East Urban Community, Site C - Site Servicing and Stormwater Management Report

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Prepared for:
Ashcroft Homes

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Sign-off Sheet

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1.0 INTRODUCTION AND BACKGROUND

Stantec Consulting Ltd. has been commissioned by Ashcroft Homes to prepare the following Site Servicing and Stormwater Management Report for Phase 1b Site C within the East Urban Community (EUC) Subdivision. The subject property is located northwest of the intersection of Esselmont Street and Markinch Road. The property is located in the City of Ottawa and is indicated in **Figure 1.**

The proposed residential development for Site C comprises approximately 0.73 ha of land and contains 49 townhome units. The site is currently in the location of an interim pond servicing the previous Phase 1A of the EUC subdivision. The objective 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 various background studies as well as the East Urban Community Phases 1B, 2A and 2B Servicing Report as outlined in **Section 2.0**.

Figure 1: Approximate Location of Site C

2.0 BACKGROUND RESOURCES

The following background studies were referenced in the preparation of this report:

- East Urban Community Phase 1B, 2A and 2B Site Servicing and Stormwater Management Report, Stantec consulting Ltd., March 8, 2018
- Geotechnical Investigation, Proposed Residential Development Eastboro – Phase2- MBLK A, B, C and F Navan Road, Ottawa, Paterson Group, October 2014
- City of Ottawa Design Guidelines – Water Distribution, Infrastructure Services Department, City of Ottawa, First Edition, July 2010
- City of Ottawa Sewer Design Guidelines, 2nd Ed., City of Ottawa, October 2012
- City of Gloucester East Urban Community Master Infrastructure Plan, R. W. Connelly Associates Inc., January 1995
- Gloucester East Urban Community Phase 2 Infrastructure Servicing Study Update, Stantec Consulting Ltd., September 27, 2013
- East Urban Community Master Infrastructure Plan, R.W. Connelly Associates Inc., January 1995
- Stormwater Management Planning and Design Manual, Ministry of the Environment (Ontario), March 2003
- Ashcroft Eastboro Phase 1 Lands, City of Ottawa, Detailed Stormwater Management Report, Stantec Consulting Ltd., April 1, 2010
- Ashcroft Homes – East Urban Community Phases 1B, 2A and 2B Serviceability Study, Stantec Consulting Ltd., December 20, 2013
- Ashcroft – Eastboro, Phase 2A & 2B Potable Water Servicing Analysis, Stantec Consulting Ltd., March 15, 2016
- East Urban Community Phases 1A, 2A & 2B Serviceability Brief in Support of Changes to Master Servicing Study, Stantec Consulting Ltd., June 26, 2015
- Geotechnical Limit of Hazard Lands Proposed Stormwater Management Pond, 3268, 3630,03650 Navan Road – Ottawa, Paterson Group, August 6, 2014
- East Urban Community Pond 2 Interim Facility Design Brief, Stantec Consulting Ltd., March 18, 2016

3.0 POTABLE WATER

The Ashcroft – Eastboro Phase 2A & 2B Potable Water Servicing Analysis (2016) provides an evaluation of the potable water distribution network Site C. The overall EUC subdivision plan was anticipated to be phased into 11 stages, with Site C being constructed during Phase 5. A Potable Water Servicing Analysis has been completed and is included in **Appendix A.**

3.1.1 BACKGROUND

The proposed development comprises 49 three-storey townhome units, complete with associated infrastructure and access areas. Townhome unit counts have remained consistent from assumptions made in the Potable Water Servicing Analysis. The site will be serviced via three 250mm diameter watermain connections to an existing watermain within Caithness Private located at the northern boundary and two connections to Esselmont Street to the south. The development is located within the City of Ottawa's Pressure Zone 2E.

Within the Eastboro Phase 2A & 2B Potable Water Servicing Analysis, the maximum day and peak hour demands followed the peaking factors from the Ministry of Environment Design Guidelines for Drinking-Water Systems (2008). The overall subdivision populations were between 2,000 and 3,000 persons, as such, a factor of 2.25 and 3.38 was multiplied by average day demands to obtain the maximum day and peak hour demands. A hydraulic model was used to simulate the proposed development conditions based on boundary conditions provided by the City of Ottawa. The hydraulic analysis for interim and ultimate scenarios were completed with H2OMAP Water Software and assessed the internal network and connections to the surrounding infrastructure. The model was tested under peak hour, minimum hour and maximum day plus fire flow conditions.

3.1.2 WATER DEMANDS

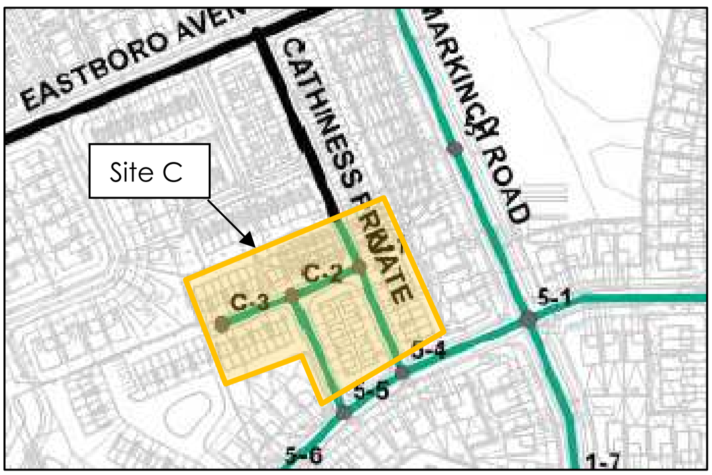
Water demands for the proposed site were estimated using the City of Ottawa Design Guidelines – Water Distribution (2010). A daily rate of 350 L/cap/day has been applied for the population of the proposed site. Population densities have been assumed as 2.7 pers./townhome unit. See **Appendix A** for detailed domestic water demand estimates.

The average day demand (AVDY) for the entire site was determined to be 0.54 L/s. The maximum daily demand (MXDY) is 2.5 times the AVDY for residential areas, which sums to 1.34 L/s. The peak hour demand (PKHR) is 2.2 times the MXDY for residential areas totaling 2.95 L/s.

Wood frame construction was considered in the assessment for fire flow requirements according to the FUS Guidelines. The FUS Guidelines indicate that low hazard occupancies include apartments, dwellings, dormitories, hotels, and schools, and as such, a low hazard occupancy / limited combustible building contents credit was applied.

The Potable Water Servicing Analysis assumed maximum fire flows based on the City's technical bulletin (ISDTB-2014-02) allowance cap of 10,000 L/min. The hydraulic modeling results presented areas during the interim conditions that were not able to achieve fire flows of 10,000 L/min due to dead end nodes (specifically node C-3). Additionally, the analysis confirms that fire flows upstream of dead-end nodes during interim conditions are capable to supply fire flows of well above 10,000 L/min. Firewalls with a minimum two-hour fire-resistance rating that comply with OBC Div. B, Subsection 3.1.10, are to be constructed to separate townhouse blocks to the allowable fire flow requirement. Units in vicinity to the dead-end on Turriff Private (Node C-3) are required meet a maximum fire flow of 9,000 L/min to conform to results of interim hydraulic modeling. Node ID as per hydraulic analysis is shown on **Figure 2**.

Figure 2: Hydraulic Analysis Node ID



Two-hour fire separation walls will be required in Blocks 19 to 22 to maintain the available fire flow. Based on calculations per the FUS Guidelines, the worst case required fire flows for this development are shown on **Table 3.1**(FUS calculations for each proposed Block have been provided in **Appendix A**).

Table 3.1: Maximum Fire Flow Based on Interim and Ultimate Conditions

Node	Available Fire Flows Per Potable Water Servicing Analysis (2016)		Proposed Maximum Fire Flow (L/s)
	Interim - Phase 5 (L/s)	Built-Out - Phase 11 (L/s)	
C-1	385	538	233 (Blocks 16-18)
C-2	244	389	183 (Block 20), 200 (Block 19)
C-3	158	199	150 (Blocks 21-22)

3.1.3 SUMMARY OF FINDINGS

Based on the findings of the previous hydraulic analysis, the proposed network is capable of servicing the proposed site and meets all servicing requirements as per City of Ottawa standards under typical demand conditions (peak hour and average day conditions) as well as under emergency fire demand conditions (maximum day + fire flow).

4.0 SANITARY SEWER

4.1 WASTEWATER BACKGROUND

Site C will be serviced by the 200mm diameter sanitary sewer within the Esselmont Street ROW located at the southern boundary of the site(see **Drawing SSP-1**). The East Urban Community Phases 1B, 2A and 2B Site Servicing Report outlined the servicing requirements for the subject property, which include an estimated sanitary peak flow allocated for Site C of 2.4 L/s assuming a population density of 132 persons.

4.2 DESIGN CRITERIA

As outlined in the City's "Ottawa Sewer Design Guidelines" the following design guidelines were used to calculate estimated wastewater flow rates and to size the sanitary sewers:

- Minimum Velocity – 0.6 m/s (City)
- Maximum Velocity – 3.0 m/s (City)
- Manning roughness coefficient for all smooth wall pipes – 0.013 (City)
- Townhouse unit – 2.7 persons/unit (City)
- Extraneous Flow Allowance – 0.33 L/s/ha
- Manhole Spacing – 120 m
- Minimum Cover – 2.5 m
- Per Capita Residential Average Daily Flow – 280 L/p/day (City)

In addition, a residential peak factor based on Harmon's Equation was used to determine the peak design flows.

4.3 PROPOSED SANITARY SEWERS

The proposed site will be serviced by gravity sewers which will direct the wastewater flows (approx. 1.7 L/s with allowance for infiltration) to the 200 mm diameter sanitary sewer. A sanitary sewer design sheet for the proposed sanitary sewers is included in **Appendix B**. Full port backwater valves are to be installed on all sanitary services within the site to prevent any surcharge from the downstream sewer main from impacting the proposed property.

5.0 STORM DRAINAGE

The following sections describe the stormwater management (SWM) design for the Ashcroft EUC Subdivision Site C in the context of the background documents and governing criteria.

5.1 PROPOSED CONDITIONS

The proposed development will consist of townhomes with associated servicing infrastructure. Site sewers will ultimately outlet to the proposed SWM Pond 2. Inlet control devices at road low points will be used to restrict inflow rates to the sewer and to provide attenuating surface storage. In the interim condition, until the downstream major system flow paths are constructed, major system flow from the western half of the EUC subdivision has been directed to a culvert crossing the existing Navan Road tributary to the downstream Mud Creek.

Quality and quantity control of runoff is provided by the proposed Interim SWM Pond 2 as discussed in the report "*East Urban Community Pond 2 Interim Facility Design Brief*" prepared by Stantec Consulting Ltd., dated June 26, 2015. As such, no additional on-site quality control measures are required within the subdivision.

5.2 CRITERIA AND CONSTRAINTS

The overall approach for storm servicing and stormwater management for the proposed development was outlined in Stantec's East Urban Community Phases 1B,2A and 2B Site Servicing Report (2018). Criteria were established by combining current design practices outlined by the City of Ottawa Design Guidelines (2012) as well as the conclusions made within the Phase 1B Servicing Report. The following summarizes the SWM criteria.

- Use of the dual drainage principle. (City of Ottawa)
- Minor system capture rate from Site C (Referred to as subcatchment area ST639D) to be restricted to 276.3 L/s (Stantec Consulting Ltd. – EUC Phase 1B, 2A and 2B). The 100 year target release rate includes a portion of the minor system flows through the proposed site from the existing Phase 1A to the north. (Stantec)
- Major system overflows to be directed to Esselmont Street, and controlled to a rate of 314.0L/s during the 100-year storm event (Stantec Consulting Ltd. – EUC Phase 1B, 2A and 2B). The overflow rate includes overland runoff from Phase 1A of the subdivision directed through Site C. (Stantec)
- Assess impact of 2-year storm, 5-year storm, the worst case 100-year storm event, and the climate change scenario (worst case 100-year storm event with a 20% increase of rainfall intensity) on the major & minor drainage systems. (City of Ottawa)

- Separation of at least 0.3 m between the 100-year hydraulic grade line (HGL) and building under side of footing (USF) must be provided. (City of Ottawa)
- Maximum 'climate change' HGL to be lower than proposed basement elevations. (City of Ottawa)
- Inlet control devices (ICDs) to have a minimum orifice diameter of 83 mm. (City of Ottawa)
- Depth of flow may extend adjacent to the right-of-way provided that the water level does not touch any part of the building envelope and remains below the lowest building opening during the stress test event (100-year increased by 20%). (City of Ottawa)
- Total maximum depth of flow under static and dynamic conditions shall be less than 0.35 m during the 100-year event. (City of Ottawa)
- There must be at least 30 cm of vertical clearance between the spill elevation on the private street and the lowest building opening that is in the proximity of the flow route or ponding area. (City of Ottawa)
- There must be at least 30 cm of vertical clearance between the spill elevation on rear yard swales and the ground elevation at the building envelope that is in the proximity of the flow route or ponding area. (City of Ottawa)
- Minimum roadway profile grades at 0.5%. (City of Ottawa)
- Minimum roadway slope of 0.1% from crest-to-crest for overland flow route. (City of Ottawa)
- Provide adequate emergency overflow conveyance off-site. (City of Ottawa)

5.3 DESIGN METHODOLOGY AND CRITERIA

The design methodology and criteria for the SWM component of the development is as follows:

- Restrict inflows to the sewer to the 5-year rate as per City of Ottawa Design Guidelines and interim pond 2 requirements.
- Produce a PCSWMM model that generates major and minor system hydrographs and that routes the hydrographs through a hydraulic model
- Ensure that the resulting 100-year hydraulic grade line does not encroach within 0.30 m of the proposed underside of footings (USF) for the units in the ultimate development scenario.
- Ensure that total dynamic and static surface ponding depths do not exceed 0.35 m during the 100-year storm scenario.

- Confirm that climate change storm simulation does not result in flooding of properties.

The site is designed using the "dual drainage" principle, whereby the minor (pipe) system is designed to convey the peak rate of runoff from the 5-year design storm and runoff from larger events is conveyed by both minor (pipe) and major (overland) channels, such as roadways and walkways, safely off site without impacting proposed or existing downstream properties.

In keeping with the 5-year inlet restriction criterion, IPEX Inlet Control Devices (ICDs) or orifice plates have been specified for all street and rear-yard catchbasins to limit the inflow to the minor system which outlets to the 750mm diameter storm sewer on Esselmont Street. Restricted inlet rates to the sewer are necessary to prevent the hydraulic grade line from surcharging storm sewers into basements during major storms. Rear-yard catchbasins will have inlet controls placed at the downstream-most structure before entering the storm sewer. Solid covers will be installed on all manholes located in ponding areas to limit inflows to the minor system to that of the ICD.

Drawings SD-1 outline the proposed storm sewer alignment, ICD locations, ponding areas, and drainage divides and labels. The major flow generated from larger events will be safely conveyed by engineered (overland) channels such as roadways and walkways. Ultimately, the major system flow will be conveyed to EUC Pond 2. Details of the Interim SWM Pond 2 can be found in the East Urban Community Interim Pond 2 Facility Design Brief (Stantec, June 26, 2015) submitted under separate cover.

All storm sewers were sized for the ultimate development condition as outlined in the 2013 ISSU. Detailed storm sewer design sheets are included in **Appendix C.1**.

5.4 MODELING RATIONALE

A comprehensive hydrologic modeling exercise was completed with PCSWMM, accounting for the estimated 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. The following assumptions were applied to the detailed model:

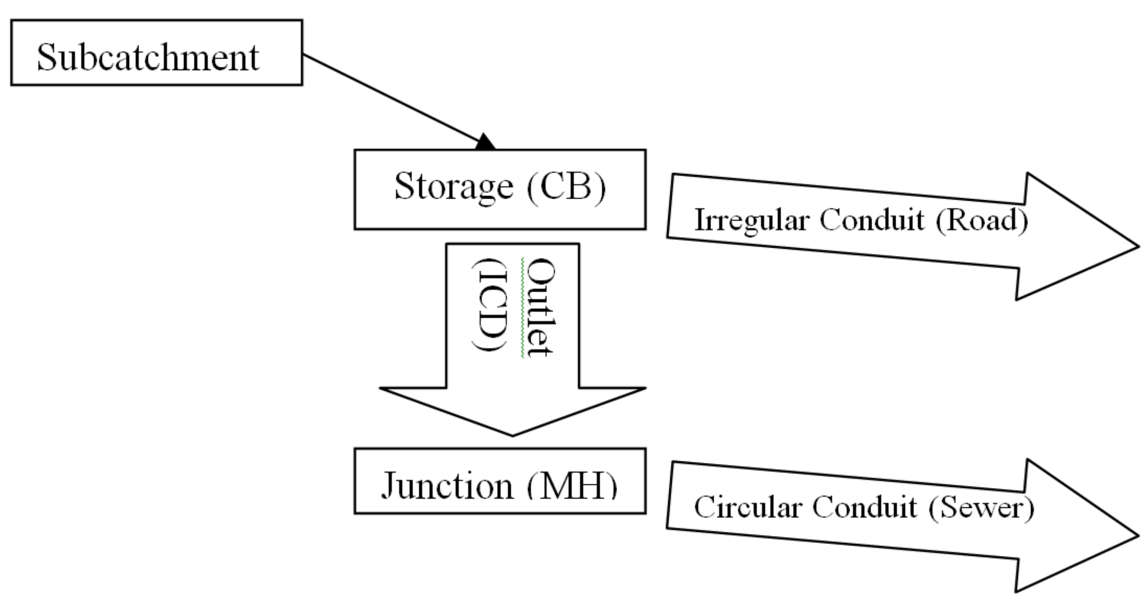
- Hydrologic parameters as per Ottawa Sewer Design Guidelines, including Horton infiltration, Manning's 'n', and depression storage values.
- 3-hour Chicago Storm distribution for 2-year, 5-year and 100-year analysis.
- To 'stress test' the system a 'climate change' scenario was created by adding 20% of the individual intensity values of the 100-year storm at their specified time step.
- Percent imperviousness calculated based on actual soft and hard surfaces on each subarea within the proposed phases, 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 and detailed grading is available.
- Width parameter was taken as twice the length of the street/swale segment for two-sided catchments and as the length of the street/swale segment for one-sided catchments.
- Catchbasin inflow restricted with inlet-control devices (ICDs) as necessary to maintain 5-year inflow target rate.
- Surface ponding in sag storage calculated based on grading plans (**Drawings GP-1**).
- Different segment cross-section types defined, accounting for varying right-of-way widths, swales and spillways.

5.4.1 SWMM Dual Drainage Methodology

The proposed subdivision is modeled in one modeling program as a dual conduit system (see **Figure 3**), 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 and high points. The dual drainage systems are connected via outlet link objects from storage node (i.e. CB) to junction (i.e. 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 3: Schematic Representing Model Object Roles



Storage nodes are used in the model to represent catchbasins as well as 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 is the top of the CB. The storage value assigned to the storage node represents only the volume available within the structure. If the available storage volume in a storage node is exceeded, flows spill above the storage node and into the sag in the irregular conduits (representing roads). The volume stored within the road sags is represented as flood volume in the model and includes the total dynamic volume and the ponded depth above the node representing the dynamic flow depth. Flow storage volumes exceeding the sag storage available in the transect (roadway) will spill at the downstream highpoint into the next sag and continue routing through the system until ultimately flows either re-enter the minor system or reach the outfall of the major system. Storages representing major system junctions are assigned both an invert and a rim elevation equal to the transect invert (spill elevation at edge of pavement). Storage values assigned to these nodes are assigned a value of 0 for linear volume calculations. No storage has been accounted for within storage nodes at high points. In this manner, storage will accumulate according to the actual ponding depths before spilling along the roadway conduit, and to the next downstream road conduit.

Storage curves in PCSWMM are required to be input as depth-area curves; as such an equivalent area was calculated for each depth along the curve. All storage was assumed to be above the rim of the storage node.

Inlet control devices are represented by orifices or outflow links which use a user-specified depth-discharge curve taken from manufacturer's specifications for the chosen ICD model.

5.4.2 Boundary Conditions

The detailed PCSWMM hydrology and the proposed storm sewers were used to assess the peak inflows and hydraulic grade line (HGL) in the subdivision. Since trunk sewers in Navan Road are proposed to service the subdivision, they were sized to accommodate the estimated ultimate condition peak flows based on detailed design and ISSU assumptions. The ultimate conditions modeling was used to assess the final anticipated HGL for Site C and incorporates the EMP assumptions for the ultimate Pond 2 storage and discharge rates. The Ultimate Pond 2 outlet is assumed to be free flowing.

5.5 INPUT PARAMETERS

Drawing SD-1 summarizes the discretized subcatchments used in the analysis of the proposed Site C and outlines the major overland flow paths. All parameters were assigned as per applicable City of Ottawa, Ministry of Environment, Conservation, and Parks (MECP) and background report requirements.

Key parameters for the subject area are summarized below; an example input file is provided for the 100-year, 3hr Chicago storm which indicates all other parameters (see **Appendix C.2**). 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.

5.5.1 Hydrologic Parameters

Table 5.1 presents the general subcatchment parameters used:

Table 5.1: General Subcatchment Parameters

Subcatchment 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 Imperv	0.013
N Perv	0.25
Dstore Imperv (mm)	1.57
Dstore Perv (mm)	4.67
Zero Imperv (%)	0

Table 5.2 presents the individual parameters that vary for each of the proposed subcatchments.

Table 5.2: Subcatchment Parameters

Area ID	Area (ha)	Width (m)	Slope (%)	% Impervious	Runoff Coefficient
C101A	0.0551	34.72	0.50	84.29	0.79
C101B	0.0655	34.20	0.50	85.71	0.80
C102A	0.0755	45.40	0.50	81.43	0.77
C102B	0.0703	68.50	0.50	81.43	0.77
C103A	0.0241	27.80	0.70	62.86	0.64
C104A	0.0632	35.60	0.50	82.86	0.78
C104B	0.0709	42.80	0.50	80.00	0.76
C106A	0.0720	41.30	0.50	81.43	0.77
C106B	0.0257	41.30	0.50	65.71	0.66
C106C	0.0534	35.40	1.50	44.29	0.51
C904A	0.0753	120.00	1.00	47.14	0.53

Table 5.3 summarizes the storage node parameters used in the model. All catchbasins have been modeled as having an outlet invert as depicted on **Drawings SSP-1**. Static ponding depths,

areas, and volumes within the proposed development area are as per **Drawings SD-1** but are not explicitly included in the PCSWMM model as per methodology presented in **Section 4.4.1**.

Table 5.3: Storage Node Parameters

Storage Node	Invert Elevation (m)	Rim Elevation (m)	Total Depth (m)
CBMH-102A	82.97	86.28	3.31
CB101AB-S	84.68	86.41	1.73
CB102AB-S	84.69	86.42	1.73
CB103A-S	84.76	86.49	1.73
CB104AB-S	84.73	86.46	1.73
CB106AB-S	84.71	86.44	1.73
CB106C-S	84.41	86.26	1.85

5.5.2 Hydraulic Parameters

As per City of Ottawa Sewer Design Guidelines, 2012, Manning's roughness values of 0.013 were used for sewer modeling and overland flow corridors representing roadways.

Storm sewers were modeled to confirm flow capacities and hydraulic grade lines (HGLs) to determine minor system peak outflows to the outlet. The detailed storm sewer design sheet is included in **Appendix C.1**.

Table 5.4 below presents the parameters for the outlet link objects in the model, which represent ICDs. A coefficient of 0.572 was applied to conform to head/discharge curves as supplied by the manufacturer for IPEX Tempest HF model ICDs (Slide type).

Table 5.4: Orifice and Outlet Link Parameters

Orifice and Outlet Name(s)	Catchbasin ID	Tributary Area ID	Minor System Node	ICD Type
C102A-IC	CB102AB-S	C102A	STM-101	IPEX TEMPEST HF (83mm ORIFICE)
C102B-IC	CB102AB-S	C102B	STM-101	IPEX TEMPEST HF (83mm ORIFICE)
C103A-IC	CB103A-S	C103A	STM-101	IPEX TEMPEST HF (83mm ORIFICE)
C104A-IC	CB104AB-S	C104A	STM-103	IPEX TEMPEST LMF 80
C104B-IC	CB104AB-S	C104B	STM-103	IPEX TEMPEST LMF 80
C106A-IC	CB106AB-S	C106A	STM-103	IPEX TEMPEST LMF 80
C106B-IC	CB106AB-S	C106B	STM-103	IPEX TEMPEST LMF 80
C106C-IC	CB106C-S	C106C	STM-103	IPEX TEMPEST HF (83mm ORIFICE)
C101A-IC	CB101AB-S	C101A	STM-639	IPEX TEMPEST HF (83mm ORIFICE)

Orifice and Outlet Name(s)	Catchbasin ID	Tributary Area ID	Minor System Node	ICD Type
C101B-IC	CB101AB-S	C101B	STM-639	1 x IPEX TEMPEST HF (83mm ORIFICE)

5.6 MODELS RESULTS AND DISCUSSION

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.2** and the electronic model files on the enclosed CD.

5.6.1 Hydrology

Table 5.5 summarizes the maximum flow rates and head across the orifice and outlet links for the 100-year design storm event.

Table 5.5: Orifice and Outlet Link Results

Catchbasin ID(s)	Tributary Area ID	ICD Type	5yr Head (m)	100yr Head (m)	5yr Flow (L/s)	100yr Flow (L/s)
CB102AB-S	C102A/B	2 x IPEX TEMPEST HF (83mm ORIFICE)	1.5	1.6	16.8 x 2	17.1 x 2
CB103A-S	C103A	IPEX TEMPEST HF (83mm ORIFICE)	1.4	1.5	15.7	16.6
CB104AB-S	C104A/B	2 x IPEX TEMPEST LMF 80	1.5	1.5	6.1 x 2	6.2 x 2
CB106AB-S	C106A/B	2 x IPEX TEMPEST LMF 80	1.5	1.5	6.0 x 2	6.2 x 2
CB106C-S	C106C	IPEX TEMPEST HF (83mm ORIFICE)	0.4	1.8	8.5	18.3
CB101AB-S	C101A/B	2 x IPEX TEMPEST HF (83mm ORIFICE)	1.1	1.6	16.2 x 2	19.1 x 2

5.6.2 Hydraulics

Table 5.6 summarizes the HGL results within the subdivision for the Ultimate Condition 100-year, 3 hour Chicago storm events and the largest HGL values for the 'climate change' scenario storm required by the City of Ottawa Sewer Design Guidelines (2012), where 100-year 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.

Table 5.6: Modeled Hydraulic Grade Line Results

STM MH	Proposed USF (m)	100-year 3hr Chicago		100-year 3hr Chicago + 20%	
		HGL (m)	USF-HGL Clearance (m)	HGL (m)	USF-HGL Clearance (m)
STM-101	84.19	83.84	0.35	83.98	0.21
STM-101A	84.19	83.83	0.36	83.97	0.22
STM-102	84.67	83.85	0.82	84.00	0.67
STM-103	84.19	83.87	0.32	84.02	0.17
STM-104	84.70	83.57	1.13	84.03	0.67
STM-106	84.19	83.89	0.30	84.03	0.16
STM-639	84.19	83.79	0.40	83.92	0.27

As is demonstrated in **Table 5.6**, the worst-case scenario results in HGL elevations that remain at least 0.30 m below the proposed underside of footings, and HGL elevations remain below the proposed basement slab elevations during the 20% increased intensity 'climate change' scenario.

5.6.3 Overland Flow

Table 5.7 presents the maximum total surface water depths (static ponding depth + dynamic flow) above the top-of-grate of catchbasins for the 100-year design storm and climate change storm. Based on the model results, the total ponding depth (static + dynamic) does not exceed the required 0.35 m maximum during the 100-year event. Total ponding depths during the climate change scenario are well below lowest adjacent building openings and should not reach any adjacent buildings.

Table 5.7: Maximum Static and Dynamic Surface Water Depths

Storage node ID	Structure ID	Rim Elevation (m)	100 year, 3 hour Chicago		100 year, 3 hour Chicago+20%	
			Max Surface HGL (m)	Total Surface Ponding Depth (m)	Max Surface HGL (m)	Total Surface Ponding Depth (m)
CB102AB-S	CB 102A & CB 102B	86.07	86.29	0.22	86.31	0.24
CB103A-S	CB 103A	86.14	86.28	0.14	86.29	0.15
CB104AB-S	CB 104A & CB 104B	86.11	86.27	0.16	86.28	0.17
CB106AB-S	CB 106A & CB 106B	86.09	86.23	0.14	86.25	0.16

Storage node ID	Structure ID	Rim Elevation (m)	100 year, 3 hour Chicago		100 year, 3 hour Chicago+20%	
			Max Surface HGL (m)	Total Surface Ponding Depth (m)	Max Surface HGL (m)	Total Surface Ponding Depth (m)
CB101AB-S	CB 101A & CB 101B	86.06	86.23	0.17	86.26	0.20

5.6.4 Minor and Major System Peak Outflows

Minor system peak flows from the site are directed to the 750 mm diameter storm sewer on Esselmont Street. Based on the PCSWMM model for the proposed development the 100-year minor system peak outflow from the proposed site is equal to 258.6 L/s, meeting the 276.3 L/s minor system target for Site C.

Similarly, major system peak flows from the site are directed to the Esselmont Street ROW from Caithness Private and Fordyce Private. Maximum overland flows during the 100-year storm event produce a runoff rate of 138.2 L/s, well below the 314.0 L/s target.

6.0 GRADING AND DRAINAGE

The proposed development site measures approximately 0.73ha in area. The site is currently the location of an interim pond. The proposed topography across the site is relatively flat, and is will drain from north to south, with overland flow being directed to the adjacent Esselmont Street ROW. A detailed grading plan (see Drawing GP-1) has been provided to satisfy the stormwater management requirements, adhere to grade raise restrictions (see Section 7.0) for the site, and provide for minimum cover requirements for storm and sanitary sewers where possible. Site grading has been established to provide emergency overland flow routes required for stormwater management in accordance with the Gloucester East Urban Community Phase 2 Infrastructure Servicing Study Update (ISSU- September 2013) requirements. The subject site is graded to provide an emergency overland flow route to Esselmont Street for storm flows exceeding those generated by the 100-year design storm.

7.0 GEOTECHNICAL CONSIDERATIONS

A geotechnical investigation was completed by Paterson Group Ltd. in October of 2014. The report summarizes the existing soil conditions within the subject area and provides construction recommendations. For details which are not summarized below, please see Paterson Report PG2444-2.

Detailed recommendations regarding the decommissioning of the dry pond will be provided by Paterson Group at a later date.

Subsurface soil conditions within the subject area were determined from 2 boreholes and one test pit distributed across Site C. In general soil stratigraphy consisted of a topsoil/organic layer followed by silty sand overlaying a sensitive silty clay deposit. Bedrock was anticipated at between 25 m – 50 m depth.

Groundwater levels were measured and estimated to vary in elevation from 0.06 to 0.8 m below ground surface. It is expected that construction may occur below the existing groundwater table and therefore a permit to take water may be required.

The recommended permissible grade raise for the site is up to 0.5m (see Drawing PG2444-4). The grade raise restriction was accounted for in the grading design of the site.

The required pavement structure for the local roadways is outlined in **Table 7.1** below.

Table 7.1: Recommended Pavement Structure – Local Roadways

Thickness (mm)	Material Description
50	Wear Course – HL 3 or Superpave 12.5 AC
150	Base - OPSS Granular 'A' crushed stone
300	Subbase - OPSS Granular 'B' Type II
	Subgrade – either fill, insitu soil or OPSS Granular B Type I or II material place over insitu soil or fill.

Table 7.2: Recommended Pavement Structure – Local Roadways

Thickness (mm)	Material Description
40	Wear Course - Superpave 12.5 AC
50	Binder Course - Superpave 19.0 AC
150	Base – OPSS Granular A Crushed Stone
450	Subbase - OPSS Granular B Type II
	Subgrade – either fill, insitu soil or OPSS Granular B Type I or II material place over insitu soil or fill.

8.0 EROSION CONTROL DURING CONSTRUCTION

In order to control erosion and migration of sediment-laden runoff during construction, an erosion and sediment control plan will be required for the subdivision. Therefore, an appropriate inspection and maintenance program is necessary that will be employed by the contractor, and will consider the following goals:

- Implementation of best management practices to provide appropriate protection of the existing and proposed drainage system and the receiving water course(s);
- Immediate stabilization and containment of any exposed soil and/or stock piles;
- Minimization of areas to be cleared and grubbed;
- Protection of exposed slopes with plastic or synthetic mulches;
- Provision of sediment traps and basins during dewatering;
- Installation of sediment traps (such as SiltSack® by Terrafix) between catch basins and frames;
- Frequent inspection of all controls during construction and after significant rainfall events (greater than 13 mm) for sediment accumulation and erosion;
- Immediate repair of all noticeable erosion, with investigation into the cause so implementation of mitigation measures to prevent recurrence will be more successful;
- Maintenance of the erosion control measures during construction;
- Preparation of monitoring reports outlining the condition of erosion control works, their overall performance, and any actions such as repairs, replacement or modification.

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

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

Drawing DS EC-1 outlines the erosion and sediment control plan.

9.0 APPROVALS

Ontario Ministry of Environment, Conservation and Parks (MECP) Environmental Compliance Approvals (ECAs, formerly Certificates of Approval (CofA)) under the Ontario Water Resources Act will be required for proposed storm and sanitary sewers and inlet control devices (Transfer of review) for the proposed site.

An MECP Permit to Take Water (PTTW) may be required for the site as some of the proposed works may be below the groundwater elevation shown in the geotechnical report. The geotechnical consultant shall determine whether a PTTW is required at the detailed design stage / prior to construction.

10.0 UTILITIES

As the subject site lies within a mature developed residential community, Hydro, Bell, Gas and Cable servicing for the proposed development should be readily available within subsurface infrastructure within the Caithness Private and Esselmont Street ROW. Exact size, location and routing of utilities, along with determination of any off-site works required for redevelopment, will be finalized after design circulation.

11.0 CONCLUSIONS

11.1 WATER SERVICING

Based on the potable water servicing analysis the proposed network is capable of servicing the subject site and meets all servicing requirements as per City of Ottawa standards under typical demand conditions (peak hour and minimum hour conditions) as well as under emergency fire demand conditions (maximum day + fire flow). The proposed internal watermains will provide the necessary looping requirements by connecting to three 250mm diameter mains within Caithness Private located at the northern boundary and two connections to Esselmont Street to the south.

11.2 STORMWATER SERVICING

- The proposed stormwater management plan is in compliance with the goals specified in the background reports and the 2012 City of Ottawa Sewer Guidelines.
- Inlet control devices are proposed to limit inflow from the site area into the minor system to the 5 year storm event based on City of Ottawa IDF curves.
- The storm sewer hydraulic grade line is maintained at least 0.30 m below the underside of footing in the subdivision during design storm events.
- All dynamic surface water depths are less than or equal to 0.35 m during all design storm events up to the 100 year event.
- Minor system peak flows from the proposed site will be captured and ultimately directed to Pond 2 for quality/quantity control.
- Major system overland flows are directed to Esslemont Street ROW.

11.3 SANITARY SERVICING

Phase B Site C will be serviced by a network of gravity sewers that will direct wastewater flows to the 200mm sanitary sewer along Esslemont Street. The proposed site will generate a total sanitary peak flow of 1.8 L/s. The receiving sewer system has sufficient available capacity to receive the design flows. The preferred cover requirement of 2.5 m for the sanitary sewer system will be satisfied in all locations. Design guidelines for slope and velocity have been met within the proposed sewers.

11.4 GRADING

Grading for the site has been designed to provide an emergency overland flow route as per City requirements and reflects the recommendations in the Geotechnical Investigation Report prepared by Paterson Group. Detailed recommendations regarding the decommissioning of the dry pond will be provided by Paterson Group at a later date. Erosion and sediment control measures will be implemented during construction to reduce the impact on existing facilities.

11.5 APPROVALS

An MECP Environmental Compliance Approval is expected to be required for the subject site as the on-site storm and sanitary sewers receive discharge from developments to the north not forming part of the site parcel. Requirements for a Permit to Take Water (PTTW) may be required as some of the proposed works may be below the groundwater elevation shown in the geotechnical report. No other approval requirements from other regulatory agencies are anticipated.

11.6 UTILITIES

Utility infrastructure exists in the general area of the subject site. Exact size, location and routing of utilities will be finalized at the detailed design stage.

Appendix A

POTABLE WATER SERVICING ANALYSIS

Ashcroft Site C - Domestic Water Demand Estimates
- Based on Proposed Site Plan (160401101)

Building ID	Units	Population 1	Daily Rate of Demand 2 ($L/m^2/day$)	Avg Day Demand		Max Day Demand 3		Peak Hour Demand 3	
				(L/min)	(L/s)	(L/min)	(L/s)	(L/min)	(L/s)
Townhomes	49	132.3	350	32.2	0.54	80.4	1.34	176.9	2.95
Total Site :	**49**	**132.3**		**32.2**	**0.54**	**80.4**	**1.34**	**176.9**	**2.95**

1 Population counts based on a conversion factor of 2.7 persons/townhome
2 Average day water demand for residential areas equal to 350 L/cap/d
3 The City of Ottawa 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
Referenced from the City of Ottawa Design Guidelines: Water Distribution (July 2010)

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401422
Project Name: Richcraft Block 221 Riverside
Date: 4/9/2020
Fire Flow Calculation #: 1
Description: Townhomes (59-66)

Notes:

Step	Task	Notes						Value Used	Req'd Fire Flow (L/min)
1	Determine Type of Construction	Wood Frame						1.5	-
2	Determine Ground Floor Area of One Unit	-						58	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						3	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						3	-
4	Determine Required Fire Flow	(F = 220 x C x $A^{1/2}$). Round to nearest 1000 L/min						-	8000
5	Determine Occupancy Charge	Limited Combustible						-15%	6800
6	Determine Sprinkler Reduction	None						0%	0
		Non-Standard Water Supply or N/A						0%	
		Not Fully Supervised or N/A						0%	
		% Coverage of Sprinkler System						0%	
7	Determine Increase for Exposures (Max. 75%)	Direction	Exposure Distance (m)	Exposed Length (m)	Exposed Height (Stories)	Length-Height Factor (m x stories)	Construction of Adjacent Wall	-	-
		North	10.1 to 20	18	3	31-60	Wood Frame or Non-Combustible	13%	1768
		East	0 to 3	13	3	31-60	Ordinary or Fire Resistive (Blank Wall)	0%	
		South	10.1 to 20	18	3	31-60	Wood Frame or Non-Combustible	13%	
		West	0 to 3	13	3	31-60	Ordinary or Fire Resistive (Blank Wall)	0%	
8	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min							9000
		Total Required Fire Flow in L/s							150.0
		Required Duration of Fire Flow (hrs)							2.00
		Required Volume of Fire Flow (m^3)							1080

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401422
Project Name: Richcraft Block 221 Riverside
Date: 4/9/2020
Fire Flow Calculation #: 1
Description: Townhomes (44-51)

Notes:

Step	Task	Notes						Value Used	Req'd Fire Flow (L/min)
1	Determine Type of Construction	Wood Frame						1.5	-
2	Determine Ground Floor Area of One Unit	-						58	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						4	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						3	-
4	Determine Required Fire Flow	(F = 220 x C x $A^{1/2}$). Round to nearest 1000 L/min						-	9000
5	Determine Occupancy Charge	Limited Combustible						-15%	7650
6	Determine Sprinkler Reduction	None						0%	0
		Non-Standard Water Supply or N/A						0%	
		Not Fully Supervised or N/A						0%	
		% Coverage of Sprinkler System						0%	
7	Determine Increase for Exposures (Max. 75%)	Direction	Exposure Distance (m)	Exposed Length (m)	Exposed Height (Stories)	Length-Height Factor (m x stories)	Construction of Adjacent Wall	-	-
		North	10.1 to 20	14	3	31-60	Wood Frame or Non-Combustible	13%	3366
		East	0 to 3	19	3	31-60	Ordinary or Fire Resistive (Blank Wall)	0%	
		South	10.1 to 20	14	3	31-60	Wood Frame or Non-Combustible	13%	
		West	3.1 to 10	19	3	31-60	Wood Frame or Non-Combustible	18%	
8	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min							11000
		Total Required Fire Flow in L/s							183.3
		Required Duration of Fire Flow (hrs)							2.00
		Required Volume of Fire Flow (m^3)							1320

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401422
Project Name: Richcraft Block 221 Riverside
Date: 4/9/2020
Fire Flow Calculation #: 1
Description: Townhomes (23-27)

Notes:

<table>
<tr><th>Step</th><th>Task</th><th colspan="6">Notes</th><th>Value Used</th><th>Req'd Fire Flow (L/min)</th></tr>
<tr><td>1</td><td>Determine Type of Construction</td><td colspan="6">Wood Frame</td><td>1.5</td><td>-</td></tr>
<tr><td rowspan="2">2</td><td>Determine Ground Floor Area of One Unit</td><td colspan="6">-</td><td>58</td><td>-</td></tr>
<tr><td>Determine Number of Adjoining Units</td><td colspan="6">Includes adjacent wood frame structures separated by 3m or less</td><td>5</td><td>-</td></tr>
<tr><td>3</td><td>Determine Height in Storeys</td><td colspan="6">Does not include floors >50% below grade or open attic space</td><td>3</td><td>-</td></tr>
<tr><td>4</td><td>Determine Required Fire Flow</td><td colspan="6">(F = 220 x C x A^1/2). Round to nearest 1000 L/min</td><td>-</td><td>10000</td></tr>
<tr><td>5</td><td>Determine Occupancy Charge</td><td colspan="6">Limited Combustible</td><td>-15%</td><td>8500</td></tr>
<tr><td rowspan="4">6</td><td rowspan="4">Determine Sprinkler Reduction</td><td colspan="6">None</td><td>0%</td><td rowspan="4">0</td></tr>
<tr><td colspan="6">Non-Standard Water Supply or N/A</td><td>0%</td></tr>
<tr><td colspan="6">Not Fully Supervised or N/A</td><td>0%</td></tr>
<tr><td colspan="6">% Coverage of Sprinkler System</td><td>0%</td></tr>
<tr><td rowspan="5">7</td><td rowspan="5">Determine Increase for Exposures (Max. 75%)</td><td>Direction</td><td>Exposure Distance (m)</td><td>Exposed Length (m)</td><td>Exposed Height (Stories)</td><td>Length-Height Factor (m x stories)</td><td>Construction of Adjacent Wall</td><td>-</td><td>-</td></tr>
<tr><td>North</td><td>3.1 to 10</td><td>13</td><td>3</td><td>31-60</td><td>Wood Frame or Non-Combustible</td><td>18%</td><td rowspan="4">5440</td></tr>
<tr><td>East</td><td>10.1 to 20</td><td>22</td><td>3</td><td>61-90</td><td>Wood Frame or Non-Combustible</td><td>14%</td></tr>
<tr><td>South</td><td>3.1 to 10</td><td>13</td><td>3</td><td>31-60</td><td>Wood Frame or Non-Combustible</td><td>18%</td></tr>
<tr><td>West</td><td>10.1 to 20</td><td>22</td><td>3</td><td>61-90</td><td>Wood Frame or Non-Combustible</td><td>14%</td></tr>
<tr><td rowspan="4">8</td><td rowspan="4">Determine Final Required Fire Flow</td><td colspan="7">Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min</td><td>14000</td></tr>
<tr><td colspan="7">Total Required Fire Flow in L/s</td><td>233.3</td></tr>
<tr><td colspan="7">Required Duration of Fire Flow (hrs)</td><td>3.00</td></tr>
<tr><td colspan="7">Required Volume of Fire Flow (m³)</td><td>2520</td></tr>
</table>

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401422
Project Name: Richcraft Block 221 Riverside
Date: 4/9/2020
Fire Flow Calculation #: 1
Description: Back-to-back Townhomes with Fire Wall

Notes:

Step	Task	Notes						Value Used	Req'd Fire Flow (L/min)
1	Determine Type of Construction	Wood Frame						1.5	-
2	Determine Ground Floor Area of One Unit	-						50	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						6	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						3	-
4	Determine Required Fire Flow	(F = 220 x C x $A^{1/2}$). Round to nearest 1000 L/min						-	10000
5	Determine Occupancy Charge	Limited Combustible						-15%	8500
6	Determine Sprinkler Reduction	None						0%	0
		Non-Standard Water Supply or N/A						0%	
		Not Fully Supervised or N/A						0%	
		% Coverage of Sprinkler System						0%	
7	Determine Increase for Exposures (Max. 75%)	Direction	Exposure Distance (m)	Exposed Length (m)	Exposed Height (Stories)	Length-Height Factor (m x stories)	Construction of Adjacent Wall	-	-
		North	10.1 to 20	14	3	31-60	Wood Frame or Non-Combustible	13%	3315
		East	10.1 to 20	19	3	31-60	Wood Frame or Non-Combustible	13%	
		South	0 to 3	14	3	31-60	Ordinary or Fire Resistive (Blank Wall)	0%	
		West	10.1 to 20	19	3	31-60	Wood Frame or Non-Combustible	13%	
8	Determine Final Required Fire Flow	**Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min**							**12000**
		Total Required Fire Flow in L/s							**200.0**
		Required Duration of Fire Flow (hrs)							**2.50**
		Required Volume of Fire Flow (m^3)							**1800**

A.1 BACKGROUND REPORT EXCERPTS

2.0 POTABLE WATER

A detailed Potable Water Servicing Analysis has been completed and is included in **Appendix A.** The report identifies and provides an evaluation of the potable water distribution network provided for Phases 1B, 2A and 2B of the Ashcroft EUC development. The following includes a summary and recommendations as outlined in the report:

2.1.1 BACKGROUND

The development is proposed to occur within the Ottawa region pressure zone 2E. The development consists of 139 single family units, 312 semi-detached and townhouse units, 136 stacked townhomes, 60 low-rise apartment units, and 19 mixed commercial-residential use buildings.

2.1.2 HYDRAULIC MODEL RESULTS

A hydraulic model was used to simulate the proposed development conditions based on boundary conditions provided by the City of Ottawa. The hydraulic analysis was completed with H2OMAP Water Software and assessed the internal network and connections to the surrounding infrastructure. The model was tested under peak hour, minimum hour and maximum day plus fire flow conditions. A model scenario was created and tested under these conditions for each development phase to ensure that sufficient capacity could be provided throughout the development process before all source locations are connected.

Both the temporary and permanent watermain layouts allow serviceable pressures to be maintained under minimum hour, peak hour and maximum day plus fire flow demands. The minimum pressure in all phasing scenarios during the peak hour scenario was 51 psi (350 kPa) and the maximum pressure modeled was 70 psi (480 kPa). These pressures are both well within the serviceable limit of 40 to 100 psi (275 to 695 kPa). The tallest structure in the development area is expected to be 4 storeys in height, which is anticipated to produce an additional pressure loss of approximately 10 psi. Given that the lowest pressure produced was 51 psi, the resultant pressure of approximately 41 psi at this 4th storey will still be within acceptable limits.

2.1.3 SUMMARY OF FINDINGS

Based on the findings of the report the proposed network is capable of servicing the development area and meets all servicing requirements as per City of Ottawa standards under typical demand conditions (peak hour and average day conditions) as well as under emergency fire demand conditions (maximum day + fire flow).

Executive Summary

The following report identifies and evaluates the proposed water distribution system for a mixed-use residential and commercial development located in the southern part of Orleans in the east end of the City of Ottawa. The proposed Ashcroft and Eastboro Phase 2A and 2B development is to be serviced by Pressure Zone 2E of the City of Ottawa water distribution system.

A hydraulic assessment was performed using a computer model developed by Stantec to assess anticipated pressures under minimum hour and peak hour demands. A fire flow analysis was also performed to determine whether the development could achieve a fire flow under maximum day demands.

Hydraulic modelling showed that the proposed watermain sizing and layout has sufficient capacity to provide domestic demands while maintaining operating pressures within the range of 276 - 552kPa (40 - 80 psi).

For the proposed townhome dwellings that require a fire flow greater than 10,000 L/min per the Fire Underwriters Survey (FUS) calculations, the City's technical bulletin (ISDTB-2014-02) provides an allowance to cap the fire flow at 10,000 L/min provided specific building separation requirements are met. Hydraulic modelling showed a number of areas (dead-ends specifically) were not able to achieve the 10,000L/min fire flow objective during interim conditions. As such, fire walls or other mitigating measures may be necessary to the fire flow requirements of certain buildings located at the end of dead ends prior to build out.

An additional analysis was performed to examine the available fire flow directly upstream of the dead-end nodes under interim network conditions. Results show that the adjacent upstream nodes are capable of supplying fire flows 10,000 L/min under interim network conditions. It is therefore, suggested that the placement of hydrants be within the allowable distance to service homes and not located at the very end of the dead-end might be an acceptable solution.

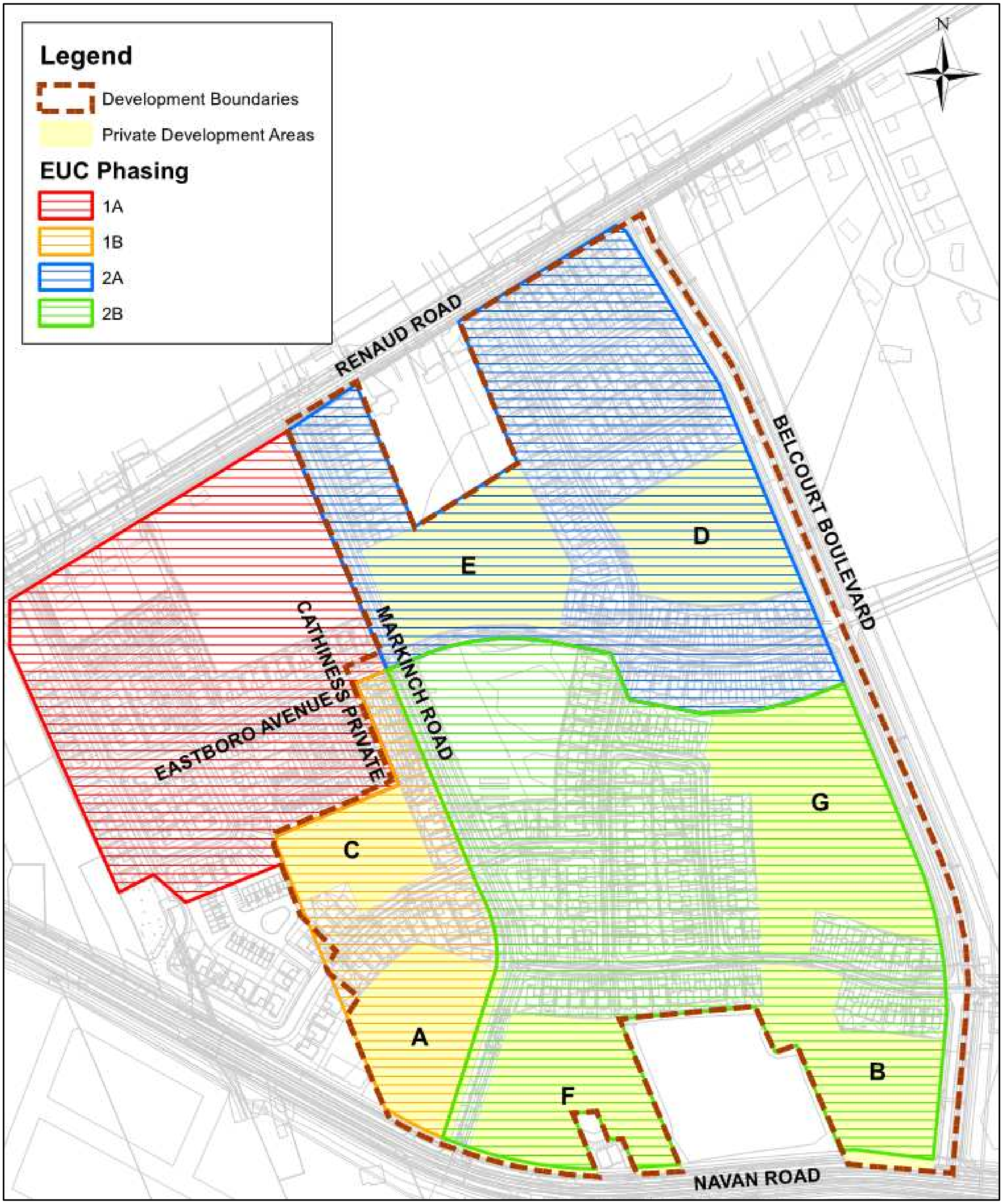
1.0 BACKGROUND

1.1 STUDY AREA

Stantec Consulting Ltd. (Stantec) has performed a hydraulic assessment for the potable water supply for the proposed development Ashcroft – Eastboro Phase 2A & 2B Community. The site is bound by Renaud Road, Navan Road, Eastboro Phase 1A development and Belcourt Boulevard. The development is within City of Ottawa boundaries and is part of the Zone 2E water distribution pressure zone. The development is a mixed-use area containing residential and commercial units.

The following report provides an analysis of the proposed network. An outline of the site boundary is provided in **Figure 1-1**. Areas considered private development are shown and labelled as A through G.

Figure 1-1: Eastboro Phase 2A & 2B Subdivision Boundaries



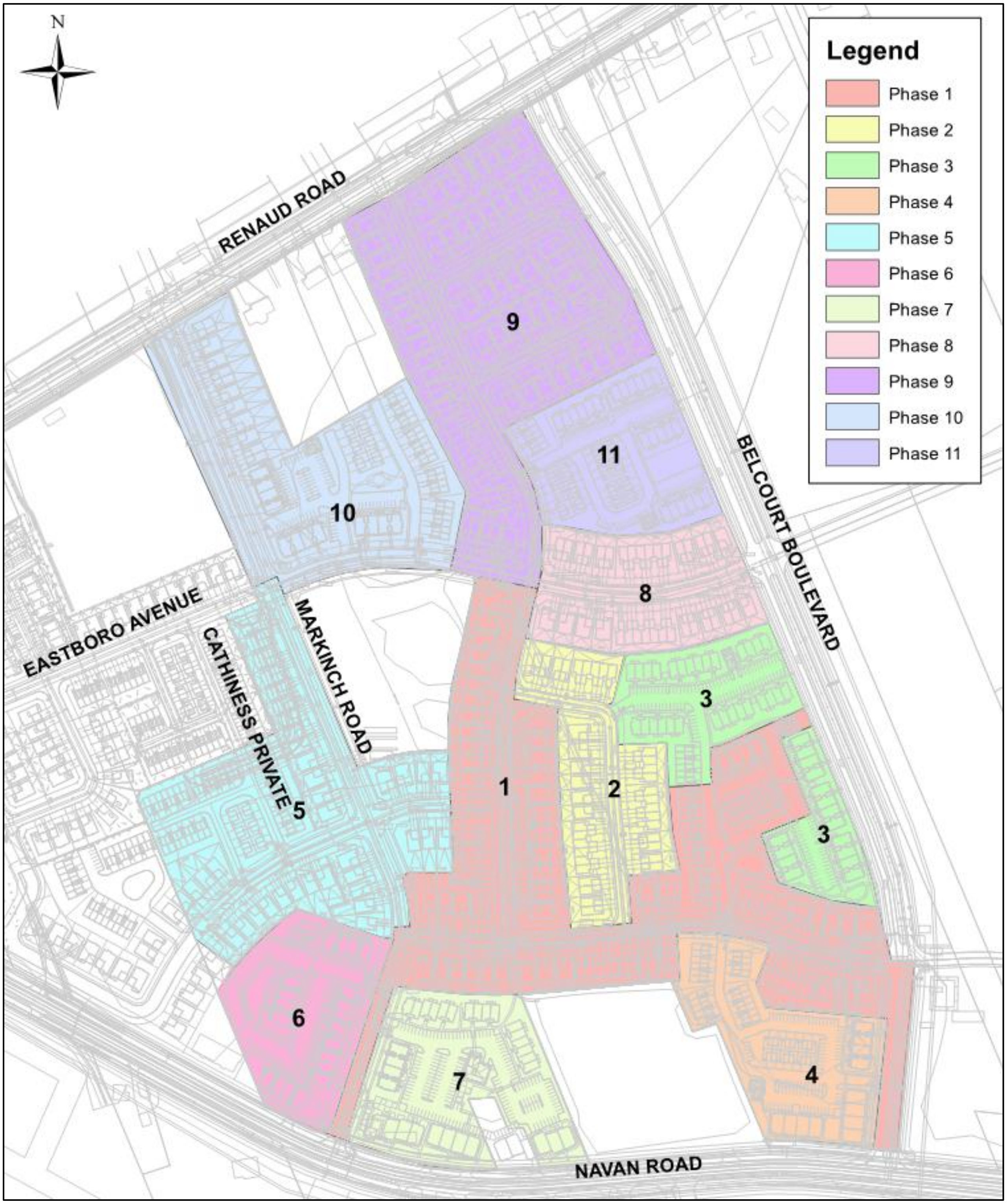
1.2 PHASING

It is anticipated that development will occur in 11 stages. Each stage has an associated area identified in **Figure 1-2** and labeled as per the expected order of development. Referring to **Figure 1-1**, the phases of the development corresponding to the EUC phases are shown in **Table** 1-1.

