	203	1493	677	n/a	n/a	1607	729	n/a	n/a	n/a	n/a

Zurn Industries, LLC | Wilkins
1747 Commerce Way, Paso Robles, CA U.S.A. 93446 Ph. 855-663-9876, Fax 805-238-5766
In Canada | **Zurn Industries Limited**
3544 Nashua Drive, Mississauga, Ontario L4V 1L2 Ph. 905-405-8272, Fax 905-405-1292
www.zurn.com

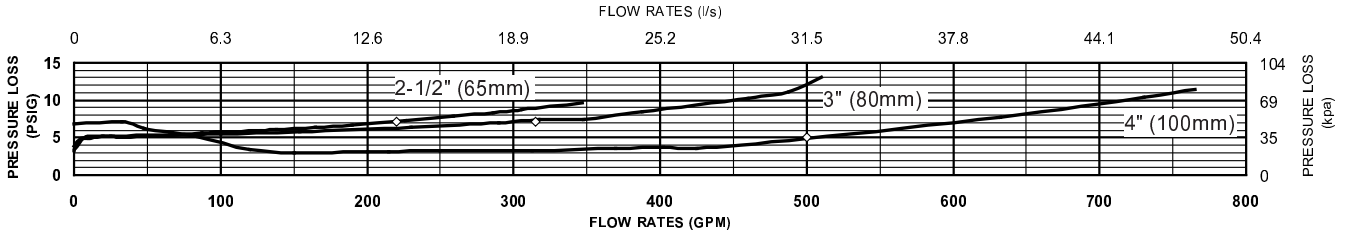
Rev. K
Date: 1/17
Document No. BF-350
Product No. Model 350

Flow Characteristics

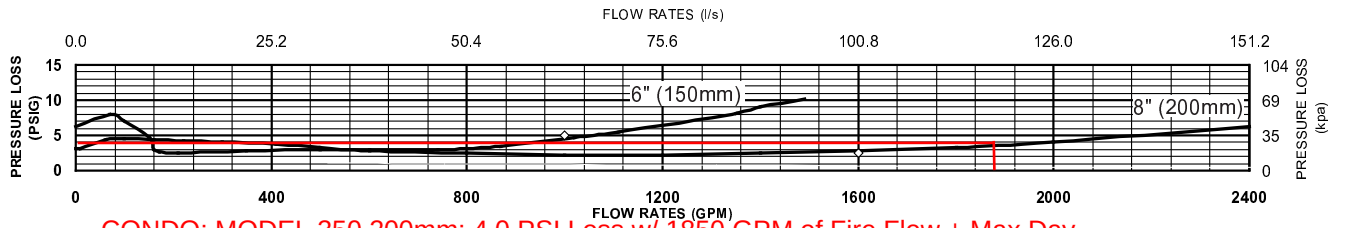
DOUBLE CHECK VALVE ASSEMBLY PRESSURE LOSS CURVE

◇ Rated Flow (established by approval agencies)

MODEL 350 2 1/2", 3" & 4" (STANDARD & METRIC)

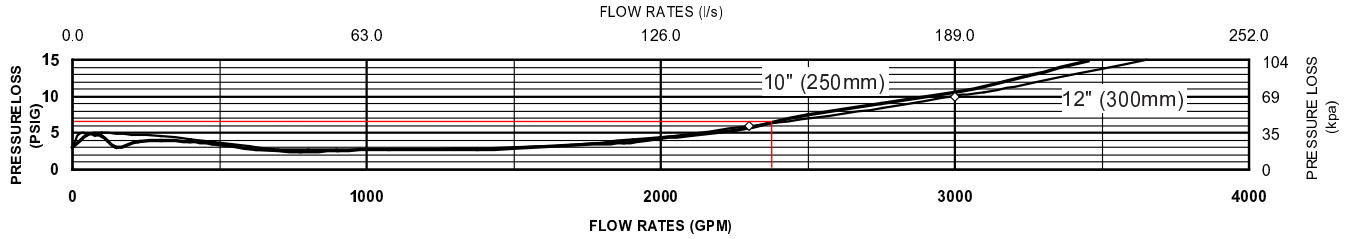


MODEL 350 6" & 8" (STANDARD & METRIC)



CONDO: MODEL 350 200mm: 4.0 PSI Loss w/ 1850 GPM of Fire Flow + Max Day

MODEL 350 10" & 12" (STANDARD & METRIC)

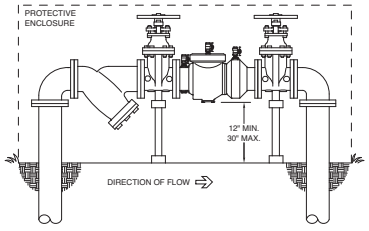


TOWN: MODEL 350 250mm: 6.5 PSI Loss w/ 2380 GPM of Fire Flow + Max Day

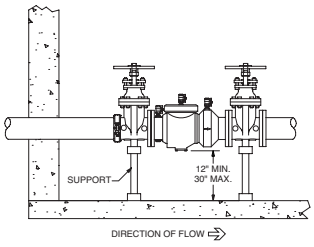
Typical Installation

Local codes shall govern installation requirements. Unless otherwise specified, the assembly shall be mounted at a minimum of 12" (305mm) and a maximum of 30" (762mm) above adequate drains with sufficient side clearance for testing and maintenance. The installation shall be made so that no part of the unit can be submerged.

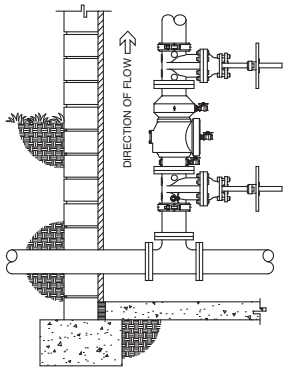
Capacity thru Schedule 40 Pipe (GPM)				
Pipe size	5 ft/sec	7.5 ft/sec	10 ft/sec	15 ft/sec
2 1/2"	75	112	149	224
3"	115	173	230	346
4"	198	298	397	595
6"	450	675	900	1351
8"	780	1169	1559	2339
10"	1229	1843	2458	3687
12"	1763	2644	3525	5288



OUTDOOR INSTALLATION



INDOOR INSTALLATION (350GF)



VERTICAL INSTALLATION (350G)

Specifications

The Double Check Backflow Prevention Assembly shall be certified to NSF/ANSI 61, ASSE® Listed 1015, and supplied with full port gate valves. The main body and access cover shall be epoxy coated ductile iron (ASTM A 536), the seat ring and check valve shall be NORYL™, the stem shall be stainless steel (ASTM A 276) and the seat disc elastomers shall be EPDM. The checks shall be accessible for maintenance without removing the device from the line. The Double Check Backflow Prevention Assembly shall be a ZURN WILKINS Model 350.

Zurn Industries, LLC | Wilkins
1747 Commerce Way, Paso Robles, CA U.S.A. 93446 Ph. 855-663-9876, Fax 805-238-5766
In Canada | **Zurn Industries Limited**
3544 Nashua Drive, Mississauga, Ontario L4V 1L2 Ph. 905-405-8272, Fax 905-405-1292
www.zurn.com

OMNI™ F²

4”, 6”, 8” and 10” OMNI F² Meter

Description

4”, 6”, 8” and 10” Sizes

The OMNI F² meter operation is based on advanced Floating Ball Technology (FBT).





AMR/AMI Mode | Totalization Mode | Resettable Test Mode

Features

CONFORMANCE TO STANDARDS

The OMNI F² meter meets and far exceeds the most recent revision of AWWA Standard C703 class II. Additionally, the meter does not require a valve to meet these standards. Each meter is performance tested to ensure compliance. All OMNI meters are NSF/ANSI Standard 61, Annex F and G approved. The OMNI F² meter is UL (Underwriters Laboratories) Listed and FM (Factory Mutual) approved for use on fire protection and domestic water applications.

PERFORMANCE

The patented measurement principles of the OMNI F² meter assure enhanced accuracy ranges, an overall greater accuracy, and a longer service life than any other comparable class meter produced. The F² meter has no restrictions as to sustained flow rates within its continuous operating range. The floating ball measurement technology allows for flows up to its rated maximum capacity without undue wear or accuracy degradation.

CONSTRUCTION

The OMNI F² meter consists of two basic assemblies; the maincase and the measuring chamber. The measuring chamber assembly includes the “floating ball” impeller with a coated titanium shaft, hybrid axial bearings, integral flow straightener and an all electronic programmable register with protective bonnet. The maincase is made from industry proven Ductile Iron with an approved NSF epoxy coating. Maincase features are; easily removable measuring chamber, unique chamber seal to the maincase using a high pressure o-ring, testing port and a convenient integral strainer with optional drain/debris-flushing ports.

OMNI ELECTRONIC REGISTER

The OMNI F² electronic register is hermetically sealed with electronic pickup containing no mechanical gearing. The large character LCD displays AMR, Totalization and a Resettable Test Totalizer. OMNI register features; AMR resolution units that are fully programmable, Pulse output frequency that are fully programmable, Integral customer data logging capability, Integral resettable accuracy testing feature compatible with the UniPro Testing Assistant Program, Large, easy-to-read LCD also displays both forward and reverse flow directions and all with a 10-year battery life guarantee.

MAGNETIC DRIVE

Meter registration is achieved by utilizing a fully magnetic pickup system. This is accomplished by the magnetic actions of the embedded rotor magnets and the ultra sensitive register pickup probe. The only moving component in water is the “floating ball” impeller.

MEASURING ELEMENT

The revolutionary thermoplastic, hydro dynamically balanced impeller floats between the bearings. The Floating Ball Technology (FBT) allows the measuring element to operate virtually without friction or wear, thus creating the extended upper and lower flow ranges capable on only the OMNI F² meter.

STRAINER

The OMNI F² meter includes the Sensus designed “V” shaped UL Listed/FM approved strainer which utilizes a stainless steel screen along with Floating Ball Technology (FBT) to create a design that gives far improved accuracy even in those once thought questionable settings. A removable strainer cover permits easy access to the screen for routine maintenance. Optional drain ports, located at the back lower corners of the strainer body, allow for easy discharging of debris without the need to remove the cover.

MAINTENANCE

The OMNI F² meter is designed for easy maintenance. Should any maintenance be required, the measuring chamber and/or strainer cover can be removed independently. Parts and or a replacement measuring chamber may be utilized in the event repairs are needed. Replacement Measuring Chambers are available for the OMNI F² meters.

AMR / AMI SYSTEMS

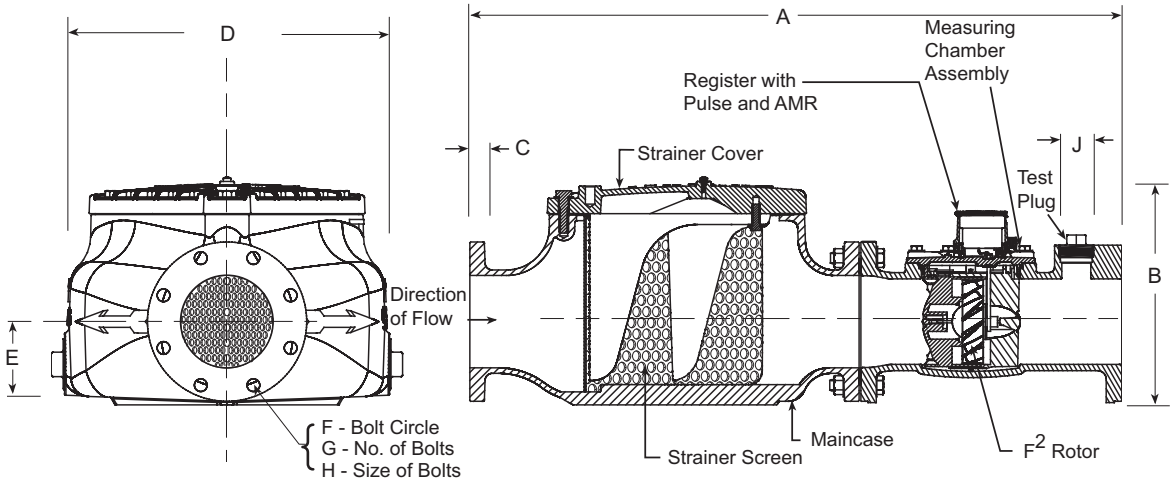
Meters and encoders are compatible with current Sensus AMR/AMI systems.

GUARANTEE

Sensus OMNI F² Meters are backed by “The Sensus Guarantee.” Ask your Sensus representative for details or see Bulletin G-500.

sensus

OMNI F²: 4", 6", 8" and 10"



DIMENSIONS AND NET WEIGHTS

Meter and Pipe Size	Normal Operating Range		Connections	A	B	C	D	E	F	G	H	J	Net Weight	Shipping Weight	Standard Fireline
4" DN 100mm	1.5 gpm .34 m³/hr	1000 gpm 227 m³/hr	Flanged	33" 838mm	13-11/16" 348mm	15/16" 24mm	17-1/2" 446mm	4-3/4" 121mm	7-1/2" 191mm	8	5/8" 16mm	2" 50mm	212 lbs. 96 kg.	252 lbs. 115 kg.	51-7/8" (1317mm)
6" DN 150mm	3.0 gpm .681 m³/hr	2000 gpm 454 m³/hr	Flanged	45" 1143mm	15-3/4" 400mm	15/16" 24mm	22-3/8" 569mm	5-3/4" 146mm	9-1/2" 242mm	8	3/4" 19mm	2" 50mm	394 lbs. 179 kg.	449 lbs. 204 kg.	67-5/8" (1717mm)
8" DN 200mm	4 gpm .91 m³/hr	3500 gpm 795 m³/hr	Flanged	53" 1346mm	18-1/2" 470mm	11/16" 17mm	31" 787mm	6-3/4" 172mm	11-3/4" 298mm	8	3/4" 19mm	2" NPT	736 lbs. 334 kg.	786 lbs. 357 kg.	77" (1956mm)
10" DN 250mm	5 gpm 1.1 m³/hr	5500 gpm 1249 m³/hr	Flanged	68" 1727mm	22-1/4" 565mm	11/16" 17mm	37-1/3" 947mm	8-1/2" 216mm	14-1/4" 362mm	12	7/8 22mm	2" NPT	1155 lbs. 524 kg.	1215 lbs. 551 kg.	90" (2286mm)

[1] **Standard Fireline lay length with optional spool piece added.**

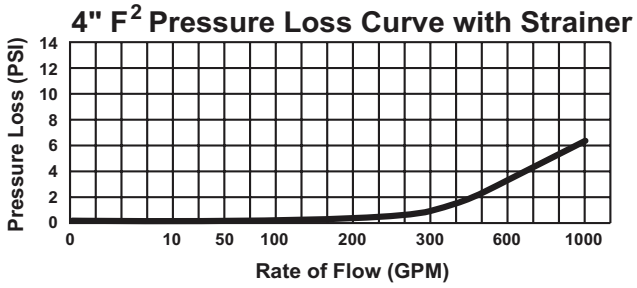
SPECIFICATIONS

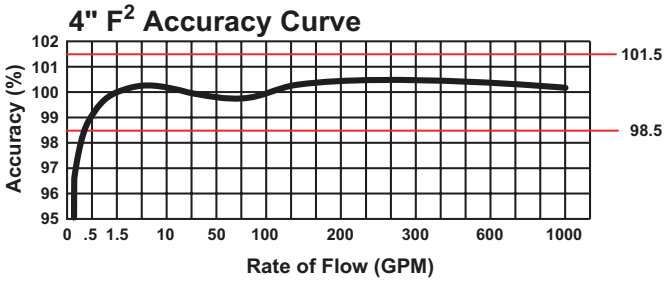
SERVICE	Measurement of potable and reclaim water. Operating temperature range of 33 ºF (56 ºC) - 150 ºF (65.6 ºC)
OPERATING RANGE (100% ± 1.5%)	4": 1.5 – 1000 GPM (.34 - 227 m³/hr) 6": 3.0 – 2000 GPM (.34 - 227 m³/hr) 8": 4– 3500 GPM (0.91-795 m³/hr) 10": 5– 5500 GPM (1.1-1249 m³/hr)
LOW FLOW (95% – 101.5%)	4": .75 GPM (.06 m³/hr) 6": 1.5 GPM (.06 m³/hr) 8": 2.5 GPM (0.57 m³/hr) 10": 3.5 GPM (0.8 m³/hr)
UL MINIMUM FLOW	8": 97% @ 3 GPM (0.68 m³/hr) 10": 97% @ 4 GPM (0.9 m³/hr)
MAXIMUM CONTINUOUS OPERATION	4": 1000 GPM (227 m³/hr) 6": 2000 GPM (454 m³/hr) 8": 3500 GPM (795 m³/hr) 10": 5500 GPM (1249 m³/hr)
MAXIMUM INTERMITTENT OPERATION	4": 1250 GPM (284 m³/hr) 6": 2500 GPM (568 m³/hr) 8": 4700 GPM (1067 m³/hr) 10": 7000 GPM (1590 m³/hr)

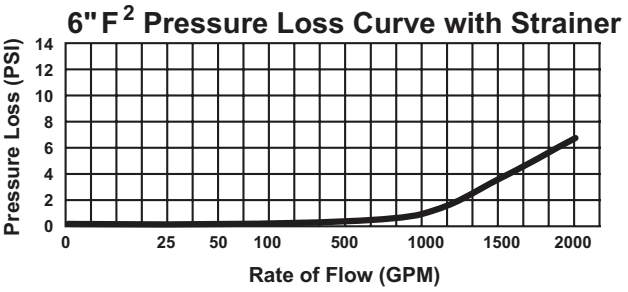
PRESSURE LOSS	4": 6.4 psi @ 1000 GPM (.60 bar @ 227 m³/hr) 6": 6.7 psi @ 2000 GPM (.56 bar @ 454 m³/hr) 8": 5 psi @ 3500 GPM (.34 bar @ 795 m³/hr) 10": 7 psi @ 5500 GPM (.48 bar @ 1249 m³/hr)
MAXIMUM OPERATING PRESSURE	175 PSI (12 bar)
FLANGE CONNECTIONS	U.S. ANSI B16.1 / AWWA Class 125
REGISTER	Fully electronic sealed register with programmable registration (Gal. /Cu.Ft./ Cu. Mtr. / Imp.Gal / Acre Ft.) Programmable AMR/AMI reading and pulse outputs Guaranteed 10 year battery life
NSF APPROVED MATERIALS	**Maincase:** Coated Ductile Iron **Measuring Chamber:** Thermoplastic **Rotor "Floating Ball":** Thermoplastic **Radial Bearings:** Hybrid Thermoplastic **Thrust Bearings:** Sapphire/Ceramic Jewel **Magnets:** Ceramic Magnet **Strainer Screen:** Stainless Steel **Strainer Cover:** Coated Ductile Iron **Test Plug:** Coated Ductile Iron

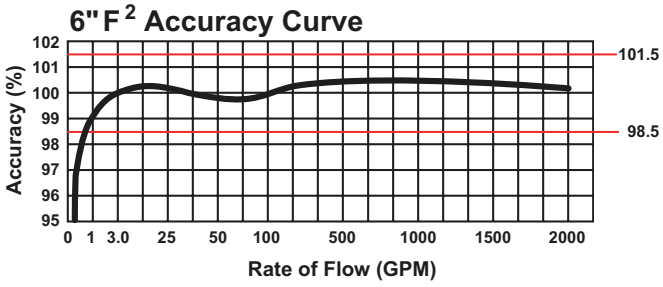
OMNI F²: 4”, 6”, 8” and 10”

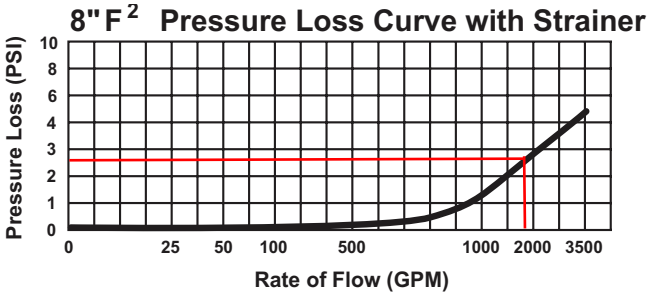
Headloss Curves

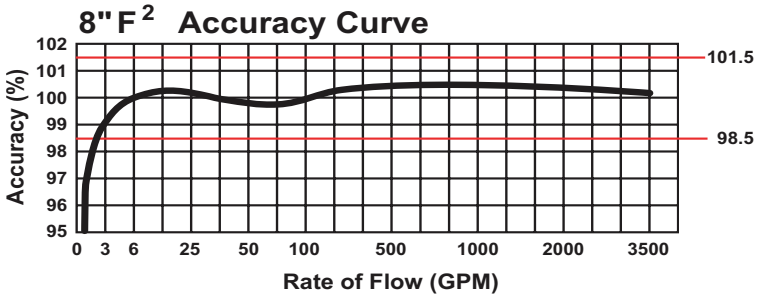




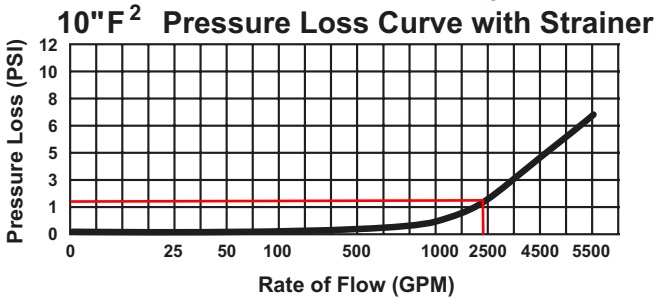


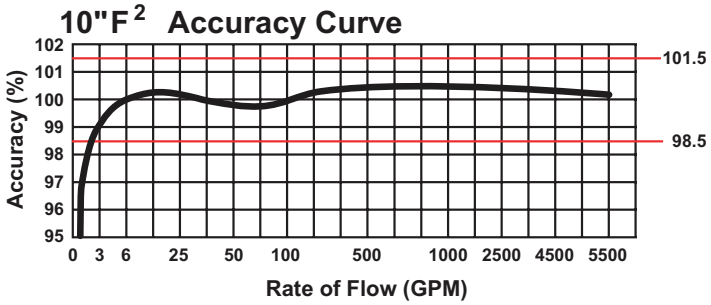






CONDO: OMNI F2 200mm: 2.5 PSI Loss w/ 1850 GPM of Fire Flow + Max Day





TOWNS: OMNI F2 250mm: 1.5 PSI Loss w/ 2380 GPM of Fire Flow + Max Day

© All products purchased and services performed are subject to Sensus' terms of sale, available at either; http://na.sensus.com/TC/TermsConditions.pdf or 1-800-METER-IT. Sensus reserves the right to modify these terms and conditions in its own discretion without notice to the customer.

This document is for informational purposes only, and SENSUS MAKES NO EXPRESS WARRANTIES IN THIS DOCUMENT. FURTHERMORE, THERE ARE NO IMPLIED WARRANTIES, INCLUDING WITHOUT LIMITATION, WARRANTIES AS TO FITNESS FOR A PARTICULAR PURPOSE AND MERCHANTABILITY. ANY USE OF THE PRODUCTS THAT IS NOT SPECIFICALLY PERMITTED HEREIN IS PROHIBITED.

