Site Servicing and Stormwater Management Report – 1357 Baseline Road, Ottawa, ON

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Sign-off Sheet

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Table of Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1.0 INTRODUCTION

Stantec Consulting Ltd. has been retained by Selection Group International Inc. to prepare the following site servicing and stormwater management (SWM) report to satisfy the City of Ottawa Site Plan Control Application process. The 0.92 ha site is located to the northeast of the intersection of Baseline Road and Clyde Avenue in the City of Ottawa (see **Figure 1** below).

The proposed development site has recently been severed from a larger parcel known as 1357 Baseline Road. Stantec prepared a stormwater management report for both the severed and retained parcels in 2010. The retained portion has since been developed. The stormwater management report considers existing development in proximity to the site, as well as servicing criteria and assumptions made for ultimate buildout.

The proposed development is presently zoned AM (Arterial Mainstreet Zone) and consists of a two 15 storey high-rise residential buildings joined by a 5 storey building and raised amenity space. The development will have commercial space on the ground floor, associated surface and underground parking, and landscaped areas. The intent of this report is to provide a servicing scenario for the site that is free of conflicts, provides on-site servicing in accordance with City of Ottawa design guidelines, and utilizes the existing local infrastructure in accordance with the guidelines outlined through consultation with City of Ottawa staff.

Figure 1: Site Location

2.0 BACKGROUND

The following background studies have been referenced during the servicing design of the proposed site:

- *Geotechnical Investigation*, Proposed Hi-Rise Development Clyde Avenue at Baseline Road, Ottawa, Ontario, Paterson Group Inc., April 3, 2019
- *Clydesdale Shopping Centers 1357 Baseline Road, Ottawa, ON - Stormwater Management Report, Stantec Consulting Ltd., March 23, 2010*
- *1357 Baseline Road SWM Update- Reference Letter, Stantec Consulting Ltd., July 16, 2010*
- *City of Ottawa Design Guidelines – Water Distribution*, City of Ottawa, July 2010
- *City of Ottawa Sewer Design Guidelines*, City of Ottawa, October 2012
- *Technical Bulletin ISDTB-2014-01,* City of Ottawa, February 2014
- *Technical Bulletin PIEDTB -2016-01,* City of Ottawa, September 6, 2016
- Hill, J, Drake, J & Sleep, B 2016, *Comparisons of extensive green roof media in Southern Ontario*, Ecological Engineering, vol. 94, pp. 418-426.

3.0 WATER DISTRIBUTION

3.1 BACKGROUND

The proposed mixed-use development comprises two residential apartment buildings complete with associated infrastructure, and an amenity area. The site is located on the east side of Clyde Avenue and north of Baseline Road. The property is located within the City's Meadowlands Pressure Zone (ME). The site will be serviced by the existing 200mm watermain servicing the existing development. The existing 200mm watermain is fed via a single connection to the 600mm diameter ME feedermain within Clyde Avenue. Additional existing watermains are located within the Clyde Avenue and Baseline Road frontage however these mains form part of the 2W2C Pressure Zone. Construction of the 200mm main included the installation of stubs for future development based on the development concept at the time. Ground elevations of the site vary from approximately 97.2m to 101.2. Under normal operating conditions, hydraulic grade lines at the 600mm main vary from approximately 158.0m to 163.5m as confirmed through boundary conditions as provided by the City of Ottawa (see **Appendix A**).

3.2 WATER DEMANDS

Water demands for the development were estimated using the Ministry of Environment's Design Guidelines for Drinking Water Systems (2008). A daily rate of 350 L/cap/day has been applied for the population of the proposed site. Although actual population densities are expected to be less given the type of development proposed, population densities have been assumed as 1.4 pers./bachelor units, 2.1 pers./two-bedroom units, 3.1 pers./three-bedroom units, and 1 pers./care unit in accordance with the City guidelines. A rate of 28,000 L/gross ha/day of commercial space was used for the proposed site. See **Appendix A** for detailed domestic water demand estimates.

The average day demand (AVDY) for the entire site was determined to be 2.6 L/s. The maximum daily demand (MXDY) is 2.5 times the AVDY for residential property and 1.5 for commercial development, which equals 6.6 L/s. The peak hour demand (PKHR) is 2.2 times the MXDY for residential and 1.8 for commercial use, totaling 14.5L/s.

As the average domestic demand for the site is greater than 50m^3/day, the site typically requires water service redundancy. As noted above, the existing connection for the site is from the 600mm feedermain on Clyde Avenue which is considered to be a highly reliable main. The other existing watermains fronting the site are in a different pressure zone (2W2C) which does not allow for a second feed to the site.

Non-combustible construction was considered in the assessment for fire flow requirements according to the Ontario Building Code (OBC) Guidelines. The OBC Fire Flow Calculations are included in **Appendix A.** The minimum required fire flow for this development has been determined to be 150 L/s (9,000L/min).

3.3 PROPOSED SERVICING

Based on boundary conditions provided by the City of Ottawa and an approximate ground elevation of 98.8m (lowest building entrance elevation), adequate domestic water supply is available for the subject site with pressures ranging from 59.2m (84.2psi) to 64.7m (92.0psi). This pressure range is above the recommended guideline of 50-80 psi as specified in the City of Ottawa Design Guidelines for Water Distribution. It is recommended that requirements for a pressure reducing valve at the building service connection be further investigated at time of construction. Since the proposed buildings are 15-storeys in height, an additional 34 kPa (5 psi) for every additional storey is required to account for the change in elevation head and additional head loss when determining available pressure at upper building floors. Given that the lowest pressure is expected to be 580 kPa (84.2 psi) at ground level, the resultant equivalent pressure at the 15th floor will be approximately 132 kPa (19 psi), below the City's objective pressures. As a result, building booster pump(s) will be required to maintain an acceptable level of service on the higher floors.

Using boundary conditions for the proposed development under maximum day demands and the previously calculated fire flow requirement of 9,000/min per the OBC methodology, it can be seen that the system will maintain a residual pressure of approximately 551 kPa (79.9 psi), which is well above the required residual of 140 kPa (20 psi). The above demonstrates that the existing watermain within the development can provide adequate fire and domestic flows in excess of flow requirements for the subject site. A hydrant is proposed along the northern boundary of the site to be within 45m of the building fire department connection per OBC requirements. Additional hydrants are available within 90m of the building along Baseline Road, and within the existing commercial development to the east.

3.4 SUMMARY OF FINDINGS

The proposed development is located in an area of the City's central water distribution system with sufficient capacity to provide both the required domestic and emergency fire flows. Based on boundary conditions as provided by City of Ottawa staff, fire flows are available for this development based on OBC guidelines and as per the City of Ottawa water distribution guidelines. A pressure reducing valve may be required to ensure normal operating pressures remain within City of Ottawa guidelines. The service connection will be capable of providing anticipated demands to the lower storeys but will require a booster pump to maintain minimum operating pressures on the higher floors.

4.0 SANITARY SEWER

The site will be serviced by the existing 250 mm diameter sanitary sewer that runs along the northern and eastern limits of the site and services the overall development site. Stubs were dropped off at the time of construction to service the future development lands based on the concept at the time. The existing stub at the northwest corner of the site will be used and a new connection made to the sanitary sewer in the southeast corner of the site (see **Drawing SSP-1**). The private sanitary collection system ultimately discharges to the existing 300mm sanitary sewer within Baseline Road.

The sanitary design for the overall site was completed as part of the Clydesdale Shopping Centre Development (see **Appendix E**) and was based on applicable City of Ottawa Design Guidelines at the time of the report. A preliminary concept plan for the site consisted of two commercial buildings with an associated parking area allowing a sanitary discharge of 0.49L/s. The overall developments sanitary flow rate estimated during preliminary design was 3.80 L/s.

4.1 SANITARY SEWER DESIGN CRITERIA

As outlined in the City of Ottawa Sewer Design Guidelines and the Ministry of the Environment, Conservation and Parks (MECP) Design Guidelines for Sewage Works, the following criteria were used to calculate estimated wastewater flow rates and to size the sanitary sewers:

- Minimum Velocity – 0.6 m/s (0.8 m/s for upstream sections)
- Maximum Velocity – 3.0 m/s
- Manning roughness coefficient for all smooth wall pipes – 0.013
- Minimum size – 200mm dia. for residential areas
- Average Wastewater Generation – 280L/cap/day
- Peak Factor – 4.0 (Harmon's) (peaking correction factor of 0.8)
- Extraneous Flow Allowance – 0.33 l/s/ha (conservative value)
- Manhole Spacing – 120 m
- Minimum Cover – 2.5m
- Population density for single-bedroom and bachelor apartments – 1.4 pers./apartment
- Population density for two-bedroom apartments – 2.1 pers./apartment
- Population density for three-bedroom apartments – 3.1 pers./apartment
- Population density for care units– 1.0 pers./apartment

4.2 PROPOSED SERVICING

The proposed site will be serviced by gravity sewers which will direct the wastewater flows to the existing 250 mm diameter sanitary sewers within the overall development site. The sanitary drainage area plan for the Clydesdale Shopping Centre Development included in **Appendix B** shows the drainage areas for the overall site contributing to the sanitary collection system.

Given that the proposed development has changed from what was originally anticipated, a new sanitary drainage area plan has been prepared for the proposed development, **Drawing SA-1.**

A sanitary sewer design sheet for the development is included in **Appendix B**. The total design flow for the proposed development is 7.52 l/s (Fridom and Seniors per the design sheet). Total design flow from the overall site is 9.82 L/s with allowance for infiltration.

The existing sewers within the development have sufficient excess capacity to receive the proposed flows as demonstrated in the sanitary design sheet. The receiving sanitary sewer within Baseline Road has capacity constraints. Based on conversations with City staff, of 8-10L/s of additional flow can be accommodated within the existing collection system. As such, the downstream sewers have sufficient capacity to service the proposed development.

Full port backwater valves are to be installed on all sanitary services within the site to prevent any potential surcharge from the downstream sewer main from impacting the proposed property. All covered underground parking drains should be connected to the internal building plumbing.

5.0 STORMWATER MANAGEMENT

5.1 OBJECTIVES

The objective of this stormwater management (SWM) plan is to determine the measures necessary to control the quantity of stormwater released from the proposed development to the required levels as identified in background reports, and to provide sufficient detail for approval and construction.

5.2 SWM CRITERIA AND CONSTRAINTS

The stormwater management criteria for the proposed site are based on Stantec's *Clydesdale Shopping Centres – 1357 Baseline Road Stormwater Management Report* (March 23, 2010), the *1357 Baseline Road SWM Update* (July 16, 2010), and City of Ottawa's Sewer Design Guidelines. The following summarizes the criteria used in the preparation of this stormwater management plan:

General

- Use of the dual drainage principle (City of Ottawa)
- Wherever feasible and practical, site-level measures should be used to reduce and control the volume and rate of runoff (City of Ottawa)
- Assess impact of 100-year event outlined in the City of Ottawa Sewer Design Guidelines, and climate change scenarios with a 20% increase of rainfall intensity, on major & minor drainage system (City of Ottawa)
- Quality control of runoff from the proposed development to be provided in the existing downstream Stormceptor prior to entering the existing storm sewer on Clyde Avenue (1357 Baseline SWM Report)
- Stormwater runoff from the proposed development up to and including the 100-year event to be stored on site and released into the minor system at a maximum rate of 770 L/s (1357 Baseline SWM Report)
- No roof storage available within proposed buildings with the exception of LID controls for green roof top (tenant requirement)

Storm Sewer & Inlet Controls

- Size storm sewers to convey the 5-year storm event under free-flow conditions using City of Ottawa I-D-F parameters (City of Ottawa)
- Minimize surface ponding during the 5-year storm event in existing catchments 104, CMH100, 105, 500A, 500B, and 500C (tenant requirement during preparation of the 1357 Baseline SWM Report)

- Hydraulic Grade Line (HGL) analysis to be conducted using the 100 year 3-hour Chicago storm distribution
- Maximum 100-year water depth of 0.35 m in parking and access areas
- 100-year Storm HGL to be a minimum of 0.30m (0.50m) below building foundation footing, otherwise foundation drains to be pumped (City of Ottawa)

Surface Storage & Overland Flow

- Building openings to be a minimum of 0.30m above the 100-year water level (City of Ottawa)
- Maximum depth of flow under either static or dynamic conditions shall be less than 0.35m (City of Ottawa)
- Provide adequate emergency overflow conveyance off-site (City of Ottawa)

5.2.1 Allowable Release Rate

The overall approach for stormwater management for the overall existing commercial development was initially completed in March 23, 2010 by Stantec Consulting Ltd., and later revised in July 16, 2010 for construction of the office building north of the subject site(refer to report excerpts in **Appendix E**). The subject site was intended to be an extension of the existing commercial area and was initially proposed to consist of two commercial buildings with associated above ground parking areas, and surface quantity control storage. Under existing conditions, a large portion of the site is pervious, and sheet drains southwest towards the Baseline Road and Clyde Avenue intersection.

During the ultimate scenario, site discharge will be conveyed to the existing 675mm diameter storm sewer outlet to sewers within Clyde avenue located at the northwestern corner of the subject site. The outlet to Clyde Avenue was constructed as part of the previous phases of the development and was sized to convey flows from the proposed site.

The overall development is controlled by an inlet control device (ICD) located upstream of two existing Stormceptor units adjacent to manhole STM101, and sized to release up to the maximum available discharge allotted to the development as noted in the 2010 SWM reports. Additional ICDs in series have been previously installed within key locations of the existing development to allow for surface storage to occur during larger storm events.

5-year and 100-year 3-hour Chicago storm events based on IDF curves from the City of Ottawa were used to design the storm system. The proposed stormwater management plan was designed to detain runoff on available rooftops, and within pipes and surface storage to ensure that peak flows after construction would not exceed the target discharge rate. Peak outflow rates from the subject site were identified per the table below:

Table 1: Existing Allowable Peak Discharge Rate

Storm Event	Peak Outflow Rate (L/s)
All Events (up to 100-Year)	770

5.3 STORMWATER MANAGEMENT DESIGN

5.3.1 Design Methodology

The intent of the stormwater management plan presented herein is to control peak outflow from the subject site while providing adequate capacity to service the proposed buildings, underground parking and access areas. As no rooftop storage is proposed and the underground parking area accounts for a large portion of the site, the proposed stormwater management plan is designed to retain runoff from the proposed site within a subsurface storage tank located at the western boundary of the site prior to discharge downstream of the existing development orifice control. Orifice controls will be reassessed to ensure allowable peak discharge from the overall development is maintained.

A LID feature (proposed green roof) will be considered for the segment of roof area which connects the two buildings (Area R101 on **Drawing SD-1**). Runoff from on-site surface catch basins and proposed roof drains are captured and conveyed to the underground storage tank or through existing storm sewer infrastructure within the existing development. As the discharge rate of the existing development is controlled by ICDs in series, a PCSWMM model has been developed to encompass the entirety of the overall development to ensure drainage of the upstream system is not negatively impacted. The proposed subsurface storage tank is restricted by an ICD, and outlets downstream of the existing ICD within STM 101. Three tanks are proposed to act as subsurface storage for the development. Each tank is capable of storing up to 76m^3 of runoff for a total allowable storage of 228 m^3.

5.3.2 Modeling Rationale

A comprehensive hydrologic modeling exercise was completed with PCSWMM, accounting for proposed and existing major and minor systems to evaluate the storm sewer infrastructure. The use of PCSWMM for modeling of the site hydrology and hydraulics allowed for an analysis of the systems response during various storm events. Surface storage estimates in the existing commercial development parking lots to the north and east mirror that from the existing 1357 Baseline SWM report. The following assumptions were applied to the detailed model:

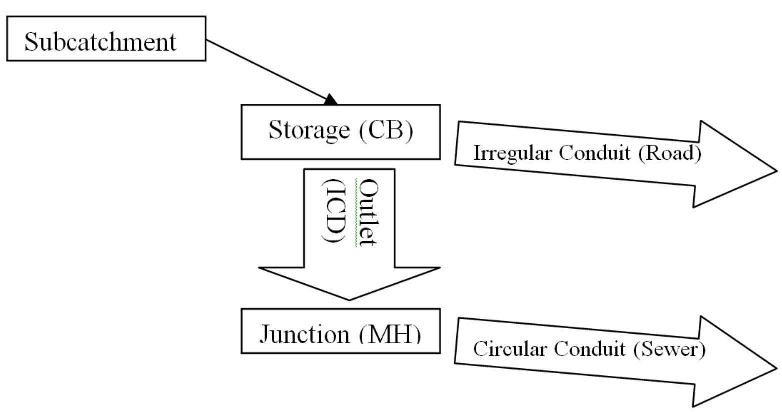
- Hydrologic parameters as per Ottawa Sewer Design Guidelines, including Horton infiltration, Manning's 'n', and depression storage values.

- 3-hour Chicago Storm distribution for the 2-year, 5-year, and 100-year analysis to verify on-site peak HGLs.
- 100-year, 12-hour SCS distribution assessed to verify adequate tank sizing for all storm events.
- To 'stress test' the system a 'climate change' scenario was created by adding 20% of the individual intensity values of the 100-year Chicago and 100-year-SCS storm event at their specified time step.
- Percent imperviousness calculated based on actual soft and hard surfaces on each subcatchment, converted to equivalent Runoff Coefficient using the relationship C = (Imp. x 0.7) + 0.2.
- Subcatchment areas are defined from high-point to high-point where sags occur. Subcatchment width (average length of overland sheet flow) was determined by dividing subcatchment area by subcatchment length (length of overland flow path measured from high-point to high-point), or using 225m/ha for existing catchment areas.
- Catchbasin inflow restricted with inlet-control devices (ICDs) as necessary to maintain inflow target rate.

5.3.2.1 SWMM Dual Drainage Methodology

The proposed subdivision is modeled in one modeling program as a dual conduit system (see Figure 2), with: 1) circular conduits representing the sewers & junction nodes representing manholes; 2) irregular conduits using street-shaped cross-sections to represent the saw-toothed overland road network from high-point to low-point and storage nodes representing catchbasins. The dual drainage systems are connected via orifice link objects (or outlets) from storage node (i.e. CB and MH), and represent inlet control devices (ICDs). Subcatchments are linked to the storage node on the surface so that generated hydrographs are directed there firstly.

Figure 2: Schematic Representing Model Object Roles



Storage nodes are used in the model to represent catchbasins, manholes and major system junctions. For storage nodes representing catchbasins (CBs), the invert of the storage node represents the invert of the CB and the rim of the storage node represents the maximum allowable flow depth elevation above the storage node (equal to the top of the CB plus an additional 0.35m or the maximum ponding depth available). An additional depth has been added to rim elevations for the climate change events to allow routing from one surface storage to the next and is unused in lesser storm events. Ponding at low points is represented via storage area-depth curves for each individual storage node. Storage volumes exceeding the sag storage available in the node will route through the connected irregular conduit to the next storage node and continue routing through the system until, ultimately, flows either re-enter the minor system or reach the outfall of the major system.

Inlet control devices, as represented by orifice links, use a user-specified diameter and discharge coefficient taken from manufacturer's specifications for the chosen ICD model. Existing ICDs have been modeled with a discharge coefficient of 0.61.

Subcatchment imperviousness was calculated via impervious area measured from **Drawing SSP-1**.

5.3.2.2 Boundary Conditions

The detailed PCSWMM hydrology and the proposed storm sewers were used to assess the peak inflows and hydraulic grade line (HGL) for the site. The boundary condition outlined in the reports prepared by Stantec Consulting Ltd. In 2010 was conservatively assumed to be 96.57 based on the obvert elevation of the inletting sewer at manhole STM101. Upon further assessment, this elevation appears to be unreasonable as it would be above the existing ground surface within the Baseline and Clyde intersection. As no prior reports of flooding were noted for properties connecting to the 900mm main within Clyde Avenue, the HGL of the receiving sewer for the purposes of this report was assumed to be equal to the obvert of the receiving sewer at elevation 94.41m.

5.3.3 Input Parameters

Drawing SD-1 summarizes the discretized subcatchments used in the analysis of the proposed site, and outlines the major overland flow paths. The grading plans are also enclosed for review.

Appendix C summarizes the modeling input parameters and results for the subject area; an example input and output file are provided for the 100-year 3hr Chicago storm. For all other input files and results of storm scenarios, please examine the electronic model files provided with this report. This analysis was performed using PCSWMM, which is a front-end GUI to the EPA-SWMM engine. Model files can be examined in any program which can read EPA-SWMM files version 5.1.013.

5.3.3.1 Hydrologic Parameters

Table 2 presents the general subcatchment parameters used:

Table 2: General Subcatchment Parameters

Parameter	Value
Infiltration Method	Horton
Max. Infil. Rate (mm/hr)	76.2
Min. Infil. Rate (mm/hr)	13.2
Decay Constant (1/hr)	4.14
N Impervious	0.013
N Pervious	0.025
Dstore Imperv. (mm)	1.57
Dstore perv. (mm)	4.67
Zero Imperv. (%)	0

Table 3 presents the individual parameters that vary for each of the proposed subcatchments.

Table 3: Subcatchment Parameters

Name	Outlet	Area (ha)	Width (m)	Slope (%)	Imperv. (%)
101A	STM101	0.231	43.2	1.0	100.0
104	STM104A-S	0.177	37.8	1.0	100.0
105	CB105-S	0.537	120.8	1.0	100.0
108	STM108	0.064	14.4	1.0	100.0
500A	CMH101-S	0.151	34	1.0	100.0
500B	500B-S	0.239	53.8	1.0	100.0
500C	500C-S	0.272	61.2	1.0	100.0
500D	CMH101-S	0.077	17.3	1.0	100.0
900A	900A-S	0.386	86.9	1.0	100.0
900B	900B-S	0.187	42.1	1.0	100.0
902	STM902	0.187	42.1	1.0	2.9
CB107	CB107-S	0.220	49.5	1.0	100.0
CB109	CB109-S	0.094	21.2	1.0	85.7
CB110	CB110-S	0.041	9.2	1.0	78.6
CMH100	CMH100-S	0.546	122.9	1.0	100.0
F_EX102A	CB500-S	0.034	26.85	2.0	100.0
F_EX102B	CB102B-S	0.014	25.29	1.5	100.0
F_EX103A	CB501-S	0.143	70.35	2.0	100.0

F100	TANK	0.230	106	2.0	81.4
F111A	STM111	0.136	77.146	2.0	100.0
F505A	TANK	0.005	13.33	1.5	0.0
F505B	TANK	0.007	13.09	1.5	28.6
F505C	TANK	0.007	13.15	1.5	28.6
F505D	TANK	0.009	15.54	1.5	27.1
R100	TANK	0.103	50.14	1.5	100.0
R101	TANK	0.049	22.23	1.5	100.0
R103	TANK	0.113	57.13	1.5	100.0
R104	TANK	0.187	84.44	2.0	100.0
ROOFA	RoofA-S	1.346	302.9	1.0	100.0
ROOFB1	RoofB1-S	0.188	42.3	1.0	100.0
ROOFE	RoofE-S	0.095	21.4	1.0	100.0
ROOFF	RoofF-S	0.111	25	1.0	100.0
UNC1	OF	0.208	46.8	1.0	24.3
UNC-1	OF	0.005	20.0	1.5	100.0
UNC2	OF	0.189	42.435	1.0	64.3
UNC-2	OF	0.001	2.72	1.5	100.0
UNC-3	OF	0.002	2.72	1.5	100.0
UNC-4	OF	0.004	7.187	1.5	100.0
UNDR	900A-S	0.022	5	1.0	100.0
TOTAL		**6.629**			**92.6**

Table 4 summarizes the storage node parameters used in the model for the overall site. Storage curves for each node have been provided based on available volumes within the roof top, surface or subsurface storage as applicable. Rim elevations for each node correspond to the rim elevation of the associated area's roof top drain or catch basin plus maximum depth of storage. Storage curves used in PCSWMM for existing roof areas are based on roof design spreadsheets which are included as **Appendix E.**

Storage volumes and release rates for the underground storage tank were obtained through iteration of the PCSWMM hydrologic/hydraulic modeling.

Table 4: Storage Node Parameters

Name	Invert	Rim	Depth	Storage Curve	Curve Name
500B-S	98.26	100.36	2.10	TABULAR	500b-IC

500C-S	98.40	100.54	2.14	TABULAR	500c-IC
900A-S	96.83	98.70	1.87	TABULAR	900A-IC
900B-S	96.77	98.84	2.07	TABULAR	900B-IC
STM110	97.76	100.15	2.39	FUNCTIONAL	*
STM111	98.03	100.87	2.84	FUNCTIONAL	*
CB102B-S	96.27	98.07	1.80	FUNCTIONAL	*
CB105-S	98.25	100.33	2.08	TABULAR	STM105-IC
CB107-S	98.56	100.65	2.09	TABULAR	CB107-IC
CB109-S	99.05	101.42	2.37	TABULAR	CB109-IC
CB110-S	98.60	100.66	2.06	TABULAR	CB110-IC
CB500-S	97.13	98.59	1.46	FUNCTIONAL	*
CB501-S	96.76	99.27	2.51	FUNCTIONAL	*
CB902A	97.07	98.50	1.43	FUNCTIONAL	*
CBMH901	96.76	100.53	3.77	FUNCTIONAL	*
CMH100-S	98.09	100.50	2.41	TABULAR	CMH100-IC
CMH101-S	97.74	100.36	2.62	TABULAR	CMH101-IC
MONITOR	93.88	97.93	4.05	FUNCTIONAL	*
ORF101	94.03	98.04	4.01	FUNCTIONAL	*
RoofA-S	110.00	110.15	0.15	TABULAR	ROOFA-S
RoofB1-S	110.00	110.15	0.15	TABULAR	ROOFB1-S
RoofE-S	110.00	110.15	0.15	TABULAR	ROOFE-S
RoofF-S	110.00	110.15	0.15	TABULAR	ROOFF-S
STM102	95.90	98.69	2.79	FUNCTIONAL	*
STM103	96.04	100.15	4.11	FUNCTIONAL	*
STM104A-S	98.25	100.33	2.08	TABULAR	STM104-IC
STM104B-S	96.98	100.38	3.40	FUNCTIONAL	*
STM105-S	97.39	100.51	3.12	FUNCTIONAL	*
STM106	97.47	100.58	3.11	FUNCTIONAL	*
STM107	97.56	100.89	3.33	FUNCTIONAL	*
STM108	98.10	100.80	2.70	FUNCTIONAL	*
STM109	97.61	101.79	4.18	FUNCTIONAL	*
STM900	96.15	99.77	3.62	FUNCTIONAL	*
TANK	94.41	97.12	2.71	FUNCTIONAL	*

5.3.3.2 Hydraulic Parameters

As per the Ottawa Sewer Design Guidelines (OSDG 2012), Manning's roughness values of 0.013 were used for sewer modeling and overland flow corridors representing roadways within the parking lot. Storm sewers were modeled to confirm flow capacities and hydraulic grade lines (HGLs) in the ultimate condition. The detailed storm sewer design sheet is included in **Appendix C**.

All on-site runoff above the underground parking structure, and a portion of the subcatchments along Baseline Road and Clyde Avenue building walkways will be internally directed towards the subsurface storage tanks. **Tables 5 and 6** below present the parameters for the outlet and orifice link objects in the model, which represent ICDs, catch basin leads, and flow controlled roof drains. All proposed IPEX tempest orifices were assigned a discharge coefficient of 0.572. Roof release discharge curves are those assumed during creation of the previous 1357 Baseline Road SWM Report (see calculation sheets in **Appendix E**).

Table 5: Orifice Parameters

Name	Inlet	Outlet	Inlet Elev.	Type	Diameter	100 Year-3 hour Chicago release rate (L/s)
500B-IC	500B-S	STM107	98.26	CIRCULAR	0.200	104.31
500C-IC	500C-S	STM107	98.40	CIRCULAR	0.300	131.46
STM110-IC	STM110	STM104B-S	97.76	CIRCULAR	0.108	32.80
CB102B-IC1	CB102B-S	STM101	96.27	CIRCULAR	0.200	11.62
CB102B-IC2	CB102B-S	STM101	96.27	CIRCULAR	0.200	11.62
CB105-IC1	CB105-S	STM105-S	98.25	CIRCULAR	0.200	111.00
CB105-IC2	CB105-S	STM105-S	98.25	CIRCULAR	0.200	111.00
CB107-IC	CB107-S	STM107	98.56	CIRCULAR	0.127	43.75
CB109-IC	CB109-S	STM109	99.05	CIRCULAR	0.090	25.77
CB110-IC	CB110-S	STM108	98.60	CIRCULAR	0.075	14.20
CB500-IC	CB500-S	STM102	97.06	CIRCULAR	0.200	17.06
CB501-IC	CB501-S	STM103	96.76	CIRCULAR	0.200	70.91
CMH100-IC	CMH100-S	STM106	98.09	CIRCULAR	0.250	188.13
IC-TANK	TANK	ORF101	94.41	CIRCULAR	0.150	74.63
ORF_900B	900B-S	ORF900B	96.77	CIRCULAR	0.154	59.77
STM104A-IC	STM104A-S	STM104	98.25	CIRCULAR	0.200	80.39
SMT101-IC	*STM101	ORF101	94.03	CIRCULAR	0.380	534.62
STM104B-IC	*STM104	STM104B-S	96.98	CIRCULAR	0.250	232.84

*ICD's that require replacement

Table 6: Outlet Parameters

Name	Inlet	Outlet	Inlet Elev.	Curve Name
RA-O	RoofA-S	STM106	110	BLDGA-O
RE-O	RoofE-S	STM109	110	BLDGE-O
RF-O	RoofF-S	STM109	110	BLDGF-O
RB-O	RoofB1-S	STM101	110	BLDGB-O

Green roof LID parameters were set based on architectural input (150mm soil depth, 150mm berm height at perimeter, 90% roof coverage), and noted in **Table 7** below. As green roof fill media has not currently been specified, porosity and soil conductivity were set based on average observed parameters for green roof media per '*Comparisons of extensive green roof media in South Ontario*' (Hill et al., 2016).

Table 7: Green Roof LID Control Parameters

Parameter	Value
Soil Thickness	150
Vegetation Volume (fraction)	0.05
Surface roughness (manning's n)	0.13
Porosity	0.65
Field Capacity	0.55
Wilting point	0.2
Conductivity (mm/hr)	36
Conductivity Slope	10
Suction Head (mm)	8.5
Drainage Mat Thickness (mm)	3
Void Fraction	0.5
Mat Roughness (Manning's n)	0.1

5.3.4 Model Results

The following section summarizes the key hydrologic and hydraulic model results. For detailed model results or inputs please refer to the example input file in **Appendix C** and the electronic model files on the enclosed media.

5.3.4.1 Hydrologic Results

The following table demonstrates the peak outflow from each modeled outfall during the design storm (Chicago and SCS) events. A fixed outfall condition corresponding to the obvert of the receiving sewer within Clyde Avenue has been modeled for these events to be conservative with respect to site peak release rates. In addition to controlled flows, outfall OF1 includes uncontrolled flows from the perimeter of the site that due to grading restrictions, are captured by the existing rights-of-way at the west and south boundaries of the site. These flows will have minimal contribution to the infrastructure within Clyde Avenue and Baseline Road, which ultimately discharge to the same site outlet. Peaks from these uncontrolled flows have been considered in the total target release rate. The total subsurface storage volume captured in the tank in the 100-year storm event is 211 m^3.

Table 8: 3 Hour Chicago Event Peak Discharge Rates

Event	Discharge Rate (L/s)
3 Hr Chicago 2-Year	444.5
3 Hr Chicago 5-Year	560.7
3 Hr Chicago 100-Year	766.1
3 Hr Chicago 100-Year + 20%	843.3
12 Hr SCS 100-Year	734.4
12 Hr SCS 100-Year + 20%	797.4

5.3.4.2 Hydraulic Results

It is proposed to replace the existing ICD within manholes STM101 from a 475mm to a 380mm diameter circular orifice and STM104 from a 240mm to a 250mm diameter circular orifice to minimize the requirement for subsurface storage within the proposed site. Other orifices within the development in series and upstream of STM101 have been reassessed to ensure available surface storage has not been exceeded, is minimized during the 5-year event as compared to the existing approved report, and does not cause upstream sewers to surcharge to the surface. **Table 9** below is a comparison of the required surface storage anticipated for all development areas from that originally approved (interim development) to the current design. In no case has 5-yr volume surface storage increased from that originally approved in 2010. Dashed values indicate structures new to the current development, or unassessed during the original approved report. Surface ponding depths do not exceed 0.35m during the 100-year design event.

Table 9: Comparison of Storage Volumes in 5-Year, 100-Year Chicago Events

Structure	5-yr Volume (m^3)		100-yr Volume (m^3)			
	Original	Proposed	Available	Original	Proposed	Prop. Max. Depth
500B-S	0.2	0.0	78.4	65.6	48.0	0.23

500C-S	0.2	0.0	15.9	9.1	2.0	0.10
900A-S	16.0	0.0	176.1	25.4	9.0	0.07
900B-S	0.2	0.0	27.5	14.9	16.0	0.23
CB105-S	0.2	0.0	94.7	51.5	84.0	0.26
CB107-S	18.6	8.0	56.5	48.7	49.0	0.27
CB109-S	1.8	0.0	10.9	9.1	9.0	0.16
CB110-S	0.2	0.0	15.1	2.0	2.0	0.10
CMH100-S	7.5	7.0	123.6	60.1	89.0	0.24
CMH101-S	0.2	0.0	57.0	92.0	31.0	0.22
STM104A-S	0.2	0.0	62.7	32.1	37.0	0.21
TANK	-	107	228	-	210	2.51

Table 10 summarizes the HGL results within the site for the 100 year, 3 hour Chicago storm event and the 'climate change' scenario storm required by the City of Ottawa Sewer Design Guidelines (2012), where intensities are increased by 20%.