Table 1-1: EUC Phase Corresponding to the Development Phases

Development Phase	EUC Phase
1	2B
2	2B
3	2B
4	2B
5	1B west of Markinch; 2B east of Markinch
6	1B
7	2B
8	2B
9	2A
10	2A
11	2A

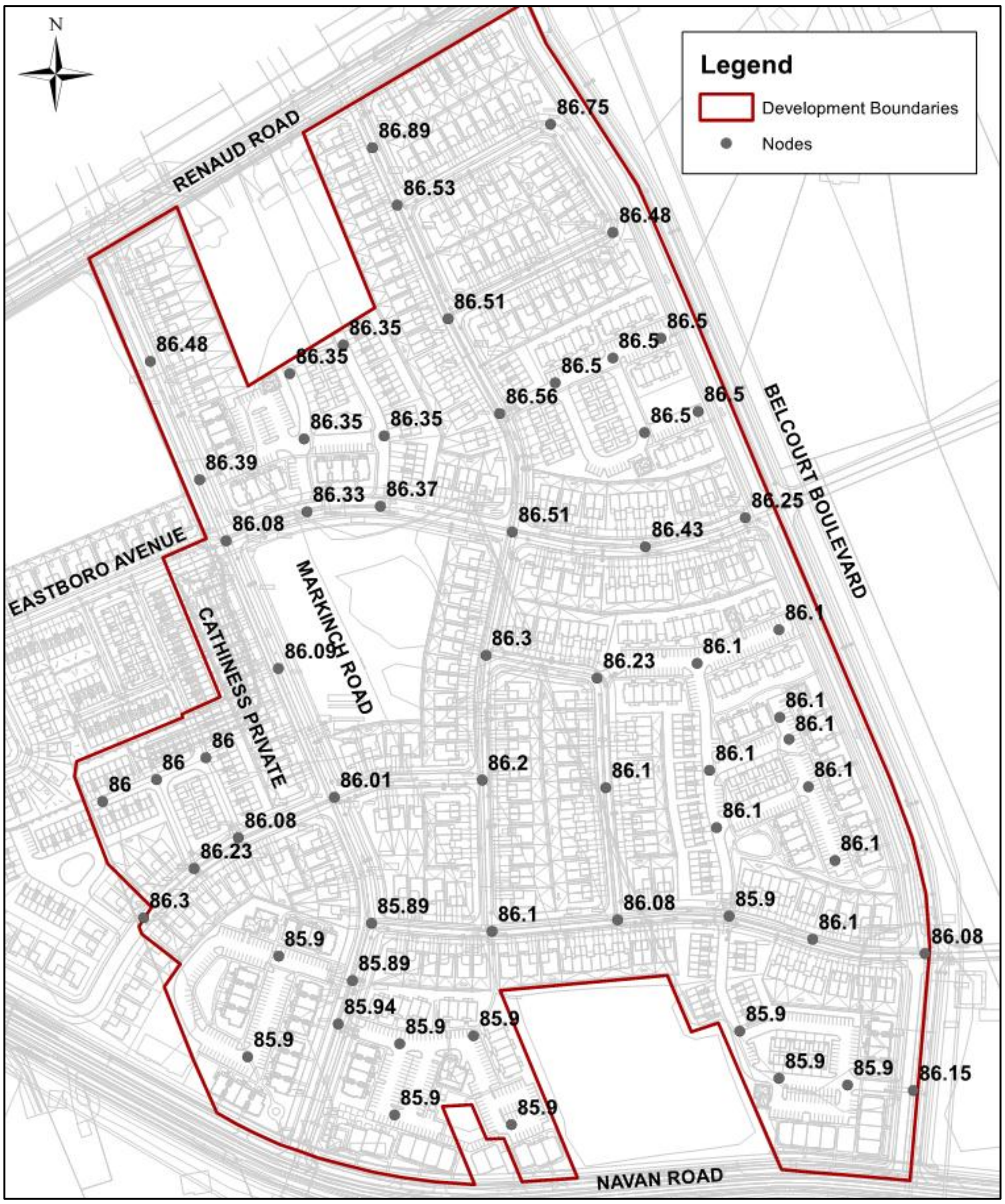
Figure 1-2: Staged Development Areas



1.3 GROUND ELEVATIONS

The grading plan for the proposed development was used to infer the approximate elevations for each node in the hydraulic model. Elevations ranged between 85.90 and 86.89m. The elevation of each node is shown in **Figure 1-3**.

Figure 1-3: Ground Elevations of Nodes in Proposed Development



2.0 SERVICEABILITY

2.1 ALLOWABLE PRESSURES

The City of Ottawa's Design Guidelines for Water Distribution (July 2010) states that system pressures under normal demand conditions, including peak hourly and minimum hourly demands, shall remain between 345 and 552kPa (50 and 80 psi) at all ground site elevations and no less than 276kPa (40 psi). A minimum ground-level pressure of 138kPa (20 psi) shall be provided during periods of maximum day plus fire flow conditions.

2.2 FIRE FLOW

Fire flows were determined for the development based on the Fire Underwriters Survey (FUS) requirements. Refer to **Appendix A** for FUS fire flow calculations for five housing types within the proposed development: a single family home, an Eastboro flat type home, a New Yorker style home, an Urban town home and a mixed use commercial-residential building. The FUS determined fire flows are summarized in **Table 2-1**bleow.

Table 2-1: Calculated FUS Fire Flow Based on Unit Type

Unit Type	FUS Fire Flow (L/min)
Single	9,000
Eastboro Flat	13,000*
New Yorker	11,000*
Urban Town	11,000*
Mixed Use	8,000

*Per the City's technical bulletin ISDTB-2014-02, for traditional side-by-side towns, row houses and single detached dwellings constructed in accordance with the OBC with a minimum 10m rear yard setback, the fire flow requirement can be capped at 10,000 L/min. We have confirmed that the proposed town home dwellings that required 13,000 L/min meet the intent of the ISDTB-2014-02 technical bulletin and therefore we have carried out our analysis with a maximum fire flow of 10,000 L/min requirement.

Additional fire flow assessments at the subdivision approval phase will be required in the future to ensure local watermains are checked for their ability to provide the objective FUS fire flows at the subdivision level.

3.0 HYDRAULIC ASSESSMENT

3.1 CONNECTION TO EXISTING INFRASTRUCTURE

The development is proposed to connect to existing City of Ottawa watermain infrastructure at three locations on the 305mm watermain along Navan Road, labeled as 1, 2 and 8 in **Figure 3-1** upon build-out. Connection 8 is incorporated in the final phasing scenario but is not anticipated to be completed until build-out. Locations 6 and 7 are connected to an existing 305mm watermain along Renaud Road. The development is also proposed to connect to the existing watermain network of Phase 1A at Cathiness Private and Eastboro Avenue, labeled as 4 and 5, respectively in **Figure 3-1** during interim. Both of these are 200mm diameter watermain connections. It is anticipated that a 406mm diameter watermain will be constructed along Belcourt Boulevard from Navan Road to Renaud Road in the future. The span of the watermain is from point 2 to 9. However, a small section will be constructed in the interim and connected to the development at point 3. Upon build-out of the Belcourt watermain, the development will connect at points 10 to 15.

The area highlighted in orange is not included in the analysis as it is anticipated to be serviced from the existing Renaud Road watermain and therefore not part of the watermain to be designed in this project.

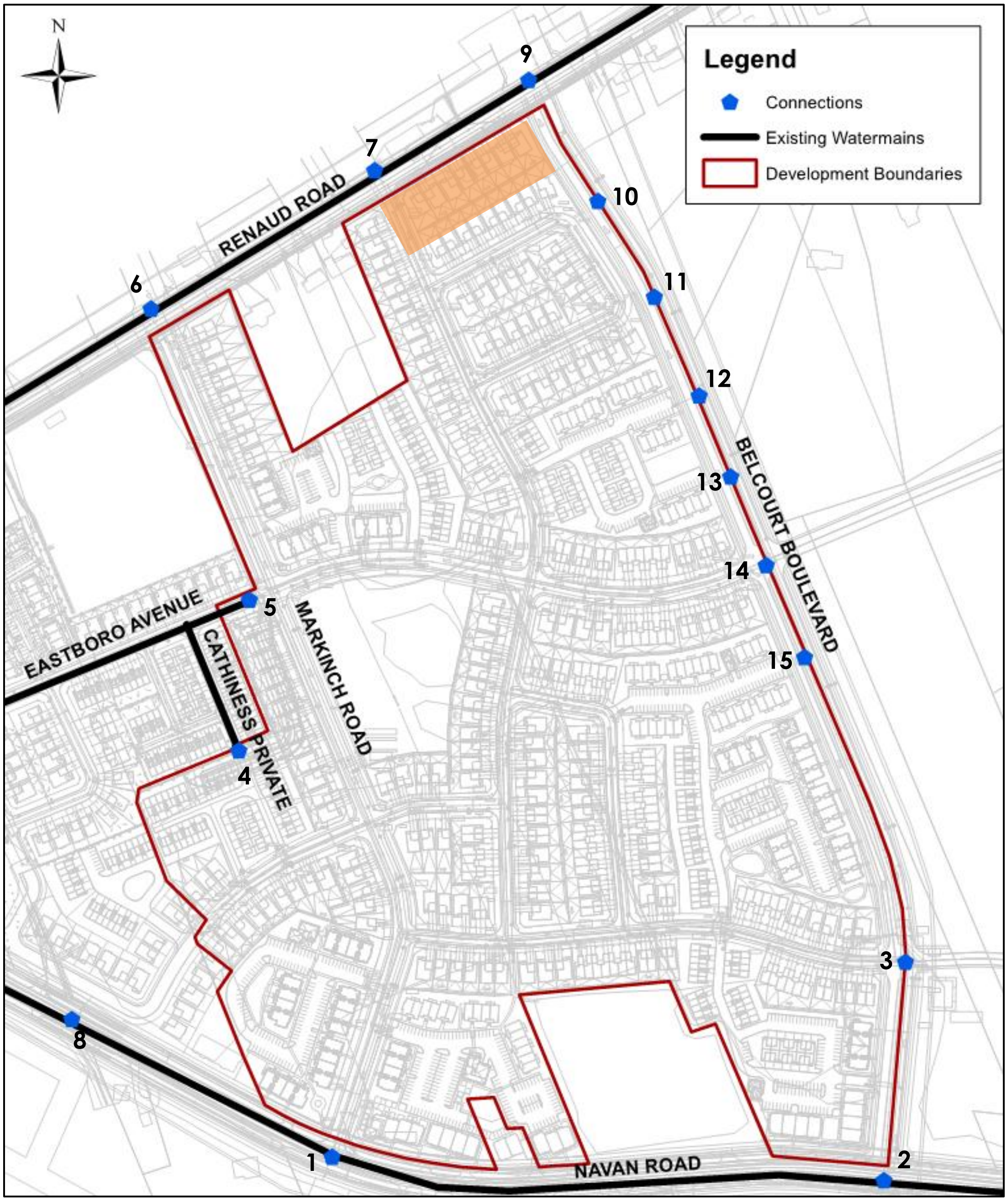
3.2 BOUNDARY CONDITIONS

The hydraulic model used for the simulation was developed by Stantec. Boundary conditions were provided by the City of Ottawa in an email dated June 18th 2014 (see **Appendix B**). Conditions were outlined for peak hour, minimum hourly and maximum daily plus fire flow scenarios. The boundary conditions set by the existing pipe network were simulated in the model with fixed head reservoirs and flow control valves which allowed for a flow of 10,000 L/min. **Table** 3-1 shows the set boundary conditions for each scenario at each connection point shown in **Figure 3-1**.

Table 3-1: Connection Boundary Conditions for Varying Scenarios

Connection	Peak Hour	Minimum Hour	Maximum Day + Fire Flow
1	125.4m	134.8m	115.7m
2	125.4m	134.8m	112.8m
3	125.3m	134.8m	107.6m
4	125.3m	134.8m	106.6m
5	125.5m	134.8m	115.1m
6	125.4m	134.8m	113.2m
7	125.4m	134.8m	113.2m
8	125.4m	134.8m	112.8m

Figure 3-1: Existing Watermain Connections to New Development



3.3 PROPOSED WATERMAIN SIZING AND LAYOUT

The layout provided in **Figure 3-2** shows the proposed servicing pipe alignment for the area before complete build-out of the surrounding areas. A portion of the 406mm diameter Belcourt Boulevard watermain from Navan Road is to be constructed as part of the current development. Complete construction of this Belcourt watermain from Navan to Renaud is not expected to be completed until the proposed area is fully developed (i.e. upon build out).

The proposed network will have 300mm diameter watermains acting as a spine through the network with a combination of 250mm and 200mm diameter pipes branching off. Note that the connection of development A will connect to the 300mm spine on Markinch upstream and downstream of the isolation valve on the watermain (shown in **Figure 3-2**). This will provide two servicing points to the area.

All dead end watermains are limited to a maximum diameter of 200mm as per City of Ottawa's technical bulletin ISDTB-2014-02.

The final network layout, once all surrounding area development has been completed, is shown in **Figure 3-3**. Additional connections to the proposed 406mm diameter Belcourt Boulevard watermain are proposed to increase redundancy in the system and provide adequate fire flow to areas that are unable to fully achieve the required fire flow during interim conditions.

Figure 3-2: Interim Watermain Servicing Configuration

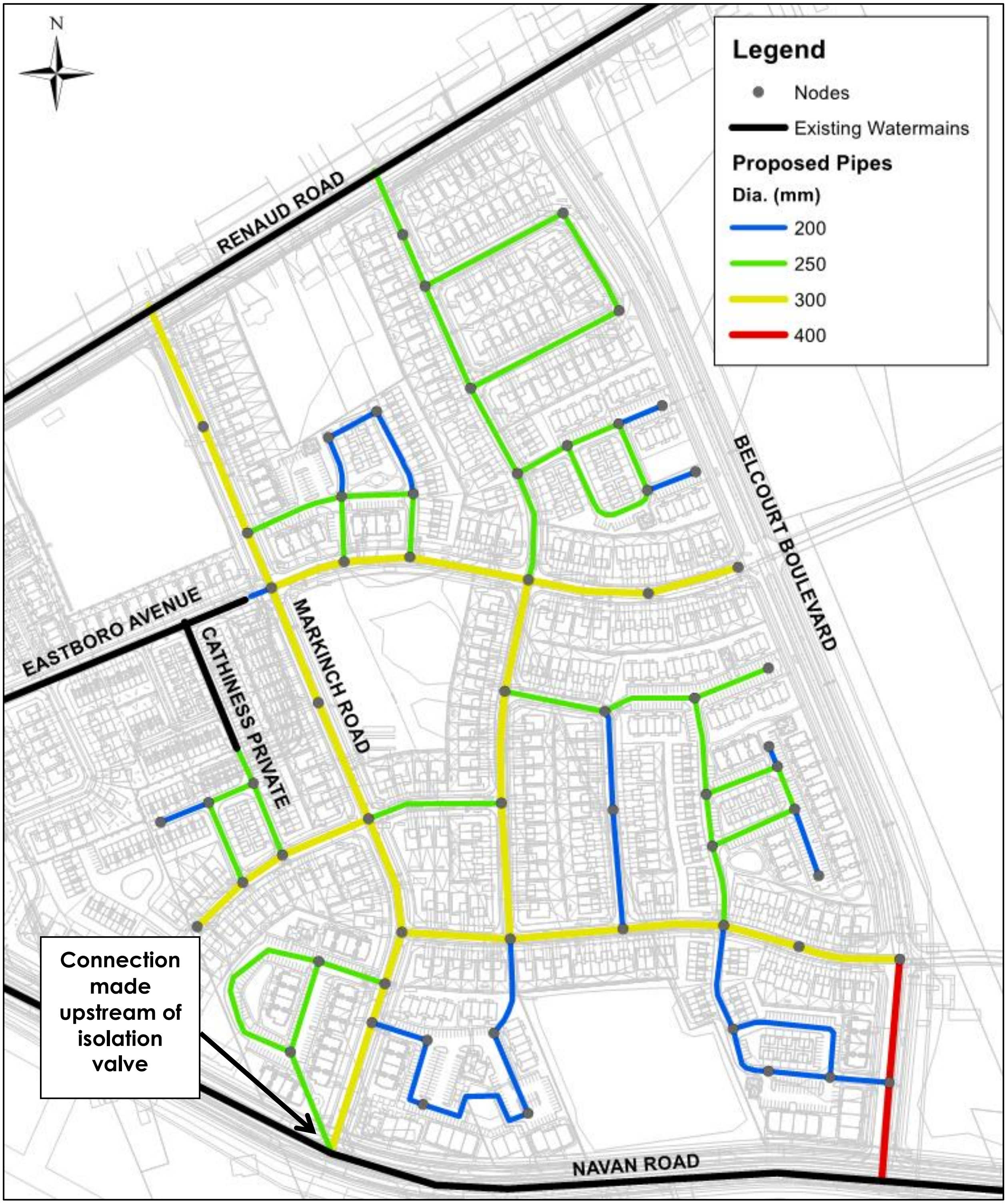
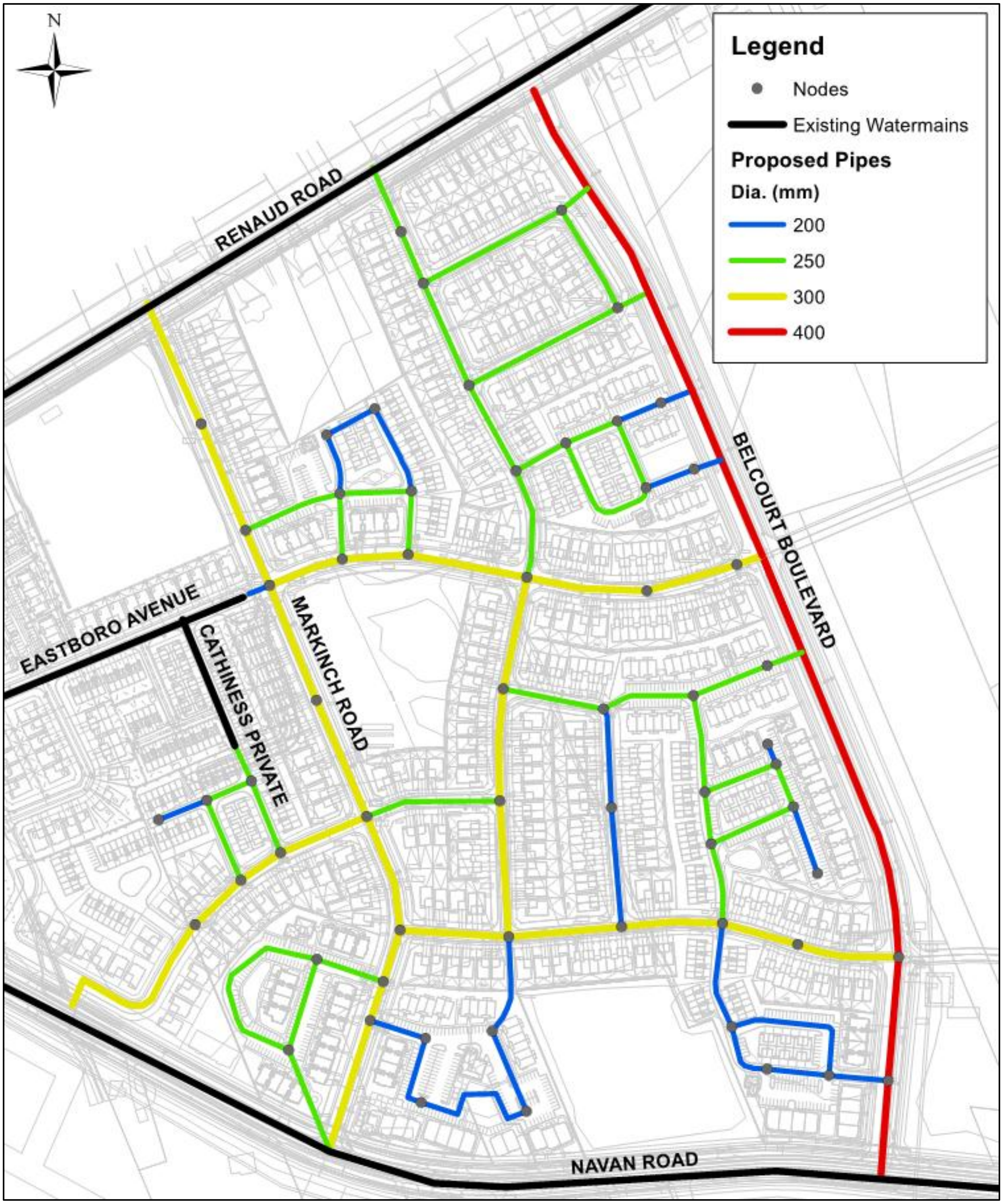


Figure 3-3: Watermain Servicing Configuration at Build Out



3.4 MODEL DEVELOPMENT

New watermains were added to the hydraulic model to simulate the proposed distribution system. Hazen-Williams coefficients ("C-Factors") were applied to the new watermain in accordance with the City of Ottawa's Water Distribution Design Guidelines (**Table 3-2**).

Table 3-2: Hazen Williams C-Factors for Different Pipe Sizes

Pipe Diameter (mm)	C-Factor
150	100
200 to 300	110
350 to 600	120
> 600	130

3.5 WATER DEMANDS

Water demand estimated based on the City of Ottawa's Design Guidelines for Water Distribution (July 2010). The phased areas were further divided into demand areas and the quantity of each household type in each demand area was interpolated from the development plan. The results are summarized in **Table 3-3**.

Table 3-3: Quantity of Households by Type

Household Type	Number of Units
Single Family	139
Semi/Townhomes	312
Apartments	60
Stacked Townhome	136
Mixed Use Residential	19

A population for each area was calculated by multiplying the number of units by the unit type density listed in **Table 3-4**. These density values were extracted from City of Ottawa's Design Guidelines for Water Distribution (July 2010).

Table 3-4: Population Densities by Household Type

Household Type	Density (persons per unit)	Residential Dwellings per Unit
Single Family	3.4	1
Semi/Townhomes	2.7	1
Apartments	2.1	1
Stacked Townhome	2.7	2
Mixed Use Residential	2.7	2

Note: Each mixed use unit consists of 2 residential units and 1 commercial unit

The population for each demand area was summed to determine the total anticipated build-out population of 2,289 persons. Each unit was assigned a phase based on the development areas shown in **Figure 1-2**. This allowed the anticipated population to be further broken down by phase as seen in **Table 3-5**.

Table 3-5: Residential Population Projections by Phase

Phase	Projected Population
1	365
2	107
3	307
4	166
5	258
6	67
7	280
8	99
9	205
10	227
11	208
TOTAL	**2,289**

The design populations were used in conjunction with a residential consumption rate of 350 L/cap/d and a commercial consumption rate of 2,500 litres per 1,000m^2 of floor space to determine the total demand.

Each commercial unit contains a total floor space of 135.25m^2. Mixed use units contain one commercial unit and two residential units. The total demand found for each demand area was applied to the nearest watermain node in the model corresponding to their phasing. The total anticipated demand for each phase is provided in **Table 3-6.**

The maximum daily demand was found by multiplying the average daily demand by a peak factor of 2.25 which follows the Ministry of Environment Design Guidelines for Drinking-Water Systems (2008) for developments with populations between 2,000 and 3,000 persons. Similarly the peak hour and minimum hour demands were found by multiplying the average daily demand by a factor of 3.38 and 0.45, respectively. The total average daily, maximum daily, peak hourly and minimum hourly demand for each phase is provided in **Table 3-6.**

Table 3-6: Demand Projections by Phase

Phase	Total Average Day Flow (L/S)	Total Maximum Day Flow (L/s)	Total Peak Hour Flow (L/s)	Total Minimum Hour Flow (L/s)
1	1.48	3.32	4.99	0.66
2	0.43	0.97	1.46	0.19
3	1.24	2.80	4.21	0.56
4	0.70	1.58	2.38	0.32
5	1.05	2.35	3.53	0.47
6	0.27	0.61	0.92	0.12
7	1.18	2.65	3.98	0.53
8	0.40	0.90	1.35	0.18
9	0.83	1.87	2.81	0.37
10	0.92	2.07	3.11	0.41
11	0.84	1.89	2.85	0.38
TOTAL:	**9.35**	**21.03**	**31.59**	**4.21**

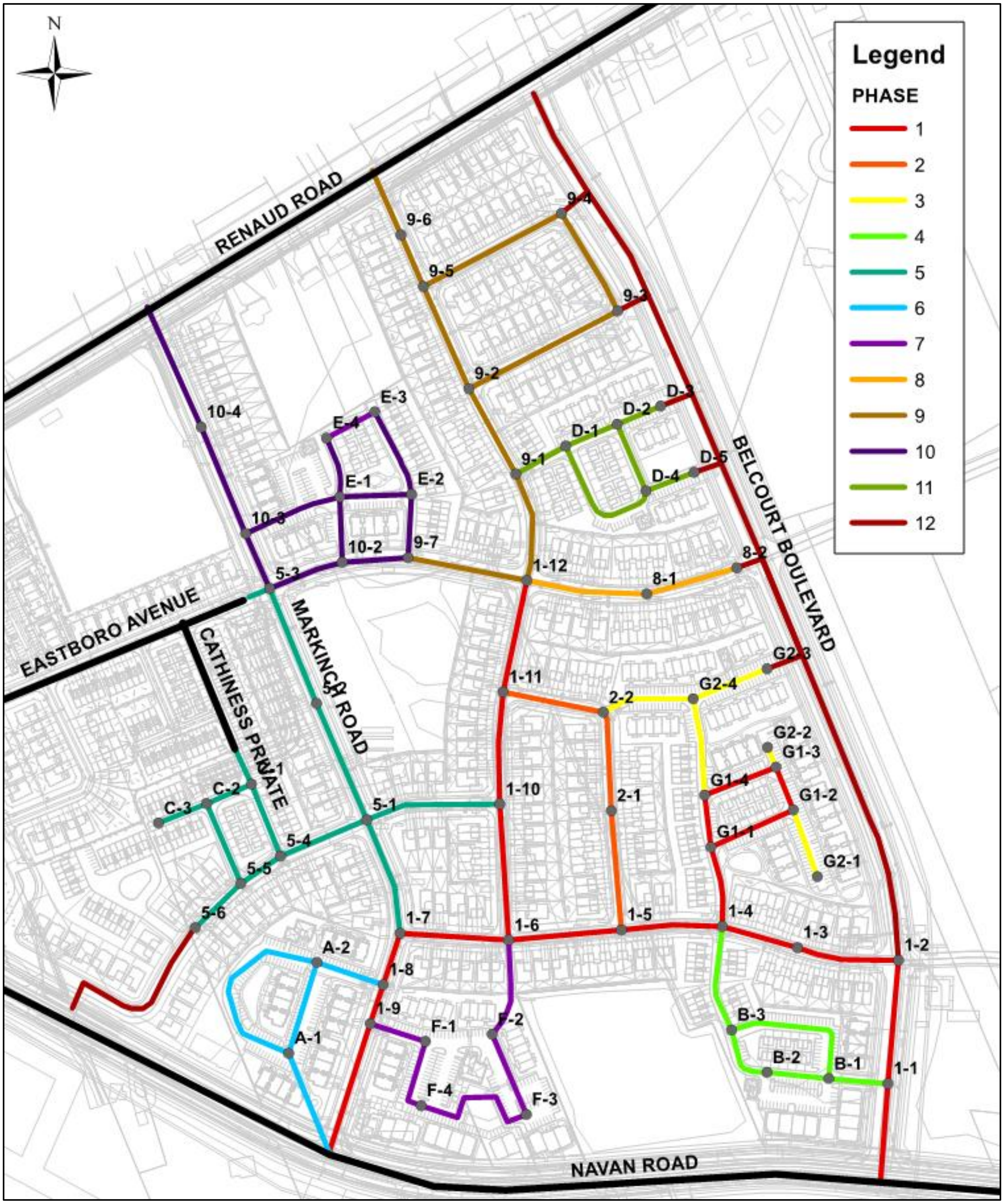
Complete calculations for each demand area, as well as node allocation diagrams are provided in **Appendix C**.

4.0 HYDRAULIC MODELLING RESULTS

The analysis was completed with H20MAP Water software by Innovyze. The model was tested under peak hour, minimum hour and maximum day plus fire flow conditions. A model scenario was created and tested under these conditions for each development phase to ensure that sufficient capacity could be provided throughout the development process before all source locations are connected. This report analyses the functionality of the system assuming a linear progression of development as per the ordered phasing, any changes to this phasing should be re-analyzed in the hydraulic model.

Node IDs from the hydraulic mode are shown in **Figure 4-1** as well as the proposed phasing of pipe installation. Each ID consists of two numbers separated by a dash: the first number representing the phase or private development assignment and the second is the ID number within the phase. All modelling results are presented in **Appendix D**.

Figure 4-1: Node ID and Pipe Layout Based on Phasing



4.1 MINIMUM HOUR DEMAND

Under minimum hour demand, the capacity head was set to 134.8m at all sources as per the boundary conditions provided. The maximum operating pressure in _all phasing_ scenarios is anticipated to be 480kPa (70 psi) and is lower than the City's maximum pressure objective of 552kPa (80psi).

4.2 PEAK HOUR DEMAND

Under minimum hour demand, the capacity head was set as per the boundary conditions provided which ranged from 124.3m and 124.5m. The minimum operating pressure in _all phasing_ scenarios is anticipated to be 350kPa (51 psi) and well above the City's minimum pressure objective of 267kPa (40 psi).

The tallest structure in the development area is expected to be 4 stories in height, which is anticipated to produce additional pressure loss of approximately 69kPa (10 psi). Given that the lowest pressure produced was 352kPa (51 psi) and allowing for 35kPa (5 psi) for each floor above two storeys accounting for height and some headloss, the resultant equivalent pressure at the 4^{th} floor will be approximately 283kPa (41 psi) and is greater than the City's objective minimum pressure.

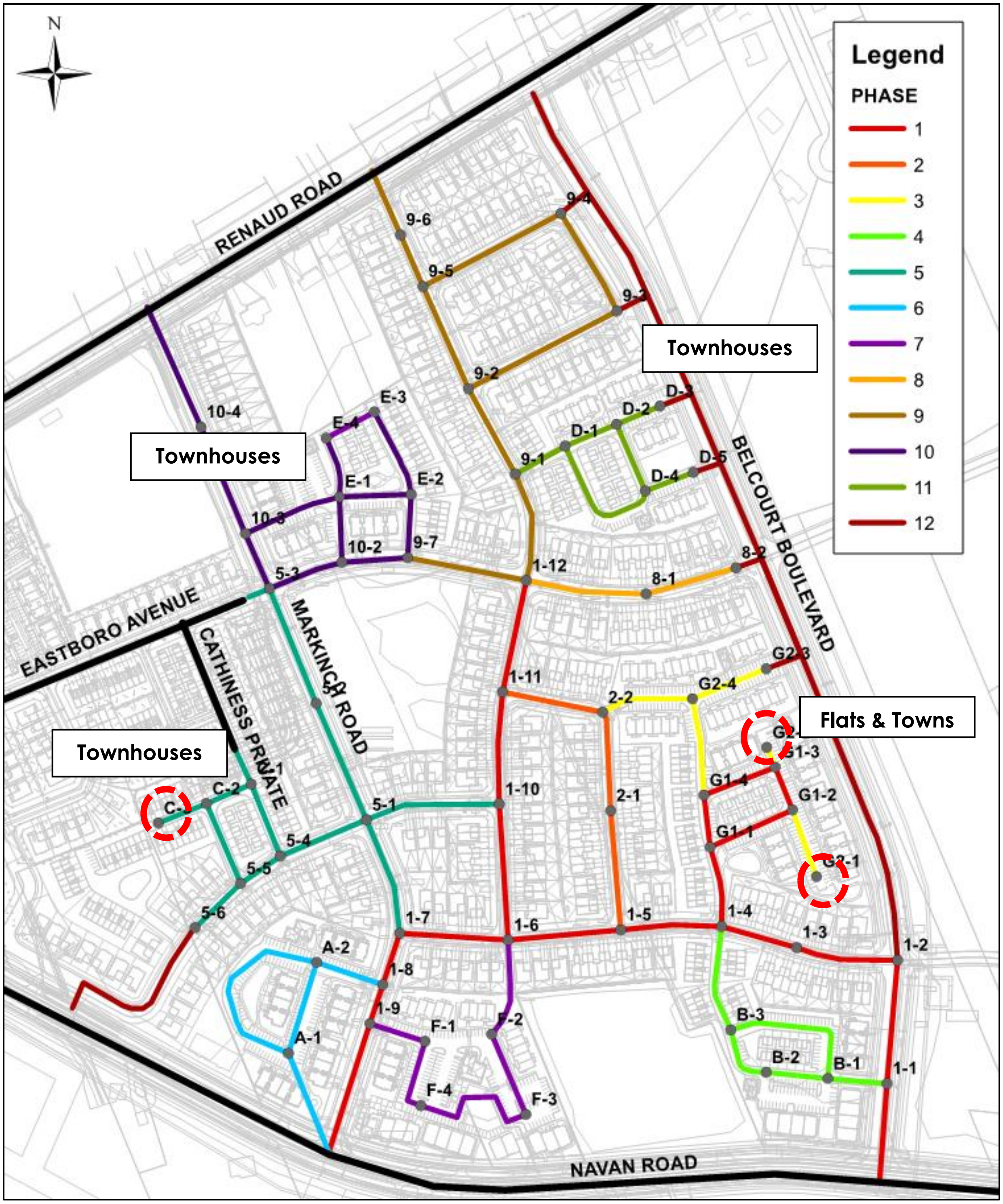
4.3 MAXIMUM DAY + FIRE FLOW

Hydraulic modelling results showed that under maximum day conditions, the majority of the areas in this development were capable of providing the fire flow objective of 10,000 L/min while maintaining a pressure of 138kPa (20 psi).

Most dead-end nodes were not capable of providing a fire flow of 10,000 L/min; however, as shown in **Figure 4-2**, the majority of the dead-end nodes will be looped upon build-out. Nodes that will remain as dead-ends are G2-1 and G2-2 as well as C-3 (*identified by red dashed circles*). According to the latest plans, these areas are to contain rows of townhouses and flats and will require a maximum 10,000 L/min of fire flow. As such, fire walls to compartmentalize units into separate fire areas or other similar mitigation measures may be necessary to meet fire flow objectives along these dead ends.

Upon build-out, the development will connect to the existing 305mm diameter watermain along Navan at a second location as well as to the future 406mm diameter watermain along Belcourt at six locations. This results in all nodes within the development being capable of supplying fire flows greater than 10,000 L/min under build-out conditions.

Figure 4-2: Areas Unable to Achieve Sufficient Fire Flow during Interim Conditions



4.3.1 Hydrant Placement

An additional analysis was performed to examine available fire flow directly upstream of the dead-end nodes during the interim "pre buildout" conditions. Shown in **Table 4-1** are the dead-end nodes unable to achieve a fire flow of 10,000 L/min during the interim and the upstream node in close proximity.

Table 4-1: Low Fire Flow Nodes and Upstream Nodes

Low Fireflow Node	Upstream Node
C-3	FF_NODE5
D-3	D-2
D-5	D-4
G2-1	FF_NODE4

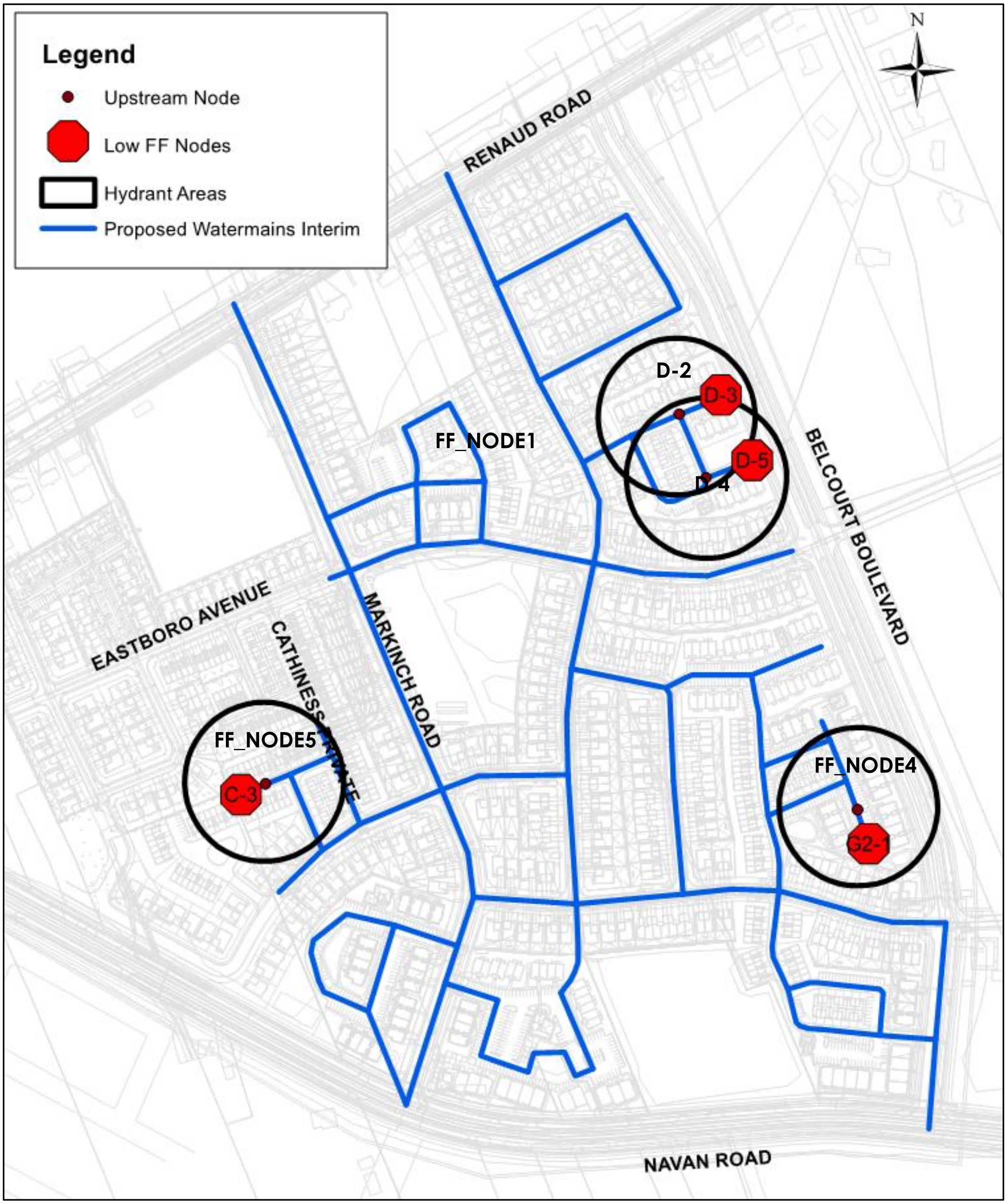
As per "Water Supply for Public Fire Protection" by Fire Underwriters' Survey, (1999) a hydrant is expected to service a circular area with a radius of approximately 61m. Therefore, each identified low fire flow area must have a point in the watermain within 61m able to provide adequate fire flow. For each of the low fire flow areas shown in **Table 4-2** and **Figure 4-3**, their respective upstream node can service the area within the 61m servicing radius.

Table 4-2: Available Fire Flow Directly Upstream of Low Fire Flow Nodes

Low Fireflow Node	Phase 3 (L/s)	Phase 4 (L/s)	Phase 5 (L/s)	Phase 6 (L/s)	Phase 7 (L/s)	Phase 8 (L/s)	Phase 9 (L/s)	Phase 10 (L/s)	Phase 11 (L/s)
FF_NODE4	10,399	10,502	10,358	10,334	10,326	10,309	11,090	11,995	11,972
FF_NODE5	-	-	11,048	11,024	11,000	10,988	11,783	11,995	12,928
D-2	-	-	-	-	-	-	-	-	12,678
D-4	-	-	-	-	-	-	-	-	12,354

The City of Ottawa requires hydrants to be within 110m of buildings within subdivisions and as such, hydrants placed within 61m upstream on the watermains servicing these low fire flow areas are expected to satisfy the required maximum 10,000 L/min fire flow during interim conditions.

Figure 4-3: Low Fire Flow Nodes



5.0 CONCLUSION

Using the proposed pipe alignment and sizing, hydraulic analysis of the Ashcroft – Eastboro Phase 2A & 2B Community showed that:

- Under peak hour and minimum hour, operating pressures are anticipated to be within the City's objective pressure range of 276 - 552kPa (40 – 80 psi);
- A fire flow of 10,000 L/min can be supplied to the majority of the area while maintaining a residual pressure of 138kPa (20 psi) during interim conditions; however, a few areas need mitigation to achieve the required fire flows;
- Many dead-ends are not capable of providing the 10,000L/min fire flow objective during interim conditions; however,
    - Most dead-end locations will be looped upon built out and will provide sufficient fire flows;
    - Some dead-ends that will remain dead-ends upon build out are currently proposed to have rows of townhouses and flats and will require the current maximum fire flow objective of 10,000 L/min; mitigation measures such as fire walls may need to be considered;
    - Nodes directly upstream of these low fire flow areas are capable of providing fire flow greater than 10,000 L/min; therefore, placing the hydrant within 61m upstream on the watermains servicing these low fire flow areas will satisfy the required fire flow;
- Upon build-out, all areas are capable of fire flows greater than 10,000 L/min as there is an increase in water transmission and fire flows available.

Appendix A FUS FIRE FLOW CALCULATIONS

FUS Fire Flow Calculation

Calculations based on: "*Water Supply for Public Fire Protection*" by Fire Underwriters' Survey, 1999

Stantec Project #: 1604-01067
Project Name: Ottawa Ashcroft Ph. 2A & 2B
Date: July 15, 2014
Data input by: Megan Young

Fire Flow Calculation #: 1
Building Type/Description/Name: Single Family Home

Notes: The analysis has been carried out based on the worst case scenario for single family homes in the development area. Lot 37, with the largest house size was used for the analysis.

Table A: Fire Underwriters Survey Determination of Required Fire Flow - Long Method

Step	Task	Term	Options	Multiplier Associated with Option	Choose:	Value Used	Unit	Total Fire Flow (L/min)
		Framing Material						
1	Choose Frame Used for Construction of Unit	Coefficient related to type of construction (C)	Wood Frame	1.5	Wood Frame	1.5	m	
			Ordinary construction	1				
			Non-combustible construction	0.8				
			Fire resistive construction (> 3 hrs)	0.6				
		Floor Space Area						
2	Choose Type of Housing (if TH, Enter Number of Units Per TH Block)	Type of Housing	Single Family	1	Single Family	1	Units	
			Townhouse - indicate # of units	6				
			Other (Comm, Ind, Apt etc.)	1				
2.2	# of Storeys	Number of Floors/Storeys in the Unit (do not include basement):			2	2	Storeys	
3	Enter Ground Floor Area of One Unit	Average Floor Area (A) based on fire resistive building design when vertical openings are inadequately protected:			1,585 Square Feet (ft2)	295	Area in Square Meters (m^2)	
4	Obtain Required Fire Flow without Reductions	Required Fire Flow (without reductions or increases per FUS) (F = 220 * C * √A) Round to nearest 1000L/min						6,000
5	Apply Factors Affecting Burning	**Reductions/Increases Due to Factors Affecting Burning**						
5.1	Choose Combustibility of Building Contents	Occupancy content hazard reduction or surcharge	Non-combustible	-0.25	Limited combustible	-0.15	N/A	5,100
			Limited combustible	-0.15				
			Combustible	0				
			Free burning	0.15				
			Rapid burning	0.25				
5.2	Choose Reduction Due to Presence of Sprinklers	Sprinkler reduction	Adequate Sprinkler conforms to NFPA13	-0.3	None	0	N/A	0
			None	0				
		Water Supply Credit	Water supply is standard for sprinkler and fire dept. hose line	-0.1	Water supply is not standard or N/A	0	N/A	0
			Water supply is not standard or N/A	0				
		Sprinkler Supervision Credit	Sprinkler system is fully supervised	-0.1	Sprinkler not fully supervised or N/A	0	N/A	0
			Sprinkler not fully supervised or N/A	0				
5.3	Choose Separation Distance Between Units	Exposure Distance Between Units	North Side	0 to 3.0m	0.25	0.75	m	3,825
			East Side	20.1 to 30.1m	0.1			
			South Side	0 to 3.0m	0.25			
			West Side	10.1 to 20.0m	0.15			
6	Obtain Required Fire Flow, Duration & Volume	*Total Required Fire Flow, rounded to nearest 1000 L/min, with max/min limits applied:*						**9,000**
		Total Required Fire Flow (above) in L/s:						**150**
		Required Duration of Fire Flow (hrs)						**1.75**
		Required Volume of Fire Flow (m^3)						**945**

FUS Fire Flow Calculation

Calculations based on: "*Water Supply for Public Fire Protection*" by Fire Underwriters' Survey, 1999

Stantec Project #: 1604-01067
Project Name: Ottawa Ashcroft Ph. 2A & 2B
Date: July 15, 2014
Data input by: Megan Young

Fire Flow Calculation #: 2
Building Type/Description/Name: Eastboro flat

Notes: The analysis has been carried out based on the worst case scenario for apartment style buildings in the development area. It was assumed no firewall would be provided, as the total area is less then 1800 m2 as per OBC 3.2.2.45. A block in area A facing 2 streets was used. One unit is 1100 square feet. There are 16 units per building, and the building is 4 storeys tall. It was assumed sprinklers would be used.

Table A: Fire Underwriters Survey Determination of Required Fire Flow - Long Method

Step	Task	Term	Options	Multiplier Associated with Option	Choose:	Value Used	Unit	Total Fire Flow (L/min)
		Framing Material						
1	Choose Frame Used for Construction of Unit	Coefficient related to type of construction (C)	Wood Frame	1.5	Wood Frame	1.5	m	
			Ordinary construction	1				
			Non-combustible construction	0.8				
			Fire resistive construction (> 3 hrs)	0.6				
		Floor Space Area						
2	Choose Type of Housing (if TH, Enter Number of Units Per TH Block)	Type of Housing	Single Family	1	Townhouse - indicate # of units	4	Units	
			Townhouse - indicate # of units	6				
			Other (Comm, Ind, Apt etc.)	1				
2.2	# of Storeys	Number of Floors/Storeys in the Unit (do not include basement):			4	4	Storeys	
3	Enter Ground Floor Area of One Unit	Average Floor Area (A) based on fire resistive building design when vertical openings are inadequately protected:			1,100 / Square Feet (ft2)	1,635	Area in Square Meters (m^2)	
4	Obtain Required Fire Flow without Reductions	Required Fire Flow (without reductions or increases per FUS) (F = 220 * C * √A) Round to nearest 1000L/min						13,000
5	Apply Factors Affecting Burning	**Reductions/Increases Due to Factors Affecting Burning**						
5.1	Choose Combustibility of Building Contents	Occupancy content hazard reduction or surcharge	Non-combustible	-0.25	Limited combustible	-0.15	N/A	11,050
			Limited combustible	-0.15				
			Combustible	0				
			Free burning	0.15				
			Rapid burning	0.25				
5.2	Choose Reduction Due to Presence of Sprinklers	Sprinkler reduction	Adequate Sprinkler conforms to NFPA13	-0.3	Adequate Sprinkler conforms to NFPA13	-0.3	N/A	-3,315
			None	0				
		Water Supply Credit	Water supply is standard for sprinkler and fire dept. hose line	-0.1	Water supply is standard for sprinkler and fire dept. hose line	-0.1	N/A	-1,105
			Water supply is not standard or N/A	0				
		Sprinkler Supervision Credit	Sprinkler system is fully supervised	-0.1	Sprinkler not fully supervised or N/A	0	N/A	0
			Sprinkler not fully supervised or N/A	0				
5.3	Choose Separation Distance Between Units	Exposure Distance Between Units	North Side	3.1 to 10.0m	0.2	0.55	m	6,078
			East Side	3.1 to 10.0m	0.2			
			South Side	20.1 to 30.1m	0.1			
			West Side	30.1 to 45.0m	0.05			
6	Obtain Required Fire Flow, Duration & Volume	*Total Required Fire Flow, rounded to nearest 1000 L/min, with max/min limits applied:*						**13,000**
		Total Required Fire Flow (above) in L/s:						**217**
		Required Duration of Fire Flow (hrs)						**2.75**
		Required Volume of Fire Flow (m^3)						**2,145**

Stantec

FUS Fire Flow Calculation

Calculations based on: "*Water Supply for Public Fire Protection*" by Fire Underwriters' Survey, 1999

Stantec Project #: 1604-01067
Project Name: Ottawa Ashcroft Ph. 2A & 2B
Date: July 15, 2014
Data input by: Megan Young

Fire Flow Calculation #: 3
Building Type/Description/Name: New Yorker

Notes: The analysis has been carried out based on the worst case scenario for New Yorkers style homes in the development area. It was assumed a firewall would be provided every 5 units as per OBC 3.2.2.47. Development block D was used with a building that faced 2 streets. One floor of one unit has 461 square feet.

Table A: Fire Underwriters Survey Determination of Required Fire Flow - Long Method

Step	Task	Term	Options	Multiplier Associated with Option	Choose:	Value Used	Unit	Total Fire Flow (L/min)
		Framing Material						
1	Choose Frame Used for Construction of Unit	Coefficient related to type of construction (C)	Wood Frame	1.5	Wood Frame	1.5	m	
			Ordinary construction	1				
			Non-combustible construction	0.8				
			Fire resistive construction (> 3 hrs)	0.6				
		Floor Space Area						
2	Choose Type of Housing (if TH, Enter Number of Units Per TH Block)	Type of Housing	Single Family	1	Townhouse - indicate # of units	4	Units	
			Townhouse - indicate # of units	4				
			Other (Comm, Ind, Apt etc.)	1				
2.2	# of Storeys	Number of Floors/Storeys in the Unit (do not include basement):			4	4	Storeys	
3	Enter Ground Floor Area of One Unit	Average Floor Area (A) based on fire resistive building design when vertical openings are inadequately protected:			461 Square Feet (ft2)	685	Area in Square Meters (m^2)	
4	Obtain Required Fire Flow without Reductions	Required Fire Flow (without reductions or increases per FUS) (F = 220 * C * √A) Round to nearest 1000L/min						9,000
5	Apply Factors Affecting Burning	**Reductions/Increases Due to Factors Affecting Burning**						
5.1	Choose Combustibility of Building Contents	Occupancy content hazard reduction or surcharge	Non-combustible	-0.25	Limited combustible	-0.15	N/A	7,650
			Limited combustible	-0.15				
			Combustible	0				
			Free burning	0.15				
			Rapid burning	0.25				
5.2	Choose Reduction Due to Presence of Sprinklers	Sprinkler reduction	Adequate Sprinkler conforms to NFPA13	-0.3	None	0	N/A	0
			None	0				
		Water Supply Credit	Water supply is standard for sprinkler and fire dept. hose line	-0.1	Water supply is not standard or N/A	0	N/A	0
			Water supply is not standard or N/A	0				
		Sprinkler Supervision Credit	Sprinkler system is fully supervised	-0.1	Sprinkler not fully supervised or N/A	0	N/A	0
			Sprinkler not fully supervised or N/A	0				
5.3	Choose Separation Distance Between Units	Exposure Distance Between Units	North Side	Fire Wall	0.1	0.45	m	3,443
			East Side	10.1 to 20.0m	0.15			
			South Side	10.1 to 20.0m	0.15			
			West Side	30.1 to 45.0m	0.05			
6	Obtain Required Fire Flow, Duration & Volume	*Total Required Fire Flow, rounded to nearest 1000 L/min, with max/min limits applied:*						**11,000**
		Total Required Fire Flow (above) in L/s:						**183**
		Required Duration of Fire Flow (hrs)						**2.25**
		Required Volume of Fire Flow (m^3)						**1,485**

Stantec

FUS Fire Flow Calculation

Calculations based on: "*Water Supply for Public Fire Protection*" by Fire Underwriters' Survey, 1999

Stantec Project #: 1604-01037
Project Name: Ottawa Ashcroft Ph. 2A & 2B
Date: July 15, 2014
Data input by: Megan Young

Fire Flow Calculation #: 4
Building Type/Description/Name: Urban Townhome

Notes: The analysis has been carried out based on the worst case scenario for Urban Town style homes in the development area. It was assumed a firewall would be provided every 4 units as per 3.2.2.47. A block in area C facing one street was used. One floor of one unit has 526 square feet.

Table A: Fire Underwriters Survey Determination of Required Fire Flow - Long Method

Step	Task	Term	Options	Multiplier Associated with Option	Choose:	Value Used	Unit	Total Fire Flow (L/min)
		Framing Material						
1	Choose Frame Used for Construction of Unit	Coefficient related to type of construction (C)	Wood Frame	1.5	Wood Frame	1.5	m	
			Ordinary construction	1				
			Non-combustible construction	0.8				
			Fire resistive construction (> 3 hrs)	0.6				
		Floor Space Area						
2	Choose Type of Housing (if TH, Enter Number of Units Per TH Block)	Type of Housing	Single Family	1	Townhouse - indicate # of units	4	Units	
			Townhouse - indicate # of units	8				
			Other (Comm, Ind, Apt etc.)	1				
2.2	# of Storeys	Number of Floors/Storeys in the Unit (do not include basement):			3	3	Storeys	
3	Enter Ground Floor Area of One Unit	Average Floor Area (A) based on fire resistive building design when vertical openings are inadequately protected:			526 / Square Feet (ft2)	586	Area in Square Meters (m^2)	
4	Obtain Required Fire Flow without Reductions	Required Fire Flow (without reductions or increases per FUS) (F = 220 * C * √A) Round to nearest 1000L/min						8,000
5	Apply Factors Affecting Burning	**Reductions/Increases Due to Factors Affecting Burning**						
5.1	Choose Combustibility of Building Contents	Occupancy content hazard reduction or surcharge	Non-combustible	-0.25	Limited combustible	-0.15	N/A	6,800
			Limited combustible	-0.15				
			Combustible	0				
			Free burning	0.15				
			Rapid burning	0.25				
5.2	Choose Reduction Due to Presence of Sprinklers	Sprinkler reduction	Adequate Sprinkler conforms to NFPA13	-0.3	None	0	N/A	0
			None	0				
		Water Supply Credit	Water supply is standard for sprinkler and fire dept. hose line	-0.1	Water supply is not standard or N/A	0	N/A	0
			Water supply is not standard or N/A	0				
		Sprinkler Supervision Credit	Sprinkler system is fully supervised	-0.1	Sprinkler not fully supervised or N/A	0	N/A	0
			Sprinkler not fully supervised or N/A	0				
5.3	Choose Separation Distance Between Units	Exposure Distance Between Units	North Side	10.1 to 20.0m	0.15	0.65	m	4,420
			East Side	0 to 3.0m	0.25			
			South Side	10.1 to 20.0m	0.15			
			West Side	Fire Wall	0.1			
6	Obtain Required Fire Flow, Duration & Volume	***Total Required Fire Flow, rounded to nearest 1000 L/min, with max/min limits applied:***						**11,000**
		Total Required Fire Flow (above) in L/s:						**183**
		Required Duration of Fire Flow (hrs)						**2.25**
		Required Volume of Fire Flow (m^3)						**1,485**

FUS Fire Flow Calculation

Calculations based on: "*Water Supply for Public Fire Protection*" by Fire Underwriters' Survey, 1999

Stantec Project #: 1604-01067
Project Name: Ottawa Ashcroft Ph. 2A & 2B
Date: July 15, 2014
Data input by: Megan Young

Fire Flow Calculation #: 5
Building Type/Description/Name: Mixed Use

Notes: This building was classified as section C and D occupancy. A building in block F was used, that faces 1 street. It was assumed a firewall would be provided between every unit as per OBC 3.2.2.47.