8601 Six Forks Road, Suite 700
Raleigh, NC 27615
1-800-638-3748
www.sensus.com/water

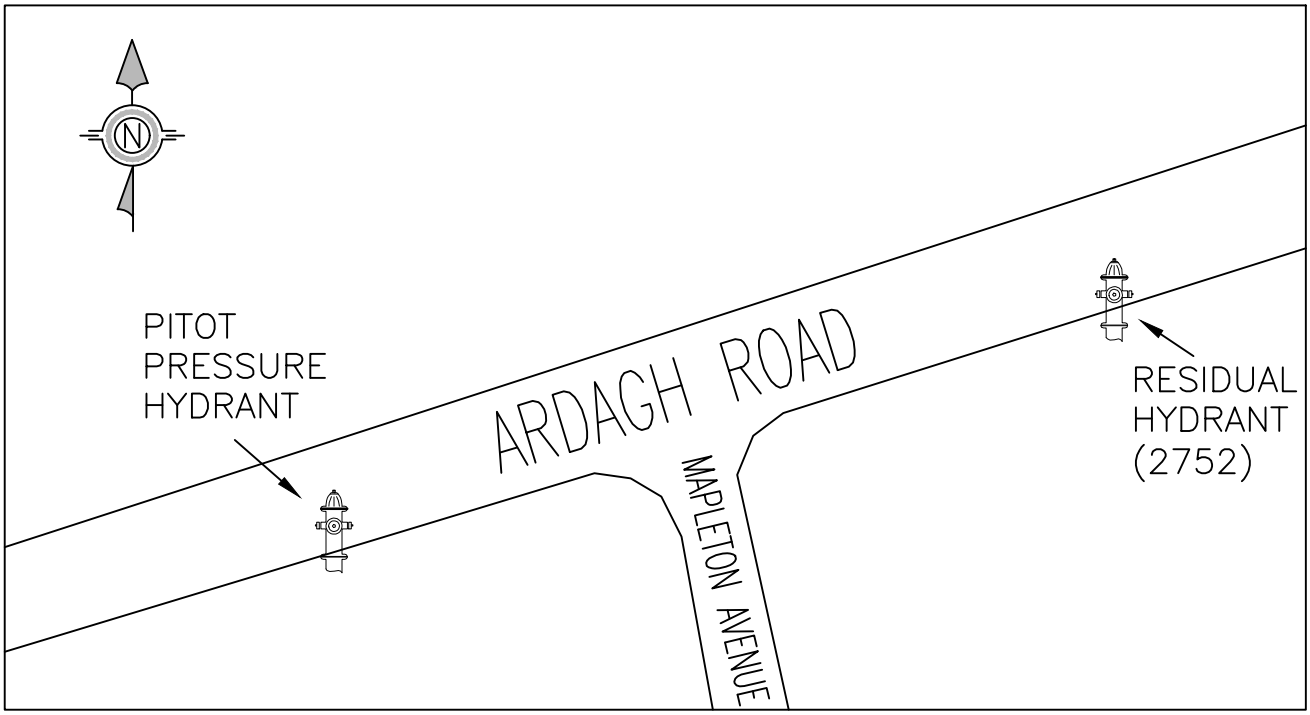
FLOW TEST RESULTS

FIRST FOR FIRE, LIFE SAFETY & SECURITY
VIPOND INC
est. 1945

DATE : TUESDAY SEPTEMBER 22, 2020 TIME : 1:20 PM

LOCATION : ARDAGH ROAD & MAPLETON AVENUE
BARRIE
ONTARIO

TEST BY : VIPOND FIRE PROTECTION AND LOCAL PUC



STATIC PRESSURE : 91 PSI UNDERGROUND TYPE & SIZE: 12" PVC

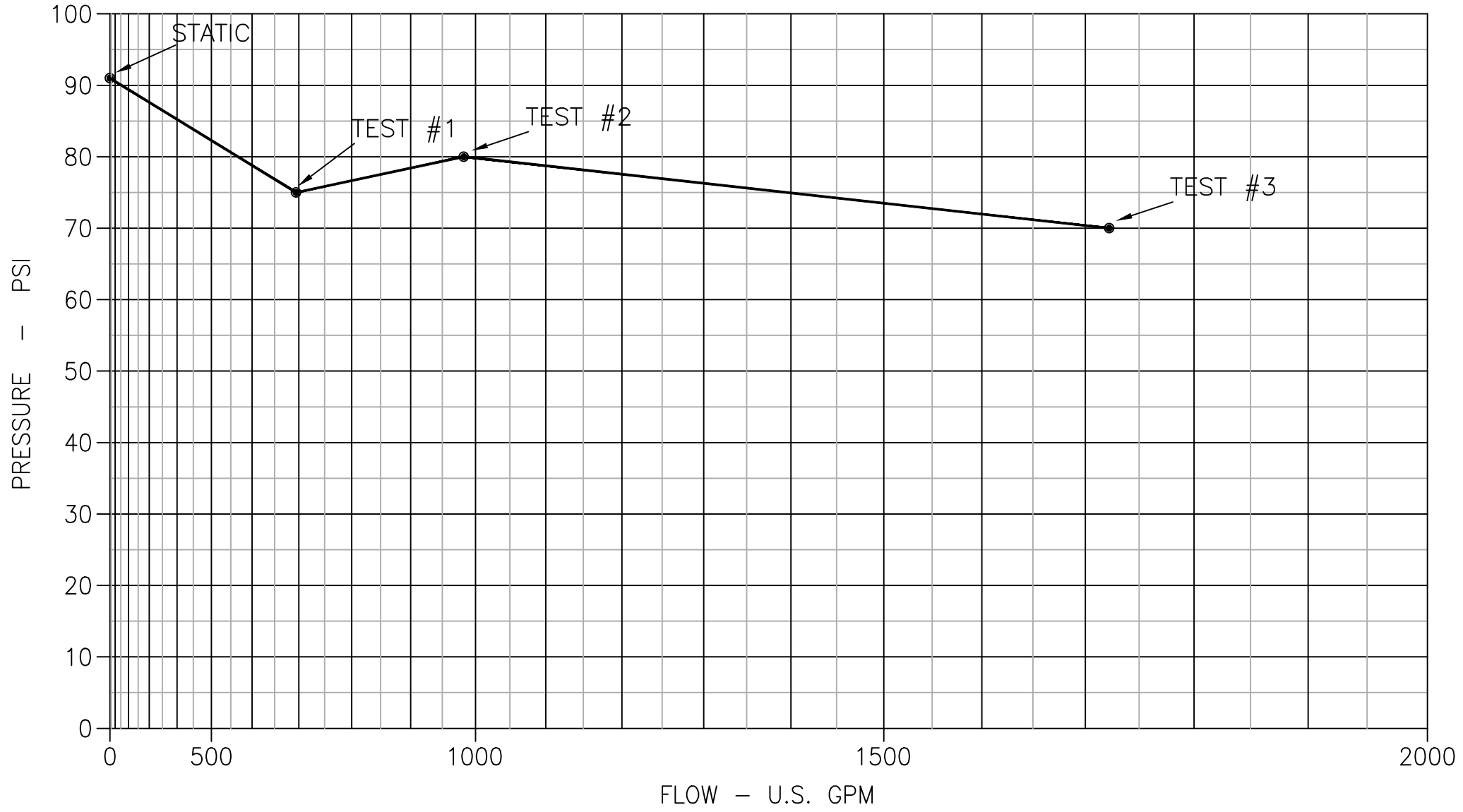
TEST NO.	NO. OF NOZZLES	NOZZLE DIAMETER (INCHES)	DISCHARGE CO-EFFICIENT	RESIDUAL PRESSURE (PSI)	PITOT PRESSURE (PSI)	DISCHARGE (U.S.GPM)
1	1	1-3/4	0.995	75	61	695
2	1	2-1/2	0.9	80	32	954
3	2	2-1/2	0.9	70	26	1720

FIRST FOR FIRE, LIFE SAFETY & SECURITY

VIPOND INC est. 1945

ARDAGH ROAD & MAPLETON AVENUE	BY : GUS A.
BARRIE	OFFICE : BARRIE
ONTARIO	TEST BY : VIPOND & PUC
	DATE : SEPTEMBER 22, 2020

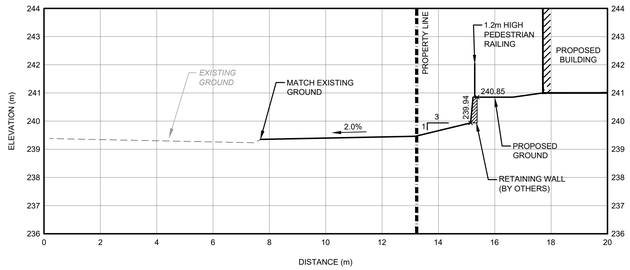
STATIC:	RESIDUAL:		FLOW:
91 PSI	TEST#1 75 PSI	@	695 GPM
	TEST#2 80 PSI	@	954 GPM
	TEST#3 70 PSI	@	1720 GPM



Appendix E

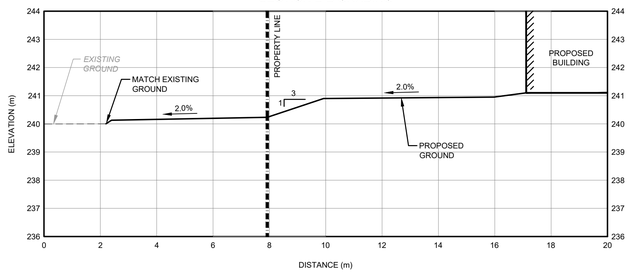
Engineering Drawings

SECTION A-A GRADING



SCALE 1:100

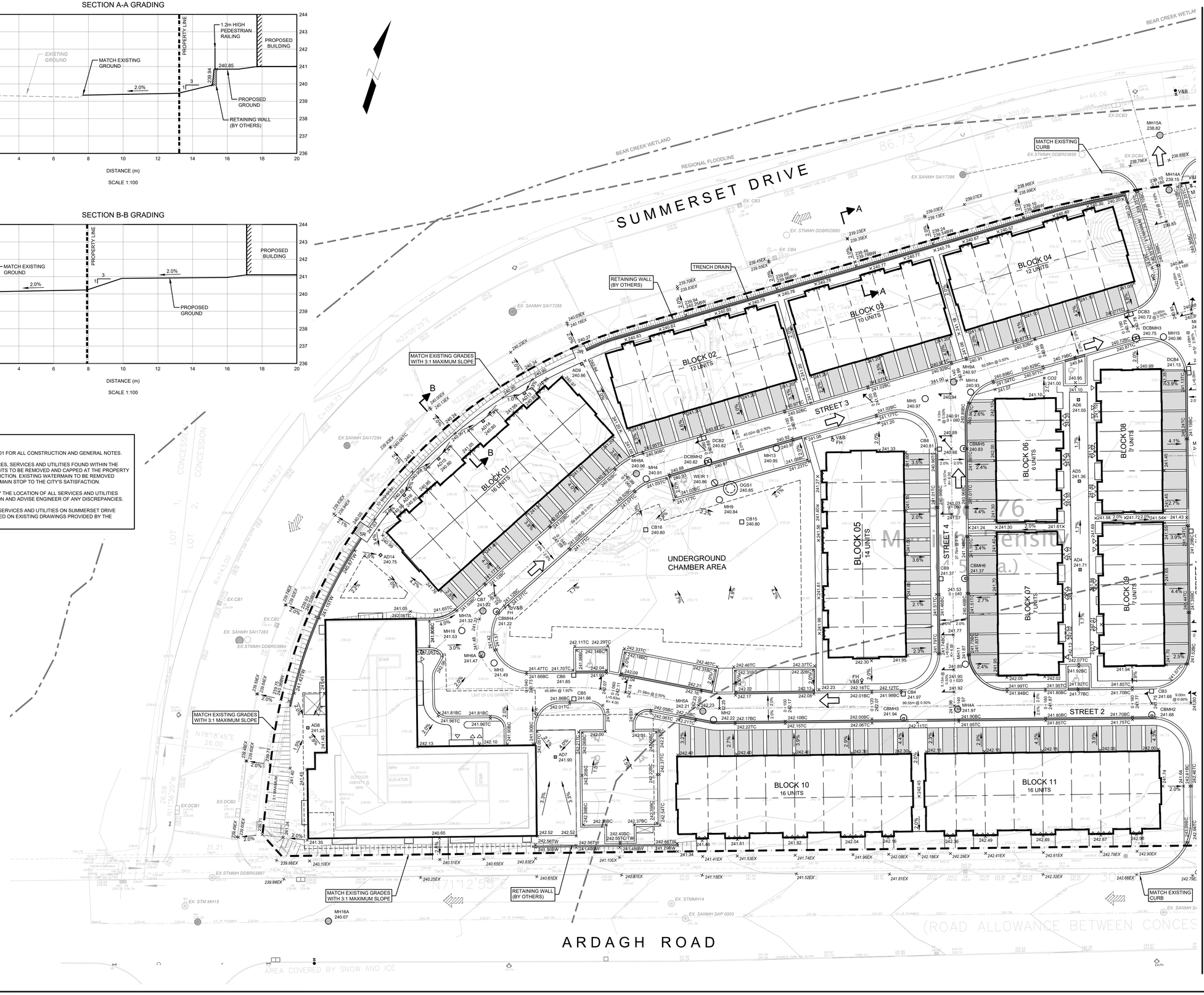
SECTION B-B GRADING

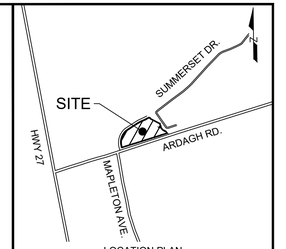


SCALE 1:100

GENERAL NOTES:

1. REFER TO DRAWING DD-01 FOR ALL CONSTRUCTION AND GENERAL NOTES.
2. ALL EXISTING STRUCTURES, SERVICES AND UTILITIES FOUND WITHIN THE EXISTING PROPERTY LIMITS TO BE REMOVED AND CAPPED AT THE PROPERTY LINE PRIOR TO CONSTRUCTION. EXISTING WATERMAIN TO BE REMOVED TO AND CAPPED AT THE MAIN STOP TO THE CITY'S SATISFACTION.
3. CONTRACTOR TO VERIFY THE LOCATION OF ALL SERVICES AND UTILITIES PRIOR TO CONSTRUCTION AND ADVISE ENGINEER OF ANY DISCREPANCIES.
4. LOCATION OF EXISTING SERVICES AND UTILITIES ON SUMMERSET DRIVE AND ARDAGH ROAD BASED ON EXISTING DRAWINGS PROVIDED BY THE CITY OF BARRIE.





LOCATION PLAN
N.T.S.

LEGEND

PROPERTY LINE	
PORPOSED GRADE	×149.50
PROPOSED GRADE (TOP OF CURB)	×149.75TC
PROPOSED GRADE (BOTTOM OF CURB)	×149.60BC
PROPOSED GRADE (TOP OF WALL)	×149.90TW
PROPOSED GRADE (BOTTOM OF WALL)	×149.20BW
EXISTING GRADE	× *149.33EX*
SWALE	SWALE @ 2.0%
SLOPE TICKS	
CURB	
HEAVY DUTY ASPHALT	
HIGH WATER LEVEL PONDING	HWL=150.05
STEP JOINT	
EMERGENCY OVERLAND FLOW ROUTE	
EXISTING OVERLAND FLOW ROUTE	
PEARMEABLE PAVERS	PERMEABLE PAVERS
BUILDING EXPOSED FOUNDATION	EXPOSED FOUNDATION
BUILDING BURRIED FOUNDATION	BURRIED FOUNDATION
PROPOSED TOE-WALL	TOE-WALL
PROPOSED RETAINING WALL	RETAINING WALL
CONCRETE PAD	CONCRETE PAD

LIST OF DRAWINGS

SG-01 - SITE GRADING PLAN
SG-02 - SITE GRADING PLAN
SS-01 - SITE SERVICING PLAN
SS-02 - SITE SERVICING PLAN
CS-01 - SERVICING CROSS SECTIONS
CS-02 - SERVICING CROSS SECTIONS
PD-01 - POND DESIGN
EC-01 - EROSION CONTROL - STAGE 1
EC-02 - EROSION CONTROL - STAGE 2
EC-03 - EROSION CONTROL DETAILS
DD-01 - NOTES AND DETAILS
DD-02 - DETAILS

SITE PLAN INFORMATION

ONESPACE UNLIMITED INC.
3700 STEELES AVE WEST. SUITE 305
VAUGHAN, ON, L4L 8K8
PHONE: (416) 848-1245
FAX: (416) 848-1246
WEBSITE: ONESPACEUNLIMITED.COM

SURVEYOR INFORMATION

SCHAEFFER DZALDOV BENNETT LTD.
64 JARDIN DRIVE, UNIT 1
CONCORD, ON, L4K 3P3
PHONE: (416) 987-0101
FAX: (905) 761-0119
E-MAIL: info@surveyontario.com

BENCHMARK INFORMATION:
ELEVATIONS SHOWN HEREON ARE GEODETIC AND ARE REFERRED TO ONTARIO MINISTRY OF NATURAL RESOURCES AND FORESTRY MONUMENT No. 03120030026 HAVING A PUBLISHED ELEVATION OF 244.262 METRES.

No.	DATE	ISSUE/REVISION	INTIAL
3	7/10/2022	ISSUED FOR FIRST SUBMISSION	TSR
2	8/30/2022	ISSUED FOR SITE ALTERATION PERMIT	TSR
1	6/1/2021	ISSUED FOR COORDINATION	TVL

CITY OF BARRIE

STATEVIEW HOMES (BEA TOWNS) INC.

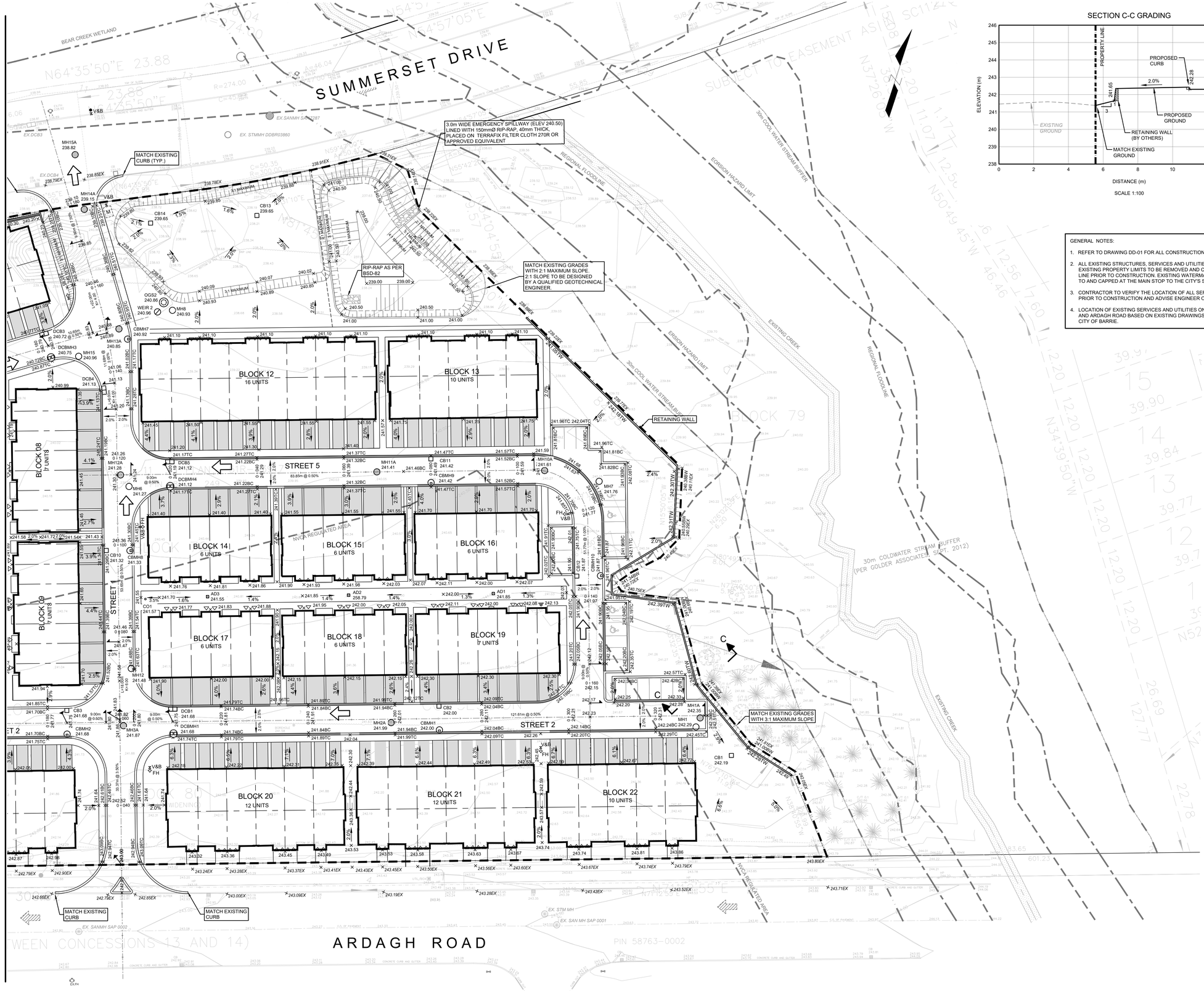
BEA TOWNS
500 ARDAGH RD.
BARRIE, ONTARIO

SITE GRADING PLAN

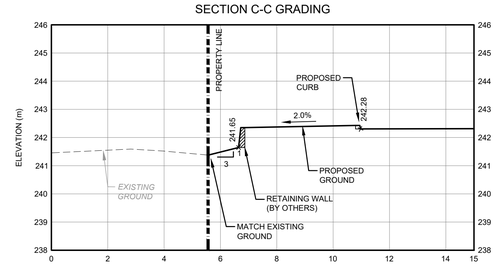
GEI Consultants

DESIGNED BY: LV	DATE: AUG 2022	CHECKED BY: TR
DRAWN BY: CVG	PROJECT No. 2104593	DRAWING No. SG-01
SCALE: 1:400		

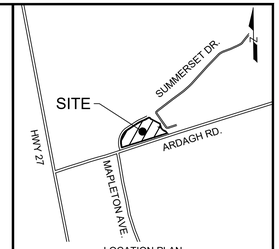
5.0 0 5.0m 10.0m 15.0m 20.0m 25.0m



SECTION C-C GRADING



SCALE 1:100



LOCATION PLAN
N.T.S.

GENERAL NOTES:

1. REFER TO DRAWING DD-01 FOR ALL CONSTRUCTION AND GENERAL NOTES.
2. ALL EXISTING STRUCTURES, SERVICES AND UTILITIES FOUND WITHIN THE EXISTING PROPERTY LIMITS TO BE REMOVED AND CAPPED AT THE PROPERTY LINE PRIOR TO CONSTRUCTION. EXISTING WATERMAIN TO BE REMOVED TO AND CAPPED AT THE MAIN STOP TO THE CITY'S SATISFACTION.
3. CONTRACTOR TO VERIFY THE LOCATION OF ALL SERVICES AND UTILITIES PRIOR TO CONSTRUCTION AND ADVISE ENGINEER OF ANY DISCREPANCIES.
4. LOCATION OF EXISTING SERVICES AND UTILITIES ON SUMMERSET DRIVE AND ARDAGH ROAD BASED ON EXISTING DRAWINGS PROVIDED BY THE CITY OF BARRIE.

LEGEND

PROPERTY LINE	
PORPOSED GRADE	×149.50
PROPOSED GRADE (TOP OF CURB)	×149.75TC
PROPOSED GRADE (BOTTOM OF CURB)	×149.60BC
PROPOSED GRADE (TOP OF WALL)	×149.90TW
PROPOSED GRADE (BOTTOM OF WALL)	×149.20BW
EXISTING GRADE	× *149.33EX*
SWALE	SWALE @ 2.0%
SLOPE TICKS	
CURB	
HEAVY DUTY ASPHALT	
HIGH WATER LEVEL PONDING	HWL=150.05
STEP JOINT	
EMERGENCY OVERLAND FLOW ROUTE	
EXISTING OVERLAND FLOW ROUTE	
PEARMEABLE PAVERS	PERMEABLE PAVERS
BUILDING EXPOSED FOUNDATION	EXPOSED FOUNDATION
BUILDING BURRIED FOUNDATION	BURRIED FOUNDATION
PROPOSED TOE-WALL	TOE-WALL
PROPOSED RETAINING WALL	RETAINING WALL
CONCRETE PAD	CONCRETE PAD

LIST OF DRAWINGS

SG-01 - SITE GRADING PLAN
SG-02 - SITE GRADING PLAN
SS-01 - SITE SERVICING PLAN
SS-02 - SITE SERVICING PLAN
CS-01 - SERVICING CROSS SECTIONS
CS-02 - SERVICING CROSS SECTIONS
PD-01 - POND DESIGN
EC-01 - EROSION CONTROL - STAGE 1
EC-02 - EROSION CONTROL - STAGE 2
EC-03 - EROSION CONTROL DETAILS
DD-01 - NOTES AND DETAILS
DD-02 - DETAILS

SITE PLAN INFORMATION

ONESPACE UNLIMITED INC.
3700 STEELES AVE WEST. SUITE 305
VAUGHAN, ON, L4L 8K8
PHONE: (416) 848-1245
FAX: (416) 848-1246
WEBSITE: ONESPACEUNLIMITED.COM

SURVEYOR INFORMATION

SCHAEFFER DZALDOV BENNETT LTD.
64 JARDIN DRIVE, UNIT 1
CONCORD, ON, L4K 3P3
PHONE: (416) 987-0101
FAX: (905) 761-0119
E-MAIL: info@surveyontario.com

BENCHMARK INFORMATION:
ELEVATIONS SHOWN HEREON ARE GEODETIC AND ARE REFERRED TO ONTARIO MINISTRY OF NATURAL RESOURCES AND FORESTRY MONUMENT No. 03120030026 HAVING A PUBLISHED ELEVATION OF 244.262 METRES.

No.	DATE	ISSUE/REVISION	INITIAL
3	7/10/2022	ISSUED FOR FIRST SUBMISSION	TSR
2	8/30/2022	ISSUED FOR SITE ALTERATION PERMIT	TSR
1	6/1/2021	ISSUED FOR COORDINATION	TVL

CITY OF BARRIE

STATEVIEW HOMES (BEA TOWNS) INC.