The City of Ottawa requires that during major storm events, the maximum hydraulic grade line be kept at least 0.30 m below the underside-of-footing (USF) of any adjacent units connected to the storm sewer during design storm events. As no on-site buildings maintain unprotected foundation drains discharging to the storm sewer, HGLs have been assessed to ensure no impacts to adjacent building openings. Proposed elevations are detailed on **Drawing GP-1**.

Table 10: Modeled Hydraulic Grade Line (HGL) Results

STM MH	Adjacent Building Opening (m)	100-year 3hr Chicago		100-year 3hr Chicago + 20%	
		HGL (m)	HGL Clearance (m)	HGL (m)	HGL Clearance (m)
STM101	98.85	97.54	1.31	97.86	0.99
STM102	98.85	97.54	1.31	97.86	0.99
STM103	99.00	97.58	1.42	97.91	1.09
STM900	99.00	97.60	1.40	97.92	1.08
STM110	100.22	99.81	0.41	100.03	0.19
STM111	101.02	99.82	1.20	100.17	0.85
STM105	101.00	100.28	0.72	100.36	0.64
STM109	101.55	100.28	1.27	100.36	1.19
STM106	101.00	100.28	0.72	100.37	0.63
STM107	101.00	100.28	0.72	100.37	0.63

STM MH	Adjacent Building Opening (m)	100-year 3hr Chicago		100-year 3hr Chicago + 20%	
		HGL (m)	HGL Clearance (m)	HGL (m)	HGL Clearance (m)
STM108	101.55	100.28	1.27	100.37	1.18
CMH101	101.00	100.28	0.72	100.37	0.63

As is demonstrated in the table above, the worst-case scenario results in HGL elevations remain at least 0.30 m below the proposed building openings, and HGL elevations remain below the proposed building openings during the 20% increased intensity 'climate change' scenario.

Uncontrolled release rates discharging to Clyde Avenue and Baseline Road from the proposed site are summarized in **Table 11** as per City request.

Table 11: 100-Year Chicago Event Uncontrolled Release Rates

Structure	Area(ha)	Imperv	Peak Release rate (L/s)
UNC-1	0.005	100	2.4
UNC-2	0.001	100	0.6
UNC-3	0.002	100	0.8
UNC-4	0.004	100	2.0

5.3.5 Results

Table 12 demonstrates that the proposed stormwater management plan provides adequate attenuation storage to meet the target peak outflow rates for the site. During the 100-year event, minor system flow is controlled to 770 L/s. These meet the target release rates identified in **Table 1**. Combined controlled and uncontrolled discharge rates are included in the table below.

Table 12: Summary of Total 5 and 100 Year Event Release Rates

Storm Event	Site Peak Discharge (L/s)*	Target Discharge Rate (L/s)*
3 Hour Chicago 5-Year	561.9	770
3 Hour Chicago 100-Year	767.6	770
3 Hour Chicago 100-Year+20%	845.7	-

*Includes uncontrolled discharge areas.

5.4 WATER QUALITY CONTROL

Stormwater quality control for runoff from the proposed commercial site has been accounted for through the existing downstream Stormceptor STC9000 hydrodynamic separator as detailed in the 1357 Baseline SWM Report (Stantec, 2010). The unit was sized assuming the subject site would be 6.13ha at 95.8% impervious area, for a total impervious treatment area of 5.87ha to achieve enhanced protection of 80% total net annual TSS removal. The proposed site less area treated by the green roof measures approximately 6.17ha at 95.6% imperviousness, for a total impervious area of 5.90ha. As the marginal development area increase is largely due to capture from relatively clean rooftop runoff, no negative effects on the existing quality control plan for the region are expected.

6.0 GRADING AND DRAINAGE

The proposed development site measures approximately 0.91 ha in area, with the overall development area consisting of approximately 6.63ha. The site has significant grade change sloping from the northeast to southwest property boundary. A detailed grading plan (see **Drawing GP-1**) has been provided to satisfy the stormwater management requirements, to meet minimum cover requirements for storm and sanitary sewers, and to provide sufficient cover over top of the underground parking garage. Site grading has been established to provide emergency overland flow routes for stormwater management in accordance with City of Ottawa requirements.

The subject site maintains emergency overland flow routes to the existing Clyde Avenue ROW and to Baseline Road south of the proposed development as depicted on **Drawings GP-1** and **SD-1**.

7.0 UTILITIES

The subject site lies within a previously developed commercial area and has existing plant within proximity to the site at the northern and eastern property boundary. Additional plant is also available through Baseline Road and Clyde Avenue. It is anticipated that existing infrastructure will be sufficient to provide the means of distribution for the proposed site. Detailed design of the required utility services will be further investigated as part of the composite utility planning process following design circulation.

8.0 APPROVALS

Ontario Ministry of the Environment, Conservation and Parks (MECP) Environmental Compliance Approval (ECAs, formerly Certificates of Approval C of A) under the Ontario Water Resources Act will be a requirement for the existing shared sewers as the overall development serviced through the Clyde Avenue and Baseline Road sewers has been severed into two distinct parcels and is no longer exempt. Application for a direct submission ECA will be made. Through preconsultation discussions with the City of Ottawa, it was agreed that the ECA application can be initiated in advance of design approval given that the sewers subject to the ECA requirement are existing.

Conservation Authority (RVCA) clearance will be required for the subject site in order to finalize the MECP ECA submission.

Requirement for an MECP Permit to Take Water (PTTW) for pumping during construction of the underground parking levels will be confirmed by the geotechnical consultant. A PTTW may be required for construction dewatering as the building parking structure will extend beyond the measured groundwater elevations per the geotechnical report (see **Section 10** below).

9.0 EROSION CONTROL DURING CONSTRUCTION

Erosion and sediment controls must be in place during construction. The following recommendations to the contractor will be included in contract documents.

1. Implement best management practices to provide appropriate protection of the existing and proposed drainage system and the receiving water course(s).
2. Limit extent of exposed soils at any given time.
3. Re-vegetate exposed areas as soon as possible.
4. Minimize the area to be cleared and grubbed.
5. Protect exposed slopes with plastic or synthetic mulches.
6. Provide sediment traps and basins during dewatering.
7. Install sediment traps (such as SiltSack® by Terrafix) between catch basins and frames.
8. Plan construction at proper time to avoid flooding.
9. Installation of a mud matt to prevent mud and debris from being transported off site.
10. Installation of a silt fence to prevent sediment runoff.

The contractor will, at every rainfall, complete inspections and guarantee proper performance. The inspection is to include:

1. Verification that water is not flowing under silt barriers.
2. Clean and change silt traps at catch basins.

Refer to **Drawing EC-DS** for the proposed location of silt fences, and other erosion control structures.

10.0 GEOTECHNICAL INVESTIGATION

A geotechnical investigation was completed by Paterson Group Ltd. in April 3, 2019. The report summarizes the existing soil conditions within the subject area and construction recommendations. For details which are not summarized below, please see the original Paterson report (Excerpts included in **Appendix D**).

Subsurface soil conditions within the proposed mixed-use development were determined from 4 boreholes distributed across the proposed site. In general soil stratigraphy consisted of topsoil or gravel fill underlain by a silty clay deposit layer.

Groundwater levels were measured on April 1, 2019 and vary in elevation from 2.1m to 3.7m below the original ground surface.

The required pavement structure for the local roadways is outlined in Table 12 and Table 13 below:

Table 13: Pavement Structure – Car Only Parking Areas

Thickness (mm)	Material Description
50	Wear Course – HL-3 or Superpave 12.5 Asphaltic Concrete
150	Base – OPSS Granular A Crushed Stone
300	Subbase - OPSS Granular B Type II
-	Subgrade – Either fill, in situ soil, or OPSS Granular B Type I or II material placed over in situ soil or fill.

Table 14: Pavement Structure – Access Lanes and Heavy Truck Parking Areas

Thickness (mm)	Material Description
40	Wear Course –HL-3 or Superpave 12.5 Asphaltic Concrete
50	Binder Course – HL-3 or Superpave 19.0 Asphaltic Concrete
150	Base – OPSS Granular A Crushed Stone
400	Subbase - OPSS Granular B Type II
-	Subgrade – Either fill, in situ soil, or OPSS Granular B Type I or II material placed over in situ soil or fill.

11.0 CONCLUSIONS

11.1 WATER SERVICING

The existing 200 mm diameter watermains within the existing commercial development fed via Clyde Avenue provide adequate fire flow capacity per requirements of the Ontario Building Code. The building service connections will also be capable of providing anticipated domestic demand. As pressures exceed the maximum objective pressure of 552 kPa (80 psi), pressure reducing measures such as a pressure reducing valve may be required to service the proposed buildings per the Ontario Plumbing Code. This will be confirmed by the building mechanical engineers.

11.2 SANITARY SERVICING

The existing private sanitary sewers are sufficiently sized to provide gravity drainage for the site. The proposed development is to be serviced by an existing 250mm sewer directing wastewater flows to the existing 300 mm diameter Baseline Road sanitary sewer. A backflow preventer will be required for the proposed building in accordance with the Ottawa Sewer Design Guidelines and will be coordinated with building mechanical engineers. Proposed sanitary peak flows are within acceptable limits per prior consultation with City of Ottawa staff.

11.3 STORMWATER SERVICING

The proposed stormwater management plan is in compliance with the goals specified through the previously approved 1357 Baseline Road SWM Report and with the City of Ottawa Design guidelines. Subsurface storage in combination with surface and rooftop storage within the existing development are proposed to limit inflow from the site area into the minor system to the required target release rate.

It is recommended that the proposed building be equipped with a backwater valve to prevent surcharge in the event the subsurface storage tank becomes blocked.

11.4 GRADING

Grading for the site has been designed to provide an emergency overland flow route as per City requirements and reflects the overall recommendations provided in the Geotechnical Investigation. Erosion and sediment control measures will be implemented during construction to reduce the impact on existing infrastructure.

11.5 UTILITIES

All utilities (Hydro Ottawa, Bell Canada, Rogers Ottawa, and Enbridge Gas) have existing plant in the subject area. Exact size, location and routing of utilities will be finalized after design circulation.

11.6 APPROVAL / PERMITS

Ontario Ministry of the Environment, Conservation and Parks (MECP) Environmental Compliance Approvals (ECA) are required for the shared existing sewers on the subject site as the development will be composed of multiple parcels under separate private ownership. Written approval from the Rideau Valley Conservation Authority (RVCA) is required to process the required MECP ECA application. A Permit to Take Water may be required for pumping requirements for construction of underground parking level. No other approval requirements from other regulatory agencies are anticipated.

APPENDICES

Appendix A POTABLE WATER SERVICING ANALYSIS

From:	Oram, Cody
To:	Rathnasooriya, Thakshika
Subject:	RE: Boundary Conditions - 1357 Baseline Road
Date:	Wednesday, September 11, 2019 10:29:56 AM
Attachments:	1357 Baseline Sept 2019.pdf

The following are boundary conditions, HGL, for hydraulic analysis at 1357 Clyde (zone ME) assumed to be connected to the 610mm on Clyde (see attached PDF for location).

Minimum HGL = 158.0m

Maximum HGL = 163.5m the maximum pressure is estimated to be above 80 psi. A pressure check at completion of construction is recommended to determine if pressure control is required.

MaxDay + FireFlow (150 L/s) = 155.0m

These are for current conditions and are based on computer model simulation.

Disclaimer: The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation.

From: Rathnasooriya, Thakshika <Thakshika.Rathnasooriya@stantec.com>
Sent: August 29, 2019 3:59 PM
To: Oram, Cody <Cody.Oram@ottawa.ca>
Subject: RE: Boundary Conditions - 1357 Baseline Road

Hi Cody,

I apologize for the late response. The attached pdf shows the possible watermain connection points to the proposed building.

Thanks,

Shika Rathnasooriya P.Eng.

Direct: 613 724-4081

Thakshika.Rathnasooriya@stantec.com

Stantec
400 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

From: Oram, Cody <Cody.Oram@ottawa.ca>
Sent: Friday, August 23, 2019 3:17 PM
To: Rathnasooriya, Thakshika <Thakshika.Rathnasooriya@stantec.com>
Subject: RE: Boundary Conditions - 1357 Baseline Road

Hi Shika,
Could you provide a sketch showing the approx. connection locations?
Thank you,
Cody

From: Rathnasooriya, Thakshika <Thakshika.Rathnasooriya@stantec.com>
Sent: August 23, 2019 12:02 PM
To: Oram, Cody <Cody.Oram@ottawa.ca>
Subject: RE: Boundary Conditions - 1357 Baseline Road

Hi Cody,

We revised the OBC calculation for the worst case scenario, please disregard the previous OBC calculation sheet. The revised minimum required fire flow is 150 L/s (9,000 L/min).

Thank you,

Shika Rathnasooriya P.Eng.

Direct: 613 724-4081
Thakshika.Rathnasooriya@stantec.com

Stantec
400 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

From: Rathnasooriya, Thakshika
Sent: Thursday, August 22, 2019 9:15 AM
To: 'Cody.Oram@ottawa.ca' <Cody.Oram@ottawa.ca>
Cc: Smadella, Karin <Karin.Smadella@stantec.com>
Subject: Boundary Conditions - 1357 Baseline Road

Hi Cody,

I am looking for watermain hydraulic boundary conditions for the proposed site at 1357 Baseline Road. We anticipate connecting to the existing 200mm diameter watermains along the northern and eastern boundary of the proposed site.

The intended land use is two residential apartment buildings which share a common ground floor lobby and commercial areas.

Estimated domestic demands and fire flow requirements are as follows:
Average Day Demand - 2.93 L/s
Max Day Demand - 7.17 L/s
Peak Hour Demand - 15.67 L/s
Per OBC - 90L/s

Thank you,

Shika Rathnasooriya P.Eng.

Direct: 613 724-4081
Thakshika.Rathnasooriya@stantec.com

Stantec
400 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

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From: Smadella, Karin
To: Rathnasooriya, Thakshika
Subject: FW: 20191030 17-1444 Clyde Baseline site and parking plans in progress
Date: Tuesday, November 19, 2019 11:22:33 AM

These are the occupancy assumptions based on their other developments. Those units that don't have 2 occupants will have 1 occupant.

Let me know if you have any questions.

Karin

Karin Smadella, P.Eng.
Project Manager

Direct: 613 724-4371
Mobile: 613 698-8088
Karin.Smadella@stantec.com

Stantec
400 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

From: Rudy Hanel <rhanel@groupeselection.com>
Sent: Thursday, October 31, 2019 3:57 PM
To: Smadella, Karin <Karin.Smadella@stantec.com>
Cc: Thomas Schweitzer <thomas.schweitzer@acdf.ca>; Simon Lussier <simon.lussier@acdf.ca>; O'Grady, Lauren <Lauren.OGrady@stantec.com>
Subject: Re: 20191030 17-1444 Clyde Baseline site and parking plans in progress

Hi Karin,

Total total peak number of residents is projected to be 523.

The underlying assumption is that x% of each size of unit across both retirement and apartment have 2 occupants, as follows: 0% of care units, 3% of studio units, 20% of 1 bedroom units, 65% of 2 bedroom units, and 100% of 3 bedroom units are projected to have 2 residents.

Regards,

Rudy Hanel
Consultant Project Director, Development, Ontario

1357 Baseline Road - Domestic Water Demand Estimates

	Senior Residance	Fridom Residence	Density
Studio	39.0	24.0	1.4
1 BR	101.0	89.0	1.4
2 BR	56.0	57.0	2.1
3 BR	4.0	4.0	3.1
Care	30.0	0.0	1.0

Building ID	Area (m^2)	Population	Daily Rate of Demand [1 2] ($L/m^2/day$)	Avg Day Demand		Max Day Demand [3,4]		Peak Hour Demand [3,4]	
				(L/min)	(L/s)	(L/min)	(L/s)	(L/min)	(L/s)
Senior Residence									
Residential		356	350	86.5	1.44	216.3	3.61	475.9	7.93
Fridom Residence									
Residential		290	350	70.6	1.18	176.4	2.94	388.1	6.47
Commercial(retail, institutional)	548		28000	1.1	0.02	1.6	0.03	2.9	0.05
Total Site :				**158.2**	**2.64**	**394.3**	**6.57**	**866.9**	**14.45**

1 Average day water demand for residential areas are equal to 350 L/cap/d
2 28,000 L/gross ha/day is used to calculate water demand for retail, office and institutional facilities.
3 Water demand criteria used to estimate peak demand rates for residential areas are as follows:
maximum day demand rate = 2.5 x average day demand rate
peak hour demand rate = 2.2 x maximum day demand rate
4 Water demand criteria used to estimate peak demand rates for commercial and institutional areas are as follows:
maximum day demand rate = 1.5 x average day demand rate
peak hour demand rate = 1.8 x maximum day demand rate

Fire Flow Calculations as per Ontario Building Code (Appendix A)

Job#	1604-01510	Designed by:	TKR
Date	3-Jan-20	Checked by:	KLS
		Description:	2nd Floor

$$Q = KVS_{tot}$$

Q = Volume of water required (L)

V = Total building volume (m3)

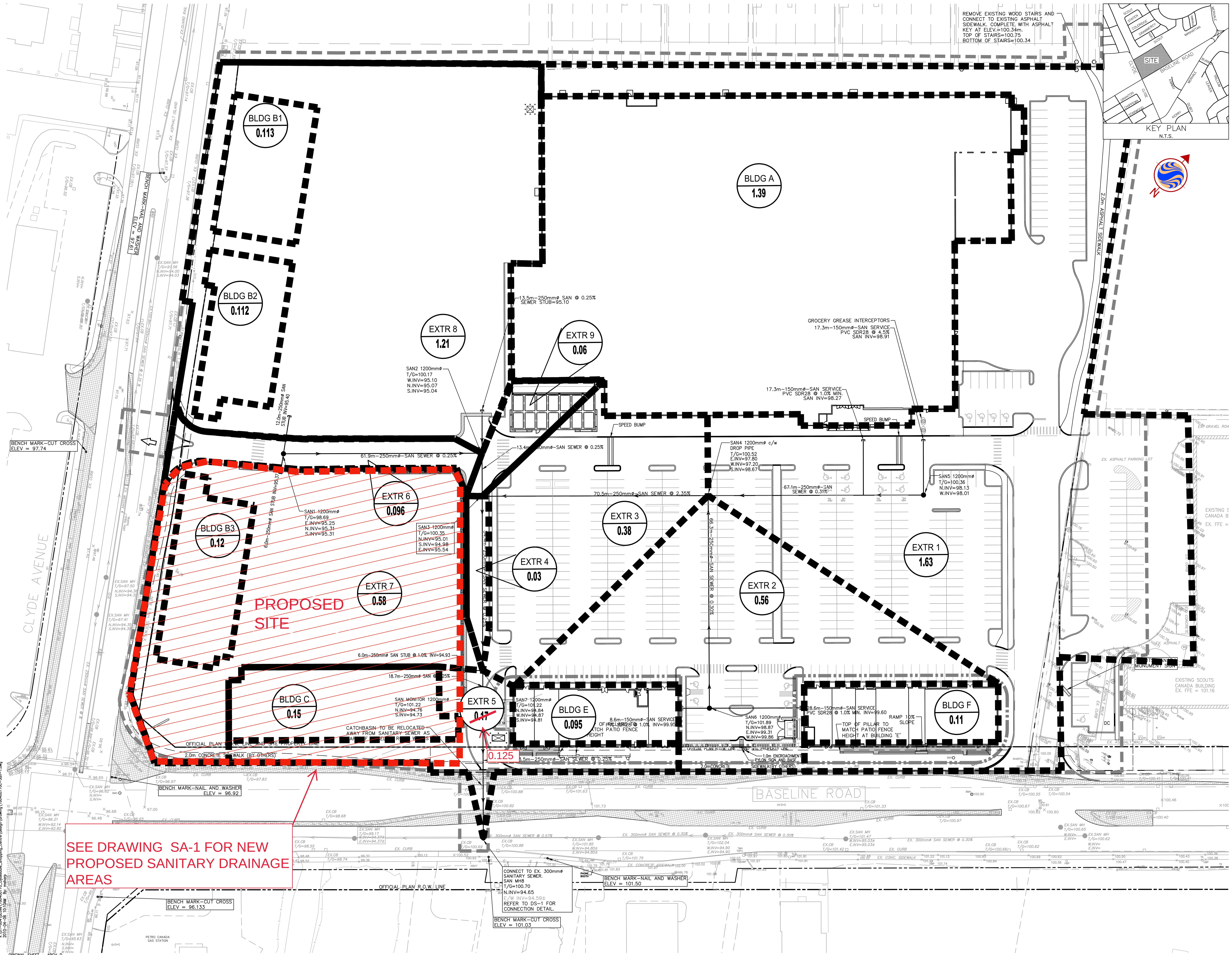
K = Water supply coefficient from Table 1

S_{tot} = Sotal of spatial coefficeint values from property line exposures on all sides as obtained from the formula

$S_{tot} = 1.0 + [S_{side1} + S_{side2} + S_{side3} + S_{side4}]$

1	Type of construction	Building Classification		Water Supply Coefficient
	Non-Combustible without Fire-Resistance Ratings	A-2, B-1, B-2, B-3, C, D		16
2	Area of one floor (m^2)	number of floors	height of ceiling (m)	Total Building Volume (m^3)
	2814.3	15	46.5	1,962,974
3	Side	Exposure Distance (m)	Spatial Coefficient	Total Spatial Coeffiecient
	North	12.8	0	1.49
	East	11.9	0	
	South	6.8	0	
	West	5.1	0.49	
4	Established Fire Safety Plan?	Reduction in Volume (%)		Total Volume Reduction
	no	0%		0%
5				**Total Volume 'Q' (L)**
				46,797,300
				Minimum Required Fire Flow (L/min)
				9,000

Appendix B SANITARY SEWER CALCULATIONS



Stantec

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Legend

- EXISTING SANITARY SEWER
- PROPOSED SANITARY SEWER
- DRAINAGE AREA ID (10)
- SANITARY DRAINAGE AREA (ha) (0.09)
- LIMIT OF SANITARY DRAINAGE AREA

Notes

GENERAL NOTES

1 ALL WORK SHALL BE CARRIED OUT IN COMPLIANCE WITH THE ONTARIO OCCUPATIONAL HEALTH AND SAFETY ACT AND REGULATIONS FOR CONSTRUCTION PROJECTS.

2 ALL WORK AND MATERIALS TO CONFORM WITH CURRENT MINISTRY OF THE ENVIRONMENT & ENERGY OF ONTARIO, CITY OF OTTAWA AND ONTARIO PROVINCIAL STANDARDS AND SPECIFICATIONS. LOCAL UTILITY STANDARDS AND MINISTRY OF TRANSPORTATION STANDARDS WILL APPLY WHERE REQUIRED.

3 THE CONTRACTOR IS ADVISED THAT WORKS BY OTHERS MAY BE ONGOING DURING THE PERIOD OF THIS CONTRACT. THE CONTRACTOR SHALL COORDINATE CONSTRUCTION ACTIVITIES AND COORDINATION WITH ALL OTHER CONTRACTORS AND PREVENT CONSTRUCTION CONFLICTS.

4 THE INFORMATION SHOWN FOR EXISTING UTILITIES WAS PROVIDED BY OTHERS. THE CONTRACTOR IS RESPONSIBLE FOR LOCATING AND PROTECTING ALL UTILITIES DURING CONSTRUCTION. ALL EXISTING UTILITIES MUST BE LOCATED AND VERIFIED BY EACH UTILITY PRIOR TO COMMENCEMENT OF WORK. ANY VARIANCE IS TO BE IMMEDIATELY REPORTED TO THE ENGINEER. LOST TIME DUE TO FAILURE OF THE CONTRACTOR TO CONFIRM UTILITY LOCATIONS AND NOTIFY THE ENGINEER OF POSSIBLE CONFLICTS PRIOR TO CONSTRUCTION WILL BE AT THE CONTRACTORS EXPENSE.

5 ALL CONSTRUCTION SHALL BE CARRIED OUT IN ACCORDANCE WITH THE RECOMMENDATIONS MADE IN THE GEOTECHNICAL REPORT.

6 THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING ALL PERMITS REQUIRED AND TO BEAR THE COST OF SAME INCLUDING WATER PERMIT AND ASSOCIATED COSTS.

7 ALL DISTURBED AREAS SHALL BE REINSTATED TO EQUAL OR BETTER CONDITION TO THE SATISFACTION THE ENGINEER AND THE CITY. PAVEMENT REINSTATEMENT FOR SERVICE AND UTILITY CUTS SHALL BE IN ACCORDANCE WITH OPSD 509.010 AND OPSS 310.

8 FOR DETAILS RELATING TO STORMWATER MANAGEMENT AND ROOF DRAINAGE, SEE THE STORMWATER MANAGEMENT REPORT PREPARED BY STANTEC CONSULTING LTD. ROOF DRAINAGE TO BE PROVIDED VIA RESTRICTED RELEASE ROOF DRAINS AS DETAILED IN THE REPORT.

9 BENCHMARKS: IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THAT THE SITE BENCHMARK(S) HAS NOT BEEN ALTERED OR DISTURBED AND THAT ITS RELATIVE ELEVATION AND DESCRIPTION AGREES WITH THE INFORMATION SHOWN ON DRAWING GP-1.

10 THE CONTRACTOR SHALL PROVIDE TO THE ENGINEER 1 (ONE) SET OF AS CONSTRUCTED SITE SERVICING, GRADING, AND SITE ELECTRICAL DWGS.

Revision	By	Appd.	YY.MM.DD
1. ISSUED FOR REVIEW	MJS	PM	09.05.20

File Name: 160400770	Dwn.	Chkd.	Dsgn.	YY.MM.DD
	MJS	PM	MJS	09.05.20

Seal

Client/Project

CLYDESDALE SHOPPING CENTRE

1357 BASELINE ROAD
Ottawa ON Canada

Title

SANITARY DRAINAGE AREA PLAN

Project No. 160400770

Scale 1:500

Drawing No. SAN-1

Sheet 1 of 4

Revision 1

Stantec

SUBDIVISION:

1357 Baseline Road

DATE: 10/6/2020
REVISION: 2
DESIGNED BY: TR
CHECKED BY: KS

SANITARY SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: 160401510

DESIGN PARAMETERS

MAX PEAK FACTOR (RES.)=	4.0	AVG. DAILY FLOW / PERSON	280 l/p/day	MINIMUM VELOCITY	0.60 m/s
MIN PEAK FACTOR (RES.)=	2.0	COMMERCIAL	28,000 l/ha/day	MAXIMUM VELOCITY	3.00 m/s
PEAKING FACTOR (INDUSTRIAL):	2.4	INDUSTRIAL (HEAVY)	55,000 l/ha/day	MANNINGS n	0.013
PEAKING FACTOR (COMM., INST.):	1.0	INDUSTRIAL (LIGHT)	35,000 l/ha/day	BEDDING CLASS	B
PERSONS / STUDIO (1 BED)	1.4	INSTITUTIONAL	50,000 l/ha/day	MINIMUM COVER	2.50 m
PERSONS / 2 BED APT	2.1	INFILTRATION	0.33 l/s/Ha		
PERSONS / 3 BED APT	3.1	HARMON CORRECTION FACTOR	0.8		
CARE UNITS	1.0				

LOCATION			RESIDENTIAL AREA AND POPULATION										COMMERCIAL		INDUSTRIAL (L)	
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (ha)	UNITS STUDIO 1 BED	2 BED	3 BED	CARE UNITS	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)
FRIDOM	STUB	SAN1	0.354	113	57	4	0	290	0.35	290	3.47	3.26	0.000	0.000	0.00	0.00
BLDG B	STUB	SAN1	0.000	0	0	0	0	0	0.00	0	3.80	0.00	0.188	0.188	0.00	0.00
EXTR 6	SAN1	SAN2	0.000	0	0	0	0	0	0.35	290	3.47	3.26	0.000	0.188	0.00	0.00
EXTR 8	SAN10	SAN2	0.000	0	0	0	0	0	0.00	0	3.80	0.00	0.000	0.000	0.00	0.00
EXTR 9	SAN2	SAN3	0.000	0	0	0	0	0	0.35	290	3.47	3.26	0.000	0.188	0.00	0.00
BLDG A	STUB	SAN5	0.000	0	0	0	0	0	0.00	0	3.80	0.00	1.390	1.390	0.00	0.00
EXTR 1	SAN5	SAN4	0.000	0	0	0	0	0	0.00	0	3.80	0.00	0.000	1.390	0.00	0.00
BLDG E	STUB	SAN6	0.000	0	0	0	0	0	0.00	0	3.80	0.00	0.095	0.095	0.00	0.00
BLDG F	STUB	SAN6	0.000	0	0	0	0	0	0.00	0	3.80	0.00	0.110	0.110	0.00	0.00
EXTR 2	SAN6	SAN4	0.000	0	0	0	0	0	0.00	0	3.80	0.00	0.000	0.205	0.00	0.00
EXTR 3	SAN4	SAN3	0.000	0	0	0	0	0	0.00	0	3.80	0.00	0.000	1.595	0.00	0.00
EXTR 4	SAN3	SAN3A	0.000	0	0	0	0	0	0.35	290	3.47	3.26	0.000	1.783	0.00	0.00
SENIORS	STUB	SAN3A	0.468	140	56	4	30	356	0.47	356	3.44	3.96	0.058	0.058	0.00	0.00
	SAN3A	SAN7	0.000	0	0	0	0	0	0.82	0	3.80	0.00	0.000	1.841	0.00	0.00
EXTR 5	SAN7	SAN8	0.000	0	0	0	0	0	0.82	647	3.33	6.99	0.000	1.841	0.00	0.00

AREA ID	INDUSTRIAL (H)		INSTITUTIONAL		GREEN / UNUSED		C+I+I	INFILTRATION			TOTAL	PIPE								
NUMBER	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	FLOW (l/s)	LENGTH (m)	DIA (mm)	MATERIAL	CLASS	SLOPE (%)	CAP. (FULL) (l/s)	CAP. V PEAK FLOW (%)	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
FRIDOM	0.00	0.00	0.00	0.00	0.000	0.00	0.00	0.354	0.35	0.12	3.38	11.7	250	PVC	SDR 35	1.00	60.6	**5.57%**	1.22	0.56
BLDG B	0.00	0.00	0.00	0.00	0.000	0.00	0.06	0.188	0.19	0.06	0.12	15.5	250	PVC	SDR 35	1.00	60.6	**0.20%**	1.22	0.19
EXTR 6	0.00	0.00	0.00	0.00	0.096	0.10	0.06	0.096	0.64	0.21	3.53	33.6	250	PVC	SDR 35	0.31	33.8	**10.47%**	0.68	0.36
EXTR 8	0.00	0.00	0.00	0.00	1.247	1.25	0.00	1.247	1.25	0.41	0.41	47.0	250	PVC	SDR 35	0.25	30.3	**1.36%**	0.61	0.18
EXTR 9	0.00	0.00	0.00	0.00	0.060	1.40	0.06	0.060	1.95	0.64	3.97	13.4	250	PVC	SDR 35	0.25	30.3	**13.08%**	0.61	0.35
BLDG A	0.00	0.00	0.00	0.00	0.000	0.00	0.45	1.390	1.39	0.46	0.91	17.3	150	PVC	DR 28	1.00	15.3	**5.93%**	0.86	0.39
EXTR 1	0.00	0.00	0.00	0.00	1.630	1.63	0.45	1.630	3.02	1.00	1.45	67.1	250	PVC	SDR 35	0.31	33.8	**4.29%**	0.68	0.28
BLDG E	0.00	0.00	0.00	0.00	0.000	0.00	0.03	0.095	0.10	0.03	0.06	8.6	150	PVC	DR 28	1.00	15.3	**0.41%**	0.86	0.16
BLDG F	0.00	0.00	0.00	0.00	0.000	0.00	0.04	0.110	0.11	0.04	0.07	28.6	150	PVC	DR 28	1.00	15.3	**0.47%**	0.86	0.19
EXTR 2	0.00	0.00	0.00	0.00	0.560	0.56	0.07	0.560	0.77	0.25	0.32	66.3	250	PVC	SDR 35	0.30	33.2	**0.96%**	0.67	0.18
EXTR 3	0.00	0.00	0.00	0.00	0.380	2.57	0.52	0.380	4.17	1.37	1.89	70.5	250	PVC	SDR 35	2.35	92.9	**2.03%**	1.87	0.61
EXTR 4	0.00	0.00	0.00	0.00	0.030	4.00	0.58	0.030	6.14	2.03	5.87	23.5	250	PVC	SDR 35	0.18	25.7	**22.80%**	0.52	0.35
SENIORS	0.00	0.00	0.00	0.00	0.000	0.00	0.02	0.525	0.53	0.17	4.16	12.1	250	PVC	SDR 35	0.50	42.9	9.70%	0.86	0.45
	0.00	0.00	0.00	0.00	0.000	4.00	0.60	0.000	0.00	0.00	0.60	29.2	250	PVC	SDR 35	0.50	42.9	1.39%	0.86	0.27
EXTR 5	0.00	0.00	0.00	0.00	0.125	4.13	0.60	0.125	6.79	2.24	9.82	33.6	250	PVC	SDR 35	0.31	33.8	29.10%	0.68	0.49

Appendix C STORMWATER MANAGEMENT CALCULATIONS

Stantec

1357 Baseline Road

DATE: 2020-10-07
REVISION: 2
DESIGNED BY: TR
CHECKED BY: DT

STORM SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: 160401510

DESIGN PARAMETERS

$I = a / (t+b)^c$ (As per City of Ottawa Guidelines, 2012)

	1:2 yr	1:5 yr	1:10 yr	1:100 yr
a =	732.951	998.071	1174.184	1735.688
b =	6.199	6.053	6.014	6.014
c =	0.810	0.814	0.816	0.820