Table A: Fire Underwriters Survey Determination of Required Fire Flow - Long Method

Step	Task	Term	Options	Multiplier Associated with Option	Choose:	Value Used	Unit	Total Fire Flow (L/min)
		Framing Material						
1	Choose Frame Used for Construction of Unit	Coefficient related to type of construction (C)	Wood Frame	1.5	Wood Frame	1.5	m	
			Ordinary construction	1				
			Non-combustible construction	0.8				
			Fire resistive construction (> 3 hrs)	0.6				
		Floor Space Area						
2	Choose Type of Housing (if TH, Enter Number of Units Per TH Block)	Type of Housing	Single Family	1	Other (Comm, Ind, Apt etc.)	1	Units	
			Townhouse - indicate # of units	6				
			Other (Comm, Ind, Apt etc.)	1				
2.2	# of Storeys	Number of Floors/Storeys in the Unit (do not include basement):			3	3	Storeys	
3	Enter Ground Floor Area of One Unit	Average Floor Area (A) based on fire resistive building design when vertical openings are inadequately protected:			1,457	406	Area in Square Meters (m^2)	
					Square Feet (ft2)			
4	Obtain Required Fire Flow without Reductions	Required Fire Flow (without reductions or increases per FUS) (F = 220 * C * √A) Round to nearest 1000L/min						7,000
5	Apply Factors Affecting Burning	**Reductions/Increases Due to Factors Affecting Burning**						
5.1	Choose Combustibility of Building Contents	Occupancy content hazard reduction or surcharge	Non-combustible	-0.25	Limited combustible	-0.15	N/A	5,950
			Limited combustible	-0.15				
			Combustible	0				
			Free burning	0.15				
			Rapid burning	0.25				
5.2	Choose Reduction Due to Presence of Sprinklers	Sprinkler reduction	Adequate Sprinkler conforms to NFPA13	-0.3	None	0	N/A	0
			None	0				
		Water Supply Credit	Water supply is standard for sprinkler and fire dept. hose line	-0.1	Water supply is not standard or N/A	0	N/A	0
			Water supply is not standard or N/A	0				
		Sprinkler Supervision Credit	Sprinkler system is fully supervised	-0.1	Sprinkler not fully supervised or N/A	0	N/A	0
			Sprinkler not fully supervised or N/A	0				
5.3	Choose Separation Distance Between Units	Exposure Distance Between Units	North Side	Fire Wall	0.1	0.35	m	2,083
			East Side	45.1m or greater	0			
			South Side	Fire Wall	0.1			
			West Side	10.1 to 20.0m	0.15			
6	Obtain Required Fire Flow, Duration & Volume	*Total Required Fire Flow, rounded to nearest 1000 L/min, with max/min limits applied:*						**8,000**
		Total Required Fire Flow (above) in L/s:						**133**
		Required Duration of Fire Flow (hrs)						**2.00**
		Required Volume of Fire Flow (m^3)						**960**

Appendix B BOUNDARY CONDITIONS

Young, Megan

From:	Kilborn, Kris
Sent:	Wednesday, June 18, 2014 4:01 PM
To:	Young, Megan
Cc:	Alemany, Kevin; Gillis, Sheridan
Subject:	FW: Ashcroft EUC - Watermain Boundary Condition Request
Attachments:	RE: Ashcroft EUC - Watermain Boundary Condition Request

Megan / Kevin

We are in receipt of the boundary conditions for Ashcroft's Eastboro Site.(see email below)
I have also attached our original request to the city identifying locations and FUS sheets
When would Megan be available to start the analysis?

Give me a shout on Thursday and we can discuss

Sincerely

Kris Kilborn
Project Manager
Stantec
400 - 1331 Clyde Avenue Ottawa ON K2C 3G4
Phone: (613) 724-4337
Cell: (613) 297-0571
Fax: (613) 722-2799
kris.kilborn@stantec.com

From: Sevigny, John [mailto:John.Sevigny@ottawa.ca]
Sent: Wednesday, June 18, 2014 3:48 PM
To: Lynch, Amanda
Subject: RE: Ashcroft EUC - Watermain Boundary Condition Request

Hi Amanda,
Please see below the boundary conditions.

We have assumed that the AVG, MX, PK demands below are for the entire development, i.e. for scenario 5 I distributed the 19 L/s MXDY demand over the 7 connection points, i.e. roughly 3 L/s each.

Please note that 167 L/s fire demand cannot generally be supplied on a single feed in this area. A 203mm loop on Markinch back to Navan Road was assumed for Connection 4 in order to produce a feasible boundary condition for any scenario. The network design must provide equivalent or higher capacity looped connection (and similar length) in order for the boundary condition to be valid.

Boundary conditions are as follows and can be used for each scenario:

Connection 1:
PKHR=125.4m
Max HGL = 134.8m
MXDY+Fire = 115.7m

Connection 2:
PKHR=125.4m
Max HGL = 134.8m
MXDY+Fire = 112.8m

Connection 3:
PKHR=125.3m
Max HGL = 134.8m
MXDY+Fire = 107.6m

Connection 4:
PKHR=125.3m
Max HGL = 134.8m
MXDY+Fire = 106.6m

Connection 5:
PKHR=125.5m
Max HGL = 134.8m
MXDY+Fire = 115.1m

Connection 6 & 7:
PKHR=125.4m
Max HGL = 134.8m
MXDY+Fire = 113.2m

John Sevigny, C.E.T.
Project Manager, Infrastructure Approvals
Development Review - Suburban Services - East Unit
Gestionnaire de projet, Approbation des demandes d'infrastructure
Examen des demandes d'aménagement (Services suburbains est)

PLANNING AND GROWTH MANAGEMENT
URBANISME ET GESTION DE LA CROISSANCE

City of Ottawa | Ville d'Ottawa
613.580.2424 ext./poste 14388
ottawa.ca/planning / ottawa.ca/urbanisme

From: Lynch, Amanda [mailto:Amanda.Lynch@stantec.com]
Sent: June 09, 2014 10:26 AM
To: Sevigny, John
Cc: Kilborn, Kris
Subject: RE: Ashcroft EUC - Watermain Boundary Condition Request

Thanks John

Amanda Lynch, EIT
Water Resources Engineering Intern

From: Sevigny, John [mailto:John.Sevigny@ottawa.ca]
Sent: Monday, June 09, 2014 10:23 AM
To: Lynch, Amanda
Subject: RE: Ashcroft EUC - Watermain Boundary Condition Request

Hi Amanda,
I've just asked to get an update and I'll let you know as soon as I hear from them.
Regards,

John Sevigny, C.E.T.
Project Manager, Infrastructure Approvals
Development Review - Suburban Services - East Unit
Gestionnaire de projet, Approbation des demandes d'infrastructure
Examen des demandes d'aménagement (Services suburbains est)

City of Ottawa | Ville d'Ottawa
613.580.2424 ext./poste 14388
ottawa.ca/planning / ottawa.ca/urbanisme

From: Lynch, Amanda [mailto:Amanda.Lynch@stantec.com]
Sent: June 09, 2014 10:20 AM
To: Sevigny, John
Subject: FW: Ashcroft EUC - Watermain Boundary Condition Request

Hi John,

I just wanted to follow up on the status of the below boundary condition request. Would you know when we might receive these?

Thanks,

Amanda Lynch, EIT
Water Resources Engineering Intern

Stantec

Phone: (613) 784-2202
Fax: (613) 722-2799

Amanda.Lynch@stantec.com

From: Lynch, Amanda
Sent: Wednesday, May 28, 2014 12:58 PM
To: Sevigny, John
Cc: Kilborn, Kris; Thiffault, Dustin
Subject: RE: Ashcroft EUC - Watermain Boundary Condition Request

Hi John,

I have revised the fire flow calculations as discussed and all calculated values are above 10,000L/min therefore, per the technical bulletin (ISDTB-2014-02 Revisions to Ottawa Design Guidelines – Water), we will require boundary conditions for a capped fire flow rate of 10,000 L/min. For convenience I have included the demand tables again in this email.

Scenario	Avg. Day (L/s)	Max Day (L/s)	Peak Hour (L/s)	Fire flow (L/s)	BC location (see map)
1	2.80	6.99	15.37	167	1, 2, 3
2	4.78	11.94	26.27	167	1 to 4 & 6
3	6.77	16.92	37.23	167	1 to 4 & 6
4	7.54	18.86	41.49	167	1 to 6
5	7.65	19.13	42.09	167	1 to 7

Thanks,

Amanda Lynch, EIT
Water Resources EIT

From: Sevigny, John [mailto:John.Sevigny@ottawa.ca]
Sent: Monday, May 26, 2014 8:58 AM
To: Lynch, Amanda
Cc: Kilborn, Kris; Thiffault, Dustin
Subject: RE: Ashcroft EUC - Watermain Boundary Condition Request

Hi Amanda,
As discussed there will be a technical bulletin being released this week. Please revise your fire flow calculations as discussed and ensure that they comply with the soon to be released technical bulletin.
Regards,

John Sevigny, C.E.T.
Project Manager - Infrastructure Approvals
Development Review - Suburban Services Branch - East Unit
Planning & Growth Management Dept.
Infrastructure Services and Community Sustainability
110 Laurier Avenue West
4th floor
Ottawa, ON K1P 1J1
tel.: (613) 580-2424 ext.14388
fax: (613) 560-6006
e-mail: john.sevigny@ottawa.ca
Mail Code: 01-14

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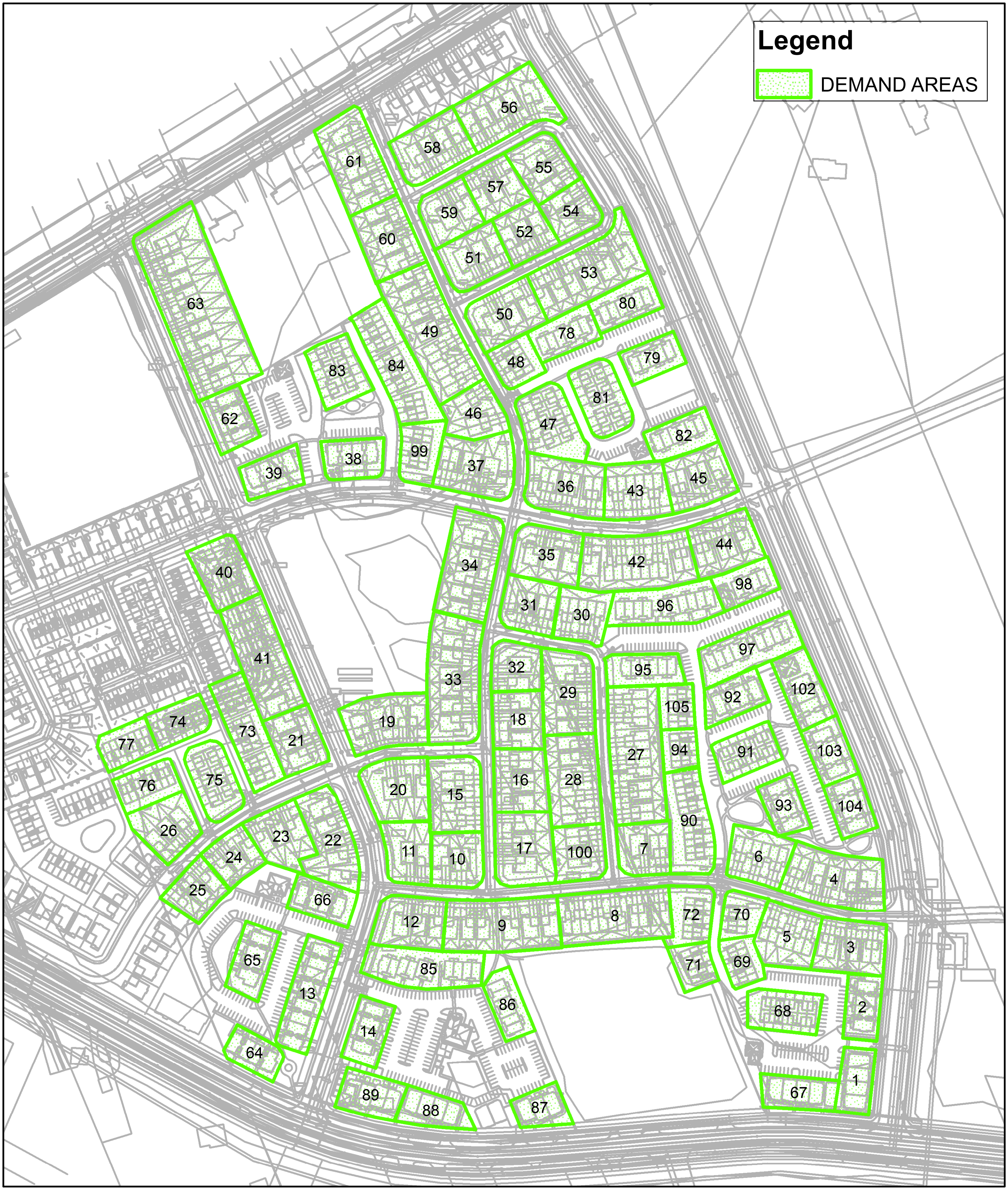
Appendix C DEMAND ALLOCATIONS



Stantec

Client/Project

ASHCROFT EUC
WATER DEMANDS ANALYSIS

Figure No. **C-1**

Title

DEMAND AREA ID

ASHCROFT WATER DEMAND PROJECTIONS

Stantec	**LOCATION:** OTTAWA - EAST URBAN COMMUNITY	**DESIGN PARAMETERS:**
PROJECT: ASHCROFT EUC WATER DEMAND ANALYSIS	**DESIGNED:** MY **CHECKED:** KA **DATE:** 20-Aug-14 **FILE REF.:** 1604-01067	

DESIGN PARAMETERS:

MXDY PF:	2.25	x AVDY	RESIDENTIAL AVDY:	350	Litres/cap/day			
MNHR PF:	0.45	x AVDY	MIXED USE COMM AVDY.:	2500	Litres/1000m^2/day @	135.25	m^2/unit
MXHR PF:	3.38	x AVDY					
SINGLE FAMILY:	3.4	persons/unit	LOFT:	2.7	persons/unit		
SEMI/TOWN:	2.7	persons/unit	EASTBORO FLATS:	2.1	persons/dwelling @	4.0	dwellings/unit
NEW YORKERS:	2.7	persons/unit	TERRACE:	2.7	persons/dwelling @	2.0	dwellings/unit
URBAN TOWNS:	2.7	persons/unit	MIXED USE RES.:	2.7	persons/dwelling @	2.0	dwellings/unit

ALLOCATED NODE ID		AREA ID	AREA PHASE	TOTAL NUMBER OF UNITS: SINGLE FAMILY	SEMI/ TOWN	NEW YORKER	URBAN TOWNS	LOFT	EASTBORO FLATS	TERRACE	MIXED USE	TOTAL RESIDENTIAL POPULATION	TOTAL COMMERCIAL AREA (m^2)	TOTAL AVDY FLOW (L/s)	TOTAL MXDY FLOW (L/s)	TOTAL PKHR FLOW (L/s)	TOTAL MNHR FLOW (L/s)
1-	2	3	1		6							16.2	0	**0.07**	**0.15**	**0.22**	**0.03**
1-	3	4	1	4	2							19.0	0	0.08	0.17	0.26	0.03
1-	3	5	1		6							16.2	0	0.07	0.15	0.22	0.03
														0.14	**0.32**	**0.48**	**0.06**
1-	4	6	1		6							16.2	0	**0.07**	**0.15**	**0.22**	**0.03**
1-	5	7	1	1	2							8.8	0	0.04	0.08	0.12	0.02
1-	5	8	1		11							29.7	0	0.12	0.27	0.41	0.05
														0.16	**0.35**	**0.53**	**0.07**
1-	6	9	1	6								20.4	0	0.08	0.19	0.28	0.04
1-	6	10	1	1	2							8.8	0	0.04	0.08	0.12	0.02
1-	6	17	1	2	2							12.2	0	0.05	0.11	0.17	0.02
														0.17	**0.38**	**0.57**	**0.08**
1-	7	11	1	2								6.8	0	0.03	0.06	0.09	0.01
1-	7	12	1	3								10.2	0	0.04	0.09	0.14	0.02
														0.07	**0.15**	**0.23**	**0.03**
1-	8	-	-									0.0	0	**0.00**	**0.00**	**0.00**	**0.00**
1-	10	15	1		6							16.2	0	0.07	0.15	0.22	0.03
1-	10	16	1	1	4							14.2	0	0.06	0.13	0.19	0.03
1-	10	18	1	3								10.2	0	0.04	0.09	0.14	0.02
														0.16	**0.37**	**0.56**	**0.07**
1-	11	32	1	2								6.8	0	0.03	0.06	0.09	0.01
1-	11	33	1	7								23.8	0	0.10	0.22	0.33	0.04
														0.12	**0.28**	**0.42**	**0.06**
1-	12	34	1	5								17.0	0	**0.07**	**0.15**	**0.23**	**0.03**
10-	2	38	10						4			33.6	0	0.14	0.31	0.46	0.06
10-	2	39	10						4			33.6	0	0.14	0.31	0.46	0.06
														0.27	**0.61**	**0.92**	**0.12**
10-	3	62	10						4			33.6	0	**0.14**	**0.31**	**0.46**	**0.06**
10-	4	63	10	7	4							34.6	0	**0.14**	**0.32**	**0.47**	**0.06**
2-	1	27	2		13							35.1	0	0.14	0.32	0.48	0.06
2-	1	28	2	2	6							23.0	0	0.09	0.21	0.31	0.04

ASHCROFT WATER DEMAND PROJECTIONS

Stantec

LOCATION: OTTAWA - EAST URBAN COMMUNITY

PROJECT: ASHCROFT EUC WATER DEMAND ANALYSIS

DESIGNED:	MY
CHECKED:	KA
DATE:	20-Aug-14
FILE REF.:	1604-01067

DESIGN PARAMETERS:

MXDY PF:	2.25	x AVDY		RESIDENTIAL AVDY:	350	Litres/cap/day	
MNHR PF:	0.45	x AVDY		MIXED USE COMM AVDY.:	2500	Litres/1000m^2/day @	135.25 m^2/unit
MXHR PF:	3.38	x AVDY					
SINGLE FAMILY:	3.4	persons/unit		LOFT:	2.7	persons/unit	
SEMI/TOWN:	2.7	persons/unit		EASTBORO FLATS:	2.1	persons/dwelling @	4.0 dwellings/unit
NEW YORKERS:	2.7	persons/unit		TERRACE:	2.7	persons/dwelling @	2.0 dwellings/unit
URBAN TOWNS:	2.7	persons/unit		MIXED USE RES.:	2.7	persons/dwelling @	2.0 dwellings/unit

ALLOCATED NODE ID		AREA ID	AREA PHASE	TOTAL NUMBER OF UNITS: SINGLE FAMILY	SEMI/ TOWN	NEW YORKER	URBAN TOWNS	LOFT	EASTBORO FLATS	TERRACE	MIXED USE	TOTAL RESIDENTIAL POPULATION	TOTAL COMMERCIAL AREA (m^2)	TOTAL AVDY FLOW (L/s)	TOTAL MXDY FLOW (L/s)	TOTAL PKHR FLOW (L/s)	TOTAL MNHR FLOW (L/s)
2-	1	100	2		4							10.8	0	0.04	0.10	0.15	0.02
														0.28	**0.63**	**0.94**	**0.13**
2-	2	29	2	4								13.6	0	0.06	0.12	0.19	0.02
2-	2	30	2		5							13.5	0	0.05	0.12	0.18	0.02
2-	2	31	2		4							10.8	0	0.04	0.10	0.15	0.02
														0.15	**0.35**	**0.52**	**0.07**
5-	1	19	5	4								13.6	0	0.06	0.12	0.19	0.02
5-	1	20	5	3								10.2	0	0.04	0.09	0.14	0.02
5-	1	22	5	5								17.0	0	0.07	0.15	0.23	0.03
														0.17	**0.37**	**0.56**	**0.07**
5-	2	21	5	3								10.2	0	0.04	0.09	0.14	0.02
5-	2	41	5	7								23.8	0	0.10	0.22	0.33	0.04
														0.14	**0.31**	**0.47**	**0.06**
5-	3	40	5	3								10.2	0	**0.04**	**0.09**	**0.14**	**0.02**
5-	4	23	5	3								10.2	0	**0.04**	**0.09**	**0.14**	**0.02**
5-	5	24	5	3								10.2	0	**0.04**	**0.09**	**0.14**	**0.02**
5-	6	25	5	3								10.2	0	0.04	0.09	0.14	0.02
5-	6	26	5	3								10.2	0	0.04	0.09	0.14	0.02
														0.08	**0.19**	**0.28**	**0.04**
8-	1	35	8	3								10.2	0	0.04	0.09	0.14	0.02
8-	1	36	8		6							16.2	0	0.07	0.15	0.22	0.03
8-	1	42	8	1	9							27.7	0	0.11	0.25	0.38	0.05
8-	1	43	8		6							16.2	0	0.07	0.15	0.22	0.03
														0.28	**0.64**	**0.96**	**0.13**
8-	2	44	8	1	4							14.2	0	0.06	0.13	0.19	0.03
8-	2	45	8	1	4							14.2	0	0.06	0.13	0.19	0.03
														0.12	**0.26**	**0.39**	**0.05**
9-	1	46	9		4							10.8	0	**0.04**	**0.10**	**0.15**	**0.02**
9-	2	49	9	2	10							33.8	0	0.14	0.31	0.46	0.06
9-	2	50	9	3								10.2	0	0.04	0.09	0.14	0.02
9-	2	51	9	3								10.2	0	0.04	0.09	0.14	0.02
														0.22	**0.49**	**0.74**	**0.10**
9-	3	52	9	3								10.2	0	0.04	0.09	0.14	0.02

ASHCROFT WATER DEMAND PROJECTIONS

Stantec

LOCATION:
OTTAWA - EAST URBAN COMMUNITY

PROJECT:
ASHCROFT EUC
WATER DEMAND ANALYSIS

DESIGNED:	MY
CHECKED:	KA
DATE:	20-Aug-14
FILE REF.:	1604-01067

DESIGN PARAMETERS:

MXDY PF:	2.25	x AVDY	RESIDENTIAL AVDY:	350	Litres/cap/day		
MNHR PF:	0.45	x AVDY	MIXED USE COMM AVDY.:	2500	Litres/1000m^2/day @	135.25	m^2/unit
MXHR PF:	3.38	x AVDY					
SINGLE FAMILY:	3.4	persons/unit	LOFT:	2.7	persons/unit		
SEMI/TOWN:	2.7	persons/unit	EASTBORO FLATS:	2.1	persons/dwelling @	4.0	dwellings/unit
NEW YORKERS:	2.7	persons/unit	TERRACE:	2.7	persons/dwelling @	2.0	dwellings/unit
URBAN TOWNS:	2.7	persons/unit	MIXED USE RES.:	2.7	persons/dwelling @	2.0	dwellings/unit

ALLOCATED NODE ID		AREA ID	AREA PHASE	TOTAL NUMBER OF UNITS: SINGLE FAMILY	SEMI/ TOWN	NEW YORKER	URBAN TOWNS	LOFT	EASTBORO FLATS	TERRACE	MIXED USE	TOTAL RESIDENTIAL POPULATION	TOTAL COMMERCIAL AREA (m^2)	TOTAL AVDY FLOW (L/s)	TOTAL MXDY FLOW (L/s)	TOTAL PKHR FLOW (L/s)	TOTAL MNHR FLOW (L/s)
9-	3	53	9	6								20.4	0	0.08	0.19	0.28	0.04
9-	3	54	9	2								6.8	0	0.03	0.06	0.09	0.01
														0.15	**0.34**	**0.51**	**0.07**
9-	4	55	9	3								10.2	0	0.04	0.09	0.14	0.02
9-	4	56	9	5								17.0	0	0.07	0.15	0.23	0.03
9-	4	57	9	3								10.2	0	0.04	0.09	0.14	0.02
														0.15	**0.34**	**0.51**	**0.07**
9-	5	58	9	4								13.6	0	0.06	0.12	0.19	0.02
9-	5	59	9	2								6.8	0	0.03	0.06	0.09	0.01
9-	5	60	9	4								13.6	0	0.06	0.12	0.19	0.02
														0.14	**0.31**	**0.47**	**0.06**
9-	6	61	9	5								17.0	0	**0.07**	**0.15**	**0.23**	**0.03**
9-	7	37	9	1	4							14.2	0	**0.06**	**0.13**	**0.19**	**0.03**
A-	1	64	7						4			33.6	0	0.14	0.31	0.46	0.06
A-	1	65	7						4			33.6	0	0.14	0.31	0.46	0.06
														0.27	**0.61**	**0.92**	**0.12**
A-	2	13	6						8			67.2	0	0.27	0.61	0.92	0.12
A-	2	66	7						4			33.6	0	0.14	0.31	0.46	0.06
														0.41	**0.92**	**1.38**	**0.18**
B-	1	1	4								4	21.6	541	0.10	0.23	0.35	0.05
B-	1	2	4						4			33.6	0	0.14	0.31	0.46	0.06
														0.24	**0.54**	**0.81**	**0.11**
B-	2	67	4								4	21.6	541	0.10	0.23	0.35	0.05
B-	2	68	4			12						32.4	0	0.13	0.30	0.44	0.06
														0.23	**0.53**	**0.79**	**0.11**
B-	3	69	4					6				16.2	0	0.07	0.15	0.22	0.03
B-	3	70	4					4				10.8	0	0.04	0.10	0.15	0.02
B-	3	71	4					5				13.5	0	0.05	0.12	0.18	0.02
B-	3	72	4					6				16.2	0	0.07	0.15	0.22	0.03
														0.23	**0.52**	**0.78**	**0.10**
C-	1	73	5				14					37.8	0	**0.15**	**0.34**	**0.52**	**0.07**
C-	2	74	5				8					21.6	0	0.09	0.20	0.30	0.04
C-	2	75	5			12						32.4	0	0.13	0.30	0.44	0.06
														0.22	**0.49**	**0.74**	**0.10**

ASHCROFT WATER DEMAND PROJECTIONS

Stantec

PROJECT: ASHCROFT EUC WATER DEMAND ANALYSIS	**LOCATION:** OTTAWA - EAST URBAN COMMUNITY	**DESIGNED:** MY	
		CHECKED: KA	
		DATE: 20-Aug-14	
		FILE REF.: 1604-01067	

DESIGN PARAMETERS:

MXDY PF:	2.25	x AVDY		RESIDENTIAL AVDY:	350	Litres/cap/day		
MNHR PF:	0.45	x AVDY		MIXED USE COMM AVDY.:	2500	Litres/1000m^2/day @	135.25	m^2/unit
MXHR PF:	3.38	x AVDY						
SINGLE FAMILY:	3.4	persons/unit		LOFT:	2.7	persons/unit		
SEMI/TOWN:	2.7	persons/unit		EASTBORO FLATS:	2.1	persons/dwelling @	4.0	dwellings/unit
NEW YORKERS:	2.7	persons/unit		TERRACE:	2.7	persons/dwelling @	2.0	dwellings/unit
URBAN TOWNS:	2.7	persons/unit		MIXED USE RES.:	2.7	persons/dwelling @	2.0	dwellings/unit

ALLOCATED NODE ID		AREA ID	AREA PHASE	TOTAL NUMBER OF UNITS: SINGLE FAMILY	SEMI/ TOWN	NEW YORKER	URBAN TOWNS	LOFT	EASTBORO FLATS	TERRACE	MIXED USE	TOTAL RESIDENTIAL POPULATION	TOTAL COMMERCIAL AREA (m^2)	TOTAL AVDY FLOW (L/s)	TOTAL MXDY FLOW (L/s)	TOTAL PKHR FLOW (L/s)	TOTAL MNHR FLOW (L/s)
C-	3	76	5				8					21.6	0	0.09	0.20	0.30	0.04
C-	3	77	5				7					18.9	0	0.08	0.17	0.26	0.03
														0.16	**0.37**	**0.55**	**0.07**
D-	1	47	11			12						32.4	0	0.13	0.30	0.44	0.06
D-	1	48	11					5				13.5	0	0.05	0.12	0.18	0.02
														0.19	**0.42**	**0.63**	**0.08**
D-	2	78	11							6		32.4	0	**0.13**	**0.30**	**0.44**	**0.06**
D-	3	79	11							5		27.0	0	0.11	0.25	0.37	0.05
D-	3	80	11							6		32.4	0	0.13	0.30	0.44	0.06
														0.24	**0.54**	**0.81**	**0.11**
D-	4	81	11			14						37.8	0	**0.15**	**0.34**	**0.52**	**0.07**
D-	5	82	11							6		32.4	0	**0.13**	**0.30**	**0.44**	**0.06**
E-	4	83	10			12						32.4	0	**0.13**	**0.30**	**0.44**	**0.06**
E-	3	84	10					16				43.2	0	**0.18**	**0.39**	**0.59**	**0.08**
E-	2	99	10					6				16.2	0	**0.07**	**0.15**	**0.22**	**0.03**
F-	1	85	7							10		54.0	0	**0.22**	**0.49**	**0.74**	**0.10**
F-	2	86	7							6		32.4	0	**0.13**	**0.30**	**0.44**	**0.06**
F-	3	87	7								3	16.2	405.75	**0.08**	**0.17**	**0.26**	**0.03**
F-	4	14	7						4			33.6	0	0.14	0.31	0.46	0.06
F-	4	88	7								4	21.6	541	0.10	0.23	0.35	0.05
F-	4	89	7								4	21.6	541	0.10	0.23	0.35	0.05
														0.34	**0.77**	**1.16**	**0.15**
G1-	1	90	1					12				32.4	0	**0.13**	**0.30**	**0.44**	**0.06**
G1-	2	91	1			12						32.4	0	**0.13**	**0.30**	**0.44**	**0.06**

ASHCROFT WATER DEMAND PROJECTIONS

Stantec

LOCATION:

OTTAWA - EAST URBAN COMMUNITY

PROJECT:

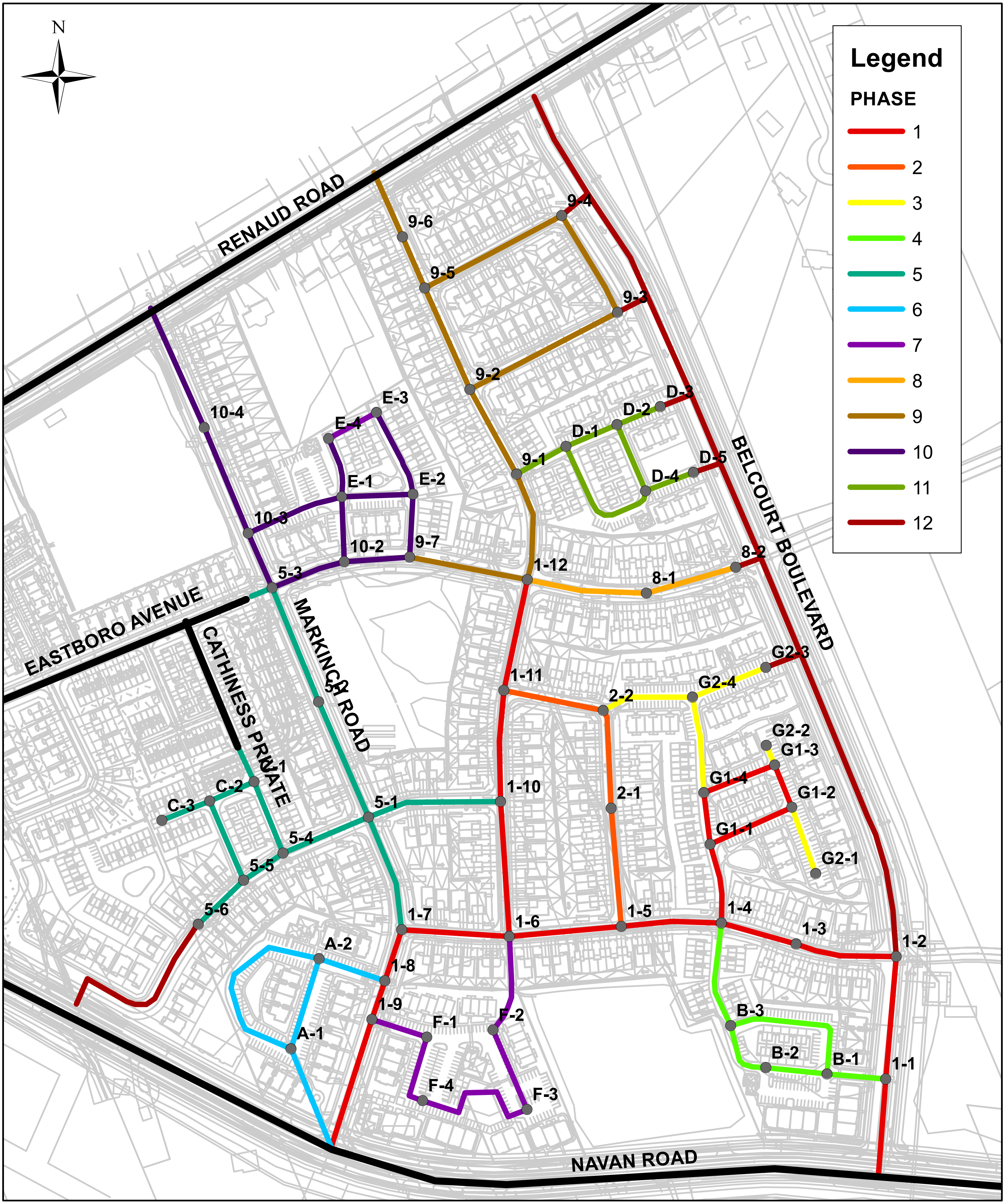
ASHCROFT EUC
WATER DEMAND ANALYSIS

DESIGNED:	MY
CHECKED:	KA
DATE:	20-Aug-14
FILE REF.:	1604-01067

DESIGN PARAMETERS:

MXDY PF:	**2.25**	x AVDY	RESIDENTIAL AVDY:	**350**	Litres/cap/day		
MNHR PF:	**0.45**	x AVDY	MIXED USE COMM AVDY.:	**2500**	Litres/1000m^2/day @	**135.25**	m^2/unit
MXHR PF:	**3.38**	x AVDY					
SINGLE FAMILY:	**3.4**	persons/unit	LOFT:	**2.7**	persons/unit		
SEMI/TOWN:	**2.7**	persons/unit	EASTBORO FLATS:	**2.1**	persons/dwelling @	**4.0**	dwellings/unit
NEW YORKERS:	**2.7**	persons/unit	TERRACE:	**2.7**	persons/dwelling @	**2.0**	dwellings/unit
URBAN TOWNS:	**2.7**	persons/unit	MIXED USE RES.:	**2.7**	persons/dwelling @	**2.0**	dwellings/unit

ALLOCATED NODE ID		AREA ID	AREA PHASE	TOTAL NUMBER OF UNITS: SINGLE FAMILY	SEMI/ TOWN	NEW YORKER	URBAN TOWNS	LOFT	EASTBORO FLATS	TERRACE	MIXED USE	TOTAL RESIDENTIAL POPULATION	TOTAL COMMERCIAL AREA (m^2)	TOTAL AVDY FLOW (L/s)	TOTAL MXDY FLOW (L/s)	TOTAL PKHR FLOW (L/s)	TOTAL MNHR FLOW (L/s)
G1-	3	92	1						4			33.6	0	**0.14**	**0.31**	**0.46**	**0.06**
G1-	4	94	1					5				13.5	0	**0.05**	**0.12**	**0.18**	**0.02**
G2-	1	93	3						4			33.6	0	0.14	0.31	0.46	0.06
G2-	1	103	3						4			33.6	0	0.14	0.31	0.46	0.06
G2-	1	104	3						4			33.6	0	0.14	0.31	0.46	0.06
														0.41	**0.92**	**1.38**	**0.18**
G2-	2	102	3						4			33.6	0	**0.14**	**0.31**	**0.46**	**0.06**
G2-	3	97	3							9		48.6	0	0.20	0.44	0.67	0.09
G2-	3	98	3							4		21.6	0	0.09	0.20	0.30	0.04
														0.28	**0.64**	**0.96**	**0.13**
G2-	4	95	3							6		32.4	0	0.13	0.30	0.44	0.06
G2-	4	96	3							10		54.0	0	0.22	0.49	0.74	0.10
G2-	4	105	3					6				16.2	0	0.07	0.15	0.22	0.03
														0.42	**0.94**	**1.40**	**0.19**
TOTAL:				**139**	**130**	**74**	**37**	**71**	**60**	**68**	**19**	**2289**	**2569.75**	**9.35**	**21.03**	**31.59**	**4.21**



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Client/Project

ASHCROFT EUC
WATER DEMANDS ANALYSIS

Figure No. D-1

NODE IDs

Appendix D HYDRAULIC MODELLING RESULTS

TABLE D-1: MINIMUM HOUR DEMAND NODE PRESSURES

Node		Elevation (m)	Head (m)	Pressure (PSI)											
				Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8	Phase 9	Phase 10	Phase 11	Build-Out
1-	1	86.2	134.8	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2
1-	2	86.1	134.8	69.3	69.3	69.3	69.1	69.3	69.3	69.3	69.3	69.3	69.3	69.3	69.3
1-	3	86.1	134.8	69.2	69.2	69.2	69.0	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2
1-	4	85.9	134.8	69.5	69.5	69.5	68.7	69.5	69.5	69.5	69.5	69.5	69.5	69.5	69.5
1-	5	86.1	134.8	69.3	69.3	69.3	69.3	69.3	69.3	69.3	69.3	69.3	69.3	69.3	69.3
1-	6	86.1	134.8	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2
1-	7	85.9	134.8	69.5	69.5	69.5	69.5	69.5	69.5	69.5	69.5	69.5	69.5	69.5	69.5
1-	8	85.9	134.8	69.5	69.5	69.5	69.3	69.5	69.5	69.5	69.5	69.5	69.5	69.5	69.5
1-	9	85.9	134.8	69.5	69.5	69.5	69.2	69.5	69.5	69.5	69.5	69.5	69.5	69.5	69.5
1-	10	86.2	134.8	69.1	69.1	69.1	69.5	69.1	69.1	69.1	69.1	69.1	69.1	69.1	69.1
1-	11	86.3	134.8	69.0	69.0	69.0	69.5	69.0	69.0	69.0	69.0	69.0	69.0	69.0	69.0
1-	12	86.5	134.8	68.7	68.7	68.7	69.5	68.7	68.7	68.7	68.7	68.7	68.7	68.7	68.7
2-	1	86.1	134.8		69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2
2-	2	86.2	134.8		69.1	69.1	69.1	69.1	69.1	69.1	69.0	69.1	69.1	69.1	69.1
5-	1	86.0	134.8					69.4	69.4	69.4	69.4	69.4	69.4	69.4	69.4
5-	2	86.1	134.8					69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.3
5-	3	86.1	134.8					69.3	69.3	69.3	69.3	69.3	69.3	69.3	69.3
5-	4	86.1	134.8					69.3	69.3	69.3	69.3	69.3	69.3	69.3	69.3
5-	5	86.2	134.8					69.1	69.1	69.1	69.1	69.1	69.1	69.1	69.1
5-	6	86.3	134.8					69.0	69.0	69.0	69.0	69.0	69.0	69.0	69.0
8-	1	86.4	134.8								68.8	68.8	68.8	68.8	68.8
8-	2	86.3	134.8								69.0	69.0	69.0	69.0	69.0
9-	1	86.6	134.8									68.6	68.6	68.6	68.6
9-	2	86.5	134.8									68.7	68.7	68.7	68.7
9-	3	86.5	134.8									68.7	68.7	68.7	68.7
9-	4	86.8	134.8									68.3	68.3	68.3	68.3
9-	5	86.5	134.8									68.6	68.6	68.6	68.6
9-	6	86.9	134.8									68.1	68.1	68.1	68.1
9-	7	86.4	134.8									68.9	68.9	68.9	68.9
10-	2	86.3	134.8										68.9	68.9	68.9
10-	3	86.4	134.8										68.8	68.8	68.8
10-	4	86.5	134.8										68.7	68.7	68.7
A-	1	89.5	134.8						64.4	64.4	64.4	64.4	64.4	64.4	64.4
A-	2	85.9	134.8						69.5	69.5	69.5	69.5	69.5	69.5	69.5
B-	1	85.9	134.8				69.5	69.5	69.5	69.5	69.5	69.5	69.5	69.5	69.5
B-	2	85.9	134.8				69.5	69.5	69.5	69.5	69.5	69.5	69.5	69.5	69.5
B-	3	85.9	134.8				69.5	69.5	69.5	69.5	69.5	69.5	69.5	69.5	69.5
C-	1	86.0	134.8					69.4	69.4	69.4	69.4	69.4	69.4	69.4	69.4
C-	2	86.0	134.8					69.4	69.4	69.4	69.4	69.4	69.4	69.4	69.4
C-	3	86.0	134.8					69.4	69.4	69.4	69.4	69.4	69.4	69.4	69.4
D-	1	86.5	134.8											68.7	68.7
D-	2	86.5	134.8											68.7	68.7
D-	3	86.5	134.8											68.7	68.7
D-	4	86.5	134.8											68.7	68.7
D-	5	86.5	134.8											68.7	68.7
E-	1	86.4	134.8										68.9	68.9	68.9
E-	2	86.4	134.8										68.9	68.9	68.9
E-	3	86.4	134.8										68.9	68.9	68.9
E-	4	86.4	134.8										68.9	68.9	68.9
F-	1	85.9	134.8							69.5	69.5	69.5	69.5	69.5	69.5
F-	2	85.9	134.8							69.5	69.5	69.5	69.5	69.5	69.5
F-	3	85.9	134.8							69.5	69.5	69.5	69.5	69.5	69.5
F-	4	85.9	134.8							69.5	69.5	69.5	69.5	69.5	69.5
G1-	1	86.1	134.8	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2
G1-	2	86.1	134.8	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2
G1-	3	86.1	134.8	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2
G1-	4	86.1	134.8	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2
G2-	1	86.1	134.8			69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2
G2-	2	86.1	134.8			69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2
G2-	3	86.1	134.8			69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2
G2-	4	86.1	134.8			69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2

Max. Pressure: **69.5**
Min Pressure: **64.4**

TABLE D-2: PEAK HOUR DEMAND NODE PRESSURES

Node		Elevation	Head	Pressure (PSI)											
		(m)	(m)	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8	Phase 9	Phase 10	Phase 11	Build-Out
1-	1	86.2	125.39	55.8	55.8	55.8	55.8	55.8	55.7	55.7	55.7	55.7	55.8	55.8	55.8
1-	2	86.1	125.39	55.9	55.9	55.9	55.9	55.9	55.9	55.8	55.8	55.8	55.9	55.9	55.9
1-	3	86.1	125.39	55.9	55.9	55.8	55.8	55.8	55.8	55.8	55.8	55.8	55.8	55.8	55.9
1-	4	85.9	125.38	56.1	56.1	56.1	56.1	56.1	56.1	56.1	56.1	56.1	56.1	56.1	56.1
1-	5	86.1	125.38	55.9	55.9	55.9	55.9	55.8	55.9	55.8	55.8	55.8	55.8	55.8	55.9
1-	6	86.1	125.38	55.9	55.9	55.8	55.8	55.8	55.8	55.8	55.8	55.8	55.8	55.8	55.9
1-	7	85.9	125.38	56.2	56.2	56.1	56.1	56.1	56.1	56.1	56.1	56.1	56.1	56.1	56.1
1-	8	85.9	125.38	56.2	56.2	56.1	56.1	56.1	56.1	56.1	56.1	56.1	56.1	56.1	56.1
1-	9	85.9	125.38	56.1	56.1	56.1	56.1	56.0	56.1	56.0	56.0	56.0	56.0	56.0	56.1
1-	10	86.2	125.38	55.7	55.7	55.7	55.7	55.7	55.7	55.6	55.6	55.6	55.7	55.7	55.7
1-	11	86.3	125.39	55.6	55.6	55.5	55.5	55.5	55.6	55.5	55.5	55.5	55.5	55.5	55.6
1-	12	86.5	125.39	55.3	55.3	55.2	55.2	55.2	55.3	55.2	55.2	55.2	55.2	55.2	55.3
2-	1	86.1	125.38		55.9	55.8	55.8	55.8	55.8	55.8	55.8	55.8	55.8	55.8	55.9
2-	2	86.2	125.38		55.7	55.6	55.6	55.6	55.6	55.6	55.6	55.6	55.6	55.6	55.7
5-	1	86.0	125.38					55.9	56.0	55.9	55.9	55.9	55.9	55.9	56.0
5-	2	86.1	125.39					55.8	55.9	55.8	55.8	55.8	55.8	55.8	55.9
5-	3	86.1	125.39					55.8	55.9	55.8	55.8	55.8	55.9	55.8	55.9
5-	4	86.1	125.38					55.8	55.9	55.8	55.8	55.8	55.8	55.8	55.9
5-	5	86.2	125.38					55.6	55.6	55.6	55.6	55.6	55.6	55.6	55.7
5-	6	86.3	125.38					55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.6
8-	1	86.4	125.39								55.3	55.3	55.4	55.3	55.4
8-	2	86.3	125.39								55.5	55.6	55.6	55.6	55.6
9-	1	86.6	125.39									55.1	55.2	55.2	55.2
9-	2	86.5	125.39									55.2	55.2	55.2	55.3
9-	3	86.5	125.39									55.2	55.3	55.3	55.3
9-	4	86.8	125.39									54.9	54.9	54.9	54.9
9-	5	86.5	125.39									55.2	55.2	55.2	55.2
9-	6	86.9	125.39									54.7	54.7	54.7	54.7
9-	7	86.4	125.39									55.4	55.4	55.4	55.5
10-	2	86.3	125.39										55.5	55.5	55.5
10-	3	86.4	125.39										55.4	55.4	55.5
10-	4	86.5	125.4										55.3	55.3	55.3
A-	1	89.5	125.38						51.0	50.9	50.9	50.9	51.0	51.0	51.0
A-	2	85.9	125.38						56.1	56.1	56.0	56.1	56.1	56.1	56.1
B-	1	85.9	125.39				56.1	56.1	56.1	56.1	56.1	56.1	56.1	56.1	56.1
B-	2	85.9	125.38				56.1	56.1	56.1	56.1	56.1	56.1	56.1	56.1	56.1
B-	3	85.9	125.38				56.1	56.1	56.1	56.1	56.1	56.1	56.1	56.1	56.1
C-	1	86.0	125.37					55.9	56.0	55.9	55.9	55.9	55.9	55.9	56.0
C-	2	86.0	125.37					55.9	56.0	55.9	55.9	55.9	55.9	55.9	56.0
C-	3	86.0	125.37					55.9	56.0	55.9	55.9	55.9	55.9	55.9	56.0
D-	1	86.5	125.39											55.2	55.3
D-	2	86.5	125.39											55.2	55.3
D-	3	86.5	125.39											55.2	55.3
D-	4	86.5	125.39											55.2	55.3
D-	5	86.5	125.39											55.2	55.3
E-	1	86.4	125.39										55.5	55.5	55.5
E-	2	86.4	125.39										55.5	55.5	55.5
E-	3	86.4	125.39										55.5	55.5	55.5
E-	4	86.4	125.39										55.5	55.5	55.5
F-	1	85.9	125.38							56.1	56.0	56.1	56.1	56.1	56.1
F-	2	85.9	125.38							56.1	56.0	56.1	56.1	56.1	56.1
F-	3	85.9	125.38							56.1	56.0	56.1	56.1	56.1	56.1
F-	4	85.9	125.38							56.1	56.0	56.1	56.1	56.1	56.1
G1-	1	86.1	125.38	55.9	55.9	55.8	55.8	55.8	55.8	55.8	55.8	55.8	55.8	55.8	55.8
G1-	2	86.1	125.38	55.9	55.9	55.8	55.8	55.8	55.8	55.8	55.8	55.8	55.8	55.8	55.8
G1-	3	86.1	125.38	55.9	55.9	55.8	55.8	55.8	55.8	55.8	55.8	55.8	55.8	55.8	55.8
G1-	4	86.1	125.38	55.9	55.9	55.8	55.8	55.8	55.8	55.8	55.8	55.8	55.8	55.8	55.8
G2-	1	86.1	125.38			55.8	55.8	55.8	55.8	55.8	55.8	55.8	55.8	55.8	55.8
G2-	2	86.1	125.38			55.8	55.8	55.8	55.8	55.8	55.8	55.8	55.8	55.8	55.8
G2-	3	86.1	125.39			55.8	55.8	55.8	55.8	55.8	55.8	55.8	55.8	55.8	55.9
G2-	4	86.1	125.38			55.8	55.8	55.8	55.8	55.8	55.8	55.8	55.8	55.8	55.9

Max. Pressure: **56.2**
Min Pressure: **50.9**

TABLE D-3: MXDY+FF SCENARIO PRESSURES

Node		Elevation (m)	Head (m)	Pressure (PSI)											
				Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8	Phase 9	Phase 10	Phase 11	Build-Out
1-	1	86.2	125.39	31.7	31.7	31.5	31.4	29.9	29.9	29.9	29.9	31.8	33.7	33.6	37.0
1-	2	86.1	125.39	31.6	31.6	31.4	31.3	29.9	29.8	29.9	29.8	31.7	33.7	33.6	37.3
1-	3	86.1	125.39	31.1	31.1	30.9	30.9	29.8	29.7	29.7	29.7	31.6	33.6	33.5	36.9
1-	4	85.9	125.38	31.1	31.0	30.9	31.2	30.2	30.2	30.2	30.2	32.0	34.2	34.1	37.4
1-	5	86.1	125.38	30.5	30.4	30.2	30.6	29.8	29.7	29.7	29.7	31.6	33.9	33.8	37.0
1-	6	86.1	125.38	30.1	30.2	30.2	30.5	29.9	29.8	29.8	29.8	31.6	34.0	34.0	37.1
1-	7	85.9	125.38	30.2	30.2	30.2	30.5	30.3	30.2	30.1	30.1	31.7	34.2	34.2	37.3
1-	8	85.9	125.38	30.1	30.1	30.1	30.3	30.0	30.0	30.0	29.9	31.6	34.0	33.9	36.9
1-	9	85.9	125.38	29.9	29.9	29.9	30.2	29.8	29.7	29.8	29.8	31.4	33.8	33.8	36.7
1-	10	86.2	125.38	27.3	28.3	28.9	29.2	29.4	29.3	29.3	29.2	31.3	33.7	33.7	36.9
1-	11	86.3	125.39	24.9	27.1	28.2	28.5	28.4	28.4	28.3	28.3	31.0	33.6	33.5	36.8
1-	12	86.5	125.39	22.4	24.6	25.7	26.0	25.9	25.8	25.8	25.7	29.9	33.2	33.2	36.8
2-	1	86.1	125.38		24.1	25.0	25.3	24.7	24.6	24.6	24.5	26.6	28.9	28.8	32.2
2-	2	86.2	125.38		25.3	28.2	28.5	28.0	27.9	27.9	27.8	30.1	32.4	32.4	36.1
5-	1	86.0	125.38					29.8	29.7	29.6	29.6	31.0	33.8	33.8	37.1
5-	2	86.1	125.39					28.3	28.3	28.3	28.2	29.2	33.4	33.3	36.4
5-	3	86.1	125.39					26.7	26.7	26.6	26.6	28.0	33.6	33.6	36.5
5-	4	86.1	125.38					28.3	28.2	28.1	28.1	29.9	31.6	31.6	35.4
5-	5	86.2	125.38					27.4	27.3	27.3	27.2	29.0	30.8	30.7	34.8
5-	6	86.3	125.38					26.1	26.0	25.9	25.9	27.7	29.4	29.4	34.1
8-	1	86.4	125.39								23.4	27.6	30.9	30.9	36.5
8-	2	86.3	125.39								21.8	26.0	29.4	29.3	37.2
9-	1	86.6	125.39									28.1	30.8	30.7	36.2
9-	2	86.5	125.39									27.1	29.5	29.3	35.9
9-	3	86.5	125.39									24.1	26.4	26.3	36.5
9-	4	86.8	125.39									23.8	26.1	25.9	34.1
9-	5	86.5	125.39									26.7	28.9	28.7	35.1
9-	6	86.9	125.39									25.9	27.9	27.8	33.3
9-	7	86.4	125.39									27.7	33.2	33.1	36.3
10-	2	86.3	125.39										33.2	33.1	36.2
10-	3	86.4	125.39										33.1	33.0	35.9
10-	4	86.5	125.4										32.3	32.3	34.9
A-	1	89.5	125.38						23.9	23.9	23.8	25.5	27.9	27.9	30.9
A-	2	85.9	125.38						26.0	26.0	25.9	27.6	30.0	29.9	32.9
B-	1	85.9	125.39				27.8	26.4	26.3	26.4	26.3	28.3	30.3	30.2	33.5
B-	2	85.9	125.38				25.3	23.9	23.9	23.9	23.9	25.8	27.8	27.8	31.1
B-	3	85.9	125.38				27.0	25.7	25.7	25.7	25.7	27.6	29.6	29.5	32.8
C-	1	86.0	125.37					27.4	27.3	27.2	27.2	29.0	30.7	30.7	33.7
C-	2	86.0	125.37					27.0	26.9	26.8	26.8	28.6	30.3	30.2	33.7
C-	3	86.0	125.37					18.3	18.2	18.1	18.1	19.9	21.5	21.5	25.0
D-	1	86.5	125.39											27.5	35.9
D-	2	86.5	125.39											26.0	35.7
D-	3	86.5	125.39											18.1	35.2
D-	4	86.5	125.39											25.4	35.6
D-	5	86.5	125.39											16.8	35.3
E-	1	86.4	125.39										32.7	32.6	35.7
E-	2	86.4	125.39										32.2	32.1	35.4
E-	3	86.4	125.39										28.1	28.0	31.1
E-	4	86.4	125.39										28.7	28.0	31.7
F-	1	85.9	125.38							24.6	24.6	26.3	28.7	6.0	31.7
F-	2	85.9	125.38							22.4	22.4	24.2	26.6	26.5	29.7
F-	3	85.9	125.38							19.9	19.9	21.7	24.1	24.0	27.1
F-	4	85.9	125.38							21.1	21.0	22.8	25.2	25.1	28.2
G1-	1	86.1	125.38	26.2	26.2	28.5	28.8	28.0	27.9	27.9	27.9	29.8	32.1	32.0	35.7
G1-	2	86.1	125.38	24.3	24.3	26.9	27.2	26.4	26.3	26.3	26.3	28.3	30.5	30.5	34.2
G1-	3	86.1	125.38	24.1	24.1	26.9	27.2	26.4	26.4	26.4	26.3	28.3	30.6	30.5	34.3
G1-	4	86.1	125.38	24.8	24.7	28.1	28.4	27.7	27.6	27.6	27.6	29.6	31.8	31.7	35.6
G2-	1	86.1	125.38			15.0	15.3	14.5	14.4	14.4	14.4	16.4	18.6	18.5	22.3
G2-	2	86.1	125.38			23.3	23.7	22.9	22.8	22.8	22.8	24.7	27.0	26.9	30.7
G2-	3	86.1	125.39			23.1	23.5	22.8	22.7	22.7	22.7	24.8	27.1	27.0	36.7
G2-	4	86.1	125.38			27.6	28.0	27.3	27.2	27.2	27.2	29.3	31.6	31.5	36.5