BEA TOWNS
500 ARDAGH RD.
BARRIE, ONTARIO

SITE GRADING PLAN

GEI Consultants

DESIGNED BY: LV	DATE: AUG 2022	CHECKED BY: TR
DRAWN BY: CVG	PROJECT No. 2104593	DRAWING No. SG-02
SCALE: 1:400		

5.0 0 5.0m 10.0m 15.0m 20.0m 25.0m

STORM SEWER STRUCTURE INVENTORY

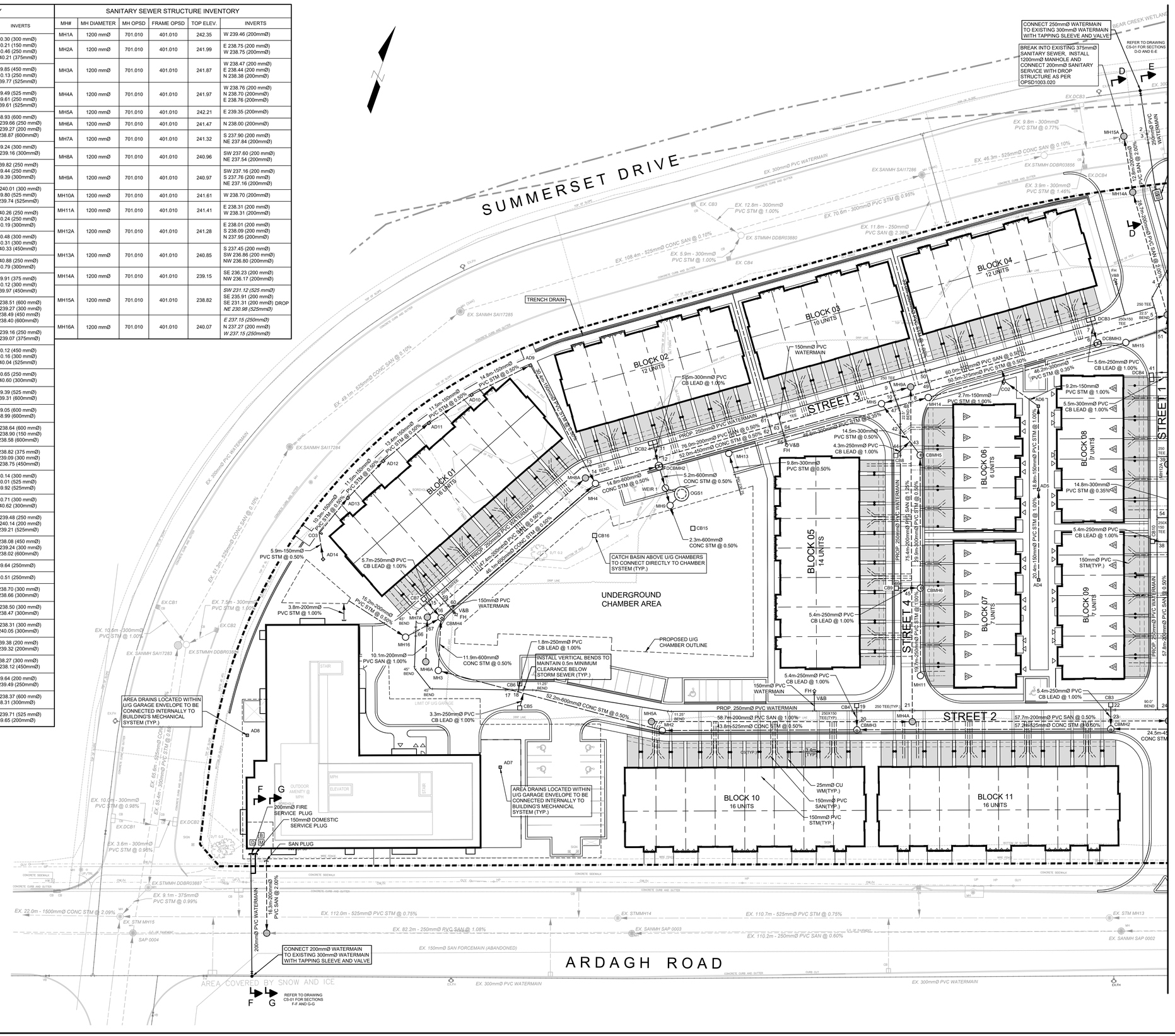
MH#	MH DIAMETER	MH OPSD	FRAME CITY/ OPSD	TOP ELEV.	INVERTS
CBMH1	1200 mmØ	701.010	400.010	242.00	E 240.30 (300 mmØ) S 240.21 (150 mmØ) N 240.46 (250 mmØ) W 240.21 (375mmØ)
CBMH2	1200 mmØ	701.010	400.010	241.68	E 239.85 (450 mmØ) N 240.13 (250 mmØ) W 239.77 (525mmØ)
CBMH3	1200 mmØ	701.010	400.010	241.94	E 239.49 (525 mmØ) N 239.61 (250 mmØ) W 239.61 (525mmØ)
CBMH4	1200 mmØ	701.010	400.010	241.22	S 238.93 (600 mmØ) NW 239.66 (250 mmØ) SW 239.27 (200 mmØ) NE 238.87 (600mmØ)
CBMH5	1200 mmØ	701.010	400.010	240.83	S 239.24 (300 mmØ) NW 239.16 (300mmØ)
CBMH6	1200 mmØ	701.010	400.010	241.37	W 239.82 (250 mmØ) S 239.44 (250 mmØ) N 239.39 (300mmØ)
CBMH7	1200 mmØ	701.010	400.010	240.92	SW 240.01 (300 mmØ) S 239.80 (525 mmØ) NE 239.74 (525mmØ)
CBMH8	1200 mmØ	701.010	400.010	241.33	W 240.26 (250 mmØ) S 240.24 (250 mmØ) N 240.19 (300mmØ)
CBMH9	1200 mmØ	701.010	400.010	241.42	E 240.48 (300 mmØ) N 240.31 (300 mmØ) W 240.33 (450mmØ)
CBMH10	1200 mmØ	701.010	400.010	241.87	W 240.88 (250 mmØ) N 240.79 (300mmØ)
DCBMH1	1500 mmØ	701.011	400.030	241.82	E 239.91 (375 mmØ) N 240.12 (300 mmØ) W 239.97 (450mmØ)
DCBMH2	1500 mmØ	701.011	400.030	240.82	SW 238.51 (600 mmØ) NW 239.27 (300 mmØ) NE 238.49 (450 mmØ) SE 238.40 (600mmØ)
DCBMH3	1500 mmØ	701.011	400.030	240.75	NW 239.16 (250 mmØ) SW 239.07 (375mmØ)
DCBMH4	1500 mmØ	701.011	400.030	241.99	E 240.12 (450 mmØ) N 240.16 (300 mmØ) W 240.04 (525mmØ)
MH1	1200 mmØ	701.010	401.010	242.29	E 240.65 (250 mmØ) W 240.60 (300mmØ)
MH2	1200 mmØ	701.010	401.010	242.22	E 239.39 (525 mmØ) W 239.31 (600mmØ)
MH3	1200 mmØ	701.010	401.010	241.49	E 239.05 (600 mmØ) N 238.99 (600mmØ)
MH4	1200 mmØ	701.010	401.010	240.91	SW 238.64 (600 mmØ) NW 238.90 (150 mmØ) NE 238.58 (600mmØ)
MH5	1200 mmØ	701.010	401.010	240.97	NE 238.82 (375 mmØ) SE 239.09 (300 mmØ) SW 238.75 (450mmØ)
MH6	1200 mmØ	701.010	401.010	241.27	S 240.14 (300 mmØ) E 240.01 (525 mmØ) N 239.92 (525mmØ)
MH7	1200 mmØ	701.010	401.010	241.76	S 240.71 (300 mmØ) W 240.62 (300mmØ)
MH8	1200 mmØ	701.010	Standard	240.93	NW 239.48 (250 mmØ) SW 240.14 (200 mmØ) NE 239.21 (525mmØ)
MH9	1200 mmØ	701.010	Standard	240.84	NE 238.08 (450 mmØ) NW 239.24 (300 mmØ) SE 238.02 (600mmØ)
MH11	1200 mmØ	701.010	401.010	241.87	N 239.64 (250mmØ)
MH12	1200 mmØ	701.010	401.010	241.48	N 240.51 (250mmØ)
MH13	1200 mmØ	701.010	401.010	240.95	SE 238.70 (300 mmØ) NE 238.66 (300mmØ)
MH14	1200 mmØ	701.010	401.010	240.93	SW 238.50 (300 mmØ) NE 238.47 (300mmØ)
MH15	1200 mmØ	701.010	401.010	240.96	SW 238.31 (300 mmØ) NE 240.05 (300mmØ)
MH16	1200 mmØ	701.010	401.010	241.53	W 239.38 (200 mmØ) NE 239.32 (200mmØ)
OGS1	3000 mmØ	JELLYFISH	JF10-11-3	240.85	W 238.27 (300 mmØ) SW 238.12 (450mmØ)
OGS2	1800 mmØ	JELLYFISH	JF6-5-1	240.86	S 239.64 (200 mmØ) SE 239.49 (250mmØ)
WEIR 1	1200 mmØ	701.010	401.010	240.86	NW 238.37 (600 mmØ) E 238.31 (300mmØ)
WEIR 2	1200 mmØ	701.010	401.010	240.96	SW 239.71 (525 mmØ) N 239.65 (200mmØ)

SANITARY SEWER STRUCTURE INVENTORY

MH#	MH DIAMETER	MH OPSD	FRAME OPSD	TOP ELEV.	INVERTS
MH1A	1200 mmØ	701.010	401.010	242.35	W 239.46 (200mmØ)
MH2A	1200 mmØ	701.010	401.010	241.99	E 238.75 (200 mmØ) W 238.75 (200mmØ)
MH3A	1200 mmØ	701.010	401.010	241.87	W 238.47 (200 mmØ) E 238.44 (200 mmØ) N 238.38 (200mmØ)
MH4A	1200 mmØ	701.010	401.010	241.97	W 238.76 (200 mmØ) N 238.70 (200mmØ) E 238.76 (200mmØ)
MH5A	1200 mmØ	701.010	401.010	242.21	E 239.35 (200mmØ)
MH6A	1200 mmØ	701.010	401.010	241.47	N 238.00 (200mmØ)
MH7A	1200 mmØ	701.010	401.010	241.32	S 237.90 (200 mmØ) NE 237.84 (200mmØ)
MH8A	1200 mmØ	701.010	401.010	240.96	SW 237.60 (200 mmØ) NE 237.54 (200mmØ)
MH9A	1200 mmØ	701.010	401.010	240.97	SW 237.16 (200 mmØ) S 237.76 (200 mmØ) NE 237.16 (200mmØ)
MH10A	1200 mmØ	701.010	401.010	241.61	W 238.70 (200mmØ)
MH11A	1200 mmØ	701.010	401.010	241.41	E 238.31 (200 mmØ) W 238.31 (200mmØ)
MH12A	1200 mmØ	701.010	401.010	241.28	E 238.01 (200 mmØ) S 238.09 (200 mmØ) N 237.95 (200mmØ)
MH13A	1200 mmØ	701.010	401.010	240.85	S 237.45 (200 mmØ) SW 236.86 (200 mmØ) NW 236.80 (200mmØ)
MH14A	1200 mmØ	701.010	401.010	239.15	SE 236.23 (200 mmØ) NW 236.17 (200mmØ)
MH15A	1200 mmØ	701.010	401.010	238.82	*SW 231.12 (525 mmØ)* SE 235.91 (200 mmØ) SE 231.31 (200 mmØ) DROP *NE 230.98 (525mmØ)*
MH16A	1200 mmØ	701.010	401.010	240.07	*E 237.15 (250mmØ)* N 237.27 (200 mmØ) *W 237.15 (250mmØ)*

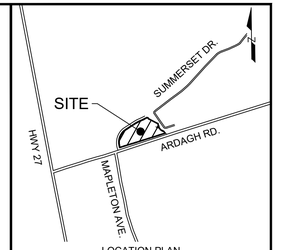
CATCHBASIN STRUCTURE INVENTORY

CB#	CB OPSD	FRAME OPSD	TOP ELEV.	INVERTS
CB1	705.010	400.010	242.19	W 240.75 (250mmØ)
CB2	705.010	400.010	242.00	S 240.51 (250mmØ)
CB3	705.010	400.010	241.68	S 240.18 (250mmØ)
CB4	705.010	400.010	241.97	S 239.67 (250mmØ)
CB5	705.010	400.010	241.86	N 240.39 (250mmØ)
CB6	705.010	400.010	241.85	S 240.35 (250mmØ)
CB7	705.010	400.010	241.22	SE 239.72 (250mmØ)
CB8	705.010	400.010	240.81	NE 239.31 (250mmØ)
CB9	705.010	400.010	241.37	E 239.87 (250mmØ)
CB10	705.010	400.010	241.32	E 240.31 (250mmØ)
CB11	705.010	400.010	241.42	S 240.36 (300mmØ)
CB12	705.010	400.010	241.87	E 240.93 (250mmØ)
CB13	705.010	400.010	239.65	SE 238.15 (250mmØ)
CB14	705.010	400.010	239.65	SE 238.15 (250mmØ)
CB15	705.010	400.010	240.80	CHAMBER
DCB1	705.020	400.030	241.68	S 240.18 (300mmØ)
DCB2	705.020	400.030	240.82	SE 239.32 (300mmØ)
DCB3	705.020	400.030	240.72	SE 239.22 (250mmØ)
DCB4	705.020	400.030	241.13	E 240.00 (300mmØ)
DCB5	705.020	400.030	241.12	S 240.22 (300mmØ)


SUMMERSET DRIVE
ARDAGH ROAD
STREET 1
STREET 2
STREET 3
STREET 4
BLOCK 01
16 UNITS
BLOCK 02
12 UNITS
BLOCK 03
10 UNITS
BLOCK 04
12 UNITS
BLOCK 05
14 UNITS
BLOCK 06
6 UNITS
BLOCK 07
7 UNITS
BLOCK 08
7 UNITS
BLOCK 09
7 UNITS
BLOCK 10
16 UNITS
BLOCK 11
16 UNITS
UNDERGROUND CHAMBER AREA
CONNECT 250mmØ WATERMAIN TO EXISTING 300mmØ WATERMAIN WITH TAPPING SLEEVE AND VALVE
BREAK INTO EXISTING 375mmØ SANITARY SEWER, INSTALL 1200mmØ MANHOLE AND CONNECT 200mmØ SANITARY SERVICE WITH DROP STRUCTURE AS PER OPSD1003.020
REFER TO DRAWING CS-01 FOR SECTIONS D-D AND E-E
TRENCH DRAIN
CATCH BASIN ABOVE U/G CHAMBERS TO CONNECT DIRECTLY TO CHAMBER SYSTEM (TYP.)
PROPOSED U/G CHAMBER OUTLINE
INSTALL VERTICAL BENDS TO MAINTAIN 0.5m MINIMUM CLEARANCE BELOW STORM SEWER (TYP.)
AREA DRAINS LOCATED WITHIN U/G GARAGE ENVELOPE TO BE CONNECTED INTERNALLY TO BUILDING'S MECHANICAL SYSTEM (TYP.)
200mmØ FIRE SERVICE PLUG
150mmØ DOMESTIC SERVICE PLUG
SAN PLUG
CONNECT 200mmØ WATERMAIN TO EXISTING 300mmØ WATERMAIN WITH TAPPING SLEEVE AND VALVE
AREA COVERED BY SNOW AND ICE
REFER TO DRAWING CS-01 FOR SECTIONS F-F AND G-G
EX. 108.4m - 525mmØ CONC SAN @ 0.10%
EX. 51.3m - 525mmØ CONC SAN @ 0.10%
EX. 46.3m - 525mmØ CONC SAN @ 0.10%
EX. 12.8m - 300mmØ PVC STM @ 1.00%
EX. 70.6m - 300mmØ PVC STM @ 0.95%
EX. 11.8m - 250mmØ PVC SAN @ 2.30%
EX. 5.9m - 300mmØ PVC STM @ 1.00%
EX. 9.8m - 300mmØ PVC STM @ 0.77%
EX. 3.9m - 300mmØ PVC STM @ 1.46%
EX. 9.1m - 525mmØ CONC SAN @ 0.10%
EX. 7.5m - 300mmØ PVC STM @ 1.00%
EX. 10.6m - 300mmØ PVC STM @ 1.00%
EX. 10.0m - 300mmØ PVC STM @ 0.98%
EX. 3.6m - 300mmØ PVC STM @ 0.98%
EX. 65.6m - 250mmØ CONC SAN @ 0.10%
EX. 65.4m - 300mmØ PVC STM @ 0.85%
EX. 9.1m - 375mmØ PVC STM @ 0.99%
EX. 22.0m - 1500mmØ CONC STM @ 2.09%
EX. 112.0m - 525mmØ PVC STM @ 0.75%
EX. 82.2m - 250mmØ PVC SAN @ 1.08%
EX. 110.7m - 525mmØ PVC STM @ 0.75%
EX. 110.2m - 250mmØ PVC SAN @ 0.60%
EX. 150mmØ SAN FORCEMAIN (ABANDONED)
EX. 300mmØ PVC WATERMAIN
EX. 65.3m - 200mmØ PVC SAN @ 2.00%
EX. SANMH SAI17285
EX. SANMH SAI17284
EX. SANMH SAI17283
EX. STMMH DDBR03880
EX. STMMH DDBR03856
EX. STMMH DDBR03887
EX. SANMH SAP 0003
EX. SANMH SAP 0002
EX. STM MH15
EX. STM MH14
EX. STM MH13
EX. SANMH SAP 0004
EX.SANMH SAI17286
EX.CB1
EX.CB2
EX.CB3
EX.CB4
EX.DCB1
EX.DCB2
EX.DCB3
EX.DCB4
EX.FH
EX.V&B
EX.FH
EX.V&B
EX. 300mmØ PVC WATERMAIN
EX. 300mmØ PVC WATERMAIN
EX. 300mmØ PVC WATERMAIN



PIPE CROSSING TABLE							
Index	Pipe 1 Diameter	Pipe 1 Top	Pipe 1 Bottom	Pipe 2 Diameter	Pipe 2 Top	Pipe 2 Bottom	Gap Distance
1	450STM	237.53	236.88	200SAN	236.15	235.94	0.73
2	250WM	237.15	236.95	525SAN	231.51	230.98	6.49
3	250WM	236.45	236.25	450STM	237.40	236.95	0.50
4	250WM	238.89	238.69	200SAN	236.86	236.66	1.83
5	250WM	239.19	238.99	200SAN	237.07	236.87	1.92
6	200SAN	237.15	236.94	250STM	239.56	239.29	2.15
7	250WM	238.71	238.51	250STM	239.46	239.21	0.50
8	200SAN	237.98	237.78	375STM	239.33	238.75	0.76
9	250WM	239.28	239.08	200SAN	237.38	237.18	1.70
10	250WM	238.33	238.13	375STM	239.21	238.83	0.50
11	250WM	237.68	237.48	375STM	238.55	238.18	0.50
12	300STM	238.54	238.09	200SAN	237.66	237.45	0.43
13	250WM	238.42	238.22	150STM	239.07	238.92	0.50
14	200SAN	237.74	237.53	150STM	239.06	238.90	1.16
15	250WM	238.33	238.13	250STM	239.08	238.83	0.50
16	200SAN	238.03	237.82	250STM	239.04	238.78	0.74
17	250WM	238.64	238.44	600STM	239.74	239.14	0.50
18	250WM	238.79	238.59	250STM	239.54	239.29	0.50
19	250WM	239.16	238.96	250STM	239.91	239.66	0.50
20	250STM	239.89	239.63	200SAN	239.09	238.88	0.53
21	250WM	240.24	240.04	200SAN	238.87	238.67	1.17
22	250WM	239.26	239.06	250STM	239.51	239.76	0.50
23	250STM	239.96	239.70	200SAN	238.74	238.53	0.96
24	250WM	240.15	239.95	200SAN	238.57	238.37	1.38
25	250WM	239.29	239.09	300STM	240.09	239.79	0.50
26	300STM	240.09	239.77	200SAN	238.71	238.49	1.07
27	250WM	239.70	239.50	250STM	240.45	240.20	0.50
28	200SAN	239.07	238.85	250STM	240.44	240.17	1.11
29	250WM	240.17	239.97	250STM	241.12	240.87	0.70
30	250WM	239.96	239.76	250STM	240.78	240.48	0.52
31	250WM	239.72	239.52	300STM	240.80	240.50	0.78
32	200SAN	238.64	238.43	300STM	240.79	240.48	1.84
33	250WM	239.42	239.22	300STM	240.53	240.23	0.81
34	300STM	240.52	240.21	200SAN	238.28	238.07	1.93
35	250WM	239.40	239.20	525SAN	240.43	239.90	0.50
36	525STM	240.56	239.78	200SAN	238.23	238.02	1.55
37	200SAN	238.39	238.17	250STM	240.54	240.27	1.89
38	200SAN	239.63	239.43	250STM	240.56	240.31	0.68
39	250WM	239.52	239.32	200SAN	238.12	237.92	1.20
40	200SAN	237.86	237.65	300STM	239.89	239.58	1.71
41	250WM	239.11	238.91	300STM	239.91	239.61	0.50
42	250WM	238.62	238.42	300STM	239.42	239.12	0.50
43	200SAN	238.12	237.91	300STM	239.52	239.07	0.95
44	250WM	238.78	238.58	250STM	239.53	239.28	0.50
45	250STM	239.74	239.47	200SAN	238.53	238.32	0.94
46	250WM	239.03	238.83	250STM	239.78	239.53	0.50
47	250WM	238.02	237.82	250STM	238.77	238.52	0.50
48	200SAN	238.01	237.79	250STM	238.77	238.50	0.50
49	250STM	239.38	239.12	200SAN	237.35	237.13	1.77
50	250WM	238.65	238.45	250STM	239.40	239.15	0.50
51	250WM	239.25	239.05	250STM	240.28	240.03	0.98
52	250STM	240.27	240.010	200SAN	237.698	237.484	2.31
53	250WM	239.64	239.44	300STM	240.47	240.17	0.53
54	250WM	239.62	239.42	200SAN	238.35	238.15	1.07
55	250WM	240.08	239.88	200SAN	238.67	238.47	1.21
56	250WM	239.44	239.24	450STM	240.39	239.94	0.50
57	250WM	240.50	240.30	200SAN	239.29	239.09	1.01
58	250WM	239.92	239.72	300STM	240.72	240.42	0.50
59	250WM	239.45	239.25	200SAN	238.01	237.81	1.24
60	250WM	238.36	238.16	600STM	239.46	238.86	0.50
61	250WM	238.65	238.45	250STM	239.40	239.15	0.50
62	200SAN	237.53	237.32	250STM	239.38	239.12	1.58
63	250WM	239.39	239.19	200SAN	237.51	237.31	1.68
64	250WM	239.41	239.21	450STM	239.08	238.63	0.50
65	250WM	238.11	237.91	250STM	238.86	238.61	0.50
66	250WM	238.80	238.60	250STM	239.55	239.30	0.50
67	200STM	239.49	239.28	200SAN	238.13	237.91	1.16



LOCATION PLAN
N.T.S.

LEGEND

- PROPERTY LINE
- PROPOSED STORM MANHOLE
- PROPOSED CATCHBASIN MANHOLE
- PROPOSED DOUBLE CATCHBASIN MANHOLE
- PROPOSED CATCH BASIN
- PROPOSED DOUBLE CATCH BASIN
- PROPOSED SANITARY MANHOLE
- EXISTING STORM MANHOLE
- EXISTING CATCHBASIN
- EXISTING SANITARY MANHOLE
- PROPOSED STORM
- PROPOSED SANITARY
- PROPOSED WATER
- EXISTING STORM
- EXISTING SANITARY
- EXISTING WATER
- PROPOSED FIRE HYDRANT (FH)
- PROPOSED VALVE AND BOX (V&B)
- PROPOSED FIRE HYDRANT (EX.FH)
- PROPOSED VALVE AND BOX (EX.V&B)
- PROPOSED STORM LATERAL
- PROPOSED SANITARY LATERAL
- PROPOSED WATER LATERAL
- CURB STOP
- PROPOSED DOMESTIC WATER METER (M)
- PROPOSED BACKFLOW PREVENTER (B)
- PROPOSED PIPE CONCRETE ENCASEMENT

LIST OF DRAWINGS

SG-01 - SITE GRADING PLAN
SG-02 - SITE GRADING PLAN
SS-01 - SITE SERVICING PLAN
SS-02 - SITE SERVICING PLAN
CS-01 - SERVICING CROSS SECTIONS
CS-02 - SERVICING CROSS SECTIONS
PD-01 - POND DESIGN
EC-01 - EROSION CONTROL - STAGE 1
EC-02 - EROSION CONTROL - STAGE 2
EC-03 - EROSION CONTROL DETAILS
DD-01 - NOTES AND DETAILS
DD-02 - DETAILS

SITE PLAN INFORMATION

ONESPACE UNLIMITED INC.
3700 STEELES AVE WEST, SUITE 305
VAUGHAN, ON, L4L 8K8
PHONE: (416) 848-1245
FAX: (416) 848-1246
WEBSITE: ONESPACEUNLIMITED.COM

SURVEYOR INFORMATION

SCHAEFFER DZALDOV BENNETT LTD.
64 JARDIN DRIVE, UNIT 1
CONCORD, ON, L4K 3P3
PHONE: (416) 987-0101
FAX: (905) 761-0119
E-MAIL: info@surveyontario.com

BENCHMARK INFORMATION:
ELEVATIONS SHOWN HEREON ARE GEODETIC AND ARE REFERRED TO ONTARIO MINISTRY OF NATURAL RESOURCES AND FORESTRY MONUMENT No. 03120030026 HAVING A PUBLISHED ELEVATION OF 244.262 METRES.