MANNING'S n = 0.013
MINIMUM COVER: 2.00 m
TIME OF ENTRY 10 min
BEDDING CLASS = B

LOCATION / DRAINAGE AREA

AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (2-YEAR) (ha)	AREA (5-YEAR) (ha)	AREA (10-YEAR) (ha)	AREA (100-YEAR) (ha)	AREA (ROOF) (ha)	C (2-YEAR) (-)	C (5-YEAR) (-)	C (10-YEAR) (-)	C (100-YEAR) (-)	A x C (2-YEAR) (ha)	ACCUM AxC (2YR) (ha)	A x C (5-YEAR) (ha)	ACCUM. AxC (5YR) (ha)	A x C (10-YEAR) (ha)	ACCUM. AxC (10YR) (ha)	A x C (100-YEAR) (ha)	ACCUM. AxC (100YR) (ha)	T of C (min)	I_{2-YEAR} (mm/h)	I_{5-YEAR} (mm/h)	$I_{10-YEAR}$ (mm/h)	$I_{100-YEAR}$ (mm/h)	$Q_{CONTROL}$ (L/s)	ACCUM. $Q_{CONTROL}$ (L/s)	Q_{ACT} (CIA/360) (L/s)
500a, 500b, 500c, 500d	CBMH101	STM107	0.00	0.739	0.00	0.00	0.000	0.00	0.90	0.00	0.00	0.000	0.000	0.665	0.665	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	192.5
																				12.83							
108, CB107, CB110	STM108	STM107	0.00	0.325	0.00	0.00	0.000	0.00	0.88	0.00	0.00	0.000	0.000	0.286	0.286	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	82.9
																				12.41							
Roof A	STM107	STM106	0.00	0.000	0.00	0.00	1.346	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.951	0.000	0.000	0.000	0.000	12.83	67.42	91.30	106.96	156.26	27.0	27.0	268.3
CMH100	STM106	STM105	0.00	0.546	0.00	0.00	0.000	0.00	0.90	0.00	0.00	0.000	0.000	0.491	1.443	0.000	0.000	0.000	0.000	14.07	64.05	86.68	101.52	148.28	0.0	27.0	374.4
																				15.10							
CB109, 105, Roof E, Roof F	STM109	STM105	0.00	0.631	0.00	0.00	0.206	0.00	0.90	0.00	0.00	0.000	0.000	0.568	0.568	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	7.0	7.0	171.4
																				11.61							
104	STM105	STM104	0.00	0.168	0.00	0.00	0.000	0.00	0.90	0.00	0.00	0.000	0.000	0.151	2.162	0.000	0.000	0.000	0.000	15.10	61.54	83.25	97.49	142.36	0.0	34.0	533.9
																				16.31							
F111A	STM111	STM110	0.00	0.136	0.00	0.00	0.000	0.00	0.90	0.00	0.00	0.000	0.000	0.122	0.122	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	35.4
	STM110	STM104	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.122	0.000	0.000	0.000	0.000	11.66	70.98	96.19	112.72	164.71	0.0	0.0	32.7
																				11.81							
	STM104	STM103	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.000	2.284	0.000	0.000	0.000	0.000	16.31	58.84	79.55	93.14	135.97	0.0	34.0	538.8
																				16.41							
902	CB	CBMH901	0.00	0.187	0.00	0.00	0.000	0.00	0.22	0.00	0.00	0.000	0.000	0.041	0.041	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	11.9
	CBMH901	STM900	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.041	0.000	0.000	0.000	0.000	11.50	71.50	96.90	113.55	165.94	0.0	0.0	11.1
																				11.77							
900A, 900B, UNDR	STM900	STM103	0.00	0.595	0.00	0.00	0.000	0.00	0.90	0.00	0.00	0.000	0.000	0.536	0.577	0.000	0.000	0.000	0.000	11.77	70.62	95.69	112.13	163.86	0.0	0.0	153.3
																				13.36							
F EX103A	STM103	STM102	0.00	0.143	0.00	0.00	0.000	0.00	0.90	0.00	0.00	0.000	0.000	0.129	2.990	0.000	0.000	0.000	0.000	16.41	58.63	79.26	92.80	135.49	0.0	34.0	692.3
																				17.34							
Roof B1	BLDG B1	STM102	0.00	0.000	0.00	0.00	0.188	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	6.0	6.0	6.0
																				10.67							
F EX102A	STM102	STM101	0.00	0.034	0.00	0.00	0.000	0.00	0.90	0.00	0.00	0.000	0.000	0.031	3.020	0.000	0.000	0.000	0.000	17.34	56.74	76.68	89.77	131.04	0.0	40.0	683.4
101A, R100-104, F505A-D,F100 , F EX102B	STM101	STRMCPTR	0.00	0.238	0.00	0.00	0.709	0.00	0.90	0.00	0.00	0.000	0.000	0.214	3.234	0.000	0.000	0.000	0.000	17.55	56.34	76.13	89.12	130.08	74.6	114.6	798.6
	STRMCPTR	MONITOR	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.000	3.234	0.000	0.000	0.000	0.000	17.57	56.30	76.08	89.06	130.00	0.0	114.6	798.2
	MONITOR	OUTLET	0.00	0.000	0.00	0.00	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.000	3.234	0.000	0.000	0.000	0.000	17.58	56.29	76.06	89.04	129.96	0.0	114.6	798.0
																				17.68							

PIPE SELECTION

FROM M.H.	TO M.H.	LENGTH (m)	PIPE WIDTH OR DIAMETE (mm)	PIPE HEIGHT (mm)	PIPE SHAPE (-)	MATERIAL (-)	CLASS (-)	SLOPE %	Q_{CAP} (FULL) (L/s)	% FULL (-)	VEL. (FULL) (m/s)	VEL. (ACT) (m/s)	TIME OF FLOW (min)
CBMH101	STM107	115.7	900	900	CIRCULAR	CONCRETE	-	0.10	597.2	**32.23%**	0.91	0.68	2.83
STM108	STM107	76.4	900	900	CIRCULAR	CONCRETE	-	0.10	597.2	**13.88%**	0.91	0.53	2.41
STM107	STM106	56.4	900	900	CIRCULAR	CONCRETE	-	0.10	597.2	**44.92%**	0.91	0.76	1.24
STM106	STM105	51.1	900	900	CIRCULAR	CONCRETE	-	0.10	597.2	**62.69%**	0.91	0.83	1.02
STM109	STM105	63.3	900	900	CIRCULAR	CONCRETE	-	0.10	597.2	**28.69%**	0.91	0.66	1.61
STM105	STM104	67.4	900	900	CIRCULAR	CONCRETE	-	0.10	597.2	**89.40%**	0.91	0.92	1.22
STM111	STM110	67.7	375	375	CIRCULAR	PVC	-	0.30	90.3	**39.24%**	0.86	0.68	1.66
STM110	STM104	6.0	375	375	CIRCULAR	PVC	-	0.30	90.3	**36.22%**	0.86	0.67	0.15
STM104	STM103	16.4	900	900	CIRCULAR	CONCRETE	-	2.32	2876.6	**18.73%**	4.38	2.79	0.10
CB	CBMH901	54.4	300	300	CIRCULAR	PVC	-	0.50	68.0	**17.51%**	0.97	0.61	1.50
CBMH901	STM900	9.7	300	300	CIRCULAR	PVC	-	0.50	68.0	**16.29%**	0.97	0.59	0.27
STM900	STM103	61.0	900	900	CIRCULAR	CONCRETE	-	0.10	597.2	**25.67%**	0.91	0.64	1.60
STM103	STM102	62.8	900	900	CIRCULAR	CONCRETE	-	0.14	706.6	**97.97%**	1.08	1.12	0.93
BLDG B1	STM102	26.0	250	250	CIRCULAR	PVC	-	1.00	60.4	**9.93%**	1.22	0.65	0.67
STM102	STM101	20.0	1050	1050	CIRCULAR	CONCRETE	-	0.40	1801.7	**37.93%**	2.02	1.59	0.21
STM101	STRMCPTR	2.5	675	675	CIRCULAR	CONCRETE	-	0.80	784.4	**101.82%**	2.12	2.24	0.02
STRMCPTR	MONITOR	1.0	675	675	CIRCULAR	CONCRETE	-	1.00	876.9	**91.02%**	2.37	2.43	0.01
MONITOR	OUTLET	15.1	675	675	CIRCULAR	CONCRETE	-	1.00	876.9	**91.00%**	2.37	2.43	0.10
			900	900									

* NOTE: Areas tributary to storage tank & ICD discharging downstream of STM 101 controlled to a maximum of 74.6L/s (100yr event)
* NOTE: In-line inlet control device at STM101 limits outflow to downstream sewers / stormceptor

```
[TITLE]

[OPTIONS]
;;Options            Value
;;------------------ ------------
FLOW_UNITS           LPS
INFILTRATION         HORTON
FLOW_ROUTING         DYNWAVE
LINK_OFFSETS         ELEVATION
MIN_SLOPE            0
ALLOW_PONDING        YES
SKIP_STEADY_STATE    NO

START_DATE           01/01/1995
START_TIME           00:00:00
REPORT_START_DATE    01/01/1995
REPORT_START_TIME    00:00:00
END_DATE             01/01/1995
END_TIME             06:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          00:01:00
WET_STEP             00:01:00
DRY_STEP             00:05:00
ROUTING_STEP         1
RULE_STEP            00:00:00

INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP        0
LENGTHENING_STEP     0
MIN_SURFAREA         0
MAX_TRIALS           8
HEAD_TOLERANCE       0.0015
SYS_FLOW_TOL         5
```



```
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              4

[EVAPORATION]
;;Type          Parameters
;;------------- ----------
MONTHLY          0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0    0.0
DRY_ONLY         NO

[RAINGAGES]
;;              Rain      Time     Snow     Data
;;Name          Type      Intrvl   Catch    Source
;;------------- --------- -------- -------- ----------
RG1             INTENSITY 0:10     1.0      TIMESERIES 100yrCHI

[SUBCATCHMENTS]
;;                                                 Total    Pcnt.             Pcnt.    Curb     Snow
;;Name          Raingage         Outlet           Area     Imperv   Width    Slope    Length   Pack
;;------------- ---------------- ---------------- -------- -------- -------- -------- -------- --------
101A            RG1              STM101           0.2305   100      43.2     1        0

104             RG1              STM104A-S        0.1774   100      37.8     1        0

105             RG1              CB105-S          0.537    100      120.8    1        0

108             RG1              STM108           0.064    100      14.4     1        0

500A            RG1              CMH101-S         0.151    100      34       1        0

500B            RG1              500B-S           0.239    100      53.8     1        0

500C            RG1              500C-S           0.272    100      61.2     1        0

500D            RG1              CMH101-S         0.077    100      17.3     1        0

900A            RG1              900A-S           0.386    100      86.9     1        0
```

900B	RG1	900B-S	0.187	100	42.1	1	0
902	RG1	STM902	0.187	2.86	42.1	1	0
CB107	RG1	CB107-S	0.22	100	49.5	1	0
CB109	RG1	CB109-S	0.094	85.71	21.2	1	0
CB110	RG1	CB110-S	0.041	78.57	9.2	1	0
CMH100	RG1	CMH100-S	0.546	100	122.9	1	0
F_EX102A	RG1	CB500-S	0.0344	100	26.85	2	0
F_EX102B	RG1	CB102B-S	0.0136	100	25.29	2	0
F_EX103A	RG1	CB501-S	0.143	100	70.35	2	0
F100	RG1	TANK	0.2299	81.429	106	2	0
F111A	RG1	STM111	0.1358	100	77.146	2	0
F505A	RG1	TANK	0.0046	0	13.325	1.5	0
F505B	RG1	TANK	0.0073	28.571	13.09	1.5	0
F505C	RG1	TANK	0.0074	28.571	13.146	1.5	0
F505D	RG1	TANK	0.0088	27.143	15.54	1.5	0
R100	RG1	TANK	0.1028	100	50.14	1.5	0
R101	RG1	TANK	0.0486	100	22.23	1.5	0
R103	RG1	TANK	0.1134	100	57.13	1.5	0

R104	RG1	TANK	0.1869	100	84.44	2	0
ROOFA	RG1	RoofA-S	1.346	100	302.9	1	0
ROOFB1	RG1	RoofB1-S	0.188	100	42.3	1	0
ROOFE	RG1	RoofE-S	0.095	100	21.4	1	0
ROOFF	RG1	RoofF-S	0.111	100	25	1	0
UNC1	RG1	OF	0.208	24.29	46.8	1	0
UNC-1	RG1	OF	0.0048	100	20	1.5	0
UNC2	RG1	OF	0.1886	64.29	42.435	1	0
UNC-2	RG1	OF	0.0011	100	2.72	1.5	0
UNC-3	RG1	OF	0.0017	100	2.72	1.5	0
UNC-4	RG1	OF	0.0041	100	7.187	1.5	0
UNDR	RG1	900A-S	0.022	100	5	1	0

[SUBAREAS]

;;Subcatchment	N-Imperv	N-Perv	S-Imperv	S-Perv	PctZero	RouteTo	PctRouted
;;--------------	----------	----------	----------	----------	----------	----------	----------
101A	0.013	0.025	1.57	4.67	0	OUTLET	
104	0.013	0.025	1.57	4.67	0	OUTLET	
105	0.013	0.025	1.57	4.67	0	OUTLET	
108	0.013	0.025	1.57	4.67	0	OUTLET	
500A	0.013	0.025	1.57	4.67	0	OUTLET	
500B	0.013	0.025	1.57	4.67	0	OUTLET	
500C	0.013	0.025	1.57	4.67	0	OUTLET	
500D	0.013	0.025	1.57	4.67	0	OUTLET	
900A	0.013	0.025	1.57	4.67	0	OUTLET	

```
900B            0.013      0.025      1.57       4.67       0          OUTLET
902             0.013      0.025      1.57       4.67       0          OUTLET
CB107           0.013      0.025      1.57       4.67       0          OUTLET
CB109           0.013      0.025      1.57       4.67       0          OUTLET
CB110           0.013      0.025      1.57       4.67       0          OUTLET
CMH100          0.013      0.025      1.57       4.67       0          OUTLET
F_EX102A        0.013      0.025      1.57       4.67       0          OUTLET
F_EX102B        0.013      0.025      1.57       4.67       0          OUTLET
F_EX103A        0.013      0.025      1.57       4.67       0          OUTLET
F100            0.013      0.025      1.57       4.67       0          OUTLET
F111A           0.013      0.025      1.57       4.67       0          OUTLET
F505A           0.013      0.025      1.57       4.67       0          OUTLET
F505B           0.013      0.025      1.57       4.67       0          OUTLET
F505C           0.013      0.025      1.57       4.67       0          OUTLET
F505D           0.013      0.025      1.57       4.67       0          OUTLET
R100            0.013      0.025      1.57       4.67       0          OUTLET
R101            0.013      0.025      1.57       4.67       0          OUTLET
R103            0.013      0.025      1.57       4.67       0          OUTLET
R104            0.013      0.025      1.57       4.67       0          OUTLET
ROOFA           0.013      0.025      1.57       4.67       0          OUTLET
ROOFB1          0.013      0.025      1.57       4.67       0          OUTLET
ROOFE           0.013      0.025      1.57       4.67       0          OUTLET
ROOFF           0.013      0.025      1.57       4.67       0          OUTLET
UNC1            0.013      0.025      1.57       4.67       0          OUTLET
UNC-1           0.013      0.025      1.57       4.67       0          OUTLET
UNC2            0.013      0.025      1.57       4.67       0          OUTLET
UNC-2           0.013      0.025      1.57       4.67       0          OUTLET
UNC-3           0.013      0.025      1.57       4.67       0          OUTLET
UNC-4           0.013      0.025      1.57       4.67       0          OUTLET
UNDR            0.013      0.025      1.57       4.67       0          OUTLET

[INFILTRATION]
;;Subcatchment   MaxRate    MinRate    Decay      DryTime    MaxInfil
;;-------------- ---------- ---------- ---------- ---------- ----------
101A            76.2       13.2       4.14       7          0
104             76.2       13.2       4.14       7          0
105             76.2       13.2       4.14       7          0
```



```
108             76.2       13.2       4.14       7          0
500A            76.2       13.2       4.14       7          0
500B            76.2       13.2       4.14       7          0
500C            76.2       13.2       4.14       7          0
500D            76.2       13.2       4.14       7          0
900A            76.2       13.2       4.14       7          0
900B            76.2       13.2       4.14       7          0
902             76.2       13.2       4.14       7          0
CB107           76.2       13.2       4.14       7          0
CB109           76.2       13.2       4.14       7          0
CB110           76.2       13.2       4.14       7          0
CMH100          76.2       13.2       4.14       7          0
F_EX102A        76.2       13.2       4.14       7          0
F_EX102B        76.2       13.2       4.14       7          0
F_EX103A        76.2       13.2       4.14       7          0
F100            76.2       13.2       4.14       7          0
F111A           76.2       13.2       4.14       7          0
F505A           76.2       13.2       4.14       7          0
F505B           76.2       13.2       4.14       7          0
F505C           76.2       13.2       4.14       7          0
F505D           76.2       13.2       4.14       7          0
R100            76.2       13.2       4.14       7          0
R101            76.2       13.2       4.14       7          0
R103            76.2       13.2       4.14       7          0
R104            76.2       13.2       4.14       7          0
ROOFA           76.2       13.2       4.14       7          0
ROOFB1          76.2       13.2       4.14       7          0
ROOFE           76.2       13.2       4.14       7          0
ROOFF           76.2       13.2       4.14       7          0
UNC1            76.2       13.2       4.14       7          0
UNC-1           76.2       13.2       4.14       7          0
UNC2            76.2       13.2       4.14       7          0
UNC-2           76.2       13.2       4.14       7          0
UNC-3           76.2       13.2       4.14       7          0
UNC-4           76.2       13.2       4.14       7          0
UNDR            76.2       13.2       4.14       7          0
```

```
[LID_CONTROLS]
;;               Type/Layer Parameters
;;-------------- ---------- ----------
LID1-R101        GR
LID1-R101        SURFACE    150        0.05       0.13       0          5
LID1-R101        SOIL       150        0.65       0.55       0.2        36         10.0       8.5
LID1-R101        DRAINMAT   3          0.5        0.1

[LID_USAGE]
;;Subcatchment   LID Process      Number  Area       Width      InitSatur  FromImprv  ToPerv     Report
File              Drain to         FromPerv
;;-------------- ---------------- ------- ---------- ---------- ---------- ---------- ---------- ----------
----------------------- ---------------- ----------------
R101             LID1-R101        1       437.4      21.2       0          100        0          *
              *                100

[JUNCTIONS]
;;               Invert     Max.       Init.      Surcharge  Ponded
;;Name           Elev.      Depth      Depth      Depth      Area
;;-------------- ---------- ---------- ---------- ---------- ----------
OF               93.73      4.27       0.68       0          0
ORF900B          96.77      2.07       0          0          0
STM101           93.98      4.09       0.43       0          0
STM104A          96.98      3.4        0          0          0
STM902           99.16      1.29       0          0          0
STRMCPTR         93.921     4.049      0.489      0          0

[OUTFALLS]
;;               Invert     Outfall    Stage/Table      Tide
;;Name           Elev.      Type       Time Series      Gate     Route To
;;-------------- ---------- ---------- ---------------- -------- ----------------
OF1              93.72      FIXED      94.41            NO

[STORAGE]
;;               Invert   Max.       Init.      Storage    Curve                                      Evap.
;;Name           Elev.    Depth      Depth      Curve      Params                                     Frac.
Infiltration parameters
```



```
;;-------------- -------- ---------- ---------- ---------- --------- --------- -------- -------- --------
-----------------------
500B-S           98.26    2.1        0          TABULAR    500b-IC                      0        0
500C-S           98.4     2.14       0          TABULAR    500c-IC                      0        0
900A-S           96.83    1.87       0          TABULAR    900A-IC                      0        0
900B-S           96.77    2.07       0          TABULAR    900B-IC                      0        0
CB102B-S         96.27    1.8        0          FUNCTIONAL 0         0         0        0        0
CB105-S          98.25    2.08       0          TABULAR    STM105-IC                    0        0
CB107-S          98.56    2.09       0          TABULAR    CB107-IC                     0        0
CB109-S          99.05    2.37       0          TABULAR    CB109-IC                     0        0
CB110-S          98.6     2.06       0          TABULAR    CB110-IC                     0        0
CB500-S          97.13    1.46       0          FUNCTIONAL 0         0         0        0        0
CB501-S          96.76    2.51       0          FUNCTIONAL 0         0         0        0        0
CB902A           97.07    1.43       0          FUNCTIONAL 0         0         0.36     0        0
CBMH901          96.76    3.77       0          FUNCTIONAL 0         0         1.13     0        0
CMH100-S         98.09    2.41       0          TABULAR    CMH100-IC                    0        0
CMH101-S         97.74    2.62       0          TABULAR    CMH101-IC                    0        0
MONITOR          93.881   4.049      0.529      FUNCTIONAL 0         0         1.13     0        0
ORF101           94.026   4.014      0.384      FUNCTIONAL 0         0         1.13     0        0
RoofA-S          110      0.15       0          TABULAR    ROOFA-S                      0        0
RoofB1-S         110      0.15       0          TABULAR    ROOFB1-S                     0        0
RoofE-S          110      0.15       0          TABULAR    ROOFE-S                      0        0
RoofF-S          110      0.15       0          TABULAR    ROOFF-S                      0        0
STM102           95.9     2.79       0          FUNCTIONAL 0         0         1.13     0        0
STM103           96.04    4.11       0          FUNCTIONAL 0         0         1.13     0        0
STM104A-S        98.25    2.08       0          TABULAR    STM104-IC                    0        0
STM104B-S        96.98    3.4        0          FUNCTIONAL 0         0         1.13     0        0
STM105-S         97.39    3.12       0          FUNCTIONAL 0         0         1.13     0        0
STM106           97.47    3.11       0          FUNCTIONAL 0         0         1.13     0        0
STM107           97.56    3.33       0          FUNCTIONAL 0         0         1.13     0        0
STM108           98.1     2.7        0          FUNCTIONAL 0         0         1.13     0        0
STM109           97.61    4.18       0          FUNCTIONAL 0         0         1.13     0        0
STM110           97.76    2.39       0          FUNCTIONAL 0         0         1.49     0        0
STM111           98.03    2.84       0          FUNCTIONAL 0         0         1.85     0        0
STM900           96.15    3.62       0          FUNCTIONAL 0         0         1.13     0        0
TANK             94.41    2.71       0          FUNCTIONAL 0         0         83.8     0        0
```

[CONDUITS]

;;Name	Inlet Node	Outlet Node	Length	Manning N	Inlet Offset	Outlet Offset	Init. Flow	Max. Flow
C1	STM111	STM110	67.7	0.013	98.03	97.82	0	0
C3	OF	OF1	1	0.013	93.73	93.72	0	0
L1	CMH101-S	STM107	115.7	0.013	97.74	97.62	0	0
L11	STM107	STM106	56.4	0.013	97.56	97.5	0	0
L14	STM105-S	STM104A	64.078	0.013	97.39	97.32	0	0
L30	STM103	STM102	61.7	0.013	96.04	95.95	0	0
L32	ORF101	STRMCPTR	2.5	0.013	94.026	94.001	0	0
L34	STM108	STM107	76.4	0.013	98.1	98.02	0	0
L45	STM902	CB902A	179.1	0.013	99.16	97.1	0	0
L50	STM109	STM105-S	63.305	0.013	97.61	97.55	0	0
L51	STM106	STM105-S	51.1	0.013	97.47	97.42	0	0
L61	STM104B-S	STM103	16.447	0.013	96.98	96.63	0	0
L63	CB902A	CBMH901	54.4	0.013	97.07	96.79	0	0
L64	CBMH901	STM900	9.7	0.013	96.76	96.71	0	0
L65	STM900	STM103	49	0.013	96.15	96.09	0	0

L68	ORF900B	STM900	24.8	0.013	96.77	96.522	0	0
L70	STRMCPTR	MONITOR	1	0.013	93.921	93.911	0	0
L71	MONITOR	OF	18.845	0.013	93.881	93.73	0	0
L72	900A-S	STM900	3	0.013	96.83	96.8	0	0
L8	STM102	STM101	20.9	0.013	95.9	95.87	0	0

[ORIFICES]

;;Name	Inlet Node	Outlet Node	Orifice Type	Crest Height	Disch. Coeff.	Flap Gate	Open/Close Time
500B-IC	500B-S	STM107	SIDE	98.26	0.61	NO	0
500C-IC	500C-S	STM107	SIDE	98.4	0.61	NO	0
CB102B-IC1	CB102B-S	STM101	SIDE	96.27	0.61	NO	0
CB102B-IC2	CB102B-S	STM101	SIDE	96.27	0.61	NO	0
CB105-IC1	CB105-S	STM105-S	SIDE	98.25	0.61	NO	0
CB105-IC2	CB105-S	STM105-S	SIDE	98.25	0.61	NO	0
CB107-IC	CB107-S	STM107	SIDE	98.56	0.572	NO	0
CB109-IC	CB109-S	STM109	SIDE	99.05	0.61	NO	0
CB110-IC	CB110-S	STM108	SIDE	98.6	0.61	NO	0
CB500-IC	CB500-S	STM102	SIDE	97.06	0.61	NO	0
CB501-IC	CB501-S	STM103	SIDE	96.76	0.61	NO	0
CMH100-IC	CMH100-S	STM106	SIDE	98.09	0.61	NO	0
IC-TANK	TANK	ORF101	SIDE	94.41	0.61	NO	0
ORF_900B	900B-S	ORF900B	SIDE	96.77	0.572	NO	0
SMT101-IC	STM101	ORF101	SIDE	94.026	0.61	NO	0
STM104A-IC	STM104A-S	STM104A	SIDE	98.25	0.61	NO	0
STM104B-IC	STM104A	STM104B-S	SIDE	96.98	0.61	NO	0
STM110-IC	STM110	STM104B-S	SIDE	97.76	0.572	NO	0

[OUTLETS]