Min Pressure: 6.0
Max Pressure: 37.4

TABLE D-4: MXDY+FF SCENARIO FLOWS

Node		Elevation (m)	Head (m)	Flow (L/s)											
				Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8	Phase 9	Phase 10	Phase 11	Build-Out
1-	1	86.2	125.39	336.7	335.7	332.9	331.3	306.1	305.1	305.2	304.5	354.2	389.6	389.4	613.8
1-	2	86.1	125.39	336.8	335.8	333.0	331.4	306.8	305.7	305.8	305.1	356.0	394.0	393.5	657.5
1-	3	86.1	125.39	337.0	336.0	333.2	331.6	308.8	307.7	307.8	307.1	362.2	408.3	407.4	584.4
1-	4	85.9	125.38	336.8	335.8	333.0	331.4	318.3	317.1	317.3	316.5	381.3	439.0	438.0	644.9
1-	5	86.1	125.38	337.0	336.0	333.2	331.6	319.1	317.8	379.3	378.4	387.4	454.3	453.1	604.5
1-	6	86.1	125.38	337.1	336.1	333.3	331.7	389.0	387.6	387.8	386.9	463.5	543.0	541.6	705.7
1-	7	85.9	125.38	336.8	335.8	333.0	331.4	395.3	393.8	391.9	391.0	465.1	519.9	518.6	688.8
1-	8	85.9	125.38	336.7	335.7	332.9	331.3	388.8	387.2	387.0	386.1	425.9	487.9	486.8	608.0
1-	9	85.9	125.38	336.7	335.7	332.9	331.3	358.5	357.1	361.1	360.4	416.1	470.5	469.5	572.0
1-	10	86.2	125.38	277.9	336.1	333.3	331.7	382.1	380.8	380.0	379.1	457.2	535.1	533.7	622.8
1-	11	86.3	125.39	195.7	277.1	333.2	331.6	276.0	274.9	274.5	273.6	356.6	445.7	444.2	630.7
1-	12	86.5	125.39	179.6	193.9	202.6	205.4	230.5	229.8	229.4	228.5	312.3	437.5	435.8	691.5
2-	1	86.1	125.38		189.9	182.6	198.9	210.5	210.0	210.1	209.7	229.5	247.1	246.7	299.6
2-	2	86.2	125.38		198.6	262.9	331.6	264.5	263.6	263.4	262.7	316.3	361.2	360.3	495.3
5-	1	86.0	125.38					669.3	667.8	666.1	665.2	731.7	749.1	747.6	846.0
5-	2	86.1	125.39					402.4	401.5	400.4	399.8	436.3	426.3	425.1	575.0
5-	3	86.1	125.39					375.3	374.5	373.7	373.2	397.7	651.8	650.4	813.0
5-	4	86.1	125.38					403.9	402.8	401.7	401.1	439.8	485.5	485.0	625.8
5-	5	86.2	125.38					380.6	379.6	378.7	378.2	284.9	319.5	318.8	455.0
5-	6	86.3	125.38					232.3	231.6	230.7	230.3	254.8	281.6	281.0	402.1
8-	1	86.4	125.39								198.7	248.4	307.1	306.2	586.6
8-	2	86.3	125.39								180.8	220.5	258.7	258.0	644.0
9-	1	86.6	125.39									331.8	371.8	369.9	533.5
9-	2	86.5	125.39									304.8	332.2	330.9	492.6
9-	3	86.5	125.39									195.8	214.5	213.5	534.4
9-	4	86.8	125.39									193.6	212.0	211.1	388.3
9-	5	86.5	125.39									294.8	318.1	317.0	508.0
9-	6	86.9	125.39									284.5	304.5	303.6	432.7
9-	7	86.4	125.39									249.0	493.1	491.7	593.8
10-	2	86.3	125.39										496.3	495.0	649.9
10-	3	86.4	125.39										490.8	489.6	620.2
10-	4	86.5	125.4										426.9	426.2	491.8
A-	1	89.5	125.38						200.8	201.1	200.8	215.0	230.8	230.4	265.5
A-	2	85.9	125.38						226.4	226.7	226.3	248.6	265.8	265.5	312.5
B-	1	85.9	125.39				243.7	232.5	231.9	231.9	231.6	250.2	267.0	266.5	335.0
B-	2	85.9	125.38				198.5	199.5	199.1	199.1	198.8	212.8	228.8	228.4	272.1
B-	3	85.9	125.38				240.6	222.1	221.7	221.8	221.5	238.4	254.6	254.1	313.5
C-	1	86.0	125.37					384.5	383.7	382.7	382.2	411.1	441.2	440.5	537.8
C-	2	86.0	125.37					243.9	243.1	242.2	241.7	268.7	297.1	296.5	388.8
C-	3	86.0	125.37					157.5	157.1	156.7	156.4	166.7	178.9	178.7	199.4
D-	1	86.5	125.39											229.1	484.1
D-	2	86.5	125.39											211.3	468.3
D-	3	86.5	125.39											158.4	425.5
D-	4	86.5	125.39											205.9	454.7
D-	5	86.5	125.39											152.5	433.7
E-	1	86.4	125.39										398.9	397.7	520.5
E-	2	86.4	125.39										367.0	366.1	476.5
E-	3	86.4	125.39										239.6	239.0	281.5
E-	4	86.4	125.39										249.6	249.1	295.6
F-	1	85.9	125.38							209.6	209.3	225.3	241.9	241.4	280.8
F-	2	85.9	125.38							185.4	185.2	198.9	215.4	215.0	247.0
F-	3	85.9	125.38							166.7	166.5	177.5	192.6	192.2	216.3
F-	4	85.9	125.38							174.9	174.6	186.4	202.0	201.7	227.9
G1-	1	86.1	125.38	205.2	204.9	333.2	331.6	262.8	261.9	261.9	261.3	302.8	331.9	331.3	451.0
G1-	2	86.1	125.38	191.2	190.9	272.8	331.6	234.4	233.7	233.7	233.2	259.9	279.8	279.4	367.8
G1-	3	86.1	125.38	190.1	189.8	273.3	331.6	235.1	234.4	234.4	233.9	261.3	281.1	280.7	370.6
G1-	4	86.1	125.38	194.2	193.9	333.0	331.4	256.3	255.5	255.4	254.8	294.2	321.5	320.9	444.0
G2-	1	86.1	125.38			148.2	149.2	140.0	139.7	139.4	139.2	150.5	161.1	160.9	180.5
G2-	2	86.1	125.38			185.1	187.2	189.2	188.7	188.7	188.4	204.0	220.8	220.4	267.9
G2-	3	86.1	125.39			184.3	186.3	188.9	188.4	188.3	188.0	205.0	222.3	221.8	539.0
G2-	4	86.1	125.38			333.8	332.2	250.3	249.5	249.4	248.8	288.1	315.5	314.8	524.8

Min Flow: 139.2
Max Flow: 846.0

Appendix B SANITARY SEWER CALCULATIONS

B.1 SANITARY SEWER DESIGN SHEET

Stantec	SUBDIVISION: **Ashcroft EUC Site Plan Blk C**		
	DATE:	March 11, 2021	
	REVISION:	3	
	DESIGNED BY:	WAJ	**FILE NUMBER:** 1604-01101
	CHECKED BY:	TKR	

SANITARY SEWER DESIGN SHEET
(City of Ottawa)

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.):	1.5	INDUSTRIAL (LIGHT)	35,000 l/ha/day	BEDDING CLASS	B
PERSONS / SINGLE UNIT	3.4	INSTITUTIONAL	28,000 l/ha/day	MINIMUM COVER	2.50 m
PERSONS / TOWNHOME	2.7	INFILTRATION	0.33 l/s/Ha	HARMON CORRECTION FACTOR	0.8
PERSONS / APARTMENT	1.8				

LOCATION			RESIDENTIAL AREA AND POPULATION									COMMERCIAL		INDUSTRIAL (L)	
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (ha)	UNITS SINGLE	UNITS TOWN	UNITS APT.	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)
REX2A	EX 2	2	0.13	0	5	0	14	0.13	14	3.72	0.2	0.00	0.00	0.00	0.00
R4A	4	3	0.29	0	16	0	43	0.29	43	3.66	0.5	0.00	0.00	0.00	0.00
R5A	5	3	0.11	0	6	0	16	0.11	16	3.71	0.2	0.00	0.00	0.00	0.00
R3A	3	2	0.14	0	7	0	19	0.54	78	3.62	0.9	0.00	0.00	0.00	0.00
R2A	2	2A	0.03	0	2	0	5	0.70	97	3.60	1.1	0.00	0.00	0.00	0.00
R2AA	2A	137-1	0.17	0	13	0	35	0.87	132	3.57	1.5	0.00	0.00	0.00	0.00
			0.87				132								

AREA ID NUMBER	INDUSTRIAL (H) AREA (ha)	INDUSTRIAL (H) ACCU. AREA (ha)	INSTITUTIONAL AREA (ha)	INSTITUTIONAL ACCU. AREA (ha)	GREEN / UNUSED AREA (ha)	GREEN / UNUSED ACCU. AREA (ha)	C+I+I PEAK FLOW (l/s)	INFILTRATION TOTAL AREA (ha)	INFILTRATION ACCU. AREA (ha)	INFILT. FLOW (l/s)	TOTAL FLOW (l/s)
REX2A	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.13	0.13	0.0	0.2
R4A	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.29	0.29	0.1	0.6
R5A	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.11	0.11	0.0	0.2
R3A	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.14	0.54	0.2	1.1
R2A	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.03	0.43	0.1	1.3
R2AA	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.17	0.60	0.2	1.7

AREA ID NUMBER	PIPE LENGTH (m)	DIA (mm)	MATERIAL	CLASS	SLOPE (%)	CAP. (FULL) (l/s)	CAP. V PEAK FLOW (%)	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
REX2A	34.1	200	PVC	SDR 35	0.65	27.0	**0.76%**	0.85	0.21
R4A	44.7	200	PVC	SDR 35	0.40	21.1	**2.89%**	0.66	0.24
R5A	45.4	200	PVC	SDR 35	0.65	27.0	**0.86%**	0.85	0.23
R3A	34.4	200	PVC	SDR 35	0.40	21.1	**5.18%**	0.67	0.29
R2A	9.3	200	PVC	SDR 35	0.40	21.0	**6.06%**	0.66	0.30
R2AA	37.3	200	PVC	SDR 35	0.40	21.0	**8.21%**	0.66	0.33
		200							

B.2 STANTEC CONSULTING LTD. EUC - PHASE 1B, 2A AND 2B SANITARY EXCERPTS

Stantec

SUBDIVISION:

ASHCROFT EAST URBAN COMMUNITY SUBDIVISION - PHASES 1B, 2A & 2B

DATE: November 24, 2017
REVISION: 5
DESIGNED BY: DCT
CHECKED BY: WAJ

SANITARY SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: 160401067

DESIGN PARAMETERS

MAX PEAK FACTOR (RES.)=	4.0	AVG. DAILY FLOW / PERSON	350 L/p/day	MINIMUM VELOCITY	0.60 m/s
MIN PEAK FACTOR (RES.)=	2.0	COMMERCIAL	50,000 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.):	1.5	INDUSTRIAL (LIGHT)	35,000 L/ha/day	BEDDING CLASS	B
PERSONS / SINGLE UNIT	3.4	INSTITUTIONAL	50,000 L/ha/day	MINIMUM COVER	2.50 m
PERSONS / TOWNHOME	2.7	INFILTRATION	0.28 L/s/ha		
PERSONS / APARTMENT	2.3				

LOCATION			RESIDENTIAL AREA AND POPULATION									COMMERCIAL		INDUSTRIAL (L)		INDUSTRIAL (H)		INSTITUTIONAL		GREEN / UNUSED		C+I+I	INFILTRATION			TOTAL	PIPE							
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (ha)	SINGLE	UNITS TOWN	APT.	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (L/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	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)
R143A	143	142	0.49	5	2	0	22	0.49	22	4.00	0.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.49	0.49	0.1	0.5	63.9	200	PVC	SDR 35	1.00	33.5	**1.50%**	1.05
R142A	142	141	0.31	0	2	0	5	0.80	28	4.00	0.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.31	0.80	0.2	0.7	103.4	200	PVC	SDR 35	0.63	26.5	**2.55%**	0.83
R146-1A	146-1	146	1.28	0	82	0	221	1.28	221	4.00	3.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	1.28	1.28	0.4	3.9	14.0	200	PVC	SDR 35	1.00	33.4	**11.80%**	1.05
R146A	146	145	0.12	0	0	0	0	1.39	221	4.00	3.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.12	1.39	0.4	4.0	35.5	200	PVC	SDR 35	0.65	27.0	**14.76%**	0.85
R145A	145	144	0.05	0	0	0	0	1.45	221	4.00	3.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.05	1.45	0.4	4.0	32.0	200	PVC	SDR 35	0.40	21.1	**18.88%**	0.67
R144A	144	141	0.08	0	0	0	0	1.53	221	4.00	3.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.08	1.53	0.4	4.0	36.0	200	PVC	SDR 35	0.40	21.1	**18.99%**	0.67
R141A	141	140	0.40	6	0	0	20	2.73	270	4.00	4.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.40	2.73	0.8	5.1	90.9	200	PVC	SDR 35	0.40	21.1	**24.27%**	0.67
R140A	140	134	0.44	7	0	0	24	3.17	293	4.00	4.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.44	3.17	0.9	5.6	90.9	200	PVC	SDR 35	0.40	21.1	**26.67%**	0.67
R139A	139	138	0.28	6	0	0	20	0.28	20	4.00	0.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.28	0.28	0.1	0.4	34.3	200	PVC	SDR 35	0.80	29.9	**1.37%**	0.94
R138A	138	137	0.16	3	0	0	10	0.44	31	4.00	0.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.16	0.44	0.1	0.6	36.6	200	PVC	SDR 35	0.80	29.9	**2.07%**	0.94
R137-1A	137-1	137	0.76	0	49	0	132	0.76	132	4.00	2.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.76	0.76	0.2	2.4	11.6	200	PVC	SDR 35	1.00	33.4	**7.05%**	1.05
R137A	137	134	0.20	2	0	0	7	1.40	170	4.00	2.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.20	1.40	0.4	3.1	65.3	200	PVC	SDR 35	1.24	37.2	**8.45%**	1.17
R136A	136	135	0.25	5	0	0	17	0.25	17	4.00	0.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.25	0.25	0.1	0.3	24.0	200	PVC	SDR 35	1.00	33.4	**1.03%**	1.05
R135A	135	134	0.16	2	0	0	7	0.41	24	4.00	0.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.16	0.41	0.1	0.5	30.1	200	PVC	SDR 35	1.00	33.4	**1.49%**	1.05
R134A	134	133	0.21	3	0	0	10	5.19	497	3.98	8.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.21	5.19	1.5	9.5	50.5	200	PVC	SDR 35	0.40	21.1	**44.72%**	0.67
R133A	133	103	0.16	2	0	0	7	5.35	504	3.97	8.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.16	5.35	1.5	9.6	33.8	200	PVC	SDR 35	1.00	33.4	**28.73%**	1.05
RF122A, RF122B	F122	110-1	49.13	0	0	0	2149	49.13	2149	3.56	31.0	15.33	15.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.3	64.46	64.46	18.0	62.4	41.7	450	CONCRETE	100-D	0.15	116.4	**53.56%**	0.71
	110-1	110	0.00	0	0	0	0	49.13	2149	3.56	31.0	0.00	15.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.3	0.00	64.46	18.0	62.4	19.9	450	CONCRETE	100-D	0.15	115.5	**53.99%**	0.70
RF126A	F126	233-1	45.29	0	0	0	2806	45.29	2806	3.47	39.4	6.96	6.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.0	52.25	52.25	14.6	60.1	202.4	450	CONCRETE	100-D	0.20	134.4	**44.69%**	0.82
	233-1	233	0.00	0	0	0	0	45.29	2806	3.47	39.4	0.00	6.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.0	0.00	52.25	14.6	60.1	20.6	450	CONCRETE	100-D	0.20	135.7	**44.29%**	0.83
R233B, R233A	233	232	2.23	0	0	0	0	47.52	2806	3.47	39.4	0.00	6.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.0	2.23	54.48	15.3	60.7	63.4	450	CONCRETE	100-D	0.20	134.4	**45.16%**	0.82
	232	231	0.00	0	0	0	0	47.52	2806	3.47	39.4	0.00	6.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.0	0.00	54.48	15.3	60.7	120.0	450	CONCRETE	100-D	0.20	134.4	**45.16%**	0.82
	231	230	0.00	0	0	0	0	47.52	2806	3.47	39.4	0.00	6.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.0	0.00	54.48	15.3	60.7	60.2	450	CONCRETE	100-D	0.20	134.4	**45.16%**	0.82
	230	110-2	0.00	0	0	0	0	47.52	2806	3.47	39.4	0.00	6.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.0	0.00	54.48	15.3	60.7	40.9	450	CONCRETE	100-D	0.20	133.8	**45.36%**	0.82
	110-2	110A	0.00	0	0	0	0	47.52	2806	3.47	39.4	0.00	6.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.0	0.00	54.48	15.3	60.7	11.8	450	CONCRETE	100-D	0.20	134.7	**45.07%**	0.82
	110A	110	0.00	0	0	0	0	47.52	2806	3.47	39.4	0.00	6.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.0	0.00	54.48	15.3	60.7	9.6	450	CONCRETE	100-D	0.20	133.8	**45.36%**	0.82
R110A	110	109	0.41	0	0	0	0	97.06	4955	3.25	65.2	0.00	22.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.3	0.41	119.35	33.4	118.0	39.8	600	CONCRETE	100-D	0.10	202.7	**58.19%**	0.69
	109	108-1	0.00	0	0	0	0	97.06	4955	3.25	65.2	0.00	22.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.3	0.00	119.35	33.4	118.0	26.5	600	CONCRETE	100-D	0.10	204.2	**57.77%**	0.70
	108-1	108	0.00	0	0	0	0	97.06	4955	3.25	65.2	0.00	22.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.3	0.00	119.35	33.4	118.0	35.5	600	CONCRETE	100-D	0.10	205.3	**57.46%**	0.70
	108	107	0.00	0	0	0	0	97.06	4955	3.25	65.2	0.00	22.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	19.3	0.00	119.35	33.4	118.0	24.6	600	CONCRETE	100-D	0.10	203.8	**57.87%**	0.70
R107-1A	107-1	107	1.20	0	65	0	176	1.20	176	4.00	2.8	1.08	1.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.9	2.28	2.28	0.6	4.4	12.5	200	PVC	SDR 35	0.40	21.1	**20.90%**	0.67
R107-2A	107-2	107A	2.34	0	173	0	467	2.34	467	3.99	7.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	2.34	2.34	0.7	8.2	9.7	200	PVC	SDR 35	0.40	21.1	**38.79%**	0.67
R109BA	109B	109A	0.19	1	3	0	12	0.19	12	4.00	0.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.19	0.19	0.1	0.2	27.1	200	PVC	SDR 35	0.65	27.0	**0.88%**	0.85
R109AA	109A	108-1A	0.27	3	5	0	24	0.46	35	4.00	0.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.27	0.46	0.1	0.7	26.2	200	PVC	SDR 35	0.35	19.8	**3.54%**	0.62
R108-1AA	108-1A	108A	0.26	0	8	0	22	0.72	57	4.00	0.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.26	0.72	0.2	1.1	35.5	200	PVC	SDR 35	0.35	19.8	**5.67%**	0.62
R108AA	108A	107A	0.10	0	2	0	5	0.82	62	4.00	1.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.10	0.82	0.2	1.2	25.0	200	PVC	SDR 35	0.35	19.8	**6.25%**	0.62
	107A	107	0.00	0	0	0	0	3.16	529	3.96	8.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	3.16	0.9	9.4	1.9	200	PVC	SDR 35	0.35	19.8	**47.41%**	0.62
R107A	107	106	0.07	0	0	0	0	101.49	5660	3.19	73.2	0.00	23.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.3	0.07	124.86	35.0	128.5	33.9	600	CONCRETE	100-D	0.10	204.6	**62.80%**	0.70
	106	105	0.00	0	0	0	0	101.49	5660	3.19	73.2	0.00	23.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.3	0.00	124.86	35.0	128.5	38.7	600	CONCRETE	100-D	0.10	204.8	**62.75%**	0.70
R112A	112	111	0.48	6	7	0	39	0.48	39	4.00	0.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.48	0.48	0.1	0.8	60.9	200	PVC	SDR 35	1.50	40.9	**1.88%**	1.29
R111A	111	105	0.49	0	14	0	38	0.97	77	4.00	1.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.49	0.97	0.3	1.5	84.2	200	PVC	SDR 35	1.50	40.9	**3.72%**	1.29

Stantec

SUBDIVISION:
ASHCROFT EAST URBAN COMMUNITY SUBDIVISION - PHASES 1B, 2A & 2B

DATE:	November 24, 2017
REVISION:	5
DESIGNED BY:	DCT
CHECKED BY:	WAJ

SANITARY SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: 160401067

DESIGN PARAMETERS

MAX PEAK FACTOR (RES.)=	4.0	AVG. DAILY FLOW / PERSON	350 L/p/day	MINIMUM VELOCITY	0.60 m/s
MIN PEAK FACTOR (RES.)=	2.0	COMMERCIAL	50,000 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.):	1.5	INDUSTRIAL (LIGHT)	35,000 L/ha/day	BEDDING CLASS	B
PERSONS / SINGLE UNIT	3.4	INSTITUTIONAL	50,000 L/ha/day	MINIMUM COVER	2.50 m
PERSONS / TOWNHOME	2.7	INFILTRATION	0.28 L/s/ha		
PERSONS / APARTMENT	2.3				

LOCATION			RESIDENTIAL AREA AND POPULATION									COMMERCIAL		INDUSTRIAL (L)		INDUSTRIAL (H)		INSTITUTIONAL		GREEN / UNUSED		C+I+I	INFILTRATION			TOTAL	PIPE							
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (ha)	UNITS SINGLE	UNITS TOWN	UNITS APT.	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (L/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	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)
	105	104	0.00	0	0	0	0	102.46	5737	3.19	74.1	0.00	23.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.3	0.00	125.83	35.2	129.6	84.3	600	CONCRETE	100-D	0.10	204.8	63.31%	0.70
G118-1A	118-1	118	0.00	0	0	0	0	0.00	0	4.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.20	1.20	0.0	1.20	1.20	0.3	0.3	14.0	150	PVC	DR 28	1.00	15.3	2.19%	0.86
R118A	118	117	0.34	1	4	0	14	0.34	14	4.00	0.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.20	0.0	0.34	1.54	0.4	0.7	57.9	200	PVC	SDR 35	2.00	47.3	1.40%	1.49
R122A	122	121	0.17	3	1	0	13	0.17	13	4.00	0.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.17	0.17	0.0	0.3	18.8	200	PVC	SDR 35	0.65	27.0	0.95%	0.85
R121A	121	120	0.44	0	13	0	35	0.61	48	4.00	0.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.44	0.61	0.2	0.9	48.2	200	PVC	SDR 35	0.35	19.8	4.80%	0.62
R120A	120	119	0.34	1	8	0	25	0.95	73	4.00	1.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.34	0.95	0.3	1.4	45.2	200	PVC	SDR 35	0.35	19.8	7.32%	0.62
R119A	119	117	0.33	3	4	0	21	1.28	94	4.00	1.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.33	1.28	0.4	1.9	43.3	200	PVC	SDR 35	0.35	19.8	9.51%	0.62
R132A	132	130	0.19	3	0	0	10	0.19	10	4.00	0.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.19	0.19	0.1	0.2	36.4	200	PVC	SDR 35	1.00	33.5	0.66%	1.05
R131A	131	130	0.76	14	0	0	48	0.76	48	4.00	0.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.76	0.76	0.2	1.0	107.6	200	PVC	SDR 35	0.65	27.0	3.65%	0.85
R130A	130	126	0.40	3	6	0	26	1.35	84	4.00	1.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.40	1.35	0.4	1.7	77.7	200	PVC	SDR 35	0.40	21.1	8.24%	0.67
R129A	129	128	0.30	5	0	0	17	0.30	17	4.00	0.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.30	0.30	0.1	0.4	61.5	200	PVC	SDR 35	0.65	27.0	1.34%	0.85
R128A	128	127	0.09	1	0	0	3	0.39	20	4.00	0.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.09	0.39	0.1	0.4	11.0	200	PVC	SDR 35	0.65	27.0	1.63%	0.85
R127A	127	126	0.72	14	0	0	48	1.11	68	4.00	1.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.72	1.11	0.3	1.4	114.4	200	PVC	SDR 35	0.40	21.1	6.68%	0.67
R126A	126	125	0.35	0	10	0	27	2.81	179	4.00	2.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.35	2.81	0.8	3.7	72.6	200	PVC	SDR 35	0.35	19.8	18.64%	0.62
R125-1A	125-1	125	1.24	0	77	0	208	1.24	208	4.00	3.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	1.24	1.24	0.3	3.7	11.5	200	PVC	SDR 35	1.00	33.4	11.12%	1.05
R125A	125	124	0.11	0	2	0	5	4.16	393	4.00	6.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.11	4.16	1.2	7.5	29.8	200	PVC	SDR 35	0.35	19.7	38.20%	0.62
R124A	124	123	0.06	0	0	0	0	4.22	393	4.00	6.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.06	4.22	1.2	7.5	33.8	200	PVC	SDR 35	0.35	19.7	38.19%	0.62
R123A	123	117	0.01	0	0	0	0	4.23	393	4.00	6.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.01	4.23	1.2	7.5	15.6	200	PVC	SDR 35	0.35	19.8	38.14%	0.62
R117A	117	115	0.32	5	0	0	17	6.17	518	3.97	8.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.20	0.0	0.32	7.37	2.1	10.4	80.5	200	PVC	SDR 35	0.35	19.8	52.48%	0.62
R116A	116	115	0.35	0	8	0	22	0.35	22	4.00	0.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.35	0.35	0.1	0.4	70.6	200	PVC	SDR 35	1.50	41.0	1.09%	1.29
R115A	115	114	0.25	6	0	0	20	6.76	560	3.95	9.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.20	0.0	0.25	7.96	2.2	11.2	37.5	200	PVC	SDR 35	0.35	19.8	56.53%	0.62
R114A	114	113	0.34	6	0	0	20	7.11	580	3.94	9.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.20	0.0	0.34	8.31	2.3	11.6	43.2	200	PVC	SDR 35	0.35	19.8	58.56%	0.62
R113A, R113B	113	104A	0.66	4	10	0	41	7.76	621	3.92	9.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.20	0.0	0.66	8.96	2.5	12.4	96.9	200	PVC	SDR 35	0.35	19.8	62.56%	0.62
R104CA	104C	104A	0.65	4	13	0	49	0.65	49	4.00	0.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.65	0.65	0.2	1.0	120.7	200	PVC	SDR 35	0.35	19.8	4.91%	0.62
R104BA	104B	104A	0.54	9	2	0	36	0.54	36	4.00	0.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.54	0.54	0.2	0.7	63.2	200	PVC	SDR 35	0.35	19.8	3.72%	0.62
	104A	104	0.00	0	0	0	0	8.96	705	3.89	11.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.20	0.0	0.00	10.16	2.8	14.0	1.9	200	PVC	SDR 35	0.35	19.8	70.61%	0.62
	104	103	0.00	0	0	0	0	111.42	6442	3.14	82.0	0.00	23.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.20	20.3	0.00	135.99	38.1	140.3	75.1	600	CONCRETE	100-D	0.10	204.8	68.54%	0.70
R103A	103	102	0.09	0	0	0	0	116.85	6946	3.11	87.5	0.00	23.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.20	20.3	0.09	141.42	39.6	147.4	41.2	600	CONCRETE	100-D	0.10	204.7	72.00%	0.70
R102-1A	102-1	102	1.12	0	80	0	216	1.12	216	4.00	3.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	1.12	1.12	0.3	3.8	14.0	200	PVC	SDR 35	1.00	33.4	11.40%	1.05
R102A	102	101	0.07	0	0	0	0	118.03	7162	3.10	89.9	0.00	23.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.20	20.3	0.07	142.60	39.9	150.1	27.8	600	PVC	SDR 35	0.10	206.5	72.66%	0.71
R101-1A	101-1	101	1.38	0	70	0	189	1.38	189	4.00	3.1	0.15	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.1	1.53	1.53	0.4	3.6	14.0	200	PVC	SDR 35	1.00	33.4	10.83%	1.05
R101A	101	607	0.22	0	0	0	0	119.63	7351	3.09	91.9	0.00	23.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.20	20.4	0.22	144.35	40.4	152.7	97.9	600	PVC	SDR 35	0.10	204.7	74.61%	0.70
	607-2	607	0.00	0	0	0	0	0.00	0	4.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.0	0.0	18.5	200	PVC	SDR 35	1.00	33.5	0.00%	1.05
CF165A	F165	F164	0.00	0	0	0	0	0.00	0	4.00	0.0	5.51	5.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.8	5.51	5.51	1.5	6.3	92.0	250	PVC	SDR 35	0.35	35.9	17.63%	0.72
	F164	F163	0.00	0	0	0	0	0.00	0	4.00	0.0	0.00	5.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.8	0.00	5.51	1.5	6.3	97.0	250	PVC	SDR 35	0.35	35.9	17.63%	0.72
	F163	F162	0.00	0	0	0	0	0.00	0	4.00	0.0	0.00	5.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.8	0.00	5.51	1.5	6.3	73.2	250	PVC	SDR 35	0.35	35.9	17.63%	0.72
	F162	607-1	0.00	0	0	0	0	0.00	0	4.00	0.0	0.00	5.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.8	0.00	5.51	1.5	6.3	36.4	250	PVC	SDR 35	0.35	35.9	17.63%	0.72
	607-1	607	0.00	0	0	0	0	0.00	0	4.00	0.0	0.00	5.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.8	0.00	5.51	1.5	6.3	11.1	250	PVC	SDR 35	0.35	35.9	17.63%	0.72
WSI FORCEMAIN (17.7L/S)	607	606A	0.00	0	0	0	0	119.63	7351	3.09	91.9	0.00	29.03	WSI	0.00	0.00	0.00	0.00	0.00	0.00	1.20	42.9	0.00	149.86	42.0	176.8	5.0	600	CONCRETE	100-D	0.10	202.2	87.41%	0.69
	606A	606	0.00	0	0	0	0	119.63	7351	3.09	91.9	0.00	29.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.20	42.9	0.00	149.86	42.0	176.8	115.0	600	CONCRETE	100-D	0.10	205.2	86.14%	0.70
	606	605	0.00	0	0	0	0	119.63	7351	3.09	91.9	0.00	29.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.20	42.9	0.00	149.86	42.0	176.8	122.3	600	CONCRETE	100-D	0.10	202.8	87.17%	0.69
R605-1A	605-1	605	2.64	16	22	0	114	2.64	114	4.00	1.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	2.64	2.64	0.7	2.6	20.6	200	PVC	SDR 35	0.35	19.8	13.05%	0.62
R605A	605	604	0.45	0	0	0	0	122.72	7465	3.08	93.1	0.00	29.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.20	42.9	0.45	152.95	42.8	178.9	117.8	600	CONCRETE	100-D	0.10	204.7	87.37%	0.70
R604A	604	603	0.31	0	0	0	0	123.03	7465	3.08	93.1	0.00	29.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.20	42.9	0.31	153.26	42.9	178.9	82.1	600	CONCRETE	100-D	0.10	204.7	87.41%	0.70
R603A	603	602	0.31	0	0	0	0	123.34	7465	3.08	93.1	0.00	29.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.20	42.9	0.31	153.57	43.0	179.0	82.0	600	CONCRETE	100-D	0.10	204.7	87.45%	0.70
R602A	602	601	0.30	0	0	0	0	123.64	7465	3.08	93.1	0.00	29.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.20	42.9	0.30	153.87	43.1	179.1	80.0	600	CONCRETE	100-D	0.10	204.7	87.49%	0.70
R601A	601	600	0.40	0	0	0	0	124.04	7465	3.08	93.1	0.00	29.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.20	42.9	0.40	154.27	43.2	179.2	120.0	600	CONCRETE	100-D	0.10	204.7	87.55%	0.70
																												600						

* ICI AREAS EAST OF BELCOURT BOULEVARD ARE DERIVED FROM THE GLOUCESTER EUC PH2 INFRASTRUCTURE SERVICING STUDY UPDATE, DATED SEPT 27, 2013. PROJECT # 163401012, DRAWING # 9, REV 2, TITLED: SANITARY SEWER SYSTEM

Appendix C STORMWATER MANAGEMENT CALCULATIONS

C.1 Storm Sewer Design Sheet

C.2 PCSWMM Model Input

C.3 PCSWMM Model Output

C.4 Stantec Consulting Ltd. EUC - Phase 1B, 2A and 2B Storm Excerpts

C.1 STORM SEWER DESIGN SHEET

Stantec	Ashcroft EUC Site Plan Blk C		STORM SEWER DESIGN SHEET (City of Ottawa)
	DATE:	2021-06-09	
	REVISION:	3	
	DESIGNED BY:	WAJ	FILE NUMBER: **1604-01101**
	CHECKED BY:	TKR	

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	MANNING'S n =	0.013	BEDDING CLASS = B
b =	6.199	6.053	6.014	6.014	MINIMUM COVER:	2.00 m	
c =	0.810	0.814	0.816	0.820	TIME OF ENTRY	10 min	

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)
	EX 102	102	0.00	0.00	0.00	0.00	0.00	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
																				10.00
EXT PHASE 1 AREA, C904A	EX 904	102A	0.00	0.62	0.00	0.00	0.00	0.00	0.65	0.00	0.00	0.000	0.000	0.404	0.404	0.000	0.000	0.000	0.000	10.00
																				10.24
C102AA	102A	102	0.00	0.10	0.00	0.00	0.00	0.00	0.53	0.00	0.00	0.000	0.000	0.053	0.457	0.000	0.000	0.000	0.000	10.24
																				10.67
C102A, C102B	102	101	0.00	0.15	0.00	0.00	0.00	0.00	0.77	0.00	0.00	0.000	0.000	0.112	0.569	0.000	0.000	0.000	0.000	10.67
																				11.08
C104B, C104A	104	103	0.00	0.13	0.00	0.00	0.00	0.00	0.77	0.00	0.00	0.000	0.000	0.103	0.103	0.000	0.000	0.000	0.000	10.00
																				10.89
C106C, C106A, C106B	106	103	0.00	0.15	0.00	0.00	0.00	0.00	0.66	0.00	0.00	0.000	0.000	0.100	0.100	0.000	0.000	0.000	0.000	10.00
																				11.34
C103A	103	101	0.00	0.02	0.00	0.00	0.00	0.00	0.64	0.00	0.00	0.000	0.000	0.015	0.218	0.000	0.000	0.000	0.000	11.34
																				12.18
	101	101A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.788	0.000	0.000	0.000	0.000	12.18
C101A, C101B	101A	639-1	0.00	0.12	0.00	0.00	0.00	0.00	0.80	0.00	0.00	0.000	0.000	0.096	0.884	0.000	0.000	0.000	0.000	12.33
														0.884						**12.89**

DRAINAGE AREA (cont.) / PIPE SELECTION

AREA ID NUMBER	FROM M.H.	TO M.H.	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)	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)
	EX 102	102	76.81	104.19	122.14	178.56	0.0	0.0	0.0	6.8	300	300	CIRCULAR	PVC	SDR 35	1.00	96.2	**0.00%**	1.37	0.00	0.00
EXT PHASE 1 AREA, C904A	EX 904	102A	76.81	104.19	122.14	178.56	0.0	0.0	117.0	13.1	525	525	CIRCULAR	CONCRETE	100-D	0.30	245.7	**47.61%**	1.10	0.92	0.24
C102AA	102A	102	75.91	102.96	120.69	176.42	0.0	0.0	130.8	25.0	525	525	CIRCULAR	CONCRETE	100-D	0.30	245.7	**53.21%**	1.10	0.96	0.44
C102A, C102B	102	101	74.32	100.77	118.11	172.64	0.0	0.0	159.4	25.0	525	525	CIRCULAR	CONCRETE	100-D	0.30	245.7	**64.87%**	1.10	1.01	0.41
C104B, C104A	104	103	76.81	104.19	122.14	178.56	0.0	0.0	29.9	42.4	300	300	CIRCULAR	PVC	SDR 35	0.50	68.0	**43.93%**	0.97	0.79	0.89
C106C, C106A, C106B	106	103	76.81	104.19	122.14	178.56	0.0	0.0	28.8	48.4	375	375	CIRCULAR	PVC	SDR 35	0.25	82.4	**34.98%**	0.78	0.60	1.34
C103A	103	101	72.01	97.60	114.37	167.15	0.0	0.0	59.2	37.4	375	375	CIRCULAR	PVC	SDR 35	0.25	82.4	**71.78%**	0.78	0.75	0.83
	101	101A	69.35	93.94	110.07	160.83	0.0	0.0	205.6	9.7	525	525	CIRCULAR	CONCRETE	SDR 35	0.30	245.7	**83.65%**	1.10	1.10	0.15
C101A, C101B	101A	639-1	68.90	93.33	109.35	159.77	0.0	0.0	229.1	38.2	525	525	CIRCULAR	CONCRETE	100-D	0.30	245.7	**93.22%**	1.10	1.13	0.56
											525	525									

C.2 PCSWMM MODEL INPUT

```
[TITLE]
;;Project Title/Notes

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

START_DATE           05/15/2014
START_TIME           00:00:00
REPORT_START_DATE    05/15/2014
REPORT_START_TIME    00:00:00
END_DATE             05/16/2014
END_TIME             12:00:00
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         5
RULE_STEP            00:00:00

INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  D-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]
;;Data Source    Parameters
;;-------------- ----------------
CONSTANT         0.0
DRY_ONLY         NO

[RAINGAGES]
;;Name           Format    Interval SCF      Source
;;-------------- --------- -------- -------- ----------
RG1              INTENSITY 0:10     1.0      TIMESERIES 100CHI3

[SUBCATCHMENTS]
;;Name           Rain Gage        Outlet           Area     %Imperv  Width    %Slope   CurbLen  SnowPack

;;-------------- ---------------- ---------------- -------- -------- -------- -------- --------
----------------
C101A            RG1              CB101AB-S        0.055085 84.286   34.72    0.5      0

C101B            RG1              CB101AB-S        0.065539 85.714   34.2     0.5      0

C102A            RG1              CB102AB-S        0.075501 81.429   45.4     0.5      0

C102AA           RG1              CBMH-102A        0.097    47.143   80       1        0

C102B            RG1              CB102AB-S        0.070315 81.429   68.5     0.5      0

C103A            RG1              CB103A-S         0.024113 62.857   27.8     0.7      0

C104A            RG1              CB104AB-S        0.063156 82.857   35.6     0.5      0

C104B            RG1              CB104AB-S        0.070935 80       42.8     0.5      0

C106A            RG1              CB106AB-S        0.072037 81.429   41.3     0.5      0

C106B            RG1              CB106AB-S        0.025667 65.714   41.3     0.5      0

C106C            RG1              CB106C-S         0.053364 44.286   35.4     1.5      0
```

C904A_1	RG1	CBMH-102A	0.0752	47.143	61	1	0
EX_ST101	RG1	EX_ST101-S	0.1777	68.5	99	1	0
EX_ST104	RG1	EX_ST104-S	0.1755	47.1	128.7	1	0
EXT-1	RG1	OF1	0.18	64.3	113	1	0
EXT-2	RG1	EXT2-S	1.13	37.9	254.3	1	0
EXT-3	RG1	OF5	0.0635	68.571	19.4	2	0
INTPOND2	RG1	INTPOND2-S	3.64	51	242.667	1.7	0
ST302-1A	RG1	ST302-1A-S	0.3923	0	45	0.1	0
ST302-2A	RG1	ST302-2A-S	0.4	0	45	0.34	0
ST302-3A	RG1	ST302-3A-S0	0.4126	0	45	0.1	0
ST302A	RG1	ST302A-S	0.2146	0	45	0.64	0
ST303-1A	RG1	ST303-1A-S	0.2085	0	45	0.1	0
ST303-2A	RG1	ST303-2A-S	0.2317	0	45	0.1	0
ST303-3A	RG1	ST303-3A-S	0.2318	0	45	0.1	0
ST601A	RG1	ST601A-S	1.22	78.571	274.5	1	0
ST602A	RG1	ST602A-S	0.452276	54.286	137.8	2	0
ST602B	RG1	ST303-1A-S	0.03	85.714	10.6	1	0
ST603A	RG1	ST603A-S	0.36	68.571	162.8	2	0
ST603B	RG1	ST603B-S	0.152116	35.714	85.6	1	0
ST605A	RG1	ST605A-S	0.68	78.7	151.7	1	0
ST605B	RG1	ST605B-S	0.61	78.7	137.3	1	0
ST605C	RG1	ST605C-S	1.04	78.7	234	1	0
ST605D	RG1	ST605D-S	0.17	41.42	97.7	1	0
ST606A	RG1	ST606A-S	0.27	68.571	89.3	2	0
ST607A	RG1	ST607A-S	0.2838	62.857	130.6	2	0
ST608A	RG1	ST608B-S	0.19	41.4	91.4	1	0
ST609A	RG1	ST609A-S	0.493348	67.143	220.6	2	0
ST610A	RG1	ST610A-S	0.3384	68.57	135	2	0
ST610B	RG1	ST610B-S	0.442367	35.714	298.6	1	0
ST610C	RG1	ST610C-S	0.172785	41.429	115.2	1	0
ST611A	RG1	ST611A-S	0.37206	68.571	195.6	2	0
ST611B	RG1	ST611B-S	0.221206	28.571	109.4	1	0
ST612A	RG1	ST612A-S	0.395856	61.429	203.7	2	0
ST612B	RG1	ST612B-S	0.3	41.429	123	1	0
ST615A	RG1	ST615A-S	0.294268	57.143	105.9	2	0
ST615B	RG1	ST615B-S	0.2	39.059	136.4	1	0
ST616A	RG1	ST616A-S	0.242687	64.286	69.3	2	0
ST616B	RG1	ST616B-S	1.2	10	270	1	0
ST617A	RG1	ST617A-S	0.428792	71.429	167.2	2	0

ST619A	RG1	ST619A-S	0.15	39.059	106	1	0
ST620A	RG1	ST620A-S	0.42	71.429	137.6	2	0
ST621A	RG1	ST621A-S	0.17	54.286	79.4	2	0
ST622A	RG1	ST622A-S	0.191927	38.571	127.8	1	0
ST623A	RG1	ST623A-S	0.23	37.143	100.8	1	0
ST623B	RG1	ST623B-S	1.242807	78.571	279.6	1	0
ST624A	RG1	ST624A-S	0.306805	65.714	128	2	0
ST624B	RG1	ST624B-S	0.182203	41.429	118.3	1	0
ST625A	RG1	ST625A-S	0.285227	65.714	129.5	2	0
ST625B	RG1	ST625B-S	0.414149	64.286	127.3	2	0
ST628A	RG1	ST628A-S	0.302679	64.286	126.1	2	0
ST628B	RG1	ST628B-S	0.25	34.286	139.3	1	0
ST628C	RG1	ST628C-S	0.30537	37.143	181.4	1	0
ST629A	RG1	ST629A-S	0.337219	37.143	105.1	1	0
ST630A	RG1	ST630A-S	0.247321	64.286	100.7	2	0
ST630B	RG1	ST630B-S	0.275414	67.143	135.6	2	0
ST631A	RG1	ST631A-S	0.311443	71.429	152.8	2	0
ST632A	RG1	ST632A-S	0.114795	41.429	76.5	1	0
ST632B	RG1	ST632B-S	1.12	78.571	252	1	0

ST633A	RG1	ST633A-S	0.18	67.143	71.6	2	0
ST633B	RG1	ST633B-S	1.36	78.571	306	1	0
ST634A	RG1	ST634A-S	0.232488	67.143	90.6	2	0
ST635A	RG1	ST635A-S	0.29	65.714	83	2	0
ST637A	RG1	ST637A-S	0.191054	67.143	93.2	2	0
ST638A	RG1	ST638A-S	0.14	85.72	50	2	0
ST639A	RG1	ST639A-S	0.23	67.143	85.6	2	0
ST639B	RG1	ST639B-S	0.274698	34.286	120.3	1	0
ST639C	RG1	ST639C-S	0.402639	44.286	311.4	1	0
;ST639E-S ST639E	RG1	ST639E-S	0.27	68.6	182.6	2	0
;ST639F-S ST639F	RG1	ST639F-S	0.2221	68.6	118.8	2	0
;ST639G-S ST639G	RG1	ST639G-S	0.0468	47.1	31.7	1	0
ST641A	RG1	ST641A-S	0.28	68.571	125.6	2	0
ST641B	RG1	ST641B-S	0.09	25.714	41.7	1	0
ST642A	RG1	ST642A-S	0.47	67.143	131.6	2	0
ST643A	RG1	ST643A-S	0.2213	68.571	98.4	2	0
ST644A	RG1	ST644A-S	0.246609	68.571	116.9	2	0
ST645A	RG1	ST645A-S	0.3924	68.571	125.6	2	0

```
ST645B           RG1              ST645B-S         0.311158 22.857   118.6    1        0

ST646A           RG1              ST646A-S         0.090391 68.571   43.1     2        0

ST648A           RG1              ST648A-S         0.180017 62.857   84.7     2        0

ST648B           RG1              ST648B-S         1.28     78.571   288      1        0


[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
C101A            0.013      0.25       1.57       4.67       0          OUTLET
C101B            0.013      0.25       1.57       4.67       0          OUTLET
C102A            0.013      0.25       1.57       4.67       0          OUTLET
C102AA           0.013      0.25       1.57       4.67       0          OUTLET
C102B            0.013      0.25       1.57       4.67       0          OUTLET
C103A            0.013      0.25       1.57       4.67       0          OUTLET
C104A            0.013      0.25       1.57       4.67       0          OUTLET
C104B            0.013      0.25       1.57       4.67       0          OUTLET
C106A            0.013      0.25       1.57       4.67       0          OUTLET
C106B            0.013      0.25       1.57       4.67       0          OUTLET
C106C            0.013      0.25       1.57       4.67       0          OUTLET
C904A_1          0.013      0.25       1.57       4.67       0          OUTLET
EX_ST101         0.013      0.25       1.57       4.67       25         OUTLET
EX_ST104         0.013      0.25       1.57       4.67       25         PERVIOUS   20
EXT-1            0.013      0.25       1.57       4.67       0          PERVIOUS   25
EXT-2            0.013      0.25       1.57       4.67       0          OUTLET
EXT-3            0.013      0.25       1.57       4.67       0          OUTLET
INTPOND2         0.013      0.25       1.57       4.67       25         PERVIOUS   50
ST302-1A         0.013      0.25       1.57       4.67       0          PERVIOUS   25
ST302-2A         0.013      0.25       1.57       4.67       0          PERVIOUS   25
ST302-3A         0.013      0.25       1.57       4.67       0          PERVIOUS   25
ST302A           0.013      0.25       1.57       4.67       0          PERVIOUS   25
ST303-1A         0.013      0.25       1.57       4.67       0          PERVIOUS   25
ST303-2A         0.013      0.25       1.57       4.67       0          PERVIOUS   25
ST303-3A         0.013      0.25       1.57       4.67       0          PERVIOUS   25
ST601A           0.013      0.25       1.57       4.67       0          OUTLET
ST602A           0.013      0.25       1.57       4.67       0          OUTLET
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ST602B           0.013      0.25       1.57       4.67       0          OUTLET
ST603A           0.013      0.25       1.57       4.67       0          OUTLET
ST603B           0.013      0.25       1.57       4.67       0          PERVIOUS   25
ST605A           0.013      0.25       1.57       4.67       0          OUTLET
ST605B           0.013      0.25       1.57       4.67       0          OUTLET
ST605C           0.013      0.25       1.57       4.67       0          OUTLET
ST605D           0.013      0.25       1.57       4.67       0          OUTLET
ST606A           0.013      0.25       1.57       4.67       0          OUTLET
ST607A           0.013      0.25       1.57       4.67       0          OUTLET
ST608A           0.013      0.25       1.57       4.67       0          OUTLET
ST609A           0.013      0.25       1.57       4.67       0          OUTLET
ST610A           0.013      0.25       1.57       4.67       0          OUTLET
ST610B           0.013      0.25       1.57       4.67       0          PERVIOUS   25
ST610C           0.013      0.25       1.57       4.67       0          PERVIOUS   25
ST611A           0.013      0.25       1.57       4.67       0          OUTLET
ST611B           0.013      0.25       1.57       4.67       0          PERVIOUS   25
ST612A           0.013      0.25       1.57       4.67       0          OUTLET
ST612B           0.013      0.25       1.57       4.67       0          PERVIOUS   25
ST615A           0.013      0.25       1.57       4.67       0          OUTLET
ST615B           0.013      0.25       1.57       4.67       0          OUTLET
ST616A           0.013      0.25       1.57       4.67       0          OUTLET
ST616B           0.013      0.25       1.57       4.67       0          OUTLET
ST617A           0.013      0.25       1.57       4.67       0          OUTLET
ST619A           0.013      0.25       1.57       4.67       0          OUTLET
ST620A           0.013      0.25       1.57       4.67       0          OUTLET
ST621A           0.013      0.25       1.57       4.67       0          OUTLET
ST622A           0.013      0.25       1.57       4.67       0          PERVIOUS   25
ST623A           0.013      0.25       1.57       4.67       0          PERVIOUS   25
ST623B           0.013      0.25       1.57       4.67       0          OUTLET
ST624A           0.013      0.25       1.57       4.67       0          OUTLET
ST624B           0.013      0.25       1.57       4.67       0          PERVIOUS   25
ST625A           0.013      0.25       1.57       4.67       0          OUTLET
ST625B           0.013      0.25       1.57       4.67       0          OUTLET
ST628A           0.013      0.25       1.57       4.67       0          OUTLET
ST628B           0.013      0.25       1.57       4.67       0          PERVIOUS   25
ST628C           0.013      0.25       1.57       4.67       0          PERVIOUS   25
ST629A           0.013      0.25       1.57       4.67       0          PERVIOUS   25
ST630A           0.013      0.25       1.57       4.67       0          OUTLET
ST630B           0.013      0.25       1.57       4.67       0          OUTLET
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ST631A          0.013      0.25       1.57       4.67       0          OUTLET
ST632A          0.013      0.25       1.57       4.67       0          PERVIOUS   25
ST632B          0.013      0.25       1.57       4.67       0          OUTLET
ST633A          0.013      0.25       1.57       4.67       0          OUTLET
ST633B          0.013      0.25       1.57       4.67       0          OUTLET
ST634A          0.013      0.25       1.57       4.67       0          OUTLET
ST635A          0.013      0.25       1.57       4.67       0          OUTLET
ST637A          0.013      0.25       1.57       4.67       0          OUTLET
ST638A          0.013      0.25       1.57       4.67       0          OUTLET
ST639A          0.013      0.25       1.57       4.67       0          OUTLET
ST639B          0.013      0.25       1.57       4.67       0          PERVIOUS   25
ST639C          0.013      0.25       1.57       4.67       0          PERVIOUS   25
ST639E          0.013      0.25       1.57       4.67       0          OUTLET
ST639F          0.013      0.25       1.57       4.67       0          OUTLET
ST639G          0.013      0.25       1.57       4.67       0          PERVIOUS   25
ST641A          0.013      0.25       1.57       4.67       0          OUTLET
ST641B          0.013      0.25       1.57       4.67       0          PERVIOUS   25
ST642A          0.013      0.25       1.57       4.67       0          OUTLET
ST643A          0.013      0.25       1.57       4.67       0          OUTLET
ST644A          0.013      0.25       1.57       4.67       0          OUTLET
ST645A          0.013      0.25       1.57       4.67       0          OUTLET
ST645B          0.013      0.25       1.57       4.67       0          PERVIOUS   25
ST646A          0.013      0.25       1.57       4.67       0          OUTLET
ST648A          0.013      0.25       1.57       4.67       0          OUTLET
ST648B          0.013      0.25       1.57       4.67       0          OUTLET

[INFILTRATION]
;;Subcatchment   MaxRate    MinRate    Decay      DryTime    MaxInfil
;;-------------- ---------- ---------- ---------- ---------- ----------
C101A           76.2       13.2       4.14       7          0
C101B           76.2       13.2       4.14       7          0
C102A           76.2       13.2       4.14       7          0
C102AA          76.2       13.2       4.14       7          0
C102B           76.2       13.2       4.14       7          0
C103A           76.2       13.2       4.14       7          0
C104A           76.2       13.2       4.14       7          0
C104B           76.2       13.2       4.14       7          0
C106A           76.2       13.2       4.14       7          0
C106B           76.2       13.2       4.14       7          0
C106C           76.2       13.2       4.14       7          0
C904A_1         76.2       13.2       4.14       7          0
EX_ST101        76.2       13.2       4.14       7          0
EX_ST104        76.2       13.2       4.14       7          0
EXT-1           76.2       13.2       4.14       7          0
EXT-2           76.2       13.2       4.14       7          0
EXT-3           76.2       13.2       4.14       7          0
INTPOND2        76.2       13.2       4.14       7          0
ST302-1A        76.2       13.2       4.14       7          0
ST302-2A        76.2       13.2       4.14       7          0
ST302-3A        76.2       13.2       4.14       7          0
ST302A          76.2       13.2       4.14       7          0
ST303-1A        76.2       13.2       4.14       7          0
ST303-2A        76.2       13.2       4.14       7          0
ST303-3A        76.2       13.2       4.14       7          0
ST601A          76.2       13.2       4.14       7          0
ST602A          76.2       13.2       4.14       7          0
ST602B          76.2       13.2       4.14       7          0
ST603A          76.2       13.2       4.14       7          0
ST603B          76.2       13.2       4.14       7          0
ST605A          76.2       13.2       4.14       7          0
ST605B          76.2       13.2       4.14       7          0
ST605C          76.2       13.2       4.14       7          0
ST605D          76.2       13.2       4.14       7          0
ST606A          76.2       13.2       4.14       7          0
ST607A          76.2       13.2       4.14       7          0
ST608A          76.2       13.2       4.14       7          0
ST609A          76.2       13.2       4.14       7          0
ST610A          76.2       13.2       4.14       7          0
ST610B          76.2       13.2       4.14       7          0
ST610C          76.2       13.2       4.14       7          0
ST611A          76.2       13.2       4.14       7          0
ST611B          76.2       13.2       4.14       7          0
ST612A          76.2       13.2       4.14       7          0
ST612B          76.2       13.2       4.14       7          0
ST615A          76.2       13.2       4.14       7          0
ST615B          76.2       13.2       4.14       7          0
ST616A          76.2       13.2       4.14       7          0
ST616B          76.2       13.2       4.14       7          0
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ST617A          76.2      13.2      4.14      7         0
ST619A          76.2      13.2      4.14      7         0
ST620A          76.2      13.2      4.14      7         0
ST621A          76.2      13.2      4.14      7         0
ST622A          76.2      13.2      4.14      7         0
ST623A          76.2      13.2      4.14      7         0
ST623B          76.2      13.2      4.14      7         0
ST624A          76.2      13.2      4.14      7         0
ST624B          76.2      13.2      4.14      7         0
ST625A          76.2      13.2      4.14      7         0
ST625B          76.2      13.2      4.14      7         0
ST628A          76.2      13.2      4.14      7         0
ST628B          76.2      13.2      4.14      7         0
ST628C          76.2      13.2      4.14      7         0
ST629A          76.2      13.2      4.14      7         0
ST630A          76.2      13.2      4.14      7         0
ST630B          76.2      13.2      4.14      7         0
ST631A          76.2      13.2      4.14      7         0
ST632A          76.2      13.2      4.14      7         0
ST632B          76.2      13.2      4.14      7         0
ST633A          76.2      13.2      4.14      7         0
ST633B          76.2      13.2      4.14      7         0
ST634A          76.2      13.2      4.14      7         0
ST635A          76.2      13.2      4.14      7         0
ST637A          76.2      13.2      4.14      7         0
ST638A          76.2      13.2      4.14      7         0
ST639A          76.2      13.2      4.14      7         0
ST639B          76.2      13.2      4.14      7         0
ST639C          76.2      13.2      4.14      7         0
ST639E          76.2      13.2      4.14      7         0
ST639F          76.2      13.2      4.14      7         0
ST639G          76.2      13.2      4.14      7         0
ST641A          76.2      13.2      4.14      7         0
ST641B          76.2      13.2      4.14      7         0
ST642A          76.2      13.2      4.14      7         0
ST643A          76.2      13.2      4.14      7         0
ST644A          76.2      13.2      4.14      7         0
ST645A          76.2      13.2      4.14      7         0
ST645B          76.2      13.2      4.14      7         0
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ST646A          76.2      13.2      4.14      7         0
ST648A          76.2      13.2      4.14      7         0
ST648B          76.2      13.2      4.14      7         0

[JUNCTIONS]
;;Name          Elevation  MaxDepth   InitDepth  SurDepth   Aponded
;;-------------- ---------- ---------- ---------- ---------- ----------
500A            77.869     5.131      0.131      0          0
501             78.063     8.75       0          0          0
502             77.822     8.762      0          0          0
503             77.91      8.504      0          0.23       0
504             78.45      8.041      0          0          0
505             78.545     7.913      0          0          0
506             78.704     6.917      0          0.23       0
507             79.115     7.412      0          0          0
508             79.231     7.371      0          0          0
509             79.347     7.274      0          0.23       0
601             79.583     6.742      0          0          0
602             80.41      5.59       0          0          0
603             80.539     5.211      0          0          0
605             80.871     4.889      0          0          0
606             80.916     5.044      0          0          0
607             80.965     4.985      0          0          0
608             82.49733   3.605      0          0          0
609             82.87734   3.256      0          0          0
610             81.071     4.899      0          0          0
611             81.4883    4.634      0          0          0
612             81.69011   4.228      0          0          0
613             81.73578   4.477      0          0          0
614             83.12044   3.11       0          0          0
615             81.84018   4.609      0          0          0
616             82.93603   3.49       0          0          0
617             82.47569   3.675      0          0          0
618             82.77481   3.636      0          0          0
619             83.02869   3.116      0          0          0
620             83.38427   2.76       0          0          0
621             82.01312   4.236      0          0          0
622             82.06271   4.374      0          0          0
623             82.18508   4.284      0          0          0
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624              82.43968   4.02       0          0          0
625              83.03339   3.364      0          0          0
626              83.31461   3.117      0          0          0
627              83.66688   3.082      0          0          0
628              82.86635   3.76       0          0          0
629              83.89499   3.156      0          0          0
630              83.79005   2.833      0          0          0
631              81.31125   4.709      0          0          0
632              81.97262   3.81       0          0          0
633              82.1651    3.666      0          0          0
634              83.01075   2.967      0          0          0
635              81.49776   4.363      0          0          0
636              81.75209   4.334      0          0          0
637              82.72404   3.232      0          0          0
638              83.07602   2.982      0          0          0
639              82.35526   3.739      0          0          0
640              82.84914   3.269      0          0          0
641              83.03884   3.255      0          0          0
642              81.99246   4.091      0          0          0
643              82.08634   3.926      0          0          0
644              83.1284    3.121      0          0          0
645              83.62936   3.386      0          0          0
646              82.52637   3.773      0          0          0
647              82.603     3.698      0          0          0
648              82.776     3.587      0          0          0
648-1            82.887     3.663      0          0          0
EXMH904          84.19      3          0          0          0
J1               76         5          2          0          0
J7               83.54      3.09       0          0          0
ST634A-S2        84.36      1.74       0          0          0

[OUTFALLS]
;;Name           Elevation  Type       Stage Data       Gated    Route To
;;-------------- ---------- ---------- ---------------- -------- ----------------
Creek            77.92      FREE                        NO
OF_MudCreek      84.26      FREE                        NO
OF1              87.12      FREE                        NO
OF2              79.5       FREE                        NO
OF3              83.5       FREE                        NO
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OF5              87.03      FREE                        NO

[STORAGE]
;;Name           Elev.    MaxDepth   InitDepth  Shape      Curve Name/Params            N/A      Fevap
Psi      Ksat     IMD
;;-------------- -------- ---------- ----------- ---------- ---------------------------- -------- --------
       -------- --------
C101B1-S         86.15    0.35       0          FUNCTIONAL 1.13      0         0         0         0
C102A-S          86.2     0.35       0          FUNCTIONAL 1.13      0         0         0         0
C103A1-S         86.26    0.35       0          FUNCTIONAL 0         0         0         0         0
C104A1-S         86.33    0.35       0          FUNCTIONAL 0         0         0         0         0
C106A1-S         86.2     0.35       0          FUNCTIONAL 0         0         0         0         0
C106B-S          86.23    0.35       0          FUNCTIONAL 1.13      0         0         0         0
C904A-S          83.21    2.91       0          FUNCTIONAL 1.13      0         0         0         0
CB101AB-S        84.68    1.73       0          FUNCTIONAL 0         0         0         0         0
CB102AB-S        84.69    1.73       0          FUNCTIONAL 0         0         0         0         0
CB103A-S         84.76    1.73       0          FUNCTIONAL 0         0         0         0         0
CB104AB-S        84.73    1.73       0          FUNCTIONAL 0         0         0         0         0
CB106AB-S        84.71    1.73       0          FUNCTIONAL 0         0         0         0         0
CB106C-S         84.41    1.85       0          FUNCTIONAL 0         0         0         0         0
CBMH-102A        82.972   3.308      0          FUNCTIONAL 0         0         0         0         0
;RD
EX_ST101-S       84.49    2.22       0          FUNCTIONAL 0         0         0         0         0
EX_ST104-S       84.74    1.92       0          FUNCTIONAL 0         0         0         0         0
EXT2-S           85.11    2.15       0          TABULAR    EXT2-S                     0         0
INTPOND2-S       76       4.95       2          TABULAR    IntPond2storage            0         0
ST302-1A-S       85.89    0.68       0          FUNCTIONAL 0         0         0         0         0
ST302-1A-S0      85.77    0.68       0          FUNCTIONAL 0         0         0         0         0
ST302-2A-S       86.22    0.68       0          FUNCTIONAL 0         0         0         0         0
ST302-3A-S0      86.51    0.68       0          FUNCTIONAL 0         0         0         0         0
ST302A-S         85.7     0.68       0          FUNCTIONAL 0         0         0         0         0
ST303-1A-S       81.494   4.126      0          FUNCTIONAL 0         0         0         0         0
;RD
ST303-1A-S0      85.82    0.45       0          FUNCTIONAL 0         0         0         0         0
ST303-2A-S       85.34    0.68       0          FUNCTIONAL 0         0         0         0         0
ST303-3A-S       85.52    0.68       0          FUNCTIONAL 0         0         0         0         0
ST601A-S         84.15    2.15       0          TABULAR    ST601A-S                   0         0
;RD
ST602A-S         83.87    2.15       0          FUNCTIONAL 0         0         0         0         0
```