No.	DATE	ISSUE/REVISION	INITIAL
3	7/10/2022	ISSUED FOR FIRST SUBMISSION	TSR
2	8/30/2022	ISSUED FOR SITE ALTERATION PERMIT	TSR
1	6/1/2021	ISSUED FOR COORDINATION	TVL

CITY OF BARRIE

STATEVIEW HOMES
(BEA TOWNS) INC.

BEA TOWNS
500 ARDAGH RD.
BARRIE, ONTARIO

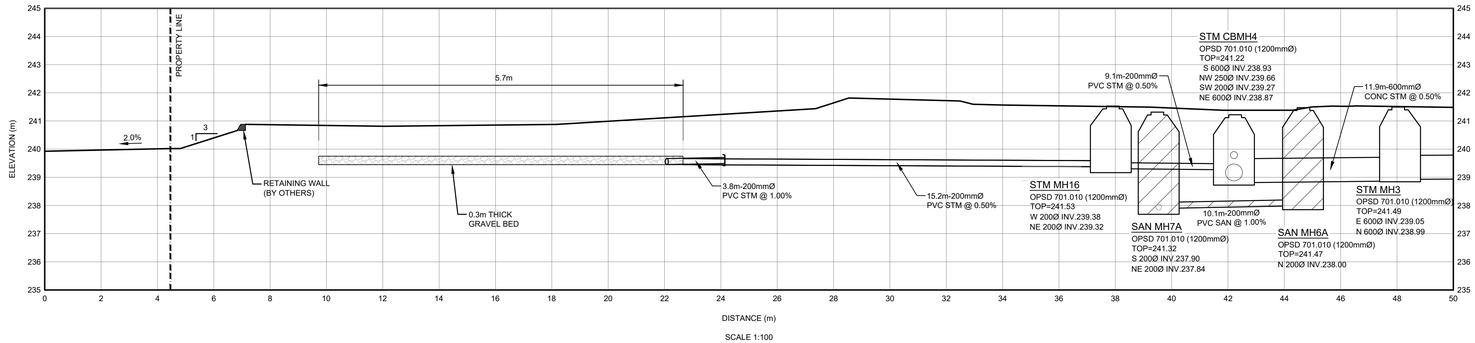
SITE SERVICING PLAN

GEI Consultants

DESIGNED BY: LV	DATE: AUG 2022	CHECKED BY: TR	
DRAWN BY: CVG	PROJECT No. 2104593	DRAWING No. SS-02	
SCALE: 1:400			

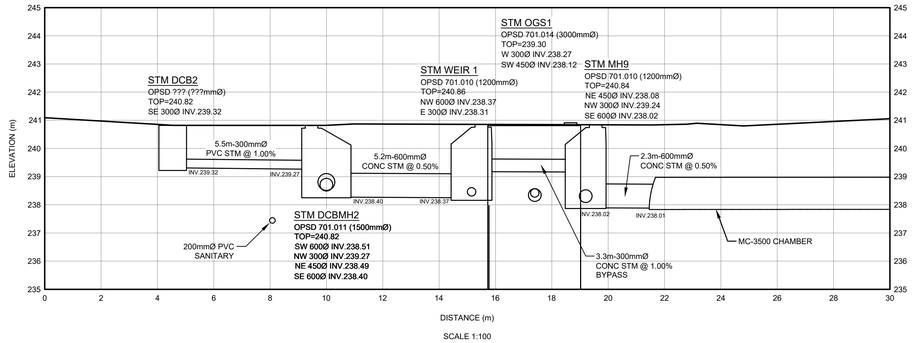
5.0 0 5.0m 10.0m 15.0m 20.0m 25.0m

SECTION H-H STORM CONNECTION



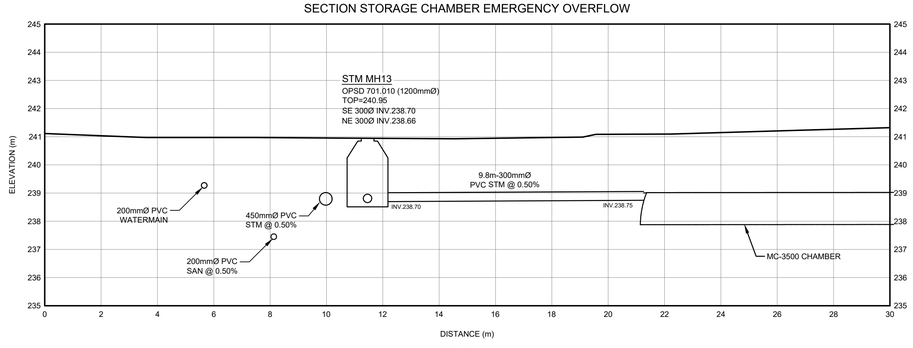
SCALE 1:100

SECTION STORAGE CHAMBER INLET

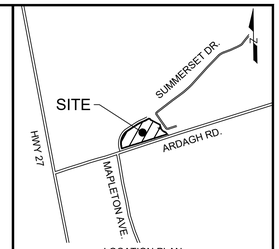


SCALE 1:100

SECTION STORAGE CHAMBER EMERGENCY OVERFLOW



SCALE 1:100



LOCATION PLAN
N.T.S.

LEGEND

LIST OF DRAWINGS

SG-01 - SITE GRADING PLAN
SG-02 - SITE GRADING PLAN
SS-01 - SITE SERVICING PLAN
SS-02 - SITE SERVICING PLAN
CS-01 - SERVICING CROSS SECTIONS
CS-02 - SERVICING CROSS SECTIONS
PD-01 - POND DESIGN
EC-01 - EROSION CONTROL - STAGE 1
EC-02 - EROSION CONTROL - STAGE 2
EC-03 - EROSION CONTROL DETAILS
DD-01 - NOTES AND DETAILS
DD-02 - DETAILS

SITE PLAN INFORMATION

ONESPACE UNLIMITED INC.
3700 STEELES AVE WEST. SUITE 305
VAUGHAN, ON, L4L 8K8
PHONE: (416) 848-1245
FAX: (416) 848-1246
WEBSITE: ONESPACEUNLIMITED.COM

SURVEYOR INFORMATION

SCHAEFFER DZALDOV BENNETT LTD.
64 JARDIN DRIVE, UNIT 1
CONCORD, ON, L4K 3P3
PHONE: (416) 987-0101
FAX: (905) 761-0119
E-MAIL: info@surveyontario.com

BENCHMARK INFORMATION:
ELEVATIONS SHOWN HEREON ARE GEODETIC AND ARE REFEERERED TO ONTARIO MINISTRY OF NATURAL RESOURCES AND FORESTRY MONUMENT No. 03120030026 HAVING A PUBLISHED ELEVATION OF 244.262 METRES.

No.	DATE	ISSUE/REVISION	INTIAL
3	7/10/2022	ISSUED FOR FIRST SUBMISSION	TSR
2	8/30/2022	ISSUED FOR SITE ALTERATION PERMIT	TSR
1	6/1/2021	ISSUED FOR COORDINATION	TVL

CITY OF BARRIE

STATEVIEW HOMES
(BEA TOWNS) INC.

BEA TOWNS
500 ARDAGH RD.
BARRIE, ONTARIO

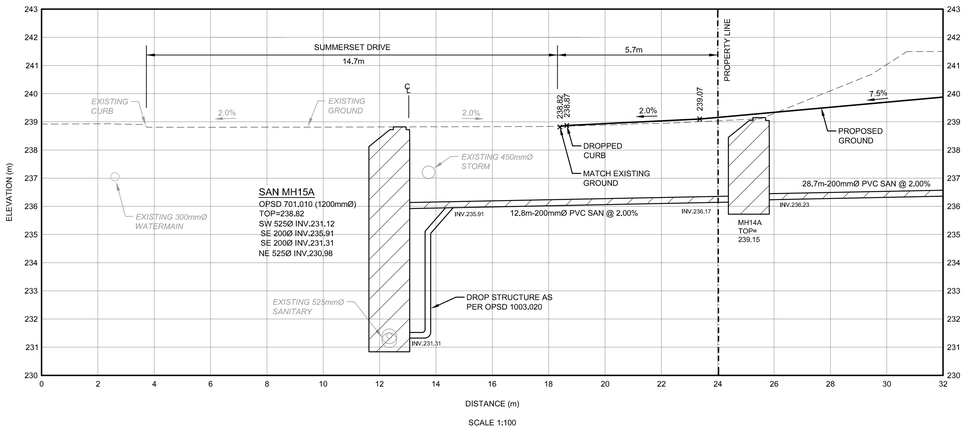
CROSS - SECTION

GEI Consultants

DESIGNED BY: LV	DATE: AUG 2022	CHECKED BY: TR
DRAWN BY: CVG	PROJECT No. 2104593	DRAWING No. CS-02
SCALE: 1:100		

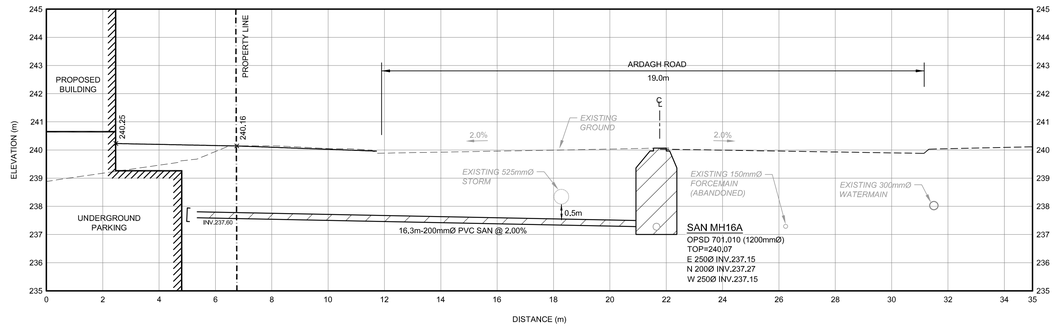
2.0 1.0 0 1.0m 2.0m 3.0m 4.0m 5.0m

SECTION D-D - SUMMERSET DRIVE SANITARY CONNECTION



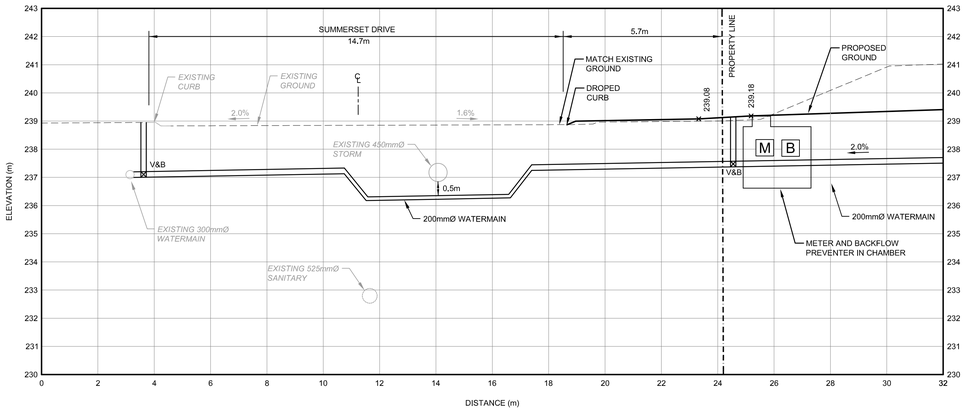
SCALE 1:100

SECTION G-G - ARDAGH ROAD SANITARY CONNECTION



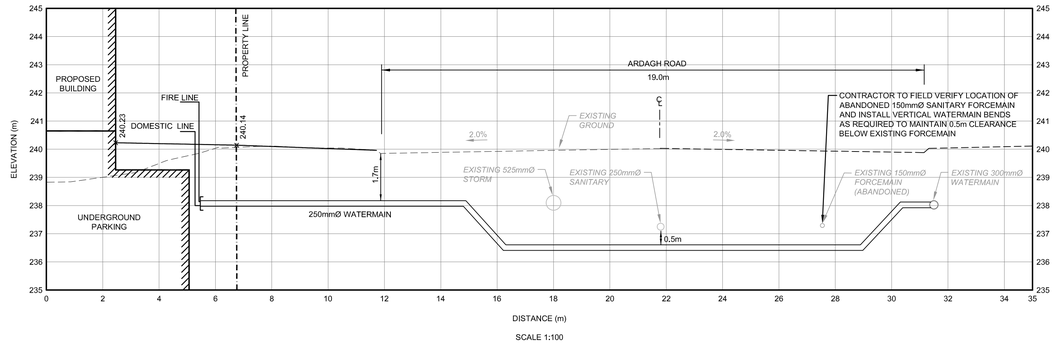
SCALE 1:100

SECTION E-E - SUMMERSET DRIVE WATER CONNECTION



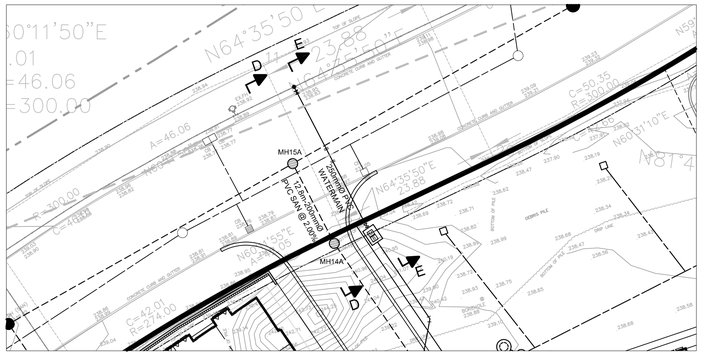
SCALE 1:100

SECTION F-F - ARDAGH ROAD WATER CONNECTION



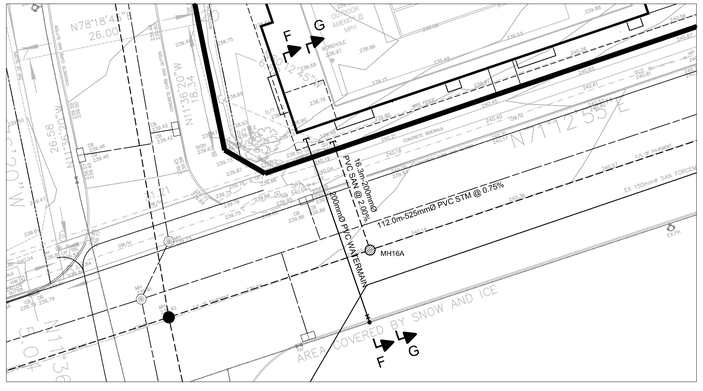
SCALE 1:100

SUMMERSET BLVD. SECTION PLAN VIEW

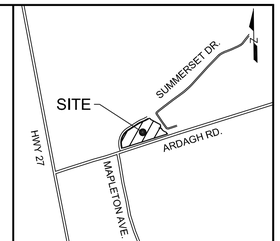


SCALE 1:400

ARGAGH RD. SECTION PLAN VIEW



SCALE 1:400



LOCATION PLAN
N.T.S.

LEGEND

LIST OF DRAWINGS

SG-01 - SITE GRADING PLAN
SG-02 - SITE GRADING PLAN
SS-01 - SITE SERVICING PLAN
SS-02 - SITE SERVICING PLAN
CS-01 - SERVICING CROSS SECTIONS
CS-02 - SERVICING CROSS SECTIONS
PD-01 - POND DESIGN
EC-01 - EROSION CONTROL - STAGE 1
EC-02 - EROSION CONTROL - STAGE 2
EC-03 - EROSION CONTROL DETAILS
DD-01 - NOTES AND DETAILS
DD-02 - DETAILS

SITE PLAN INFORMATION

ONESPACE UNLIMITED INC.
3700 STEELES AVE WEST, SUITE 305
VAUGHAN, ON, L4L 8K8
PHONE: (416) 848-1245
FAX: (416) 848-1246
WEBSITE: ONESPACEUNLIMITED.COM

SURVEYOR INFORMATION

SCHAEFFER DZALDOV BENNETT LTD.
64 JARDIN DRIVE, UNIT 1
CONCORD, ON, L4K 3P3
PHONE: (416) 987-0101
FAX: (905) 761-0119
E-MAIL: info@surveyontario.com

BENCHMARK INFORMATION:
ELEVATIONS SHOWN HEREON ARE GEODETIC AND ARE REFERRED TO ONTARIO MINISTRY OF NATURAL RESOURCES AND FORESTRY MONUMENT No. 03120030026 HAVING A PUBLISHED ELEVATION OF 244.262 METRES.

No.	DATE	ISSUE/REVISION	INTIAL
3	7/10/2022	ISSUED FOR FIRST SUBMISSION	TSR
2	8/30/2022	ISSUED FOR SITE ALTERATION PERMIT	TSR
1	6/1/2021	ISSUED FOR COORDINATION	TVL

CITY OF BARRIE

STATEVIEW HOMES
(BEA TOWNS) INC.

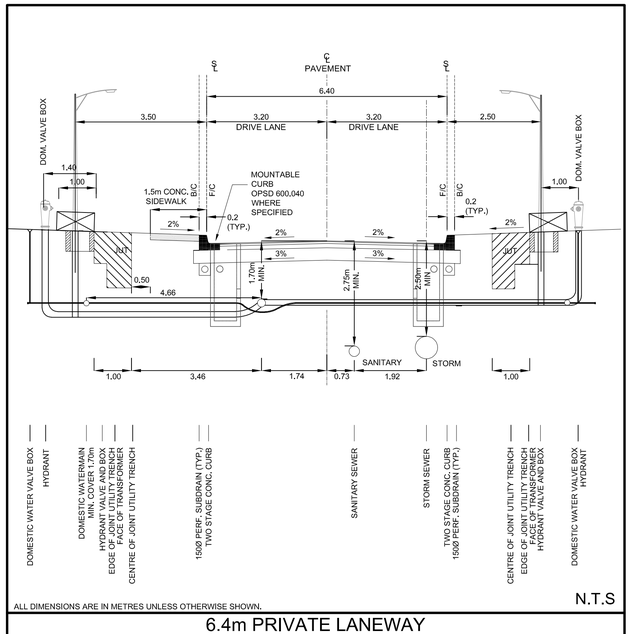
BEA TOWNS
500 ARDAGH RD.
BARRIE, ONTARIO

CROSS - SECTION

GEI Consultants

DESIGNED BY: LV	DATE: AUG 2022	CHECKED BY: TR
DRAWN BY: CVG	PROJECT No. 2104593	DRAWING No. CS-01
SCALE:		

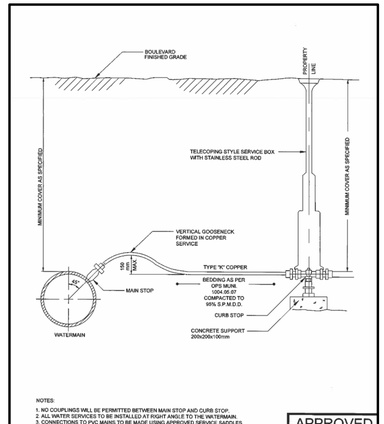
C:\ProgramData\Autodesk\ApplicationPlugIns\Landproject22.bundle\Contents B:\Working\STATEVIEW HOMES\2104593 Bear Creek Village Barrie\00_CAD\Design\Sheets\2103462-SHT-XSEC-01.dwg - 10/7/2022



N.T.S

ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE SHOWN.

6.4m PRIVATE LANEWAY
(NO PARKING)



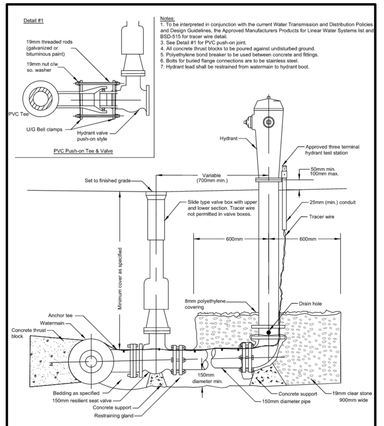
NOTES:
1. NO COUPLINGS WILL BE PERMITTED BETWEEN MAIN STOP AND CURB STOP.
2. ALL WATER SERVICES TO BE INSTALLED AT RIGHT ANGLE TO THE WATERMAIN.
3. CONNECTIONS TO PVC MAINS TO BE MADE USING APPROVED SERVICE SADDLES.
4. TAPPING TO BE AT 2 OR 10 O'CLOCK POSITION ONLY.
5. WATERMAIN TO BE DRILLED AND TAPPED WITH AWWA INLET THREAD
6. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN.

APPROVED
DATE... May 29/15...
DIRECTOR OF ENGINEERING

City of BARRIE STANDARD DETAIL

COPPER WATER SERVICE CONNECTION DETAIL 25mm DIAMETER SIZE

REV No. 2 | DATE: MAY 2015 | SCALE: N.T.S. | BSD-502



Notes:
1. To be interpreted in conjunction with the current Water Transmission and Distribution Policies and Design Guidelines, the Approved Manufacturers Products for Linear Water Systems list and BSD-515 for tracer wire detail.
3. See Detail #1 for PVC push-on joint.
4. All concrete thrust blocks to be poured against undisturbed ground.
5. Polyethylene bond breaker to be used between concrete and fittings.
6. Bolts for bunked flange connections are to be stainless steel.
7. Hydrant lead shall be restrained from watermain to hydrant boot.

Barrie

Standard Hydrant and Valve Installation

REV No. 2 | DATE: April 2019 | SCALE: N.T.S. | BSD-507

GENERAL NOTES - WATERMAIN

1. CONTRACTORS SHALL INFORM THE CITY OF BARRIE WATER OPERATIONS DEPARTMENT A MINIMUM OF 48 HOURS IN ADVANCE OF THEIR INTENTIONS TO PERFORM WORK ON WATER INFRASTRUCTURE.

2. OPERATION OF HYDRANTS AND VALVES ON THE POTABLE WATER SYSTEM BY OTHER THAN QUALIFIED WATER OPERATIONS STAFF OR THEIR DESIGNATED AGENTS IS PROHIBITED BY CURRENT BY-LAW. CITY SERVICE FEES ARE PER THE CURRENT FEES BY-LAW. THE CITY'S WATER OPERATIONS STAFF WILL STAFF AS REQUIRED TO WITNESS HYDRANT FLOW TEST, CHLORINATE AND FLUSH ALL NEW WATERMAINS.

3. MINIMUM COVER OVER WATERMAIN SHALL BE 1.7m. THE MINIMUM HORIZONTAL SEPARATION BETWEEN WATERMAIN AND SEWERS SHALL BE 2.5m WHERE WATERMAIN CONFLICTS WITH SEWER PIPES, DEFLECT WATERMAIN HORIZONTALLY OR VERTICALLY WHILE PROVIDING MINIMUM CLEARANCE BETWEEN WATERMAIN AND SEWERS. MAINTAIN MINIMUM DEPTH OF COVER AT ALL TIMES.

4. WATERMAIN SHALL BE INSTALLED IN BEDDING AS PER OPSD 802.010 (GRANULAR 'A' EMBEDMENT MATERIAL) FOR FLEXIBLE PIPE AND OPSD 802.030 OR 802.031 CLASS 'B' (GRANULAR 'A' BEDDING MATERIAL, GRANULAR 'A' OR SELECT NATIVE COVER MATERIAL) FOR RIGID PIPE AND OPSD OTHERWISE APPROVED BY THE DIRECTOR OF WATER OPERATIONS. ALTERNATIVE EMBEDMENT MATERIAL - SAND MEETING OPSS.PROV 1010 REQUIREMENTS OF OPSS.MUNI 1004.05.07 COMPACTED TO 95% STANDARD PROCTOR MAXIMUM DRY DENSITY IS PERMISSIBLE WHERE STANDARD DETAILS. GEOTECHNICAL CERTIFICATION OF MATERIAL AND COMPACTION TESTING MUST BE PROVIDED EVERY 15 m COMPACTION TESTING MUST INCLUDE THE ENTIRE EMBEDMENT ENVELOPE (HAUNCHES, BEDDING, TOP OF PIPE AND COVER).

5. COPPER WATER MAINS AND SERVICES 25mm TO 50mm IN DIAMETER SHALL BE EMBEDDED IN SAND 100mm ABOVE AND BELOW PIPE AND FITTINGS AS PER OPSS.MUNI 1004.05.01.

6. RESTRAINING WILL BE REQUIRED ON ALL HYDRANTS, THRUST BLOCKS, AS PER OPSD 1103.010 AND 1103.020. RESTRAINING IS ALSO REQUIRED IN ADDITION TO STANDARD CONCRETE THRUST BLOCKING WHERE SOIL CONDITIONS WARRANT AT THE CITY'S DISCRETION.

7. NEW WATERMAINS TO BE PVC DR18 CL150 MINIMUM; DUCTILE IRON CL53 AS PER THE APPROVED MANUFACTURERS PRODUCTS FOR LINEAR WATER SYSTEMS LIST.