;; Inlet Outlet Outflow Outlet Qcoeff/
Flap

```
;;Name           Node             Node             Height     Type             QTable           Qexpon
Gate
;;-------------- ---------------- ---------------- ---------- ---------------- ---------------- ----------
----
RA-O             RoofA-S          STM106           110        TABULAR/HEAD     BLDGA-O
NO
RB-O             RoofB1-S         STM101           110        TABULAR/HEAD     BLDGB-O
NO
RE-O             RoofE-S          STM109           110        TABULAR/HEAD     BLDGE-O
NO
RF-O             RoofF-S          STM109           110        TABULAR/HEAD     BLDGF-O
NO

[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4      Barrels
;;-------------- ------------ ---------------- ---------- ---------- ---------- ----------
C1               CIRCULAR     0.375            0          0          0          1
C3               DUMMY        0                0          0          0          1
L1               CIRCULAR     0.9              1          1          1          1
L11              CIRCULAR     0.9              1          1          1          1
L14              CIRCULAR     0.9              1          1          1          1
L30              CIRCULAR     0.9              1          1          1          1
L32              CIRCULAR     0.675            1          1          1          1
L34              CIRCULAR     0.9              1          1          1          1
L45              CIRCULAR     0.3              1          1          1          1
L50              CIRCULAR     0.9              1          1          1          1
L51              CIRCULAR     0.9              1          1          1          1
L61              CIRCULAR     0.9              1          1          1          1
L63              CIRCULAR     0.3              1          1          1          1
L64              CIRCULAR     0.3              1          1          1          1
L65              CIRCULAR     0.9              1          1          1          1
L68              CIRCULAR     0.25             1          1          1          1
L70              CIRCULAR     0.675            1          1          1          1
L71              CIRCULAR     0.675            1          1          1          1
L72              CIRCULAR     0.2              1          1          1          1
L8               CIRCULAR     1.05             1          1          1          1
500B-IC          CIRCULAR     0.2              0          0          0
```



```
500C-IC          CIRCULAR     0.3              0          0          0
CB102B-IC1       CIRCULAR     0.2              0          0          0
CB102B-IC2       CIRCULAR     0.2              0          0          0
CB105-IC1        CIRCULAR     0.2              0          0          0
CB105-IC2        CIRCULAR     0.2              0          0          0
CB107-IC         CIRCULAR     0.127            0          0          0
CB109-IC         CIRCULAR     0.09             0          0          0
CB110-IC         CIRCULAR     0.075            0          0          0
CB500-IC         CIRCULAR     0.2              0          0          0
CB501-IC         CIRCULAR     0.2              0          0          0
CMH100-IC        CIRCULAR     0.25             0          0          0
IC-TANK          CIRCULAR     0.15             0          0          0
ORF_900B         CIRCULAR     0.154            0          0          0
SMT101-IC        CIRCULAR     0.38             0          0          0
STM104A-IC       CIRCULAR     0.2              0          0          0
STM104B-IC       CIRCULAR     0.25             0          0          0
STM110-IC        CIRCULAR     0.108            0          0          0

[TRANSECTS]
;;Transect Data in HEC-2 format
;
NC 0.013    0.013    0.013
X1 Roadway_Half      3        0.0      0.0      0.0      0.0      0.0      0.0      0.0
GR 0.15     0        0        0        0.12     4

[LOSSES]
;;Link           Inlet      Outlet     Average    Flap Gate  SeepageRate
;;-------------- ---------- ---------- ---------- ---------- ----------
L1               0          1.32       0          NO         0
L11              0          0.02       0          NO         0
L14              0          1.32       0          NO         0
L30              0          0.02       0          NO         0
L32              0          0.02       0          NO         0
L34              0          1.32       0          NO         0
L45              0          1.32       0          NO         0
L50              0          1.32       0          NO         0
L51              0          0.02       0          NO         0
```

```
L61             0          1.32       0          NO         0
L63             0          0.39       0          NO         0
L64             0          0.39       0          NO         0
L65             0          1.32       0          NO         0
L68             0          1.32       0          NO         0
L70             0          0.02       0          NO         0
L71             0          0.02       0          NO         0
L72             0          0.32       0          NO         0
L8              0          0.02       0          NO         0

[CURVES]
;;Name           Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
TANK-PUMP        Pump1      0          70
TANK-PUMP                   0.5        70
TANK-PUMP                   1          70
TANK-PUMP                   1.5        70
TANK-PUMP                   2          70

BLDGA-O          Rating     0          0
BLDGA-O                     0.025      17.6
BLDGA-O                     0.05       35.7
BLDGA-O                     0.075      52.9
BLDGA-O                     0.1        70.6
BLDGA-O                     0.2        139.3

BLDGB-O          Rating     0          0
BLDGB-O                     0.025      2.5
BLDGB-O                     0.05       5
BLDGB-O                     0.075      7.4
BLDGB-O                     0.1        9.9
BLDGB-O                     0.2        19.5

BLDGE-O          Rating     0          0
BLDGE-O                     0.025      1.2
BLDGE-O                     0.05       2.5
BLDGE-O                     0.075      3.7
```



```
BLDGE-O                     0.1        5
BLDGE-O                     0.2        9.8

BLDGF-O          Rating     0          0
BLDGF-O                     0.025      0.4
BLDGF-O                     0.05       0.8
BLDGF-O                     0.075      1.1
BLDGF-O                     0.1        1.5
BLDGF-O                     0.2        3

500b-IC          Storage    0          0
500b-IC                     1.8        0
500b-IC                     2.1        522.67

500c-IC          Storage    0          0
500c-IC                     1.8        0
500c-IC                     2.14       132.5

900A-IC          Storage    0          0
900A-IC                     1.57       0
900A-IC                     1.87       1174

900B-IC          Storage    0          0
900B-IC                     1.77       0
900B-IC                     2.07       183.3

CB107-IC         Storage    0          0
CB107-IC                    1.8        0
CB107-IC                    2.09       389.66

CB109-IC         Storage    0          0
CB109-IC                    2.2        0
CB109-IC                    2.37       128

CB110-IC         Storage    0          0
CB110-IC                    1.8        0
CB110-IC                    2.06       116.15
```

```
CMH100-IC        Storage    0          0
CMH100-IC                   0.525      27.79
CMH100-IC                   0.5251     0
CMH100-IC                   2.11       0
CMH100-IC                   2.41       824

CMH101-IC        Storage    0          0
CMH101-IC                   2.32       0
CMH101-IC                   2.62       380

ROOFA-S          Storage    0          0
ROOFA-S                     0.025      10771
ROOFA-S                     0.05       10771
ROOFA-S                     0.075      10771
ROOFA-S                     0.1        10771
ROOFA-S                     0.2        10771

ROOFB1-S         Storage    0          0
ROOFB1-S                    0.025      1507
ROOFB1-S                    0.05       1507
ROOFB1-S                    0.075      1507
ROOFB1-S                    0.1        1507
ROOFB1-S                    0.2        1507

ROOFE-S          Storage    0          0
ROOFE-S                     0.025      760
ROOFE-S                     0.05       760
ROOFE-S                     0.075      760
ROOFE-S                     0.1        760
ROOFE-S                     0.2        760

ROOFF-S          Storage    0          0
ROOFF-S                     0.025      888
ROOFF-S                     0.05       888
ROOFF-S                     0.075      888
ROOFF-S                     0.1        888
```



```
ROOFF-S                     0.2        888

STM104-IC        Storage    0          0
STM104-IC                   1.8        0
STM104-IC                   2.08       447.85

STM105-IC        Storage    0          0
STM105-IC                   1.8        0
STM105-IC                   2.08       676.42

[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
100yrCHI                    0:10       6.04573
100yrCHI                    0:20       7.54219
100yrCHI                    0:30       10.1588
100yrCHI                    0:40       15.96889
100yrCHI                    0:50       40.65497
100yrCHI                    1:00       178.559
100yrCHI                    1:10       54.04853
100yrCHI                    1:20       27.3187
100yrCHI                    1:30       18.24039
100yrCHI                    1:40       13.73692
100yrCHI                    1:50       11.05876
100yrCHI                    2:00       9.28521
100yrCHI                    2:10       8.02389
100yrCHI                    2:20       7.08022
100yrCHI                    2:30       6.34698
100yrCHI                    2:40       5.76029
100yrCHI                    2:50       5.27978
100yrCHI                    3:00       4.87871

5yrCHI                      0:10       3.68223
5yrCHI                      0:20       4.58232
5yrCHI                      0:30       6.15055
5yrCHI                      0:40       9.6141
5yrCHI                      0:50       24.17035
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5yrCHI                     1:00       104.193
5yrCHI                     1:10       32.03692
5yrCHI                     1:20       16.3375
5yrCHI                     1:30       10.96479
5yrCHI                     1:40       8.28693
5yrCHI                     1:50       6.68897
5yrCHI                     2:00       5.6279
5yrCHI                     2:10       4.87167
5yrCHI                     2:20       4.30483
5yrCHI                     2:30       3.8637
5yrCHI                     2:40       3.51028
5yrCHI                     2:50       3.22046
5yrCHI                     3:00       2.97831

[REPORT]
;;Reporting Options
INPUT      YES
CONTROLS   YES
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]

[MAP]
DIMENSIONS       364257.7732      5024908.9474     364649.4348      5025285.8866
UNITS            Meters

[COORDINATES]
;;Node           X-Coord          Y-Coord
;;-------------- ---------------- ----------------
OF               364312.336       5025001.612
ORF900B          364374.812       5025090.618
STM101           364339.028       5025015.871
STM104A          364421.543       5025044.254
STM902           364508.242       5025253.984
STRMCPTR         364330.724       5025012.357
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OF1              364301.746       5025018.852
500B-S           364539.868       5025169.412
500C-S           364541.573       5025150.916
900A-S           364353.592       5025101.592
900B-S           364369.167       5025084.799
CB102B-S         364340.665       5025009.567
CB105-S          364469.88        5025054.409
CB107-S          364583.471       5025143.393
CB109-S          364511.343       5025035.203
CB110-S          364612.328       5025089.374
CB500-S          364355.406       5025013.356
CB501-S          364383.528       5025030.044
CB902A           364354.83        5025161.938
CBMH901          364383.29        5025116.098
CMH100-S         364545.781       5025094.192
CMH101-S         364507.991       5025235.447
MONITOR          364328.55        5025011.214
ORF101           364334.834       5025014.135
RoofA-S          364508.902       5025121.665
RoofB1-S         364347.1         5025043.482
RoofE-S          364502.499       5025019.952
RoofF-S          364529.214       5025036.056
STM102           364357.664       5025023.736
STM103           364409.854       5025056.609
STM104A-S        364438.838       5025038.036
STM104B-S        364418.264       5025042.475
STM105-S         364475.679       5025078.529
STM106           364519.2         5025105.789
STM107           364566.601       5025138.782
STM108           364607.415       5025071.12
STM109           364509.622       5025025.098
STM110           364417.45        5025036.098
STM111           364448.738       5024981.523
STM900           364377.612       5025108.341
TANK             364340.946       5024997.56

[VERTICES]
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;;Link           X-Coord          Y-Coord
;;-------------- ---------------- ----------------
L45              364364.277       5025162.792
L72              364363.756       5025103.083
CB102B-IC1       364338.246       5025011.665
CB105-IC1        364471.022       5025060.946
CB105-IC2        364478.443       5025052.772

[POLYGONS]
;;Subcatchment   X-Coord          Y-Coord
;;-------------- ---------------- ----------------
101A             364394.672       5025051.112
101A             364389.933       5025042.349
101A             364351.748       5025018.159
101A             364350.793       5025017.554
101A             364337.431       5025011.52
101A             364335.521       5025016.024
101A             364336.718       5025018.805
101A             364333.993       5025023.086
101A             364332.844       5025022.393
101A             364329.061       5025028.402
101A             364330.077       5025029.041
101A             364330.218       5025029.662
101A             364326.435       5025035.67
101A             364367.015       5025061.214
101A             364372.534       5025058.76
101A             364376.781       5025058.264
101A             364383.031       5025064.845
101A             364387.238       5025068.025
101A             364392.533       5025071.359
101A             364384.518       5025084.091
101A             364396.777       5025091.808
101A             364405.11        5025078.57
101A             364405.347       5025078.718
101A             364411.276       5025069.204
101A             364405.825       5025065.874
101A             364405.362       5025065.051
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101A             364399.482       5025060.006
101A             364394.672       5025051.112
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104              364455.931       5025003.1
104              364448.466       5025007.973
104              364443.981       5025007.183
104              364442.701       5025006.958
104              364441.66        5025007.55
104              364440.57        5025008.848
104              364418.28        5025044.258
104              364416.852       5025046.87
104              364417.758       5025048.792
104              364420.36        5025051.939
104              364421.715       5025053.579
104              364427.687       5025060.803
104              364433.234       5025064.29
104              364432.193       5025074.549
104              364473.83        5025008.406
104              364458.619       5024998.831
105              364490.726       5025100.434
105              364520.265       5025053.447
105              364520.265       5025053.447
105              364523.681       5025047.606
105              364523.681       5025047.606
105              364523.685       5025046.258
105              364523.685       5025046.258
105              364516.852       5025042.125
105              364516.852       5025042.125
105              364508.558       5025036.904
105              364508.558       5025036.904
105              364501.844       5025032.572
105              364501.844       5025032.572
105              364498.369       5025029.626
105              364498.369       5025029.626
105              364500.126       5025024.959
105              364500.126       5025024.959
105              364473.83        5025008.406
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105	364473.83	5025008.406
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105	364432.193	5025074.549
105	364422.695	5025089.638
105	364422.695	5025089.638
105	364429.664	5025094.025
105	364429.664	5025094.025
105	364435.572	5025084.629
105	364435.572	5025084.629
105	364487.408	5025117.26
105	364487.408	5025117.26
105	364489.124	5025114.438
105	364489.124	5025114.438
105	364490.746	5025115.459
105	364490.746	5025115.459
105	364492.593	5025112.404
105	364492.593	5025112.404
105	364490.726	5025100.434
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108	364590.19	5025069.003
108	364590.19	5025069.003
108	364584.487	5025078.064
108	364584.487	5025078.064
108	364578.401	5025080.866
108	364578.401	5025080.866
108	364578.863	5025093.022
108	364578.863	5025093.022
108	364577.255	5025095.569
108	364577.255	5025095.569
108	364591.963	5025104.816
108	364591.963	5025104.816
108	364596.773	5025107.499
108	364596.773	5025107.499
108	364601.757	5025100.434
108	364601.757	5025100.434
108	364601.522	5025100.448
108	364601.522	5025100.448

108	364599.87	5025099.575
108	364599.87	5025099.575
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108	364599.684	5025089.757
108	364599.69	5025089.748
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108	364608.587	5025080.569
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500A	364544.035	5025206.581
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500A	364524.481	5025205.534
500A	364524.481	5025205.534
500A	364518.449	5025202.516
500A	364518.449	5025202.516
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500A	364513.721	5025207.451
500A	364502.97	5025223.775
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500A	364495.968	5025238.229
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500A	364499.691	5025240.573
500A	364499.911	5025241.539
500A	364499.911	5025241.539
500A	364499.439	5025242.289
500A	364499.439	5025242.289
500A	364505.617	5025246.178

500A	364505.617	5025246.178
500A	364506.089	5025245.427
500A	364506.089	5025245.427
500A	364507.054	5025245.208
500A	364507.054	5025245.208
500A	364510.947	5025247.659
500A	364510.947	5025247.659
500A	364519.133	5025265.251
500A	364519.133	5025265.251
500A	364524.195	5025253.335
500A	364524.195	5025253.335
500A	364532.445	5025233.912
500B	364544.035	5025206.581
500B	364558.616	5025172.194
500B	364558.616	5025172.194
500B	364543.822	5025168.254
500B	364543.822	5025168.254
500B	364536.108	5025163.714
500B	364536.108	5025163.714
500B	364520.952	5025154.49
500B	364520.952	5025154.49
500B	364484.958	5025212.196
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500B	364502.97	5025223.775
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500C	364566.969	5025144.572
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500C	364544.564	5025132.772
500C	364544.564	5025132.772
500C	364544.4	5025134.382
500C	364544.4	5025134.382
500C	364530.311	5025136.313
500C	364530.311	5025136.313
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500C	364536.108	5025163.714
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500C	364543.822	5025168.254
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500C	364558.616	5025172.194
500C	364562.568	5025162.874
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500C	364568.833	5025166.829
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500C	364584.378	5025176.643
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500C	364592.214	5025180.963
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500C	364594.665	5025176.8
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500C	364605.18	5025159.772
500C	364605.18	5025159.772
500C	364588.934	5025153.349

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500C	364579.104	5025154.621
500C	364579.104	5025154.621
500C	364570.014	5025151.25
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500C	364566.969	5025144.572
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500D	364562.568	5025162.874
500D	364558.616	5025172.194
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500D	364524.195	5025253.335
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500D	364519.133	5025265.251
500D	364524.799	5025268.753
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900A	364366.793	5025108.59
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900A	364290.488	5025107.912

900A	364291.511	5025106.261
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900A	364293.712	5025107.646
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900A	364356.177	5025153.703
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900A	364366.061	5025158.721
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900A	364382.146	5025133.168
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900A	364372.804	5025127.288
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900B	364382.146	5025133.168
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900B	364396.777	5025091.808
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900B	364384.518	5025084.091
900B	364384.518	5025084.091
900B	364392.533	5025071.359

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900B	364387.238	5025068.025
900B	364387.238	5025068.025
900B	364383.031	5025064.845
900B	364383.031	5025064.845
900B	364376.781	5025058.264
900B	364376.781	5025058.264
900B	364372.534	5025058.76
900B	364372.534	5025058.76
900B	364367.015	5025061.214
900B	364367.015	5025061.214
900B	364346.173	5025094.31
900B	364346.173	5025094.31
900B	364361.533	5025103.979
900B	364361.533	5025103.979
900B	364366.793	5025108.59
900B	364366.793	5025108.59
900B	364374.531	5025113.489
900B	364374.531	5025113.489
900B	364379.782	5025116.203
900B	364379.782	5025116.203
900B	364372.804	5025127.288
900B	364372.804	5025127.288
900B	364382.146	5025133.168
902	364353.188	5025151.822
902	364348.266	5025159.642
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902	364519.133	5025265.251
902	364519.133	5025265.251
902	364510.947	5025247.659
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902	364507.054	5025245.208
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902	364506.089	5025245.427
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902	364505.617	5025246.178
902	364505.617	5025246.178

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902	364499.691	5025240.573
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902	364495.968	5025238.229
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902	364495.582	5025235.512
902	364495.582	5025235.512
902	364492.228	5025233.401
902	364492.228	5025233.401
902	364490.091	5025236.797
902	364490.091	5025236.797
902	364366.061	5025158.721
902	364366.061	5025158.721
902	364356.177	5025153.703
902	364356.177	5025153.703
902	364353.188	5025151.822
CB107	364605.18	5025159.772
CB107	364631.632	5025116.935
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CB107	364613.436	5025105.696
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CB107	364611.921	5025102.197
CB107	364611.921	5025102.197
CB107	364601.757	5025100.434
CB107	364601.757	5025100.434
CB107	364596.773	5025107.499
CB107	364596.773	5025107.499
CB107	364591.963	5025104.816
CB107	364591.963	5025104.816
CB107	364566.969	5025144.572
CB107	364566.969	5025144.572
CB107	364570.014	5025151.25
CB107	364570.014	5025151.25
CB107	364579.104	5025154.621

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CB107	364588.934	5025153.349
CB107	364588.934	5025153.349
CB107	364605.18	5025159.772
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CB109	364509.871	5025009.478
CB109	364509.871	5025009.478
CB109	364500.126	5025024.959
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CB109	364501.844	5025032.572
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CB109	364516.852	5025042.125
CB109	364516.852	5025042.125
CB109	364523.685	5025046.258
CB109	364523.685	5025046.258
CB109	364523.681	5025047.606
CB109	364523.681	5025047.606
CB109	364527.744	5025050.163
CB109	364527.744	5025050.163
CB109	364529.123	5025049.85
CB109	364529.123	5025049.85
CB109	364529.125	5025049.846
CB109	364529.125	5025049.846
CB109	364531.249	5025046.454
CB109	364531.249	5025046.454
CB109	364533.3	5025045.842
CB109	364533.3	5025045.842
CB109	364543.045	5025030.361
CB109	364543.045	5025030.361
CB109	364541.666	5025029.033
CB110	364613.605	5025104.242
CB110	364625.108	5025086.51
CB110	364625.108	5025086.51

CB110	364623.028	5025085.161
CB110	364623.028	5025085.161
CB110	364615.852	5025080.728
CB110	364615.852	5025080.728
CB110	364609.782	5025080.613
CB110	364609.782	5025080.613
CB110	364608.587	5025080.569
CB110	364608.587	5025080.569
CB110	364603.613	5025083.509
CB110	364603.613	5025083.509
CB110	364599.69	5025089.748
CB110	364599.69	5025089.748
CB110	364599.684	5025089.757
CB110	364599.684	5025089.757
CB110	364599.87	5025099.575
CB110	364599.87	5025099.575
CB110	364601.522	5025100.448
CB110	364601.522	5025100.448
CB110	364601.757	5025100.434
CB110	364601.757	5025100.434
CB110	364611.921	5025102.197
CB110	364611.921	5025102.197
CB110	364613.436	5025105.696
CB110	364613.436	5025105.696
CB110	364613.605	5025104.242
CMH100	364584.487	5025078.064
CMH100	364533.3	5025045.842
CMH100	364533.3	5025045.842
CMH100	364531.249	5025046.454
CMH100	364531.249	5025046.454
CMH100	364529.125	5025049.846
CMH100	364529.125	5025049.846
CMH100	364529.123	5025049.85
CMH100	364529.123	5025049.85
CMH100	364527.744	5025050.163
CMH100	364527.744	5025050.163
CMH100	364523.681	5025047.606

CMH100	364523.681	5025047.606
CMH100	364520.265	5025053.447
CMH100	364520.265	5025053.447
CMH100	364490.726	5025100.434
CMH100	364490.726	5025100.434
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F_EX102A	364355.11	5025012.853
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F_EX102B	364352.845	5025013.285
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F100	364390.69	5024938.041
F100	364390.69	5024938.041
F100	364389.853	5024936.681
F100	364389.853	5024936.681
F100	364388.231	5024934.081
F100	364388.231	5024934.081
F100	364386.586	5024932.144
F111A	364444.097	5024974.917
F111A	364444.135	5024974.941
F111A	364444.135	5024974.941
F111A	364437.34	5024985.736
F111A	364437.34	5024985.736
F111A	364436.341	5024987.247
F111A	364436.341	5024987.247
F111A	364405.189	5025036.642
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F111A	364440.57	5025008.848
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F111A	364442.701	5025006.958
F111A	364442.701	5025006.958
F111A	364448.466	5025007.973
F111A	364448.466	5025007.973
F111A	364455.931	5025003.1

F111A	364455.931	5025003.1
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F111A	364456.394	5024997.43
F111A	364456.394	5024997.43
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F111A	364457.281	5024981.944
F111A	364457.281	5024981.944
F111A	364451.719	5024990.78
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F111A	364447.168	5024970.039
F111A	364447.168	5024970.039
F111A	364444.097	5024974.917
F505A	364398.969	5024944.393
F505A	364401.003	5024941.162
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F505A	364386.586	5024932.144
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F505A	364390.69	5024938.041
F505A	364390.69	5024938.041
F505A	364391.692	5024939.285
F505A	364391.692	5024939.285
F505A	364392.844	5024940.392
F505A	364392.844	5024940.392
F505A	364394.126	5024941.344
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F505A	364398.969	5024944.393
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F505C	364414.022	5024955.986
F505D	364431.077	5024966.722
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F505D	364431.077	5024966.722
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R100	364367.561	5025012.955
R100	364367.561	5025012.955
R100	364377.492	5024997.213
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R100	364377.776	5024996.515
R100	364377.776	5024996.515
R100	364390.57	5024965.113
R100	364390.57	5024965.113
R100	364371.635	5024957.413
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R100	364352.754	5025003.634

R100	364352.754	5025003.634
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R101	364367.561	5025012.955
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R101	364388.81	5025026.331
R101	364388.81	5025026.331
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R101	364399.121	5025009.951
R101	364377.776	5024996.515
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R103	364419.987	5024976.805
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R103	364400.746	5025007.37
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R104	364390.677	5024963.116
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R104	364391.712	5024963.538
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ROOFA	364366.061	5025158.721
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ROOFA	364490.091	5025236.797
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ROOFA	364492.228	5025233.401
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ROOFB1	364318.832	5025054.938
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ROOFE	364463.622	5024985.947
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ROOFE	364463.622	5024985.947
ROOFF	364594.232	5025062.583
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UNC1	364308.15	5025070.818
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UNC1	364335.521	5025016.024
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UNC1	364325.02	5025006.484
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UNC1	364353.188	5025151.822
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UNC1	364286.41	5025105.354
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UNC-1	364347.497	5024963.14
UNC-1	364347.492	5024963.131

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UNC-1	364347.422	5024962.916
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UNC-1	364347.419	5024962.895
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UNC-1	364347.417	5024962.873
UNC-1	364347.417	5024962.862
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UNC-1	364347.416	5024962.84
UNC-1	364347.416	5024962.83
UNC-1	364347.416	5024962.819
UNC-1	364347.416	5024962.808
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UNC-1	364347.418	5024962.786
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UNC-1	364347.421	5024962.754
UNC-1	364347.422	5024962.743

UNC-1	364347.424	5024962.733
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UNC-1	364347.428	5024962.711
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UNC-1	364347.433	5024962.69
UNC-1	364347.435	5024962.68
UNC-1	364347.438	5024962.669
UNC-1	364347.441	5024962.659
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UNC-1	364333.494	5024997.111
UNC-1	364333.494	5024997.111
UNC-1	364333.576	5024996.932
UNC-1	364333.66	5024996.755
UNC-1	364333.748	5024996.579
UNC-1	364333.838	5024996.405
UNC-1	364333.932	5024996.232
UNC-1	364334.029	5024996.061
UNC-1	364334.129	5024995.892
UNC-1	364334.231	5024995.724
UNC-1	364334.337	5024995.559
UNC-1	364334.445	5024995.395
UNC-1	364334.557	5024995.234
UNC-1	364334.671	5024995.074
UNC-1	364334.788	5024994.916
UNC-1	364334.908	5024994.761
UNC-1	364335.03	5024994.607
UNC-1	364335.156	5024994.456

UNC-1	364335.283	5024994.307
UNC-1	364335.414	5024994.16
UNC-1	364335.547	5024994.016
UNC-1	364335.683	5024993.873
UNC-1	364335.821	5024993.734
UNC-1	364335.961	5024993.597
UNC-1	364336.104	5024993.462
UNC-1	364336.249	5024993.33
UNC-1	364336.397	5024993.2
UNC-1	364336.547	5024993.073
UNC-1	364336.699	5024992.949
UNC-1	364336.853	5024992.827
UNC-1	364337.009	5024992.708
UNC-1	364337.168	5024992.592
UNC-1	364337.328	5024992.479
UNC-1	364337.49	5024992.369
UNC-1	364337.655	5024992.261
UNC-1	364337.821	5024992.156
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UNC-1	364338.159	5024991.956
UNC-1	364338.263	5024991.904
UNC-1	364338.367	5024991.85
UNC-1	364338.47	5024991.795
UNC-1	364338.572	5024991.738
UNC-1	364338.673	5024991.679
UNC-1	364338.772	5024991.618
UNC-1	364338.871	5024991.555
UNC-1	364338.969	5024991.491
UNC-1	364339.065	5024991.425
UNC-1	364339.16	5024991.357
UNC-1	364339.254	5024991.288
UNC-1	364339.347	5024991.217
UNC-1	364339.439	5024991.145
UNC-1	364339.529	5024991.071

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UNC-1	364339.706	5024990.918
UNC-1	364339.793	5024990.839
UNC-1	364339.878	5024990.759
UNC-1	364339.961	5024990.678
UNC-1	364340.043	5024990.595
UNC-1	364340.124	5024990.51
UNC-1	364340.203	5024990.424
UNC-1	364340.281	5024990.337
UNC-1	364340.357	5024990.248
UNC-1	364340.432	5024990.159
UNC-1	364340.505	5024990.067
UNC-1	364340.577	5024989.975
UNC-1	364340.647	5024989.881
UNC-1	364340.715	5024989.787
UNC-1	364340.781	5024989.691
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UNC-1	364340.91	5024989.495
UNC-1	364340.971	5024989.396
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UNC-1	364341.089	5024989.194
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UNC-1	364341.399	5024988.566
UNC-1	364341.444	5024988.458
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UNC-1	364341.529	5024988.24
UNC-1	364341.569	5024988.13
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UNC-1	364341.676	5024987.797
UNC-1	364341.708	5024987.684
UNC-1	364341.738	5024987.571
UNC-1	364341.766	5024987.458

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UNC-1	364341.816	5024987.23
UNC-1	364341.838	5024987.115
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UNC-1	364341.876	5024986.884
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UNC-1	364341.906	5024986.653
UNC-1	364341.918	5024986.536
UNC-1	364341.928	5024986.42
UNC-1	364341.936	5024986.303
UNC-1	364341.942	5024986.187
UNC-1	364341.945	5024986.07
UNC-1	364341.947	5024985.953
UNC-1	364341.947	5024985.836
UNC-1	364341.945	5024985.719
UNC-1	364341.941	5024985.603
UNC-1	364341.934	5024985.486
UNC-1	364341.926	5024985.369
UNC-1	364341.916	5024985.253
UNC-1	364341.903	5024985.137
UNC-1	364341.889	5024985.021
UNC-1	364341.873	5024984.905
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UNC-1	364341.834	5024984.675
UNC-1	364341.834	5024984.675
UNC-1	364341.812	5024984.564
UNC-1	364341.789	5024984.454
UNC-1	364341.764	5024984.345
UNC-1	364341.737	5024984.236
UNC-1	364341.708	5024984.127
UNC-1	364341.677	5024984.019
UNC-1	364341.645	5024983.911
UNC-1	364341.61	5024983.804
UNC-1	364341.574	5024983.697
UNC-1	364341.574	5024983.697

UNC-1	364341.574	5024983.697
UNC-1	364341.574	5024983.697
UNC-1	364341.514	5024983.543
UNC-1	364341.456	5024983.388
UNC-1	364341.401	5024983.231
UNC-1	364341.348	5024983.074
UNC-1	364341.299	5024982.916
UNC-1	364341.252	5024982.757
UNC-1	364341.208	5024982.597
UNC-1	364341.167	5024982.436
UNC-1	364341.128	5024982.275
UNC-1	364341.128	5024982.275
UNC-1	364341.128	5024982.275
UNC-1	364341.128	5024982.275
UNC-1	364341.094	5024982.117
UNC-1	364341.062	5024981.959
UNC-1	364341.033	5024981.8
UNC-1	364341.007	5024981.64
UNC-1	364340.983	5024981.481
UNC-1	364340.962	5024981.32
UNC-1	364340.944	5024981.16
UNC-1	364340.929	5024980.999
UNC-1	364340.917	5024980.838
UNC-1	364340.907	5024980.677
UNC-1	364340.9	5024980.515
UNC-1	364340.896	5024980.354
UNC-1	364340.895	5024980.192
UNC-1	364340.896	5024980.03
UNC-1	364340.9	5024979.869
UNC-1	364340.907	5024979.707
UNC-1	364340.917	5024979.546
UNC-1	364340.93	5024979.385
UNC-1	364340.945	5024979.224
UNC-1	364340.964	5024979.064
UNC-1	364340.984	5024978.904
UNC-1	364341.008	5024978.744
UNC-1	364341.035	5024978.584

UNC-1	364341.064	5024978.425
UNC-1	364341.064	5024978.425
UNC-1	364341.064	5024978.425
UNC-1	364342.275	5024975.307
UNC-1	364342.275	5024975.307
UNC-1	364342.275	5024975.307
UNC-1	364342.358	5024975.173
UNC-1	364342.444	5024975.041
UNC-1	364342.532	5024974.91
UNC-1	364342.622	5024974.781
UNC-1	364342.715	5024974.653
UNC-1	364342.809	5024974.527
UNC-1	364342.906	5024974.403
UNC-1	364343.005	5024974.28
UNC-1	364343.105	5024974.158
UNC-1	364343.208	5024974.039
UNC-1	364343.313	5024973.921
UNC-1	364343.42	5024973.805
UNC-1	364343.42	5024973.805
UNC-1	364343.42	5024973.805
UNC-1	364343.42	5024973.805
UNC-1	364343.431	5024973.793
UNC-1	364343.443	5024973.781
UNC-1	364343.455	5024973.769
UNC-1	364343.467	5024973.758
UNC-1	364343.48	5024973.746
UNC-1	364343.492	5024973.735
UNC-1	364343.505	5024973.724
UNC-1	364343.518	5024973.714
UNC-1	364343.531	5024973.703
UNC-1	364343.545	5024973.693
UNC-1	364343.558	5024973.683
UNC-1	364343.572	5024973.673
UNC-1	364343.586	5024973.664
UNC-1	364343.6	5024973.655
UNC-1	364343.614	5024973.646
UNC-1	364343.628	5024973.637

UNC-1	364343.643	5024973.628
UNC-1	364343.657	5024973.62
UNC-1	364343.672	5024973.612
UNC-1	364343.687	5024973.604
UNC-1	364343.702	5024973.597
UNC-1	364343.717	5024973.59
UNC-1	364343.732	5024973.583
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UNC-1	364343.827	5024973.546
UNC-1	364343.843	5024973.541
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UNC-1	364343.875	5024973.532
UNC-1	364343.891	5024973.528
UNC-1	364343.907	5024973.524
UNC-1	364343.924	5024973.52
UNC-1	364343.94	5024973.517
UNC-1	364343.957	5024973.514
UNC-1	364343.973	5024973.511
UNC-1	364343.99	5024973.509
UNC-1	364343.99	5024973.509
UNC-1	364343.99	5024973.509
UNC-1	364344.123	5024973.49
UNC-1	364344.123	5024973.49
UNC-1	364344.123	5024973.49
UNC-1	364344.1	5024973.31
UNC-1	364344.08	5024973.13
UNC-1	364344.063	5024972.949
UNC-1	364344.049	5024972.768
UNC-1	364344.039	5024972.587
UNC-1	364344.031	5024972.406
UNC-1	364344.027	5024972.224
UNC-1	364344.026	5024972.043
UNC-1	364344.029	5024971.861

UNC-1	364344.034	5024971.68
UNC-1	364344.042	5024971.498
UNC-1	364344.054	5024971.317
UNC-1	364344.069	5024971.136
UNC-1	364344.087	5024970.956
UNC-1	364344.108	5024970.775
UNC-1	364344.108	5024970.775
UNC-1	364344.108	5024970.775
UNC-1	364345.001	5024970.888
UNC-1	364345.001	5024970.888
UNC-1	364345.001	5024970.888
UNC-1	364345.023	5024970.724
UNC-1	364345.048	5024970.56
UNC-1	364345.076	5024970.396
UNC-1	364345.107	5024970.234
UNC-1	364345.14	5024970.071
UNC-1	364345.177	5024969.909
UNC-1	364345.216	5024969.748
UNC-1	364345.258	5024969.588
UNC-1	364345.303	5024969.428
UNC-1	364345.351	5024969.269
UNC-1	364345.401	5024969.112
UNC-1	364345.454	5024968.954
UNC-1	364345.51	5024968.798
UNC-1	364345.569	5024968.643
UNC-1	364345.63	5024968.489
UNC-1	364345.694	5024968.336
UNC-1	364345.76	5024968.184
UNC-1	364345.83	5024968.034
UNC-1	364345.902	5024967.884
UNC-1	364345.976	5024967.736
UNC-1	364346.053	5024967.589
UNC-1	364346.133	5024967.444
UNC-1	364346.215	5024967.3
UNC-1	364346.299	5024967.157
UNC-1	364346.387	5024967.016
UNC-1	364346.476	5024966.877

UNC-1	364346.568	5024966.739
UNC-1	364346.662	5024966.602
UNC-1	364346.759	5024966.468
UNC-1	364346.858	5024966.335
UNC-1	364346.858	5024966.335
UNC-1	364346.858	5024966.335
UNC-1	364346.141	5024965.791
UNC-1	364346.141	5024965.791
UNC-1	364346.141	5024965.791
UNC-1	364346.252	5024965.647
UNC-1	364346.366	5024965.505
UNC-1	364346.482	5024965.366
UNC-1	364346.6	5024965.228
UNC-1	364346.721	5024965.093
UNC-1	364346.844	5024964.959
UNC-1	364346.969	5024964.828
UNC-1	364347.097	5024964.699
UNC-1	364347.227	5024964.572
UNC-1	364347.359	5024964.448
UNC-1	364347.493	5024964.325
UNC-1	364347.629	5024964.206
UNC-1	364347.768	5024964.088
UNC-1	364347.908	5024963.973
UNC-1	364348.051	5024963.861
UNC-1	364348.051	5024963.861
UNC-1	364348.051	5024963.861
UNC-1	364347.526	5024963.186
UNC2	364620.029	5025069.435
UNC2	364605.209	5025060.117
UNC2	364598.761	5025056.063
UNC2	364584.628	5025047.316
UNC2	364562.117	5025033.355
UNC2	364545.292	5025022.57
UNC2	364539.5	5025018.804
UNC2	364528.441	5025011.851
UNC2	364517.286	5025005.074
UNC2	364506.901	5024998.544

UNC2	364496.515	5024992.015
UNC2	364478.975	5024980.977
UNC2	364461.852	5024969.985
UNC2	364461.373	5024970.747
UNC2	364461.028	5024971.161
UNC2	364454.68	5024974.738
UNC2	364457.01	5024976.196
UNC2	364448.93	5024989.031
UNC2	364451.719	5024990.78
UNC2	364457.281	5024981.944
UNC2	364463.622	5024985.947
UNC2	364466.144	5024981.94
UNC2	364509.871	5025009.478
UNC2	364541.666	5025029.033
UNC2	364543.045	5025030.361
UNC2	364594.232	5025062.583
UNC2	364590.19	5025069.003
UNC2	364608.587	5025080.569
UNC2	364609.782	5025080.613
UNC2	364615.852	5025080.728
UNC2	364623.028	5025085.161
UNC2	364625.108	5025086.51
UNC2	364628.277	5025080.68
UNC2	364631.027	5025076.349
UNC2	364620.029	5025069.435
UNC-2	364398.969	5024944.393
UNC-2	364401.508	5024945.991
UNC-2	364401.508	5024945.991
UNC-2	364403.547	5024942.754
UNC-2	364403.547	5024942.754
UNC-2	364401.003	5024941.162
UNC-2	364401.003	5024941.162
UNC-2	364398.969	5024944.393
UNC-3	364411.483	5024954.39
UNC-3	364414.022	5024955.986
UNC-3	364414.022	5024955.986
UNC-3	364417.039	5024951.193

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UNC-3           364417.039       5024951.193
UNC-3           364414.495       5024949.602
UNC-3           364414.495       5024949.602
UNC-3           364411.483       5024954.39
UNC-4           364424.983       5024962.886
UNC-4           364431.077       5024966.722
UNC-4           364431.077       5024966.722
UNC-4           364434.125       5024961.881
UNC-4           364434.125       5024961.881
UNC-4           364428.02        5024958.062
UNC-4           364428.02        5024958.062
UNC-4           364424.983       5024962.886
UNDR            364372.391       5025127.028
UNDR            364372.804       5025127.288
UNDR            364372.804       5025127.288
UNDR            364379.782       5025116.203
UNDR            364379.782       5025116.203
UNDR            364374.531       5025113.489
UNDR            364374.531       5025113.489
UNDR            364368.085       5025119.796
UNDR            364368.085       5025119.796
UNDR            364366.943       5025121.61
UNDR            364366.943       5025121.61
UNDR            364356.987       5025137.963
UNDR            364356.987       5025137.963
UNDR            364363.081       5025141.798
UNDR            364363.081       5025141.798
UNDR            364372.391       5025127.028

[SYMBOLS]
;;Gage          X-Coord          Y-Coord
;;-------------- ---------------- ----------------

[LABELS]
;;X-Coord       Y-Coord          Label
125.05          489.94           "Job#160400770: Clydesdale Shopping Centre" Arial "10" 0 0 0
114.05          485.92           "July 15, 2010" Arial "10" 0 0 0
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EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.013)

****
Element Count
****
Number of rain gages 1
Number of subcatchments ... 39
Number of nodes 41
Number of links 42
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
RG1	100yrCHI	INTENSITY	10 min.

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
101A	0.23	43.20	100.00	1.0000	RG1	STM101
104	0.18	37.80	100.00	1.0000	RG1	STM104A-S
105	0.54	120.80	100.00	1.0000	RG1	CB105-S
108	0.06	14.40	100.00	1.0000	RG1	STM108
500A	0.15	34.00	100.00	1.0000	RG1	CMH101-S

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
500B	0.24	53.80	100.00	1.0000	RG1	500B-S
500C	0.27	61.20	100.00	1.0000	RG1	500C-S
500D	0.08	17.30	100.00	1.0000	RG1	CMH101-S
900A	0.39	86.90	100.00	1.0000	RG1	900A-S
900B	0.19	42.10	100.00	1.0000	RG1	900B-S
902	0.19	42.10	2.86	1.0000	RG1	STM902
CB107	0.22	49.50	100.00	1.0000	RG1	CB107-S
CB109	0.09	21.20	85.71	1.0000	RG1	CB109-S
CB110	0.04	9.20	78.57	1.0000	RG1	CB110-S
CMH100	0.55	122.90	100.00	1.0000	RG1	CMH100-S
F_EX102A	0.03	26.85	100.00	2.0000	RG1	CB500-S
F_EX102B	0.01	25.29	100.00	2.0000	RG1	CB102B-S
F_EX103A	0.14	70.35	100.00	2.0000	RG1	CB501-S
F100	0.23	106.00	81.43	2.0000	RG1	TANK
F111A	0.14	77.15	100.00	2.0000	RG1	STM111
F505A	0.00	13.32	0.00	1.5000	RG1	TANK
F505B	0.01	13.09	28.57	1.5000	RG1	TANK
F505C	0.01	13.15	28.57	1.5000	RG1	TANK
F505D	0.01	15.54	27.14	1.5000	RG1	TANK
R100	0.10	50.14	100.00	1.5000	RG1	TANK
R101	0.05	22.23	100.00	1.5000	RG1	TANK
R103	0.11	57.13	100.00	1.5000	RG1	TANK
R104	0.19	84.44	100.00	2.0000	RG1	TANK
ROOFA	1.35	302.90	100.00	1.0000	RG1	RoofA-S
ROOFB1	0.19	42.30	100.00	1.0000	RG1	RoofB1-S
ROOFE	0.10	21.40	100.00	1.0000	RG1	RoofE-S
ROOFF	0.11	25.00	100.00	1.0000	RG1	RoofF-S
UNC1	0.21	46.80	24.29	1.0000	RG1	OF
UNC-1	0.00	20.00	100.00	1.5000	RG1	OF
UNC2	0.19	42.44	64.29	1.0000	RG1	OF
UNC-2	0.00	2.72	100.00	1.5000	RG1	OF
UNC-3	0.00	2.72	100.00	1.5000	RG1	OF
UNC-4	0.00	7.19	100.00	1.5000	RG1	OF
UNDR	0.02	5.00	100.00	1.0000	RG1	900A-S

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LID Control Summary
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Subcatchment	LID Control	No. of Units	Unit Area	Unit Width	% Area Covered	% Imperv Treated	% Perv Treated
R101	LID1-R101	1	437.40	21.20	90.00	100.00	100.00

****
Node Summary
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Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
OF	JUNCTION	93.73	4.27	0.0	
ORF900B	JUNCTION	96.77	2.07	0.0	
STM101	JUNCTION	93.98	4.09	0.0	
STM104A	JUNCTION	96.98	3.40	0.0	
STM902	JUNCTION	99.16	1.29	0.0	
STRMCPTR	JUNCTION	93.92	4.05	0.0	
OF1	OUTFALL	93.72	0.00	0.0	
500B-S	STORAGE	98.26	2.10	0.0	
500C-S	STORAGE	98.40	2.14	0.0	
900A-S	STORAGE	96.83	1.87	0.0	
900B-S	STORAGE	96.77	2.07	0.0	
CB102B-S	STORAGE	96.27	1.80	0.0	
CB105-S	STORAGE	98.25	2.08	0.0	
CB107-S	STORAGE	98.56	2.09	0.0	
CB109-S	STORAGE	99.05	2.37	0.0	
CB110-S	STORAGE	98.60	2.06	0.0	
CB500-S	STORAGE	97.13	1.46	0.0	
CB501-S	STORAGE	96.76	2.51	0.0	
CB902A	STORAGE	97.07	1.43	0.0	
CBMH901	STORAGE	96.76	3.77	0.0	
CMH100-S	STORAGE	98.09	2.41	0.0	
CMH101-S	STORAGE	97.74	2.62	0.0	
MONITOR	STORAGE	93.88	4.05	0.0	

ORF101	STORAGE	94.03	4.01	0.0	
RoofA-S	STORAGE	110.00	0.15	0.0	
RoofB1-S	STORAGE	110.00	0.15	0.0	
RoofE-S	STORAGE	110.00	0.15	0.0	
RoofF-S	STORAGE	110.00	0.15	0.0	
STM102	STORAGE	95.90	2.79	0.0	
STM103	STORAGE	96.04	4.11	0.0	
STM104A-S	STORAGE	98.25	2.08	0.0	
STM104B-S	STORAGE	96.98	3.40	0.0	
STM105-S	STORAGE	97.39	3.12	0.0	
STM106	STORAGE	97.47	3.11	0.0	
STM107	STORAGE	97.56	3.33	0.0	
STM108	STORAGE	98.10	2.70	0.0	
STM109	STORAGE	97.61	4.18	0.0	
STM110	STORAGE	97.76	2.39	0.0	
STM111	STORAGE	98.03	2.84	0.0	
STM900	STORAGE	96.15	3.62	0.0	
TANK	STORAGE	94.41	2.71	0.0	

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Link Summary
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Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	STM111	STM110	CONDUIT	67.7	0.3102	0.0130
C3	OF	OF1	CONDUIT	1.0	1.0001	0.0130
L1	CMH101-S	STM107	CONDUIT	115.7	0.1037	0.0130
L11	STM107	STM106	CONDUIT	56.4	0.1064	0.0130
L14	STM105-S	STM104A	CONDUIT	64.1	0.1092	0.0130
L30	STM103	STM102	CONDUIT	61.7	0.1459	0.0130
L32	ORF101	STRMCPTR	CONDUIT	2.5	1.0001	0.0130
L34	STM108	STM107	CONDUIT	76.4	0.1047	0.0130
L45	STM902	CB902A	CONDUIT	179.1	1.1503	0.0130
L50	STM109	STM105-S	CONDUIT	63.3	0.0948	0.0130
L51	STM106	STM105-S	CONDUIT	51.1	0.0978	0.0130
L61	STM104B-S	STM103	CONDUIT	16.4	2.1285	0.0130

L63	CB902A	CBMH901	CONDUIT	54.4	0.5147	0.0130
L64	CBMH901	STM900	CONDUIT	9.7	0.5155	0.0130
L65	STM900	STM103	CONDUIT	49.0	0.1224	0.0130
L68	ORF900B	STM900	CONDUIT	24.8	1.0001	0.0130
L70	STRMCPTR	MONITOR	CONDUIT	1.0	1.0001	0.0130
L71	MONITOR	OF	CONDUIT	18.8	0.8013	0.0130
L72	900A-S	STM900	CONDUIT	3.0	1.0001	0.0130
L8	STM102	STM101	CONDUIT	20.9	0.1435	0.0130
500B-IC	500B-S	STM107	ORIFICE			
500C-IC	500C-S	STM107	ORIFICE			
CB102B-IC1	CB102B-S	STM101	ORIFICE			
CB102B-IC2	CB102B-S	STM101	ORIFICE			
CB105-IC1	CB105-S	STM105-S	ORIFICE			
CB105-IC2	CB105-S	STM105-S	ORIFICE			
CB107-IC	CB107-S	STM107	ORIFICE			
CB109-IC	CB109-S	STM109	ORIFICE			
CB110-IC	CB110-S	STM108	ORIFICE			
CB500-IC	CB500-S	STM102	ORIFICE			
CB501-IC	CB501-S	STM103	ORIFICE			
CMH100-IC	CMH100-S	STM106	ORIFICE			
IC-TANK	TANK	ORF101	ORIFICE			
ORF_900B	900B-S	ORF900B	ORIFICE			
SMT101-IC	STM101	ORF101	ORIFICE			
STM104A-IC	STM104A-S	STM104A	ORIFICE			
STM104B-IC	STM104A	STM104B-S	ORIFICE			
STM110-IC	STM110	STM104B-S	ORIFICE			
RA-O	RoofA-S	STM106	OUTLET			
RB-O	RoofB1-S	STM101	OUTLET			
RE-O	RoofE-S	STM109	OUTLET			
RF-O	RoofF-S	STM109	OUTLET			

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Cross Section Summary
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Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	CIRCULAR	0.38	0.11	0.09	0.38	1	97.66
C3	DUMMY	0.00	0.00	0.00	0.00	1	0.00
L1	CIRCULAR	0.90	0.64	0.23	0.90	1	583.05
L11	CIRCULAR	0.90	0.64	0.23	0.90	1	590.49
L14	CIRCULAR	0.90	0.64	0.23	0.90	1	598.38
L30	CIRCULAR	0.90	0.64	0.23	0.90	1	691.45
L32	CIRCULAR	0.68	0.36	0.17	0.68	1	840.66
L34	CIRCULAR	0.90	0.64	0.23	0.90	1	585.84
L45	CIRCULAR	0.30	0.07	0.07	0.30	1	103.72
L50	CIRCULAR	0.90	0.64	0.23	0.90	1	557.36
L51	CIRCULAR	0.90	0.64	0.23	0.90	1	566.31
L61	CIRCULAR	0.90	0.64	0.23	0.90	1	2641.31
L63	CIRCULAR	0.30	0.07	0.07	0.30	1	69.38
L64	CIRCULAR	0.30	0.07	0.07	0.30	1	69.43
L65	CIRCULAR	0.90	0.64	0.23	0.90	1	633.52
L68	CIRCULAR	0.25	0.05	0.06	0.25	1	59.47
L70	CIRCULAR	0.68	0.36	0.17	0.68	1	840.66
L71	CIRCULAR	0.68	0.36	0.17	0.68	1	752.50
L72	CIRCULAR	0.20	0.03	0.05	0.20	1	32.80
L8	CIRCULAR	1.05	0.87	0.26	1.05	1	1034.65

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Transect Summary
****

Transect Roadway_Half
Area:

0.0004	0.0017	0.0038	0.0067	0.0104
0.0150	0.0204	0.0267	0.0338	0.0417
0.0504	0.0600	0.0704	0.0817	0.0938
0.1067	0.1204	0.1350	0.1504	0.1667
0.1838	0.2017	0.2204	0.2400	0.2604
0.2817	0.3038	0.3267	0.3504	0.3750
0.4004	0.4267	0.4538	0.4817	0.5104

	0.5400	0.5704	0.6017	0.6338	0.6667
	0.7000	0.7333	0.7667	0.8000	0.8333
	0.8667	0.9000	0.9333	0.9667	1.0000
Hrad:					
	0.0168	0.0336	0.0504	0.0672	0.0839
	0.1007	0.1175	0.1343	0.1511	0.1679
	0.1847	0.2015	0.2182	0.2350	0.2518
	0.2686	0.2854	0.3022	0.3190	0.3358
	0.3525	0.3693	0.3861	0.4029	0.4197
	0.4365	0.4533	0.4701	0.4869	0.5036
	0.5204	0.5372	0.5540	0.5708	0.5876
	0.6044	0.6212	0.6379	0.6547	0.6715
	0.7046	0.7376	0.7706	0.8035	0.8364
	0.8692	0.9020	0.9347	0.9674	1.0000
Width:					
	0.0250	0.0500	0.0750	0.1000	0.1250
	0.1500	0.1750	0.2000	0.2250	0.2500
	0.2750	0.3000	0.3250	0.3500	0.3750
	0.4000	0.4250	0.4500	0.4750	0.5000
	0.5250	0.5500	0.5750	0.6000	0.6250
	0.6500	0.6750	0.7000	0.7250	0.7500
	0.7750	0.8000	0.8250	0.8500	0.8750
	0.9000	0.9250	0.9500	0.9750	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000
	1.0000	1.0000	1.0000	1.0000	1.0000