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;RD
ST602A-S0       86.03   0.35    0       FUNCTIONAL 0    0       0       0       0
;RD
ST603A-S        84.29   1.73    0       FUNCTIONAL 0    0       0       0       0
;RD
ST603A-S0       85.97   0.35    0       FUNCTIONAL 0    0       0       0       0
ST603B-S        83.68   2.38    0       FUNCTIONAL 0    0       0       0       0
ST605A-S        84.25   2.15    0       TABULAR    ST605A-S             0       0
ST605B-S        84.51   2.15    0       TABULAR    ST605B-S             0       0
ST605C-S        84.4    2.15    0       TABULAR    ST605C-S             0       0
ST605D-S        83.96   2.2     0       FUNCTIONAL 0    0       0       0       0
;RD
ST606A-S        84.34   1.73    0       FUNCTIONAL 0    0       0       0       0
;RD
ST606A-S1       86.08   0.35    0       FUNCTIONAL 0    0       0       0       0
;RD
ST607A-S        84.07   2.15    0       FUNCTIONAL 0    0       0       0       0
ST608B-S        84      2.3     0       FUNCTIONAL 0    0       0       0       0
;RD
ST609A-S        84.08   2.15    0       FUNCTIONAL 0    0       0       0       0
;RD
ST610A-S        84.36   1.73    0       FUNCTIONAL 0    0       0       0       0
;RD
ST610A-S0       86.11   0.35    0       FUNCTIONAL 0    0       0       0       0
ST610B-S        83.75   2.36    0       FUNCTIONAL 0    0       0       0       0
ST610C-S        84.08   2.32    0       FUNCTIONAL 0    0       0       0       0
;RD
ST611A-S        83.93   2.15    0       FUNCTIONAL 0    0       0       0       0
ST611B-S        83.78   2.34    0       FUNCTIONAL 0    0       0       0       0
;RD
ST611C-S0       86.08   0.35    0       FUNCTIONAL 0    0       0       0       0
;RD
ST612A-S        84.03   2.15    0       FUNCTIONAL 0    0       0       0       0
;RD
ST612A-S0       86.21   0.35    0       FUNCTIONAL 0    0       0       0       0
ST612B-S        83.86   2.46    0       FUNCTIONAL 0    0       0       0       0
;RD
ST613A-S0       86.17   0.35    0       FUNCTIONAL 0    0       0       0       0
ST614A-S0       86.17   0.35    0       FUNCTIONAL 0    0       0       0       0
```

```
;RD
ST615A-S        84.22   2.15    0       FUNCTIONAL 0    0       0       0       0
;RD
ST615A-S0       86.4    0.35    0       FUNCTIONAL 0    0       0       0       0
ST615B-S        84.22   2.32    0       FUNCTIONAL 0    0       0       0       0
;RD
ST616A-S        84.33   2.15    0       FUNCTIONAL 0    0       0       0       0
;RD
ST616A-S0       86.38   0.35    0       FUNCTIONAL 0    0       0       0       0
ST616B-S        84.63   2.15    0       FUNCTIONAL 0    0       0       0       0
;RD
ST617A-S        84.22   2.15    0       FUNCTIONAL 0    0       0       0       0
;RD
ST617A-S0       86.27   0.35    0       FUNCTIONAL 0    0       0       0       0
ST619A-S        84.25   2.13    0       FUNCTIONAL 0    0       0       0       0
;RD
ST620A-S        84.18   2.15    0       FUNCTIONAL 0    0       0       0       0
;RD
ST621A-S        84.38   2.15    0       FUNCTIONAL 0    0       0       0       0
;RD
ST621A-S0       86.45   0.35    0       FUNCTIONAL 0    0       0       0       0
ST622A-S        84.28   2.18    0       FUNCTIONAL 0    0       0       0       0
ST623A-S        84.36   2.31    0       FUNCTIONAL 0    0       0       0       0
ST623B-S        84.95   2.15    0       TABULAR    ST623B-S             0       0
;RD
ST624A-S        84.4    2.15    0       FUNCTIONAL 0    0       0       0       0
;RD
ST624A-S0       86.56   0.35    0       FUNCTIONAL 0    0       0       0       0
;RD
ST624A-S1       86.38   0.35    0       FUNCTIONAL 0    0       0       0       0
ST624B-S        84.25   2.33    0       FUNCTIONAL 0    0       0       0       0
;RD
ST625A-S        84.49   2.15    0       FUNCTIONAL 0    0       0       0       0
;RD
ST625B-S        84.51   2.15    0       FUNCTIONAL 0    0       0       0       0
;RD
ST625B-S0       86.56   0.35    0       FUNCTIONAL 0    0       0       0       0
;RD
ST628A-S        84.51   2.15    0       FUNCTIONAL 0    0       0       0       0
```

```
;RD
ST628A-S0        87.19    0.35     0          FUNCTIONAL 0        0        0        0        0
;RD
ST628A-S1        87.06    0.35     0          FUNCTIONAL 0        0        0        0        0
ST628B-S         84.51    2.5      0          FUNCTIONAL 0        0        0        0        0
ST628C-S         84.48    2.34     0          FUNCTIONAL 0        0        0        0        0
ST629A-S         84.95    2.38     0          FUNCTIONAL 0        0        0        0        0
;RD
ST630A-S         84.61    2.15     0          FUNCTIONAL 0        0        0        0        0
;RD
ST630B-S         84.7     2.15     0          FUNCTIONAL 0        0        0        0        0
;RD
ST630B-S0        86.69    0.35     0          FUNCTIONAL 0        0        0        0        0
;RD
ST630B-S1        86.69    0.35     0          FUNCTIONAL 0        0        0        0        0
;RD
ST631A-S         84.27    1.73     0          FUNCTIONAL 0        0        0        0        0
;RD
ST631A-S0        85.97    0.35     0          FUNCTIONAL 0        0        0        0        0
ST632A-S         83.71    2.42     0          FUNCTIONAL 0        0        0        0        0
ST632B-S         84.1     2.15     0          TABULAR    ST632B-S                   0        0
;RD
ST633A-S         83.83    2.15     0          FUNCTIONAL 0        0        0        0        0
;RD
ST633A-S0        85.89    0.35     0          FUNCTIONAL 0        0        0        0        0
ST633B-S         84.15    2.15     0          TABULAR    ST633B-S                   0        0
;RD
ST634A-S         83.78    2.15     0          FUNCTIONAL 0        0        0        0        0
;RD
ST634A-S0        85.77    0.35     0          FUNCTIONAL 0        0        0        0        0
;RD
ST634A-S1        85.75    0.35     0          FUNCTIONAL 0        0        0        0        0
;RD
ST635A-S         83.94    2.15     0          FUNCTIONAL 0        0        0        0        0
;RD
ST637A-S         84       2.15     0          FUNCTIONAL 0        0        0        0        0
;RD
ST637A-S0        86.06    0.35     0          FUNCTIONAL 0        0        0        0        0
;RD
```

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ST638A-S         84.06    2.15     0          FUNCTIONAL 0        0        0        0        0
;RD
ST639A-S         83.94    2.15     0          FUNCTIONAL 0        0        0        0        0
;RD
ST639A-S0        86       0.35     0          FUNCTIONAL 0        0        0        0        0
ST639B-S         83.83    2.37     0          FUNCTIONAL 0        0        0        0        0
ST639C-S         83.83    2.36     0          FUNCTIONAL 0        0        0        0        0
;ST639E-S
ST639E-S         84.33    2.25     0          FUNCTIONAL 0        0        6.47     0        0
;ST639F-S
ST639F-S         84.77    1.96     0          FUNCTIONAL 0        0        1.18     0        0
;ST639G-S
ST639G-S         84.85    2.15     0          FUNCTIONAL 0        0        0        0        0
;RD
ST641A-S         84.17    2.15     0          FUNCTIONAL 0        0        0        0        0
;RD
ST641A-S0        86.15    0.35     0          FUNCTIONAL 0        0        0        0        0
;RD
ST641A-S1        86.09    0.35     0          FUNCTIONAL 0        0        0        0        0
ST641B-S         84.07    2.41     0          FUNCTIONAL 0        0        0        0        0
;RD
ST642A-S         83.95    2.15     0          FUNCTIONAL 0        0        0        0        0
;RD
ST642A-S0        86.13    0.35     0          FUNCTIONAL 0        0        0        0        0
;RD
ST643A-S         84.18    2.15     0          FUNCTIONAL 0        0        0        0        0
;RD
ST643A-S0        86.26    0.35     0          FUNCTIONAL 0        0        0        0        0
;RD
ST643A-S1        86.13    0.35     0          FUNCTIONAL 0        0        0        0        0
;RD
ST644A-S         84.19    2.15     0          FUNCTIONAL 0        0        0        0        0
;RD
ST645A-S         84.29    2.15     0          FUNCTIONAL 0        0        0        0        0
;RD
ST645A-S0        87.15    0.35     0          FUNCTIONAL 0        0        0        0        0
;RD
ST645A-S1        86.28    0.35     0          FUNCTIONAL 0        0        0        0        0
ST645B-S         84.13    2.61     0          FUNCTIONAL 0        0        0        0        0
```

```
;RD
ST646A-S         84.22    2.15       0          FUNCTIONAL 0         0         0        0        0
;RD
ST648A-S         84.21    2.25       0          FUNCTIONAL 0         0         0        0        0
;RD
ST648A-S0        86.42    0.35       0          FUNCTIONAL 0         0         0        0        0
;RD
ST648A-S1        86.28    0.35       0          FUNCTIONAL 0         0         0        0        0
ST648B-S         84.57    2.15       0          TABULAR    ST648B-S                   0        0
;1200mm
STM-101          82.872   3.332      0          FUNCTIONAL 1.13      0         0        0        0
STM-101A         82.728   3.528      0          FUNCTIONAL 1.13      0         0        0        0
;1500mm
STM-102          82.977   3.262      0          FUNCTIONAL 1.13      0         0        0        0
;1200mm
STM-103          83.327   2.96       0          FUNCTIONAL 1.13      0         0        0        0
;1200mm
STM-104          83.569   2.718      0          FUNCTIONAL 1.13      0         0        0        0
;1200mm
STM-106          82.94    3.272      0          FUNCTIONAL 0         0         0        0        0
;1200mm
STM-639          82.713   3.476      0          FUNCTIONAL 1.13      0         0        0        0

[CONDUITS]
;;Name           From Node        To Node          Length     Roughness  InOffset   OutOffset  InitFlow
MaxFlow
;;-------------- ---------------- ---------------- ---------- ---------- ---------- ---------- ----------
----------
14               CB102AB-S        C102A-S          19.931     0.013      86.07      86.2       0          0

15               C102A-S          CB101AB-S        28.277     0.013      86.2       86.06      0          0

16               CB101AB-S        C101B1-S         14.355     0.013      86.06      86.15      0          0

18               CB104AB-S        C106B-S          18.555     0.013      86.12      86.23      0          0

19               C106B-S          CB106AB-S        34.06      0.013      86.23      86.09      0          0

9                STM-101A         STM-639          38.2       0.013      83.028     82.914     0          0

C1               ST645A-S1        ST644A-S         49         0.013      86.28      85.99      0          0

C10              ST623A-S         ST621A-S         5          0.025      86.62      86.52      0          0

C11              ST623B-S         ST621A-S0        100        0.013      86.95      86.45      0          0

C12              ST634A-S2        OF_MudCreek      10         0.013      84.36      84.26      0          0

C13              ST619A-S         ST302A-S         7          0.025      86.33      86.19      0          0

C14              ST616B-S         ST642A-S         70         0.025      86.43      86.08      0          0

C15              ST622A-S         ST302-1A-S0      7          0.025      86.31      86.17      0          0

C16              ST605B-S         ST612A-S0        100        0.013      86.51      86.21      0          0

C17              ST615B-S         ST615A-S         5          0.025      86.45      86.35      0          0

C18              ST639C-S         ST639A-S         5          0.025      86.09      85.99      0          0

C19              ST605C-S         ST303-1A-S       138        0.013      86.4       85.92      0          0

C2               ST630B-S1        ST628A-S         38.647     0.013      86.69      86.31      0          0

C20              ST608B-S         ST607A-S         5          0.025      86.25      86.15      0          0

C21              ST607A-S         ST610A-S         48.13      0.013      85.87      85.74      0          0

C22              ST605D-S         ST303-1A-S0      5          0.013      86.11      86.01      0          0

C23              ST601A-S         ST602A-S0        115        0.013      86.15      86.03      0          0

C24              ST603B-S         ST603A-S         5          0.025      85.94      85.84      0          0

C25              ST610B-S         ST610A-S         5          0.025      86.01      85.89      0          0

C26              ST610C-S         ST610A-S         5          0.025      86.01      85.91      0          0
```

C27	ST612B-S	ST638A-S	5	0.025	86.23	86.13	0	0
C28	ST639B-S	ST639A-S	5	0.025	86.09	85.89	0	0
C29	ST611B-S	ST611A-S	5	0.013	86.04	85.94	0	0
C3	648-1	648	10.504	0.013	83.187	83.151	0	0
C30	ST632A-S	ST633A-S0	5	0.013	85.98	85.89	0	0
C304_1	509	508	112.699	0.013	79.647	79.534	0	0
C304_3	508	507	112.851	0.013	79.531	79.418	0	0
C304_4	507	506	111.446	0.013	79.415	79.304	0	0
C305_1	506	505	119.018	0.013	79.004	78.849	0	0
C305_3	505	504	70.302	0.013	78.845	78.754	0	0
C305_4	504	503	120	0.013	78.75	78.51	0	0
C306_1	502	501	39.062	0.013	78.122	78.083	0	0
C31	ST633B-S	ST634A-S0	55	0.013	86.15	85.77	0	0
C32	ST632B-S	ST634A-S0	53.7	0.013	86.1	85.77	0	0
C33	ST641B-S	ST641A-S1	13	0.025	86.32	86.18	0	0
C34	C106A1-S	ST641A-S1	11.365	0.013	86.2	86.09	0	0
C35	ST630A-S	ST628A-S	16.75	0.013	86.41	86.31	0	0
C36	ST648B-S	ST648A-S1	38	0.013	86.57	86.28	0	0
C37	500A	INTPOND2-S	59.335	0.013	77.869	77.78	0	0
C38	EXT2-S	ST648B-S	108	0.013	87.11	86.57	0	0
C39	INTPOND2-S	OF2	36.1	0.025	79.95	79.5	0	0
C4	ST615A-S	ST613A-S0	26.52	0.013	86.02	86.17	0	0
C40	ST639G-S	ST639F-S	5	0.025	86.65	86.38	0	0
C41	ST639E-S	CB102AB-S	52.57	0.013	86.23	86.07	0	0
C42	ST639F-S	ST639E-S	32.09	0.013	86.38	86.23	0	0
C43	J1	Creek	16.6	0.013	78	77.92	0	0
C44	ST302-2A-S	ST302-1A-S	145.1	0.035	86.22	85.89	0	0
C46	503	502	88.39	0.013	78.21	78.122	0	0
C47	C101B1-S	ST639A-S	23.397	0.013	86.15	86.09	0	0
C48	C104A1-S	CB104AB-S	27.511	0.01	86.33	86.12	0	0
C49	ST603A-S0	ST606A-S	50	0.013	85.97	85.72	0	0
C5	ST628C-S	ST624A-S0	5	0.025	86.72	86.62	0	0
C50	ST603A-S0	ST603A-S	50	0.013	85.97	85.67	0	0
C51	ST621A-S0	ST624A-S	55	0.013	86.45	86.2	0	0
C52	ST605A-S	ST606A-S	84	0.013	86.25	85.87	0	0
C53	C103A1-S	C106B-S	6.745	0.01	86.26	86.23	0	0
C54	C103A1-S	CB103A-S	18.511	0.01	86.26	86.14	0	0
C55	CB106AB-S	C106A1-S	20.277	0.013	86.09	86.2	0	0
C56	CB103A-S	C102A-S	11.919	0.01	86.14	86.2	0	0

C57	C904A-S	CBMH-102A	13.1	0.013	83.51	83.47	0	0
C58	CBMH-102A	STM-102	25.4	0.013	83.47	83.39	0	0
C59	J7	OF3	10	0.013	83.54	83.5	0	0
C6	ST629A-S	ST628A-S1	5	0.025	87.23	87.13	0	0
C60	EX_ST101-S	ST643A-S1	51.81	0.013	86.36	86.13	0	0
C61	EX_ST104-S	ST643A-S1	7	0.013	86.31	86.26	0	0
C62	STM-101	STM-101A	9.7	0.013	83.064	83.035	0	0
C7	ST645B-S	ST645A-S	5	0.013	86.41	86.31	0	0
C7_1	ST625A-S	ST624A-S1	5	0.013	86.29	86.38	0	0
C7_2	ST624A-S1	ST624A-S	17.15	0.013	86.38	86.2	0	0
C72	501	500A	129.122	0.013	78.063	77.869	0	0
C8	ST628B-S	ST623A-S	125	0.025	86.66	86.32	0	0
C9	ST624B-S	ST624A-S	5	0.025	86.5	86.4	0	0
EXT-11-S0-O_2	ST302-3A-S0	ST302-2A-S	145	0.035	86.51	86.22	0	0
EXT-4-S0-O_1	ST303-2A-S	ST303-1A-S	31.7	0.035	85.34	85.27	0	0
EXT-4-S0-O_3	ST303-3A-S	ST303-2A-S	77.92	0.035	85.52	85.34	0	0
EXT-6-S-O_3	ST302-1A-S0	ST302A-S	30.7	0.035	85.77	85.7	0	0
EXT-6-S-O_4	ST302A-S	ST303-3A-S	74.8	0.035	85.7	85.52	0	0
EXT-9-S0-O_2	ST302-1A-S	ST302-1A-S0	54.14	0.035	85.89	85.77	0	0
N73-O	ST645A-S0	ST645A-S	64.64	0.013	87.15	86.09	0	0
Pipe_-_(100)	619	618	47.77499	0.013	83.32869	83.08981	0	0
Pipe_-_(101)	620	619	18.655	0.013	83.61	83.479	0	0
Pipe_-_(102)	621	615	15.29578	0.013	82.31313	82.29018	0	0
Pipe_-_(103)	622	621	30.06056	0.013	82.36272	82.31763	0	0
Pipe_-_(104)	623	622	31.5809	0.013	82.48508	82.43771	0	0
Pipe_-_(105)	624	623	69.73537	0.013	82.73969	82.63509	0	0
Pipe_-_(106)	628	624	80.66366	0.013	83.16635	82.96469	0	0
Pipe_-_(107)	629	628	36.51594	0.013	84.19499	83.86635	0	0
Pipe_-_(108)	625	624	117.4802	0.013	83.33339	83.03969	0	0
Pipe_-_(109)	626	625	11.24394	0.013	83.61461	83.55839	0	0
Pipe_-_(110)	627	626	64.45425	0.013	83.96688	83.64461	0	0
Pipe_-_(111)	630	628	107.492	0.013	84.015	83.316	0	0
Pipe_-_(174)	STM-639	639	9.967	0.013	82.905	82.805	0	0
Pipe_-_(64)	601	509	70.54971	0.013	79.883	79.707	0	0
Pipe_-_(65)	602	601	90.72388	0.013	80.71024	80.48342	0	0
Pipe_-_(66)	603	602	45.67835	0.013	80.83875	80.77023	0	0
Pipe_-_(67)	605	603	90.96	0.013	81.171	80.989	0	0
Pipe_-_(69)	606	605	34.36401	0.013	81.21551	81.17427	0	0
Pipe_-_(70)	607	606	38.10904	0.013	81.26484	81.21911	0	0

Pipe_-_(71)	608	607	83.12344	0.013	82.79733	82.46484	0	0
Pipe_-_(72)	609	608	61.00217	0.013	83.17735	82.87233	0	0
Pipe_-_(73)	610	607	85.23029	0.013	81.37071	81.26844	0	0
Pipe_-_(74)	631	610	75.44692	0.013	81.61125	81.52071	0	0
Pipe_-_(75)	632	631	40.91494	0.013	82.27262	82.21125	0	0
Pipe_-_(76)	633	632	28.32265	0.013	82.4651	82.42262	0	0
Pipe_-_(77)	634	633	79.12876	0.013	83.31075	82.91511	0	0
Pipe_-_(78)	635	631	30.43381	0.013	81.79777	81.76125	0	0
Pipe_-_(79)	636	635	52.16104	0.013	82.05209	81.94777	0	0
Pipe_-_(80)	637	636	34.14693	0.013	83.02405	82.80209	0	0
Pipe_-_(81)	638	637	31.0726	0.013	83.37602	83.17405	0	0
Pipe_-_(82)	639	636	61.26672	0.013	82.65526	82.50209	0	0
Pipe_-_(83)	640	639	39.62978	0.013	83.14915	83.03026	0	0
Pipe_-_(84)	641	640	34.93969	0.013	83.33884	83.16415	0	0
Pipe_-_(85)	642	636	90.375	0.013	82.29247	82.2021	0	0
Pipe_-_(86)	643	642	90.875	0.013	82.38634	82.29547	0	0
Pipe_-_(87)	644	643	103.4107	0.013	83.4284	82.91135	0	0
Pipe_-_(88)	645	644	60.85191	0.013	83.92936	83.5034	0	0
Pipe_-_(89)	646	643	40.00727	0.013	82.82637	82.68634	0	0
Pipe_-_(90)	647	646	29.45	0.013	82.94	82.837	0	0
Pipe_-_(91)	648	647	35.799	0.013	83.076	82.95	0	0
Pipe_-_(92)	611	610	97.98791	0.013	81.7883	81.67072	0	0
Pipe_-_(93)	612	611	43.17542	0.013	81.99011	81.9383	0	0
Pipe_-_(94)	613	612	35.05891	0.013	82.03578	81.99371	0	0
Pipe_-_(95)	614	613	74.5633	0.013	83.42044	82.93578	0	0
Pipe_-_(96)	615	613	83.99915	0.013	82.14018	82.03938	0	0
Pipe_-_(97)	616	615	53.20753	0.013	83.23603	82.89018	0	0
Pipe_-_(98)	617	615	44.20535	0.013	82.7757	82.66518	0	0
Pipe_-_(99)	618	617	44.82499	0.013	83.07481	82.85069	0	0
Pipe_2	STM-102	STM-101	33.963	0.013	83.332	83.256	0	0
Pipe_6	STM-103	STM-101	38.37	0.013	83.303	83.207	0	0
Pipe_7	STM-104	STM-103	42.398	0.013	83.94	83.728	0	0
Pipe_8	STM-106	STM-103	48.393	0.013	83.484	83.363	0	0
ST602A-S0-O	ST602A-S0	ST602A-S	98.378	0.013	86.03	85.67	0	0
ST602A-S-O	ST303-1A-S0	ST602A-S	79.47	0.013	85.82	85.67	0	0
ST603A-S0-O	ST603A-S	ST303-1A-S0	51.52	0.013	85.67	85.82	0	0
ST606A-S-O	ST606A-S1	ST606A-S	39.92749	0.013	86.08	85.72	0	0
ST610A-S0-O	ST610A-S0	ST610A-S	66	0.013	86.11	85.74	0	0
ST610A-S-O	ST631A-S0	ST610A-S	56.79	0.013	85.97	85.74	0	0

ST611A-S0-O	ST611C-S0	ST611A-S	44.97	0.013	86.08	85.73	0	0
ST611A-S-O	ST611A-S	ST631A-S0	28.25	0.013	85.73	85.97	0	0
ST611C-S0-O	ST611C-S0	ST638A-S	31.74	0.013	86.08	85.86	0	0
ST612A-S0-O	ST612A-S0	ST609A-S	35.52208	0.013	86.21	85.88	0	0
ST612A-S-O	ST609A-S	ST610A-S0	46.498	0.013	85.88	86.11	0	0
ST613A-S0-O	ST613A-S0	ST612A-S	39.812	0.013	86.17	85.83	0	0
ST613A-S-O	ST611C-S0	ST612A-S	43.86	0.013	86.08	85.83	0	0
ST615A-S0-O	ST615A-S0	ST615A-S	35.02	0.013	86.4	86.02	0	0
ST616A-S0-O	ST616A-S	ST616A-S0	35.46	0.013	86.13	86.38	0	0
ST616A-S1-O	ST616A-S0	ST615A-S0	19.9	0.013	86.38	86.4	0	0
ST616A-S-O	ST648A-S0	ST616A-S	42.34319	0.013	86.42	86.13	0	0
ST617A-S0-O	ST617A-S0	ST617A-S	44.85249	0.013	86.27	86.02	0	0
ST617A-S-O	ST616A-S0	ST617A-S	45.1	0.013	86.38	86.02	0	0
ST620A-S0-O_1	ST620A-S	ST302-1A-S0	48.46	0.013	85.98	86.25	0	0
ST620A-S-O	ST617A-S0	ST620A-S	59.2384	0.013	86.27	85.98	0	0
ST621A-S0-O	ST621A-S0	ST621A-S	53.12235	0.013	86.45	86.18	0	0
ST621A-S-O	ST616A-S0	ST621A-S	39.63	0.013	86.38	86.18	0	0
ST624A-S0-O_1	ST624A-S0	ST624A-S1	28	0.013	86.56	86.38	0	0
ST624A-S-O	ST625B-S0	ST624A-S1	64.156	0.013	86.56	86.38	0	0
ST625B-S0-O	ST625B-S	ST625B-S0	37	0.013	86.31	86.56	0	0

ST625B-S-O	ST630B-S0	ST625B-S	55.56	0.013	86.69	86.31	0	0
ST628A-S0-O_1	ST628A-S0	ST628A-S1	33.01	0.013	87.19	87.06	0	0
ST628A-S0-O_2	ST628A-S1	ST628A-S	42.48	0.013	87.06	86.31	0	0
ST628A-S-O	ST628A-S	ST624A-S0	33.76	0.013	86.31	86.56	0	0
ST630B-S0-O	ST630B-S0	ST630B-S	28.81176	0.013	86.69	86.5	0	0
ST630B-S-O	ST630B-S1	ST630B-S	38.8	0.013	86.69	86.5	0	0
ST631A-S0-O	ST631A-S0	ST631A-S	50.73466	0.013	85.97	85.65	0	0
ST631A-S-O	ST631A-S	ST633A-S0	41.48	0.013	85.65	85.89	0	0
ST633A-S0-O	ST633A-S0	ST633A-S	37.82	0.013	85.89	85.63	0	0
ST633A-S-O	ST633A-S	ST634A-S0	21.22	0.013	85.63	85.77	0	0
ST634A-S0-O	ST634A-S0	ST634A-S	39.5	0.013	85.77	85.58	0	0
ST634A-S1-O	ST634A-S1	ST634A-S	24.5	0.013	85.75	85.58	0	0
ST635A-S0-O	ST639A-S0	ST635A-S	44.56	0.013	86	85.74	0	0
ST635A-S-O	ST635A-S	ST633A-S0	37.42	0.013	85.74	85.89024	0	0
ST637A-S0-O	ST637A-S0	ST637A-S	32.68769	0.013	86.06	85.8	0	0
ST637A-S-O	ST639A-S0	ST637A-S	28.69	0.013	86	85.8	0	0
ST638A-S-O	ST637A-S0	ST638A-S	25.2	0.013	86.06	85.86	0	0
ST639A-S0-O	ST639A-S	ST639A-S0	47.65	0.013	85.74	86	0	0
ST639A-S-O	ST641A-S0	ST639A-S	54.576	0.013	86.15	85.74	0	0

ST641A-S0-O_1	ST641A-S0	ST641A-S1	9.127	0.013	86.15	86.09	0	0
ST641A-S0-O_2	ST641A-S1	ST641A-S	20.616	0.013	86.09	85.97	0	0
ST641A-S-O	ST614A-S0	ST641A-S	35.24927	0.013	86.17	85.97	0	0
ST642A-S0-O	ST642A-S0	ST642A-S	75	0.013	86.13	85.75	0	0
ST642A-S-O	ST642A-S	ST639A-S0	69.09	0.013	85.75	86	0	0
ST643A-S0-O	ST643A-S0	ST646A-S	24	0.013	86.26	86.02	0	0
ST643A-S1-O	ST643A-S1	ST643A-S	26.8	0.013	86.13	85.98	0	0
ST643A-S-O	ST643A-S	ST642A-S0	30	0.013	85.98	86.13	0	0
ST644A-S-O	ST644A-S	ST643A-S1	26	0.013	85.99	86.13	0	0
ST645A-S-O	ST645A-S	ST645A-S1	67.44	0.013	86.09	86.28	0	0
ST646A-S-O	ST646A-S	ST643A-S1	19.2	0.013	86.02	86.13	0	0
ST648A-S0-O_1	ST648A-S0	ST648A-S1	13.9	0.013	86.42	86.28	0	0
ST648A-S0-O_4	ST648A-S1	ST648A-S	23.6	0.013	86.28	86.01	0	0
ST648A-S-O	ST648A-S	ST643A-S0	37.432	0.013	86.01	86.26	0	0

[ORIFICES]

;;Name	From Node	To Node	Type	Offset	Qcoeff	Gated	CloseTime
C101A-IC	CB101AB-S	STM-639	SIDE	84.69	0.65	NO	0
C101B-IC	CB101AB-S	STM-639	SIDE	84.68	0.65	NO	0
C102A-IC	CB102AB-S	STM-101	SIDE	84.72	0.572	NO	0
C102B-IC	CB102AB-S	STM-101	SIDE	84.69	0.572	NO	0
C103A-IC	CB103A-S	STM-101	SIDE	84.76	0.572	NO	0
C106C-IC	CB106C-S	STM-103	SIDE	84.41	0.572	NO	0
C45	ST303-1A-S	602	SIDE	82.094	0.65	NO	0
ORF_QUAL	INTPOND2-S	J1	SIDE	77.8	0.61	NO	0
ORF-QUAN	INTPOND2-S	J1	SIDE	78.5	0.61	NO	0
ST602A-O	ST602A-S	602	SIDE	83.87	0.572	NO	0
ST602A-O1	ST602A-S	602	SIDE	83.87	0.572	NO	0
ST603A-O	ST603A-S	603	SIDE	84.29	0.572	NO	0
ST603A-O1	ST603A-S	603	SIDE	84.29	0.572	NO	0
ST603B-O	ST603B-S	603	SIDE	83.68	0.572	NO	0
ST605D-O	ST605D-S	605	SIDE	83.96	0.572	NO	0
ST606A-O	ST606A-S	606	SIDE	84.34	0.572	NO	0
ST606A-O1	ST606A-S	606	SIDE	84.34	0.572	NO	0
ST607A-O	ST607A-S	607	SIDE	84.07	0.572	NO	0
ST607A-O1	ST607A-S	607	SIDE	84.07	0.572	NO	0
ST608B-O	ST608B-S	608	SIDE	84	0.572	NO	0
ST609A-O	ST609A-S	609	SIDE	84.08	0.572	NO	0
ST609A-O1	ST609A-S	609	SIDE	84.08	0.572	NO	0
ST610A-O	ST610A-S	610	SIDE	84.36	0.572	NO	0
ST610A-O1	ST610A-S	610	SIDE	84.36	0.572	NO	0
ST610B-O	ST610B-S	610	SIDE	83.75	0.572	NO	0
ST610C-O	ST610C-S	610	SIDE	84.08	0.572	NO	0
ST611A-O	ST611A-S	611	SIDE	83.93	0.572	NO	0
ST611A-O1	ST611A-S	611	SIDE	83.93	0.572	NO	0
ST611B-O	ST611B-S	611	SIDE	83.78	0.572	NO	0
ST612A-O	ST612A-S	612	SIDE	84.03	0.572	NO	0
ST612A-O1	ST612A-S	612	SIDE	84.03	0.572	NO	0
ST612B-O	ST612B-S	612	SIDE	83.86	0.572	NO	0
ST615A-O	ST615A-S	615	SIDE	84.22	0.572	NO	0
ST615A-O1	ST615A-S	615	SIDE	84.22	0.572	NO	0
ST615B-O	ST615B-S	615	SIDE	84.22	0.572	NO	0
ST616A-O	ST616A-S	616	SIDE	84.33	0.572	NO	0
ST616A-O1	ST616A-S	616	SIDE	84.33	0.572	NO	0
ST617A-O	ST617A-S	617	SIDE	84.22	0.572	NO	0
ST617A-O1	ST617A-S	617	SIDE	84.22	0.572	NO	0
ST619A-O	ST619A-S	619	SIDE	84.25	0.572	NO	0
ST620A-O	ST620A-S	620	SIDE	84.18	0.572	NO	0
ST620A-O1	ST620A-S	620	SIDE	84.18	0.572	NO	0
ST621A-O	ST621A-S	621	SIDE	84.38	0.572	NO	0
ST621A-O1	ST621A-S	621	SIDE	84.38	0.572	NO	0
ST622A-O	ST622A-S	622	SIDE	84.28	0.572	NO	0
ST623A-O	ST623A-S	623	SIDE	84.36	0.572	NO	0

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ST624A-O        ST624A-S        624             SIDE        84.4       0.572      NO       0
ST624A-O1       ST624A-S        624             SIDE        84.4       0.572      NO       0
ST624B-O        ST624B-S        624             SIDE        84.25      0.572      NO       0
ST625A-O        ST625A-S        625             SIDE        84.49      0.572      NO       0
ST625A-O1       ST625A-S        625             SIDE        84.49      0.572      NO       0
ST625B-O        ST625B-S        625             SIDE        84.51      0.572      NO       0
ST625B-O1       ST625B-S        625             SIDE        84.51      0.572      NO       0
ST628A-O        ST628A-S        628             SIDE        84.51      0.572      NO       0
ST628A-O1       ST628A-S        628             SIDE        84.51      0.572      NO       0
ST628B-O        ST628B-S        628             SIDE        84.51      0.572      NO       0
ST628C-O        ST628C-S        628             SIDE        84.48      0.572      NO       0
ST629A-O        ST629A-S        629             SIDE        84.95      0.572      NO       0
ST630A-O        ST630A-S        630             SIDE        84.61      0.572      NO       0
ST630A-O1       ST630A-S        630             SIDE        84.61      0.572      NO       0
ST630B-O        ST630B-S        630             SIDE        84.7       0.572      NO       0
ST630B-O1       ST630B-S        630             SIDE        84.7       0.572      NO       0
ST631A-O        ST631A-S        631             SIDE        84.27      0.572      NO       0
ST631A-O1       ST631A-S        631             SIDE        84.27      0.572      NO       0
ST632A-O        ST632A-S        632             SIDE        83.71      0.572      NO       0
ST633A-O        ST633A-S        633             SIDE        83.83      0.572      NO       0
ST633A-O1       ST633A-S        633             SIDE        83.83      0.572      NO       0
ST634A-O        ST634A-S        634             SIDE        83.78      0.572      NO       0
ST634A-O1       ST634A-S        634             SIDE        83.78      0.572      NO       0
ST635A-O        ST635A-S        635             SIDE        83.94      0.572      NO       0
ST635A-O1       ST635A-S        635             SIDE        83.94      0.572      NO       0
ST637A-O        ST637A-S        637             SIDE        84         0.572      NO       0
ST637A-O1       ST637A-S        637             SIDE        84         0.572      NO       0
ST638A-O        ST638A-S        611             SIDE        84.06      0.572      NO       0
ST638A-O1       ST638A-S        611             SIDE        84.06      0.572      NO       0
ST639A-O        ST639A-S        639             SIDE        83.94      0.572      NO       0
ST639A-O1       ST639A-S        639             SIDE        83.94      0.572      NO       0
ST639B-O        ST639B-S        639             SIDE        83.83      0.572      NO       0
ST639C-O        ST639C-S        639             SIDE        83.83      0.572      NO       0
ST639E-O        ST639E-S        EXMH904         SIDE        84.33      0.61       NO       0
ST639F-O        ST639F-S        EXMH904         SIDE        84.77      0.61       NO       0
ST639G-O        ST639G-S        EXMH904         SIDE        84.85      0.61       NO       0
ST641A-O        ST641A-S        641             SIDE        84.17      0.572      NO       0
ST641A-O1       ST641A-S        641             SIDE        84.17      0.572      NO       0
ST641B-O        ST641B-S        641             SIDE        84.07      0.572      NO       0
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ST642A-O        ST642A-S        642             SIDE        83.95      0.572      NO       0
ST642A-O1       ST642A-S        642             SIDE        83.95      0.572      NO       0
ST643A-O        ST643A-S        643             SIDE        84.18      0.572      NO       0
ST643A-O1       ST643A-S        643             SIDE        84.18      0.572      NO       0
ST644A-O        ST644A-S        644             SIDE        84.19      0.572      NO       0
ST644A-O1       ST644A-S        644             SIDE        84.19      0.572      NO       0
ST645A-O        ST645A-S        645             SIDE        84.29      0.572      NO       0
ST645A-O1       ST645A-S        645             SIDE        84.29      0.572      NO       0
ST645B-O        ST645B-S        644             SIDE        84.13      0.61       NO       0
ST646A-O        ST646A-S        646             SIDE        84.22      0.572      NO       0
ST646A-O1       ST646A-S        646             SIDE        84.22      0.572      NO       0
ST648A-O        ST648A-S        648             SIDE        84.21      0.572      NO       0
ST648A-O1       ST648A-S        648             SIDE        84.21      0.572      NO       0

[WEIRS]
;;Name          From Node       To Node         Type         CrestHt    Qcoeff     Gated    EndCon
EndCoeff   Surcharge  RoadWidth  RoadSurf   Coeff. Curve
;;-------------- ---------------- ---------------- ------------ ---------- ---------- -------- --------
---------- ---------- ---------- ---------- ----------------
20              CB106C-S        CB106AB-S       TRANSVERSE   86.21      1.38       NO       0        0
       YES
21              CBMH-102A       CB102AB-S       TRANSVERSE   86.22      1.38       NO       0        0
       YES
ST634A-S-O      ST634A-S1       ST634A-S2       TRANSVERSE   85.75      1.7        NO       0        0
       YES
ST634A-S-W      ST634A-S1       ST634A-S2       TRANSVERSE   85.75      1.7        NO       0        0
       YES
Weir1           INTPOND2-S      J1              TRANSVERSE   80         1.7        NO       0        0
       YES

[OUTLETS]
;;Name          From Node       To Node         Offset     Type            QTable/Qcoeff    Qexpon
Gated
;;-------------- ---------------- ---------------- ---------- ---------------- ---------------- ----------
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C104A-IC        CB104AB-S       STM-103         84.73      FUNCTIONAL/HEAD  5.005           0.5
NO
C104B-IC        CB104AB-S       STM-103         84.76      FUNCTIONAL/HEAD  5.005           0.5
NO
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C106A-IC         CB106AB-S        STM-103          84.71      FUNCTIONAL/HEAD  5.005            0.5
NO
C106B-IC         CB106AB-S        STM-103          84.71      FUNCTIONAL/HEAD  5.005            0.5
NO
EX101-O          EX_ST101-S       J7               84.49      TABULAR/DEPTH    ST101
NO
EX104-O          EX_ST104-S       J7               84.74      TABULAR/DEPTH    ST104
NO
EXT2-O           EXT2-S           648-1            85.11      TABULAR/DEPTH    EXT-2
NO
ST601A-O         ST601A-S         601              84.15      TABULAR/DEPTH    ST601A
NO
ST605A-O         ST605A-S         605              84.25      TABULAR/DEPTH    ST605A
NO
ST605B-O         ST605B-S         605              84.51      TABULAR/DEPTH    ST605B
NO
ST605C-O         ST605C-S         605              84.4       TABULAR/DEPTH    ST605C
NO
ST616B-O         ST616B-S         616              84.63      TABULAR/DEPTH    ST616B
NO
ST623B-O         ST623B-S         623              84.95      TABULAR/DEPTH    ST623B
NO
ST632B-O         ST632B-S         632              84.1       TABULAR/DEPTH    ST632B
NO
ST633B-O         ST633B-S         633              84.15      TABULAR/DEPTH    ST633B
NO
ST648B-O         ST648B-S         648-1            84.57      TABULAR/DEPTH    ST648B
NO
;ST639E-S
ST904-O          EXMH904          C904A-S          84.33      TABULAR/DEPTH    EXMH904
NO