8. TRACING WIRE SHALL BE #12 AWG HIGH STRENGTH COPPER CLAD (HS-CSS) AND SHALL BE INSTALLED ON THE TOTAL LENGTH OF WATERMAIN AND BROUGHT UP AT EACH HYDRANT AND CONNECTED TO FLANGE BOLT. ALL SPLICES TO UTILIZE CONNECTORS AS PER THE APPROVED MANUFACTURERS PRODUCTS FOR LINEAR WATER SYSTEMS LIST.

9. ALL WATER SERVICES SHALL BE MINIMUM 25mm TYPE 'K' COPPER OR 25mm CROSS-LINKED POLYETHYLENE UNLESS OTHERWISE APPROVED BY THE DIRECTOR OF WATER OPERATIONS. WATER SERVICE SADDLES SHALL BE USED WHEN TAPPING INTO PVC WATERMAIN.

10. SERVICE TAPPINGS SHALL BE PLACED AT A MINIMUM SEPARATION OF 1.0m AND A MINIMUM OF 0.6m FROM JOINTS. (ENDS OF 1 PIPE).

11. RISER PIPES ARE TO BE INSTALLED AS PER BSD-515, AND REMOVED AS DIRECTED. SWABBING SCHEDULE TO BE SUPPLIED BY THE CONTRACTOR TO OPERATIONS FIELD REPRESENTATIVE. ALL RISERS ARE TO BE RESTRAINED OR THRUST BLOCKED.

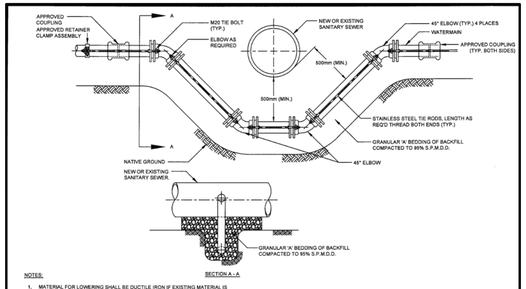
12. ALL NEW CURB STOPS AND BOXES TO BE LOCATED AT PROPERTY LINE AND OUT OF DRIVEWAYS AND SIDEWALKS.

City of BARRIE STANDARD DETAIL

GENERAL NOTES - WATERMAIN

REV No. 2 | DATE: MAY 2015 | SCALE: N.T.S. | BSD-500

APPROVED
DATE... May 29/15...
DIRECTOR OF ENGINEERING



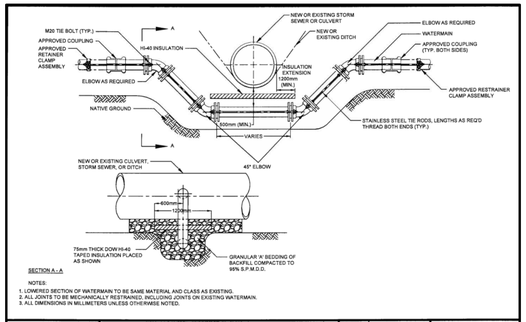
NOTES:
1. MATERIAL FOR LOWERING SHALL BE DUCTILE IRON IF EXISTING MATERIAL IS METALLIC
2. UNITS IN MILLIMETERS UNLESS OTHERWISE NOTED.
3. ALL JOINTS TO BE MECHANICALLY RESTRAINED, INCLUDING JOINTS ON EXISTING WATERMAIN.

City of BARRIE STANDARD DETAIL

LOWERING DETAIL AT NEW OR EXIST. WATERMAIN CROSSING OF NEW OR EXIST. SANITARY SEWER

REV No. 1 | DATE: FEB 2015 | SCALE: N.T.S. | BSD-518

APPROVED
DATE... 6 FEB 2015...
DIRECTOR OF ENGINEERING



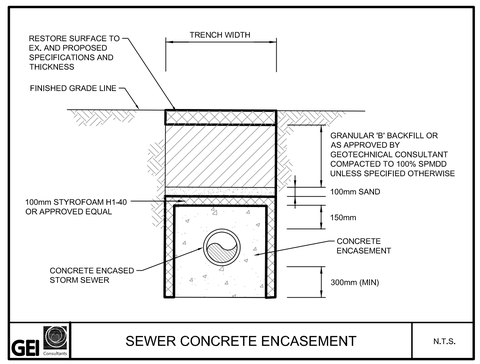
NOTES:
1. LOWERED SECTION OF WATERMAIN TO BE SAME MATERIAL AND CLASS AS EXISTING.
2. ALL JOINTS TO BE MECHANICALLY RESTRAINED, INCLUDING JOINTS ON EXISTING WATERMAIN.
3. ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE NOTED.

City of BARRIE STANDARD DETAIL

LOWERING DETAILOF NEW OR EXIST. WATERMAIN CROSSING NEW OR EXIST. CULVERT, STORM SEWER OR DITCH

REV No. 1 | DATE: FEB 2015 | SCALE: N.T.S. | BSD-519

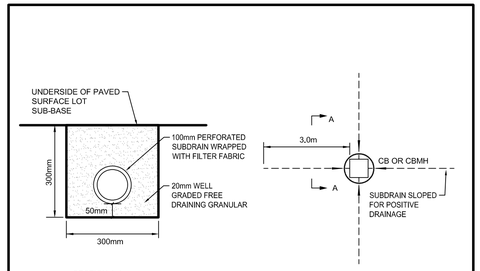
APPROVED
DATE... 6 FEB 2015...
DIRECTOR OF ENGINEERING



GEI Consultants

SEWER CONCRETE ENCASEMENT

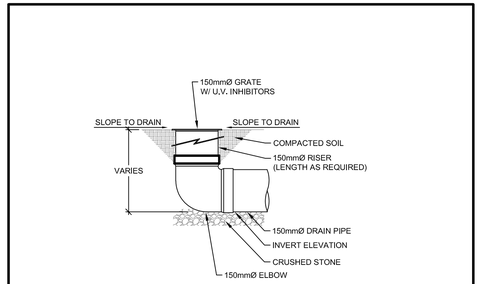
N.T.S.



GEI Consultants

SUBDRAIN DETAIL

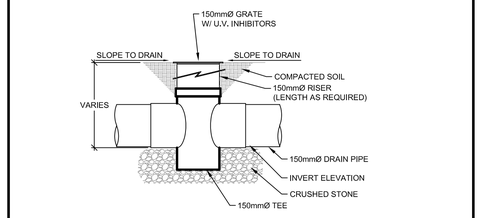
N.T.S.



GEI Consultants

AREA DRAIN WITH ELBOW

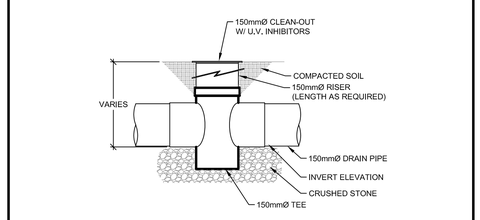
N.T.S.



GEI Consultants

AREA DRAIN WITH TEE

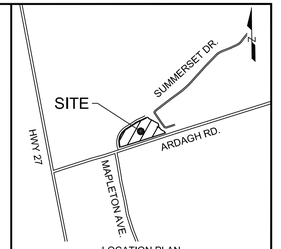
N.T.S.



GEI Consultants

CLEAN-OUT WITH TEE

N.T.S.



LOCATION PLAN
N.T.S.

LEGEND

LIST OF DRAWINGS

SG-01 - SITE GRADING PLAN
SG-02 - SITE GRADING PLAN
SS-01 - SITE SERVICING PLAN
SS-02 - SITE SERVICING PLAN
CS-01 - SERVICING CROSS SECTIONS
CS-02 - SERVICING CROSS SECTIONS
PD-01 - POND DESIGN
EC-01 - EROSION CONTROL - STAGE 1
EC-02 - EROSION CONTROL - STAGE 2
EC-03 - EROSION CONTROL DETAILS
DD-01 - NOTES AND DETAILS
DD-02 - DETAILS

SITE PLAN INFORMATION
ONESPACE UNLIMITED INC.
3700 STEELES AVE WEST, SUITE 305
VAUGHAN, ON, L4L 8K8
PHONE: (416) 848-1245
FAX: (416) 848-1246
WEBSITE: ONESPACEUNLIMITED.COM

SURVEYOR INFORMATION
SCHAEFFER DZALDOV BENNETT LTD.
64 JARDIN DRIVE, UNIT 1
CONCORD, ON, L4K 3P3
PHONE: (416) 987-2101
FAX: (905) 761-0119
E-MAIL: info@surveyontario.com

BENCHMARK INFORMATION:
ELEVATIONS SHOWN HEREON ARE GEODETIC AND ARE REFERRED TO ONTARIO MINISTRY OF NATURAL RESOURCES AND FORESTRY MONUMENT No, 03120030026 HAVING A PUBLISHED ELEVATION OF 244.262 METRES.

No.	DATE	ISSUE/REVISION	INTIAL
3	7/10/2022	ISSUED FOR FIRST SUBMISSION	TSR
2	8/30/2022	ISSUED FOR SITE ALTERATION PERMIT	TSR
1	6/1/2021	ISSUED FOR COORDINATION	TVL

CITY OF BARRIE

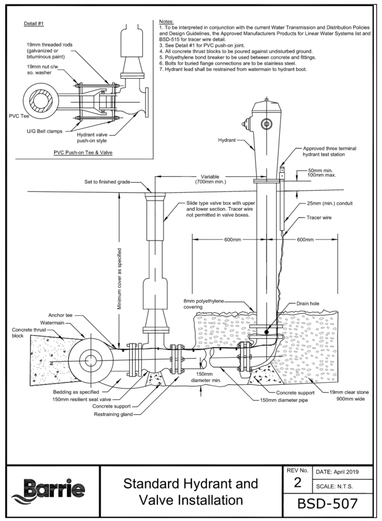
STATEVIEW HOMES (BEA TOWNS) INC.

BEA TOWNS
500 ARDAGH RD.
BARRIE, ONTARIO

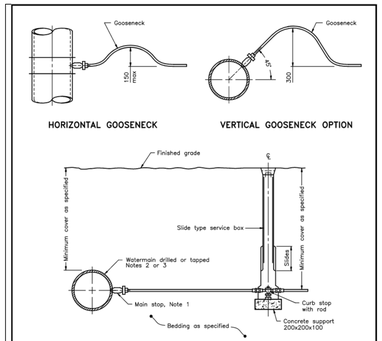
NOTES AND DETAILS

GEI Consultants

DESIGNED BY: LV	DATE: AUG 2022	CHECKED BY: TR
DRAWN BY: CVG	PROJECT No. 2104593	DRAWING No. DD-02
SCALE:		



Barrie	Standard Hydrant and Valve Installation	REV No. 2	DATE: April 2019
			SCALE: N.T.S.
		BSD-507	



NOTES:

1 For plastic service pipes, install main stop at 15° above horizontal with a minimum 1.2m long gooseneck.

2 Direct tap ductile iron pipe with approved tool with standard AWWA inlet thread.

3 Service connections to plastic watermains shall be made using service saddles or factory made tees.

A When specified, the vertical gooseneck option shall be used.

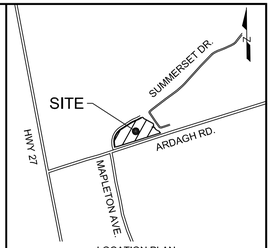
B Couplings shall not be permitted unless the service length exceeds 20m between the main stop and curb stop.

C All water services shall be installed 90° to the longitudinal axis of the watermain.

D Backfill material within 500mm of service box shall be native or imported, as specified.

E All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2018	Rev 4
WATER SERVICE CONNECTION 19 and 25mm DIAMETER SIZES		
	OPSD 1104.010	



LOCATION PLAN
N.T.S.

LEGEND

LIST OF DRAWINGS

SG-01 - SITE GRADING PLAN
SG-02 - SITE GRADING PLAN
SS-01 - SITE SERVICING PLAN
SS-02 - SITE SERVICING PLAN
CS-01 - SERVICING CROSS SECTIONS
CS-02 - SERVICING CROSS SECTIONS
PD-01 - POND DESIGN
EC-01 - EROSION CONTROL - STAGE 1
EC-02 - EROSION CONTROL - STAGE 2
EC-03 - EROSION CONTROL DETAILS
DD-01 - NOTES AND DETAILS
DD-02 - DETAILS

SITE PLAN INFORMATION
ONESPACE UNLIMITED INC.
3700 STEELES AVE WEST, SUITE 305
VAUGHAN, ON, L4L 8K8
PHONE: (416) 848-1245
FAX: (416) 848-1246
WEBSITE: ONESPACEUNLIMITED.COM

SURVEYOR INFORMATION
SCHAEFFER DZALDOV BENNETT LTD.
64 JARDIN DRIVE, UNIT 1
CONCORD, ON, L4K 3P3
PHONE: (416) 987-0101
FAX: (905) 761-0119
E-MAIL: info@surveyontario.com

BENCHMARK INFORMATION:
ELEVATIONS SHOWN HEREON ARE GEODETIC AND ARE REFERRED TO ONTARIO MINISTRY OF NATURAL RESOURCES AND FORESTRY MONUMENT No, 03120030026 HAVING A PUBLISHED ELEVATION OF 244.262 METRES.

No.	DATE	ISSUE/REVISION	INTIAL
3	7/10/2022	ISSUED FOR FIRST SUBMISSION	TSR
2	8/30/2022	ISSUED FOR SITE ALTERATION PERMIT	TSR
1	6/1/2021	ISSUED FOR COORDINATION	TVL

CITY OF BARRIE

STATEVIEW HOMES
(BEA TOWNS) INC.

BEA TOWNS
500 ARDAGH RD.
BARRIE, ONTARIO

NOTES AND DETAILS

GEI Consultants

DESIGNED BY: LV	DATE: AUG 2022	CHECKED BY: TR
DRAWN BY: CVG	PROJECT No. 2104593	DRAWING No. DD-03
SCALE:		

GENERAL NOTES

SITE PLANS

1. AT ALL ENTRANCES TO THE SITE, THE ROAD CURB AND SIDEWALK WILL BE CONTINUOUS THROUGH THE DRIVEWAY, THE DRIVEWAY GRADE WILL BE COMPATIBLE WITH THE EXISTING SIDEWALK AND CURB DEPRESSION WILL BE PROVIDED FOR EACH ENTRANCE.
2. ALL UNDERGROUND SERVICE MATERIALS AND INSTALLATIONS TO BE IN ACCORDANCE WITH THE CITY OF BARRIE'S LATEST STANDARDS AND CODES.
3. ALL SURFACE DRAINAGE SHALL BE SELF CONTAINED, COLLECTED AND DISCHARGED AT A LOCATION TO BE APPROVED PRIOR TO THE ISSUANCE OF A BUILDING PERMIT. DRAINAGE OF ABUTTING PROPERTIES SHALL NOT BE ADVERSELY AFFECTED.
4. ALL STORM SEWER MATERIALS AND CONSTRUCTION METHODS MUST CORRESPOND TO CURRENT MUNICIPAL AND PROVINCIAL STANDARDS AND SPECIFICATIONS.
5. ALL CATCHBASINS ARE TO BE AS OPSD 705.010. MANHOLES ARE TO BE AS OPSD STD G 701.010 & 701.011.
6. ALL PAVEMENT MARKING, LINE PAINTING, DIRECTIONAL LINES/ARROWS ETC. SHALL BE PLACED IN ACCORDANCE WITH THE ARCHITECTURAL SITE PLAN OR THE OWNER'S TRAFFIC ENGINEERING CONSULTANT'S DRAWINGS. LINE PAINTING AND DIRECTIONAL SYMBOLS SHALL BE APPLIED WITH A MINIMUM OF TWO COATS OF ORGANIC SOLVENT BASED PAINT IN ACCORDANCE WITH OPSS 171
7. ALL CONCRETE CURBS TO BE CONSTRUCTED IN ACCORDANCE WITH OPSD 600.110 CURB LOCATIONS AND EXTENTS AS PER SITE PLAN DRAWING A100 4. ORDER OF PRECEDENCE OF STANDARD DRAWINGS IS FIRSTLY CITY OF BARRIE STANDARD DRAWINGS (BSD..), AND SECONDLY ONTARIO PROVINCIAL STANDARD DRAWINGS (OPSD).

DRAWINGS

1. ALL DIMENSIONS ARE IN METRES, EXCEPT PIPE DIAMETERS, WHICH ARE IN MILLIMETRES, UNLESS SPECIFIED OTHERWISE.
2. GENERAL
3. ALL WORK SHALL BE IN ACCORDANCE WITH CURRENT CITY OF BARRIE STANDARD DRAWINGS (BSD) AND ONTARIO PROVINCIAL STANDARD DRAWINGS (OPSD).
4. ORDER OF PRECEDENCE OF STANDARD DRAWINGS IS FIRSTLY CITY OF BARRIE STANDARD DRAWINGS (BSD) AND SECONDLY ONTARIO PROVINCIAL STANDARD DRAWINGS (OPSD).
5. LOCATION OF EXISTING SERVICES ARE NOT GUARANTEED.THE CONTRACTOR IS REQUIRED TO NOTIFY THE VARIOUS UTILITY COMPANIES 48 HOURS PRIOR TO THE COMMENCEMENT OF ANY WORK.
6. A ROAD OCCUPANCY PERMIT IS REQUIRED FROM THE ROADS AND PARKS OPERATIONS BRANCH PRIOR TO THE COMMENCEMENT OF WORK WITHIN ANY CITY RIGHT--OF--WAY.
7. COMPACTION TO BE AS PER THE PETO MACCALLUM LTD REPORT JANUARY 2017. NATIVE MATERIAL, SUITABLE FOR BACKFILL, SHALL BE COMPACTED TO 95% MAXIMUM DRY DENSITY.GRANULAR MATERIAL, USED FOR BACKFILL, SHALL BE PLACED IN LAYERS 150mm IN DEPTH MAXIMUM AND COMPACTED TO 100% STANDARD PROCTOR MAXIMUM DRY DENSITY.
8. ALL DISTURBED AREAS ARE TO BE REINSTATED TO THEIR ORIGINAL CONDITION OR BETTER, AS DETERMINED BY THE CITY ENGINEERING DEPARTMENT.
9. ALL SILT CONTROL AND EROSION PROTECTION DEVICES ARE TO BE IN PLACE PRIOR TO COMMENCEMENT OF CONSTRUCTION AND SHALL REMAIN IN PLACE AND BE MAINTAINED BY THE CONTRACTOR UNTIL CONSTRUCTION IS COMPLETE AND THE GRASS HAS ESTABLISHED GROWTH, SUBJECT TO APPROVAL BY THE CITY ENGINEERING DEPARTMENT.

SANITARY SEWERS

1. SEWERS SHALL BE CONSTRUCTED WITH BEDDINGS AS PER OPSD--802.010, (GRAN. A' EMBEDMENT MATERIAL) FOR FLEXIBLE PIPES AND OPSD--802.030 OR 802.031 CLASS B (GRAN. 'A' BEDDING MATERIAL) FOR RIGID PIPE UNLESS OTHERWISE APPROVED BY THE DIRECTOR OF ENGINEERING.
2. MAXIMUM DEFLECTION FROM COMBINED LIVE AND DEAD LOADING SHALL NOT EXCEED ANY C.S.A., O.P.S. OR MANUFACTURERS RECOMMENDED SPECIFICATIONS.
3. PVC, CONCRETE AND PROFILE WALL PVC SEWERS SHALL HAVE RUBBER GASKET TYPE JOINTS AND SHALL BE CERTIFIED TO CONFORM TO ALL APPLICABLE CURRENT C.S.A. SPECIFICATIONS.
4. MAINTENANCE HOLE TOPS (FRAMES) ARE TO BE SET TO BASE COURSE ASPHALT GRADE AND THEN ADJUSTED TO FINAL GRADE WHEN THE TOP LIFT OF ASPHALT IS PLACE. ALL ADJUSTMENT WILL BE ACCORDANCE WITH BSD--N2.
5. ALL CONNECTIONS TO NEW SANITARY MAINS SHALL BE PRE--MANUFACTURED, FABRICATED TEES. CONNECTIONS TO EXISTING SANITARY SEWER SHALL BE MADE WITH APPROVED FACTORY MADE TEES OR INSERTA--TEES IN STRICT ACCORDANCE TO MANUFACTURES GUIDELINES.

STORMWATER MANAGEMENT POND

1. GRADING AND EARTH EXCAVATION a)BERMS TO BE CONSTRUCTED USING SELECT SOIL PLACED IN MAXIMUM 300 MM THICK LIFTS COMPACTED TO 95% SPMDD. FINISHED SLOPES OF THE PONDS NOT TO EXCEED FIVE HORIZONTAL TO ONE VERTICAL (5H:1V) FOR THE INTERIOR. SLOPES TO BE PROVIDED WITH VEGETATED COVER OR OTHER MEANS FOR EROSION PROTECTION.
2. RIP RAP

   RIP RAP FOR THE OVERLAND FLOW PATHS TO THE POND AND AT CULVERT SHALL BE 100MM TO 200MM DURABLE, HARD, ANGULAR ROCK AND SHALL BE AS PER OPSD 810.010 TYPE 'B', COMPLETE WITH FILTER FABRIC. WORK UNDER THIS ITEM INCLUDES REGRADING OF THE POND EMBANKMENT TO DIRECT OVERLAND FLOW TO THE ROCK CHUTE AND RESTORATION OF ALL AREAS DISTURBED AS A RESULT OF THE CONSTRUCTION ACTIVITIES.

   PLACING TOPSOIL, SEED & MULCH

   WORK UNDER THIS ITEM SHALL INCLUDE THE LOADING OF TOPSOIL FROM THE EXISTING TOPSOIL STOCKPILE, HAULING AND PLACEMENT IN THE DISTURBED SITE AREAS. TOPSOIL TO BE FERTILE, FRIABLE NATURAL LOAM ORGANIC MATTER FOR SANDY LOAMS AND CAPABLE OF SUSTAINING VIGOROUS PLANT GROWTH, FREE OF ADMIXTURE OF SUBSOIL, CLAY LUMPS AND FROM STONES AND ROOTS OVER 50 MM (2 IN.) IN DIA. AND OTHER FOREIGN MATTER.

   PLACE 50MM THICK TOPSOIL, SEED AND MULCH ON THE PONDS, TEMPORARY SEDIMENT AND EROSION CONTROL POND SLOPES, BERMS AND SWALES IMMEDIATELY AFTER CONSTRUCTION. PLACE 50MM TOPSOIL SEED AND MULCH ON ALL LOTS NOT EXPECTED TO BE BUILT UPON WITHIN 30 DAYS OF THE COMPLETION OF THE AREA GRADING (ASSUME ALL LOTS UNLESS DIRECTED OTHERWISE).

   FINAL GRADING OF THE BOULEVARD SUBGRADE IN PREPARATION FOR TOPSOIL PLACEMENT IS INCIDENTAL TO THIS ITEM. TOPSOIL TO BE PLACED ON THE PREPARED SUBGRADE TO A UNIFORM DEPTH OF 50MM AND COMPACTED IN PLACE TO THE SPECIFIED LINE AND GRADE.

   SEED AND MULCH SHALL BE SUPPLIED AND INSTALLED AS PER OPSS.MUNI 804. ANY AREAS WHERE THE SEED HAS NOT TAKEN WILL BE RE-SEEDED AT THE CONTRACTOR'S COST.

   THE CONTRACTOR SHALL CONTINUE TO PROVIDE ONGOING MAINTENANCE UNTIL A CATCH HAS BEEN ESTABLISHED.