```
*********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
*********************************************************

****************
Analysis Options
****************
Flow Units ............... LPS
```



```
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ YES
  Water Quality .......... NO
Infiltration Method ...... HORTON
Flow Routing Method ...... DYNWAVE
Surcharge Method ......... EXTRAN
Starting Date ............ 01/01/1995 00:00:00
Ending Date .............. 01/01/1995 06:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:01:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 1.00 sec
Variable Time Step ....... NO
Maximum Trials ........... 8
Number of Threads ........ 4
Head Tolerance ........... 0.001500 m


*********************
Control Actions Taken
*********************


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Initial LID Storage ......         0.001         0.198
Total Precipitation ......         0.474        71.665
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.022         3.285
Surface Runoff ...........         0.440        66.460
```

LID Drainage	0.001	0.175
Final Storage	0.013	2.008
Continuity Error (%)	-0.092	

****
Flow Routing Continuity
****

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.441	4.408
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.407	4.072
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.001	0.008
Final Stored Volume	0.035	0.347
Continuity Error (%)	-0.047	

****
Highest Continuity Errors
****

Node CB902A (-4.68%)
Node STM108 (1.99%)

****
Highest Flow Instability Indexes
****

Link CB102B-IC1 (7)
Link CB102B-IC2 (7)
Link STM104A-IC (4)
Link 500B-IC (3)
Link L70 (3)

****
Routing Time Step Summary
****

Minimum Time Step	:	1.00 sec
Average Time Step	:	1.00 sec
Maximum Time Step	:	1.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.25
Percent Not Converging	:	0.11

****
Subcatchment Runoff Summary
****

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff LPS	Runoff Coeff
101A	71.66	0.00	0.00	0.00	70.12	0.00	70.12	0.16	113.95	0.978
104	71.66	0.00	0.00	0.00	70.13	0.00	70.13	0.12	87.81	0.979
105	71.66	0.00	0.00	0.00	70.13	0.00	70.13	0.38	265.92	0.979
108	71.66	0.00	0.00	0.00	70.13	0.00	70.13	0.04	31.69	0.979

500A	71.66	0.00	0.00	0.00	70.13	0.00	70.13	0.11	74.77	0.979
500B	71.66	0.00	0.00	0.00	70.13	0.00	70.13	0.17	118.35	0.979
500C	71.66	0.00	0.00	0.00	70.13	0.00	70.13	0.19	134.69	0.979
500D	71.66	0.00	0.00	0.00	70.13	0.00	70.13	0.05	38.13	0.979
900A	71.66	0.00	0.00	0.00	70.13	0.00	70.13	0.27	191.14	0.979
900B	71.66	0.00	0.00	0.00	70.13	0.00	70.13	0.13	92.60	0.979
902	71.66	0.00	0.00	43.02	2.01	26.66	28.67	0.05	73.44	0.400
CB107	71.66	0.00	0.00	0.00	70.13	0.00	70.13	0.15	108.94	0.979
CB109	71.66	0.00	0.00	6.25	60.12	4.02	64.13	0.06	45.66	0.895
CB110	71.66	0.00	0.00	9.39	55.11	6.00	61.12	0.03	19.71	0.853
CMH100	71.66	0.00	0.00	0.00	70.13	0.00	70.13	0.38	270.37	0.979
F_EX102A	71.66	0.00	0.00	0.00	70.20	0.00	70.20	0.02	17.06	0.980
F_EX102B	71.66	0.00	0.00	0.00	70.21	0.00	70.21	0.01	6.75	0.980
F_EX103A	71.66	0.00	0.00	0.00	70.19	0.00	70.19	0.10	70.93	0.979
F100	71.66	0.00	0.00	8.12	57.16	5.24	62.39	0.14	111.09	0.871
F111A	71.66	0.00	0.00	0.00	70.19	0.00	70.19	0.10	67.36	0.979
F505A	71.66	0.00	0.00	43.70	0.00	28.20	28.20	0.00	1.97	0.394
F505B	71.66	0.00	0.00	31.22	20.04	20.14	40.18	0.00	3.26	0.561
F505C	71.66	0.00	0.00	31.22	20.04	20.14	40.18			

								0.00	3.31	0.561
F505D	71.66	0.00	0.00	31.84	19.04	20.54	39.58	0.00	3.92	0.552
R100	71.66	0.00	0.00	0.00	70.18	0.00	70.18	0.07	50.99	0.979
R101	71.66	0.00	0.00	0.00	7.02	0.00	23.88	0.01	3.23	0.333
R103	71.66	0.00	0.00	0.00	70.18	0.00	70.18	0.08	56.25	0.979
R104	71.66	0.00	0.00	0.00	70.18	0.00	70.18	0.13	92.70	0.979
ROOFA	71.66	0.00	0.00	0.00	70.13	0.00	70.13	0.94	666.52	0.979
ROOFB1	71.66	0.00	0.00	0.00	70.13	0.00	70.13	0.13	93.10	0.979
ROOFE	71.66	0.00	0.00	0.00	70.13	0.00	70.13	0.07	47.04	0.979
ROOFF	71.66	0.00	0.00	0.00	70.13	0.00	70.13	0.08	54.97	0.979
UNC1	71.66	0.00	0.00	33.43	17.05	20.89	37.94	0.08	88.74	0.529
UNC-1	71.66	0.00	0.00	0.00	70.17	0.00	70.17	0.00	2.38	0.979
UNC2	71.66	0.00	0.00	15.68	45.10	9.96	55.06	0.10	88.65	0.768
UNC-2	71.66	0.00	0.00	0.00	70.21	0.00	70.21	0.00	0.55	0.980
UNC-3	71.66	0.00	0.00	0.00	70.21	0.00	70.21	0.00	0.84	0.980
UNC-4	71.66	0.00	0.00	0.00	70.21	0.00	70.21	0.00	2.03	0.980
UNDR	71.66	0.00	0.00	0.00	70.13	0.00	70.13	0.02	10.89	0.979

****
LID Performance Summary

****

Subcatchment	LID Control	Total Inflow mm	Evap Loss mm	Infil Loss mm	Surface Outflow mm	Drain Outflow mm	Initial Storage mm	Final Storage mm	Continuity Error %
R101	LID1-R101	79.46	0.00	0.00	0.00	26.53	30.00	82.94	-0.02

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
OF	JUNCTION	0.66	0.68	94.41	0 00:00	0.67
ORF900B	JUNCTION	0.07	1.02	97.79	0 01:14	1.02
STM101	JUNCTION	0.91	3.54	97.52	0 01:14	3.53
STM104A	JUNCTION	1.33	3.28	100.26	0 01:25	3.28
STM902	JUNCTION	0.01	0.18	99.34	0 01:10	0.18
STRMCPTR	JUNCTION	0.48	0.55	94.47	0 01:14	0.55
OF1	OUTFALL	0.69	0.69	94.41	0 00:00	0.69
500B-S	STORAGE	0.64	2.03	100.29	0 01:40	2.03
500C-S	STORAGE	0.56	1.90	100.30	0 01:20	1.90
900A-S	STORAGE	0.12	1.64	98.47	0 01:10	1.64
900B-S	STORAGE	0.18	2.00	98.77	0 01:12	2.00

CB102B-S	STORAGE	0.07	1.25	97.52	0 01:14	1.24
CB105-S	STORAGE	0.65	2.06	100.31	0 01:32	2.06
CB107-S	STORAGE	0.63	2.07	100.63	0 01:25	2.07
CB109-S	STORAGE	0.45	2.36	101.41	0 01:12	2.36
CB110-S	STORAGE	0.51	1.90	100.50	0 01:13	1.90
CB500-S	STORAGE	0.02	0.40	97.53	0 01:14	0.39
CB501-S	STORAGE	0.08	1.24	98.00	0 01:10	1.24
CB902A	STORAGE	0.03	0.59	97.66	0 01:14	0.59
CBMH901	STORAGE	0.04	0.84	97.60	0 01:14	0.83
CMH100-S	STORAGE	0.74	2.35	100.44	0 01:22	2.35
CMH101-S	STORAGE	0.84	2.54	100.28	0 01:33	2.54
MONITOR	STORAGE	0.52	0.58	94.46	0 01:14	0.58
ORF101	STORAGE	0.38	0.47	94.49	0 01:14	0.46
RoofA-S	STORAGE	0.05	0.07	110.07	0 01:50	0.07
RoofB1-S	STORAGE	0.05	0.07	110.07	0 01:50	0.07
RoofE-S	STORAGE	0.05	0.07	110.07	0 01:50	0.07
RoofF-S	STORAGE	0.07	0.09	110.09	0 03:11	0.09
STM102	STORAGE	0.28	1.63	97.53	0 01:14	1.62
STM103	STORAGE	0.29	1.53	97.57	0 01:14	1.52
STM104A-S	STORAGE	0.62	2.01	100.26	0 01:38	2.01
STM104B-S	STORAGE	0.15	0.60	97.58	0 01:14	0.59
STM105-S	STORAGE	1.08	2.89	100.28	0 01:32	2.89
STM106	STORAGE	1.03	2.81	100.28	0 01:32	2.81
STM107	STORAGE	0.95	2.72	100.28	0 01:32	2.72
STM108	STORAGE	0.67	2.18	100.28	0 01:32	2.18
STM109	STORAGE	0.92	2.67	100.28	0 01:32	2.67
STM110	STORAGE	0.18	2.05	99.81	0 01:11	2.05
STM111	STORAGE	0.13	1.79	99.82	0 01:11	1.78
STM900	STORAGE	0.20	1.43	97.58	0 01:14	1.43
TANK	STORAGE	0.52	2.52	96.93	0 01:20	2.52

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days	hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
OF	JUNCTION	183.19	766.07	0	01:10	0.191	4.07	-0.001
ORF900B	JUNCTION	0.00	59.80	0	01:06	0	0.131	0.399
STM101	JUNCTION	113.95	550.00	0	01:07	0.162	3.43	-0.072
STM104A	JUNCTION	0.00	235.31	0	01:22	0	2.47	-0.067
STM902	JUNCTION	73.44	73.44	0	01:10	0.0536	0.0536	4.637
STRMCPTR	JUNCTION	0.00	606.42	0	01:14	0	3.88	0.001
OF1	OUTFALL	0.00	766.07	0	01:10	0	4.07	0.000
500B-S	STORAGE	118.35	118.35	0	01:10	0.168	0.168	0.042
500C-S	STORAGE	134.69	134.69	0	01:10	0.191	0.191	0.031
900A-S	STORAGE	202.04	202.04	0	01:10	0.286	0.286	0.017
900B-S	STORAGE	92.60	92.60	0	01:10	0.131	0.131	0.032
CB102B-S	STORAGE	6.75	35.89	0	01:07	0.00955	0.00988	12.447
CB105-S	STORAGE	265.92	265.92	0	01:10	0.377	0.377	0.030
CB107-S	STORAGE	108.94	108.94	0	01:10	0.154	0.154	0.022
CB109-S	STORAGE	45.66	45.66	0	01:10	0.0603	0.0603	0.043
CB110-S	STORAGE	19.71	19.71	0	01:10	0.0251	0.0251	0.027
CB500-S	STORAGE	17.06	17.06	0	01:10	0.0242	0.0242	-0.002
CB501-S	STORAGE	70.93	70.93	0	01:10	0.1	0.1	-0.000
CB902A	STORAGE	0.00	71.62	0	01:10	0	0.0512	-4.468
CBMH901	STORAGE	0.00	64.36	0	01:08	0	0.0539	-0.901
CMH100-S	STORAGE	270.37	270.37	0	01:10	0.383	0.383	0.001
CMH101-S	STORAGE	112.90	238.45	0	01:06	0.16	0.187	-0.209
MONITOR	STORAGE	0.00	606.43	0	01:14	0	3.88	-0.007
ORF101	STORAGE	0.00	606.44	0	01:14	0	3.88	-0.004
RoofA-S	STORAGE	666.52	666.52	0	01:10	0.944	0.944	0.003
RoofB1-S	STORAGE	93.10	93.10	0	01:10	0.132	0.132	0.003
RoofE-S	STORAGE	47.04	47.04	0	01:10	0.0666	0.0666	0.003
RoofF-S	STORAGE	54.97	54.97	0	01:10	0.0778	0.0778	0.009
STM102	STORAGE	0.00	482.30	0	01:14	0	3.16	0.024
STM103	STORAGE	0.00	549.46	0	01:08	0	3.14	0.127
STM104A-S	STORAGE	87.81	87.81	0	01:10	0.124	0.128	0.273
STM104B-S	STORAGE	0.00	260.03	0	01:23	0	2.57	0.009

STM105-S	STORAGE	0.00	431.18	0	01:06	0	2.38	0.220
STM106	STORAGE	0.00	329.80	0	01:06	0	1.88	0.146
STM107	STORAGE	0.00	543.89	0	01:05	0	0.82	-0.252
STM108	STORAGE	31.69	299.97	0	01:05	0.0449	0.0984	2.030
STM109	STORAGE	0.00	121.10	0	01:03	0	0.154	0.574
STM110	STORAGE	0.00	49.09	0	01:10	0	0.0953	-0.145
STM111	STORAGE	67.36	67.36	0	01:10	0.0953	0.0953	0.055
STM900	STORAGE	0.00	271.91	0	01:07	0	0.471	-0.060
TANK	STORAGE	323.49	323.49	0	01:10	0.449	0.449	0.000

****
Node Surcharge Summary
****

Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Meters	Min. Depth Below Rim Meters
OF	JUNCTION	0.01	0.006	3.589
ORF900B	JUNCTION	0.40	0.772	1.048
STM101	JUNCTION	0.32	0.598	0.552
STM104A	JUNCTION	2.49	2.042	0.118

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow LPS
500B-S	0.008	10	0	0	0.048	61	0 01:40	104.31
500C-S	0.000	1	0	0	0.002	8	0 01:20	131.46
900A-S	0.000	0	0	0	0.009	5	0 01:10	180.40
900B-S	0.001	2	0	0	0.016	59	0 01:12	59.80
CB102B-S	0.000	0	0	0	0.000	0	0 00:00	21.01
CB105-S	0.014	15	0	0	0.084	89	0 01:32	222.00
CB107-S	0.008	14	0	0	0.049	87	0 01:25	43.75
CB109-S	0.000	4	0	0	0.009	84	0 01:12	25.77
CB110-S	0.000	1	0	0	0.002	15	0 01:13	14.20
CB500-S	0.000	0	0	0	0.000	0	0 00:00	17.06
CB501-S	0.000	0	0	0	0.000	0	0 00:00	70.91
CB902A	0.000	2	0	0	0.000	41	0 01:14	49.06
CBMH901	0.000	1	0	0	0.001	22	0 01:14	46.50
CMH100-S	0.013	10	0	0	0.089	68	0 01:22	188.13
CMH101-S	0.004	7	0	0	0.031	54	0 01:33	171.75
MONITOR	0.001	13	0	0	0.001	14	0 01:14	606.47
ORF101	0.000	9	0	0	0.001	12	0 01:14	606.42
RoofA-S	0.388	26	0	0	0.647	44	0 01:50	51.26
RoofB1-S	0.054	26	0	0	0.090	44	0 01:50	7.16
RoofE-S	0.028	26	0	0	0.046	44	0 01:50	3.59
RoofF-S	0.051	42	0	0	0.067	55	0 03:11	1.31
STM102	0.000	10	0	0	0.002	58	0 01:14	480.52
STM103	0.000	7	0	0	0.002	37	0 01:14	477.32
STM104A-S	0.006	9	0	0	0.037	59	0 01:38	80.38
STM104B-S	0.000	5	0	0	0.001	18	0 01:14	271.37
STM105-S	0.001	35	0	0	0.003	92	0 01:32	235.31
STM106	0.001	33	0	0	0.003	90	0 01:32	248.38
STM107	0.001	29	0	0	0.003	82	0 01:32	302.00
STM108	0.001	25	0	0	0.002	81	0 01:32	97.95
STM109	0.001	22	0	0	0.003	64	0 01:32	40.78
STM110	0.000	8	0	0	0.003	86	0 01:11	32.80

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow LPS
STM111	0.000	5	0	0	0.003	63	0 01:11	49.09
STM900	0.000	5	0	0	0.002	40	0 01:14	244.70
TANK	0.044	19	0	0	0.211	93	0 01:20	74.63

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
OF1	97.98	192.40	766.07	4.072
System	97.98	192.40	766.07	4.072

****
Link Flow Summary
****

Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	49.09	0 01:10	0.59	0.50	1.00
C3	DUMMY	766.07	0 01:10			
L1	CONDUIT	171.75	0 01:08	0.29	0.29	1.00
L11	CONDUIT	248.38	0 01:04	0.49	0.42	1.00
L14	CONDUIT	235.31	0 01:22	0.73	0.39	1.00
L30	CONDUIT	477.32	0 01:14	1.36	0.69	1.00
L32	CONDUIT	606.42	0 01:14	2.31	0.72	0.69
L34	CONDUIT	256.13	0 01:05	0.64	0.44	1.00
L45	CONDUIT	71.62	0 01:10	1.48	0.69	0.80

L50	CONDUIT	96.16	0	01:03	0.27	0.17	1.00
L51	CONDUIT	248.36	0	01:06	0.58	0.44	1.00
L61	CONDUIT	271.37	0	01:22	2.06	0.10	0.83
L63	CONDUIT	49.06	0	01:08	1.00	0.71	1.00
L64	CONDUIT	46.50	0	01:24	0.91	0.67	1.00
L65	CONDUIT	244.70	0	01:08	0.74	0.39	1.00
L68	CONDUIT	59.84	0	01:06	1.28	1.01	1.00
L70	CONDUIT	606.43	0	01:14	1.96	0.72	0.81
L71	CONDUIT	606.47	0	01:14	1.76	0.81	0.92
L72	CONDUIT	180.40	0	01:07	5.74	5.50	1.00
L8	CONDUIT	480.52	0	01:14	1.42	0.46	1.00
500B-IC	ORIFICE	104.31	0	01:04			1.00
500C-IC	ORIFICE	131.46	0	01:08			1.00
CB102B-IC1	ORIFICE	14.57	0	01:07			1.00
CB102B-IC2	ORIFICE	14.57	0	01:07			1.00
CB105-IC1	ORIFICE	111.00	0	01:03			1.00
CB105-IC2	ORIFICE	111.00	0	01:03			1.00
CB107-IC	ORIFICE	43.75	0	01:04			1.00
CB109-IC	ORIFICE	25.77	0	01:06			1.00
CB110-IC	ORIFICE	14.20	0	01:06			1.00
CB500-IC	ORIFICE	17.06	0	01:08			1.00
CB501-IC	ORIFICE	70.91	0	01:07			1.00
CMH100-IC	ORIFICE	188.13	0	01:02			1.00
IC-TANK	ORIFICE	74.63	0	01:20			1.00
ORF_900B	ORIFICE	59.80	0	01:06			1.00
SMT101-IC	ORIFICE	533.32	0	01:14			1.00
STM104A-IC	ORIFICE	80.38	0	01:05			1.00
STM104B-IC	ORIFICE	232.75	0	01:25			1.00
STM110-IC	ORIFICE	32.80	0	01:11			1.00
RA-O	DUMMY	51.26	0	01:50			
RB-O	DUMMY	7.16	0	01:50			
RE-O	DUMMY	3.59	0	01:50			
RF-O	DUMMY	1.31	0	03:11			

****
Flow Classification Summary

****

Conduit	Adjusted /Actual Length	Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
		---------- Fraction of Time in Flow Class ----------								
C1	1.00	0.07	0.00	0.00	0.21	0.00	0.00	0.73	0.06	0.00
L1	1.00	0.07	0.00	0.00	0.66	0.00	0.00	0.27	0.08	0.00
L11	1.00	0.07	0.00	0.00	0.92	0.00	0.00	0.01	0.02	0.00
L14	1.00	0.07	0.00	0.00	0.57	0.00	0.00	0.36	0.00	0.00
L30	1.00	0.07	0.00	0.00	0.09	0.00	0.00	0.84	0.00	0.00
L32	1.00	0.00	0.00	0.00	0.90	0.10	0.00	0.00	0.00	0.00
L34	1.00	0.07	0.00	0.00	0.45	0.00	0.00	0.48	0.02	0.00
L45	1.00	0.07	0.00	0.00	0.05	0.01	0.00	0.88	0.05	0.00
L50	1.00	0.07	0.00	0.00	0.61	0.00	0.00	0.32	0.03	0.00
L51	1.00	0.07	0.00	0.00	0.91	0.00	0.00	0.02	0.00	0.00
L61	1.00	0.07	0.00	0.00	0.05	0.01	0.00	0.87	0.01	0.00
L63	1.00	0.07	0.00	0.00	0.06	0.00	0.00	0.87	0.01	0.00
L64	1.00	0.08	0.00	0.00	0.06	0.00	0.00	0.86	0.00	0.00
L65	1.00	0.07	0.00	0.00	0.91	0.00	0.00	0.02	0.00	0.00
L68	1.00	0.07	0.00	0.00	0.07	0.00	0.00	0.86	0.01	0.00
L70	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L71	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
L72	1.00	0.07	0.00	0.00	0.05	0.00	0.00	0.88	0.00	0.00
L8	1.00	0.07	0.00	0.00	0.09	0.00	0.00	0.84	0.00	0.00

****
Conduit Surcharge Summary
****

Conduit	Hours Full: Both Ends	Hours Full: Upstream	Hours Full: Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited

C1	0.56	0.56	0.70	0.01	0.01
L1	2.13	2.13	2.22	0.01	0.02
L11	2.26	2.26	2.31	0.01	0.01
L14	2.42	2.42	2.49	0.01	0.01
L30	0.32	0.32	0.34	0.01	0.01
L34	1.90	1.90	1.95	0.01	0.01
L45	0.01	0.01	0.19	0.01	0.01
L50	2.23	2.23	2.27	0.01	0.01
L51	2.34	2.34	2.39	0.01	0.01
L61	0.01	0.01	0.05	0.01	0.01
L63	0.20	0.20	0.29	0.01	0.01
L64	0.30	0.30	0.31	0.01	0.01
L65	0.29	0.29	0.31	0.01	0.01
L68	0.34	0.40	0.38	0.01	0.12
L71	0.01	0.01	0.01	0.01	0.01
L72	0.43	0.55	0.43	0.59	0.43
L8	0.31	0.31	0.32	0.01	0.01

Analysis begun on: Tue Oct 6 13:47:01 2020
Analysis ended on: Tue Oct 6 13:47:02 2020
Total elapsed time: 00:00:01

Appendix D GEOTECHNICAL INVESTIGATION

Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

patersongroup

Supplemental Geotechnical Investigation

Proposed Hi-Rise Development
Clyde Avenue at Baseline Road
Ottawa, Ontario

Prepared For

Groupe Sélection

April 3, 2019

Report: PG4871-1

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Table of Contents

Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by Groupe Sélection to conduct a supplemental geotechnical investigation for the proposed high rise development to be located at Clyde Avenue and Baseline Road in the City of Ottawa (refer to Figure 1 - Key Plan in Appendix 2 of this report).

The objective of the current investigation was to:

- ❑ Determine the subsoil and groundwater conditions at this site by means of boreholes.

- ❑ Provide geotechnical recommendations pertaining to design of the proposed development including construction considerations which may affect the design.

The following report has been prepared specifically and solely for the aforementioned project which is described herein. It contains our findings and includes geotechnical recommendations pertaining to the design and construction of the subject development as they are understood at the time of writing this report.

Investigating the presence or potential presence of contamination on the subject property was not part of the scope of work of the current investigation.

2.0 Proposed Development

The proposed development is understood to consist of a 13 storey building with 2 levels of underground parking. The underground parking levels are anticipated to extend beyond the proposed building footprint and occupy the majority of the subject site. At-grade paved access lanes, parking areas and landscaped areas are also anticipated.

3.0 Method of Investigation

3.1 Field Investigation

Field Program

The field program for the current investigation was completed on March 25, 2019. At that time, 4 boreholes were advanced to a maximum depth of 7.6 m below existing grade. Previous investigations were carried out on June 11 to 13, 2008 and August 17, 2009. The borehole locations were distributed in a manner to provide general coverage of the proposed development. The locations were determined in the field by Paterson personnel taking into consideration site features and underground services. The locations of the test holes are shown in Drawing PG4871-1 - Test Hole Location Plan included in Appendix 2.

The boreholes were advanced using a truck-mounted auger drill rig operated by a two person crew. All fieldwork was conducted under the full-time supervision of our personnel under the direction of a senior engineer from the geotechnical department. The drilling procedure consisted of augering to the required depths at the selected locations and sampling the overburden.

Sampling and In Situ Testing

Soil samples from the boreholes were recovered from the auger flights or using a 50 mm diameter split-spoon sampler. All soil samples were initially classified on site, placed in sealed plastic bags and transported to our laboratory for further examination. The depths at which the auger and split spoon samples were recovered from the test holes are shown as AU and SS, respectively, on the Soil Profile and Test Data sheets presented in Appendix 1.

The Standard Penetration Test (SPT) was conducted in conjunction with the recovery of the split spoon samples. The SPT results are recorded as "N" values on the Soil Profile and Test Data sheets. The "N" value is the number of blows required to drive the split spoon sampler 300 mm into the soil after a 150 mm initial penetration using a 63.5 kg hammer falling from a height of 760 mm.

Coring of the bedrock using diamond drilling was carried out at two borehole locations to assess the bedrock quality. A recovery value and a Rock Quality Designation (RQD) value were calculated for each drilled section of bedrock and are shown on the Soil Profile and Test Data sheets in Appendix 1. The recovery value is the ratio, in percentage, of the length of the bedrock sample recovered over the length of the drilled section. The RQD value is the ratio, in percentage, of the total length of intact rock pieces longer than 100 mm in one drilled section over the length of the drilled section. These values are indicative of the quality of the bedrock.

The subsurface conditions observed in the boreholes were recorded in detail in the field. The soil profiles are logged on the Soil Profile and Test Data sheets presented in Appendix 1 of this report.

Groundwater

Flexible standpipes were installed in all boreholes to permit monitoring of the groundwater levels subsequent to the completion of the sampling program.

Sample Storage

All samples will be stored in the laboratory for a period of one month after issuance of this report. They will then be discarded unless we are otherwise directed.

3.2 Field Survey

The test hole locations were selected in the field by Paterson personnel in a manner to provide general coverage of the subject site, taking into consideration site features. The ground surface elevations at the borehole locations were provided by Stantec Geomatics. The test hole locations and ground surface elevations at the test hole locations are presented in Drawing PG4871-1 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

All soil samples were recovered from the subject site and visually examined in our laboratory to review the results of the field logging.

3.4 Analytical Testing

One soil sample was submitted for analytical testing to assess the corrosion potential for exposed ferrous metals and the potential of sulphate attacks against subsurface concrete structures. The sample was analysed to determine the concentrations of sulphate and chloride, the resistivity and the pH of the sample. The analytical test results are presented in Appendix 1 and discussed in Subsection 6.7 of this report.

4.0 Observations

4.1 Surface Conditions