[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4      Barrels    Culvert
;;-------------- ------------ ---------------- ---------- ---------- ---------- ---------- ----------
14               IRREGULAR    14.0mROW         0          0          0          1
15               IRREGULAR    14.0mROW         0          0          0          1
16               IRREGULAR    14.0mROW         0          0          0          1
18               IRREGULAR    13.5mROW         0          0          0          1
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19               IRREGULAR    13.5mROW         0          0          0          1
9                CIRCULAR     0.525            0          0          0          1
C1               IRREGULAR    26mROW           0          0          0          1
C10              TRAPEZOIDAL  0.15             2          10         10         1
C11              IRREGULAR    8.5mROW_overland 0          0          0          1
C12              CIRCULAR     0.375            0          0          0          2
C13              TRAPEZOIDAL  0.15             2          10         10         1
C14              TRAPEZOIDAL  0.15             2          10         10         1
C15              TRAPEZOIDAL  0.15             2          10         10         1
C16              IRREGULAR    8.5mROW_overland 0          0          0          1
C17              TRAPEZOIDAL  0.15             2          10         10         1
C18              TRAPEZOIDAL  0.15             2          10         10         1
C19              IRREGULAR    8.5mROW_overland 0          0          0          1
C2               IRREGULAR    18mROW           0          0          0          1
C20              TRAPEZOIDAL  0.15             2          10         10         1
C21              IRREGULAR    18mROW_half      0          0          0          1
C22              TRAPEZOIDAL  0.15             2          10         10         1
C23              IRREGULAR    8.5mROW_overland 0          0          0          1
C24              TRAPEZOIDAL  0.15             2          10         10         1
C25              TRAPEZOIDAL  0.15             2          10         10         1
C26              TRAPEZOIDAL  0.15             2          10         10         1
C27              TRAPEZOIDAL  0.15             2          10         10         1
C28              TRAPEZOIDAL  0.15             2          10         10         1
C29              IRREGULAR    8.5mROW_overland 0          0          0          1
C3               CIRCULAR     0.675            0          0          0          1
C30              TRAPEZOIDAL  0.15             2          10         10         1
C304_1           CIRCULAR     2.4              0          0          0          1
C304_3           CIRCULAR     2.4              0          0          0          1
C304_4           CIRCULAR     2.4              0          0          0          1
C305_1           CIRCULAR     2.7              0          0          0          1
C305_3           CIRCULAR     2.7              0          0          0          1
C305_4           CIRCULAR     2.7              0          0          0          1
C306_1           CIRCULAR     3                0          0          0          1
C31              IRREGULAR    8.5mROW_overland 0          0          0          1
C32              IRREGULAR    8.5mROW_overland 0          0          0          1
C33              TRAPEZOIDAL  0.15             2          10         10         1
C34              IRREGULAR    8.5mROW          0          0          0          1
C35              IRREGULAR    18mROW_half      0          0          0          1
C36              IRREGULAR    8.5mROW_overland 0          0          0          1
```

C37	CIRCULAR	1.5	0	0	0	1
C38	IRREGULAR	8.5mROW_overland	0	0	0	1
C39	TRAPEZOIDAL	1	10	4	4	1
C4	IRREGULAR	18mROW	0	0	0	1
C40	TRAPEZOIDAL	0.15	2	10	10	1
C41	IRREGULAR	18mROW	0	0	0	1
C42	IRREGULAR	18mROW	0	0	0	1
C43	CIRCULAR	1.2	0	0	0	1
C44	TRIANGULAR	0.33	2	0	0	1
C46	CIRCULAR	3	0	0	0	1
C47	IRREGULAR	10mROW	0	0	0	1
C48	IRREGULAR	13.5mROW	0	0	0	1
C49	IRREGULAR	18mROW	0	0	0	1
C5	TRAPEZOIDAL	0.15	2	10	10	1
C50	IRREGULAR	18mROW	0	0	0	1
C51	IRREGULAR	18mROW	0	0	0	1
C52	IRREGULAR	8.5mROW_overland	0	0	0	1
C53	IRREGULAR	13.5mROW	0	0	0	1
C54	IRREGULAR	13.5mROW	0	0	0	1
C55	IRREGULAR	13.5mROW	0	0	0	1
C56	IRREGULAR	13.5mROW	0	0	0	1
C57	CIRCULAR	0.525	0	0	0	1
C58	CIRCULAR	0.525	0	0	0	1
C59	CIRCULAR	0.3	0	0	0	1
C6	TRAPEZOIDAL	0.15	2	10	10	1
C60	IRREGULAR	18m_overland	0	0	0	1
C61	TRAPEZOIDAL	0.15	2	10	10	1
C62	CIRCULAR	0.525	0	0	0	1
C7	TRAPEZOIDAL	0.15	2	10	10	1
C7_1	IRREGULAR	18mROW_half	0	0	0	1
C7_2	IRREGULAR	18mROW	0	0	0	1
C72	CIRCULAR	1.5	0	0	0	1
C8	TRAPEZOIDAL	0.15	2	10	10	1
C9	TRAPEZOIDAL	0.15	2	10	10	1
EXT-11-S0-O_2	TRIANGULAR	0.33	2	0	0	1
EXT-4-S0-O_1	TRIANGULAR	0.33	2	0	0	1
EXT-4-S0-O_3	TRIANGULAR	0.33	2	0	0	1
EXT-6-S-O_3	TRIANGULAR	0.33	2	0	0	1
EXT-6-S-O_4	TRIANGULAR	0.33	2	0	0	1

EXT-9-S0-O_2	TRIANGULAR	0.33	2	0	0	1
N73-O	IRREGULAR	26mROW	0	0	0	1
Pipe_-_(100)	CIRCULAR	0.6	0	0	0	1
Pipe_-_(101)	CIRCULAR	0.45	0	0	0	1
Pipe_-_(102)	CIRCULAR	1.05	0	0	0	1
Pipe_-_(103)	CIRCULAR	1.05	0	0	0	1
Pipe_-_(104)	CIRCULAR	0.975	0	0	0	1
Pipe_-_(105)	CIRCULAR	0.825	0	0	0	1
Pipe_-_(106)	CIRCULAR	0.6	0	0	0	1
Pipe_-_(107)	CIRCULAR	0.3	0	0	0	1
Pipe_-_(108)	CIRCULAR	0.525	0	0	0	1
Pipe_-_(109)	CIRCULAR	0.3	0	0	0	1
Pipe_-_(110)	CIRCULAR	0.3	0	0	0	1
Pipe_-_(111)	CIRCULAR	0.45	0	0	0	1
Pipe_-_(174)	CIRCULAR	0.6	0	0	0	1
Pipe_-_(64)	CIRCULAR	2.4	0	0	0	1
Pipe_-_(65)	CIRCULAR	1.8	0	0	0	1
Pipe_-_(66)	CIRCULAR	1.8	0	0	0	1
Pipe_-_(67)	CIRCULAR	1.65	0	0	0	1
Pipe_-_(69)	CIRCULAR	1.65	0	0	0	1
Pipe_-_(70)	CIRCULAR	1.65	0	0	0	1
Pipe_-_(71)	CIRCULAR	0.45	0	0	0	1
Pipe_-_(72)	CIRCULAR	0.375	0	0	0	1
Pipe_-_(73)	CIRCULAR	1.65	0	0	0	1
Pipe_-_(74)	CIRCULAR	1.5	0	0	0	1
Pipe_-_(75)	CIRCULAR	0.9	0	0	0	1
Pipe_-_(76)	CIRCULAR	0.75	0	0	0	1
Pipe_-_(77)	CIRCULAR	0.3	0	0	0	1
Pipe_-_(78)	CIRCULAR	1.35	0	0	0	1
Pipe_-_(79)	CIRCULAR	1.2	0	0	0	1
Pipe_-_(80)	CIRCULAR	0.45	0	0	0	1
Pipe_-_(81)	CIRCULAR	0.3	0	0	0	1
Pipe_-_(82)	CIRCULAR	0.75	0	0	0	1
Pipe_-_(83)	CIRCULAR	0.375	0	0	0	1
Pipe_-_(84)	CIRCULAR	0.375	0	0	0	1
Pipe_-_(85)	CIRCULAR	1.05	0	0	0	1
Pipe_-_(86)	CIRCULAR	1.05	0	0	0	1
Pipe_-_(87)	CIRCULAR	0.525	0	0	0	1
Pipe_-_(88)	CIRCULAR	0.45	0	0	0	1

Pipe_-_(89)	CIRCULAR	0.75	0	0	0	1
Pipe_-_(90)	CIRCULAR	0.75	0	0	0	1
Pipe_-_(91)	CIRCULAR	0.75	0	0	0	1
Pipe_-_(92)	CIRCULAR	1.35	0	0	0	1
Pipe_-_(93)	CIRCULAR	1.2	0	0	0	1
Pipe_-_(94)	CIRCULAR	1.2	0	0	0	1
Pipe_-_(95)	CIRCULAR	0.3	0	0	0	1
Pipe_-_(96)	CIRCULAR	1.2	0	0	0	1
Pipe_-_(97)	CIRCULAR	0.45	0	0	0	1
Pipe_-_(98)	CIRCULAR	0.675	0	0	0	1
Pipe_-_(99)	CIRCULAR	0.6	0	0	0	1
Pipe_2	CIRCULAR	0.525	0	0	0	1
Pipe_6	CIRCULAR	0.375	0	0	0	1
Pipe_7	CIRCULAR	0.3	0	0	0	1
Pipe_8	CIRCULAR	0.375	0	0	0	1
ST602A-S0-O	IRREGULAR	32.5mROW_half	0	0	0	1
ST602A-S-O	IRREGULAR	32.5mROW_half	0	0	0	1
ST603A-S0-O	IRREGULAR	18mROW	0	0	0	1
ST606A-S-O	IRREGULAR	18mROW	0	0	0	1
ST610A-S0-O	IRREGULAR	18mROW_half	0	0	0	1
ST610A-S-O	IRREGULAR	18mROW	0	0	0	1
ST611A-S0-O	IRREGULAR	18mROW	0	0	0	1
ST611A-S-O	IRREGULAR	18mROW	0	0	0	1
ST611C-S0-O	IRREGULAR	18mROW	0	0	0	1
ST612A-S0-O	IRREGULAR	18mROW	0	0	0	1
ST612A-S-O	IRREGULAR	18mROW	0	0	0	1
ST613A-S0-O	IRREGULAR	18mROW	0	0	0	1
ST613A-S-O	IRREGULAR	18mROW	0	0	0	1
ST615A-S0-O	IRREGULAR	18mROW	0	0	0	1
ST616A-S0-O	IRREGULAR	24mROW	0	0	0	1
ST616A-S1-O	IRREGULAR	18mROW	0	0	0	1
ST616A-S-O	IRREGULAR	24mROW	0	0	0	1
ST617A-S0-O	IRREGULAR	24mROW	0	0	0	1
ST617A-S-O	IRREGULAR	24mROW	0	0	0	1
ST620A-S0-O_1	IRREGULAR	24mROW	0	0	0	1
ST620A-S-O	IRREGULAR	24mROW	0	0	0	1
ST621A-S0-O	IRREGULAR	18mROW	0	0	0	1
ST621A-S-O	IRREGULAR	18mROW	0	0	0	1
ST624A-S0-O_1	IRREGULAR	18mROW	0	0	0	1
ST624A-S-O	IRREGULAR	18mROW	0	0	0	1
ST625B-S0-O	IRREGULAR	18mROW	0	0	0	1
ST625B-S-O	IRREGULAR	18mROW	0	0	0	1
ST628A-S0-O_1	IRREGULAR	18mROW_half	0	0	0	1
ST628A-S0-O_2	IRREGULAR	18mROW_half	0	0	0	1
ST628A-S-O	IRREGULAR	18mROW	0	0	0	1
ST630B-S0-O	IRREGULAR	18mROW	0	0	0	1
ST630B-S-O	IRREGULAR	18mROW	0	0	0	1
ST631A-S0-O	IRREGULAR	18mROW	0	0	0	1
ST631A-S-O	IRREGULAR	18mROW	0	0	0	1
ST633A-S0-O	IRREGULAR	26mROW	0	0	0	1
ST633A-S-O	IRREGULAR	26mROW	0	0	0	1
ST634A-S0-O	IRREGULAR	26mROW	0	0	0	1
ST634A-S1-O	IRREGULAR	26mROW	0	0	0	1
ST635A-S0-O	IRREGULAR	26mROW	0	0	0	1
ST635A-S-O	IRREGULAR	26mROW	0	0	0	1
ST637A-S0-O	IRREGULAR	18mROW	0	0	0	1
ST637A-S-O	IRREGULAR	18mROW	0	0	0	1
ST638A-S-O	IRREGULAR	18mROW	0	0	0	1
ST639A-S0-O	IRREGULAR	18mROW	0	0	0	1
ST639A-S-O	IRREGULAR	18mROW	0	0	0	1
ST641A-S0-O_1	IRREGULAR	18mROW	0	0	0	1
ST641A-S0-O_2	IRREGULAR	18mROW	0	0	0	1
ST641A-S-O	IRREGULAR	18mROW	0	0	0	1
ST642A-S0-O	IRREGULAR	26mROW	0	0	0	1
ST642A-S-O	IRREGULAR	26mROW	0	0	0	1
ST643A-S0-O	IRREGULAR	24mROW	0	0	0	1
ST643A-S1-O	IRREGULAR	26mROW	0	0	0	1
ST643A-S-O	IRREGULAR	26mROW	0	0	0	1
ST644A-S-O	IRREGULAR	26mROW	0	0	0	1
ST645A-S-O	IRREGULAR	26mROW	0	0	0	1
ST646A-S-O	IRREGULAR	24mROW	0	0	0	1
ST648A-S0-O_1	IRREGULAR	24mROW	0	0	0	1
ST648A-S0-O_4	IRREGULAR	24mROW	0	0	0	1
ST648A-S-O	IRREGULAR	24mROW	0	0	0	1
C101A-IC	CIRCULAR	0.083	0	0	0	
C101B-IC	CIRCULAR	0.083	0	0	0	
C102A-IC	CIRCULAR	0.083	0	0	0	
C102B-IC	CIRCULAR	0.083	0	0	0	

C103A-IC	CIRCULAR	0.083	0	0	0
C106C-IC	CIRCULAR	0.083	0	0	0
C45	CIRCULAR	0.3	0	0	0
ORF_QUAL	CIRCULAR	0.15	0	0	0
ORF-QUAN	CIRCULAR	0.38	0	0	0
ST602A-O	CIRCULAR	0.127	0	0	0
ST602A-O1	CIRCULAR	0.127	0	0	0
ST603A-O	CIRCULAR	0.152	0	0	0
ST603A-O1	CIRCULAR	0.152	0	0	0
ST603B-O	CIRCULAR	0.095	0	0	0
ST605D-O	CIRCULAR	0.108	0	0	0
ST606A-O	CIRCULAR	0.127	0	0	0
ST606A-O1	CIRCULAR	0.127	0	0	0
ST607A-O	CIRCULAR	0.108	0	0	0
ST607A-O1	CIRCULAR	0.108	0	0	0
ST608B-O	CIRCULAR	0.108	0	0	0
ST609A-O	CIRCULAR	0.152	0	0	0
ST609A-O1	CIRCULAR	0.152	0	0	0
ST610A-O	CIRCULAR	0.152	0	0	0
ST610A-O1	CIRCULAR	0.152	0	0	0
ST610B-O	CIRCULAR	0.178	0	0	0
ST610C-O	CIRCULAR	0.102	0	0	0
ST611A-O	CIRCULAR	0.127	0	0	0
ST611A-O1	CIRCULAR	0.127	0	0	0
ST611B-O	CIRCULAR	0.095	0	0	0
ST612A-O	CIRCULAR	0.127	0	0	0
ST612A-O1	CIRCULAR	0.127	0	0	0
ST612B-O	CIRCULAR	0.127	0	0	0
ST615A-O	CIRCULAR	0.102	0	0	0
ST615A-O1	CIRCULAR	0.102	0	0	0
ST615B-O	CIRCULAR	0.108	0	0	0
ST616A-O	CIRCULAR	0.095	0	0	0
ST616A-O1	CIRCULAR	0.095	0	0	0
ST617A-O	CIRCULAR	0.152	0	0	0
ST617A-O1	CIRCULAR	0.152	0	0	0
ST619A-O	CIRCULAR	0.095	0	0	0
ST620A-O	CIRCULAR	0.152	0	0	0
ST620A-O1	CIRCULAR	0.152	0	0	0
ST621A-O	CIRCULAR	0.083	0	0	0

ST621A-O1	CIRCULAR	0.083	0	0	0
ST622A-O	CIRCULAR	0.108	0	0	0
ST623A-O	CIRCULAR	0.108	0	0	0
ST624A-O	CIRCULAR	0.108	0	0	0
ST624A-O1	CIRCULAR	0.127	0	0	0
ST624B-O	CIRCULAR	0.102	0	0	0
ST625A-O	CIRCULAR	0.108	0	0	0
ST625A-O1	CIRCULAR	0.127	0	0	0
ST625B-O	CIRCULAR	0.127	0	0	0
ST625B-O1	CIRCULAR	0.127	0	0	0
ST628A-O	CIRCULAR	0.108	0	0	0
ST628A-O1	CIRCULAR	0.108	0	0	0
ST628B-O	CIRCULAR	0.095	0	0	0
ST628C-O	CIRCULAR	0.127	0	0	0
ST629A-O	CIRCULAR	0.127	0	0	0
ST630A-O	CIRCULAR	0.102	0	0	0
ST630A-O1	CIRCULAR	0.102	0	0	0
ST630B-O	CIRCULAR	0.108	0	0	0
ST630B-O1	CIRCULAR	0.108	0	0	0
ST631A-O	CIRCULAR	0.152	0	0	0
ST631A-O1	CIRCULAR	0.152	0	0	0
ST632A-O	CIRCULAR	0.083	0	0	0
ST633A-O	CIRCULAR	0.095	0	0	0
ST633A-O1	CIRCULAR	0.095	0	0	0
ST634A-O	CIRCULAR	0.102	0	0	0
ST634A-O1	CIRCULAR	0.102	0	0	0
ST635A-O	CIRCULAR	0.108	0	0	0
ST635A-O1	CIRCULAR	0.108	0	0	0
ST637A-O	CIRCULAR	0.095	0	0	0
ST637A-O1	CIRCULAR	0.095	0	0	0
ST638A-O	CIRCULAR	0.083	0	0	0
ST638A-O1	CIRCULAR	0.083	0	0	0
ST639A-O	CIRCULAR	0.102	0	0	0
ST639A-O1	CIRCULAR	0.102	0	0	0
ST639B-O	CIRCULAR	0.108	0	0	0
ST639C-O	CIRCULAR	0.178	0	0	0
ST639E-O	CIRCULAR	0.2	0	0	0
ST639F-O	CIRCULAR	0.2	0	0	0
ST639G-O	CIRCULAR	0.25	0	0	0

```
ST641A-O         CIRCULAR     0.108           0          0          0
ST641A-O1        CIRCULAR     0.108           0          0          0
ST641B-O         CIRCULAR     0.083           0          0          0
ST642A-O         CIRCULAR     0.152           0          0          0
ST642A-O1        CIRCULAR     0.152           0          0          0
ST643A-O         CIRCULAR     0.102           0          0          0
ST643A-O1        CIRCULAR     0.102           0          0          0
ST644A-O         CIRCULAR     0.108           0          0          0
ST644A-O1        CIRCULAR     0.108           0          0          0
ST645A-O         CIRCULAR     0.127           0          0          0
ST645A-O1        CIRCULAR     0.127           0          0          0
ST645B-O         CIRCULAR     0.127           0          0          0
ST646A-O         CIRCULAR     0.083           0          0          0
ST646A-O1        CIRCULAR     0.083           0          0          0
ST648A-O         CIRCULAR     0.083           0          0          0
ST648A-O1        CIRCULAR     0.083           0          0          0
20               RECT_OPEN    0.3             1          0          0
21               RECT_OPEN    0.3             1          0          0
ST634A-S-O       RECT_OPEN    0.15            1.2        0          0
ST634A-S-W       RECT_OPEN    0.15            1.2        0          0
Weir1            RECT_OPEN    0.5             2.9        0          0

[TRANSECTS]
;;Transect Data in HEC-2 format
;
;Full street, width = 10m, curb = 0.15m , cross-slope = 0.02m/m, bank-slope = 0.02m/m, bank-height = 0.23m.
NC 0.02     0.02     0.014
X1 10mROW            7        4        14       0.0      0.0      0.0      0.0      0.0
GR 0.23     0        0.15     4        0        4        0.1      9        0        14
GR 0.15     14       0.23     18
;
NC 0.02     0.02     0.013
X1 13.5mROW          5        0        13.5     0.0      0.0      0.0      0.0      0.0
GR 0.18     0        0        3.5      0.1      6.75     0        10       0.18     13.5
;
NC 0.02     0.02     0.013
X1 14.0mROW          5        0.0      14       0.0      0.0      0.0      0.0      0.0
GR 0.18     0        0        3.5      0.11     7        0        10.5     0.18     14
;
;Full street, width = 8.5m, curb = 0.15m , cross-slope = 0.02m/m, bank-slope = 0.02m/m, bank-height =
0.23m.
NC 0.02     0.02     0.013
X1 16.5mROW          7        4        12.5     0.0      0.0      0.0      0.0      0.0
GR 0.23     0        0.15     4        0        4        0.13     8.25     0        12.5
GR 0.15     12.5     0.23     16.5
;
;Half street, width = 4.25m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope = 0.02m/m, bank-height =
0.23m.
NC 0.02     0.02     0.013
X1 16.5mROW_half     4        0.0      4.25     0.0      0.0      0.0      0.0      0.0
GR 0.13     0        0        4.25     0.15     4.25     0.23     8.25
;
NC 0.013    0.013    0.013
X1 18m_overland      9        0.0      0.0      0.0      0.0      0.0      0.0      0.0
GR 0.13     0        0.045    4.75     0        4.75     0        8        0.025    9
GR 0        10       0        13.25    0.045    13.25    0.13     18
;
;Full street, width = 8.5m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope = 0.02m/m, bank-height =
0.245m.
NC 0.02     0.02     0.013
X1 18mROW            7        4.75     13.25    0.0      0.0      0.0      0.0      0.0
GR 0.25     0        0.15     4.75     0        4.75     0.13     9        0        13.25
GR 0.15     13.25    0.25     18
;
;Half street, width = 4.25m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope = 0.02m/m, bank-height =
0.245m.
NC 0.02     0.02     0.013
X1 18mROW_half       4        0.0      4.25     0.0      0.0      0.0      0.0      0.0
GR 0.13     0        0        4.25     0.15     4.25     0.25     9
;
;Full street, width = 8.5m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope = 0.02m/m, bank-height =
0.27m.
NC 0.02     0.02     0.013
X1 20mROW            7        5.75     14.25    0.0      0.0      0.0      0.0      0.0
GR 0.27     0        0.15     5.75     0        5.75     0.13     10       0        14.25
GR 0.15     14.25    0.27     20.5
;
;Half street, width = 4.25m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope = 0.02m/m, bank-height =
```

```
0.27m.
NC 0.02     0.02     0.013
X1 20mROW_half       4        0.0      4.25     0.0      0.0      0.0      0.0      0.0
GR 0.13     0        0        4.25     0.15     4.25     0.27     10
;
NC 0.01     0.01     0.01
X1 24m_overland      6        0.0      0.0      0.0      0.0      0.0      0.0      0.0
GR 0.13     0        0.045    6.5      0        6.5      0        17.5     0.045    17.5
GR 0.13     24
;
;Full street, width = 24m, curb = 0.15m , cross-slope = 0.016m/m, bank-slope = 0.02m/m, bank-height =
0.23m.
NC 0.02     0.02     0.014
X1 24mROW            7        4        28       0.0      0.0      0.0      0.0      0.0
GR 0.23     0        0.15     6.5      0        6.5      0.17     12       0        17.5
GR 0.15     17.5     0.23     24
;
;Half street, width = 5.5m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope = 0.02m/m, bank-height =
0.28m.
NC 0.02     0.02     0.013
X1 24mROW_half       4        0.0      5.5      0.0      0.0      0.0      0.0      0.0
GR 0.17     0        0        5.5      0.15     5.5      0.28     12
;
NC 0.01     0.01     0.01
X1 26mROW            7        0.0      0.0      0.0      0.0      0.0      0.0      0.0
GR 0.3      0        0.15     7.5      0        7.5      0.165    13       0        18.5
GR 0.15     18.5     0.3      26
;
NC 0.02     0.02     0.013
X1 32.5mROW_half     5        0.0      0.0      0.0      0.0      0.0      0.0      0.0
GR 0.31     0        0.15     8        0        8        0.1725   13.75    0.3225   16.25
;
;Full street, width = 5.5m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope = 0.02m/m, bank-height =
0.23m.
NC 0.02     0.02     0.013
X1 8.5mROW           7        1.5      7        0.0      0.0      0.0      0.0      0.0
GR 0.18     0        0.15     1.5      0        1.5      0.08     4.25     0        7
GR 0.15     7        0.18     8.5
;
```

```
;Half street, width = 2.75m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope = 0.02m/m, bank-height =
0.18m.
NC 0.02     0.02     0.013
X1 8.5mROW_half      4        0.0      2.75     0.0      0.0      0.0      0.0      0.0
GR 0.08     0        0        2.75     0.15     2.75     0.18     4.25
;
NC 0.01     0.01     0.01
X1 8.5mROW_overland  7        0.0      0.0      0.0      0.0      0.0      0.0      0.0
GR 0.12     0        0.07     1.5      0        1.5      0        4.25     0        7
GR 0.07     7        0.12     8.5
;
NC 0.02     0.02     0.013
X1 MerBleu           7        0.0      0.0      0.0      0.0      0.0      0.0      0.0
GR 0.3      0        0.15     2.5      0        2.5      0.185    11.75    0        21
GR 0.15     21       0.3      23.5
;
NC 0.013    0.013    0.013
X1 MerBleu_overland  9        0.0      0.0      0.0      0.0      0.0      0.0      0.0
GR 0.25     0        0.1      2.5      0        2.5      0        5        0.135    11.75
GR 0        18.5     0        21       0.1      21       0.25     23.5
;
NC 0.025    0.025    0.013
X1 MSS_local         7        0.0      0.0      0.0      0.0      0.0      0.0      0.0
GR 0.25     0        0.15     1.5      0        1.5      0.075    4.75     0        8.5
GR 0.15     8.5      0.25     10

[LOSSES]
;;Link           Kentry     Kexit      Kavg       Flap Gate  Seepage
;;-------------- ---------- ---------- ---------- ---------- ----------
9                0          0.02       0          NO         0
C3               0          1.344      0          NO         0
C304_1           0          0.022      0          NO         0
C304_3           0          0.022      0          NO         0
C304_4           0          0.022      0          NO         0
C305_1           0          0.022      0          NO         0
C305_3           0          0.022      0          NO         0
C305_4           0          0.022      0          NO         0
C306_1           0          0.022      0          NO         0
C46              0          1.344      0          NO         0
```

```
C57             0          0.02       0          NO         0
C58             0          1.32       0          NO         0
C62             0          0.02       0          NO         0
C72             0          0.503      0          NO         0
Pipe_-_(100)    0          0.094      0          NO         0
Pipe_-_(101)    0          0.053      0          NO         0
Pipe_-_(102)    0          0.022      0          NO         0
Pipe_-_(103)    0          0.053      0          NO         0
Pipe_-_(104)    0          0.157      0          NO         0
Pipe_-_(105)    0          0.042      0          NO         0
Pipe_-_(106)    0          0.034      0          NO         0
Pipe_-_(107)    0          0.021      0          NO         0
Pipe_-_(108)    0          1.344      0          NO         0
Pipe_-_(109)    0          0.405      0          NO         0
Pipe_-_(110)    0          0.503      0          NO         0
Pipe_-_(174)    0          1.34       0          NO         0
Pipe_-_(64)     0          1.344      0          NO         0
Pipe_-_(65)     0          0.022      0          NO         0
Pipe_-_(66)     0          1.344      0          NO         0
Pipe_-_(67)     0          0.061      0          NO         0
Pipe_-_(69)     0          0.081      0          NO         0
Pipe_-_(70)     0          0.053      0          NO         0
Pipe_-_(71)     0          1.344      0          NO         0
Pipe_-_(72)     0          0.034      0          NO         0
Pipe_-_(73)     0          0.022      0          NO         0
Pipe_-_(74)     0          0.053      0          NO         0
Pipe_-_(75)     0          1.061      0          NO         0
Pipe_-_(76)     0          0.034      0          NO         0
Pipe_-_(77)     0          0.022      0          NO         0
Pipe_-_(78)     0          1.061      0          NO         0
Pipe_-_(79)     0          0.094      0          NO         0
Pipe_-_(80)     0          1.323      0          NO         0
Pipe_-_(81)     0          0.157      0          NO         0
Pipe_-_(82)     0          1.344      0          NO         0
Pipe_-_(83)     0          0.053      0          NO         0
Pipe_-_(84)     0          0.061      0          NO         0
Pipe_-_(85)     0          0.022      0          NO         0
Pipe_-_(86)     0          0.021      0          NO         0
Pipe_-_(87)     0          0.022      0          NO         0
```

```
Pipe_-_(88)     0          0.022      0          NO         0
Pipe_-_(89)     0          1.344      0          NO         0
Pipe_-_(90)     0          0.061      0          NO         0
Pipe_-_(91)     0          0.061      0          NO         0
Pipe_-_(92)     0          1.344      0          NO         0
Pipe_-_(93)     0          0.022      0          NO         0
Pipe_-_(94)     0          0.042      0          NO         0
Pipe_-_(95)     0          1.344      0          NO         0
Pipe_-_(96)     0          0.042      0          NO         0
Pipe_-_(97)     0          1.344      0          NO         0
Pipe_-_(98)     0          1.344      0          NO         0
Pipe_-_(99)     0          0.053      0          NO         0
Pipe_2          0          0.02       0          NO         0
Pipe_6          0          1.32       0          NO         0
Pipe_7          0          0.02       0          NO         0
Pipe_8          0          1.32       0          NO         0

[CURVES]
;;Name          Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
2xIPEX_C        Rating     0          0
2xIPEX_C                   0.1        23.1848
2xIPEX_C                   0.2        31.76
2xIPEX_C                   0.3        37.46
2xIPEX_C                   0.4        42.78
2xIPEX_C                   0.5        47.76
2xIPEX_C                   0.6        52.36
2xIPEX_C                   0.7        56.6
2xIPEX_C                   0.8        60.48
2xIPEX_C                   0.9        64.04
2xIPEX_C                   1          67.3
2xIPEX_C                   1.1        70.36
2xIPEX_C                   1.2        73.14
2xIPEX_C                   1.3        75.6
2xIPEX_C                   1.4        77.76
2xIPEX_C                   1.5        79.6
2xIPEX_C                   1.6        81.18
2xIPEX_C                   1.7        82.3
2xIPEX_C                   1.8        83
```

2xIPEX_C		1.9	83.44
2xIPEX_C		2	83.66
2xIPEX_C		2.1	83.82
2xIPEX_C		2.2	83.94
2xIPEX_C		2.3	84.02
2xIPEX_C		2.4	84.06
2xIPEX_C		2.5	84.08
2xIPEX_C		2.6	84.08
2xIPEX_C		2.7	84.08
2xIPEX_C		2.8	84.08
2xIPEX_C		2.9	84.08
2xIPEX_C		3	84.08
2xIPEX_C		3.1	84.08
2xIPEX_C		3.2	84.08
2xIPEX_C		3.3	84.08
2xIPEX_C		3.4	84.08
2xIPEX_C		3.5	84.08
2xIPEX_C		3.6	84.08
2xIPEX_C		3.7	84.08
2xIPEX_C		3.8	84.08
2xIPEX_C		3.9	84.08
2xIPEX_C		4	84.08

2xIPEX_D	Rating	0	0
2xIPEX_D		0.1	33.7
2xIPEX_D		0.2	45.72
2xIPEX_D		0.3	53.64
2xIPEX_D		0.4	61.32
2xIPEX_D		0.5	68.58
2xIPEX_D		0.6	75.26
2xIPEX_D		0.7	81.48
2xIPEX_D		0.8	87.36
2xIPEX_D		0.9	92.9
2xIPEX_D		1	98.16
2xIPEX_D		1.1	103.42
2xIPEX_D		1.2	108.4
2xIPEX_D		1.3	113.16
2xIPEX_D		1.4	117.68
2xIPEX_D		1.5	122
2xIPEX_D		1.6	126.14
2xIPEX_D		1.7	130.12
2xIPEX_D		1.8	133.96
2xIPEX_D		1.9	137.66
2xIPEX_D		2	141.22
2xIPEX_D		2.1	144.46
2xIPEX_D		2.2	147.58
2xIPEX_D		2.3	150.58
2xIPEX_D		2.4	153.5
2xIPEX_D		2.5	156.32
2xIPEX_D		2.6	159.04
2xIPEX_D		2.7	161.62
2xIPEX_D		2.8	164.08
2xIPEX_D		2.9	166.46
2xIPEX_D		3	168.74
2xIPEX_D		3.1	171.08
2xIPEX_D		3.2	173.34
2xIPEX_D		3.3	175.52
2xIPEX_D		3.4	177.62
2xIPEX_D		3.5	179.68
2xIPEX_D		3.6	181.64
2xIPEX_D		3.7	183.5
2xIPEX_D		3.8	185.22
2xIPEX_D		3.9	186.82
2xIPEX_D		4	188.36

639G	Rating	0	0
639G		1.8	7.7
639G		2.05	8.3

AR201	Rating	0	0
AR201		1.8	394

AR201B	Rating	0	0
AR201B		1.8	196.2

AR202	Rating	0	0
AR202		1.8	370

AR204	Rating	0	0
AR204		1.8	615
AR503	Rating	0	0
AR503		1.8	374
AR506	Rating	0	0
AR506		1.8	325
AR509	Rating	0	0
AR509		1.8	217
AR514A	Rating	0	0
AR514A		1.8	499
AR516A	Rating	0	0
AR516A		1.8	327
AR516A		2.1	343
EX108	Rating	0	0
EX108		1.5	6.8
EX108		1.86	7.5
EX110	Rating	0	0
EX110		1.8	8
EX110		1.94	8.6
EX110A	Rating	0	0
EX110A		1.5	12.8
EX110A		1.99	14.9
EX110B	Rating	0	0
EX110B		1.5	7.8
EX110B		1.84	8.8
EX111	Rating	0	0
EX111		1.8	36.8
EX111		1.9	40.4

EXMH904	Rating	0	0
EXMH904		2.14	29.2
EXT-2	Rating	0	0
EXT-2		1.8	142.67
EXT-2		2.15	142.67
IPEX_A	Rating	0	0
IPEX_A		0.2	8.2
IPEX_A		0.26	10
IPEX_A		0.41	12
IPEX_A		0.58	14
IPEX_A		0.76	16
IPEX_A		0.95	18
IPEX_A		1.31	20
IPEX_A		1.8	21.5
IPEX_A		3	25.17
IPEX_B	Rating	0	0
IPEX_B		0.2	12.5
IPEX_B		0.25	14
IPEX_B		0.34	16
IPEX_B		0.43	18
IPEX_B		0.55	20
IPEX_B		0.68	22
IPEX_B		0.84	24
IPEX_B		1	26
IPEX_B		1.19	28
IPEX_B		1.41	30
IPEX_B		1.69	32
IPEX_B		1.79	32.5
IPEX_B		3	38.55
IPEX_C	Rating	0	0
IPEX_C		0.2	16
IPEX_C		0.26	18
IPEX_C		0.32	20
IPEX_C		0.4	22
IPEX_C		0.49	24

IPEX_C		0.58	26
IPEX_C		0.69	28
IPEX_C		0.8	30
IPEX_C		0.91	32
IPEX_C		1.02	34
IPEX_C		1.14	36
IPEX_C		1.3	38
IPEX_C		1.53	40
IPEX_C		1.78	41.5
IPEX_C		3	48.82
IPEX_D	Rating	0	0
IPEX_D		0.2	21
IPEX_D		0.38	30
IPEX_D		0.65	40
IPEX_D		1	50
IPEX_D		1.43	60
IPEX_D		2	70
IPEX_D		2.65	80
IPEX_D		3.45	90
IPEX_D		4.25	95
IPEX_F	Rating	0	0
IPEX_F		0.2	32
IPEX_F		0.35	40
IPEX_F		0.5	50
IPEX_F		0.75	60
IPEX_F		1	70
IPEX_F		1.35	80
IPEX_F		1.75	90
IPEX_F		2.3	100
IPEX_F		2.95	110
IPEX_F		3.9	120
IPEX_F		4.02	121
Model105	Rating	0	0
Model105		0.22	4.49
Model105		0.25	4.58
Model105		0.37	5.5
Model105		0.5	6.2
Model105		0.67	7
Model105		0.75	7.55
Model105		1.01	8.78
Model105		1.26	9.92
Model105		1.5	10.91
Model105		1.75	11.9
Model105		2	12.86
Model105		2.25	13.55
Model105		2.5	14.47
Model105		3	16.31
Model45	Rating	0	0
Model45		0.19	1.77
Model45		0.25	1.95
Model45		0.37	2.1
Model45		0.52	2.25
Model45		0.7	2.5
Model45		0.75	2.55
Model45		1	2.78
Model45		1.25	3
Model45		1.5	3.2
Model45		2	3.55
Model45		2.5	3.83
Model45		2.58	3.9
Model45		3	4.27
Model55	Rating	0	0
Model55		0.2	2.42
Model55		0.25	2.54
Model55		0.38	3
Model55		0.5	3.12
Model55		0.75	3.52
Model55		1.01	3.8
Model55		1.26	4.1
Model55		1.5	4.42
Model55		1.75	4.55
Model55		2	4.85
Model55		2.25	4.98

Model55		2.5	5.15
Model55		3	5.49
Model65	Rating	0	0
Model65		0.22	2.78
Model65		0.25	3.01
Model65		0.37	3.5
Model65		0.5	3.85
Model65		0.75	4.52
Model65		1.01	5.02
Model65		1.26	5.46
Model65		1.5	5.8
Model65		1.75	6.2
Model65		2	6.5
Model65		2.25	6.8
Model65		2.5	7.15
Model65		3	7.85
Model75	Rating	0	0
Model75		0.22	3.27
Model75		0.25	3.41
Model75		0.37	4
Model75		0.5	4.5
Model75		0.62	4.99
Model75		0.75	5.42
Model75		1.01	6.15
Model75		1.26	6.77
Model75		1.5	7.4
Model75		1.75	7.93
Model75		2	8.42
Model75		2.25	8.9
Model75		2.5	9.4
Model75		3	10.1
Model85	Rating	0	0
Model85		0.25	3.45
Model85		0.35	4
Model85		0.4	4.5
Model85		0.5	4.8

Model85		0.62	5.5
Model85		0.75	5.88
Model85		1.01	6.8
Model85		1.26	7.62
Model85		1.5	8.35
Model85		1.75	8.97
Model85		2	9.55
Model85		2.25	10.1
Model85		2.5	10.6
Model85		3	11.6
Model95	Rating	0	0
Model95		0.25	3.58
Model95		0.28	4
Model95		0.38	5
Model95		0.5	5.44
Model95		0.6	6
Model95		0.75	6.75
Model95		1.01	7.82
Model95		1.26	8.77
Model95		1.5	9.6
Model95		1.75	10.46
Model95		2	11.12
Model95		2.25	11.78
Model95		2.5	12.48
Model95		3	13.88
R202A	Rating	0	0
R202A		1.8	696
R202A		2.05	751.684
S1_1	Rating	0	0
S1_1		1.8	40.88
S1_1		2.1	44.15
S1_2	Rating	0	0
S1_2		1.8	45.63
S1_2		2.1	49.28

ST101	Rating	0	0
ST101		1.8	25.8
ST101		1.87	26
ST104	Rating	0	0
ST104		1.5	15
ST104		1.57	15.2
ST201	Rating	0	0
ST201		2.1	597
ST201A	Rating	0	0
ST201A		2.1	82.7
ST201B	Rating	0	0
ST201B		2.1	1176
ST202A	Rating	0	0
ST202A		2.1	594
ST202B	Rating	0	0
ST202B		2.1	460
ST202C	Rating	0	0
ST202C		2.1	531
ST204A	Rating	0	0
ST204A		2.1	630
ST204B	Rating	0	0
ST204B		2.1	433
ST302	Rating	0	0
ST302		2.1	1208
ST302C	Rating	0	0
ST302C		2.1	276
ST305-1	Rating	0	0
ST305-1		2.1	394
ST305AA	Rating	0	0
ST305AA		2.1	523
ST305CA	Rating	0	0
ST305CA		2.1	245
ST305CB	Rating	0	0
ST305CB		2.1	1184
ST305DA	Rating	0	0
ST305DA		2.1	1173
ST305DB	Rating	0	0
ST305DB		2.1	1621
ST503A	Rating	0	0
ST503A		2.1	202
ST503B	Rating	0	0
ST503B		2.1	331
ST506A	Rating	0	0
ST506A		2.1	216
ST509A	Rating	0	0
ST509A		2.1	138
ST511A	Rating	0	0
ST511A		2.1	248
ST513A	Rating	0	0
ST513A		2.1	593
ST516B	Rating	0	0
ST516B		2.1	390
ST601A	Rating	0	0

ST601A		1.8	293.91
ST601A		2.15	293.91
ST601B	Rating	0	0
ST601B		2.1	447
ST605A	Rating	0	0
ST605A		1.8	163.98
ST605A		2.15	163.98
ST605B	Rating	0	0
ST605B		1.8	147.17
ST605B		2.15	147.17
ST605C	Rating	0	0
ST605C		1.8	250.91
ST605C		2.15	250.91
ST616B	Rating	0	0
ST616B		1.8	55
ST616B		2.15	55
ST623B	Rating	0	0
ST623B		1.8	299.41
ST623B		2.15	299.41
ST632B	Rating	0	0
ST632B		1.8	269.82
ST632B		2.15	269.82
ST633B	Rating	0	0
ST633B		1.8	327.64
ST633B		2.15	327.64
ST639D	Rating	0	0
ST639D		1.8	244
ST639D		2.15	244
ST639F	Rating	0	0

ST639F		1.8	43.6
ST639F		2.05	47.11
ST648B	Rating	0	0
ST648B		1.8	308.47
ST648B		2.15	308.47
UltPond2discharge	Rating	0	0
UltPond2discharge		0.1	9
UltPond2discharge		0.2	25
UltPond2discharge		0.3	45
UltPond2discharge		0.4	223
UltPond2discharge		0.5	312
UltPond2discharge		0.6	410
UltPond2discharge		0.7	516
UltPond2discharge		0.8	631
UltPond2discharge		0.9	753
UltPond2discharge		1	882
UltPond2discharge		1.1	1017
UltPond2discharge		1.2	1159
UltPond2discharge		1.3	1307
UltPond2discharge		1.4	1461
UltPond2discharge		1.5	1620
UltPond2discharge		1.6	1785
UltPond2discharge		1.7	1954
UltPond2discharge		1.8	2129
UltPond2discharge		1.9	2309
UltPond2discharge		2	2494
UltPond2discharge		2.1	2683
UltPond2discharge		2.2	2877
UltPond2discharge		2.3	3076
UltPond2discharge		2.4	3278
506A-S	Storage	0	0
506A-S		1.8	0
506A-S		2	694
DryPondA	Storage	0	0
DryPondA		0.88	0

DryPondA		0.9	100.1
DryPondA		1.88	170.6
DryPondA		2.7	283.2
DryPondB	Storage	0	0
DryPondB		1	0
DryPondB		1.05	276.3
DryPondB		2	470.6
DryPondB		3.05	662.1
EXT2-S	Storage	0	0
EXT2-S		1.8	0
EXT2-S		2	565
EXT2-S		2.001	0
EXT2-S		2.15	0
IntPond2storage	Storage	0	0
IntPond2storage		0.4	0
IntPond2storage		1	0
IntPond2storage		1.8	0
IntPond2storage		1.99	0
IntPond2storage		2	5213
IntPond2storage		2.1	5377
IntPond2storage		2.3	5669
IntPond2storage		2.5	6123
IntPond2storage		3	7060
IntPond2storage		3.5	7844
IntPond2storage		4	8711
IntPond2storage		4.5	9574
ST201A-S	Storage	0	0
ST201A-S		1.8	0
ST201A-S		2	236
ST201B-S	Storage	0	0
ST201B-S		1.8	0
ST201B-S		2	3470
ST201-S	Storage	0	0

ST201-S		1.8	0
ST201-S		2	1705
ST202A-S	Storage	0	0
ST202A-S		1.8	0
ST202A-S		2	1949
ST202B-S	Storage	0	0
ST202B-S		1.8	0
ST202B-S		2	2409
ST202C-S	Storage	0	0
ST202C-S		1.8	0
ST202C-S		2	1740
ST204A-S	Storage	0	0
ST204A-S		1.8	0
ST204A-S		2	1800
ST204B-S	Storage	0	0
ST204B-S		1.8	0
ST204B-S		2	1445
ST302-S	Storage	0	0
ST302-S		1.8	0
ST302-S		2	3820
ST305-1-S	Storage	0	0
ST305-1-S		1.8	0
ST305-1-S		2	1267
ST305AA-S	Storage	0	0
ST305AA-S		1.8	0
ST305AA-S		2	1580
ST305CB-S	Storage	0	0
ST305CB-S		1.8	0
ST305CB-S		2	3410

ST305DA-S	Storage	1	0
ST305DA-S		1.8	0
ST305DA-S		2	3350
ST305DB-S	Storage	0	0
ST305DB-S		1.8	0
ST305DB-S		2	4705
ST503A-S	Storage	0	0
ST503A-S		1.8	0
ST503A-S		2	795
ST503B-S	Storage	0	0
ST503B-S		1.8	0
ST503B-S		2	1305
ST509A-S	Storage	0	0
ST509A-S		1.8	0
ST509A-S		2	414
ST511-S	Storage	0	0
ST511-S		1.8	0
ST511-S		2	730
ST513A-S	Storage	0	0
ST513A-S		1.8	0
ST513A-S		2	1690
ST516B-S	Storage	0	0
ST516B-S		1.8	0
ST516B-S		2	822.1
ST601A-S	Storage	0	0
ST601A-S		1.8	0
ST601A-S		2	610
ST601A-S		2.001	0
ST601A-S		2.15	0
ST601B-S	Storage	0	0
ST601B-S		1.8	0
ST601B-S		2	1340
ST605A-S	Storage	0	0
ST605A-S		1.8	0
ST605A-S		2	340
ST605A-S		2.001	0
ST605A-S		2.15	0
ST605B-S	Storage	0	0
ST605B-S		1.8	0
ST605B-S		2	305
ST605B-S		2.001	0
ST605B-S		2.15	0
ST605C-S	Storage	0	0
ST605C-S		1.8	0
ST605C-S		2	520
ST605C-S		2.001	0
ST605C-S		2.15	0
ST623B-S	Storage	0	0
ST623B-S		1.8	0
ST623B-S		2	620
ST623B-S		2.001	0
ST623B-S		2.15	0
ST632B-S	Storage	0	0
ST632B-S		1.8	0
ST632B-S		2	560
ST632B-S		2.001	0
ST632B-S		2.15	0
ST633B-S	Storage	0	0
ST633B-S		1.8	0
ST633B-S		2	680
ST633B-S		2.001	0
ST633B-S		2.15	0

```
ST639D-S         Storage    0          0
ST639D-S                    1.8        0
ST639D-S                    2          385
ST639D-S                    2.001      0
ST639D-S                    2.15       0

ST647A-S         Storage    0          0
ST647A-S                    1.8        0
ST647A-S                    2          370

ST648B-S         Storage    0          0
ST648B-S                    1.8        0
ST648B-S                    2          640
ST648B-S                    2.001      0
ST648B-S                    2.15       0

UltPond2storage  Storage    0          0
UltPond2storage             1.999999999 0
UltPond2storage             2          26302
UltPond2storage             2.1        26459.1
UltPond2storage             2.2        26650
UltPond2storage             2.3        26836.2
UltPond2storage             2.4        27020
UltPond2storage             2.5        27199.3
UltPond2storage             2.6        27373.8
UltPond2storage             2.7        27552.4
UltPond2storage             2.8        27733.3
UltPond2storage             2.9        27941.6
UltPond2storage             3          28356
UltPond2storage             3.1        28747.1
UltPond2storage             3.2        29119.1
UltPond2storage             3.3        29477.8
UltPond2storage             3.4        29826.7
UltPond2storage             3.5        30158.8
UltPond2storage             3.6        30480
UltPond2storage             3.7        30782.6
UltPond2storage             3.8        31069.3
UltPond2storage             3.9        31339
UltPond2storage             4          31588
```

```
UltPond2storage             4.1        31818.4
UltPond2storage             4.2        32033.1
UltPond2storage             4.3        32233
UltPond2storage             4.4        32416.5

[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
002SCS12                    0:00       0.9002
002SCS12                    0:05       0.8353
002SCS12                    0:10       0.8842
002SCS12                    0:15       0.8977
002SCS12                    0:20       0.9115
002SCS12                    0:25       0.9261
002SCS12                    0:30       0.9408
002SCS12                    0:35       0.9552
002SCS12                    0:40       0.9689
002SCS12                    0:45       0.9824
002SCS12                    0:50       0.9962
002SCS12                    0:55       1.0108
002SCS12                    1:00       1.0255
002SCS12                    1:05       1.0399
002SCS12                    1:10       1.0535
002SCS12                    1:15       1.0671
002SCS12                    1:20       1.0809
002SCS12                    1:25       1.0955
002SCS12                    1:30       1.1101
002SCS12                    1:35       1.1246
002SCS12                    1:40       1.1382
002SCS12                    1:45       1.1518
002SCS12                    1:50       1.1668
002SCS12                    1:55       1.1878
002SCS12                    2:00       1.2092
002SCS12                    2:05       1.232
002SCS12                    2:10       1.2598
002SCS12                    2:15       1.288
002SCS12                    2:20       1.3162
002SCS12                    2:25       1.3445
002SCS12                    2:30       1.3727
```

002SCS12	2:35	1.4009
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002SCS12	2:45	1.4574
002SCS12	2:50	1.4856
002SCS12	2:55	1.5138
002SCS12	3:00	1.5421
002SCS12	3:05	1.5703
002SCS12	3:10	1.5985
002SCS12	3:15	1.6267
002SCS12	3:20	1.655
002SCS12	3:25	1.6832
002SCS12	3:30	1.7114
002SCS12	3:35	1.7397
002SCS12	3:40	1.7679
002SCS12	3:45	1.7961
002SCS12	3:50	1.8349
002SCS12	3:55	1.9161
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002SCS12	4:05	2.0961
002SCS12	4:10	2.2337
002SCS12	4:15	2.3748
002SCS12	4:20	2.5028
002SCS12	4:25	2.5777
002SCS12	4:30	2.6483
002SCS12	4:35	2.7268
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002SCS12	4:45	2.95
002SCS12	4:50	3.0947
002SCS12	4:55	3.3664
002SCS12	5:00	3.6487
002SCS12	5:05	3.9628
002SCS12	5:10	4.4039
002SCS12	5:15	4.8555
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002SCS12	6:20	6.2847
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002SCS12	6:55	3.3429
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002SCS12	7:35	2.3808
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002SCS12	8:35	1.6792
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002SCS12	11:50	0.942
002SCS12	11:55	0.9378
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005CHI3	1:10	32.03692
005CHI3	1:20	16.3375
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005CHI3	1:50	6.68897
005CHI3	2:00	5.6279
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005CHI3	2:30	3.8637
005CHI3	2:40	3.51028
005CHI3	2:50	3.22046
005CHI3	3:00	2.97831
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005SCS12	1:50	1.5478

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005SCS12	11:30	1.2863
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005SCS12	11:55	1.244

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010SCS12	2:45	2.2447

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010SCS12	4:35	4.1999
010SCS12	4:40	4.3698
010SCS12	4:45	4.5437
010SCS12	4:50	4.7666
010SCS12	4:55	5.1851
010SCS12	5:00	5.6199
010SCS12	5:05	6.1036
010SCS12	5:10	6.783
010SCS12	5:15	7.4787
010SCS12	5:20	8.3211
010SCS12	5:25	9.7505
010SCS12	5:30	11.2289
010SCS12	5:35	17.8433
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010SCS12	5:45	73.8735
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010SCS12	6:00	42.2196

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010SCS12	6:25	8.6744
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010SCS12	7:05	4.589
010SCS12	7:10	4.4272
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010SCS12	7:30	3.8187
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010SCS12	8:50	2.4221
010SCS12	8:55	2.3682
010SCS12	9:00	2.3143
010SCS12	9:05	2.2602
010SCS12	9:10	2.2054
010SCS12	9:15	2.1507

010SCS12	9:20	2.096
010SCS12	9:25	2.0421
010SCS12	9:30	1.9881
010SCS12	9:35	1.9341
010SCS12	9:40	1.8793
010SCS12	9:45	1.8246
010SCS12	9:50	1.774
010SCS12	9:55	1.7404
010SCS12	10:00	1.7082
010SCS12	10:05	1.68
010SCS12	10:10	1.6674
010SCS12	10:15	1.6561
010SCS12	10:20	1.6449
010SCS12	10:25	1.6344
010SCS12	10:30	1.624
010SCS12	10:35	1.6134
010SCS12	10:40	1.6021
010SCS12	10:45	1.5908
010SCS12	10:50	1.5797
010SCS12	10:55	1.5692
010SCS12	11:00	1.5588
010SCS12	11:05	1.5482
010SCS12	11:10	1.5369
010SCS12	11:15	1.5256
010SCS12	11:20	1.5145
010SCS12	11:25	1.504
010SCS12	11:30	1.4936
010SCS12	11:35	1.483
010SCS12	11:40	1.4717
010SCS12	11:45	1.4604
010SCS12	11:50	1.4509
010SCS12	11:55	1.4444

025mmCHI	0:10	1.516088055
025mmCHI	0:20	1.749115351
025mmCHI	0:30	2.078715445
025mmCHI	0:40	2.583625152
025mmCHI	0:50	3.461716789
025mmCHI	1:00	5.394996968
025mmCHI	1:10	13.44811663
025mmCHI	1:20	56.72433275
025mmCHI	1:30	17.78358976
025mmCHI	1:40	9.131254948
025mmCHI	1:50	6.147712357
025mmCHI	2:00	4.655383456
025mmCHI	2:10	3.762897479
025mmCHI	2:20	3.169361772
025mmCHI	2:30	2.745825503
025mmCHI	2:40	2.428071751
025mmCHI	2:50	2.180598417
025mmCHI	3:00	1.982179574
025mmCHI	3:10	1.819403154
025mmCHI	3:20	1.683310546
025mmCHI	3:30	1.567742242
025mmCHI	3:40	1.468311255
025mmCHI	3:50	1.381797508
025mmCHI	4:00	1.305793328

025SCS12	0:00	1.6241
025SCS12	0:05	1.507
025SCS12	0:10	1.5952
025SCS12	0:15	1.6197
025SCS12	0:20	1.6445
025SCS12	0:25	1.6708
025SCS12	0:30	1.6973
025SCS12	0:35	1.7234
025SCS12	0:40	1.748
025SCS12	0:45	1.7725
025SCS12	0:50	1.7973
025SCS12	0:55	1.8236
025SCS12	1:00	1.8501
025SCS12	1:05	1.8762
025SCS12	1:10	1.9008
025SCS12	1:15	1.9253
025SCS12	1:20	1.9501
025SCS12	1:25	1.9764
025SCS12	1:30	2.0029
025SCS12	1:35	2.029

025SCS12	1:40	2.0536
025SCS12	1:45	2.0781
025SCS12	1:50	2.1052
025SCS12	1:55	2.143
025SCS12	2:00	2.1817
025SCS12	2:05	2.2227
025SCS12	2:10	2.2729
025SCS12	2:15	2.3238
025SCS12	2:20	2.3747
025SCS12	2:25	2.4257
025SCS12	2:30	2.4766
025SCS12	2:35	2.5275
025SCS12	2:40	2.5785
025SCS12	2:45	2.6294
025SCS12	2:50	2.6803
025SCS12	2:55	2.7313
025SCS12	3:00	2.7822
025SCS12	3:05	2.8331
025SCS12	3:10	2.8841
025SCS12	3:15	2.935
025SCS12	3:20	2.9859
025SCS12	3:25	3.0369
025SCS12	3:30	3.0878
025SCS12	3:35	3.1387
025SCS12	3:40	3.1897
025SCS12	3:45	3.2406
025SCS12	3:50	3.3106
025SCS12	3:55	3.4571
025SCS12	4:00	3.6098
025SCS12	4:05	3.7817
025SCS12	4:10	4.03
025SCS12	4:15	4.2847
025SCS12	4:20	4.5155
025SCS12	4:25	4.6508
025SCS12	4:30	4.7781
025SCS12	4:35	4.9198
025SCS12	4:40	5.1187
025SCS12	4:45	5.3225
025SCS12	4:50	5.5835

025SCS12	4:55	6.0737
025SCS12	5:00	6.583
025SCS12	5:05	7.1497
025SCS12	5:10	7.9455
025SCS12	5:15	8.7604
025SCS12	5:20	9.7472
025SCS12	5:25	11.4216
025SCS12	5:30	13.1533
025SCS12	5:35	20.9015
025SCS12	5:40	52.7152
025SCS12	5:45	86.5345
025SCS12	5:50	108.1299
025SCS12	5:55	80.83
025SCS12	6:00	49.4556
025SCS12	6:05	23.2953
025SCS12	6:10	17.9919
025SCS12	6:15	14.4267
025SCS12	6:20	11.3389
025SCS12	6:25	10.1611
025SCS12	6:30	9.1424
025SCS12	6:35	8.2001
025SCS12	6:40	7.5635
025SCS12	6:45	6.9523
025SCS12	6:50	6.3913
025SCS12	6:55	6.0313
025SCS12	7:00	5.688
025SCS12	7:05	5.3755
025SCS12	7:10	5.186
025SCS12	7:15	5.0067
025SCS12	7:20	4.8278
025SCS12	7:25	4.6504
025SCS12	7:30	4.4732
025SCS12	7:35	4.2955
025SCS12	7:40	4.1164
025SCS12	7:45	3.9371
025SCS12	7:50	3.7689
025SCS12	7:55	3.645
025SCS12	8:00	3.5248
025SCS12	8:05	3.4151

025SCS12	8:10	3.3474
025SCS12	8:15	3.2832
025SCS12	8:20	3.2193
025SCS12	8:25	3.156
025SCS12	8:30	3.0929
025SCS12	8:35	3.0295
025SCS12	8:40	2.9654
025SCS12	8:45	2.9012
025SCS12	8:50	2.8373
025SCS12	8:55	2.774
025SCS12	9:00	2.7109
025SCS12	9:05	2.6475
025SCS12	9:10	2.5834
025SCS12	9:15	2.5193
025SCS12	9:20	2.4553
025SCS12	9:25	2.392
025SCS12	9:30	2.3289
025SCS12	9:35	2.2655
025SCS12	9:40	2.2014
025SCS12	9:45	2.1373
025SCS12	9:50	2.0781
025SCS12	9:55	2.0387
025SCS12	10:00	2.001
025SCS12	10:05	1.9679
025SCS12	10:10	1.9531
025SCS12	10:15	1.9399
025SCS12	10:20	1.9268
025SCS12	10:25	1.9146
025SCS12	10:30	1.9023
025SCS12	10:35	1.8899
025SCS12	10:40	1.8767
025SCS12	10:45	1.8635
025SCS12	10:50	1.8504
025SCS12	10:55	1.8382
025SCS12	11:00	1.8259
025SCS12	11:05	1.8135
025SCS12	11:10	1.8003
025SCS12	11:15	1.7871
025SCS12	11:20	1.774

025SCS12	11:25	1.7618
025SCS12	11:30	1.7495
025SCS12	11:35	1.7371
025SCS12	11:40	1.7239
025SCS12	11:45	1.7107
025SCS12	11:50	1.6996
025SCS12	11:55	1.6919

050SCS12	0:00	1.8052
050SCS12	0:05	1.675
050SCS12	0:10	1.773
050SCS12	0:15	1.8002
050SCS12	0:20	1.8278
050SCS12	0:25	1.8571
050SCS12	0:30	1.8866
050SCS12	0:35	1.9156
050SCS12	0:40	1.9429
050SCS12	0:45	1.9701
050SCS12	0:50	1.9977
050SCS12	0:55	2.0269
050SCS12	1:00	2.0564
050SCS12	1:05	2.0854
050SCS12	1:10	2.1127
050SCS12	1:15	2.1399
050SCS12	1:20	2.1675
050SCS12	1:25	2.1968
050SCS12	1:30	2.2262
050SCS12	1:35	2.2552
050SCS12	1:40	2.2825
050SCS12	1:45	2.3097
050SCS12	1:50	2.3399
050SCS12	1:55	2.3819
050SCS12	2:00	2.4249
050SCS12	2:05	2.4705
050SCS12	2:10	2.5263
050SCS12	2:15	2.5829
050SCS12	2:20	2.6395
050SCS12	2:25	2.6961
050SCS12	2:30	2.7527

050SCS12	2:35	2.8093
050SCS12	2:40	2.8659
050SCS12	2:45	2.9225
050SCS12	2:50	2.9791
050SCS12	2:55	3.0357
050SCS12	3:00	3.0924
050SCS12	3:05	3.149
050SCS12	3:10	3.2056
050SCS12	3:15	3.2622
050SCS12	3:20	3.3188
050SCS12	3:25	3.3754
050SCS12	3:30	3.432
050SCS12	3:35	3.4886
050SCS12	3:40	3.5452
050SCS12	3:45	3.6019
050SCS12	3:50	3.6797
050SCS12	3:55	3.8425
050SCS12	4:00	4.0123
050SCS12	4:05	4.2033
050SCS12	4:10	4.4793
050SCS12	4:15	4.7624
050SCS12	4:20	5.0189
050SCS12	4:25	5.1693
050SCS12	4:30	5.3108
050SCS12	4:35	5.4682
050SCS12	4:40	5.6894
050SCS12	4:45	5.9158
050SCS12	4:50	6.2059
050SCS12	4:55	6.7508
050SCS12	5:00	7.3169
050SCS12	5:05	7.9467
050SCS12	5:10	8.8313
050SCS12	5:15	9.737
050SCS12	5:20	10.8339
050SCS12	5:25	12.695
050SCS12	5:30	14.6197
050SCS12	5:35	23.2316
050SCS12	5:40	58.5921
050SCS12	5:45	96.1816
050SCS12	5:50	120.1845
050SCS12	5:55	89.8412
050SCS12	6:00	54.969
050SCS12	6:05	25.8923
050SCS12	6:10	19.9977
050SCS12	6:15	16.035
050SCS12	6:20	12.603
050SCS12	6:25	11.2938
050SCS12	6:30	10.1616
050SCS12	6:35	9.1143
050SCS12	6:40	8.4067
050SCS12	6:45	7.7274
050SCS12	6:50	7.1039
050SCS12	6:55	6.7037
050SCS12	7:00	6.3221
050SCS12	7:05	5.9748
050SCS12	7:10	5.7641
050SCS12	7:15	5.5648
050SCS12	7:20	5.366
050SCS12	7:25	5.1688
050SCS12	7:30	4.9718
050SCS12	7:35	4.7744
050SCS12	7:40	4.5753
050SCS12	7:45	4.376
050SCS12	7:50	4.1891
050SCS12	7:55	4.0513
050SCS12	8:00	3.9177
050SCS12	8:05	3.7958
050SCS12	8:10	3.7206
050SCS12	8:15	3.6493
050SCS12	8:20	3.5782
050SCS12	8:25	3.5079
050SCS12	8:30	3.4377
050SCS12	8:35	3.3673
050SCS12	8:40	3.296
050SCS12	8:45	3.2247
050SCS12	8:50	3.1536
050SCS12	8:55	3.0833
050SCS12	9:00	3.0131

050SCS12	9:05	2.9427
050SCS12	9:10	2.8714
050SCS12	9:15	2.8001
050SCS12	9:20	2.729
050SCS12	9:25	2.6587
050SCS12	9:30	2.5885
050SCS12	9:35	2.5181
050SCS12	9:40	2.4469
050SCS12	9:45	2.3755
050SCS12	9:50	2.3097
050SCS12	9:55	2.266
050SCS12	10:00	2.2241
050SCS12	10:05	2.1873
050SCS12	10:10	2.1709
050SCS12	10:15	2.1562
050SCS12	10:20	2.1417
050SCS12	10:25	2.128
050SCS12	10:30	2.1144
050SCS12	10:35	2.1006
050SCS12	10:40	2.086
050SCS12	10:45	2.0712
050SCS12	10:50	2.0567
050SCS12	10:55	2.0431
050SCS12	11:00	2.0295
050SCS12	11:05	2.0157
050SCS12	11:10	2.001
050SCS12	11:15	1.9863
050SCS12	11:20	1.9718
050SCS12	11:25	1.9582
050SCS12	11:30	1.9446
050SCS12	11:35	1.9308
050SCS12	11:40	1.9161
050SCS12	11:45	1.9014
050SCS12	11:50	1.8891
050SCS12	11:55	1.8806

100CHI12	0:00	1.49
100CHI12	0:10	1.5498
100CHI12	0:20	1.6153
100CHI12	0:30	1.6873
100CHI12	0:40	1.7668
100CHI12	0:50	1.855
100CHI12	1:00	1.9537
100CHI12	1:10	2.0647
100CHI12	1:20	2.1908
100CHI12	1:30	2.3352
100CHI12	1:40	2.5025
100CHI12	1:50	2.6988
100CHI12	2:00	2.9327
100CHI12	2:10	3.2164
100CHI12	2:20	3.5685
100CHI12	2:30	4.0183
100CHI12	2:40	4.6146
100CHI12	2:50	5.446
100CHI12	3:00	6.6922
100CHI12	3:10	8.7819
100CHI12	3:20	13.0571
100CHI12	3:30	27.032
100CHI12	3:40	166.0697
100CHI12	3:50	73.769
100CHI12	4:00	32.337
100CHI12	4:10	20.558
100CHI12	4:20	15.1038
100CHI12	4:30	11.98
100CHI12	4:40	9.9602
100CHI12	4:50	8.5472
100CHI12	5:00	7.5028
100CHI12	5:10	6.6988
100CHI12	5:20	6.0601
100CHI12	5:30	5.5402
100CHI12	5:40	5.1083
100CHI12	5:50	4.7436
100CHI12	6:00	4.4313
100CHI12	6:10	4.1606
100CHI12	6:20	3.9238
100CHI12	6:30	3.7146
100CHI12	6:40	3.5284
100CHI12	6:50	3.3616

100CHI12	7:00	3.2112
100CHI12	7:10	3.0748
100CHI12	7:20	2.9506
100CHI12	7:30	2.8369
100CHI12	7:40	2.7324
100CHI12	7:50	2.6361
100CHI12	8:00	2.547
100CHI12	8:10	2.4642
100CHI12	8:20	2.3872
100CHI12	8:30	2.3152
100CHI12	8:40	2.248
100CHI12	8:50	2.1848
100CHI12	9:00	2.1255
100CHI12	9:10	2.0696
100CHI12	9:20	2.0169
100CHI12	9:30	1.967
100CHI12	9:40	1.9198
100CHI12	9:50	1.8751
100CHI12	10:00	1.8325
100CHI12	10:10	1.7921
100CHI12	10:20	1.7536
100CHI12	10:30	1.7168
100CHI12	10:40	1.6818
100CHI12	10:50	1.6482
100CHI12	11:00	1.6162
100CHI12	11:10	1.5854
100CHI12	11:20	1.556
100CHI12	11:30	1.5277
100CHI12	11:40	1.5005
100CHI12	11:50	1.4744

100CHI3	0:10	6.04573
100CHI3	0:20	7.54219
100CHI3	0:30	10.1588
100CHI3	0:40	15.96889
100CHI3	0:50	40.65497
100CHI3	1:00	178.559
100CHI3	1:10	54.04853
100CHI3	1:20	27.3187
100CHI3	1:30	18.24039
100CHI3	1:40	13.73692
100CHI3	1:50	11.05876
100CHI3	2:00	9.28521
100CHI3	2:10	8.02389
100CHI3	2:20	7.08022
100CHI3	2:30	6.34698
100CHI3	2:40	5.76029
100CHI3	2:50	5.27978
100CHI3	3:00	4.87871

;Chicago100y_3h_10m_City+20%: Time Step(hh:mm), Intensity(mm/hr)

100CHI3+20	00:00	7.255
100CHI3+20	00:10	9.051
100CHI3+20	00:20	12.191
100CHI3+20	00:30	19.163
100CHI3+20	00:40	48.786
100CHI3+20	00:50	214.271
100CHI3+20	01:00	64.858
100CHI3+20	01:10	32.782
100CHI3+20	01:20	21.888
100CHI3+20	01:30	16.484
100CHI3+20	01:40	13.271
100CHI3+20	01:50	11.142
100CHI3+20	02:00	9.629
100CHI3+20	02:10	8.496
100CHI3+20	02:20	7.616
100CHI3+20	02:30	6.912
100CHI3+20	02:40	6.336
100CHI3+20	02:50	5.854

100CHI6	0:00	2.7638
100CHI6	0:10	3.011
100CHI6	0:20	3.3127
100CHI6	0:30	3.6901
100CHI6	0:40	4.177
100CHI6	0:50	4.8312
100CHI6	1:00	5.7604
100CHI6	1:10	7.1926

100CHI6	1:20	9.7082
100CHI6	1:30	15.3576
100CHI6	1:40	40.6918
100CHI6	1:50	178.5052
100CHI6	2:00	53.7231
100CHI6	2:10	27.639
100CHI6	2:20	18.5588
100CHI6	2:30	14.0121
100CHI6	2:40	11.2954
100CHI6	2:50	9.4913
100CHI6	3:00	8.206
100CHI6	3:10	7.2432
100CHI6	3:20	6.4945
100CHI6	3:30	5.8951
100CHI6	3:40	5.4039
100CHI6	3:50	4.9938
100CHI6	4:00	4.646
100CHI6	4:10	4.347
100CHI6	4:20	4.0871
100CHI6	4:30	3.859
100CHI6	4:40	3.6571
100CHI6	4:50	3.477
100CHI6	5:00	3.3153
100CHI6	5:10	3.1693
100CHI6	5:20	3.0367
100CHI6	5:30	2.9158
100CHI6	5:40	2.805
100CHI6	5:50	2.703

;SCS100y_12h_5m: Time Step(hh:mm), Intensity(mm/hr)

100SCS12	0:00	1.9962
100SCS12	0:05	1.8522
100SCS12	0:10	1.9607
100SCS12	0:15	1.9907
100SCS12	0:20	2.0213
100SCS12	0:25	2.0537
100SCS12	0:30	2.0862
100SCS12	0:35	2.1183
100SCS12	0:40	2.1485
100SCS12	0:45	2.1785
100SCS12	0:50	2.2091
100SCS12	0:55	2.2415
100SCS12	1:00	2.274
100SCS12	1:05	2.3061
100SCS12	1:10	2.3363
100SCS12	1:15	2.3663
100SCS12	1:20	2.3969
100SCS12	1:25	2.4293
100SCS12	1:30	2.4618
100SCS12	1:35	2.4939
100SCS12	1:40	2.5241
100SCS12	1:45	2.5542
100SCS12	1:50	2.5875
100SCS12	1:55	2.634
100SCS12	2:00	2.6815
100SCS12	2:05	2.7319
100SCS12	2:10	2.7936
100SCS12	2:15	2.8562
100SCS12	2:20	2.9188
100SCS12	2:25	2.9814
100SCS12	2:30	3.044
100SCS12	2:35	3.1066
100SCS12	2:40	3.1692
100SCS12	2:45	3.2318
100SCS12	2:50	3.2944
100SCS12	2:55	3.357
100SCS12	3:00	3.4196
100SCS12	3:05	3.4822
100SCS12	3:10	3.5448
100SCS12	3:15	3.6074
100SCS12	3:20	3.67
100SCS12	3:25	3.7326
100SCS12	3:30	3.7952
100SCS12	3:35	3.8578
100SCS12	3:40	3.9204
100SCS12	3:45	3.983
100SCS12	3:50	4.0691
100SCS12	3:55	4.2491

100SCS12	4:00	4.4369
100SCS12	4:05	4.6482
100SCS12	4:10	4.9534
100SCS12	4:15	5.2664
100SCS12	4:20	5.55
100SCS12	4:25	5.7163
100SCS12	4:30	5.8728
100SCS12	4:35	6.0469
100SCS12	4:40	6.2915
100SCS12	4:45	6.5419
100SCS12	4:50	6.8627
100SCS12	4:55	7.4653
100SCS12	5:00	8.0913
100SCS12	5:05	8.7877
100SCS12	5:10	9.7659
100SCS12	5:15	10.7675
100SCS12	5:20	11.9804
100SCS12	5:25	14.0385
100SCS12	5:30	16.1669
100SCS12	5:35	25.6902
100SCS12	5:40	64.7929
100SCS12	5:45	106.3604
100SCS12	5:50	132.9036
100SCS12	5:55	99.349
100SCS12	6:00	60.7863
100SCS12	6:05	28.6325
100SCS12	6:10	22.1141
100SCS12	6:15	17.732
100SCS12	6:20	13.9367
100SCS12	6:25	12.4891
100SCS12	6:30	11.237
100SCS12	6:35	10.0789
100SCS12	6:40	9.2964
100SCS12	6:45	8.5451
100SCS12	6:50	7.8557
100SCS12	6:55	7.4131
100SCS12	7:00	6.9912
100SCS12	7:05	6.6071
100SCS12	7:10	6.3741

100SCS12	7:15	6.1538
100SCS12	7:20	5.9339
100SCS12	7:25	5.7159
100SCS12	7:30	5.498
100SCS12	7:35	5.2797
100SCS12	7:40	5.0595
100SCS12	7:45	4.8391
100SCS12	7:50	4.6324
100SCS12	7:55	4.4801
100SCS12	8:00	4.3324
100SCS12	8:05	4.1975
100SCS12	8:10	4.1143
100SCS12	8:15	4.0355
100SCS12	8:20	3.9568
100SCS12	8:25	3.8791
100SCS12	8:30	3.8015
100SCS12	8:35	3.7236
100SCS12	8:40	3.6448
100SCS12	8:45	3.566
100SCS12	8:50	3.4873
100SCS12	8:55	3.4096
100SCS12	9:00	3.332
100SCS12	9:05	3.2541
100SCS12	9:10	3.1753
100SCS12	9:15	3.0964
100SCS12	9:20	3.0178
100SCS12	9:25	2.9401
100SCS12	9:30	2.8625
100SCS12	9:35	2.7846
100SCS12	9:40	2.7058
100SCS12	9:45	2.6269
100SCS12	9:50	2.5542
100SCS12	9:55	2.5058
100SCS12	10:00	2.4595
100SCS12	10:05	2.4188
100SCS12	10:10	2.4006
100SCS12	10:15	2.3843
100SCS12	10:20	2.3683
100SCS12	10:25	2.3532