3. STORMWATER MANAGEMENT POND OUTLET STRUCTURES
4. CONTRACTOR SHALL INCLUDE ALL LABOUR, EQUIPMENT AND MATERIAL TO BUILD THE SWM OUTLET STRUCTURES AS DETAILED ON THE CONTRACT DRAWINGS INCLUDING:
   - SUPPLY AND PLACE MODIFIED OPSD 804.040 POND INLET HEADWALL C/W RODENT GRATE AND PROTECTION BLACK VINYL FENCING. FENCING TO BE IN ACCORDANCE WITH OPSD 972.131
   - SUPPLY AND PLACE PERFORATED CSP RISER C/W LADDER, LOCKABLE ACCESS COVER, CLEARSTONE, CONCRETE PAD
   - SUPPLY AND PLACE DITCH INLET CATCHBASINS INCLUDING OPSD 401.011 FRAME AND GRATE, WELDED TRASH GRATE FOR DICB, AND LINK PIPE
   - SUPPLY AND PLACE INLET AND OUTLET PIPE
5. STORMWATER MANAGEMENT POND OVERFLOW STRUCTURES CONTRACTOR SHALL INCLUDE ALL LABOUR, EQUIPMENT AND MATERIAL TO BUILD THE SWM OVERFLOW STRUCTURES AS DETAILED ON THE CONTRACT DRAWINGS INCLUDING:
   - EXCAVATION AS REQUIRED TO PLACE MATERIAL TO GRADE - SUPPLY AND PLACEMENT OF RIP RAP MATERIAL
   - SUPPLY AND INSTALLATION OF CONCRETE ON 200MM GRANULAR "A" BEDDING WHERE THE MAINTENANCE ACCESS ROAD CROSSES THE OVERFLOW STRUCTURE
   - SUPPLY AND INSTALL OPSD 810.010 TYPE B RIPRAP WITH FILTER FABRIC
6. HEADWALLS

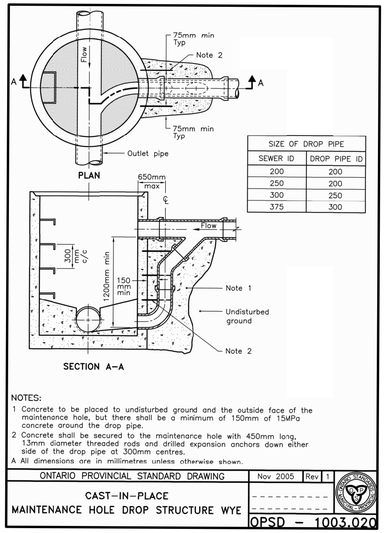
   HEADWALLS SHALL BE AS PER OPSD 804.030 COMPLETE WITH GRATING AS PER OPSD 804.050 AND PEDESTRIAN FENCE. INCLUDED IN THIS ITEM IS THE RIVER STONE PLACED ON THE EMBANKMENT AT THE POND OUTFALL. RIVER STONE SHALL BE 150MM TO 250MM DURABLE, HARD, ROUNDED ROCK, SIMILAR TO OPSD 810.010 TYPE 'A' RIP RAP. NO FILTER FABRIC IS TO BE INSTALLED WITH THIS ITEM. WORK UNDER THIS ITEM INCLUDES REGRADING OF THE OUTFALL LOCATIONS TO ACHIEVE THE SPECIFIED GRADE AROUND THE OUTLET STRUCTURE AND RESTORATION OF THE ALL AREAS DISTURBED AS A RESULT OF THE CONSTRUCTION ACTIVITIES.

STORM SEWERS

1. PLACE ALL CATCH BASIN LATERALS AT 2% GRADE UNLESS OTHERWISE NOTED. PIPE SIZE MINIMUM 250mm DIA. SINGLE , 300mm DIA. DOUBLE.
2. STORM SEWERS SHALL BE CONSTRUCTED WITH BEDDING AS PER OPSD--802.010 (GRAN. 'A' EMBEDMENT MATERIAL) FOR FLEXIBLE PIPES AND OPSD--802.030 OR 802.031 CLASS B (GRAN. 'A' BEDDING MATERIAL) FOR RIGID PIPE UNLESS OTHERWISE APPROVED BY THE DIRECTOR OF ENGINEERING.
3. MAINTENANCE HOLE TOPS (FRAMES) AND CATCH BASIN (FRAMES) ARE TO BE SET TO BASE COURSE ASPHALT GRADE AND THEN ADJUSTED TO FINAL GRADE WHEN THE TOP LIFT OF ASPHALT IS PLACED. ALL ADJUSTMENT WILL BE ACCORDANCE WITH BSD--N2.
4. ALL CONNECTIONS TO THE STORM MAIN SHALL BE MADE WITH A STORM MANHOLE OR APPROVED FACTORY TEE CONNECTION AS PER OPSD--708.01 OR 708.03.
5. PIPE MATERIAL TO BE REINFORCED CONCRETE WITH A MINIMUM STRENGTH OF 50 N/mm/mm CERTIFIED TO C.S.A. STANDARD A247.2--I982, CLASS 50--D (PREVIOUSLY C.S.A. STANDARD A257.2--I974., CLASS III).
6. PVC PIPE MATERIAL TO BE CERTIFIED TO C.S.A. STANDARDS 182.2 AND 182.4.
7. POLYETHYLENE DUAL WALL CORRUGATED GRAVITY SEWER PIPE TO BE IN ACCORDANCE WITH CSA B182.6 AND CSA B182.8, AND TO BE INSTALLED IN ACCORDANCE WITH OPSD 802.010 AND OPSD 806.020
8. STORM SEWER TO BE MINIMUM 300mm DIAMETER WITH JOINTS CONFORMING TO C.S.A. STANDARD A257.3.
9. ALL PIPE BEDDING MUST CONFORM TO OPSD, MAXIMUM COVER TABLE. NO FLEXIBLE PIPE SEWERS WILL BE INSTALLED WITH A DEPTH OF COVER GREATER THAN 6 METRES UNLESS SPECIFICALLY APPROVED BY THE DIRECTOR OF ENGINEERING.
10. ALL PIPE HANDLING INSTALLATIONS MUST BE IN STRICT COMPLIANCE WITH MANUFACTURES INSTALLATION GUIDES AND THE O.C.P.A. OR UNIBELL GUIDELINES.

WATERMAIN

1. CONTRACTORS SHALL INFORM THE CITY OF BARRIE WATER OPERATIONS DEPARTMENT A MINIMUM OF 48 HOURS IN ADVANCE OF THEIR INTENTIONS TO PERFORM WORK ON WATER INFRASTRUCTURE.
2. OPERATION OF HYDRANTS AND VALVES ON THE POTABLE WATER SYSTEM BY OTHER THAN QUALIFIED WATER OPERATIONS STAFF IS PROHIBITED BY CURRENT BY-LAW. CITY SERVICE FEES ARE PER THE CURRENT FEES BY-LAW. THE CITY'S WATER OPERATIONS STAFF WILL SWAB, PRESSURE TEST, CHLORINATE AND FLUSH ALL NEW WATERMAINS.
3. MINIMUM COVER OVER WATERMAIN SHALL BE 1.7m. THE MINIMUM HORIZONTAL SEPARATION BETWEEN WATERMAIN AND SEWERS SHALL BE 2.5m WHERE WATERMAIN CONFLICTS WITH SEWER PIPES. DEFLECT WATERMAIN HORIZONTALLY OR VERTICALLY WHILE PROVIDING A MINIMUM OF 0.5m CLEARANCE BETWEEN WATERMAIN AND SEWERS. MAINTAIN MINIMUM DEPTH OF COVER AT ALL TIMES.
4. WATERMAIN SHALL BE INSTALLED IN BEDDING AS PER OPSD 802.010 (GRANULAR 'A' EMBEDMENT MATERIAL) FOR FLEXIBLE PIPES AND OPSD 802.030 OR 802.031 CLASS 'B' (GRANULAR 'A' BEDDING MATERIAL, GRANULAR 'A' OR SELECT NATIVE COVER MATERIAL) FOR RIGID PIPE UNLESS OTHERWISE APPROVED BY THE DIRECTOR OF WATER OPERATIONS ALTERNATIVE EMBEDMENT MATERIAL - SAND MEETING GRADATION REQUIREMENTS OF OPSS.MUNI 1004.05.07 COMPACTED TO 95% STANDARD PROCTOR MAXIMUM DRY DENSITY IS PERMISSIBLE WHERE NOTED IN STANDARD DETAILS. GEOTECHNICAL CERTIFICATION OF MATERIAL AND COMPACTION TESTING MUST BE PROVIDED EVERY 150 METRES. THE COMPACTION TESTING MUST INCLUDE THE ENTIRE EMBEDMENT ENVELOPE (HAUNCHES, BEDDING, TOP OF PIPE AND COVER).
5. COPPER WATER MAINS AND SERVICES 25mm TO 50mm IN DIAMETER SHALL BE EMBEDDED IN SAND 100mm ABOVE AND BELOW TO CONFORM TO OPSS MUNI 1004.05.07.
6. RESTRAINING WILL BE REQUIRED ON ALL HYDRANTS. THRUST BLOCKS, AS PER OPSD 1103.010 AND 1103.020. RESTRAINING DEVICES MAY BE REQUIRED IN ADDITION TO STANDARD CONCRETE THRUST BLOCKING WHERE SOIL CONDITIONS WARRANT AT THE CITY'S DISCRETION.
7. NEW WATERMAINS TO BE PVC DR18 CL150 MINIMUM; DUCTILE IRON CL52 AS PER THE APPROVED MANUFACTURERS PRODUCTS FOR LINEAR WATER SYSTEMS LIST.
8. TRACING WIRE SHALL BE #12 AWG HIGH STRENGTH COPPER CLAD (HS-CSS) AND SHALL BE INSTALLED ON THE TOTAL LENGTH OF ALL WATERMAIN AND BROUGHT UP AT EACH HYDRANT AND CONNECTED TO FLANGE BOLT. ALL SPLICES TO UTILIZE CONNECTORS AS PER THE APPROVED MANUFACTURERS PRODUCTS FOR LINEAR WATER SYSTEMS LIST.
9. SERVICE TAPPINGS SHALL BE PLACED AT A MINIMUM SEPARATION OF 1.0m AND A MINIMUM OF 0.6m FROM JOINTS. (ENDS OF PIPE)
10. RISER PIPES ARE TO BE INSTALLED AS PER BSD-510 AND REMOVED AS DIRECTED. SWABBING SCHEDULE TO BE SUPPLIED BY A WATER OPERATIONS FIELD REPRESENTATIVE. ALL RISERS ARE TO BE RESTRAINED OR THRUST BLOCKED.
11. ALL NEW CURB STOPS AND BOXES TO BE LOCATED AT PROPERTY LINE AND OUT OF DRIVEWAYS AND SIDEWALKS.

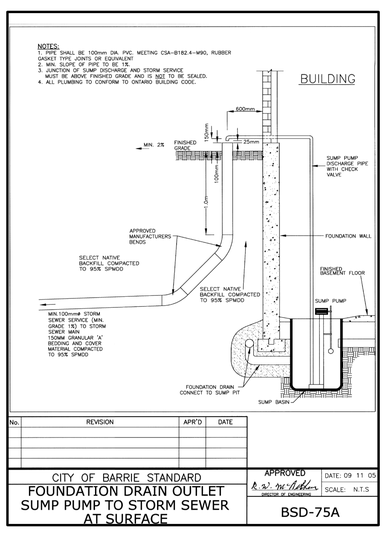


SIZE OF DROP PIPE	
SEWER ID	DROP PIPE ID
200	200
250	200
300	250
375	300

NOTES:
1. Concrete to be placed to undisturbed ground and the outside face of the maintenance hole, but there shall be a minimum of 150mm of 15MPa concrete around the drop pipe.
2. Concrete shall be secured to the maintenance hole with 450mm long, 13mm diameter threaded rods and drilled expansion anchors down either side of the drop pipe at 300mm centres.

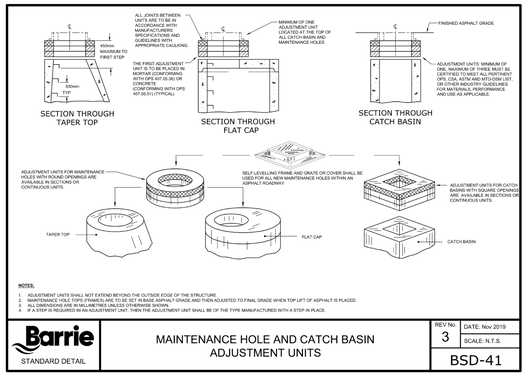
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2005	Rev	1
CAST–IN–PLACE MAINTENANCE HOLE DROP STRUCTURE WYE		OPSD – 1003.020	



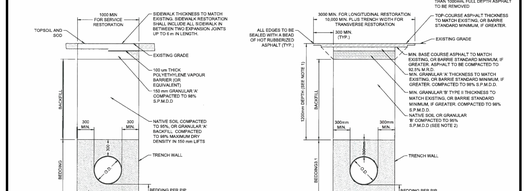
No.	REVISION	APR'D	DATE

CITY OF BARRIE STANDARD	APPROVED	DATE: 09 11 05
FOUNDATION DRAIN OUTLET SUMP PUMP TO STORM SEWER AT SURFACE	DIRECTOR OF ENGINEERING	SCALE: N.T.S
		BSD-75A



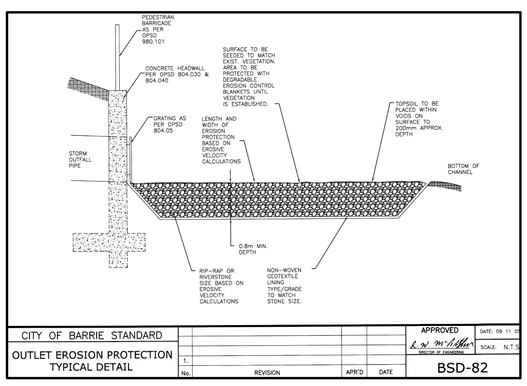
NOTES:
1. ADJUSTMENT UNITS SHALL NOT EXTEND BEYOND THE OUTSIDE EDGE OF THE STRUCTURE.
2. MAINTENANCE HOLE TOPS (FRAMES) ARE TO BE SET IN BASE ASPHALT GRADE AND THEN ADJUSTED TO FINAL GRADE WHEN TOP LIFT OF ASPHALT IS PLACED.
3. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN.
4. IF A STEP IS REQUIRED IN AN ADJUSTMENT UNIT, THEN THE ADJUSTMENT UNIT SHALL BE OF THE TYPE MANUFACTURED WITH A STEP IN PLACE.

Barrie STANDARD DETAIL	MAINTENANCE HOLE AND CATCH BASIN ADJUSTMENT UNITS	REV No. 3	DATE: Nov 2019
			SCALE: N.T.S.
			BSD-41



NOTES:
1. FROST TAPER USED IF DEPTH IS LESS THAN 1200mm
2. UNSHRINKABLE FILL TO BE USED IN INTERSECTIONS AND ON HIGH VOLUME ARTERIAL/COLLECTOR ROADS.
3. ALL DIMENSIONS SHOWN IN MILLIMETRES UNLESS OTHERWISE NOTED.

Barrie STANDARD DETAIL	TYPICAL TRENCH RESTORATION	REV No. 1	DATE: OCT 2017	APPROVED DATE: Oct. 28/17. DIRECTOR OF ENGINEERING
			SCALE: N.T.S.	
			BSD-330	



CITY OF BARRIE STANDARD	APPROVED	DATE: 09 11 05
OUTLET EROSION PROTECTION TYPICAL DETAIL	DIRECTOR OF ENGINEERING	SCALE: N.T.S
		BSD-82

No.	REVISION	APR'D	DATE
1.			

1. GRADE AND CROSSFALL ADJUSTEMENT OF MAINTENANCE HOLE AND CATCHBASIN FRAMES WILL BE MADE USING PRODUCTS SPECIFICALLY MANUFACTURED FOR THAT PURPOSE.
2. ADJUSTMENT UNITS MUST BE CERTIFIED TO MEET ALL PERTINENT OPS, CSA, ASTM AND MTO-DSM LISTS, OR OTHER INDUSTRY GUIDELINES FOR MATERIALS, PERFORMANCE AND USE AS APPLICABLE.
3. ADJUSTMENT UNITS AND JOINTS WILL BE SEALED AND OR PARGED IN COMPLIANCE WITH MANUFACTURERS SPECIFICATIONS AND GUIDELINES
4. MORTAR IS USED FOR LEVELING OF PRECAST UNITS ONLY. THE THICKNESS OF MORTAR WILL BE 10mm TO FILL ALL VOIDS CREATED BY IRREGULARITIES IN THE PRECAST UNITS TO ENSURE AN EVEN SURFACE ONLY.

Barrie STANDARD DETAIL	GENERAL NOTES ROADWORKS	REV No. 1	DATE: OCT 2017	APPROVED DATE: Oct. 28/17.
			SCALE: N.T.S.	
			BSD-N2	

GENERAL NOTES – SANITARY SEWER

SANITARY SEWERS

A. SANITARY SEWER TO BE LOCATED AT THE CENTRELINE OF THE ROAD.

B. SEWERS SHALL BE CONSTRUCTED WITH BEDDINGS AS PER OPSD–802.010, (GRAN. 'A' EMBEDMENT MATERIAL) FOR FLEXIBLE PIPES AND OPSD–802.030 OR 802.031 CLASS B (GRAN. 'A' BEDDING MATERIAL) FOR RIGID PIPE UNLESS OTHERWISE APPROVED BY THE DIRECTOR OF ENGINEERING.

C. MAXIMUM DEFLECTION FROM COMBINED LIVE AND DEAD LOADING SHALL NOT EXCEED ANY C.S.A., O.P.S. OR MANUFACTURERS RECOMMENDED SPECIFICATIONS.

D. PVC, CONCRETE AND PROFILE WALL PVC SEWERS SHALL HAVE RUBBER GASKET TYPE JOINTS AND SHALL BE CERTIFIED TO CONFORM TO ALL APPLICABLE CURRENT C.S.A. SPECIFICATIONS.

E. CONCRETE SANITARY SEWERS SHALL HAVE A MINIMUM STRENGTH OF 50 N/m/mm CONFORMING TO CSA STANDARD A257.2–1982, CLASS 50–D (PREVIOUSLY C.S.A. STANDARD A257.2–1974, CLASS III).

F. MAINTENANCE HOLE TOPS (FRAMES) ARE TO BE SET TO BASE COURSE ASPHALT GRADE AND THEN ADJUSTED TO FINAL GRADE WHEN THE TOP LIFT OF ASPHALT IS PLACE. ALL ADJUSTMENT WILL BE ACCORDANCE WITH BSD–N2.

G. ALL CONNECTIONS TO NEW SANITARY MAINS SHALL BE PRE–MANUFACTURED, FABRICATED TEES. CONNECTIONS TO EXISTING SANITARY SEWER SHALL BE MADE WITH APPROVED FACTORY MADE TEES OR INSERTA–TEES IN STRICT ACCORDANCE TO MANUFACTURES GUIDELINES.

CITY OF BARRIE STANDARD						APR'D	R.G.N.	DATE	92.05.15
GENERAL NOTES SANITARY SEWERS	4.	NOTE 'B' – "ENGINEERING"	B.R.	2002.10.30		DRAWN	L.A.J.	SCALE	N.T.S.
	3.	NOTE 'B' OPSD NUMBER REVISION	K.C.	2000.03.14					
	2.	NOTE 'F' CHANGED	K.C.	98.03.30					
	1.	CHANGES TO B. TO G.	K.C.	95.04.24					
	NO.	REVISION	APR'D	DATE		BSD-N3			

GENERAL NOTES – SANITARY SEWER

SANITARY SERVICE LATERALS

A. SANITARY LATERAL CONNECTION TO BE LOCATED AT THE CENTRELINE OF THE LOT AND CAPPED.

B. LOCATION OF LATERAL TO BE MARKED 2.0m PAST PROPERTY LINE WITH A 50 x 100mm WOOD MARKER, PAINTED GREEN, EXTENDING FROM SERVICE INVERT TO 300mm ABOVE GROUND LEVEL.

C. PIPE TO BE MINIMUM 100 mm DIA. PVC SDR28, RUBBER GASKET TYPE JOINTS AND SHALL CONFORM TO C.S.A. (B–182.2.3.4) (COUPLERS) FOR A RESIDENTIAL HOUSE AND 150mm MINIMUM DIA. PVC SDR28 FOR INDUSTRIAL/COMMERCIAL DEVELOPMENT.

D. MINIMUM DEPTH OF LATERAL AT PROPERTY LINE SHALL BE 2.4m MEASURED FROM THE SEWER OBVERT TO FINISHED GROUND SURFACE ELEVATION UNLESS NOTED OTHERWISE.

E. ALL CONNECTIONS TO NEW SANITARY MAINS SHALL BE PRE–MANUFACTURED, FABRICATED TEES. CONNECTIONS TO EXISTING SANITARY SEWER SHALL BE MADE WITH APPROVED FACTORY MADE TEES OR INSERTA–TEES IN STRICT ACCORDANCE TO MANUFACTURES GUIDELINES.

F. MINIMUM PIPE SLOPE TO BE 2.0%. MAXIMUM 8.0% (SEE OPSD–1006.010, 1006.020).

CITY OF BARRIE STANDARD						APR'D	R.G.N.	DATE	92.05.15
GENERAL NOTES SANITARY SEWERS	2.	OPSD NUMBERS REVISED	K.C.	2000.08.17		DRAWN	L.A.J.	SCALE	N.T.S.
	1.	CHANGES TO B. TO G.	K.C.	95.04.24					
	NO.	REVISION	APR'D	DATE		BSD-N4			

GENERAL NOTES – STORM SEWER

STORM SEWER

A. STORM SEWER TO BE PROVIDED ON ALL ROADS WITH CURB AND GUTTER.

B. PLACE ALL CATCH BASIN LATERALS AT 2% GRADE UNLESS OTHERWISE NOTED. PIPE SIZE MINIMUM 250mm DIA. SINGLE , 300mm DIA. DOUBLE.

C. STORM SEWERS SHALL BE CONSTRUCTED WITH BEDDING AS PER OPSD–802.010 (GRAN. 'A' EMBEDMENT MATERIAL) FOR FLEXIBLE PIPES AND OPSD–802.030 OR 802.031 CLASS B (GRAN. 'A' BEDDING MATERIAL) FOR RIGID PIPE UNLESS OTHERWISE APPROVED BY THE DIRECTOR OF ENGINEERING.

D. MAINTENANCE HOLE TOPS (FRAMES) AND CATCH BASIN (FRAMES) ARE TO BE SET TO BASE COURSE ASPHALT GRADE AND THEN ADJUSTED TO FINAL GRADE WHEN THE TOP LIFT OF ASPHALT IS PLACED. ALL ADJUSTMENT WILL BE ACCORDANCE WITH BSD–N2.

E. STORM SEWER TO BE LOCATED OFFSET 3.0m SOUTH OR EAST OF CENTRELINE UNLESS OTHERWISE SPECIFIED.

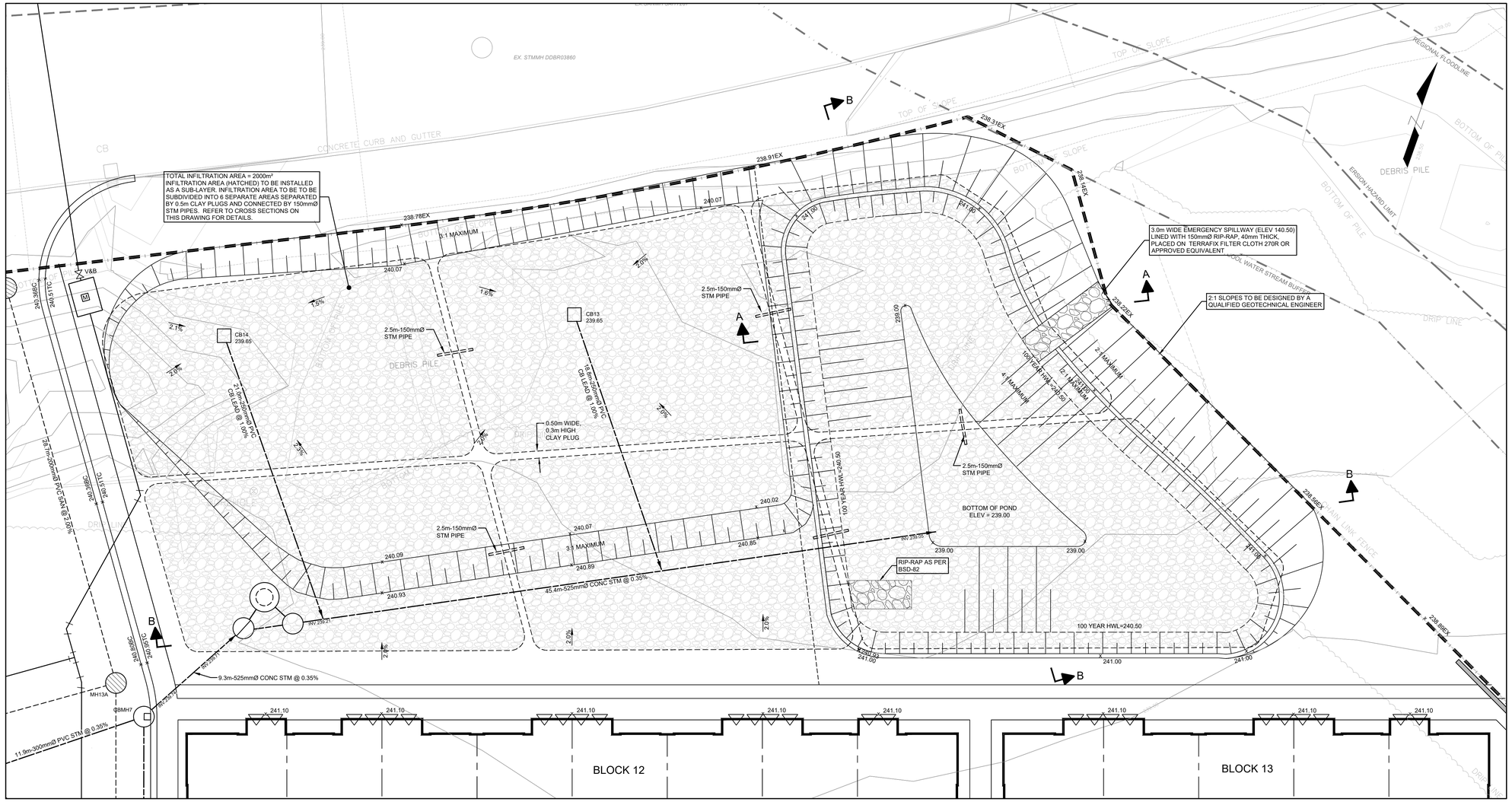
F. ALL CONNECTIONS TO THE STORM MAIN SHALL BE MADE WITH A STORM MANHOLE OR APPROVED FACTORY TEE CONNECTION AS PER OPSD–708.01 OR 708.03.