The subject site is currently unoccupied vacant land with a grass surface. During winter months the subject site is used as overflow parking for the neighbouring commercial properties and businesses. The site is relatively flat and approximately at grade with neighbouring properties and nearby roadways. The site is bordered to the north and east by commercial properties, to the south by Baseline Road and to the west by Clyde Avenue.

4.2 Subsurface Profile

Generally, the soil profile at the borehole locations consisted of a thin layer of topsoil and/or gravel fill followed by a layer of silty sand. A glacial till deposit was encountered below the fill/silty sand layer. The fine matrix of the glacial till was observed to consist of silty sand with gravel, cobbles and trace clay. Practical auger refusal was encountered at depths ranging from 2.6 to 3.5 m below ground surface. Specific details of the soil profile at each borehole location are provided on the Soil Profile and Test Data sheets in Appendix 1.

Bedrock

Grey limestone bedrock was cored at BHs 2 and 3 to a maximum depth of 7.7 m. The recovery values and RQD values for the bedrock cores were calculated. The recorded recovery values were 100% for all samples, while the RQD values vary between 82 and 100%. Based on these results the quality of the bedrock ranges from good to excellent.

Based on available geological mapping, the local bedrock consists of interbedded limestone and dolostone of the Gull River formation with an anticipated overburden thickness of 0 to 1 m.

4.3 Groundwater

Groundwater levels (GWL) were measured on April 1, 2019 in the standpipes installed at the borehole locations. The GWL readings and open hole groundwater observations are presented in Table 1 below. It is important to note that groundwater level readings could be influenced by surface water infiltrating the backfilled borehole. The groundwater table level can also be estimated based on moisture levels and colour of the recovered soil samples. Based on these observations at the borehole locations, the permanent groundwater table is expected below a 3 m depth. As groundwater levels are subject to seasonal fluctuations, it should be noted that groundwater may vary at the time of construction.

Table 1 - Summary of Groundwater Levels

Borehole Number	Ground Surface Elevation (m)	Measured Groundwater Level (m)		Recording Date
		Depth	Groundwater Elevation (m)	
BH 1	98.37	Blocked	-	April 1, 2019
BH 2	98.92	3.67	95.25	April 1, 2019
BH 3	98.37	2.11	96.26	April 1, 2019
BH 4	98.54	2.22	96.32	April 1, 2019

Note: The ground surface elevations at the borehole locations were provided by Stantec Geomatics.

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is suitable for the proposed residential hi-rise development. It is anticipated that bedrock removal will be required to accommodate the proposed underground parking levels.

The above and other considerations are discussed in the following paragraphs.

5.2 Site Grading and Preparation

Stripping Depth

Topsoil and deleterious fill, such as those containing organic materials, should be stripped from under any buildings and other settlement sensitive structures. Existing foundation walls and other construction debris should be entirely removed from within the building perimeter. Under paved areas, existing construction remnants such as foundation walls should be excavated to a minimum of 1 m below final grade.

Bedrock Removal

Bedrock removal can be accomplished by hoe ramming where only a small quantity of the bedrock needs to be removed. Sound bedrock may be removed by line drilling and controlled blasting and/or hoe ramming.

Prior to considering blasting operations, the blasting effects on the existing services, buildings and other structures should be addressed. A pre-blast or pre-construction survey of the existing structures located in proximity of the blasting operations should be carried out prior to commencing site activities. The extent of the survey should be determined by the blasting consultant and should be sufficient to respond to any inquiries/claims related to the blasting operations.

As a general guideline, peak particle velocities (measured at the structures) should not exceed 25 mm per second during the blasting program to reduce the risks of damage to the existing structures.

The blasting operations should be planned and conducted under the supervision of a licensed professional engineer who is also an experienced blasting consultant.

Excavation side slopes in sound bedrock can be carried out using almost vertical side walls. A minimum 1 m horizontal ledge should be left between the bottom of the overburden excavation and the top of the bedrock surface to provide an area to allow for potential sloughing.

Fill Placement

Fill used for grading purposes beneath the proposed building, unless otherwise specified, should consist of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. An OPSS Granular B Type I (pit run) material or existing granular material approved by the geotechnical consultant can also be used below the proposed building footprint. The fill should be tested and approved prior to delivery to the site. It should be placed in lifts no greater than 300 mm in thickness and compacted using suitable compaction equipment for the specified lift thickness. Fill placed beneath the building areas should be compacted to at least 98% of its standard Proctor maximum dry density (SPMDD).

Non-specified existing fill along with site-excavated soil can be used as general landscaping fill where settlement of the ground surface is of minor concern. These materials should be spread in thin lifts and be compacted at minimum by the tracks of the spreading equipment to minimize voids. If these materials are to be used to build up the subgrade level for areas to be paved, they should be compacted in thin lifts to a minimum density of 95% of their respective SPMDD. Non-specified existing fill and site-excavated soils are not suitable for use as backfill against foundation walls, unless deemed acceptable by the geotechnical consultant.

5.3 Foundation Design

Shallow footings placed on a clean, surface sounded bedrock bearing surface can be designed using a factored bearing resistance value at ultimate limit states (ULS) of **1,500 kPa**, incorporating a geotechnical resistance factor of 0.5. Footings placed on a clean, surface-sounded bedrock bearing surface will be subjected to negligible post-construction total and differential settlements.

A clean, surface-sounded bedrock bearing surface should be free of loose materials, and have no near surface seams, voids, fissures or open joints which can be detected from surface sounding with a rock hammer.

For the footings at depth for the parking garage and building foundation, a factored bearing resistance value at ULS of **4,500 kPa**, incorporating a geotechnical resistance factor of 0.5 could be used if founded on limestone bedrock provided the bedrock is free of seams, fractures and voids within 1.5 m below the founding level.

Lateral Support

The bearing medium under footing-supported structures is required to be provided with adequate lateral support. Near vertical (1H:6V) slopes can be used for unfractured bedrock bearing media; a 1H:1V slope can be used for fractured or weathered bedrock.

5.4 Design for Earthquakes

Shear wave velocity testing was completed for the subject site to accurately determine the applicable seismic site classification for the proposed buildings from Table 4.1.8.4.A of the Ontario Building Code 2012. The shear wave velocity testing was completed by Paterson personnel and the interpretation was completed by Dr. Dariush Motazedian, an expert seismologist with Carleton University. The results of the shear wave interpretation are presented in Appendix 2.

Field Program

The shear wave testing was located adjacent to the subject site, as presented in Drawing PG4871-2 - Seismic Survey Location Plan presented in Appendix 2. Paterson field personnel placed 24 horizontal geophones in a straight line in roughly a north-south orientation. The 4.5 Hz horizontal geophones were mounted to the surface by means of a 75 mm ground spike attached to the geophone land case. The geophones were spaced at 3 m intervals and were connected by a geophone spread cable to a Geode 24 Channel seismograph.

The seismograph was also connected to a computer laptop and a hammer trigger switch attached to a 12 pound dead blow hammer. The hammer trigger switch sends a start signal to the seismograph. The hammer is used to strike an I-beam seated into the ground surface, which creates a polarized shear wave. The hammer shots are repeated between 4 to 8 times at each shot location to improve signal to noise ratio. The shot locations are also completed in forward and reverse directions (i.e.-striking both sides of the I-beam seated parallel to the geophone array). The shot locations are located at the centre of the geophone array and 3, 4.5 and 30 m away from the first and last geophone.

The methods of testing completed by Paterson are guided by the standard testing procedures used by the expert seismologists at Carleton University and Geological Survey of Canada (GSC).

Data Processing and Interpretation

Interpretation for the shear wave velocity results were completed by Dr. Dariush Motazedian, an expert seismologist with Carleton University. The shear wave velocity measurement was made using reflection/refraction methods. The interpretation is performed by recovering arrival times from direct and refracted waves. The interpretation is repeated at each shot location to provide an average shear wave velocity, Vs_{30}, of the upper 30 m profile. The layer intercept times, velocities from different layers and critical distances are interpreted from the shear wave records to compute the bedrock depth at each location. The bedrock velocity was interpreted using the main refractor wave velocity, this is considered a conservative estimate of the bedrock velocity due to the increasing quality of the bedrock with depth. It should be noted that as bedrock quality increases, the bedrock shear wave velocity also increases.

Based on the available concept drawings and plans, the building footings will be placed directly on the bedrock.

The Vs_{30} was calculated using the standard equation for average shear wave velocity calculation from the Ontario Building Code (OBC) 2012.

$$V_{s30} = \frac{Depth_{OfInterest}(m)}{\sum\left(\frac{(Depth_{Layer1}(m)}{Vs_{Layer1}(m/s)} + \frac{Depth_{Layer2}(m)}{Vs_{Layer2}(m/s)}\right)}$$

$$V_{s30} = \frac{30m}{\sum\left(\frac{30m}{2{,}907m/s}\right)}$$

$$V_{s30} = 2{,}907m/s$$

Based on the results of the seismic testing , the average shear wave velocity of the upper 30 m profile below the proposed underside of foundation, Vs_{30}, was calculated to be **2,907 m/s**. Therefore, a **Site Class A** is applicable for the proposed buildings founded directly on bedrock as per Table 4.1.8.4.A of the OBC 2012. The soils underlying the site are not susceptible to liquefaction.

5.5 Basement Slab

All overburden soil will be removed for the proposed building and underground parking levels and the basement floor slab will be placed over a bedrock medium. OPSS Granular A or Granular B Type II, with a maximum particle size of 50 mm, are recommended for backfilling below the floor slab. It is recommended that the upper 200 mm of sub-slab fill consist of a 19 mm clear crushed stone.

In consideration of the groundwater conditions encountered during the investigation, a subfloor drainage system, consisting of lines of perforated drainage pipe subdrains connected to a positive outlet, should be provided in the clear stone backfill under the lower basement floor.

5.6 Basement Wall

Where soil is to be retained, the conditions can be well-represented by assuming the retained soil consists of a material with an angle of internal friction of 30 degrees and a dry unit weight of 20 kN/m^3. Undrained conditions are anticipated (i.e. below the groundwater level). Therefore, the applicable effective unit weight of the retained soil can be taken as 13 kN/m^3, where applicable. A hydrostatic pressure should be added to the total static earth pressure when using the effective unit weight.

Two distinct conditions, static and seismic should be reviewed for design calculations. The parameters for design calculations for the two conditions are presented below.

Lateral Earth Pressures

The static horizontal earth pressure (P_o) can be calculated using a triangular earth pressure distribution equal to $K_o \cdot \gamma \cdot H$ where:

K_o = at-rest earth pressure coefficient of the applicable retained soil, 0.5
γ = unit weight of the applicable retained soil (kN/m^3)
H = height of the wall (m)

An additional pressure having a magnitude equal to $K_o \cdot q$ and acting on the entire height of the wall should be added to the above diagram for any surcharge loading, q (kPa), that may be placed at ground surface adjacent to the wall. The surcharge pressure will only be applicable for static analyses and should not be used in conjunction with the seismic loading case.

Actual earth pressures could be higher than the "at-rest" case if care is not exercised during the compaction of the backfill materials to maintain a minimum separation of 0.3 m from the walls with the compaction equipment.

Seismic Earth Pressures

The total seismic force (P_{AE}) includes both the earth force component (P_o) and the seismic component (ΔP_{AE}). The seismic earth force (ΔP_{AE}) can be calculated using $0.375 \cdot a_c \cdot \gamma \cdot H^2/g$ where:

a_c = $(1.45 - a_{max}/g)a_{max}$
γ = unit weight of fill of the applicable retained soil (kN/m^3)
H = height of the wall (m)
g = gravity, 9.81 m/s^2

The peak ground acceleration, (a_{max}), for the Ottawa area is 0.32g according to OBC 2012. Note that the vertical seismic coefficient is assumed to be zero.

The earth force component (P_o) under seismic conditions can be calculated using $P_o = 0.5 \cdot K_o \cdot \gamma \cdot H^2$, where $K_o = 0.5$ for the soil conditions noted above.

The total earth force (P_{AE}) is considered to act at a height, h (m), from the base of the wall, where:

$h = \{P_o \cdot (H/3) + \Delta P_{AE} \cdot (0.6 \cdot H)\}/P_{AE}$

The earth forces calculated are unfactored. For the ULS case, the earth loads should be factored as live loads, as per OBC 2012.

5.7 Rock Anchor Design

The geotechnical design of grouted rock anchors in sedimentary bedrock is based upon two possible failure modes. The anchor can fail either by shear failure along the grout/rock interface or by pullout from a 60 to 90 degree cone with the apex near the middle of the anchor bonded length. Interaction may develop between the failure cones of adjacent anchors resulting in a total group capacity less than the sum of the individual anchor load capacity. A third failure mode of shear failure along the grout/steel interface should also be reviewed by a qualified structural engineer to ensure all typical failure modes have been reviewed. Typical rock anchor suppliers, such as Dywidag Systems International (DSI Canada), have qualified personnel on staff to recommend appropriate rock anchor size and materials.

Centre-to-centre spacing between anchors should be at least four times the anchor hole diameter and greater than 1/5 of the total anchor length (minimum of 1.2 m) to lower the group influence effects. Anchors in close proximity to each other are recommended to be grouted at the same time to ensure any fractures or voids are completely in-filled and grout does not flow from one hole to an adjacent empty one.

Regardless of whether an anchor is of the passive or post tensioned type, the anchor is recommended to be provided with a fixed length at the anchor base, which will provide the anchor capacity, and a free length between the rock surface and the bonded length. As the depth at which the apex of the shear failure cone develops midway along the bonded length, a fully bonded anchor has a much shallower cone, and therefore less geotechnical resistance, than one where the bonded length is at the bottom portion of the anchor.

Permanent anchors should be provided with corrosion protection. As a minimum, this requires that the entire drill hole be filled with cementitious grout. The free anchor length is provided by installing a sleeve to act as a bond break, with the sleeve filled with grout. Double corrosion protection can be provided with factory assembled systems, such as those available from Dywidag Systems International or Williams Form Engineering Corp. Recognizing the importance of the anchors for the long term performance of the foundation of the proposed buildings, the rock anchors for this project are recommended to be provided with double corrosion protection.

Grout to Rock Bond

Generally, the unconfined compressive strength of limestone and dolostone bedrock exceeds 80 MPa, which is stronger than most routine grouts. A factored tensile grout to rock bond resistance value at ULS of 1,000 kPa, incorporating a resistance factor of 0.3, can be used. A minimum grout strength of 40 MPa is recommended.

Rock Cone Uplift

As discussed previously, the geotechnical capacity of the rock anchors depends on the dimensions of the rock anchors and the configuration of the anchorage system. A **Rock Mass Rating (RMR) of 65** was assigned to the bedrock, and Hoek and Brown parameters (**m and s**) were taken as **0.575 and 0.00293**, respectively. For design purposes, all rock anchors were assumed to be placed at least 1.2 m apart to reduce group anchor effects.

Recommended Rock Anchor Lengths

Rock anchor lengths can be designed based on the required loads. Rock anchor lengths for some typical loads have been calculated and are presented on the following page. Load specified rock anchor lengths can be provided, if required. For calculations the parameters given in Table 2 were used.

Table 2 - Parameters Used in Rock Anchor Review	
Grout to Rock Bond Strength - Factored at ULS	1.0 MPa
Compressive Strength - Grout	40 MPa
Rock Mass Rating (RMR) - Good Quality Limestone Hoek and Brown parameters	65 m=0.575 and s=0.00293
Unconfined compressive strength - Limestone bedrock	80 MPa
Unit weight - Submerged Bedrock	15 kN/m^3
Apex angle of failure cone	60^o
Apex of failure cone	mid-point of fixed anchor length

From a geotechnical perspective, the fixed anchor length will depend on the diameter of the drill holes. Recommended anchor lengths for a 75 and 125 mm diameter hole are provided in Table 3.

Table 3 - Recommended Rock Anchor Lengths - Grouted Rock Anchor

Diameter of Drill Hole (mm)	Anchor Lengths (m)			Factored Tensile Resistance (kN)
	Bonded Length	Unbonded Length	Total Length	
75	3.0	1.5	4.5	250
	4.2	2.2	6.4	500
	6.5	2.6	9.1	1000
	10	3.5	13.5	2000
125	2.8	1.5	4.3	250
	3.5	2.4	5.9	500
	5.5	2.8	8.3	1000
	8	3.8	11.8	2000

The anchor drill holes should be within 1.5 to 2 times the rock anchor tendon diameter, inspected by geotechnical personnel and flushed clean with water prior to grouting. A tremie tube is recommended to place grout from the bottom of the anchor holes. Compressive strength testing is recommended to be completed for the rock anchor grout. A set of grout cubes should be tested for each day that grout is prepared.

The geotechnical capacity of each rock anchor should be proof tested at the time of construction. More information on testing can be provided upon request. Compressive strength testing is recommended to be completed for the rock anchor grout. A set of grout cubes should be tested for each day grout is prepared.

5.8 Pavement Design

Car only parking and heavy traffic areas are anticipated at this site. The subgrade material will consist of glacial till. The proposed pavement structures are shown in Tables 4 and 5.

Table 4 - Recommended Pavement Structure - Car Only Parking Areas

Thickness (mm)	Material Description
50	**Wear Course -** HL-3 or Superpave 12.5 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
300	**SUBBASE** - OPSS Granular B Type II
	SUBGRADE - Either fill, in situ soil, or OPSS Granular B Type I or II material placed over in situ soil or fill

Table 5 - Recommended Pavement Structure - Access Lanes and Heavy Truck Parking Areas

Thickness (mm)	Material Description
40	**Wear Course -** HL-3 or Superpave 12.5 Asphaltic Concrete