```
100SCS12                    10:30      2.3382
100SCS12                    10:35      2.3229
100SCS12                    10:40      2.3067
100SCS12                    10:45      2.2904
100SCS12                    10:50      2.2744
100SCS12                    10:55      2.2593
100SCS12                    11:00      2.2443
100SCS12                    11:05      2.229
100SCS12                    11:10      2.2128
100SCS12                    11:15      2.1965
100SCS12                    11:20      2.1805
100SCS12                    11:25      2.1654
100SCS12                    11:30      2.1504
100SCS12                    11:35      2.1351
100SCS12                    11:40      2.1189
100SCS12                    11:45      2.1026
100SCS12                    11:50      2.089
100SCS12                    11:55      2.0796

[REPORT]
;;Reporting Options
INPUT      NO
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]
Node       C904A-S          RY
Node       CB106C-S         RY
Link       14               Maj_system
Link       15               Maj_system
Link       16               Maj_system
Link       18               Maj_system
Link       19               Maj_system
Link       C1               Maj_system
Link       C10              Maj_system
Link       C11              Maj_system
Link       C13              maj_system
Link       C14              Maj_system
Link       C15              Maj_system
Link       C16              Maj_system
Link       C17              Maj_system
Link       C18              Maj_system
Link       C19              Maj_system
Link       C2               Maj_system
Link       C20              Maj_system
Link       C21              Maj_system
Link       C22              Maj_system
Link       C23              Maj_system
Link       C24              Maj_system
Link       C25              Maj_system
Link       C26              Maj_system
Link       C27              Maj_system
Link       C28              Maj_system
Link       C29              Maj_system
Link       C30              Maj_system
Link       C31              Maj_system
Link       C32              Maj_system
Link       C33              Maj_system
Link       C34              Maj_system
Link       C35              Maj_system
Link       C36              Maj_system
Link       C38              Maj_system
Link       C39              Maj_system
Link       C4               Maj_system
Link       C40              Maj_system
Link       C41              Maj_system
Link       C42              Maj_system
Link       C44              Maj_system
Link       C47              Maj_system
Link       C48              Maj_system
Link       C49              Maj_system
Link       C5               Maj_system
Link       C50              Maj_system
Link       C51              Maj_system
Link       C52              Maj_system
Link       C53              Maj_system
```

Link	C54	Maj_system
Link	C55	Maj_system
Link	C56	Maj_system
Link	C6	Maj_system
Link	C60	Maj_system
Link	C61	Maj_system
Link	C7	Maj_system
Link	C7_1	Maj_system
Link	C7_2	Maj_system
Link	C8	Maj_system
Link	C9	Maj_system
Link	EXT-11-S0-O_2	Maj_system
Link	EXT-4-S0-O_1	Maj_system
Link	EXT-4-S0-O_3	Maj_system
Link	EXT-6-S-O_3	Maj_system
Link	EXT-6-S-O_4	Maj_system
Link	EXT-9-S0-O_2	Maj_system
Link	N73-O	Maj_system
Link	ST602A-S0-O	Maj_system
Link	ST602A-S-O	Maj_system
Link	ST603A-S0-O	Maj_system
Link	ST606A-S-O	Maj_system
Link	ST610A-S0-O	Maj_system
Link	ST610A-S-O	Maj_system
Link	ST611A-S0-O	Maj_system
Link	ST611A-S-O	Maj_system
Link	ST611C-S0-O	Maj_system
Link	ST612A-S0-O	Maj_system
Link	ST612A-S-O	Maj_system
Link	ST613A-S0-O	Maj_system
Link	ST613A-S-O	Maj_system
Link	ST615A-S0-O	Maj_system
Link	ST616A-S0-O	Maj_system
Link	ST616A-S1-O	Maj_system
Link	ST616A-S-O	Maj_system
Link	ST617A-S0-O	Maj_system
Link	ST617A-S-O	Maj_system
Link	ST620A-S0-O_1	Maj_system
Link	ST620A-S-O	Maj_system

Link	ST621A-S0-O	Maj_system
Link	ST621A-S-O	Maj_system
Link	ST624A-S0-O_1	Maj_system
Link	ST624A-S-O	Maj_system
Link	ST625B-S0-O	Maj_system
Link	ST625B-S-O	Maj_system
Link	ST628A-S0-O_1	Maj_system
Link	ST628A-S0-O_2	Maj_system
Link	ST628A-S-O	Maj_system
Link	ST630B-S0-O	Maj_system
Link	ST630B-S-O	Maj_system
Link	ST631A-S0-O	Maj_system
Link	ST631A-S-O	Maj_system
Link	ST633A-S0-O	Maj_system
Link	ST633A-S-O	Maj_system
Link	ST634A-S0-O	Maj_system
Link	ST634A-S1-O	Maj_system
Link	ST635A-S0-O	Maj_system
Link	ST635A-S-O	Maj_system
Link	ST637A-S0-O	Maj_system
Link	ST637A-S-O	Maj_system
Link	ST638A-S-O	Maj_system
Link	ST639A-S0-O	Maj_system
Link	ST639A-S-O	Maj_system
Link	ST641A-S0-O_1	Maj_system
Link	ST641A-S0-O_2	Maj_system
Link	ST641A-S-O	Maj_system
Link	ST642A-S0-O	Maj_system
Link	ST642A-S-O	Maj_system
Link	ST643A-S0-O	Maj_system
Link	ST643A-S1-O	Maj_system
Link	ST643A-S-O	Maj_system
Link	ST644A-S-O	Maj_system
Link	ST645A-S-O	Maj_system
Link	ST646A-S-O	Maj_system
Link	ST648A-S0-O_1	Maj_system
Link	ST648A-S0-O_4	Maj_system
Link	ST648A-S-O	Maj_system
Link	ST634A-S-O	Maj_system

```
Link       ST634A-S-W       Maj_system

[MAP]
DIMENSIONS       382195.9289      5031896.7718     383809.8511      5033301.5862
UNITS            Meters

[COORDINATES]
;;Node           X-Coord            Y-Coord
;;-------------- ------------------ ------------------
500A             383606.508         5032250.667
501              383606.221         5032286
502              383603.3           5032322
503              383515.8           5032335
504              383398             5032358
505              383329             5032372
506              383213.6           5032401
507              383104.9           5032426
508              382992.8           5032438
509              382880.7           5032450
601              382887.7           5032520
602              382895.6           5032610
603              382849.9           5032610
605              382762             5032633
606              382727.7           5032635
607              382689.7           5032631
608              382682.1           5032714
609              382679.5           5032775
610              382604.8           5032624
611              382602             5032722
612              382600.7           5032765
613              382603.8           5032800
614              382676.9           5032786
615              382621.2           5032882
616              382569.2           5032893
617              382664.5           5032874
618              382709.3           5032871
619              382755.7           5032882
620              382772.9           5032889
621              382624.4           5032897
622              382625.8           5032927
623              382613.9           5032957
624              382581.2           5033018
625              382686.4           5033070
626              382690.2           5033081
627              382656             5033136
628              382548.6           5033092
629              382533.8           5033125
630              382642.8           5033144
631              382529.5           5032630
632              382517.6           5032591
633              382508.8           5032564
634              382484.3           5032488
635              382525.5           5032660
636              382505.3           5032708
637              382537             5032721
638              382568.1           5032721
639              382449.3           5032683
640              382416.1           5032662
641              382390.7           5032638
642              382470.4           5032791
643              382435.3           5032875
644              382396.2           5032971
645              382373.5           5033027
646              382472.2           5032891
647              382502.535         5032896.482
648              382536.8           5032898
648-1            382535.445         5032950.646
EXMH904          382380.862         5032774.666
J1               383582.829         5032065.147
J7               382293.336         5032826.101
ST634A-S2        382512.762         5032490.079
Creek            383608.365         5031960.627
OF_MudCreek      382514.005         5032495.382
OF1              382577.595         5033180.305
OF2              383664.675         5032074.741
OF3              382269.289         5032830.531
OF5              382359.934         5033067.119
C101B1-S         382443.641         5032688.048
```

C102A-S	382427.339	5032727.117
C103A1-S	382398.022	5032720.058
C104A1-S	382353.161	5032700.057
C106A1-S	382414.377	5032669.325
C106B-S	382392.258	5032716.558
C904A-S	382378.88	5032754.215
CB101AB-S	382436.004	5032700.202
CB102AB-S	382416.859	5032744.07
CB103A-S	382415.449	5032726.299
CB104AB-S	382378.628	5032710.459
CB106AB-S	382409.625	5032689.037
CB106C-S	382393.171	5032693.021
CBMH-102A	382396.144	5032760.705
EX_ST101-S	382362.365	5032846.554
EX_ST104-S	382330.077	5032866.172
EXT2-S	382476.331	5033028.662
INTPOND2-S	383607.171	5032234.147
ST302-1A-S	382794.849	5032963.341
ST302-1A-S0	382817.081	5032900.035
ST302-2A-S	382749.09	5033074.819
ST302-3A-S0	382689.795	5033123.302
ST302A-S	382826.796	5032865.522
ST303-1A-S	382912.895	5032609.9
ST303-1A-S0	382890.335	5032607.455
ST303-2A-S	382893.035	5032725.346
ST303-3A-S	382862.235	5032793.97
ST601A-S	382821.436	5032523.572
ST602A-S	382883.456	5032528.301
ST602A-S0	382877	5032460
ST603A-S	382838.841	5032608.902
ST603A-S0	382795.956	5032622.331
ST603B-S	382854.736	5032573.684
ST605A-S	382743.409	5032685.06
ST605B-S	382740.237	5032795.997
ST605C-S	382823.23	5032696.606
ST605D-S	382839.164	5032642.929
ST606A-S	382754.419	5032628.73
ST606A-S1	382713.181	5032631.66
ST607A-S	382699.479	5032664.459

ST608B-S	382719.029	5032673.394
ST609A-S	382677.745	5032750.072
ST610A-S	382663.235	5032632.8
ST610A-S0	382685.3	5032695
ST610B-S	382645.023	5032707.982
ST610C-S	382672.506	5032596.148
ST611A-S	382609.244	5032675.823
ST611B-S	382564.852	5032672.844
ST611C-S0	382604.624	5032720.556
ST612A-S	382606.338	5032764.379
ST612A-S0	382650	5032792
ST612B-S	382573.24	5032760.12
ST613A-S0	382606.5	5032801
ST614A-S0	382396.9	5032619
ST615A-S	382614.457	5032826.3
ST615A-S0	382621.724	5032860.082
ST615B-S	382683.668	5032833.077
ST616A-S	382587.259	5032885.489
ST616A-S0	382623.856	5032878.376
ST616B-S	382523.048	5032824.736
ST617A-S	382667.497	5032871.264
ST617A-S0	382707.2	5032870
ST619A-S	382735.363	5032839.099
ST620A-S	382742.778	5032877.492
ST621A-S	382630.064	5032921.256
ST621A-S0	382619.5	5032951
ST622A-S	382701.766	5032908.842
ST623A-S	382592.457	5032929.119
ST623B-S	382653.716	5032988.541
ST624A-S	382597.443	5033001.755
ST624A-S0	382570.7	5033046
ST624A-S1	382587.992	5033020.174
ST624B-S	382658.068	5033023.149
ST625A-S	382604.868	5033044.691
ST625B-S	382669.375	5033077.35
ST625B-S0	382639.9	5033049
ST628A-S	382553.863	5033086.381
ST628A-S0	382519.5	5033161
ST628A-S1	382533.676	5033131.19

ST628B-S	382539.577	5033037.525
ST628C-S	382618.44	5033082.459
ST629A-S	382571.224	5033148.084
ST630A-S	382555.688	5033107.748
ST630B-S	382628.969	5033132.581
ST630B-S0	382657.2	5033131
ST630B-S1	382594.28	5033115.929
ST631A-S	382571.536	5032622.989
ST631A-S0	382607.3	5032623
ST632A-S	382608.455	5032591.906
ST632B-S	382459.397	5032554.937
ST633A-S	382521.007	5032588.151
ST633A-S0	382531.658	5032625.776
ST633B-S	382558.332	5032543.585
ST634A-S	382494.799	5032512.135
ST634A-S0	382510.057	5032555.551
ST634A-S1	382485.874	5032482.781
ST635A-S	382529.391	5032662.11
ST637A-S	382535.474	5032716.304
ST637A-S0	382557.1	5032719
ST638A-S	382572.92	5032719.016
ST639A-S	382466.649	5032683.805
ST639A-S0	382508.463	5032706.647
ST639B-S	382470.23	5032651.851
ST639C-S	382460.92	5032713.806
ST639E-S	382402.248	5032794.567
ST639F-S	382371.733	5032784.647
ST639G-S	382338.144	5032786.554
ST641A-S	382405.227	5032645.8
ST641A-S0	382432.3	5032671
ST641A-S1	382423.992	5032663.267
ST641B-S	382382.565	5032673.438
ST642A-S	382484.014	5032772.323
ST642A-S0	382457.5	5032829
ST643A-S	382449.715	5032853.15
ST643A-S0	382478.4	5032890
ST643A-S1	382438.296	5032880.663
ST644A-S	382424.775	5032909.171
ST645A-S	382389.042	5033008.137
ST645A-S0	382364.625	5033055.512
ST645A-S1	382413.017	5032945.004
ST645B-S	382431.007	5032985.805
ST646A-S	382457.762	5032888.387
ST648A-S	382515.543	5032892.543
ST648A-S0	382552.7	5032895
ST648A-S1	382546.095	5032894.563
ST648B-S	382544.756	5032950.812
STM-101	382426.7	5032736
STM-101A	382431.174	5032727.983
STM-102	382413.483	5032767.284
STM-103	382391.3	5032721
STM-104	382352.2	5032705
STM-106	382411.998	5032669.58
STM-639	382445.1	5032692

[VERTICES]

;;Link	X-Coord	Y-Coord
;;--------------	------------------	------------------
C304_1	382918.067	5032446
C304_1	382955.433	5032442
C304_3	383015.22	5032435.6
C304_3	383037.64	5032433.2
C304_3	383060.06	5032430.8
C304_3	383082.48	5032428.4
C304_4	383132.075	5032419.75
C304_4	383159.25	5032413.5
C304_4	383186.425	5032407.25
C305_1	383252.067	5032391.333
C305_1	383290.533	5032381.667
C305_3	383346.25	5032368.5
C305_3	383363.5	5032365
C305_3	383380.75	5032361.5
C305_4	383421.56	5032353.4
C305_4	383445.12	5032348.8
C305_4	383468.68	5032344.2
C305_4	383492.24	5032339.6
C39	383736.491	5032179.422
Pipe_-_(101)	382767.151	5032884.52

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ST602A-S-O       382890.306       5032607.396
ST625B-S-O       382657.095       5033131.264
ST633A-S-O       382515.532       5032571.851
ST648A-S0-O_4    382538.368       5032893.879
C101A-IC         382441.892       5032697.456
C102B-IC         382422.426       5032741.741
ORF_QUAL         383536.23        5032149.128
ST602A-O1        382889.771       5032556.637
ST603A-O1        382842.048       5032610.555
ST606A-O1        382732.721       5032632.007
ST607A-O1        382690.366       5032651.354
ST609A-O1        382675.132       5032764.049
ST610A-O1        382627.012       5032631.047
ST611A-O1        382603.887       5032698.068
ST612A-O1        382604.007       5032767.949
ST615A-O1        382614.446       5032842.172
ST616A-O1        382581.771       5032889.072
ST617A-O1        382664.005       5032869.934
ST620A-O         382757.467       5032883.866
ST620A-O1        382755.091       5032887.027
ST621A-O1        382626.492       5032912.494
ST623A-O         382600.777       5032934.84
ST624A-O1        382590.241       5033005.187
ST625A-O1        382642.118       5033060.958
ST625B-O1        382679.147       5033077.345
ST628A-O1        382549.63        5033085.949
ST630A-O1        382595.34        5033129.575
ST630B-O1        382638.767       5033136.081
ST631A-O1        382538.163       5032626.39
ST633A-O1        382515.877       5032581.717
ST634A-O1        382492.375       5032498.955
ST635A-O1        382526.513       5032662.96
ST637A-O1        382534.009       5032718.168
ST638A-O1        382587.014       5032722.495
ST639A-O1        382459.858       5032685.752
ST641A-O1        382398.572       5032638.141
ST641B-O         382382.556       5032656.478
ST642A-O1        382477.268       5032778.251
ST643A-O1        382441.732       5032862.561
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ST644A-O1        382412.873       5032940.721
ST645A-O1        382380.721       5033015.057
ST646A-O         382467.789       5032893.025
ST648A-O1        382526.561       5032891.416
20               382397.665       5032690.055
21               382406.994       5032750.913
ST634A-S-W       382500.538       5032485.057
Weir1            383667.412       5032153.336
C104B-IC         382382.651       5032716.306
C106A-IC         382401.173       5032700.47

[POLYGONS]
;;Subcatchment   X-Coord            Y-Coord
;;-------------- ------------------ ------------------
C101A            382458.017         5032695.393
C101A            382444.715         5032688.201
C101A            382428.375         5032726.975
C101A            382442.315         5032732.811
C101A            382447.669         5032720.023
C101A            382449.059         5032716.702
C101A            382458.017         5032695.393
C101B            382444.715         5032688.201
C101B            382429.317         5032679.875
C101B            382412.783         5032719.226
C101B            382420.655         5032722.524
C101B            382423.643         5032724.992
C101B            382428.375         5032726.975
C101B            382444.715         5032688.201
C102A            382442.315         5032732.811
C102A            382428.375         5032726.975
C102A            382428.375         5032726.975
C102A            382425.638         5032733.508
C102A            382425.638         5032733.508
C102A            382409.06          5032773.071
C102A            382409.06          5032773.071
C102A            382423.012         5032778.922
C102A            382423.012         5032778.922
C102A            382437.334         5032744.712
C102A            382437.334         5032744.712
```

C.3 PCSWMM MODEL OUTPUT

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.014)
--------------------------------------------------------------

WARNING 03: negative offset ignored for Link Pipe_6

*********************************************************
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 ............ 05/15/2014 00:00:00
Ending Date .............. 05/16/2014 12:00:00
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 ........ 5.00 sec
Variable Time Step ....... NO
Maximum Trials ........... 8
Number of Threads ........ 4
Head Tolerance ........... 0.001500 m
```

```
**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         2.367        71.665
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.697        21.119
Surface Runoff ...........         1.643        49.748
Final Storage ............         0.028         0.861
Continuity Error (%) .....        -0.089


**************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         1.643        16.429
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         1.481        14.809
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.004         0.037
Final Stored Volume ......         0.170         1.699
Continuity Error (%) .....        -0.251


*************************
Highest Continuity Errors
*************************
Node ST602A-S0 (6.99%)
Node ST633A-S0 (-5.90%)
Node ST612A-S0 (5.63%)
Node ST624A-S0 (-4.83%)
Node ST628A-S1 (-3.12%)
```

```
********************************
Highest Flow Instability Indexes
********************************
Link ST639E-O (6)
Link ST639F-O (6)
Link ST639G-O (5)
Link C37 (3)
Link ORF_QUAL (2)


*************************
Routing Time Step Summary
*************************
Minimum Time Step           :     5.00 sec
Average Time Step           :     5.00 sec
Maximum Time Step           :     5.00 sec
Percent in Steady State     :     0.00
Average Iterations per Step :     2.25
Percent Not Converging      :     1.67


***************************
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
C101A	71.66	0.00	0.00	6.94	59.15	4.33	63.48	0.03	26.51	0.886
C101B	71.66	0.00	0.00	6.32	60.15	3.93	64.08	0.04	31.58	0.894
C102A	71.66	0.00	0.00	8.23	57.15	5.10	62.24	0.05	35.95	0.869
C102AA	71.66	0.00	0.00	23.56	33.10	14.35	47.45	0.05	40.88	0.662
C102B	71.66	0.00	0.00	8.18	57.16	5.14	62.30	0.04	33.80	0.869
C103A	71.66	0.00	0.00	16.43	44.13	10.22	54.35	0.01	11.07	0.758
C104A	71.66	0.00	0.00	7.59	58.15	4.71	62.85	0.04	30.18	0.877
C104B	71.66	0.00	0.00	8.87	56.14	5.48	61.62	0.04	33.59	0.860
C106A	71.66	0.00	0.00	8.23	57.14	5.09	62.23	0.04	34.25	0.868
C106B	71.66	0.00	0.00	15.12	46.14	9.48	55.62	0.01	11.97	0.776
C106C	71.66	0.00	0.00	24.87	31.10	15.09	46.18	0.02	22.06	0.644
C904A_1	71.66	0.00	0.00	23.57	33.10	14.34	47.44	0.04	31.62	0.662
EX_ST101	71.66	0.00	0.00	14.01	48.35	8.58	56.94	0.10	80.94	0.794
EX_ST104	71.66	0.00	0.00	24.80	33.26	19.81	46.41	0.08	74.25	0.648
EXT-1	71.66	0.00	0.00	17.59	45.14	19.31	53.17	0.10	82.97	0.742
EXT-2	71.66	0.00	0.00	29.24	26.60	15.27	41.87	0.47	327.81	0.584
EXT-3	71.66	0.00	0.00	14.05	48.13	8.49	56.62	0.04	28.40	0.790
INTPOND2	71.66	0.00	0.00	26.91	35.97	26.20	44.19	1.61	846.48	0.617
ST302-1A	71.66	0.00	0.00	58.65	0.00	13.01	13.01	0.05	11.37	0.182
ST302-2A	71.66	0.00	0.00	54.88	0.00	16.79	16.79	0.07	19.04	0.234
ST302-3A	71.66	0.00	0.00	58.98	0.00	12.69	12.69			

								0.05	11.46	0.177
ST302A	71.66	0.00	0.00	49.88	0.00	21.79	21.79	0.05	19.28	0.304
ST303-1A	71.66	0.00	0.00	54.64	0.00	17.03	17.03	0.04	10.24	0.238
ST303-2A	71.66	0.00	0.00	55.29	0.00	16.38	16.38	0.04	10.46	0.229
ST303-3A	71.66	0.00	0.00	55.29	0.00	16.38	16.38	0.04	10.46	0.229
ST601A	71.66	0.00	0.00	9.64	55.12	5.73	60.85	0.74	555.61	0.849
ST602A	71.66	0.00	0.00	20.63	38.11	12.15	50.25	0.23	182.41	0.701
ST602B	71.66	0.00	0.00	6.32	60.15	3.93	64.07	0.02	14.44	0.894
ST603A	71.66	0.00	0.00	13.95	48.14	8.60	56.74	0.20	165.41	0.792
ST603B	71.66	0.00	0.00	30.17	25.08	22.20	41.01	0.06	55.48	0.572
ST605A	71.66	0.00	0.00	9.58	55.21	5.69	60.90	0.41	309.79	0.850
ST605B	71.66	0.00	0.00	9.58	55.21	5.69	60.91	0.37	278.06	0.850
ST605C	71.66	0.00	0.00	9.58	55.21	5.69	60.91	0.63	474.06	0.850
ST605D	71.66	0.00	0.00	26.41	29.08	15.60	44.68	0.08	64.67	0.623
ST606A	71.66	0.00	0.00	14.02	48.13	8.52	56.65	0.15	121.52	0.790
ST607A	71.66	0.00	0.00	16.52	44.13	10.12	54.25	0.15	127.12	0.757
ST608A	71.66	0.00	0.00	26.56	29.07	15.45	44.52	0.08	69.55	0.621
ST609A	71.66	0.00	0.00	14.59	47.14	8.98	56.11	0.28	225.11	0.783
ST610A	71.66	0.00	0.00	13.97	48.13	8.57	56.70	0.19	154.32	0.791
ST610B	71.66	0.00	0.00	30.02	25.08	22.35	41.16	0.18	169.03	0.574
ST610C	71.66	0.00	0.00	27.54	29.09	21.74	43.56	0.08	69.20	0.608
ST611A	71.66	0.00	0.00	13.92	48.14	8.63	56.77	0.21	172.27	0.792
ST611B	71.66	0.00	0.00	33.47	20.06	22.77	37.81	0.08	71.36	0.528
ST612A	71.66	0.00	0.00	17.14	43.13	10.53	53.66	0.21	177.62	0.749
ST612B	71.66	0.00	0.00	27.93	29.08	21.34	43.16	0.13	106.83	0.602
ST615A	71.66	0.00	0.00	19.22	40.11	11.51	51.63	0.15	124.20	0.720
ST615B	71.66	0.00	0.00	27.37	27.42	16.33	43.75	0.09	77.25	0.611
ST616A	71.66	0.00	0.00	16.04	45.12	9.57	54.69	0.13	104.88	0.763
ST616B	71.66	0.00	0.00	43.45	7.02	21.06	28.08	0.34	193.02	0.392
ST617A	71.66	0.00	0.00	12.69	50.14	7.80	57.94	0.25	197.90	0.809
ST619A	71.66	0.00	0.00	27.35	27.42	16.35	43.78	0.07	58.35	0.611
ST620A	71.66	0.00	0.00	12.73	50.13	7.76	57.90	0.24	191.87	0.808
ST621A	71.66	0.00	0.00	20.41	38.11	12.38	50.49	0.09	72.71	0.705
ST622A	71.66	0.00	0.00	28.79	27.08	22.04	42.35	0.08	75.00	0.591
ST623A	71.66	0.00	0.00	29.78	26.08	21.81	41.37	0.10	79.34	0.577
ST623B	71.66	0.00	0.00	9.64	55.12	5.73	60.85	0.76	565.99	0.849
ST624A	71.66	0.00	0.00	15.26	46.13	9.34	55.47	0.17	138.38	0.774
ST624B	71.66	0.00	0.00	27.56	29.09	21.72	43.54	0.08	72.58	0.608
ST625A	71.66	0.00	0.00	15.23	46.13	9.36	55.49	0.16	129.42	0.774
ST625B	71.66	0.00	0.00	16.01	45.12	9.60	54.73			

								0.23	180.35	0.764
ST628A	71.66	0.00	0.00	15.90	45.13	9.71	54.84	0.17	135.50	0.765
ST628B	71.66	0.00	0.00	30.81	24.07	22.34	40.39	0.10	89.56	0.564
ST628C	71.66	0.00	0.00	29.50	26.08	22.10	41.66	0.13	114.62	0.581
ST629A	71.66	0.00	0.00	30.20	26.07	21.39	40.94	0.14	104.25	0.571
ST630A	71.66	0.00	0.00	15.91	45.13	9.70	54.83	0.14	110.51	0.765
ST630B	71.66	0.00	0.00	14.57	47.14	9.00	56.14	0.15	126.38	0.783
ST631A	71.66	0.00	0.00	12.65	50.14	7.85	57.99	0.18	145.30	0.809
ST632A	71.66	0.00	0.00	27.54	29.09	21.74	43.56	0.05	45.97	0.608
ST632B	71.66	0.00	0.00	9.64	55.12	5.73	60.85	0.68	510.07	0.849
ST633A	71.66	0.00	0.00	14.62	47.13	8.94	56.08	0.10	81.49	0.782
ST633B	71.66	0.00	0.00	9.64	55.12	5.73	60.85	0.83	619.37	0.849
ST634A	71.66	0.00	0.00	14.63	47.13	8.94	56.07	0.13	105.10	0.782
ST635A	71.66	0.00	0.00	15.38	46.12	9.21	55.33	0.16	126.61	0.772
ST637A	71.66	0.00	0.00	14.57	47.14	9.00	56.13	0.11	87.63	0.783
ST638A	71.66	0.00	0.00	6.30	60.16	3.95	64.11	0.09	67.75	0.895
ST639A	71.66	0.00	0.00	14.64	47.13	8.93	56.06	0.13	103.63	0.782
ST639B	71.66	0.00	0.00	31.06	24.07	22.08	40.13	0.11	91.45	0.560
ST639C	71.66	0.00	0.00	26.22	31.10	21.52	44.84	0.18	169.16	0.626
ST639E	71.66	0.00	0.00	13.86	48.17	8.67	56.83	0.15	126.25	0.793
ST639F	71.66	0.00	0.00	13.90	48.16	8.63	56.79	0.13	102.93	0.792
ST639G	71.66	0.00	0.00	25.07	33.07	21.15	45.95	0.02	19.64	0.641
ST641A	71.66	0.00	0.00	13.95	48.14	8.60	56.73	0.16	128.60	0.792
ST641B	71.66	0.00	0.00	34.83	18.05	22.95	36.49	0.03	27.29	0.509
ST642A	71.66	0.00	0.00	14.73	47.12	8.83	55.96	0.26	206.75	0.781
ST643A	71.66	0.00	0.00	13.95	48.14	8.59	56.73	0.13	101.59	0.792
ST644A	71.66	0.00	0.00	13.94	48.14	8.61	56.75	0.14	113.60	0.792
ST645A	71.66	0.00	0.00	14.03	48.13	8.51	56.64	0.22	176.17	0.790
ST645B	71.66	0.00	0.00	36.43	16.05	22.89	34.93	0.11	83.51	0.487
ST646A	71.66	0.00	0.00	13.94	48.14	8.61	56.75	0.05	41.65	0.792
ST648A	71.66	0.00	0.00	16.52	44.13	10.13	54.25	0.10	80.77	0.757
ST648B	71.66	0.00	0.00	9.64	55.12	5.73	60.85	0.78	582.94	0.849

****
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
500A	JUNCTION	0.86	1.91	79.78	0 02:36	1.91
501	JUNCTION	0.68	2.17	80.23	0 01:26	2.17
502	JUNCTION	0.92	2.41	80.24	0 01:25	2.41
503	JUNCTION	0.83	2.41	80.32	0 01:25	2.41

504	JUNCTION	0.49	1.89	80.34	0	01:24	1.89
505	JUNCTION	0.46	1.82	80.37	0	01:24	1.82
506	JUNCTION	0.42	1.73	80.43	0	01:24	1.73
507	JUNCTION	0.36	1.55	80.67	0	01:23	1.55
508	JUNCTION	0.35	1.64	80.88	0	01:16	1.64
509	JUNCTION	0.35	1.70	81.05	0	01:16	1.70
601	JUNCTION	0.35	1.90	81.48	0	01:16	1.90
602	JUNCTION	0.34	1.56	81.97	0	01:15	1.56
603	JUNCTION	0.36	2.13	82.67	0	01:15	2.13
605	JUNCTION	0.35	2.11	82.98	0	01:15	2.10
606	JUNCTION	0.35	2.17	83.08	0	01:15	2.15
607	JUNCTION	0.35	2.22	83.19	0	01:15	2.21
608	JUNCTION	0.31	1.02	83.52	0	01:14	1.01
609	JUNCTION	0.31	0.99	83.86	0	01:11	0.96
610	JUNCTION	0.35	2.30	83.37	0	01:15	2.29
611	JUNCTION	0.34	2.09	83.58	0	01:14	2.09
612	JUNCTION	0.33	1.96	83.65	0	01:15	1.95
613	JUNCTION	0.33	1.97	83.71	0	01:15	1.96
614	JUNCTION	0.29	0.64	83.76	0	01:14	0.59
615	JUNCTION	0.33	1.99	83.83	0	01:15	1.98
616	JUNCTION	0.31	0.99	83.93	0	01:15	0.97
617	JUNCTION	0.31	1.44	83.92	0	01:15	1.44
618	JUNCTION	0.31	1.18	83.95	0	01:15	1.16
619	JUNCTION	0.31	0.95	83.98	0	01:15	0.94
620	JUNCTION	0.23	0.62	84.00	0	01:15	0.61
621	JUNCTION	0.33	1.84	83.85	0	01:15	1.83
622	JUNCTION	0.33	1.83	83.89	0	01:15	1.81
623	JUNCTION	0.33	1.76	83.95	0	01:15	1.76
624	JUNCTION	0.32	1.62	84.06	0	01:15	1.62
625	JUNCTION	0.31	1.36	84.39	0	01:12	1.26
626	JUNCTION	0.30	1.06	84.38	0	01:12	0.97
627	JUNCTION	0.29	0.66	84.33	0	01:14	0.62
628	JUNCTION	0.31	1.39	84.26	0	01:15	1.38
629	JUNCTION	0.30	0.45	84.35	0	01:10	0.45
630	JUNCTION	0.23	0.63	84.42	0	01:17	0.63
631	JUNCTION	0.34	2.15	83.46	0	01:14	2.14
632	JUNCTION	0.33	1.62	83.59	0	01:15	1.61
633	JUNCTION	0.32	1.48	83.64	0	01:15	1.46
634	JUNCTION	0.31	0.99	84.00	0	01:11	0.89

635	JUNCTION	0.34	2.04	83.54	0	01:15	2.02
636	JUNCTION	0.33	1.86	83.62	0	01:15	1.84
637	JUNCTION	0.30	0.90	83.62	0	01:15	0.88
638	JUNCTION	0.29	0.55	83.63	0	01:15	0.54
639	JUNCTION	0.32	1.40	83.76	0	01:15	1.39
640	JUNCTION	0.31	1.00	83.85	0	01:15	0.99
641	JUNCTION	0.31	0.89	83.93	0	01:15	0.89
642	JUNCTION	0.33	1.73	83.72	0	01:15	1.71
643	JUNCTION	0.33	1.72	83.81	0	01:15	1.69
644	JUNCTION	0.31	0.99	84.11	0	01:15	0.88
645	JUNCTION	0.30	0.49	84.12	0	01:15	0.49
646	JUNCTION	0.32	1.47	83.99	0	01:15	1.43
647	JUNCTION	0.35	1.45	84.06	0	01:15	1.41
648	JUNCTION	0.32	1.36	84.13	0	01:15	1.32
648-1	JUNCTION	0.32	1.39	84.27	0	01:15	1.34
EXMH904	JUNCTION	0.22	2.18	86.37	0	01:09	2.18
J1	JUNCTION	2.14	2.30	78.30	0	02:42	2.30
J7	JUNCTION	0.01	0.17	83.71	0	01:01	0.17
ST634A-S2	JUNCTION	0.00	0.11	84.47	0	01:14	0.11
Creek	OUTFALL	0.14	0.30	78.22	0	02:43	0.30
OF_MudCreek	OUTFALL	0.00	0.11	84.37	0	01:14	0.11
OF1	OUTFALL	0.00	0.00	87.12	0	00:00	0.00
OF2	OUTFALL	0.00	0.00	79.50	0	00:00	0.00
OF3	OUTFALL	0.01	0.16	83.66	0	01:01	0.16
OF5	OUTFALL	0.00	0.00	87.03	0	00:00	0.00
C101B1-S	STORAGE	0.00	0.08	86.23	0	01:13	0.08
C102A-S	STORAGE	0.00	0.07	86.27	0	01:11	0.07
C103A1-S	STORAGE	0.00	0.02	86.28	0	01:11	0.01
C104A1-S	STORAGE	0.00	0.00	86.33	0	00:00	0.00
C106A1-S	STORAGE	0.00	0.03	86.23	0	01:16	0.03
C106B-S	STORAGE	0.00	0.04	86.27	0	01:11	0.04
C904A-S	STORAGE	0.30	0.66	83.87	0	01:16	0.65
CB101AB-S	STORAGE	0.03	1.55	86.23	0	01:13	1.55
CB102AB-S	STORAGE	0.04	1.60	86.29	0	01:10	1.60
CB103A-S	STORAGE	0.02	1.52	86.28	0	01:10	1.51
CB104AB-S	STORAGE	0.05	1.54	86.27	0	01:10	1.54
CB106AB-S	STORAGE	0.05	1.52	86.23	0	01:15	1.52
CB106C-S	STORAGE	0.01	1.82	86.23	0	01:10	1.82
CBMH-102A	STORAGE	0.50	0.89	83.87	0	01:16	0.89

EX_ST101-S	STORAGE	0.04	1.89	86.38	0	01:10	1.89
EX_ST104-S	STORAGE	0.04	1.61	86.35	0	01:10	1.61
EXT2-S	STORAGE	0.05	2.02	87.13	0	01:11	2.02
INTPOND2-S	STORAGE	2.72	3.77	79.77	0	02:42	3.77
ST302-1A-S	STORAGE	0.01	0.21	86.10	0	01:39	0.21
ST302-1A-S0	STORAGE	0.02	0.21	85.98	0	01:10	0.21
ST302-2A-S	STORAGE	0.01	0.18	86.40	0	01:35	0.18
ST302-3A-S0	STORAGE	0.01	0.13	86.64	0	01:32	0.13
ST302A-S	STORAGE	0.02	0.27	85.97	0	01:11	0.27
ST303-1A-S	STORAGE	0.60	1.26	82.75	0	01:11	1.26
ST303-1A-S0	STORAGE	0.00	0.04	85.86	0	01:10	0.04
ST303-2A-S	STORAGE	0.02	0.28	85.62	0	01:41	0.28
ST303-3A-S	STORAGE	0.02	0.25	85.77	0	01:15	0.25
ST601A-S	STORAGE	0.03	2.09	86.24	0	01:10	2.08
ST602A-S	STORAGE	0.04	1.99	85.86	0	01:15	1.99
ST602A-S0	STORAGE	0.01	0.08	86.11	0	01:13	0.08
ST603A-S	STORAGE	0.02	1.53	85.82	0	01:11	1.53
ST603A-S0	STORAGE	0.00	0.00	85.97	0	00:00	0.00
ST603B-S	STORAGE	0.03	2.29	85.97	0	01:10	2.29
ST605A-S	STORAGE	0.03	2.03	86.28	0	01:10	2.03
ST605B-S	STORAGE	0.03	2.04	86.55	0	01:10	2.04
ST605C-S	STORAGE	0.04	2.04	86.44	0	01:10	2.04
ST605D-S	STORAGE	0.02	2.17	86.13	0	01:10	2.17
ST606A-S	STORAGE	0.02	1.55	85.89	0	01:12	1.55
ST606A-S1	STORAGE	0.00	0.00	86.08	0	00:00	0.00
ST607A-S	STORAGE	0.02	1.90	85.97	0	01:10	1.90
ST608B-S	STORAGE	0.03	2.28	86.28	0	01:10	2.28
ST609A-S	STORAGE	0.03	2.00	86.08	0	01:12	2.00
ST610A-S	STORAGE	0.02	1.61	85.97	0	01:11	1.61
ST610A-S0	STORAGE	0.00	0.00	86.11	0	00:00	0.00
ST610B-S	STORAGE	0.02	2.30	86.05	0	01:10	2.30
ST610C-S	STORAGE	0.02	1.96	86.04	0	01:10	1.96
ST611A-S	STORAGE	0.03	2.03	85.96	0	01:12	2.03
ST611B-S	STORAGE	0.03	2.28	86.06	0	01:05	2.27
ST611C-S0	STORAGE	0.00	0.00	86.08	0	00:00	0.00
ST612A-S	STORAGE	0.03	2.00	86.03	0	01:13	2.00
ST612A-S0	STORAGE	0.00	0.05	86.26	0	01:12	0.04
ST612B-S	STORAGE	0.03	2.41	86.27	0	01:10	2.41
ST613A-S0	STORAGE	0.00	0.05	86.22	0	01:11	0.04
ST614A-S0	STORAGE	0.00	0.00	86.17	0	00:00	0.00
ST615A-S	STORAGE	0.03	2.00	86.22	0	01:10	2.00
ST615A-S0	STORAGE	0.00	0.00	86.40	0	00:00	0.00
ST615B-S	STORAGE	0.03	2.26	86.48	0	01:10	2.26
ST616A-S	STORAGE	0.03	1.96	86.29	0	01:12	1.96
ST616A-S0	STORAGE	0.00	0.00	86.38	0	00:00	0.00
ST616B-S	STORAGE	0.06	1.89	86.52	0	01:11	1.89
ST617A-S	STORAGE	0.02	1.96	86.18	0	01:10	1.96
ST617A-S0	STORAGE	0.00	0.00	86.27	0	00:00	0.00
ST619A-S	STORAGE	0.02	2.11	86.36	0	01:10	2.11
ST620A-S	STORAGE	0.02	1.94	86.12	0	01:10	1.94
ST621A-S	STORAGE	0.04	1.95	86.33	0	01:17	1.95
ST621A-S0	STORAGE	0.00	0.06	86.51	0	01:11	0.06
ST622A-S	STORAGE	0.02	2.06	86.34	0	01:10	2.06
ST623A-S	STORAGE	0.06	2.17	86.53	0	01:22	2.17
ST623B-S	STORAGE	0.03	2.05	87.00	0	01:09	2.05
ST624A-S	STORAGE	0.04	2.06	86.46	0	01:12	2.06
ST624A-S0	STORAGE	0.00	0.04	86.60	0	01:10	0.04
ST624A-S1	STORAGE	0.00	0.08	86.46	0	01:13	0.08
ST624B-S	STORAGE	0.03	2.28	86.53	0	01:10	2.28
ST625A-S	STORAGE	0.02	2.00	86.49	0	01:14	1.99
ST625B-S	STORAGE	0.03	1.98	86.49	0	01:12	1.98
ST625B-S0	STORAGE	0.00	0.00	86.56	0	00:00	0.00
ST628A-S	STORAGE	0.04	2.04	86.55	0	01:13	2.04
ST628A-S0	STORAGE	0.00	0.00	87.19	0	00:00	0.00
ST628A-S1	STORAGE	0.00	0.06	87.12	0	01:10	0.06
ST628B-S	STORAGE	0.04	2.21	86.72	0	01:10	2.21
ST628C-S	STORAGE	0.03	2.28	86.76	0	01:10	2.28
ST629A-S	STORAGE	0.03	2.32	87.27	0	01:10	2.32
ST630A-S	STORAGE	0.03	1.94	86.55	0	01:12	1.94
ST630B-S	STORAGE	0.03	1.98	86.68	0	01:11	1.98
ST630B-S0	STORAGE	0.00	0.00	86.69	0	00:00	0.00
ST630B-S1	STORAGE	0.00	0.00	86.69	0	00:00	0.00
ST631A-S	STORAGE	0.02	1.48	85.75	0	01:10	1.48
ST631A-S0	STORAGE	0.00	0.00	85.97	0	00:00	0.00
ST632A-S	STORAGE	0.03	2.29	86.00	0	01:10	2.29
ST632B-S	STORAGE	0.03	2.05	86.15	0	01:08	2.05
ST633A-S	STORAGE	0.03	2.04	85.87	0	01:12	2.04
ST633A-S0	STORAGE	0.00	0.02	85.91	0	01:10	0.02

ST633B-S	STORAGE	0.03	2.05	86.20	0	01:08	2.05
ST634A-S	STORAGE	0.04	2.03	85.81	0	01:14	2.03
ST634A-S0	STORAGE	0.00	0.09	85.86	0	01:10	0.09
ST634A-S1	STORAGE	0.00	0.06	85.81	0	01:14	0.06
ST635A-S	STORAGE	0.03	1.96	85.90	0	01:12	1.96
ST637A-S	STORAGE	0.02	1.94	85.94	0	01:11	1.94
ST637A-S0	STORAGE	0.00	0.01	86.07	0	01:12	0.01
ST638A-S	STORAGE	0.03	2.01	86.07	0	01:12	2.01
ST639A-S	STORAGE	0.06	2.08	86.02	0	01:20	2.08
ST639A-S0	STORAGE	0.00	0.02	86.02	0	01:22	0.02
ST639B-S	STORAGE	0.03	2.29	86.12	0	01:10	2.29
ST639C-S	STORAGE	0.02	2.31	86.14	0	01:10	2.31
ST639E-S	STORAGE	0.09	2.01	86.34	0	01:10	2.01
ST639F-S	STORAGE	0.05	1.68	86.45	0	01:10	1.68
ST639G-S	STORAGE	0.05	1.54	86.39	0	01:10	1.54
ST641A-S	STORAGE	0.03	1.98	86.15	0	01:11	1.98
ST641A-S0	STORAGE	0.00	0.00	86.15	0	01:13	0.00
ST641A-S1	STORAGE	0.00	0.07	86.16	0	01:11	0.07
ST641B-S	STORAGE	0.02	2.25	86.32	0	01:11	2.25
ST642A-S	STORAGE	0.04	2.00	85.95	0	01:21	2.00
ST642A-S0	STORAGE	0.00	0.03	86.16	0	01:12	0.03
ST643A-S	STORAGE	0.03	1.98	86.16	0	01:11	1.98
ST643A-S0	STORAGE	0.00	0.02	86.28	0	01:14	0.02
ST643A-S1	STORAGE	0.00	0.05	86.18	0	01:10	0.05
ST644A-S	STORAGE	0.03	1.98	86.17	0	01:12	1.98
ST645A-S	STORAGE	0.03	1.96	86.25	0	01:12	1.96
ST645A-S0	STORAGE	0.00	0.00	87.15	0	00:00	0.00
ST645A-S1	STORAGE	0.00	0.00	86.28	0	00:00	0.00
ST645B-S	STORAGE	0.03	2.30	86.43	0	01:10	2.30
ST646A-S	STORAGE	0.02	1.92	86.14	0	01:12	1.92
ST648A-S	STORAGE	0.05	2.06	86.27	0	01:16	2.06
ST648A-S0	STORAGE	0.00	0.00	86.42	0	00:00	0.00
ST648A-S1	STORAGE	0.00	0.09	86.37	0	01:10	0.09
ST648B-S	STORAGE	0.04	2.04	86.61	0	01:10	2.04
STM-101	STORAGE	0.21	0.97	83.84	0	01:16	0.97
STM-101A	STORAGE	0.31	1.10	83.83	0	01:16	1.10
STM-102	STORAGE	0.36	0.88	83.85	0	01:16	0.87
STM-103	STORAGE	0.01	0.55	83.87	0	01:17	0.55
STM-104	STORAGE	0.00	0.00	83.57	0	00:00	0.00