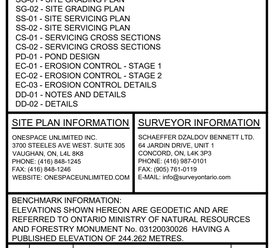
G. PIPE MATERIAL TO BE REINFORCED CONCRETE WITH A MINIMUM STRENGTH OF 50 N/m/mm CERTIFIED TO C.S.A. STANDARD A247.2–1982, CLASS 50–D (PREVIOUSLY C.S.A. STANDARD A257.2–1974, CLASS III) OR PVC CERTIFIED TO C.S.A. STANDARDS 182.2 AND 182.4.

H. STORM SEWER TO BE MINIMUM 300mm DIAMETER WITH JOINTS CONFORMING TO C.S.A. STANDARD A257.3.

I. ALL PIPE BEDDING MUST CONFORM TO OPSD, MAXIMUM COVER TABLE. NO FLEXIBLE PIPE SEWERS WILL BE INSTALLED WITH A DEPTH OF COVER GREATER THAN 6 METRES UNLESS SPECIFICALLY APPROVED BY THE DIRECTOR OF ENGINEERING.

J. ALL PIPE





LEGEND

PORPOSED GRADE	×149.50
EXISTING GRADE	× *149.33EX*
PROPOSED STORM MANHOLE	○
PROPOSED CATCHBASIN MANHOLE	◎
PROPOSED CATCH BASIN	□
PROPOSED DOUBLE CATCH BASIN	▭
PROPOSED SANITARY MANHOLE	●
PROPOSED WEIR	⊘
PROPOSED OIL-GRIT SEPARATOR	◎
PROPOSED STORM	———
PROPOSED SANITARY	- - - - -
PROPOSED WATER	———
INFILTRATION AREA	▭

LIST OF DRAWINGS

SG-01 - SITE GRADING PLAN
SG-02 - SITE GRADING PLAN
SS-01 - SITE SERVICING PLAN
SS-02 - SITE SERVICING PLAN
CS-01 - SERVICING CROSS SECTIONS
CS-02 - SERVICING CROSS SECTIONS
PD-01 - POND DESIGN
EC-01 - EROSION CONTROL - STAGE 1
EC-02 - EROSION CONTROL - STAGE 2
EC-03 - EROSION CONTROL DETAILS
DD-01 - NOTES AND DETAILS
DD-02 - DETAILS

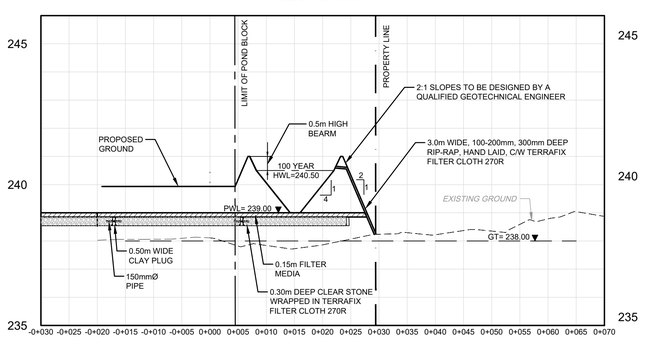
SITE PLAN INFORMATION
ONESPACE UNLIMITED INC.
3700 STEELES AVE WEST. SUITE 305
VAUGHAN, ON, L4L 8K8
PHONE: (416) 848-1245
FAX: (416) 848-1246
WEBSITE: ONESPACEUNLIMITED.COM

SURVEYOR INFORMATION
SCHAEFFER DZALDOV BENNETT LTD.
64 JARDIN DRIVE, UNIT 1
CONCORD, ON, L4K 3P3
PHONE: (416) 987-0101
FAX: (905) 761-0119
E-MAIL: info@surveyontario.com

BENCHMARK INFORMATION:
ELEVATIONS SHOWN HEREON ARE GEODETIC AND ARE REFERRED TO ONTARIO MINISTRY OF NATURAL RESOURCES AND FORESTRY MONUMENT No. 03120030026 HAVING A PUBLISHED ELEVATION OF 244.262 METRES.

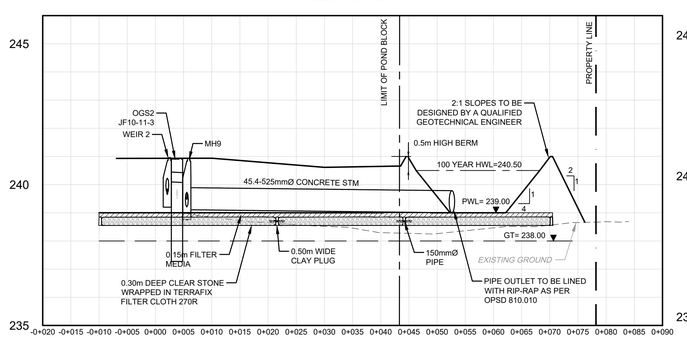
No.	DATE	ISSUE/REVISION	INTIAL
3	7/10/2022	ISSUED FOR FIRST SUBMISSION	TSR
2	8/30/2022	ISSUED FOR SITE ALTERATION PERMIT	TSR
1	6/1/2021	ISSUED FOR COORDINATION	TVL

SECTION A-A



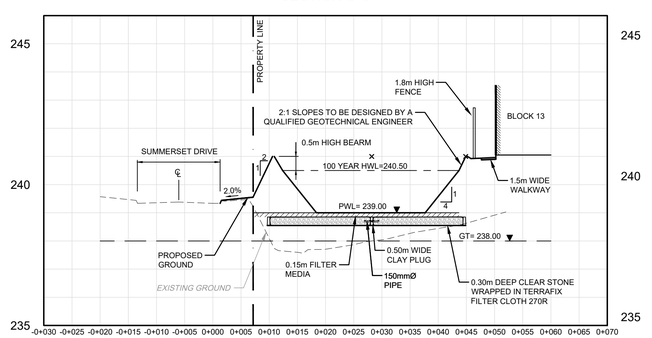
DISTANCE(m)
SCALE HORZ=1:500 VERT=1:100

SECTION B-B



DISTANCE(m)
SCALE HORZ=1:500 VERT=1:100

SECTION C-C



DISTANCE(m)
SCALE HORZ=1:500 VERT=1:100

CITY OF BARRIE

STATEVIEW HOMES (BEA TOWNS) INC.

BEA TOWNS
500 ARDAGH RD.
BARRIE, ONTARIO

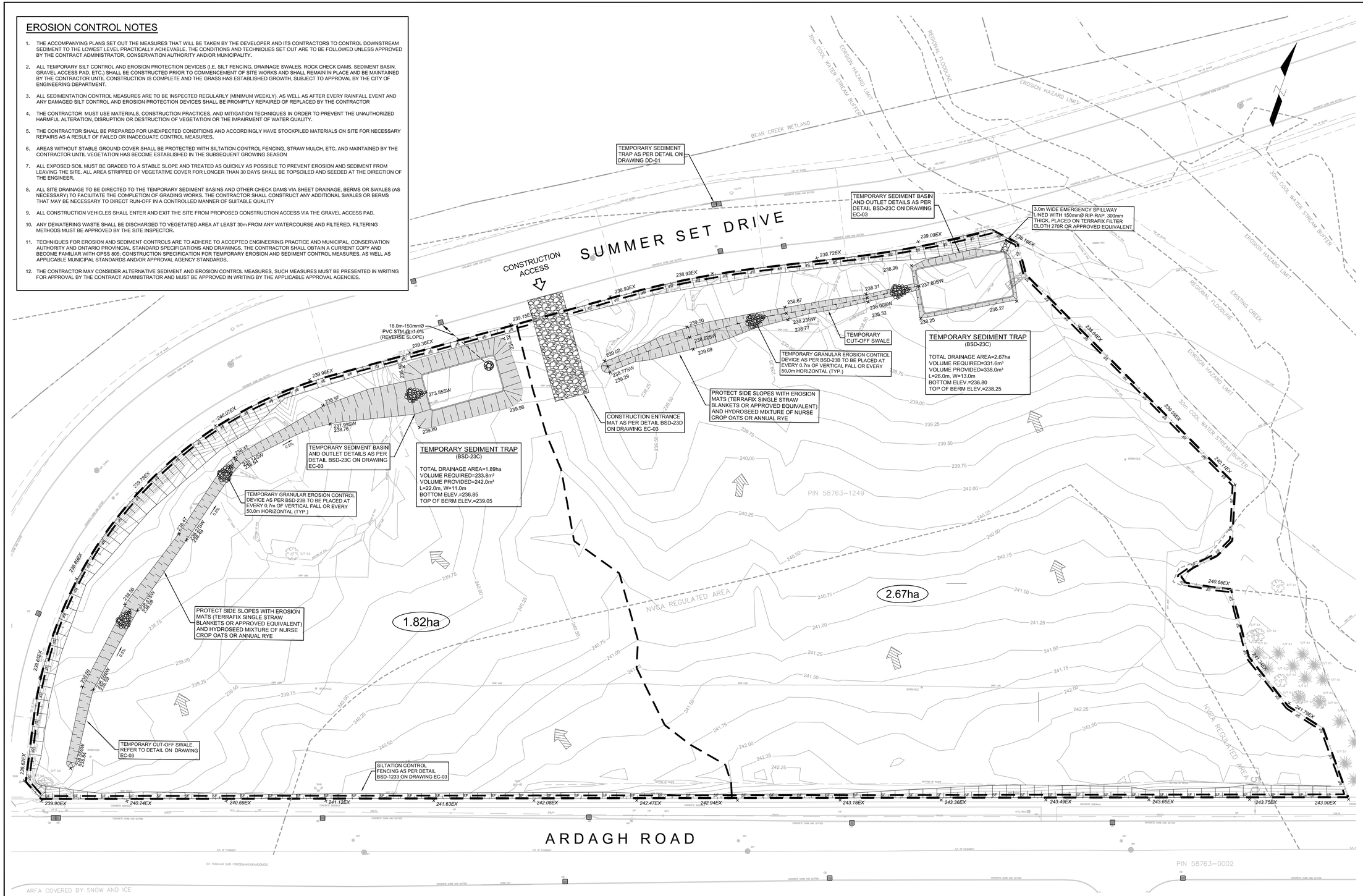
POND DESIGN

GEI Consultants

DESIGNED BY: LV	DATE: AUG 2022	CHECKED BY: TR
DRAWN BY: CVG	PROJECT No. 2104593	DRAWING No. PD-01
SCALE:		

EROSION CONTROL NOTES

1. THE ACCOMPANYING PLANS SET OUT THE MEASURES THAT WILL BE TAKEN BY THE DEVELOPER AND ITS CONTRACTORS TO CONTROL DOWNSTREAM SEDIMENT TO THE LOWEST LEVEL PRACTICALLY ACHIEVABLE. THE CONDITIONS AND TECHNIQUES SET OUT ARE TO BE FOLLOWED UNLESS APPROVED BY THE CONTRACT ADMINISTRATOR, CONSERVATION AUTHORITY AND/OR MUNICIPALITY.
2. ALL TEMPORARY SILT CONTROL AND EROSION PROTECTION DEVICES (I.E. SILT FENCING, DRAINAGE SWALES, ROCK CHECK DAMS, SEDIMENT BASIN, GRAVEL ACCESS PAD, ETC.) SHALL BE CONSTRUCTED PRIOR TO COMMENCEMENT OF SITE WORKS AND SHALL REMAIN IN PLACE AND BE MAINTAINED BY THE CONTRACTOR UNTIL CONSTRUCTION IS COMPLETE AND THE GRASS HAS ESTABLISHED GROWTH, SUBJECT TO APPROVAL BY THE CITY OF ENGINEERING DEPARTMENT.
3. ALL SEDIMENTATION CONTROL MEASURES ARE TO BE INSPECTED REGULARLY (MINIMUM WEEKLY), AS WELL AS AFTER EVERY RAINFALL EVENT AND ANY DAMAGED SILT CONTROL AND EROSION PROTECTION DEVICES SHALL BE PROMPTLY REPAIRED OF REPLACED BY THE CONTRACTOR
4. THE CONTRACTOR MUST USE MATERIALS, CONSTRUCTION PRACTICES, AND MITIGATION TECHNIQUES IN ORDER TO PREVENT THE UNAUTHORIZED HARMFUL ALTERATION, DISRUPTION OR DESTRUCTION OF VEGETATION OR THE IMPAIRMENT OF WATER QUALITY.
5. THE CONTRACTOR SHALL BE PREPARED FOR UNEXPECTED CONDITIONS AND ACCORDINGLY HAVE STOCKPILED MATERIALS ON SITE FOR NECESSARY REPAIRS AS A RESULT OF FAILED OR INADEQUATE CONTROL MEASURES.
6. AREAS WITHOUT STABLE GROUND COVER SHALL BE PROTECTED WITH SILTATION CONTROL FENCING, STRAW MULCH, ETC. AND MAINTAINED BY THE CONTRACTOR UNTIL VEGETATION HAS BECOME ESTABLISHED IN THE SUBSEQUENT GROWING SEASON
7. ALL EXPOSED SOIL MUST BE GRADED TO A STABLE SLOPE AND TREATED AS QUICKLY AS POSSIBLE TO PREVENT EROSION AND SEDIMENT FROM LEAVING THE SITE, ALL AREA STRIPPED OF VEGETATIVE COVER FOR LONGER THAN 30 DAYS SHALL BE TOPSOILED AND SEEDED AT THE DIRECTION OF THE ENGINEER.
8. ALL SITE DRAINAGE TO BE DIRECTED TO THE TEMPORARY SEDIMENT BASINS AND OTHER CHECK DAMS VIA SHEET DRAINAGE, BERMS OR SWALES (AS NECESSARY) TO FACILITATE THE COMPLETION OF GRADING WORKS. THE CONTRACTOR SHALL CONSTRUCT ANY ADDITIONAL SWALES OR BERMS THAT MAY BE NECESSARY TO DIRECT RUN-OFF IN A CONTROLLED MANNER OF SUITABLE QUALITY
9. ALL CONSTRUCTION VEHICLES SHALL ENTER AND EXIT THE SITE FROM PROPOSED CONSTRUCTION ACCESS VIA THE GRAVEL ACCESS PAD.
10. ANY DEWATERING WASTE SHALL BE DISCHARGED TO VEGETATED AREA AT LEAST 30m FROM ANY WATERCOURSE AND FILTERED. FILTERING METHODS MUST BE APPROVED BY THE SITE INSPECTOR.
11. TECHNIQUES FOR EROSION AND SEDIMENT CONTROLS ARE TO ADHERE TO ACCEPTED ENGINEERING PRACTICE AND MUNICIPAL, CONSERVATION AUTHORITY AND ONTARIO PROVINCIAL STANDARD SPECIFICATIONS AND DRAWINGS. THE CONTRACTOR SHALL OBTAIN A CURRENT COPY AND BECOME FAMILIAR WITH OPSS 805; CONSTRUCTION SPECIFICATION FOR TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES, AS WELL AS APPLICABLE MUNICIPAL STANDARDS AND/OR APPROVAL AGENCY STANDARDS.
12. THE CONTRACTOR MAY CONSIDER ALTERNATIVE SEDIMENT AND EROSION CONTROL MEASURES, SUCH MEASURES MUST BE PRESENTED IN WRITING FOR APPROVAL BY THE CONTRACT ADMINISTRATOR AND MUST BE APPROVED IN WRITING BY THE APPLICABLE APPROVAL AGENCIES.



CONSTRUCTION SEQUENCE

THE FOLLOWING CONSTRUCTION SEQUENCE IS PROVIDED FOR CONTRACTOR GUIDANCE:

1. CONSTRUCT ALL TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES INCLUDING SILT FENCE, TREE PRESERVATION FENCE, MUD MATS, CHECK DAMS, SWALES/BERMS, ETC
2. STRIPPING AND REMOVAL OF TOPSOIL. TOPSOIL TO BE REMOVED FROM SITE. CONSTRUCT TEMPORARY SEDIMENT BASIN.

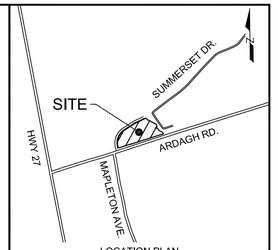
NOTE SILTATION AND EROSION CONTROL MEASURES ARE TO BE MONITORED AND MAINTAINED THROUGHOUT CONSTRUCTION AND NECESSARY REPAIRS TO BE PROMPTLY COMPLETED AS REQUIRED.

CONTINGENCY PLAN

IF UNFORESEEN EVENTS CAUSE THE STRATEGIES SET OUT IN THIS PLAN TO BE INSUFFICIENT OR INAPPROPRIATE TO MEET THE OBJECTIVE, THE CONTRACTOR IS EXPECTED TO RESPOND IN A TIMELY MANNER WITH ALL REASONABLE MEASURES CONSISTENT WITH SAFETY, TO PREVENT, COUNTERACT OR REMEDY DOWNSTREAM SEDIMENTATION AND EROSION.

IF A SPILL OCCURS IT SHALL BE REPORTED TO THE MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE AND THE MINISTRY OF NATURAL RESOURCES, THE ON CALL CITY OF BARRIE ENVIRONMENTAL OFFICER SHOULD ALSO BE NOTIFIED VIA CELL PHONE (705) 725-3374

IF APPROVAL AGENCIES DETERMINE THAT LONG TERM DAMAGE TO THE NATURAL ENVIRONMENT HAS OCCURRED DUE TO FAILURE OF THIS PLAN TO CONTROL SEDIMENTS, A RESTORATION PLAN WILL BE DEVELOPED BY THE CONTRACTOR IN CONSULTATION WITH AND APPROVAL FROM THE APPROPRIATE AGENCIES FOR IMPLEMENTATION BY THE CONTRACTOR.



LOCATION PLAN
N.T.S.

LEGEND

- PROPERTY LINE
- TEMPORARY SILT FENCE
- TEMPORARY MUD MAT
- TEMPORARY ROCK CHECK DAM
- TEMPORARY SEDIMENT BASKET
- TEMPORARY CONSTRUCTION ACCESS — CONSTRUCTION ACCESS
- EXISTING GRADE — x 146.53EX
- PROPOSED BOTTOM OF SWALE GRADE — x 145.25SW
- PROPOSED FINISHED GROUND GRADE — x 145.25
- PROPOSED COUNTOUR POST TOPSOIL STRIPING — 146.75
- DRAINAGE AREA — 2.67ha
- EXISTING OVERLAND FLOW ROUTE

LIST OF DRAWINGS

SG-01 - SITE GRADING PLAN
SG-02 - SITE GRADING PLAN
SS-01 - SITE SERVICING PLAN
SS-02 - SITE SERVICING PLAN
CS-01 - SERVICING CROSS SECTIONS
CS-02 - SERVICING CROSS SECTIONS
PD-01 - POND DESIGN
EC-01 - EROSION CONTROL - STAGE 1
EC-02 - EROSION CONTROL - STAGE 2
EC-03 - EROSION CONTROL DETAILS
DD-01 - NOTES AND DETAILS
DD-02 - DETAILS

SITE PLAN INFORMATION
ONESPACE UNLIMITED INC.
3700 STEELES AVE WEST, SUITE 305
VAUGHAN, ON, L4L 8K8
PHONE: (416) 848-1245
FAX: (416) 848-1246
WEBSITE: ONESPACEUNLIMITED.COM

SURVEYOR INFORMATION
SCHAEFFER DZALDOV BENNETT LTD.
64 JARDIN DRIVE, UNIT 1
CONCORD, ON, L4K 3P3
PHONE: (416) 987-0101
FAX: (905) 761-5119
E-MAIL: info@surveyontario.com

BENCHMARK INFORMATION:
ELEVATIONS SHOWN HEREON ARE GEODETIC AND ARE REFERRED TO ONTARIO MINISTRY OF NATURAL RESOURCES AND FORESTRY MONUMENT No. 03120030026 HAVING A PUBLISHED ELEVATION OF 244.262 METRES.

No.	DATE	ISSUE/REVISION	INTIAL
3	7/10/2022	ISSUED FOR FIRST SUBMISSION	TSR
2	8/30/2022	ISSUED FOR SITE ALTERATION PERMIT	TSR
1	6/1/2021	ISSUED FOR COORDINATION	TVL

CITY OF BARRIE

STATEVIEW HOMES (BEA TOWNS) INC.

BEA TOWNS
500 ARDAGH RD.
BARRIE, ONTARIO

EROSION CONTROL - STAGE 1

GEI Consultants

DESIGNED BY: LV	DATE: AUG 2022		CHECKED BY: TR
DRAWN BY: CVG	PROJECT No. 2104593		DRAWING No. EC-01
SCALE: 1:750			

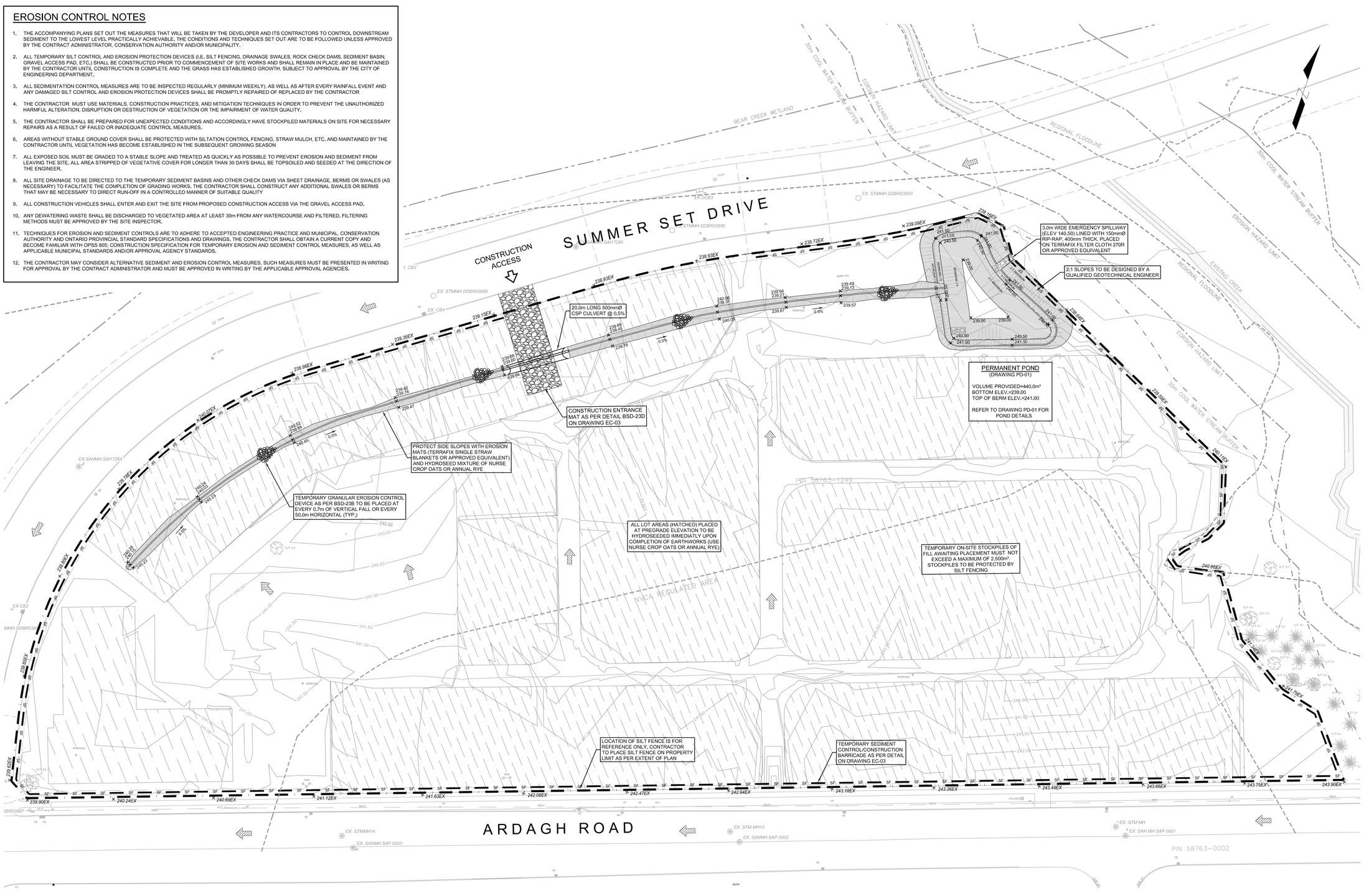
5.0m 0 5.0m 10.0m 15.0m 20.0m 25.0m 30.0m