50	**Binder Course -** HL-8 or Superpave 19.0 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
400	**SUBBASE** - OPSS Granular B Type II
	SUBGRADE - Either fill, in situ soil, or OPSS Granular B Type I or II material placed over in situ soil or fill

Minimum Performance Graded (PG) 58-34 asphalt cement should be used for this project.

If soft spots develop in the subgrade during compaction or due to construction traffic, the affected areas should be excavated and replaced with OPSS Granular B Type I or Type II material.

The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 98% of the material's SPMDD using suitable compaction equipment.

Pavement Structure Drainage

Satisfactory performance of the pavement structure is largely dependent on keeping the contact zone between the subgrade material and the base stone in a dry condition. Failure to provide adequate drainage under conditions of heavy wheel loading can result in the fine subgrade soil being pumped into the voids in the stone subbase, thereby reducing its load carrying capacity.

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

It is recommended that a perimeter foundation drainage system be provided for the proposed structure. The system should consist of a 150 mm diameter perforated corrugated plastic pipe, surrounded on all sides by 150 mm of 10 mm clear crushed stone, placed at the footing level around the exterior perimeter of the structure. The pipe should have a positive outlet, such as a gravity connection to the storm sewer.

Backfill against the exterior sides of the foundation walls should consist of free-draining non frost susceptible granular materials. It is anticipated that imported granular materials, such as clean sand or OPSS Granular B Type I granular material, should be used for this purpose. It should also be noted that existing granular material approved by the geotechnical consultant is also acceptable for backfill against the foundation walls.

6.2 Protection of Footings Against Frost Action

Perimeter footings of heated structures are required to be insulated against the deleterious effect of frost action. A minimum of 1.5 m thick soil cover (or equivalent) should be provided in this regard.

A minimum of 2.1 m thick soil cover (or equivalent) should be provided for other exterior unheated footings.

For footings founded directly on sound bedrock where insufficient soil cover is available, insulation can be used to make up the shortfall. Also, if the bedrock is considered to be non-frost susceptible, the suggested insulation can be omitted. Non-frost susceptible bedrock requires confirmation of no significant soil bearing seams within the potential frost penetration depth. This confirmation is carried out using probeholes which are verified by geotechnical personnel.

6.3 Excavation Side Slopes

The side slopes of excavations in the soil and fill overburden materials should either be cut back at acceptable slopes or should be retained by shoring systems from the start of the excavation until the structure is backfilled. It is assumed that sufficient room will be available for the greater part of the excavation to be undertaken by open-cut methods (i.e. unsupported excavations).

The excavation side slopes above the groundwater level extending to a maximum depth of 3 m should be cut back at 1H:1V or flatter. The flatter slope is required for excavation below groundwater level. The subsoil at this site is considered to be mainly a Type 2 and 3 soil according to the Occupational Health and Safety Act and Regulations for Construction Projects.

Excavated soil should not be stockpiled directly at the top of excavations and heavy equipment should be kept away from the excavation sides.

It is recommended that a trench box be used at all times to protect personnel working in trenches with steep or vertical sides. It is expected that services will be installed by “cut and cover” methods and excavations will not be left open for extended periods of time.

6.4 Pipe Bedding and Backfill

At least 150 mm of OPSS Granular A should be used for pipe bedding for sewer and water pipes. The bedding should extend to the spring line of the pipe. Cover material, from the spring line to at least 300 mm above the obvert of the pipe should consist of OPSS Granular A. The bedding and cover materials should be placed in maximum 225 mm thick lifts compacted to a minimum of 95% of the material’s SPMDD.

Generally, it should be possible to re-use the moist, not wet, glacial till above the cover material if the excavation and filling operations are carried out in dry weather conditions. The wet glacial till should be given a sufficient drying period to decrease its moisture content to an acceptable level to make compaction possible prior to being re-used.

Where hard surface areas are considered above the trench backfill, the trench backfill material within the frost zone (about 1.8 m below finished grade) should match the soils exposed at the trench walls to minimize differential frost heaving. The trench backfill should be placed in maximum 300 mm thick loose lifts and compacted to a minimum of 95% of the material’s SPMDD.

6.5 Groundwater Control

The contractor should be prepared to direct water away from all bearing surfaces and subgrades, regardless of the source, to prevent disturbance to the founding medium.

It is anticipated that pumping from open sumps will be sufficient to control the groundwater influx through the sides of the excavations.

A temporary Ministry of the Environment, Conservation and Parks (MECP) permit to take water (PTTW) may be required for this project if more than 400,000 L/day of ground and/or surface water is to be pumped during the construction phase. A minimum of 4 to 5 months should be allowed for completion of the PTTW application package and issuance of the permit by the MECP.

For typical ground or surface water volumes being pumped during the construction phase, between 50,000 to 400,000 L/day, it is required to register in the Environmental Activity and Sector Registry (EASR). A minimum of two to four weeks should be allotted for completion of the EASR registration and the Water Taking and Discharge Plan to be prepared by a Qualified Person as stipulated under O.Reg. 63/16. If a project qualifies for a PTTW based upon anticipated conditions, an EASR will not be allowed as a temporary dewatering measure while awaiting the MECP review of the PTTW application.

6.6 Winter Construction

Precautions must be taken if winter construction is considered for this project.

The subsoil conditions at this site consist of frost susceptible materials. In the presence of water and freezing conditions, ice could form within the soil mass. Heaving and settlement upon thawing could occur.

In the event of construction during below zero temperatures, the founding stratum should be protected from freezing temperatures by the use of straw, propane heaters and tarpaulins or other suitable means. In this regard, the base of the excavations should be insulated from sub-zero temperatures immediately upon exposure and until such time as heat is adequately supplied to the building and the footings are protected with sufficient soil cover to prevent freezing at founding level.

Trench excavations and pavement construction are also difficult activities to complete during freezing conditions without introducing frost in the subgrade or in the excavation walls and bottoms. Precautions should be taken if such activities are to be carried out during freezing conditions. Additional information could be provided, if required.

6.7 Corrosion Potential and Sulphate

The results of analytical testing show that the sulphate content is less than 0.1%. This result is indicative that Type 10 Portland cement (normal cement) would be appropriate for this site. The chloride content and the pH of the sample indicate that they are not significant factors in creating a corrosive environment for exposed ferrous metals at this site, whereas the resistivity is indicative of an aggressive to very aggressive corrosive environment.

7.0 Recommendations

It is a requirement for the foundation design data provided herein to be applicable that the following material testing and observation program be performed by the geotechnical consultant.

- ❏ Review of the geotechnical aspects of the excavation contractor's shoring design, prior to construction.
- ❏ Review the bedrock stabilization and excavation requirements.
- ❏ Review proposed foundation drainage design and requirements.
- ❏ Observation of all bearing surfaces prior to the placement of concrete.
- ❏ Sampling and testing of the concrete and fill materials used.
- ❏ Periodic observation of the condition of unsupported excavation side slopes in excess of 3 m in height, if applicable.
- ❏ Observation of all subgrades prior to backfilling and follow-up field density tests to determine the level of compaction achieved.
- ❏ Sampling and testing of the bituminous concrete including mix design reviews.

A report confirming that these works have been conducted in general accordance with our recommendations could be issued upon the completion of a satisfactory inspection program by the geotechnical consultant.

8.0 Statement of Limitations

The recommendations made in this report are in accordance with our present understanding of the project. We request that we be permitted to review the grading plan once available. Also, our recommendations should be reviewed when the project drawings and specifications are complete.

A soils investigation is a limited sampling of a site. Should any conditions at the site be encountered which differ from those at the test locations, we request that we be notified immediately in order to permit reassessment of our recommendations.

The present report applies only to the project described in this document. Use of this report for purposes other than those described herein or by person(s) other than Groupe Sélection or their agent(s) is not authorized without review by this firm for the applicability of our recommendations to the altered use of the report.

Paterson Group Inc.

Nathan F. S. Christie, P.Eng.

Carlos P. Da Silva, P.Eng., ing, QP_{ESA}

Report Distribution:

- ❑ Groupe Sélection (3 copies)
- ❑ Paterson Group (1 copy)

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

ANALYTICAL TESTING RESULTS

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Clyde Avenue and Baseline Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

FILE NO. PG4871

REMARKS

HOLE NO. BH 1

BORINGS BY CME 55 Power Auger **DATE** March 25, 2019

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	98.37
FILL: Gravel — 0.08							
Compact, brown **SILTY SAND**		AU	1				
		SS	2	75	14	1	97.37
— 1.52							
GLACIAL TILL: Compact to dense, brown silty sand with gravel, some cobbles, trace clay		SS	3	83	14		
						2	96.37
		SS	4	92	50+		
— 2.59							
End of Borehole							
Practical refusal to augering at 2.59m depth							
(Piezometer blocked at 1.3m depth - April 1, 2019)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Clyde Avenue and Baseline Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

REMARKS

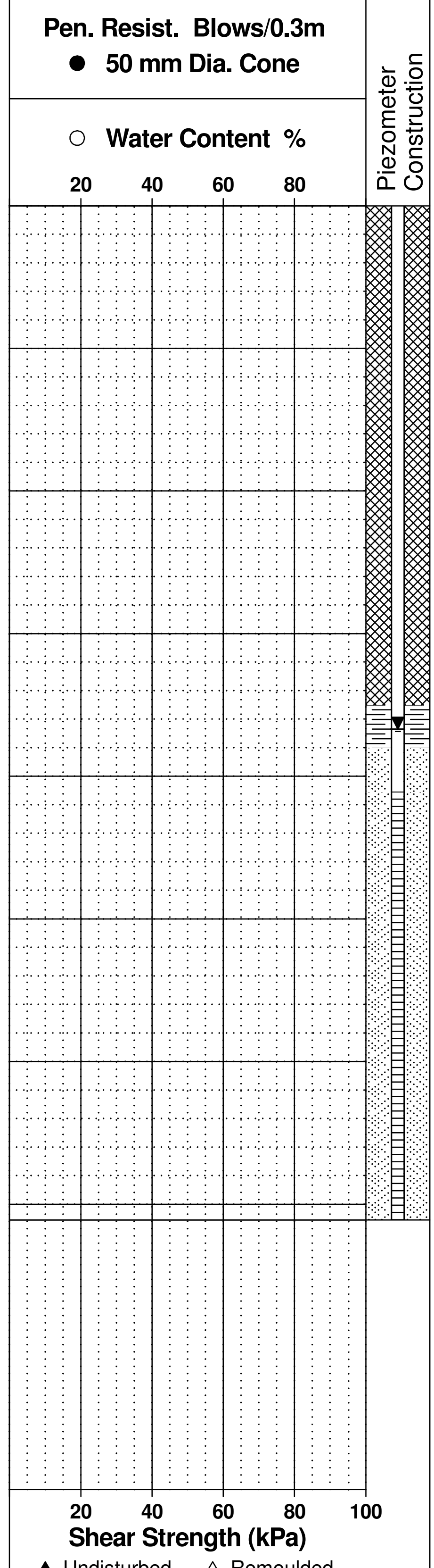
BORINGS BY CME 55 Power Auger

DATE March 25, 2019

FILE NO. PG4871

HOLE NO. BH 2

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	98.92
FILL: Brown silty sand with gravel (to 0.53)		AU	1				
Loose, brown **SILTY SAND** (to 1.37)		SS	2	54	9	1	97.92
GLACIAL TILL: Compact to dense, brown silty sand with gravel, some cobbles (to 3.02)		SS	3	83	12	2	96.92
		SS	4	88	33	3	95.92
BEDROCK: Good to excellent quality, grey limestone (to 7.11)		RC	1	100	95	4	94.92
		RC	2	100	90	5	93.92
		RC	3	100	82	6	92.92
End of Borehole						7	91.92
(GWL @ 3.67m - April 1, 2019)							



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Clyde Avenue and Baseline Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

FILE NO. PG4871

REMARKS

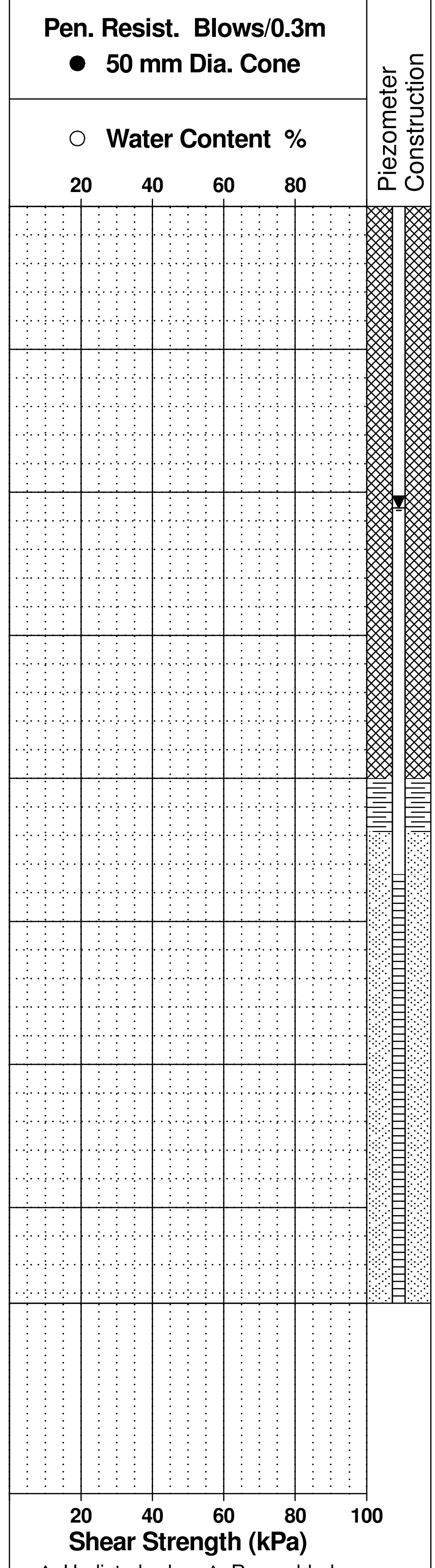
HOLE NO. BH 3

BORINGS BY CME 55 Power Auger

DATE March 25, 2019

SOIL DESCRIPTION	Strata depth (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE					
TOPSOIL	0.10	AU	1		
Very loose to loose, brown **SILTY SAND**	1.60	SS	2	75	1
GLACIAL TILL: Compact to dense, brown silty sand with gravel, some cobbles, trace clay		SS	3	54	9
		SS	4	71	26
	3.30	SS	5	75	50+
BEDROCK: Good to excellent quality, grey limestone		RC	1	100	91
		RC	2	100	98
		RC	3	100	83
	7.67	RC	4	100	100
End of Borehole					
(GWL @ 2.11m - April 1, 2019)					

DEPTH (m)	ELEV. (m)
0	98.37
1	97.37
2	96.37
3	95.37
4	94.37
5	93.37
6	92.37
7	91.37



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Clyde Avenue and Baseline Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

FILE NO. PG4871

REMARKS

HOLE NO. BH 4

BORINGS BY CME 55 Power Auger

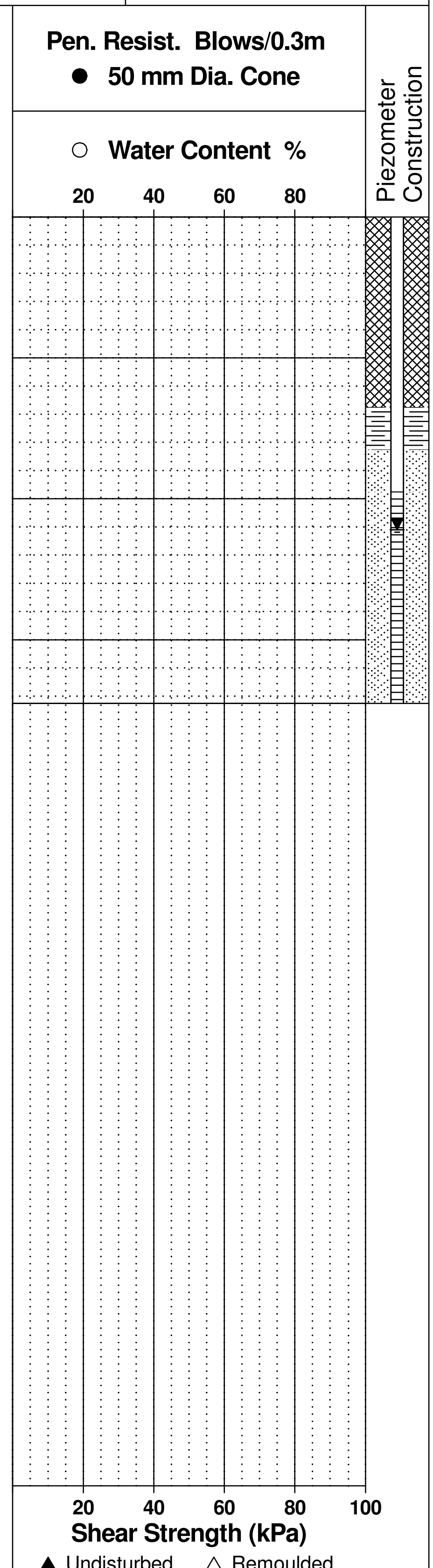
DATE March 25, 2019

SOIL DESCRIPTION	Depth to base (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	98.54
TOPSOIL	0.30	AU	1				
Very loose, brown **SILTY SAND**	1.30	SS	2	58	3	1	97.54
Brown **SILTY CLAY**	1.37						
GLACIAL TILL: Compact to dense, brown silty sand with gravel, trace clay	3.45	SS	3	33	6	2	96.54
		SS	4	67	16	3	95.54
		SS	5	100	50+		

End of Borehole

Practical refusal to augering at 3.45m depth

(GWL @ 2.22m - April 1, 2019)



SYMBOLS AND TERMS

SOIL DESCRIPTION

Behavioural properties, such as structure and strength, take precedence over particle gradation in describing soils. Terminology describing soil structure are as follows:

Desiccated	-	having visible signs of weathering by oxidation of clay minerals, shrinkage cracks, etc.
Fissured	-	having cracks, and hence a blocky structure.
Varved	-	composed of regular alternating layers of silt and clay.
Stratified	-	composed of alternating layers of different soil types, e.g. silt and sand or silt and clay.
Well-Graded	-	Having wide range in grain sizes and substantial amounts of all intermediate particle sizes (see Grain Size Distribution).
Uniformly-Graded	-	Predominantly of one grain size (see Grain Size Distribution).

The standard terminology to describe the relative strength of cohesionless soils is the compactness condition, usually inferred from the results of the Standard Penetration Test (SPT) 'N' value. The SPT N value is the number of blows of a 63.5 kg hammer, falling 760 mm, required to drive a 51 mm O.D. split spoon sampler 300 mm into the soil after an initial penetration of 150 mm. An SPT N value of "P" denotes that the split-spoon sampler was pushed 300 mm into the soil without the use of a falling hammer.

Compactness Condition	'N' Value	Relative Density %
Very Loose	<4	<15
Loose	4-10	15-35
Compact	10-30	35-65
Dense	30-50	65-85
Very Dense	>50	>85

The standard terminology to describe the strength of cohesive soils is the consistency, which is based on the undisturbed undrained shear strength as measured by the in situ or laboratory shear vane tests, unconfined compression tests, or occasionally by the Standard Penetration Test (SPT). Note that the typical correlations of undrained shear strength to SPT N value (tabulated below) tend to underestimate the consistency for sensitive silty clays, so Paterson reviews the applicable split spoon samples in the laboratory to provide a more representative consistency value based on tactile examination.

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

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

Cohesive soils can also be classified according to their “sensitivity”. The sensitivity, S_t, is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil. The classes of sensitivity may be defined as follows:

Low Sensitivity:	$S_t < 2$
Medium Sensitivity:	$2 < S_t < 4$
Sensitive:	$4 < S_t < 8$
Extra Sensitive:	$8 < S_t < 16$
Quick Clay:	$S_t > 16$

ROCK DESCRIPTION

The structural description of the bedrock mass is based on the Rock Quality Designation (RQD).

The RQD classification is based on a modified core recovery percentage in which all pieces of sound core over 100 mm long are counted as recovery. The smaller pieces are considered to be a result of closely-spaced discontinuities (resulting from shearing, jointing, faulting, or weathering) in the rock mass and are not counted. RQD is ideally determined from NQ or larger size core. However, it can be used on smaller core sizes, such as BQ, if the bulk of the fractures caused by drilling stresses (called “mechanical breaks”) are easily distinguishable from the normal in situ fractures.

RQD %	**ROCK QUALITY**
90-100	Excellent, intact, very sound
75-90	Good, massive, moderately jointed or sound
50-75	Fair, blocky and seamy, fractured
25-50	Poor, shattered and very seamy or blocky, severely fractured
0-25	Very poor, crushed, very severely fractured

SAMPLE TYPES

SS	-	Split spoon sample (obtained in conjunction with the performing of the Standard Penetration Test (SPT))
TW	-	Thin wall tube or Shelby tube, generally recovered using a piston sampler
G	-	"Grab" sample from test pit or surface materials
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size BQ, NQ, HQ, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

PLASTICITY LIMITS AND GRAIN SIZE DISTRIBUTION

WC%	-	Natural water content or water content of sample, %
LL	-	Liquid Limit, % (water content above which soil behaves as a liquid)
PL	-	Plastic Limit, % (water content above which soil behaves plastically)
PI	-	Plasticity Index, % (difference between LL and PL)
Dxx	-	Grain size at which xx% of the soil, by weight, is of finer grain sizes These grain size descriptions are not used below 0.075 mm grain size
D10	-	Grain size at which 10% of the soil is finer (effective grain size)
D60	-	Grain size at which 60% of the soil is finer
Cc	-	Concavity coefficient = $(D30)^2 / (D10 \times D60)$
Cu	-	Uniformity coefficient = D60 / D10

Cc and Cu are used to assess the grading of sands and gravels:
Well-graded gravels have: $1 < Cc < 3$ and $Cu > 4$
Well-graded sands have: $1 < Cc < 3$ and $Cu > 6$
Sands and gravels not meeting the above requirements are poorly-graded or uniformly-graded.
Cc and Cu are not applicable for the description of soils with more than 10% silt and clay (more than 10% finer than 0.075 mm or the #200 sieve)

CONSOLIDATION TEST

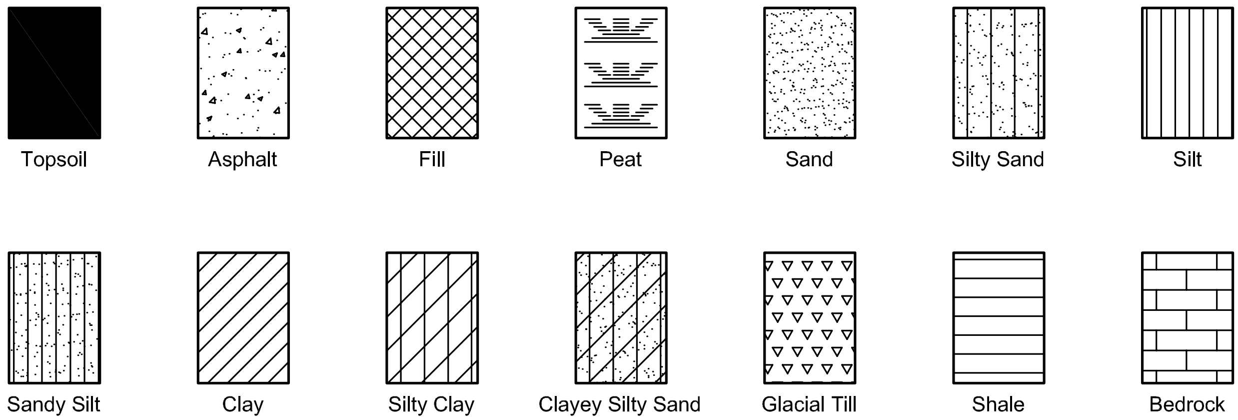
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void Ratio		Initial sample void ratio = volume of voids / volume of solids
Wo	-	Initial water content (at start of consolidation test)

PERMEABILITY TEST

k	-	Coefficient of permeability or hydraulic conductivity is a measure of the ability of water to flow through the sample. The value of k is measured at a specified unit weight for (remoulded) cohesionless soil samples, because its value will vary with the unit weight or density of the sample during the test.

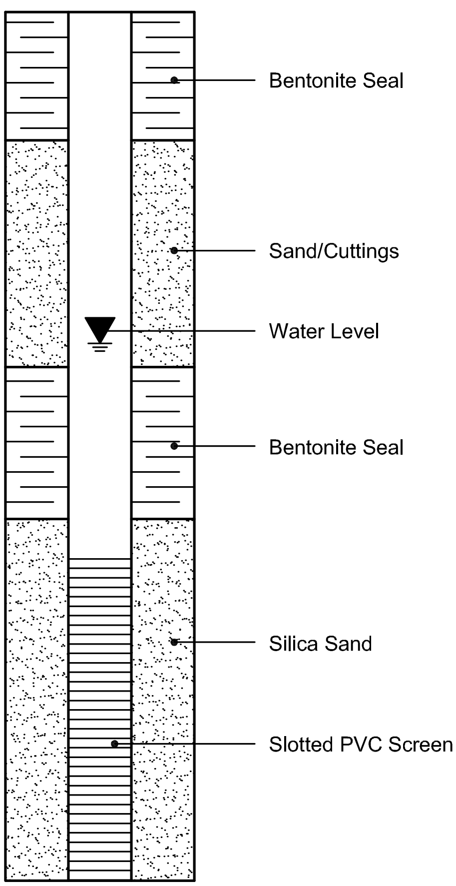
SYMBOLS AND TERMS (continued)

STRATA PLOT

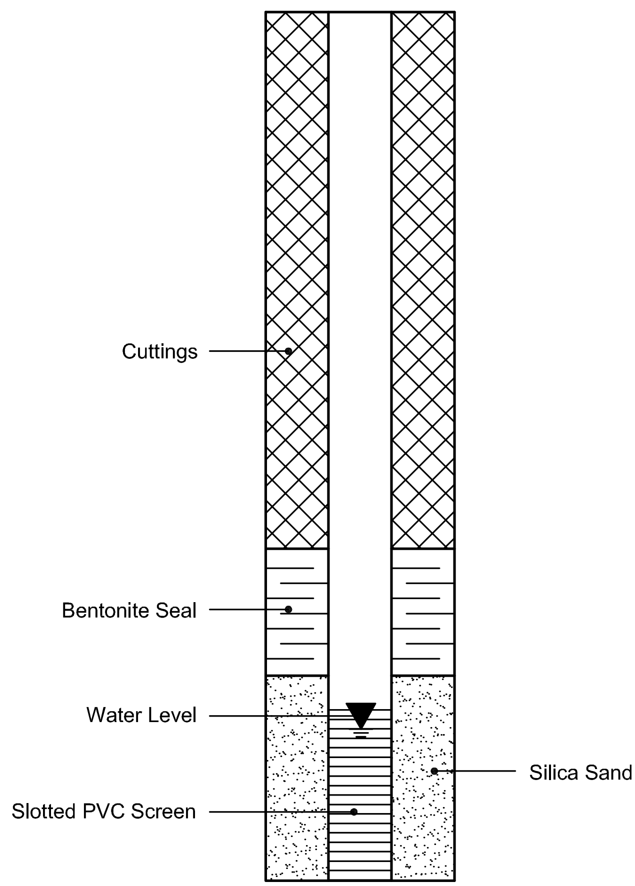


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 26252

Report Date: 29-Mar-2019

Order Date: 25-Mar-2019

Project Description: PG4871

	Client ID:	BH3-SS2	-	-	-
	Sample Date:	03/25/2019 12:00	-	-	-
	Sample ID:	1913155-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	81.5	-	-	-
General Inorganics					
pH	0.05 pH Units	7.38	-	-	-
Resistivity	0.10 Ohm.m	18.2	-	-	-
Anions					
Chloride	5 ug/g dry	274	-	-	-
Sulphate	5 ug/g dry	26	-	-	-

APPENDIX 2

FIGURE 1 - KEY PLAN

SHEAR WAVE VELOCITY MEASUREMENT REPORT

DRAWING PG4871-1 - TEST HOLE LOCATION PLAN

DRAWING PG4871-2 - SEISMIC SURVEY LOCATION

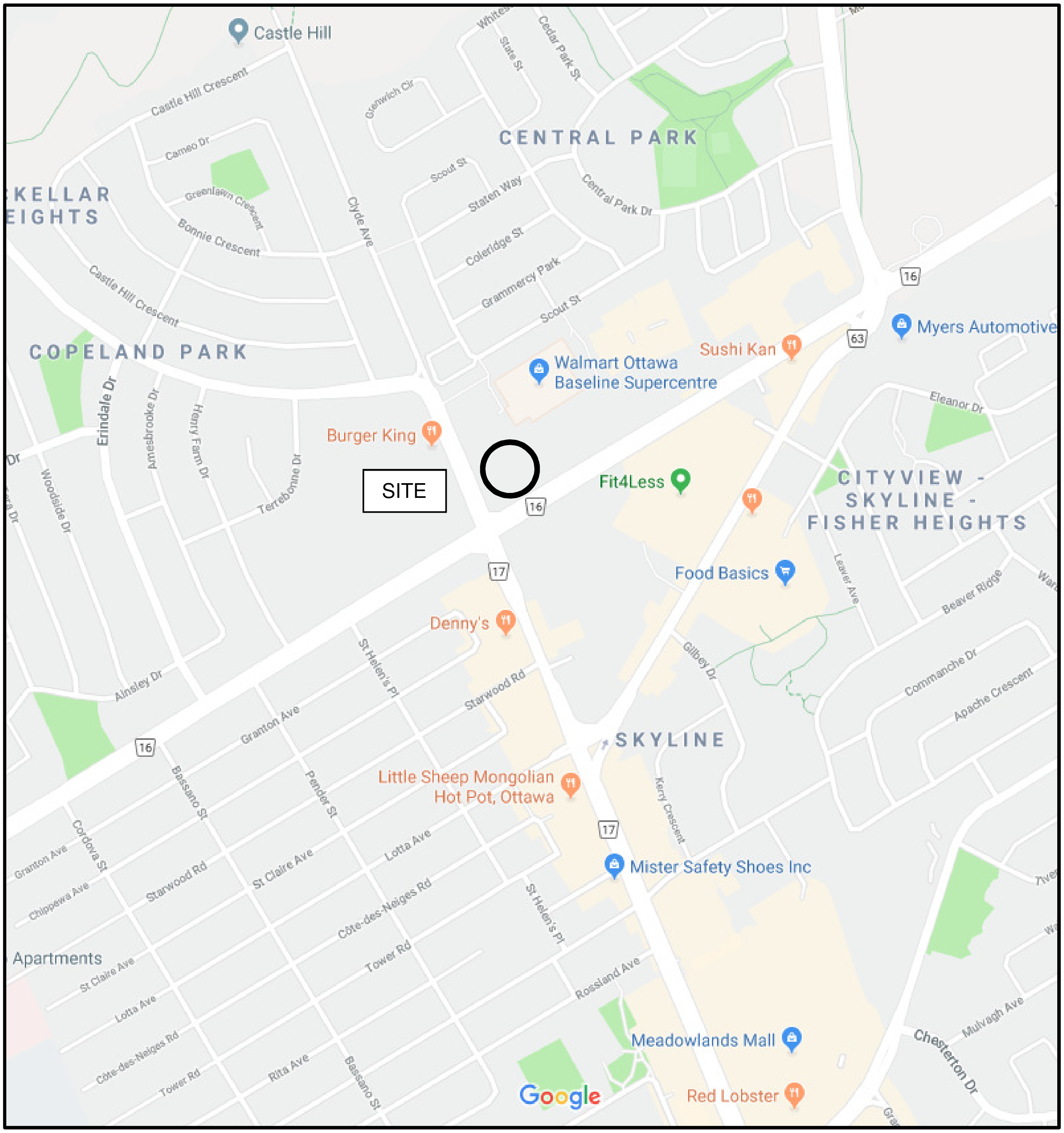
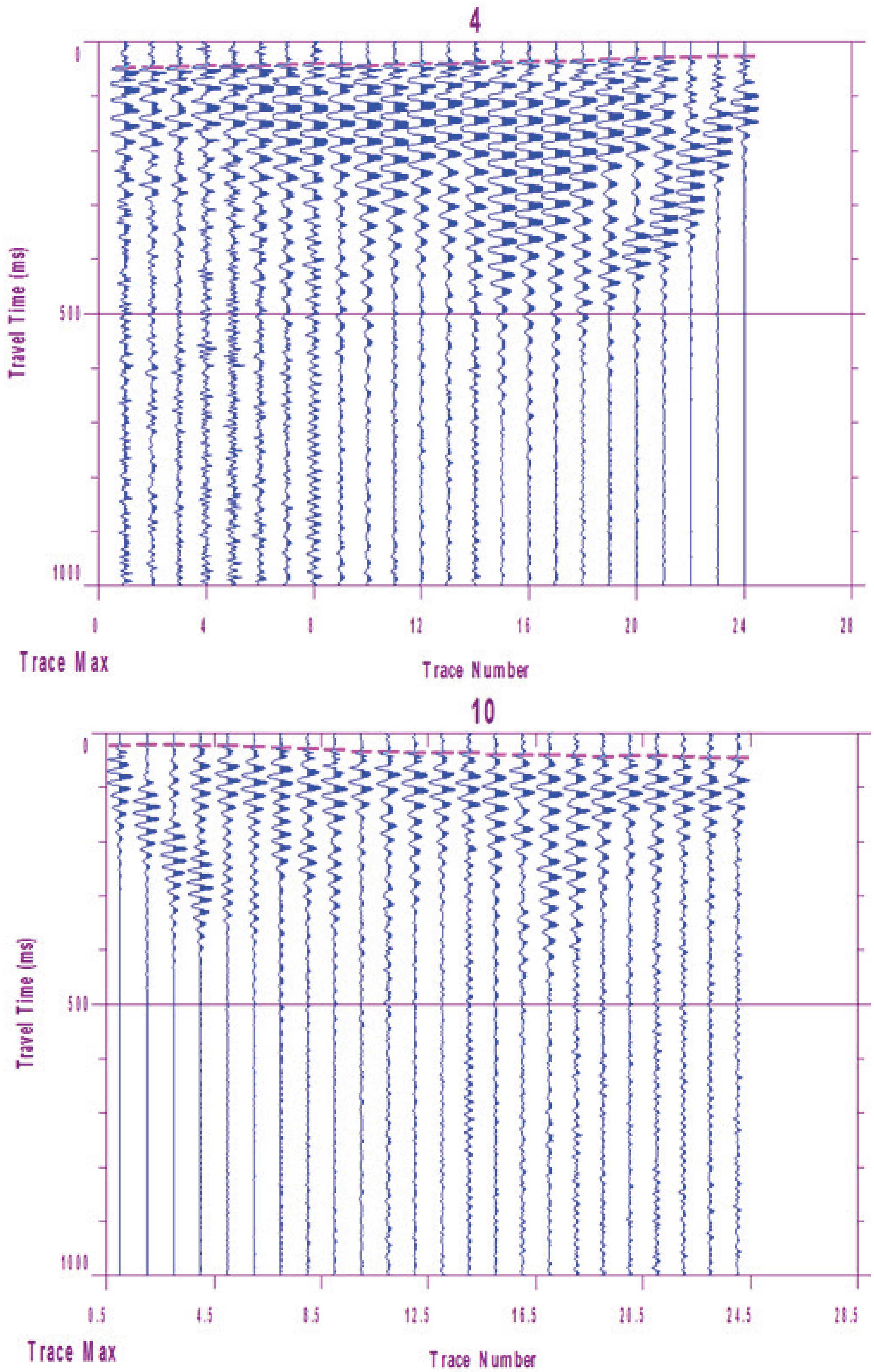


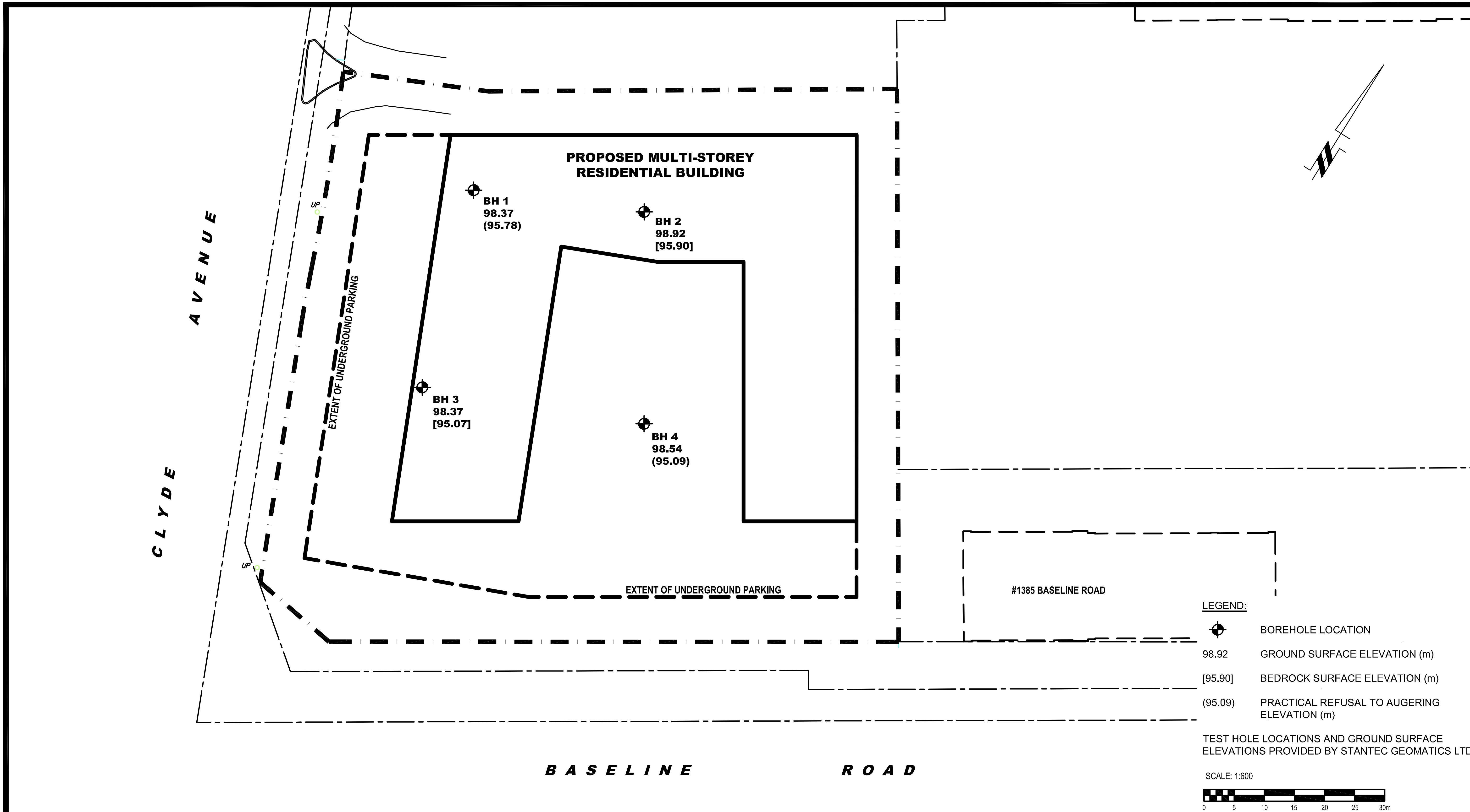
FIGURE 1

KEY PLAN

patersongroup

Figure 1. A few raw records, as examples, at -4.5m (graph #4) and +3m (graph #10).





patersongroup
consulting engineers

154 Colonnade Road South
Ottawa, Ontario K2E 7J5
Tel: (613) 226-7381 Fax: (613) 226-6344

NO.	REVISIONS	DATE	INITIAL

GROUPE SELECTION

GEOTECHNICAL INVESTIGATION
PROP. MULTI-STOREY BUILDING - CLYDE AVE. AT BASELINE ROAD
OTTAWA, ONTARIO

Title:
TEST HOLE LOCATION PLAN

Scale: 1:600	Date: 03/2019
Drawn by: MPG	Report No.: PG4871-1
Checked by: NC	PG4871-1
Approved by: DJG	Revision No.:

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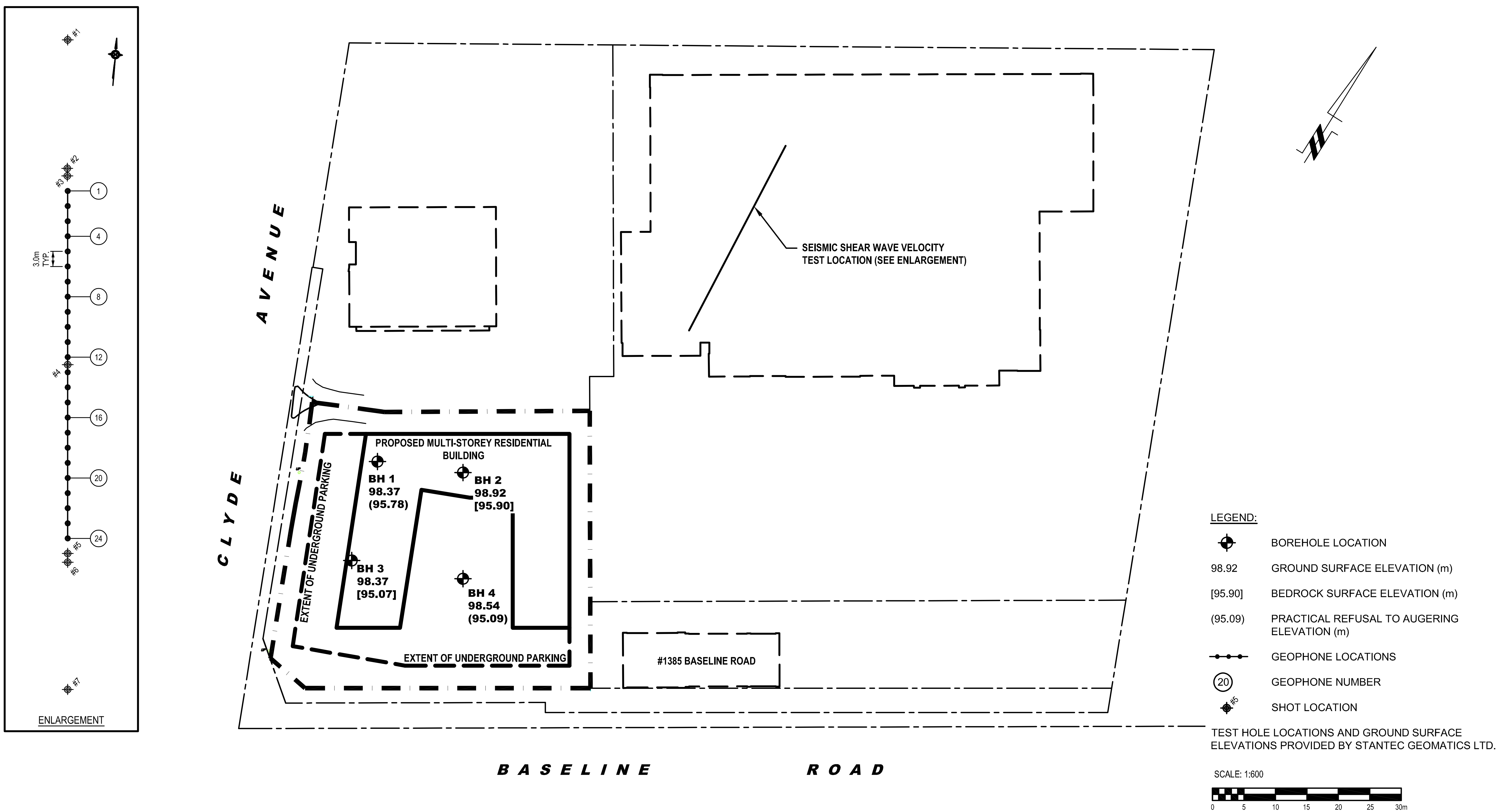

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consulting engineers

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NO.	REVISIONS	DATE	INITIAL

GROUPE SELECTION

GEOTECHNICAL INVESTIGATION
PROP. MULTI-STOREY BUILDING - CLYDE AVE. AT BASELINE ROAD
OTTAWA, ONTARIO

Title:

SEISMIC SURVEY LOCATION

Scale: 1:1250
Date: 03/2019
Drawn by: MPG
Report No.: PG4871-1
Checked by: NC
Approved by: DJG
PG4871-2
Revision No.:

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Appendix E BACKGROUND REPORTS EXCERPTS

Stantec Consulting Ltd.
1505 Laperriere Avenue
Ottawa ON K1Z 7T1
Tel: (613) 722-4420
Fax: (613) 722-2799

July 16, 2010
File: 160400770/83

City of Ottawa
110 Laurier Avenue West
Ottawa, Ontario
K1P 1J1

Dear Sir or Madam:

Reference: 1357 Baseline Road SWM Update, City of Ottawa File No. D07-12-09-0193

This letter details the update of the stormwater management (SWM) design of the proposed commercial development at 1357 Baseline Road. The update has been prompted by the revised design of Phase 2 of the development. This report ensures that the proposed design meets all SWM criteria used during the original design. This report should be read in conjunction with the original City-approved report by Stantec Consulting Ltd. entitled "*Clydesdale Shopping Centres, 1357 Baseline Road, Ottawa, ON Stormwater Management Report*" dated April 26, 2010.

Phase 2 of the Clydesdale project is located in the northwest corner of the site, bounded by property lines to the north and west, by Building A to the east, and by the main access laneway to the south. Phase 3 of the site is located in the southwest portion of the site, bounded by property lines to the west and south, by Phase 1 to the east, and by the main access laneway to the north. See attached **Drawing SP-1** for more detail. Phase 2 is the area being proposed to be developed in this update.

Phase 2 was considered in the original report to be part of the "ultimate" design of the site. The SWM design for Phase 2 was based on a preliminary site plan which has subsequently changed. As of the writing of this letter, construction is underway for all parts of the original plan which were listed as part of the "interim" development. This letter examines the continued phasing of the project and how stormwater flows will be impacted by the revised site plan. A new "interim" scenario is considered where Phases 1 & 2 are built-out but Phase 3 is not. The "ultimate" scenario is considered to be when all phases are built-out.

Based on the revised site plan for Phase 2 from the client, Stantec delineated new SWM catchments and ponding limits. The existing SWMHYMO hydrologic model was updated and re-run incorporating these new catchments. The storm sewer design sheet and XP-SWMM hydraulic model were updated as well according to storm sewer changes. Hydrographs from SWMHYMO were input to the XP-SWMM hydraulic model to obtain ponding depths, hydraulic grade lines, and outflow hydrographs for the site.

One inlet control device size was revised (at manhole STM101) in order to continue to meet the required SWM criteria.

Reference: 1357 Baseline Road SWM Update, City of Ottawa File No. D07-12-09-0193

The following tables should be used to replace those in the original report:

Table 3.1: Interim ICD Schedule

INTERIM ICD SCHEDULE			
Structure ID	**ICD Type**	**Frame & Plate vs. Plug**	**Mount ICD on [Invert Direction]**
CB110	75 mm Circular Orifice	Plug	In CB
CB107C	75 mm Circular Orifice	Plug	In CB
CB109A	75 mm Circular Orifice	Plug	In CB
STM104	240 mm Circular Orifice	Frame & Plate	North Inv.
CB900B1	75 mm Circular Orifice	Plug	In CB
STM101	475 mm Circular Orifice	Frame & Plate	West Inv.

Table 3.2: Ultimate ICD Schedule

ULTIMATE ICD SCHEDULE			
Structure ID	**ICD Type**	**Frame & Plate vs. Plug**	**Mount ICD on [Invert Direction]**
CB110	75 mm Circular Orifice	Plug	In CB
CB107C	75 mm Circular Orifice	Plug	In CB
CB109A	75 mm Circular Orifice	Plug	In CB
STM104	240 mm Circular Orifice	Frame & Plate	North Inv.
CB900B1	75 mm Circular Orifice	Plug	In CB
STM101	475 mm Circular Orifice	Frame & Plate	West Inv.
STM901	127 mm Circular Orifice	Plug	In CB

Table 3.3: Summary of Roof Ponding Release Characteristics

Roof	Roof Area (m^2)	Available Ponding Depth (mm)	Available Storage Volume (m^3)	100 Year Storage Volume (m^3)	100 Year Ponding Depth (mm)	100 Year Inflow Rate (L/s)	100 Year Outflow Rate (L/s)[1]	Drawdown (hours)
Building A	13,463	75	808	692	64	657	45	7.1
Building B1	1,884	75	113	97	64	92	6	7.1
Building B2	1,220	75	73	63	64	60	4	7.1

Reference: 1357 Baseline Road SWM Update, City of Ottawa File No. D07-12-09-0193

Roof	Roof Area (m^2)	Available Ponding Depth (mm)	Available Storage Volume (m^3)	100 Year Storage Volume (m^3)	100 Year Ponding Depth (mm)	100 Year Inflow Rate (L/s)	100 Year Outflow Rate (L/s)[1]	Drawdown (hours)
Building C	1,530	75	92	79	64	75	5	7.1
Building E	950	75	57	49	64	47	3	7.1
Building F	1,110	75	67	57	64	55	4	7.1

Table 3.4: Summary of Ponding Depths and Volumes, 5 Year Event

Catchment	5 YEAR, 3 HOUR CHICAGO STORM							
	HGL (m)		T/G[1] (m)	Depth (m)			Volume (m^3)	
	Interim	Ultimate		Available	Interim	Ultimate	Interim	Ultimate
104	99.53	99.52	100.05	0.28	0.00	0.00	0.2	0.2
CMH100	99.65	99.65	100.20	0.30	0.00	0.00	7.5	7.5
105	99.54	99.53	100.05	0.28	0.00	0.00	0.2	0.2
500a	99.56	99.54	100.06	0.30	0.00	0.00	0.2	0.2
500b	99.56	99.54	100.06	0.30	0.00	0.00	0.2	0.2
500c	99.56	99.55	100.20	0.24	0.00	0.00	0.2	0.2
CB107	100.46	100.46	100.36	0.29	0.09	0.09	18.6	18.6
CB110	99.59	99.57	100.40	0.26	0.00	0.00	0.2	0.2
CB109	101.28	101.28	101.25	0.17	0.03	0.03	1.8	1.8
900A	98.43	98.43	98.40	0.30	0.03	0.03	16.0	16.0
900B	98.29	98.29	98.54	0.30	0.00	0.00	0.2	0.2
901	N/A	98.80	98.70	0.30	N/A	0.10	N/A	25.4

Table 3.5: Summary of Ponding Depths and Volumes, 100 Year Event, with Boundary Condition = 96.57m

Catchment	100 YEAR WITH BC, 3 HOUR CHICAGO STORM							
	HGL (m)		T/G[1] (m)	Depth (m)			Volume (m^3)	
	Interim	Ultimate		Available	Interim	Ultimate	Interim	Ultimate
104	100.19	100.18	100.05	0.28	0.14	0.13	32.1	30.1
CMH100	100.33	100.32	100.20	0.30	0.13	0.12	60.1	56.4
105	100.20	100.20	100.05	0.28	0.15	0.15	51.5	49.8
500a	100.21	100.20	100.06	0.30	0.14	0.14	27.6	26.1
500b	100.21	100.20	100.06	0.30	0.14	0.14	65.6	62.0
500c	100.34	100.32	100.20	0.24	0.13	0.12	9.1	8.3
CB107	100.61	100.61	100.36	0.29	0.25	0.25	48.7	48.7
CB110	100.43	100.43	100.40	0.26	0.03	0.03	2.0	2.0

	100 YEAR WITH BC, 3 HOUR CHICAGO STORM							
Catchment	**HGL (m)**		**T/G[1] (m)**	**Depth (m)**			**Volume (m^3)**	
	Interim	**Ultimate**		**Available**	**Interim**	**Ultimate**	**Interim**	**Ultimate**
CB109	101.39	101.39	101.25	0.17	0.14	0.14	9.1	9.1
900A	98.44	98.47	98.40	0.30	0.04	0.07	25.4	39.5
900B	98.70	98.68	98.54	0.30	0.16	0.14	14.9	12.8
901	N/A	98.96	98.70	0.30	N/A	0.25	N/A	62.6

Table 3.6: Summary of Ponding Depths and Volumes, 100 Year Event, with no Boundary Condition

	100 YEAR WITHOUT BC, 3 HOUR CHICAGO STORM							
Catchment	**HGL (m)**		**T/G[1] (m)**	**Depth (m)**			**Volume (m^3)**	
	Interim	**Ultimate**		**Available**	**Interim**	**Ultimate**	**Interim**	**Ultimate**
104	100.18	100.18	100.05	0.28	0.13	0.13	29.2	28.5
CMH100	100.33	100.33	100.20	0.30	0.13	0.13	60.1	61.8
105	100.19	100.19	100.05	0.28	0.14	0.14	48.8	48.1
500a	100.20	100.19	100.06	0.30	0.13	0.13	25.7	25.1
500b	100.20	100.19	100.06	0.30	0.13	0.13	61.1	59.7
500c	100.31	100.31	100.20	0.24	0.11	0.11	7.7	7.3
CB107	100.61	100.60	100.36	0.29	0.25	0.24	48.3	47.4
CB110	100.43	100.43	100.40	0.26	0.03	0.03	2.0	1.9
CB109	101.40	101.40	101.25	0.17	0.15	0.15	9.6	9.5
900A	98.51	98.49	98.40	0.30	0.11	0.09	64.7	52.4
900B	98.65	98.65	98.54	0.30	0.11	0.11	10.0	9.9
901	N/A	98.96	98.70	0.30	N/A	0.26	N/A	63.6

Table 3.7: Summary of Peak Outflows

	Peak Outflows (cms)				
	5 Year from Site	**100 Year w BC**		**100 Year w/o BC**	
		From Site	**Site Plus Uncontrolled Flows**	**From Site**	**Site Plus Uncontrolled Flows**
Interim Condition	0.380	0.527	0.712	0.558	0.743
Ultimate Condition	0.420	0.521	0.636	0.602	0.717

As mentioned in the original report, the allowable peak outflow from the site was calculated as 770 L/s using a 3 hour Chicago storm distribution based on City of Ottawa IDF parameters and an overall site C-value of 0.50. It can be seen from the revised **Table 3.7** that outflows from all of the modeled scenarios result in peak flows less than 770 L/s. Results from **tables 3.4 – 3.6** also show that available ponding is not exceeded in in any of the modeled events – i.e. there is no spilling of major flows from the site during the 100 year storm (other than the uncontrolled areas which have already been accounted for in **Table 3.7**).

Unlike the other commercial buildings on the site, Building B1 contains a basement with a finished floor elevation of 96.05 m. The underground parking structure including basement will drain to the sanitary sewer. The storm service invert to the building is 96.22 m and cannot be lowered due to tie-in restrictions with the trunk sewer. The perimeter drains for the building foundation will therefore be pumped to the storm service. The storm service will also be protected with a backwater valve due to high hydraulic grade line in the storm sewer (worst-case 100 year HGL at the storm service invert is 97.95 m).

Stormwater quality control will continue to be provided by An STC9000 Stormceptor® unit to 90 % TSS removal, as per the original report's specification.

In conclusion, this letter updates the previously submitted report according to a revised site plan for Phase 2. The analysis of the revised Phase 2 design confirms that all original SWM criteria continue to be satisfied.

Sincerely,

STANTEC CONSULTING LTD.

LICENSED PROFESSIONAL ENGINEER
P. MOROZ
JULY 16, 2010
PROVINCE OF ONTARIO

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Attachment:

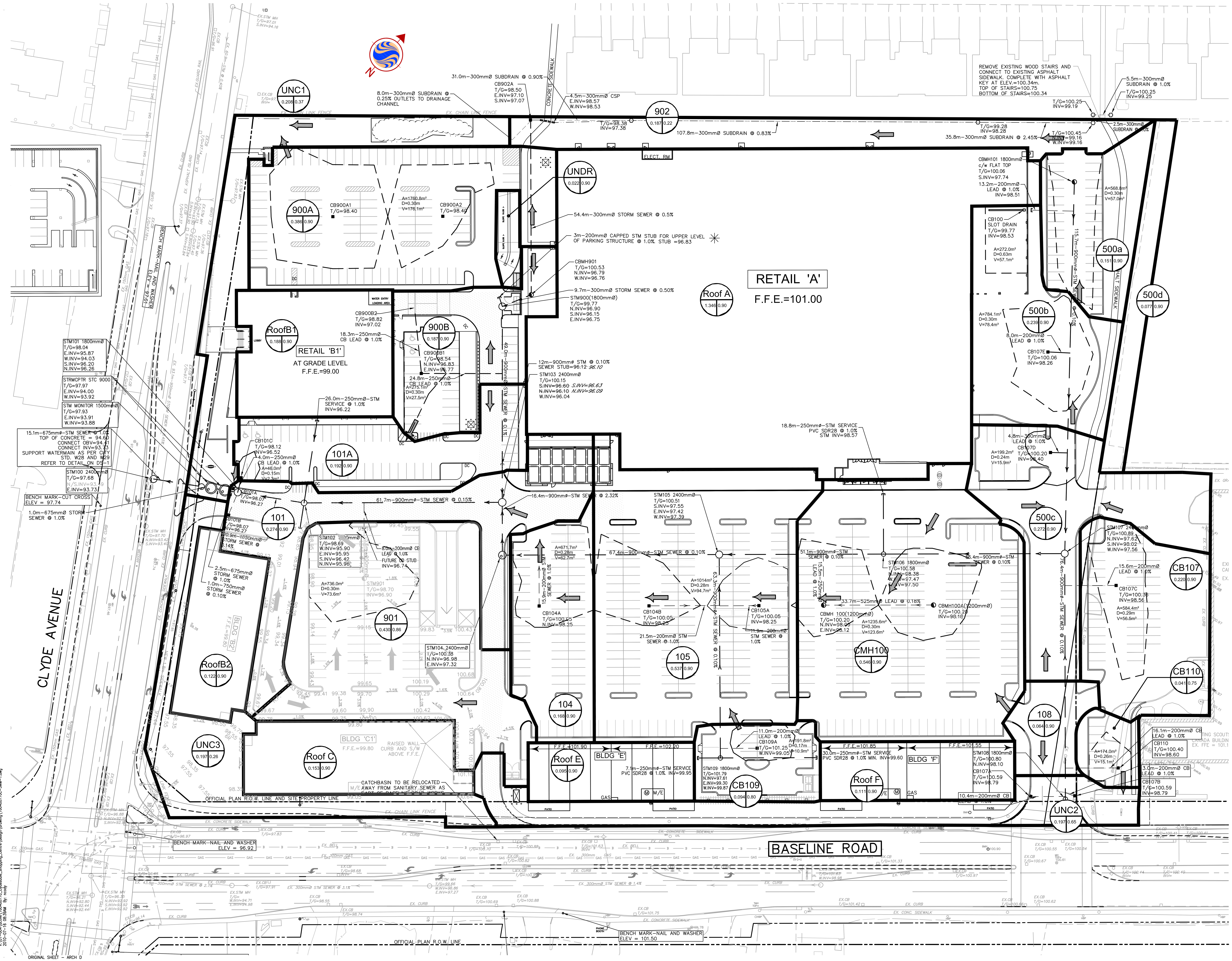
- Drawing SWM-1 INTERIM STORM DRAINAGE PLAN
- Drawing SWM-2 ULTIMATE STORM DRAINAGE PLAN
- Drawing SP-1 SERVICING PLAN
- Drawing GP-1 GRADING PLAN
- APPENDIX A STORM SEWER DESIGN SHEET
- APPENDIX B AREA CALCULATIONS AND CATCHMENT SUMMARIES
- APPENDIX C SWMHYMO HYDROLOGIC MODELLING
- APPENDIX D XPSWMM HYDRAULIC MODELLING
  - Appendix D.1 5 Year Interim Conditions
  - Appendix D.2 100 Year Interim Conditions, With Boundary Condition
  - Appendix D.3 100 Year Interim Conditions, Without Boundary Condition
  - Appendix D.4 5 Year Ultimate Conditions
  - Appendix D.5 100 Year Ultimate Conditions, With Boundary Condition

Reference: 1357 Baseline Road SWM Update, City of Ottawa File No. D07-12-09-0193

Appendix D.6 100 Year Ultimate Conditions, Without Boundary Condition
- CD containing stormwater management modeling files

c.

npc v:\01-604\active\160400770_clydesdale_shopping_centre\design\report\swm\2010-07-16_subm4\let_2010-07-16_swm_update_ph2.docx



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Legend

85.59 ×	PROPOSED ELEVATION
85.64t/c ×	PROPOSED TOP OF CURB
1.0%	PROPOSED GRADE
	MAXIMUM PONDING LIMITS
500d / 0.077 / 0.90	AREA ID AREA (HA) / RUNOFF COEFF.
	DRAINAGE DIVIDE BOUNDARY
	100–YEAR PONDING LIMITS
	EMERGENCY OVERLAND FLOW DIRECTION
	PROPOSED STORM SEWER
	PROPOSED CATCHBASIN MANHOLE
	PROPOSED CATCHBASIN
	PROPOSED CATCHBASIN TEE
	EXISTING STORM SEWER
	EXISTING CATCHBASIN

Notes

ULTIMATE ICD SCHEDULE

Structure ID	ICD Type	Frame & Plate vs. Plug	Mount ICD on [Invert Direction]
CB110	75 mm Circular Orifice	Plug	In CB
CB107C	75 mm Circular Orifice	Plug	In CB
CB109A	75 mm Circular Orifice	Plug	In CB
STM104	240 mm Circular Orifice	Frame & Plate	North Inv.
CB900B1	75 mm Circular Orifice	Plug	In CB
STM101	475 mm Circular Orifice	Frame & Plate	West Inv.
STM901	127 mm Circular Orifice	Plug	In CB

Revision	By	Appd.	YY.MM.DD
4. REVISED FOR PHASE 2 SP	NPC	PM	10.07.15
3. REVISED AS PER CITY COMMENTS & SP	AML	MAF	10.04.23
2. ISSUED TO CITY FOR SPA	NPC	PM	10.03.19
1. ISSUED FOR REVIEW	NPC	PM	09.10.19

File Name: 160400770	Dwn.	Chkd.	Dsgn.	YY.MM.DD
	MJS	PM	MJS	09.05.20

Seal

Client/Project

CLYDESDALE SHOPPING CENTRE

1357 BASELINE ROAD

Ottawa ON Canada

Title

ULTIMATE STORM DRAINAGE PLAN

Project No. 160400770

Scale 1:500

Drawing No. SWM-2

Sheet 2 of 2

Revision 4

Stantec

Development: **Clydesdale Shopping Centre**

DATE: September 10, 2009
REVISION: July 14, 2010
DESIGN BY: npc
CHECKED BY:

STORM SEWER DESIGN SHEET

SmartCentres

Proposed Storm Sewer System

FILE NUMBER: 1604-00770

DESIGN PARAMETERS

1 in 5 years

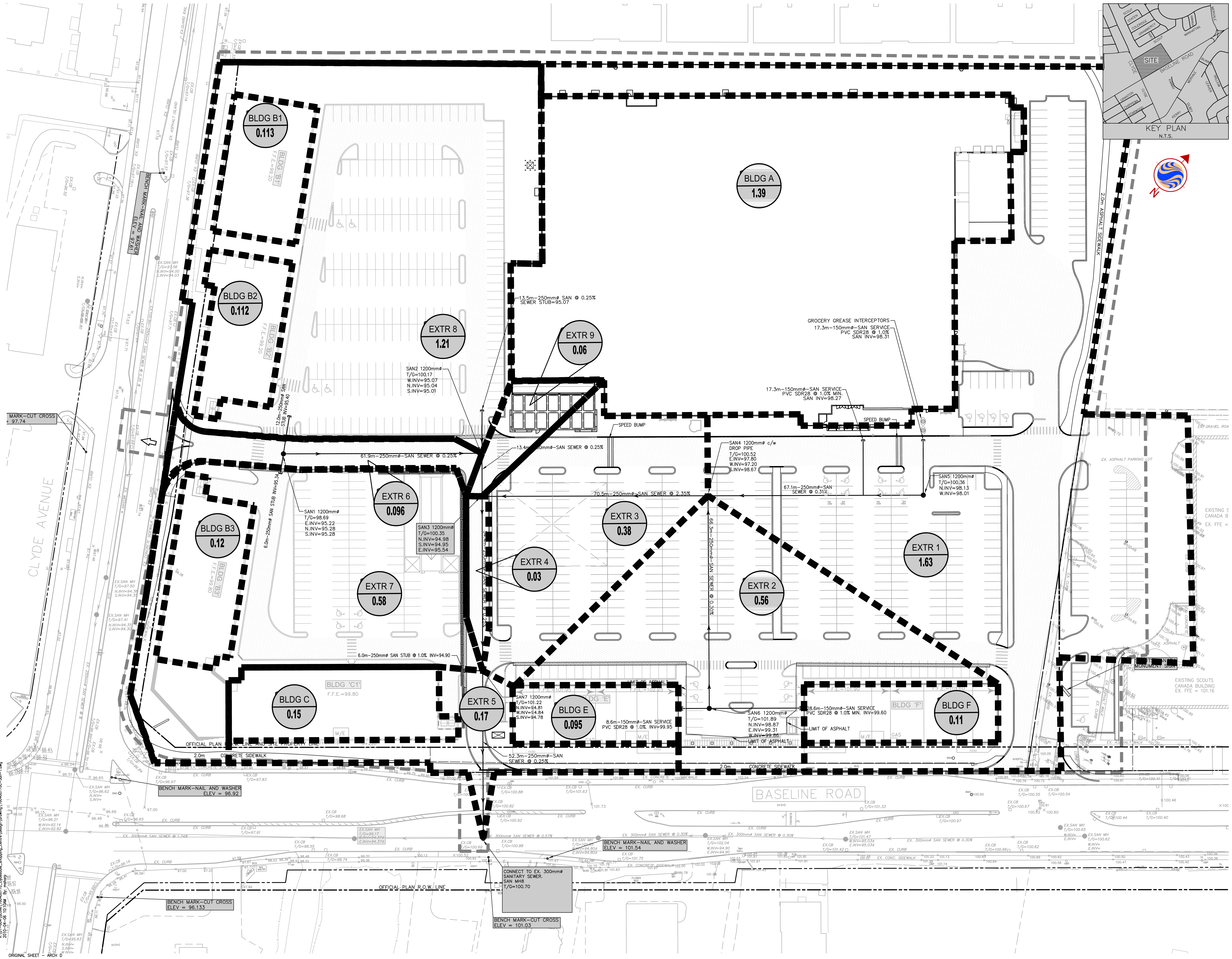
$I = a/(t+b)^c$ Ottawa Sewer Guideline IDF Parameters

a =	998.071	MANNING'S n =	0.013		
b =	6.053	MINIMUM COVER:	1.50	m	
c =	0.814	TIME OF ENTRY	10	min	

LOCATION	FROM M.H.	TO M.H.	DRAINAGE AREA: AREA (ha)	C	ACCUM. AREA (ha)	A x C (ha)	ACCUM. AxC (ha)	T of C (min)	I (mm/h)	Q_{5yr} Roof (L/s)	Q_{total} (L/s)	PIPE SELECTION: LENGTH (m)	PIPE SIZE (mm)	SLOPE %	CAP. (FULL) (L/s)	Qtotal/Qcapacity	VEL. (FULL) (m/s)	VEL. (ACT) (m/s)	TIME OF FLOW (min)
500a, 500b, 500c, 500d	CBMH101	STM107	0.739	0.90	0.74	0.67	0.67	10.00	104.19	0.0	192.5	115.7	900	0.10	597.2	0.32	0.91	0.80	2.40
								12.40											
108, CB107, CB110	STM108	STM107	0.325	0.90	0.33	0.29	0.29	10.00	104.19	0.0	84.7	70.2	900	0.11	626.4	0.14	0.95	0.63	1.86
								11.86											
	STM107	STM106			1.06	0.00	0.96	12.40	93.04	0.0	247.5	56.4	900	0.11	634.9	0.39	0.97	0.89	1.05
CMH100, Roof A	STM106	STM105	0.546	0.90	1.61	0.49	1.45	13.45	88.94	27.0	385.0	51.1	900	0.10	597.2	0.64	0.91	0.97	0.88
								14.32											
CB109, 105, Roof E, Roof F	STM109	STM105	0.631	0.90	0.63	0.57	0.57	10.00	104.19	3+4	164.4	63.3	900	0.10	597.2	0.28	0.91	0.75	1.41
								11.41											
104	STM105	STM104	0.168	0.90	2.41	0.15	2.17	14.32	85.81	27.0	543.8	68.7	900	0.10	597.2	0.91	0.91	1.04	1.10
	STM104	STM103			2.41	0.00	2.17	15.42	82.22	27.0	522.2	16.4	900	2.11	2,744.8	0.19	4.18	3.09	0.09
								15.51											
902	CB	CBMH901	0.187	0.22	0.19	0.04	0.04	10.00	104.19	0.0	11.9	54.4	300	0.50	71.3	0.17	0.98	0.70	1.29
	CBMH901	STM900			0.19	0.00	0.04	11.29	97.85	0.0	11.2	9.7	300	0.50	71.3	0.16	0.98	0.67	0.24
								11.53											
900A	STUB	STM900	0.386	0.90	0.39	0.35	0.35	10.00	104.19	0.0	100.5	3.0	300	1.00	100.9	1.00	1.38	1.60	0.03
								10.03											
900B	STM900	STUB	0.187	0.90	0.76	0.17	0.56	11.53	96.76	0.0	149.7	49.0	900	0.10	597.2	0.25	0.91	0.73	1.12
	STUB	STM103			0.76	0.00	0.56	12.65	92.01	0.0	142.4	12.0	900	0.10	597.2	0.24	0.91	0.71	0.28
								12.93											
901	STM103	STM102	0.430	0.90	3.60	0.39	3.11	15.51	81.94	27.0	735.4	60.5	900	0.15	792.4	0.93	1.21	1.39	0.73
								16.24											
Roof B1	N.STUB	STM102			0.00	0.00	0.00	10.00	104.19	6.0	6.0	26.0	250	1.00	62.0	0.10	1.22	0.71	0.61
								10.61											
Roof B2, Roof C	S.STUB	STM102			0.00	0.00	0.00	10.00	104.19	9.0	9.0	84.5	900	0.11	616.4	0.01	0.94	0.38	3.75
								13.75											
	STM102	STM101			3.60	0.00	3.11	16.24	79.76	42.0	731.6	20.9	1050	0.14	1,066.0	0.69	1.19	1.29	0.27
101, 101A	STM101	STRMCPTR	0.466	0.90	4.07	0.42	3.53	16.51	78.99	42.0	816.8	2.5	675	1.00	877.0	0.93	2.37	2.73	0.02
	STRMCPTR	MONITOR			4.07	0.00	3.53	16.52	78.94	42.0	816.4	1.0	675	1.00	877.0	0.93	2.37	2.73	0.01
	MONITOR	OUTLET			4.07	0.00	3.53	16.53	78.93	42.0	816.2	15.1	675	1.00	877.0	0.93	2.37	2.73	0.09
								16.62											

Area to Sewer	4.07	ha
Roofs	2.02	ha
Total Area	6.08	ha

\# - Indicates individual building roof release rate, otherwise value is accumulated roof release



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Legend

- EXISTING SANITARY SEWER
- PROPOSED SANITARY SEWER
- 10 — DRAINAGE AREA ID
- 0.09 — SANITARY DRAINAGE AREA (ha)
- LIMIT OF SANITARY DRAINAGE AREA

Notes

GENERAL NOTES

1 ALL WORK SHALL BE CARRIED OUT IN COMPLIANCE WITH THE ONTARIO OCCUPATIONAL HEALTH AND SAFETY ACT AND REGULATIONS FOR CONSTRUCTION PROJECTS.

2 ALL WORK AND MATERIALS TO CONFORM WITH CURRENT MINISTRY OF THE ENVIRONMENT & ENERGY OF ONTARIO, CITY OF OTTAWA AND ONTARIO PROVINCIAL STANDARDS AND SPECIFICATIONS. LOCAL UTILITY STANDARDS AND MINISTRY OF TRANSPORTATION STANDARDS WILL APPLY WHERE REQUIRED.

3 THE CONTRACTOR IS ADVISED THAT WORKS BY OTHERS MAY BE ONGOING DURING THE PERIOD OF THIS CONTRACT. THE CONTRACTOR SHALL COORDINATE CONSTRUCTION ACTIVITIES AND COORDINATION WITH ALL OTHER CONTRACTORS AND PREVENT CONSTRUCTION CONFLICTS.

4 THE INFORMATION SHOWN FOR EXISTING UTILITIES WAS PROVIDED BY OTHERS. THE CONTRACTOR IS RESPONSIBLE FOR LOCATING AND PROTECTING ALL UTILITIES DURING CONSTRUCTION. ALL EXISTING UTILITIES MUST BE LOCATED AND VERIFIED BY EACH UTILITY PRIOR TO COMMENCEMENT OF WORK. ANY VARIANCE IS TO BE IMMEDIATELY REPORTED TO THE ENGINEER. LOST TIME DUE TO FAILURE OF THE CONTRACTOR TO CONFIRM UTILITY LOCATIONS AND NOTIFY THE ENGINEER OF POSSIBLE CONFLICTS PRIOR TO CONSTRUCTION WILL BE AT THE CONTRACTORS EXPENSE.

5 ALL CONSTRUCTION SHALL BE CARRIED OUT IN ACCORDANCE WITH THE RECOMMENDATIONS MADE IN THE GEOTECHNICAL REPORT.

6 THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING ALL PERMITS REQUIRED AND TO BEAR THE COST OF SAME INCLUDING WATER PERMIT AND ASSOCIATED COSTS.

7 ALL DISTURBED AREAS SHALL BE REINSTATED TO EQUAL OR BETTER CONDITION TO THE SATISFACTION THE ENGINEER AND THE CITY. PAVEMENT REINSTATEMENT FOR SERVICE AND UTILITY CUTS SHALL BE IN ACCORDANCE WITH OPSD 509.010 AND OPSS 310.

8 FOR DETAILS RELATING TO STORMWATER MANAGEMENT AND ROOF DRAINAGE, SEE THE STORMWATER MANAGEMENT REPORT PREPARED BY STANTEC CONSULTING LTD. ROOF DRAINAGE TO BE PROVIDED VIA RESTRICTED RELEASE ROOF DRAINS AS DETAILED IN THE REPORT.

9 BENCHMARKS: IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THAT THE SITE BENCHMARK(S) HAS NOT BEEN ALTERED OR DISTURBED AND THAT ITS RELATIVE ELEVATION AND DESCRIPTION AGREES WITH THE INFORMATION SHOWN ON DRAWING GP–1.

10 THE CONTRACTOR SHALL PROVIDE TO THE ENGINEER 1 (ONE) SET OF AS CONSTRUCTED SITE SERVICING, GRADING, AND SITE ELECTRICAL DWGS.

Revision	By	Appd.	YY.MM.DD
1. ISSUED FOR REVIEW	MJS	PM	09.05.20

File Name: 160400770	Dwn.	Chkd.	Dsgn.	YY.MM.DD
	MJS	PM	MJS	09.05.20

Seal

Client/Project

CLYDESDALE SHOPPING CENTRE

1357 BASELINE ROAD
Ottawa ON Canada

Title

SANITARY DRAINAGE AREA PLAN

Project No. 160400770

Scale 1:500 (0 5 15 25m)

Drawing No. SAN-1

Sheet 1 of 4

Revision 1

Stantec

Clydesdale Shopping Centre

DATE: March 30, 2010
REVISION:
DESIGNED MJS
CHECKED PM

SANITARY SEWER DESIGN SHEET

(City of Ottawa)

FILE NUMBERS: **Clydesdale** **1604-00770**

DESIGN PARAMETERS

AVG. DAILY FLOW / PERSON =	350.000	l/p/day	COMMERCIAL	0.60	l/s/Ha
MINIMUM VELOCITY =	0.600	m/s	INDUSTRIAL	0.40	l/s/Ha
n =	0.013		INSTITUTIONAL	0.60	l/s/Ha
MAX PEAK FACTOR =	4.000		INFILTRATION	0.28	l/s/Ha
MIN PEAK FACTOR =	2.400		RESIDENTIAL PERSONS/TOWNS.UNIT =	2.7	
Peacking Factor Industrial:	2.400		RESIDENTIAL PERSONS/APT.UNIT =	2.4	
Peacking Factor Comm. / Inst.:	1.500				

LOCATION			PARKING LOT AND ROAD				COMM		INDUST		INSTIT		C+I+I	INFILTRATION				PIPE					
STREET	FROM M.H.	TO M.H.	AREA (ha)	CUMULATIVE AREA (ha)	PEAK FACT.	**PEAK FLOW (l/s)**	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	**TOTAL FLOW (l/s)**	DIST (m)	DIA (mm)	SLOPE (%)	CAP. (FULL) (l/s)	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
BLDG B1, BLDG B2	STUB	MH1	0.000	0.000			0.23	0.23					0.21	0.230	0.230	0.064	**0.27**	12.0	250	1.00	62.73	1.23	0.00
BLDG B3, EXTR 7	STUB	MH1	0.580	0.580			0.12	0.12					0.11	0.700	0.700	0.196	**0.31**	6.0	250	1.00	62.73	1.23	0.00
EXTR 6	MH1	MH2	0.096	0.676			0.00	0.35					0.32	0.096	1.026	0.287	**0.61**	61.9	250	0.25	31.11	0.61	0.00
EXTR 8	STUB	MH2	1.210	1.210			0.00	0.00					0.00	1.210	1.210	0.339	**0.34**	13.5	250	0.25	31.11	0.61	0.00
EXTR 9	MH2	MH3	0.060	1.946			0.00	0.35					0.32	0.060	2.296	0.643	**0.96**	13.4	250	0.25	31.11	0.61	0.24
BLDG A	STUB	MH5	0.000	0.000			1.39	1.39					1.25	1.390	1.390	0.389	**1.64**	17.3	150	1.00	15.48	0.86	0.53
EXTR 1	MH5	MH4	1.630	1.630			0.00	1.39					1.25	1.630	3.020	0.846	**2.10**	67.1	250	0.31	34.68	0.68	0.35
BLDG F	STUB	MH6	0.000	0.000			0.11	0.11					0.10	0.110	0.110	0.031	**0.13**	28.6	150	1.00	15.48	0.86	0.00
BLDG E	STUB	MH6	0.000	0.000			0.10	0.10					0.09	0.100	0.100	0.028	**0.12**	8.6	150	1.00	15.48	0.86	0.00
EXTR 2	MH6	MH4	0.560	0.560			0.00	0.21					0.19	0.560	0.770	0.216	**0.41**	66.3	250	0.30	34.17	0.67	0.00
EXTR 3	MH4	MH3	0.380	2.570			0.00	1.60					1.44	0.380	4.170	1.168	**2.61**	70.5	250	2.35	95.88	1.88	0.75
EXTR 4	MH3	MH7	0.030	4.546			0.00	1.95					1.76	0.030	6.496	1.819	**3.58**	54.4	250	0.25	31.11	0.61	0.38
BLDG C1	STUB	MH7	0.000	0.000			0.15	0.15					0.14	0.150	0.150	0.042	**0.18**	6.0	250	1.00	62.73	1.23	0.00
EXTR 5	MH7	MH8	0.170	4.716			0.00	2.10					1.89	0.170	6.816	1.908	**3.80**	52.3	250	0.25	31.11	0.61	0.40

Appendix F DRAWINGS