1:750

C:\ProgramData\Autodesk\ApplicationPlugins\Landproject22.bundle\Contents B:\Working\STATEVIEW HOMES\2104593 Bear Creek Village Barrie\00_CAD\Design\Sheets\2103462-SHT-ESCD-01.dwg - 9/30/2022

EROSION CONTROL NOTES

1. THE ACCOMPANYING PLANS SET OUT THE MEASURES THAT WILL BE TAKEN BY THE DEVELOPER AND ITS CONTRACTORS TO CONTROL DOWNSTREAM SEDIMENT TO THE LOWEST LEVEL PRACTICALLY ACHIEVABLE. THE CONDITIONS AND TECHNIQUES SET OUT ARE TO BE FOLLOWED UNLESS APPROVED BY THE CONTRACT ADMINISTRATOR, CONSERVATION AUTHORITY AND/OR MUNICIPALITY.
2. ALL TEMPORARY SILT CONTROL AND EROSION PROTECTION DEVICES (I.E. SILT FENCING, DRAINAGE SWALES, ROCK CHECK DAMS, SEDIMENT BASIN, GRAVEL ACCESS PAD, ETC.) SHALL BE CONSTRUCTED PRIOR TO COMMENCEMENT OF SITE WORKS AND SHALL REMAIN IN PLACE AND BE MAINTAINED BY THE CONTRACTOR UNTIL CONSTRUCTION IS COMPLETE AND THE GRASS HAS ESTABLISHED GROWTH, SUBJECT TO APPROVAL BY THE CITY OF ENGINEERING DEPARTMENT.
3. ALL SEDIMENTATION CONTROL MEASURES ARE TO BE INSPECTED REGULARLY (MINIMUM WEEKLY), AS WELL AS AFTER EVERY RAINFALL EVENT AND ANY DAMAGED SILT CONTROL AND EROSION PROTECTION DEVICES SHALL BE PROMPTLY REPAIRED OF REPLACED BY THE CONTRACTOR
4. THE CONTRACTOR MUST USE MATERIALS, CONSTRUCTION PRACTICES, AND MITIGATION TECHNIQUES IN ORDER TO PREVENT THE UNAUTHORIZED HARMFUL ALTERATION, DISRUPTION OR DESTRUCTION OF VEGETATION OR THE IMPAIRMENT OF WATER QUALITY.
5. THE CONTRACTOR SHALL BE PREPARED FOR UNEXPECTED CONDITIONS AND ACCORDINGLY HAVE STOCKPILED MATERIALS ON SITE FOR NECESSARY REPAIRS AS A RESULT OF FAILED OR INADEQUATE CONTROL MEASURES.
6. AREAS WITHOUT STABLE GROUND COVER SHALL BE PROTECTED WITH SILTATION CONTROL FENCING, STRAW MULCH, ETC, AND MAINTAINED BY THE CONTRACTOR UNTIL VEGETATION HAS BECOME ESTABLISHED IN THE SUBSEQUENT GROWING SEASON
7. ALL EXPOSED SOIL MUST BE GRADED TO A STABLE SLOPE AND TREATED AS QUICKLY AS POSSIBLE TO PREVENT EROSION AND SEDIMENT FROM LEAVING THE SITE, ALL AREA STRIPPED OF VEGETATIVE COVER FOR LONGER THAN 30 DAYS SHALL BE TOPSOILED AND SEEDED AT THE DIRECTION OF THE ENGINEER.
8. ALL SITE DRAINAGE TO BE DIRECTED TO THE TEMPORARY SEDIMENT BASINS AND OTHER CHECK DAMS VIA SHEET DRAINAGE, BERMS OR SWALES (AS NECESSARY) TO FACILITATE THE COMPLETION OF GRADING WORKS. THE CONTRACTOR SHALL CONSTRUCT ANY ADDITIONAL SWALES OR BERMS THAT MAY BE NECESSARY TO DIRECT RUN-OFF IN A CONTROLLED MANNER OF SUITABLE QUALITY
9. ALL CONSTRUCTION VEHICLES SHALL ENTER AND EXIT THE SITE FROM PROPOSED CONSTRUCTION ACCESS VIA THE GRAVEL ACCESS PAD.
10. ANY DEWATERING WASTE SHALL BE DISCHARGED TO VEGETATED AREA AT LEAST 30m FROM ANY WATERCOURSE AND FILTERED, FILTERING METHODS MUST BE APPROVED BY THE SITE INSPECTOR.
11. TECHNIQUES FOR EROSION AND SEDIMENT CONTROLS ARE TO ADHERE TO ACCEPTED ENGINEERING PRACTICE AND MUNICIPAL, CONSERVATION AUTHORITY AND ONTARIO PROVINCIAL STANDARD SPECIFICATIONS AND DRAWINGS. THE CONTRACTOR SHALL OBTAIN A CURRENT COPY AND BECOME FAMILIAR WITH OPSS 805; CONSTRUCTION SPECIFICATION FOR TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES, AS WELL AS APPLICABLE MUNICIPAL STANDARDS AND/OR APPROVAL AGENCY STANDARDS.
12. THE CONTRACTOR MAY CONSIDER ALTERNATIVE SEDIMENT AND EROSION CONTROL MEASURES, SUCH MEASURES MUST BE PRESENTED IN WRITING FOR APPROVAL BY THE CONTRACT ADMINISTRATOR AND MUST BE APPROVED IN WRITING BY THE APPLICABLE APPROVAL AGENCIES.



CONSTRUCTION SEQUENCE

1. PROCEED WITH EARTH EXCAVATION AND PRE-GRADING. PROCEED WITH SEEDING OF RESTORATION AREAS AS IDENTIFIED (THIS DWG) AND AS DIRECTED BY ENGINEER.
2. PROCEED WITH SITE WORKS I.E. SITE WORKS I.E. SITE SERVICING AND SURFACE WORKS INSTALLATIONS. COMPLETE TEMPORARY CONNECTIONS FROM SEDIMENT BASINS TO INTERNAL STORM SEWERS,
3. RESTORATION OF DISTURBED AREAS.
4. REMOVAL OF SEDIMENT AND EROSION CONTROLS.

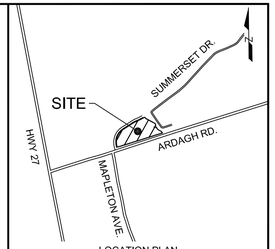
** NOTE** SILTATION AND EROSION CONTROL MEASURES ARE TO BE MONITORED AND MAINTAINED THROUGHOUT CONSTRUCTION AND NECESSARY REPAIRS TO BE PROMPTLY COMPLETED AS REQUIRED.

CONTINGENCY PLAN

IF UNFORESEEN EVENTS CAUSE THE STRATEGIES SET OUT IN THIS PLAN TO BE INSUFFICIENT OR INAPPROPRIATE TO MEET THE OBJECTIVE, THE CONTRACTOR IS EXPECTED TO RESPOND IN A TIMELY MANNER WITH ALL REASONABLE MEASURES CONSISTENT WITH SAFETY, TO PREVENT, COUNTERACT OR REMEDY DOWNSTREAM SEDIMENTATION AND EROSION.

IF A SPILL OCCURS IT SHALL BE REPORTED TO THE MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE AND THE MINISTRY OF NATURAL RESOURCES. THE ON CALL CITY OF BARRIE ENVIRONMENTAL OFFICER SHOULD ALSO BE NOTIFIED VIA CELL PHONE (705) 725-3374

IF APPROVAL AGENCIES DETERMINE THAT LONG TERM DAMAGE TO THE NATURAL ENVIRONMENT HAS OCCURRED DUE TO FAILURE OF THIS PLAN TO CONTROL SEDIMENTS, A RESTORATION PLAN WILL BE DEVELOPED BY THE CONTRACTOR IN CONSULTATION WITH AND APPROVAL FROM THE APPROPRIATE AGENCIES FOR IMPLEMENTATION BY THE CONTRACTOR.



LOCATION PLAN
N.T.S.

LEGEND

- PROPERTY LINE
- TEMPORARY SILT FENCE — SF — SF —
- TEMPORARY MUD MAT
- TEMPORARY ROCK CHECK DAM
- TEMPORARY SEDIMENT BASKET
- TEMPORARY CONSTRUCTION ACCESS — CONSTRUCTION ACCESS
- EXISTING GRADE — x *146.53EX*
- PROPOSED BOTTOM OF SWALE GRADE — x 145.25SW
- PROPOSED FINISHED GROUND GRADE — x 145.25
- PROPOSED PREGRADE COUNTOUR — 145.75 —
- EXISTING OVERLAND FLOW ROUTE
- AREA TO BE HYDROSEEDED

LIST OF DRAWINGS

SG-01 - SITE GRADING PLAN
SG-02 - SITE GRADING PLAN
SS-01 - SITE SERVICING PLAN
SS-02 - SITE SERVICING PLAN
CS-01 - SERVICING CROSS SECTIONS
CS-02 - SERVICING CROSS SECTIONS
PD-01 - POND DESIGN
EC-01 - EROSION CONTROL - STAGE 1
EC-02 - EROSION CONTROL - STAGE 2
EC-03 - EROSION CONTROL DETAILS
DD-01 - NOTES AND DETAILS
DD-02 - DETAILS

SITE PLAN INFORMATION

ONESPACE UNLIMITED INC.
3700 STEELES AVE WEST, SUITE 305
VAUGHAN, ON, L4L 8K8
PHONE: (416) 848-1245
FAX: (416) 848-1246
WEBSITE: ONESPACEUNLIMITED.COM

SURVEYOR INFORMATION

SCHAEFFER DZALDOV BENNETT LTD.
64 JARDIN DRIVE, UNIT 1
CONCORD, ON, L4K 3P3
PHONE: (416) 987-0101
FAX: (905) 761-0119
E-MAIL: info@surveyontario.com

BENCHMARK INFORMATION:
ELEVATIONS SHOWN HEREON ARE GEODETIC AND ARE REFERRED TO ONTARIO MINISTRY OF NATURAL RESOURCES AND FORESTRY MONUMENT No. 031200300026 HAVING A PUBLISHED ELEVATION OF 244.262 METRES.

No.	DATE	ISSUE/REVISION	INTIAL
3	7/10/2022	ISSUED FOR FIRST SUBMISSION	TSR
2	8/30/2022	ISSUED FOR SITE ALTERATION PERMIT	TSR
1	6/1/2021	ISSUED FOR COORDINATION	TVL

CITY OF BARRIE

STATEVIEW HOMES
(BEA TOWNS) INC.

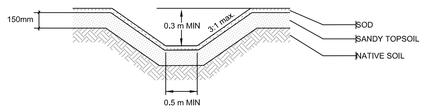
BEA TOWNS
500 ARDAGH RD.
BARRIE, ONTARIO

EROSION CONTROL - STAGE 2

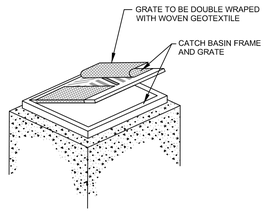
GEI Consultants

DESIGNED BY: LV	DATE: AUG 2022	CHECKED BY: TR
DRAWN BY: CVG	PROJECT No. 2104593	DRAWING No. EC-02
SCALE: 1:500		

5.0m 0 5.0m 10.0m 15.0m 20.0m 25.0m 30.0m



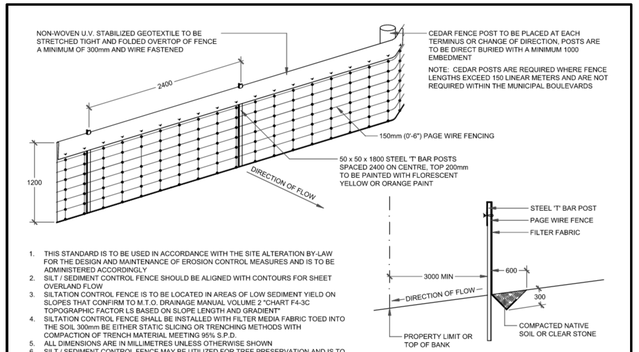
SWALE DETAIL (NO SUBDRAIN) — N.T.S.



NOTES:

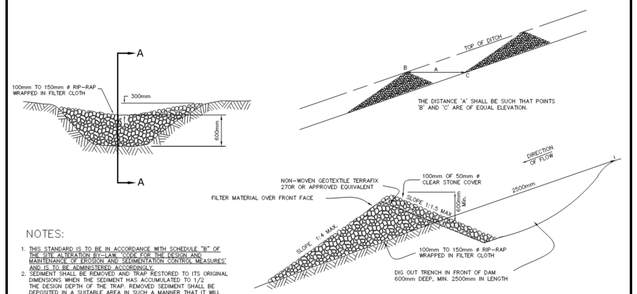
1) TO BE USED UNDER APPROPRIATE DRAINAGE CIRCUMSTANCES, DURING THE CONSTRUCTION PERIOD.
2) WOVEN GEOTEXTILE TO HAVE A MINIMUM EQUIVALENT OPENING SIZE OF 0,15mm AND A MAXIMUM EQUIVALENT OPENING SIZE OF 0.25mm.
3) WOVEN GEOTEXTILE TO BE REPLACED PERIODICALLY WHEN ACCUMULATED SEDIMENTS INTERFERE WITH DRAINAGE.
4) ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN.

TEMPORARY SEDIMENT TRAP — N.T.S.



1. THIS STANDARD IS TO BE USED IN ACCORDANCE WITH THE SITE ALTERATION BY-LAW FOR THE DESIGN AND MAINTENANCE OF EROSION CONTROL MEASURES AND IS TO BE ADMINISTERED ACCORDINGLY
2. SILT / SEDIMENT CONTROL FENCE SHOULD BE ALIGNED WITH CONTOURS FOR SHEET OVERLAND FLOW
3. SILTATION CONTROL FENCE IS TO BE LOCATED IN AREAS OF LOW SEDIMENT YIELD ON SLOPES THAT CONFIRM TO M.T.O. DRAINAGE MANUAL VOLUME 2 "CHART F4-3C TOPOGRAPHIC FACTOR LS BASED ON SLOPE LENGTH AND GRADIENT"
4. SILTATION CONTROL FENCE SHALL BE INSTALLED WITH FILTER MEDIA FABRIC TOED INTO THE SOIL 300mm BE EITHER STATIC SLICING OR TRENCHING METHODS WITH COMPACTION OF TRENCH MATERIAL MEETING 95% S.P.D.
5. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN
6. SILT / SEDIMENT CONTROL FENCE MAY BE UTILIZED FOR TREE PRESERVATION AND IS TO BE USED IN CONJUNCTION WITH BSD-1231, BSD-1232 AND BSD-1235

Barrie STANDARD DETAIL	SILTATION CONTROL FENCING	REV No. 2	DATE: OCT 2017	APPROVED Oct 10/17 DATE: Original Signed By DIRECTOR OF ENGINEERING
		SCALE: N.T.S.	BSD-1233 FORMERLY BSD-23A	

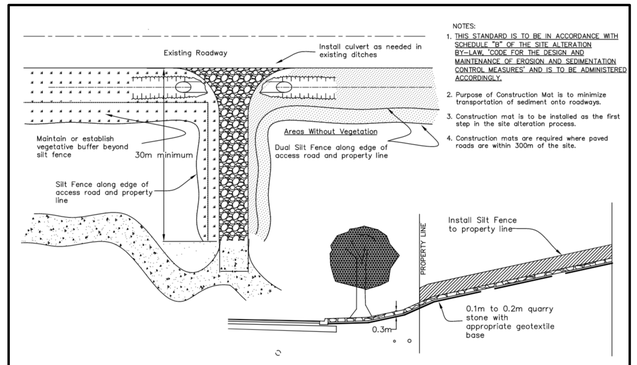


NOTES:

1. THIS STANDARD IS TO BE IN ACCORDANCE WITH 'SCHEDULE "B" OF THE SITE ALTERATION BY-LAW, 'CODE FOR THE DESIGN AND MAINTENANCE OF EROSION AND SEDIMENTATION CONTROL MEASURES' AND IS TO BE ADMINISTERED ACCORDINGLY.
2. SEDIMENT SHALL BE REMOVED AND RETURNED TO ITS ORIGINAL LOCATIONS WHEN THE BOARD HAS ACCUMULATED TO ½ THE DESIGN DEPTH OF THE TRAP. REMOVED SEDIMENT SHALL BE DEPOSITED IN A SUITABLE AREA IN SUCH A MANNER THAT IT WILL NOT ERODE. THE STRUCTURE SHALL BE INSPECTED AFTER EACH RAIN AND REPAIRS MADE AS NEEDED. CONSTRUCTION OPERATIONS SHALL BE CARRIED OUT IN SUCH A MANNER THAT EROSION AND WATER POLLUTION IS MINIMIZED.
3. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN.

SECTION A – A

CITY OF BARRIE STANDARD					APR'D: R.G.N.	DATE: 04.03.16	
TYPICAL GRANULAR EROSION CONTROL DEVICE	2.	MODIFICATIONS BY ENV. SER.		2004.04.06	DRAWN: L.A.J.	SCALE: N.T.S.	
	1.	TRENCH ADDED AND FABRIC EXTENDED INTO IT	B.R.	2003.02.19	BSD-23B		
	NO.	REVISION	APR'D	DATE			



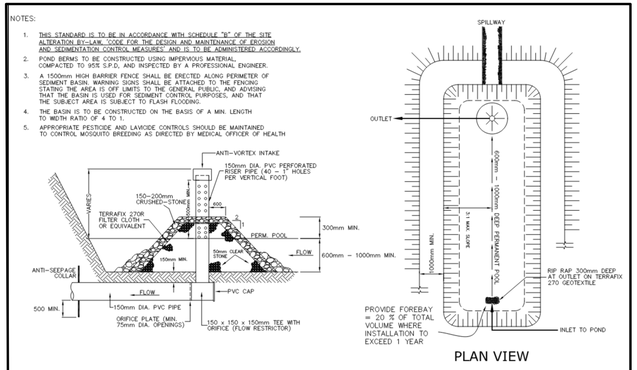
NOTES:

1. THIS STANDARD IS TO BE IN ACCORDANCE WITH SCHEDULE "B" OF THE SITE ALTERATION BY-LAW, 'CODE FOR THE DESIGN AND MAINTENANCE OF EROSION AND SEDIMENTATION CONTROL MEASURES' AND IS TO BE ADMINISTERED ACCORDINGLY.
2. Purpose of Construction Mat is to minimize transportation of sediment onto roadways.
3. Construction mat is to be installed as the first step in the site alteration process.
4. Construction mats are required where paved roads are within 300m of the site.

CITY OF BARRIE STANDARD	1.	Standardized Dimension Text	J.S.	05.10.28	APR'D: R.G.N.	DATE: 04.03.16	
CONSTRUCTION ENTRANCE MAT					DRAWN: A.S.C	SCALE: N.T.S	
	NO.	REVISION	APR'D	DATE	BSD-23D		

NOTES:

1. THIS STANDARD IS TO BE IN ACCORDANCE WITH SCHEDULE "B" OF THE SITE ALTERATION BY-LAW, 'CODE FOR THE DESIGN AND MAINTENANCE OF EROSION AND SEDIMENTATION CONTROL MEASURES' AND IS TO BE ADMINISTERED ACCORDINGLY.
2. POND BERMS TO BE CONSTRUCTED USING IMPERVIOUS MATERIAL, COMPACTED TO 95% S.P.D, AND INSPECTED BY A PROFESSIONAL ENGINEER.
3. A 1500mm HIGH BARRIER FENCE SHALL BE ERECTED ALONG PERIMETER OF SEDIMENT BASIN. WARNING SIGNS SHALL BE ATTACHED TO THE FENCING THAT CLEARLY INDICATE THE PURPOSE OF THE GENERAL PUBLIC, AND ADVISING THAT THE BASIN IS USED FOR SEDIMENT CONTROL PURPOSES, AND THAT THE SUBJECT AREA IS SUBJECT TO FLASH FLOODING.
4. THE BASIN IS TO BE CONSTRUCTED ON THE BASIS OF A MIN. LENGTH TO WIDTH RATIO OF 4 TO 1.
5. APPROPRIATE PESTICIDE AND LAVICIDE CONTROLS SHOULD BE MAINTAINED TO CONTROL MOSQUITO BREEDING AS DIRECTED BY MEDICAL OFFICER OF HEALTH



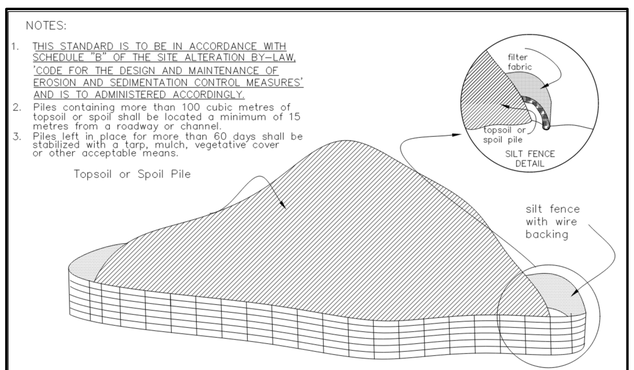
PLAN VIEW

PROVIDE FOREBAY = 20 % OF TOTAL VOLUME WHERE INSTALLATION TO EXCEED 1 YEAR

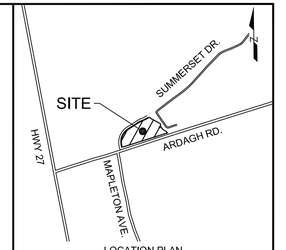
CITY OF BARRIE STANDARD					APR'D: R.G.N.	DATE: 03.08.29	
TEMPORARY SEDIMENT BASIN AND OUTLET DETAILS					DRAWN: A.S.C	SCALE: N.T.S	
	1	MODIFICATIONS BY ENV. SER.		04.04.06	BSD-23C		
	NO.	REVISION	APR'D	DATE			

NOTES:

1. THIS STANDARD IS TO BE IN ACCORDANCE WITH SCHEDULE "B" OF THE SITE ALTERATION BY-LAW, 'CODE FOR THE DESIGN AND MAINTENANCE OF EROSION AND SEDIMENTATION CONTROL MEASURES' AND IS TO ADMINISTERED ACCORDINGLY.
2. Piles containing more than 100 cubic metres of topsoil or spoil shall be located a minimum of 15 metres from a roadway or channel.
3. Piles left in place for more than 60 days shall be stabilized with a tarp, mulch, vegetative cover or other acceptable means.



CITY OF BARRIE STANDARD					APR'D: R.G.N.	DATE: 04.03.16	
TOPSOIL OR SPOIL PILE SILTATION CONTROL					DRAWN: A.S.C	SCALE: N.T.S	
	NO.	REVISION	APR'D	DATE	BSD-23E		



LOCATION PLAN
N.T.S.

LEGEND

LIST OF DRAWINGS

SG-01 - SITE GRADING PLAN
SG-02 - SITE GRADING PLAN
SS-01 - SITE SERVICING PLAN
SS-02 - SITE SERVICING PLAN
CS-01 - SERVICING CROSS SECTIONS
CS-02 - SERVICING CROSS SECTIONS
PD-01 - POND DESIGN
EC-01 - EROSION CONTROL - STAGE 1
EC-02 - EROSION CONTROL - STAGE 2
EC-03 - EROSION CONTROL DETAILS
DD-01 - NOTES AND DETAILS
DD-02 - DETAILS

SITE PLAN INFORMATION
ONESPACE UNLIMITED INC.
3700 STEELES AVE WEST, SUITE 305
VAUGHAN, ON, L4L 8K8
PHONE: (416) 848-1245
FAX: (416) 848-1246
WEBSITE: ONESPACEUNLIMITED.COM

SURVEYOR INFORMATION
SCHAEFFER DZALDOV BENNETT LTD.
64 JARDIN DRIVE, UNIT 1
CONCORD, ON, L4K 3P3
PHONE: (416) 987-0101
FAX: (905) 761-0119
E-MAIL: info@surveyontario.com

BENCHMARK INFORMATION:
ELEVATIONS SHOWN HEREON ARE GEODETIC AND ARE REFERRED TO ONTARIO MINISTRY OF NATURAL RESOURCES AND FORESTRY MONUMENT No, 03120030026 HAVING A PUBLISHED ELEVATION OF 244.262 METRES.

No.	DATE	ISSUE/REVISION	INTIAL
3	7/10/2022	ISSUED FOR FIRST SUBMISSION	TSR
2	8/30/2022	ISSUED FOR SITE ALTERATION PERMIT	TSR
1	6/1/2021	ISSUED FOR COORDINATION	TVL

CITY OF BARRIE

STATEVIEW HOMES (BEA TOWNS) INC.

BEA TOWNS
500 ARDAGH RD.
BARRIE, ONTARIO

EROSION CONTROL - DETAILS

GEI Consultants

DESIGNED BY: LV	DATE: AUG 2022	CHECKED BY: TR
DRAWN BY: CVG	PROJECT No. 2104593	DRAWING No. EC-03
SCALE:		

C:\ProgramData\Autodesk\ApplicationPlugIns\Landproject22.bundle\Contents B:\Working\STATEVIEW HOMES\2104593 Bear Creek Village Barrie\00_CAD\Design\Sheets\2103462-SHT-ESCD-03.dwg - 9/30/2022