STM-106	STORAGE	0.53	0.95	83.89	0	01:16	0.92
STM-639	STORAGE	0.21	1.07	83.79	0	01:15	1.07

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Node Inflow Summary
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Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days	Time of Max Occurrence hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
500A	JUNCTION	0.00	5218.69	0	01:25	0	14.5	0.481
501	JUNCTION	0.00	5283.64	0	01:23	0	14.6	0.133
502	JUNCTION	0.00	5279.72	0	01:20	0	14.6	0.025
503	JUNCTION	0.00	5392.96	0	01:19	0	14.5	-0.504
504	JUNCTION	0.00	5515.89	0	01:19	0	14.5	0.278
505	JUNCTION	0.00	5634.37	0	01:18	0	14.5	-0.519
506	JUNCTION	0.00	5689.85	0	01:18	0	14.4	-0.452
507	JUNCTION	0.00	5689.46	0	01:17	0	14.5	0.731
508	JUNCTION	0.00	5687.87	0	01:16	0	14.5	0.033
509	JUNCTION	0.00	5688.36	0	01:16	0	14.5	0.023
601	JUNCTION	0.00	5689.12	0	01:16	0	14.5	0.040
602	JUNCTION	0.00	5395.63	0	01:15	0	13.8	-0.034
603	JUNCTION	0.00	5247.70	0	01:15	0	13.1	0.004
605	JUNCTION	0.00	5115.16	0	01:15	0	12.9	0.032
606	JUNCTION	0.00	4517.89	0	01:15	0	11.5	0.041
607	JUNCTION	0.00	4441.24	0	01:15	0	11.3	0.245
608	JUNCTION	0.00	162.35	0	01:11	0	0.369	0.766
609	JUNCTION	0.00	127.64	0	01:12	0	0.297	0.686
610	JUNCTION	0.00	4217.07	0	01:15	0	10.8	-0.054
611	JUNCTION	0.00	1750.13	0	01:17	0	4.35	-0.055
612	JUNCTION	0.00	1595.19	0	01:17	0	3.94	-0.130
613	JUNCTION	0.00	1457.80	0	01:17	0	3.59	-0.512
614	JUNCTION	0.00	19.32	0	01:13	0	0.00257	-12.436
615	JUNCTION	0.00	1454.45	0	01:16	0	3.58	-0.035
616	JUNCTION	0.00	104.63	0	01:12	0	0.353	0.076

617	JUNCTION	0.00	276.42	0	01:15	0	0.545	0.724
618	JUNCTION	0.00	152.51	0	01:09	0	0.296	-0.485
619	JUNCTION	0.00	151.15	0	01:10	0	0.297	0.471
620	JUNCTION	0.00	125.41	0	01:11	0	0.242	0.293
621	JUNCTION	0.00	1007.42	0	01:21	0	2.46	-0.051
622	JUNCTION	0.00	966.62	0	01:21	0	2.35	-0.091
623	JUNCTION	0.00	939.04	0	01:21	0	2.29	0.198
624	JUNCTION	0.00	657.27	0	01:23	0	1.45	-0.298
625	JUNCTION	0.00	172.72	0	01:20	0	0.393	1.367
626	JUNCTION	0.00	57.07	0	01:11	0	0.00762	2.612
627	JUNCTION	0.00	24.39	0	01:12	0	0.002	-12.782
628	JUNCTION	0.00	316.31	0	01:20	0	0.783	-0.103
629	JUNCTION	0.00	48.22	0	01:10	0	0.119	0.363
630	JUNCTION	0.00	121.30	0	01:12	0	0.296	0.927
631	JUNCTION	0.00	2258.06	0	01:15	0	5.98	-0.031
632	JUNCTION	0.00	727.95	0	01:11	0	1.75	0.296
633	JUNCTION	0.00	436.49	0	01:11	0	1.07	0.081
634	JUNCTION	0.00	58.16	0	01:12	0	0.164	-0.121
635	JUNCTION	0.00	1597.73	0	01:23	0	4.05	-0.053
636	JUNCTION	0.00	1526.18	0	01:23	0	3.89	0.130
637	JUNCTION	0.00	54.69	0	01:22	0	0.11	1.016
638	JUNCTION	0.00	18.80	0	01:11	0	0.0013	18.909
639	JUNCTION	0.00	482.59	0	01:08	0	1.33	0.144
640	JUNCTION	0.00	86.38	0	01:23	0	0.202	-0.198
641	JUNCTION	0.00	84.91	0	01:11	0	0.203	0.500
642	JUNCTION	0.00	961.20	0	01:23	0	2.43	-0.826
643	JUNCTION	0.00	829.12	0	01:23	0	2.04	-0.116
644	JUNCTION	0.00	204.08	0	01:15	0	0.487	-0.075
645	JUNCTION	0.00	88.40	0	01:12	0	0.227	0.682
646	JUNCTION	0.00	541.09	0	01:11	0	1.42	0.174
647	JUNCTION	0.00	504.69	0	01:23	0	1.35	-0.120
648	JUNCTION	0.00	493.72	0	01:11	0	1.35	0.047
648-1	JUNCTION	0.00	451.14	0	01:01	0	1.2	0.062
EXMH904	JUNCTION	0.00	43.42	0	01:09	0	0.161	-1.980
J1	JUNCTION	0.00	377.08	0	02:42	0	14.5	0.000
J7	JUNCTION	0.00	41.20	0	01:01	0	0.124	0.001
ST634A-S2	JUNCTION	0.00	63.17	0	01:14	0	0.0341	0.004
Creek	OUTFALL	0.00	377.08	0	02:43	0	14.5	0.000
OF_MudCreek	OUTFALL	0.00	63.18	0	01:14	0	0.0341	0.000

OF1	OUTFALL	82.97	82.97	0	01:10	0.0957	0.0957	0.000	
OF2	OUTFALL	0.00	0.00	0	00:00	0	0	0.000	ltr
OF3	OUTFALL	0.00	41.46	0	01:01	0	0.124	0.000	
OF5	OUTFALL	28.40	28.40	0	01:10	0.036	0.036	0.000	
C101B1-S	STORAGE	0.00	129.72	0	01:12	0	0.0663	0.436	
C102A-S	STORAGE	0.00	203.24	0	01:09	0	0.115	-0.416	
C103A1-S	STORAGE	0.00	15.51	0	01:09	0	0.000992	13.423	
C104A1-S	STORAGE	0.00	0.00	0	00:00	0	0	0.000	ltr
C106A1-S	STORAGE	0.00	15.34	0	01:14	0	0.0125	1.641	
C106B-S	STORAGE	0.00	34.19	0	01:10	0	0.0182	-0.680	
C904A-S	STORAGE	0.00	27.84	0	01:10	0	0.151	0.016	
CB101AB-S	STORAGE	58.08	208.69	0	01:10	0.077	0.171	0.772	
CB102AB-S	STORAGE	69.74	285.46	0	01:10	0.0908	0.246	0.599	
CB103A-S	STORAGE	11.07	96.67	0	01:08	0.0131	0.0361	0.109	
CB104AB-S	STORAGE	63.76	63.76	0	01:10	0.0834	0.084	0.264	
CB106AB-S	STORAGE	46.22	69.74	0	01:10	0.0591	0.0771	0.596	
CB106C-S	STORAGE	22.06	22.06	0	01:10	0.0246	0.0281	-0.004	
CBMH-102A	STORAGE	72.50	122.64	0	01:10	0.0817	0.246	0.622	
EX_ST101-S	STORAGE	80.94	80.94	0	01:10	0.101	0.101	-0.170	
EX_ST104-S	STORAGE	74.25	74.25	0	01:10	0.0814	0.0814	0.098	
EXT2-S	STORAGE	327.81	327.81	0	01:10	0.473	0.473	-1.270	
INTPOND2-S	STORAGE	846.48	5632.25	0	01:21	1.61	16.1	-0.175	
ST302-1A-S	STORAGE	11.37	37.98	0	01:34	0.0511	0.171	0.497	
ST302-1A-S0	STORAGE	0.00	41.56	0	01:10	0	0.184	-0.118	
ST302-2A-S	STORAGE	19.04	28.80	0	01:26	0.0672	0.12	-0.067	
ST302-3A-S0	STORAGE	11.46	11.46	0	01:30	0.0524	0.0524	-0.399	
ST302A-S	STORAGE	19.28	73.78	0	01:10	0.0468	0.24	-0.589	
ST303-1A-S	STORAGE	22.62	145.34	0	01:10	0.0547	0.398	0.176	
ST303-1A-S0	STORAGE	0.00	30.68	0	01:10	0	0.0122	1.301	
ST303-2A-S	STORAGE	10.46	71.23	0	01:16	0.038	0.317	0.319	
ST303-3A-S	STORAGE	10.46	72.73	0	01:12	0.038	0.279	0.203	
ST601A-S	STORAGE	555.61	555.61	0	01:10	0.742	0.742	0.120	
ST602A-S	STORAGE	182.41	187.81	0	01:10	0.227	0.268	-0.172	
ST602A-S0	STORAGE	0.00	238.97	0	01:10	0	0.0414	7.515	
ST603A-S	STORAGE	165.41	207.79	0	01:10	0.204	0.222	0.250	
ST603A-S0	STORAGE	0.00	0.00	0	00:00	0	0	0.000	ltr
ST603B-S	STORAGE	55.48	55.48	0	01:10	0.0624	0.0624	-0.183	
ST605A-S	STORAGE	309.79	309.79	0	01:10	0.414	0.414	1.542	
ST605B-S	STORAGE	278.06	278.06	0	01:10	0.372	0.372	0.235	

ST605C-S	STORAGE	474.06	474.06	0	01:10	0.633	0.633	0.389	
ST605D-S	STORAGE	64.67	64.67	0	01:10	0.076	0.076	0.025	
ST606A-S	STORAGE	121.52	218.23	0	01:10	0.153	0.172	-2.460	
ST606A-S1	STORAGE	0.00	0.00	0	00:00	0	0	0.000	ltr
ST607A-S	STORAGE	127.12	161.66	0	01:10	0.154	0.172	0.427	
ST608B-S	STORAGE	69.55	69.55	0	01:10	0.0846	0.0846	-0.024	
ST609A-S	STORAGE	225.11	229.89	0	01:10	0.277	0.297	0.051	
ST610A-S	STORAGE	154.32	363.96	0	01:10	0.192	0.256	-1.198	
ST610A-S0	STORAGE	0.00	0.00	0	00:00	0	0	0.000	ltr
ST610B-S	STORAGE	169.03	169.03	0	01:10	0.182	0.182	0.109	
ST610C-S	STORAGE	69.20	69.20	0	01:10	0.0753	0.0753	0.271	
ST611A-S	STORAGE	172.27	216.47	0	01:10	0.211	0.229	-0.064	
ST611B-S	STORAGE	71.36	71.36	0	01:10	0.0836	0.0836	-0.529	
ST611C-S0	STORAGE	0.00	0.00	0	00:00	0	0	0.000	ltr
ST612A-S	STORAGE	177.62	197.47	0	01:10	0.212	0.225	0.369	
ST612A-S0	STORAGE	0.00	121.98	0	01:10	0	0.0211	5.961	
ST612B-S	STORAGE	106.83	106.83	0	01:10	0.129	0.129	0.007	
ST613A-S0	STORAGE	0.00	53.36	0	01:10	0	0.0135	3.936	
ST614A-S0	STORAGE	0.00	0.00	0	00:00	0	0	0.000	ltr
ST615A-S	STORAGE	124.20	166.57	0	01:10	0.152	0.166	0.242	
ST615A-S0	STORAGE	0.00	0.00	0	00:00	0	0	0.000	ltr
ST615B-S	STORAGE	77.25	77.25	0	01:10	0.0875	0.0875	-0.002	
ST616A-S	STORAGE	104.88	104.88	0	01:10	0.133	0.133	-0.118	
ST616A-S0	STORAGE	0.00	0.00	0	00:00	0	0	0.000	ltr
ST616B-S	STORAGE	193.02	193.02	0	01:10	0.337	0.337	-0.394	
ST617A-S	STORAGE	197.90	197.90	0	01:10	0.248	0.248	0.195	
ST617A-S0	STORAGE	0.00	0.00	0	00:00	0	0	0.000	ltr
ST619A-S	STORAGE	58.35	58.35	0	01:10	0.0657	0.0657	0.019	
ST620A-S	STORAGE	191.87	191.87	0	01:10	0.243	0.243	0.341	
ST621A-S	STORAGE	72.71	112.03	0	01:10	0.0858	0.11	0.565	
ST621A-S0	STORAGE	0.00	278.30	0	01:10	0	0.0484	2.069	
ST622A-S	STORAGE	75.00	75.00	0	01:10	0.0813	0.0813	0.027	
ST623A-S	STORAGE	79.34	122.79	0	01:10	0.0952	0.126	-1.067	
ST623B-S	STORAGE	565.99	565.99	0	01:10	0.756	0.756	-0.001	
ST624A-S	STORAGE	138.38	285.55	0	01:10	0.17	0.228	-0.142	
ST624A-S0	STORAGE	0.00	66.22	0	01:10	0	0.0228	-4.604	
ST624A-S1	STORAGE	0.00	104.67	0	01:11	0	0.0439	-0.498	
ST624B-S	STORAGE	72.58	72.58	0	01:10	0.0793	0.0793	0.040	
ST625A-S	STORAGE	129.42	151.80	0	01:14	0.158	0.181	0.285	

ST625B-S	STORAGE	180.35	180.35	0	01:10	0.227	0.227	0.056	
ST625B-S0	STORAGE	0.00	0.00	0	00:00	0	0	0.000	ltr
ST628A-S	STORAGE	135.50	264.06	0	01:09	0.166	0.218	-0.173	
ST628A-S0	STORAGE	0.00	0.00	0	00:00	0	0	0.000	ltr
ST628A-S1	STORAGE	0.00	55.36	0	01:10	0	0.0197	-3.027	
ST628B-S	STORAGE	89.56	89.56	0	01:10	0.101	0.101	-4.111	
ST628C-S	STORAGE	114.62	114.62	0	01:10	0.127	0.127	-0.116	
ST629A-S	STORAGE	104.25	104.25	0	01:10	0.138	0.138	-0.071	
ST630A-S	STORAGE	110.51	110.51	0	01:10	0.136	0.16	0.269	
ST630B-S	STORAGE	126.38	126.38	0	01:10	0.155	0.155	0.011	
ST630B-S0	STORAGE	0.00	0.00	0	00:00	0	0	0.000	ltr
ST630B-S1	STORAGE	0.00	0.00	0	00:00	0	0	0.000	ltr
ST631A-S	STORAGE	145.30	150.86	0	01:10	0.181	0.183	0.224	
ST631A-S0	STORAGE	0.00	0.00	0	00:00	0	0	0.000	ltr
ST632A-S	STORAGE	45.97	45.97	0	01:10	0.05	0.05	-0.060	
ST632B-S	STORAGE	510.07	510.07	0	01:10	0.682	0.682	0.206	
ST633A-S	STORAGE	81.49	333.47	0	01:10	0.101	0.147	1.681	
ST633A-S0	STORAGE	0.00	25.34	0	01:10	0	0.00742	-5.571	
ST633B-S	STORAGE	619.37	619.37	0	01:10	0.828	0.828	0.174	
ST634A-S	STORAGE	105.10	309.77	0	01:10	0.13	0.2	1.124	
ST634A-S0	STORAGE	0.00	560.35	0	01:08	0	0.111	-1.491	
ST634A-S1	STORAGE	0.00	66.91	0	01:13	0	0.0343	0.499	
ST635A-S	STORAGE	126.61	132.56	0	01:10	0.16	0.165	0.081	
ST637A-S	STORAGE	87.63	87.63	0	01:10	0.107	0.109	0.022	
ST637A-S0	STORAGE	0.00	11.84	0	01:11	0	0.000674	98.646	
ST638A-S	STORAGE	67.75	124.83	0	01:10	0.0898	0.109	0.445	
ST639A-S	STORAGE	103.63	268.10	0	01:10	0.129	0.238	-0.139	
ST639A-S0	STORAGE	0.00	38.06	0	01:17	0	0.00788	34.362	
ST639B-S	STORAGE	91.45	91.45	0	01:10	0.11	0.11	0.135	
ST639C-S	STORAGE	169.16	169.16	0	01:10	0.181	0.181	-0.058	
ST639E-S	STORAGE	126.25	220.12	0	01:10	0.153	0.209	-0.353	
ST639F-S	STORAGE	102.93	102.93	0	01:10	0.126	0.126	-0.487	
ST639G-S	STORAGE	19.64	19.64	0	01:10	0.0215	0.0221	-1.195	
ST641A-S	STORAGE	128.60	128.60	0	01:10	0.159	0.174	0.238	
ST641A-S0	STORAGE	0.00	2.75	0	01:11	0	0.000378	159.357	
ST641A-S1	STORAGE	0.00	17.97	0	01:10	0	0.016	1.822	
ST641B-S	STORAGE	27.29	27.29	0	01:10	0.0328	0.0328	-0.027	
ST642A-S	STORAGE	206.75	297.09	0	01:10	0.263	0.388	0.033	
ST642A-S0	STORAGE	0.00	42.15	0	01:10	0	0.00783	4.089	

ST643A-S	STORAGE	101.59	141.39	0	01:10	0.126	0.151	0.436	
ST643A-S0	STORAGE	0.00	26.48	0	01:13	0	0.00222	28.126	
ST643A-S1	STORAGE	0.00	112.45	0	01:10	0	0.0597	-1.384	
ST644A-S	STORAGE	113.60	152.64	0	01:10	0.14	0.16	0.862	
ST645A-S	STORAGE	176.17	207.94	0	01:10	0.222	0.228	0.411	
ST645A-S0	STORAGE	0.00	0.00	0	00:00	0	0	0.000	ltr
ST645A-S1	STORAGE	0.00	0.00	0	00:00	0	0	0.000	ltr
ST645B-S	STORAGE	83.51	83.51	0	01:10	0.109	0.109	-0.060	
ST646A-S	STORAGE	41.65	69.47	0	01:10	0.0513	0.0688	0.129	
ST648A-S	STORAGE	80.77	300.18	0	01:10	0.0977	0.155	1.576	
ST648A-S0	STORAGE	0.00	0.00	0	00:00	0	0	0.000	ltr
ST648A-S1	STORAGE	0.00	261.34	0	01:10	0	0.0556	-1.878	
ST648B-S	STORAGE	582.94	586.10	0	01:10	0.779	0.803	0.689	
STM-101	STORAGE	0.00	202.10	0	01:09	0	0.549	-0.110	
STM-101A	STORAGE	0.00	206.52	0	01:23	0	0.549	-0.092	
STM-102	STORAGE	0.00	120.61	0	01:10	0	0.244	0.141	
STM-103	STORAGE	0.00	59.52	0	01:11	0	0.159	0.683	
STM-104	STORAGE	0.00	0.00	0	00:00	0	0	0.000	ltr
STM-106	STORAGE	0.00	25.79	0	01:12	0	0.00314	-2.067	
STM-639	STORAGE	0.00	250.94	0	01:23	0	0.652	0.055	

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Node Surcharge Summary
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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
500A	JUNCTION	5.03	0.411	3.220
603	JUNCTION	0.13	0.033	3.078
605	JUNCTION	0.20	0.158	2.778
606	JUNCTION	0.21	0.215	2.876
607	JUNCTION	0.23	0.268	2.764
608	JUNCTION	0.20	0.275	2.580
609	JUNCTION	0.20	0.310	2.271
610	JUNCTION	0.24	0.349	2.600
611	JUNCTION	0.26	0.442	2.542
612	JUNCTION	0.26	0.459	2.266
613	JUNCTION	0.25	0.470	2.503
614	JUNCTION	0.01	0.042	2.468
615	JUNCTION	0.24	0.491	2.618
616	JUNCTION	0.18	0.243	2.497
617	JUNCTION	0.22	0.467	2.233
618	JUNCTION	0.15	0.261	2.460
619	JUNCTION	0.06	0.046	2.169
621	JUNCTION	0.24	0.484	2.397
622	JUNCTION	0.24	0.476	2.548
623	JUNCTION	0.23	0.487	2.522
624	JUNCTION	0.23	0.500	2.395
625	JUNCTION	0.19	0.533	2.006
626	JUNCTION	0.17	0.432	2.055
627	JUNCTION	0.01	0.061	2.421
628	JUNCTION	0.10	0.089	2.371
631	JUNCTION	0.23	0.346	2.563
632	JUNCTION	0.23	0.419	2.191
633	JUNCTION	0.23	0.426	2.190
634	JUNCTION	0.19	0.393	1.974
635	JUNCTION	0.25	0.393	2.320
636	JUNCTION	0.23	0.364	2.470
637	JUNCTION	0.17	0.148	2.334
639	JUNCTION	0.24	0.352	2.337
640	JUNCTION	0.22	0.312	2.267
641	JUNCTION	0.19	0.213	2.367
642	JUNCTION	0.23	0.375	2.363
643	JUNCTION	0.22	0.372	2.204
644	JUNCTION	0.07	0.161	2.135
646	JUNCTION	0.22	0.407	2.306
647	JUNCTION	0.21	0.356	2.245
648	JUNCTION	0.20	0.307	2.230
648-1	JUNCTION	0.22	0.412	2.276
EXMH904	JUNCTION	2.99	1.931	0.819

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Node Flooding Summary
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No nodes were flooded.

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Storage Volume Summary
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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
C101B1-S	0.000	0	0	0	0.000	23	0	01:13	123.25
C102A-S	0.000	0	0	0	0.000	21	0	01:11	197.27
C103A1-S	0.000	0	0	0	0.000	0	0	00:00	5.40
C104A1-S	0.000	0	0	0	0.000	0	0	00:00	0.00
C106A1-S	0.000	0	0	0	0.000	0	0	00:00	14.99
C106B-S	0.000	0	0	0	0.000	11	0	01:11	26.43
C904A-S	0.000	10	0	0	0.001	23	0	01:16	31.75
CB101AB-S	0.000	0	0	0	0.000	0	0	00:00	167.96
CB102AB-S	0.000	0	0	0	0.000	0	0	00:00	253.49
CB103A-S	0.000	0	0	0	0.000	0	0	00:00	39.23
CB104AB-S	0.000	0	0	0	0.000	0	0	00:00	45.53
CB106AB-S	0.000	0	0	0	0.000	0	0	00:00	31.89
CB106C-S	0.000	0	0	0	0.000	0	0	00:00	21.96
CBMH-102A	0.000	0	0	0	0.000	0	0	00:00	120.61
EX_ST101-S	0.000	0	0	0	0.000	0	0	00:00	79.75
EX_ST104-S	0.000	0	0	0	0.000	0	0	00:00	73.95
EXT2-S	0.001	1	0	0	0.057	100	0	01:10	217.47
INTPOND2-S	4.416	19	0	0	12.077	52	0	02:42	377.08
ST302-1A-S	0.000	0	0	0	0.000	0	0	00:00	37.46
ST302-1A-S0	0.000	0	0	0	0.000	0	0	00:00	37.38
ST302-2A-S	0.000	0	0	0	0.000	0	0	00:00	27.13
ST302-3A-S0	0.000	0	0	0	0.000	0	0	00:00	11.22
ST302A-S	0.000	0	0	0	0.000	0	0	00:00	64.08
ST303-1A-S	0.000	0	0	0	0.000	0	0	00:00	145.01
ST303-1A-S0	0.000	0	0	0	0.000	0	0	00:00	19.56
ST303-2A-S	0.000	0	0	0	0.000	0	0	00:00	64.25
ST303-3A-S	0.000	0	0	0	0.000	0	0	00:00	61.68
ST601A-S	0.000	1	0	0	0.061	100	0	01:07	532.88
ST602A-S	0.000	0	0	0	0.000	0	0	00:00	100.83
ST602A-S0	0.000	0	0	0	0.000	0	0	00:00	38.49
ST603A-S	0.000	0	0	0	0.000	0	0	00:00	110.88
ST603A-S0	0.000	0	0	0	0.000	0	0	00:00	0.00
ST603B-S	0.000	0	0	0	0.000	0	0	00:00	55.10
ST605A-S	0.000	1	0	0	0.034	100	0	01:07	272.75
ST605B-S	0.000	1	0	0	0.031	100	0	01:07	269.15
ST605C-S	0.000	1	0	0	0.052	100	0	01:07	373.20
ST605D-S	0.000	0	0	0	0.000	0	0	00:00	64.45
ST606A-S	0.000	0	0	0	0.000	0	0	00:00	78.37
ST606A-S1	0.000	0	0	0	0.000	0	0	00:00	0.00
ST607A-S	0.000	0	0	0	0.000	0	0	00:00	157.92
ST608B-S	0.000	0	0	0	0.000	0	0	00:00	69.18
ST609A-S	0.000	0	0	0	0.000	0	0	00:00	127.64
ST610A-S	0.000	0	0	0	0.000	0	0	00:00	158.31
ST610A-S0	0.000	0	0	0	0.000	0	0	00:00	0.00
ST610B-S	0.000	0	0	0	0.000	0	0	00:00	168.68
ST610C-S	0.000	0	0	0	0.000	0	0	00:00	69.05
ST611A-S	0.000	0	0	0	0.000	0	0	00:00	90.08
ST611B-S	0.000	0	0	0	0.000	0	0	00:00	92.72
ST611C-S0	0.000	0	0	0	0.000	0	0	00:00	0.00
ST612A-S	0.000	0	0	0	0.000	0	0	00:00	89.32
ST612A-S0	0.000	0	0	0	0.000	0	0	00:00	38.60
ST612B-S	0.000	0	0	0	0.000	0	0	00:00	106.25
ST613A-S0	0.000	0	0	0	0.000	0	0	00:00	37.57
ST614A-S0	0.000	0	0	0	0.000	0	0	00:00	0.00
ST615A-S	0.000	0	0	0	0.000	0	0	00:00	111.13
ST615A-S0	0.000	0	0	0	0.000	0	0	00:00	0.00
ST615B-S	0.000	0	0	0	0.000	0	0	00:00	76.88
ST616A-S	0.000	0	0	0	0.000	0	0	00:00	49.63
ST616A-S0	0.000	0	0	0	0.000	0	0	00:00	0.00
ST616B-S	0.000	0	0	0	0.000	0	0	00:00	156.60
ST617A-S	0.000	0	0	0	0.000	0	0	00:00	126.17
ST617A-S0	0.000	0	0	0	0.000	0	0	00:00	0.00
ST619A-S	0.000	0	0	0	0.000	0	0	00:00	57.93

ST620A-S	0.000	0	0	0	0.000	0	0	00:00	125.41
ST621A-S	0.000	0	0	0	0.000	0	0	00:00	37.87
ST621A-S0	0.000	0	0	0	0.000	0	0	00:00	136.14
ST622A-S	0.000	0	0	0	0.000	0	0	00:00	74.47
ST623A-S	0.000	0	0	0	0.000	0	0	00:00	33.79
ST623B-S	0.000	1	0	0	0.062	100	0	01:07	577.71
ST624A-S	0.000	0	0	0	0.000	0	0	00:00	159.73
ST624A-S0	0.000	0	0	0	0.000	0	0	00:00	63.14
ST624A-S1	0.000	0	0	0	0.000	0	0	00:00	122.48
ST624B-S	0.000	0	0	0	0.000	0	0	00:00	72.24
ST625A-S	0.000	0	0	0	0.000	0	0	00:00	129.09
ST625B-S	0.000	0	0	0	0.000	0	0	00:00	88.99
ST625B-S0	0.000	0	0	0	0.000	0	0	00:00	0.00
ST628A-S	0.000	0	0	0	0.000	0	0	00:00	97.90
ST628A-S0	0.000	0	0	0	0.000	0	0	00:00	0.00
ST628A-S1	0.000	0	0	0	0.000	0	0	00:00	52.01
ST628B-S	0.000	0	0	0	0.000	0	0	00:00	72.50
ST628C-S	0.000	0	0	0	0.000	0	0	00:00	114.05
ST629A-S	0.000	0	0	0	0.000	0	0	00:00	103.57
ST630A-S	0.000	0	0	0	0.000	0	0	00:00	110.20
ST630B-S	0.000	0	0	0	0.000	0	0	00:00	64.43
ST630B-S0	0.000	0	0	0	0.000	0	0	00:00	0.00
ST630B-S1	0.000	0	0	0	0.000	0	0	00:00	0.00
ST631A-S	0.000	0	0	0	0.000	0	0	00:00	109.13
ST631A-S0	0.000	0	0	0	0.000	0	0	00:00	0.00
ST632A-S	0.000	0	0	0	0.000	0	0	00:00	45.89
ST632B-S	0.000	1	0	0	0.056	100	0	01:07	521.99
ST633A-S	0.000	0	0	0	0.000	0	0	00:00	208.29
ST633A-S0	0.000	0	0	0	0.000	0	0	00:00	20.39
ST633B-S	0.000	1	0	0	0.068	100	0	01:07	635.82
ST634A-S	0.000	0	0	0	0.000	0	0	00:00	124.43
ST634A-S0	0.000	0	0	0	0.000	0	0	00:00	473.98
ST634A-S1	0.000	0	0	0	0.000	0	0	00:00	63.17
ST635A-S	0.000	0	0	0	0.000	0	0	00:00	64.08
ST637A-S	0.000	0	0	0	0.000	0	0	00:00	49.41
ST637A-S0	0.000	0	0	0	0.000	0	0	00:00	0.64
ST638A-S	0.000	0	0	0	0.000	0	0	00:00	50.26
ST639A-S	0.000	0	0	0	0.000	0	0	00:00	96.92
ST639A-S0	0.000	0	0	0	0.000	0	0	00:00	9.15
ST639B-S	0.000	0	0	0	0.000	0	0	00:00	91.24
ST639C-S	0.000	0	0	0	0.000	0	0	00:00	168.65
ST639E-S	0.001	4	0	0	0.013	89	0	01:10	215.95
ST639F-S	0.000	3	0	0	0.002	86	0	01:10	102.23
ST639G-S	0.000	0	0	0	0.000	0	0	00:00	19.81
ST641A-S	0.000	0	0	0	0.000	0	0	00:00	81.22
ST641A-S0	0.000	0	0	0	0.000	0	0	00:00	0.07
ST641A-S1	0.000	0	0	0	0.000	0	0	00:00	23.06
ST641B-S	0.000	0	0	0	0.000	0	0	00:00	21.03
ST642A-S	0.000	0	0	0	0.000	0	0	00:00	127.59
ST642A-S0	0.000	0	0	0	0.000	0	0	00:00	13.30
ST643A-S	0.000	0	0	0	0.000	0	0	00:00	99.63
ST643A-S0	0.000	0	0	0	0.000	0	0	00:00	5.18
ST643A-S1	0.000	0	0	0	0.000	0	0	00:00	107.93
ST644A-S	0.000	0	0	0	0.000	0	0	00:00	75.77
ST645A-S	0.000	0	0	0	0.000	0	0	00:00	88.40
ST645A-S0	0.000	0	0	0	0.000	0	0	00:00	0.00
ST645A-S1	0.000	0	0	0	0.000	0	0	00:00	0.00
ST645B-S	0.000	0	0	0	0.000	0	0	00:00	82.97
ST646A-S	0.000	0	0	0	0.000	0	0	00:00	37.63
ST648A-S	0.000	0	0	0	0.000	0	0	00:00	65.46
ST648A-S0	0.000	0	0	0	0.000	0	0	00:00	0.00
ST648A-S1	0.000	0	0	0	0.000	0	0	00:00	242.68
ST648B-S	0.000	1	0	0	0.064	100	0	01:07	569.81
STM-101	0.000	6	0	0	0.001	29	0	01:16	206.52
STM-101A	0.000	9	0	0	0.001	31	0	01:16	213.19
STM-102	0.000	11	0	0	0.001	27	0	01:16	119.02
STM-103	0.000	0	0	0	0.001	18	0	01:17	61.90
STM-104	0.000	0	0	0	0.000	0	0	00:00	0.00
STM-106	0.000	0	0	0	0.000	0	0	00:00	12.91
STM-639	0.000	6	0	0	0.001	31	0	01:15	258.57

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Outfall Loading Summary
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                        Flow       Avg       Max       Total
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Outfall Node	Freq Pcnt	Flow LPS	Flow LPS	Volume 10^6 ltr
Creek	98.19	114.09	377.08	14.519
OF_MudCreek	1.18	22.30	63.18	0.034
OF1	8.72	8.47	82.97	0.096
OF2	0.00	0.00	0.00	0.000
OF3	9.90	9.63	41.46	0.124
OF5	8.58	3.23	28.40	0.036
System	21.10	157.72	28.40	14.809

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Link Flow Summary
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Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days	hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
14	CHANNEL	195.04	0	01:10	0.26	0.09	0.71
15	CHANNEL	170.27	0	01:11	0.24	0.09	0.68
16	CHANNEL	129.72	0	01:12	0.17	0.06	0.71
18	CHANNEL	33.18	0	01:10	0.09	0.02	0.52
19	CHANNEL	26.43	0	01:11	0.07	0.02	0.49
9	CONDUIT	213.19	0	01:23	1.07	0.91	1.00
C1	CHANNEL	0.00	0	00:00	0.00	0.00	0.30
C10	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
C11	CHANNEL	278.30	0	01:10	1.10	0.28	0.44
C12	CONDUIT	63.18	0	01:14	1.20	0.18	0.29
C13	CONDUIT	32.14	0	01:10	0.57	0.05	0.19
C14	CONDUIT	101.60	0	01:11	0.48	0.31	0.51
C15	CONDUIT	41.56	0	01:10	0.54	0.06	0.22
C16	CHANNEL	121.98	0	01:10	0.69	0.16	0.29
C17	CONDUIT	42.37	0	01:10	0.54	0.06	0.22
C18	CONDUIT	74.74	0	01:10	0.65	0.11	0.31
C19	CHANNEL	122.29	0	01:10	0.63	0.15	0.30
C2	CHANNEL	0.00	0	00:00	0.00	0.00	0.47
C20	CONDUIT	34.54	0	01:10	0.51	0.05	0.20
C21	CHANNEL	94.77	0	01:10	0.47	0.09	0.64
C22	CONDUIT	30.68	0	01:10	0.73	0.02	0.13
C23	CHANNEL	238.97	0	01:10	0.70	0.52	0.54
C24	CONDUIT	28.22	0	01:10	0.48	0.04	0.17
C25	CONDUIT	74.82	0	01:10	0.67	0.10	0.34
C26	CONDUIT	40.42	0	01:10	0.53	0.06	0.25
C27	CONDUIT	57.07	0	01:10	0.60	0.09	0.27
C28	CONDUIT	56.50	0	01:10	1.15	0.06	0.45
C29	CHANNEL	65.87	0	01:05	0.75	0.03	0.14
C3	CONDUIT	455.04	0	01:11	1.45	0.92	1.00
C30	CONDUIT	25.34	0	01:10	0.83	0.02	0.14
C304_1	CONDUIT	5687.87	0	01:16	2.13	0.73	0.57
C304_3	CONDUIT	5689.46	0	01:17	2.29	0.73	0.54
C304_4	CONDUIT	5689.85	0	01:18	2.61	0.73	0.50
C305_1	CONDUIT	5634.37	0	01:18	2.14	0.46	0.55
C305_3	CONDUIT	5515.89	0	01:19	2.24	0.45	0.58
C305_4	CONDUIT	5392.96	0	01:19	2.21	0.36	0.63
C306_1	CONDUIT	5283.64	0	01:23	1.24	0.37	0.71
C31	CHANNEL	308.18	0	01:08	1.20	0.26	0.56
C32	CHANNEL	252.17	0	01:08	1.00	0.23	0.55
C33	CONDUIT	0.63	0	01:11	0.09	0.00	0.02
C34	CHANNEL	14.99	0	01:16	0.30	0.01	0.26
C35	CHANNEL	53.88	0	01:09	0.46	0.03	0.75
C36	CHANNEL	261.34	0	01:10	0.86	0.21	0.55
C37	CONDUIT	5212.49	0	01:25	3.15	1.90	1.00
C38	CHANNEL	74.80	0	01:11	0.50	0.07	0.27
C39	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
C4	CHANNEL	53.36	0	01:10	0.13	0.02	0.48
C40	CONDUIT	0.00	0	00:00	0.00	0.00	0.22
C41	CHANNEL	215.95	0	01:10	0.43	0.09	0.65
C42	CHANNEL	78.40	0	01:10	0.32	0.03	0.35
C43	CONDUIT	377.08	0	02:43	1.68	0.14	0.25
C44	CONDUIT	27.13	0	01:35	0.24	0.21	0.59
C46	CONDUIT	5279.72	0	01:20	1.35	0.37	0.70
C47	CHANNEL	123.25	0	01:13	0.46	0.06	0.32
C48	CHANNEL	0.00	0	00:00	0.00	0.00	0.41
C49	CHANNEL	0.00	0	00:00	0.00	0.00	0.35

C5	CONDUIT	66.22	0	01:10	0.63	0.10	0.29
C50	CHANNEL	0.00	0	00:00	0.00	0.00	0.30
C51	CHANNEL	66.17	0	01:11	0.19	0.02	0.63
C52	CHANNEL	108.77	0	01:10	0.65	0.11	0.25
C53	CHANNEL	2.72	0	01:11	0.07	0.00	0.15
C54	CHANNEL	15.51	0	01:09	0.06	0.01	0.41
C55	CHANNEL	15.34	0	01:14	0.05	0.01	0.48
C56	CHANNEL	85.81	0	01:08	0.44	0.05	0.57
C57	CONDUIT	31.75	0	01:10	0.59	0.13	0.72
C58	CONDUIT	120.61	0	01:10	1.05	0.50	0.82
C59	CONDUIT	41.46	0	01:01	1.05	0.68	0.55
C6	CONDUIT	55.36	0	01:10	0.59	0.08	0.26
C60	CHANNEL	53.75	0	01:10	0.27	0.04	0.25
C61	CONDUIT	58.75	0	01:10	0.66	0.08	0.25
C62	CONDUIT	206.52	0	01:23	1.14	0.88	1.00
C7	CONDUIT	31.77	0	01:10	0.74	0.03	0.13
C7_1	CHANNEL	106.84	0	01:14	0.81	0.04	0.54
C7_2	CHANNEL	81.65	0	01:11	0.15	0.02	0.66
C72	CONDUIT	5218.69	0	01:25	2.96	1.90	1.00
C8	CONDUIT	46.07	0	01:10	0.17	0.19	0.70
C9	CONDUIT	41.30	0	01:10	0.53	0.06	0.25
EXT-11-S0-O_2	CONDUIT	11.22	0	01:32	0.15	0.09	0.48
EXT-4-S0-O_1	CONDUIT	64.25	0	01:41	0.45	0.50	0.65
EXT-4-S0-O_3	CONDUIT	61.68	0	01:16	0.34	0.47	0.78
EXT-6-S-O_3	CONDUIT	37.38	0	01:41	0.27	0.29	0.74
EXT-6-S-O_4	CONDUIT	64.08	0	01:12	0.38	0.48	0.74
EXT-9-S0-O_2	CONDUIT	37.46	0	01:39	0.29	0.29	0.63
N73-O	CHANNEL	0.00	0	00:00	0.00	0.00	0.26
Pipe_-_(100)	CONDUIT	152.51	0	01:09	1.39	0.35	1.00
Pipe_-_(101)	CONDUIT	125.93	0	01:16	1.51	0.53	0.94
Pipe_-_(102)	CONDUIT	1010.62	0	01:21	1.39	0.96	1.00
Pipe_-_(103)	CONDUIT	969.60	0	01:21	1.33	0.92	1.00
Pipe_-_(104)	CONDUIT	941.08	0	01:21	1.57	1.08	1.00
Pipe_-_(105)	CONDUIT	659.21	0	01:23	1.33	1.19	1.00
Pipe_-_(106)	CONDUIT	392.45	0	01:23	1.42	1.28	1.00
Pipe_-_(107)	CONDUIT	48.21	0	01:10	1.31	0.53	0.76
Pipe_-_(108)	CONDUIT	172.85	0	01:23	1.06	0.80	1.00
Pipe_-_(109)	CONDUIT	57.07	0	01:11	0.83	0.83	1.00
Pipe_-_(110)	CONDUIT	24.39	0	01:12	0.46	0.36	1.00

Pipe_-_(111)	CONDUIT	137.24	0	01:22	1.39	0.60	0.95
Pipe_-_(174)	CONDUIT	258.57	0	01:23	1.22	0.42	1.00
Pipe_-_(64)	CONDUIT	5688.36	0	01:16	1.95	0.46	0.61
Pipe_-_(65)	CONDUIT	5395.21	0	01:16	2.98	0.94	0.67
Pipe_-_(66)	CONDUIT	5249.23	0	01:15	2.32	1.18	0.83
Pipe_-_(67)	CONDUIT	5111.06	0	01:15	2.39	1.25	1.00
Pipe_-_(69)	CONDUIT	4523.09	0	01:15	2.12	1.43	1.00
Pipe_-_(70)	CONDUIT	4439.74	0	01:15	2.08	1.41	1.00
Pipe_-_(71)	CONDUIT	164.28	0	01:23	1.24	0.91	1.00
Pipe_-_(72)	CONDUIT	131.11	0	01:23	1.38	1.06	1.00
Pipe_-_(73)	CONDUIT	4218.65	0	01:15	1.97	1.34	1.00
Pipe_-_(74)	CONDUIT	2261.46	0	01:15	1.41	0.92	1.00
Pipe_-_(75)	CONDUIT	729.19	0	01:11	1.53	1.04	1.00
Pipe_-_(76)	CONDUIT	437.62	0	01:11	1.27	1.01	1.00
Pipe_-_(77)	CONDUIT	71.82	0	01:23	1.18	1.05	1.00
Pipe_-_(78)	CONDUIT	1601.25	0	01:23	1.23	0.87	1.00
Pipe_-_(79)	CONDUIT	1534.39	0	01:23	1.53	0.88	1.00
Pipe_-_(80)	CONDUIT	94.01	0	01:23	1.06	0.41	1.00
Pipe_-_(81)	CONDUIT	18.80	0	01:11	0.37	0.24	0.92
Pipe_-_(82)	CONDUIT	473.77	0	01:23	1.36	0.85	1.00
Pipe_-_(83)	CONDUIT	89.51	0	01:24	1.10	0.93	1.00
Pipe_-_(84)	CONDUIT	86.38	0	01:23	1.15	0.70	1.00
Pipe_-_(85)	CONDUIT	980.30	0	01:24	1.45	1.14	1.00
Pipe_-_(86)	CONDUIT	833.64	0	01:23	1.21	0.97	1.00
Pipe_-_(87)	CONDUIT	242.79	0	01:23	1.51	0.80	1.00
Pipe_-_(88)	CONDUIT	88.96	0	01:15	1.36	0.37	0.71
Pipe_-_(89)	CONDUIT	544.00	0	01:11	1.50	0.83	1.00
Pipe_-_(90)	CONDUIT	512.76	0	01:23	1.54	0.78	1.00
Pipe_-_(91)	CONDUIT	504.69	0	01:23	1.61	0.76	1.00
Pipe_-_(92)	CONDUIT	1749.85	0	01:17	1.22	0.95	1.00
Pipe_-_(93)	CONDUIT	1595.33	0	01:17	1.62	1.18	1.00
Pipe_-_(94)	CONDUIT	1457.43	0	01:17	1.43	1.08	1.00
Pipe_-_(95)	CONDUIT	19.32	0	01:13	0.34	0.25	1.00
Pipe_-_(96)	CONDUIT	1454.29	0	01:17	1.44	1.08	1.00
Pipe_-_(97)	CONDUIT	142.09	0	01:23	1.31	0.62	1.00
Pipe_-_(98)	CONDUIT	276.86	0	01:16	1.20	0.66	1.00
Pipe_-_(99)	CONDUIT	175.77	0	01:23	1.04	0.40	1.00
Pipe_2	CONDUIT	119.02	0	01:10	1.14	0.59	1.00
Pipe_6	CONDUIT	61.90	0	01:24	0.78	0.63	1.00

Pipe_7	CONDUIT	0.00	0	00:00	0.00	0.00	0.24
Pipe_8	CONDUIT	25.79	0	01:12	0.35	0.29	1.00
ST602A-S0-O	CHANNEL	38.49	0	01:13	0.21	0.02	0.41
ST602A-S-O	CHANNEL	11.78	0	01:16	0.06	0.01	0.34
ST603A-S0-O	CHANNEL	15.43	0	01:10	0.25	0.01	0.38
ST606A-S-O	CHANNEL	0.00	0	00:00	0.00	0.00	0.35
ST610A-S0-O	CHANNEL	0.00	0	00:00	0.00	0.00	0.45
ST610A-S-O	CHANNEL	0.00	0	00:00	0.00	0.00	0.45
ST611A-S0-O	CHANNEL	0.00	0	00:00	0.00	0.00	0.46
ST611A-S-O	CHANNEL	0.00	0	00:00	0.00	0.00	0.46
ST611C-S0-O	CHANNEL	0.00	0	00:00	0.00	0.00	0.41
ST612A-S0-O	CHANNEL	38.60	0	01:12	0.33	0.01	0.49
ST612A-S-O	CHANNEL	0.00	0	00:00	0.00	0.00	0.40
ST613A-S0-O	CHANNEL	37.57	0	01:11	0.15	0.01	0.48
ST613A-S-O	CHANNEL	0.00	0	00:00	0.00	0.00	0.40
ST615A-S0-O	CHANNEL	0.00	0	00:00	0.00	0.00	0.39
ST616A-S0-O	CHANNEL	0.00	0	00:00	0.00	0.00	0.34
ST616A-S1-O	CHANNEL	0.00	0	00:00	0.00	0.00	0.00
ST616A-S-O	CHANNEL	0.00	0	00:00	0.00	0.00	0.34
ST617A-S0-O	CHANNEL	0.00	0	00:00	0.00	0.00	0.34
ST617A-S-O	CHANNEL	0.00	0	00:00	0.00	0.00	0.34
ST620A-S0-O_1	CHANNEL	0.00	0	00:00	0.00	0.00	0.29
ST620A-S-O	CHANNEL	0.00	0	00:00	0.00	0.00	0.29
ST621A-S0-O	CHANNEL	69.97	0	01:11	0.26	0.02	0.39
ST621A-S-O	CHANNEL	0.00	0	00:00	0.00	0.00	0.30
ST624A-S0-O_1	CHANNEL	30.45	0	01:10	0.36	0.01	0.23
ST624A-S-O	CHANNEL	0.00	0	00:00	0.00	0.00	0.16
ST625B-S0-O	CHANNEL	0.00	0	00:00	0.00	0.00	0.37
ST625B-S-O	CHANNEL	0.00	0	00:00	0.00	0.00	0.37
ST628A-S0-O_1	CHANNEL	0.00	0	00:00	0.00	0.00	0.12
ST628A-S0-O_2	CHANNEL	52.01	0	01:10	0.18	0.02	0.57
ST628A-S-O	CHANNEL	32.68	0	01:10	0.10	0.01	0.54
ST630B-S0-O	CHANNEL	0.00	0	00:00	0.00	0.00	0.36
ST630B-S-O	CHANNEL	0.00	0	00:00	0.00	0.00	0.36
ST631A-S0-O	CHANNEL	0.00	0	00:00	0.00	0.00	0.21
ST631A-S-O	CHANNEL	5.81	0	01:10	0.22	0.00	0.26
ST633A-S0-O	CHANNEL	8.37	0	01:10	0.15	0.00	0.43
ST633A-S-O	CHANNEL	255.67	0	01:10	0.45	0.03	0.51
ST634A-S0-O	CHANNEL	218.31	0	01:10	0.35	0.03	0.51

ST634A-S1-O	CHANNEL	66.91	0	01:13	0.13	0.01	0.49
ST635A-S0-O	CHANNEL	3.18	0	01:22	0.23	0.00	0.26
ST635A-S-O	CHANNEL	6.21	0	01:10	0.12	0.00	0.30
ST637A-S0-O	CHANNEL	0.32	0	01:12	0.12	0.00	0.29
ST637A-S-O	CHANNEL	2.64	0	01:22	0.26	0.00	0.28
ST638A-S-O	CHANNEL	11.84	0	01:11	0.03	0.00	0.43
ST639A-S0-O	CHANNEL	38.06	0	01:17	0.07	0.01	0.53
ST639A-S-O	CHANNEL	0.03	0	01:13	0.01	0.00	0.51
ST641A-S0-O_1	CHANNEL	2.75	0	01:11	0.08	0.00	0.14
ST641A-S0-O_2	CHANNEL	23.06	0	01:16	0.26	0.01	0.50
ST641A-S-O	CHANNEL	0.00	0	00:00	0.00	0.00	0.37
ST642A-S0-O	CHANNEL	13.30	0	01:12	0.14	0.00	0.36
ST642A-S-O	CHANNEL	2.50	0	01:22	0.12	0.00	0.36
ST643A-S0-O	CHANNEL	2.92	0	01:14	0.21	0.00	0.29
ST643A-S1-O	CHANNEL	40.28	0	01:10	0.23	0.01	0.37
ST643A-S-O	CHANNEL	42.15	0	01:10	0.19	0.01	0.35
ST644A-S-O	CHANNEL	39.51	0	01:10	0.23	0.01	0.37
ST645A-S-O	CHANNEL	0.00	0	00:00	0.00	0.00	0.26
ST646A-S-O	CHANNEL	28.15	0	01:10	0.36	0.01	0.36
ST648A-S0-O_1	CHANNEL	0.00	0	00:00	0.00	0.00	0.19
ST648A-S0-O_4	CHANNEL	242.68	0	01:10	0.38	0.08	0.68
ST648A-S-O	CHANNEL	26.48	0	01:13	0.06	0.01	0.54
C101A-IC	ORIFICE	19.11	0	01:13			1.00
C101B-IC	ORIFICE	19.17	0	01:13			1.00
C102A-IC	ORIFICE	16.94	0	01:10			1.00
C102B-IC	ORIFICE	17.11	0	01:10			1.00
C103A-IC	ORIFICE	16.64	0	01:10			1.00
C106C-IC	ORIFICE	18.28	0	01:10			1.00
C45	ORIFICE	145.01	0	01:11			1.00
ORF_QUAL	ORIFICE	57.94	0	02:42			1.00
ORF-QUAN	ORIFICE	319.14	0	02:42			1.00
ST602A-O	ORIFICE	44.53	0	01:15			1.00
ST602A-O1	ORIFICE	44.53	0	01:15			1.00
ST603A-O	ORIFICE	55.44	0	01:11			1.00
ST603A-O1	ORIFICE	55.44	0	01:11			1.00
ST603B-O	ORIFICE	26.88	0	01:10			1.00
ST605D-O	ORIFICE	33.76	0	01:10			1.00
ST606A-O	ORIFICE	39.19	0	01:12			1.00
ST606A-O1	ORIFICE	39.19	0	01:12			1.00

ST607A-O	ORIFICE	31.57	0	01:10	1.00
ST607A-O1	ORIFICE	31.57	0	01:10	1.00
ST608B-O	ORIFICE	34.64	0	01:10	1.00
ST609A-O	ORIFICE	63.82	0	01:12	1.00
ST609A-O1	ORIFICE	63.82	0	01:12	1.00
ST610A-O	ORIFICE	56.90	0	01:11	1.00
ST610A-O1	ORIFICE	56.90	0	01:11	1.00
ST610B-O	ORIFICE	93.86	0	01:10	1.00
ST610C-O	ORIFICE	28.63	0	01:10	1.00
ST611A-O	ORIFICE	45.04	0	01:12	1.00
ST611A-O1	ORIFICE	45.04	0	01:12	1.00
ST611B-O	ORIFICE	26.84	0	01:05	1.00
ST612A-O	ORIFICE	44.66	0	01:13	1.00
ST612A-O1	ORIFICE	44.66	0	01:13	1.00
ST612B-O	ORIFICE	49.18	0	01:10	1.00
ST615A-O	ORIFICE	28.89	0	01:10	1.00
ST615A-O1	ORIFICE	28.89	0	01:10	1.00
ST615B-O	ORIFICE	34.51	0	01:10	1.00
ST616A-O	ORIFICE	24.82	0	01:12	1.00
ST616A-O1	ORIFICE	24.82	0	01:12	1.00
ST617A-O	ORIFICE	63.08	0	01:10	1.00
ST617A-O1	ORIFICE	63.08	0	01:10	1.00
ST619A-O	ORIFICE	25.79	0	01:10	1.00
ST620A-O	ORIFICE	62.71	0	01:11	1.00
ST620A-O1	ORIFICE	62.71	0	01:11	1.00
ST621A-O	ORIFICE	18.94	0	01:17	1.00
ST621A-O1	ORIFICE	18.94	0	01:17	1.00
ST622A-O	ORIFICE	32.91	0	01:10	1.00
ST623A-O	ORIFICE	33.79	0	01:22	1.00
ST624A-O	ORIFICE	32.88	0	01:13	1.00
ST624A-O1	ORIFICE	45.36	0	01:13	1.00
ST624B-O	ORIFICE	30.94	0	01:10	1.00
ST625A-O	ORIFICE	32.38	0	01:14	1.00
ST625A-O1	ORIFICE	44.67	0	01:14	1.00
ST625B-O	ORIFICE	44.50	0	01:12	1.00
ST625B-O1	ORIFICE	44.50	0	01:12	1.00
ST628A-O	ORIFICE	32.68	0	01:13	1.00
ST628A-O1	ORIFICE	32.68	0	01:13	1.00
ST628B-O	ORIFICE	26.43	0	01:10	1.00
ST628C-O	ORIFICE	47.83	0	01:10	1.00
ST629A-O	ORIFICE	48.22	0	01:10	1.00
ST630A-O	ORIFICE	28.46	0	01:12	1.00
ST630A-O1	ORIFICE	28.46	0	01:12	1.00
ST630B-O	ORIFICE	32.21	0	01:11	1.00
ST630B-O1	ORIFICE	32.21	0	01:11	1.00
ST631A-O	ORIFICE	54.56	0	01:10	1.00
ST631A-O1	ORIFICE	54.56	0	01:10	1.00
ST632A-O	ORIFICE	20.55	0	01:10	1.00
ST633A-O	ORIFICE	25.33	0	01:12	1.00
ST633A-O1	ORIFICE	25.33	0	01:12	1.00
ST634A-O	ORIFICE	29.08	0	01:12	1.00
ST634A-O1	ORIFICE	29.08	0	01:12	1.00
ST635A-O	ORIFICE	32.04	0	01:12	1.00
ST635A-O1	ORIFICE	32.04	0	01:12	1.00
ST637A-O	ORIFICE	24.70	0	01:11	1.00
ST637A-O1	ORIFICE	24.70	0	01:11	1.00
ST638A-O	ORIFICE	19.22	0	01:13	1.00
ST638A-O1	ORIFICE	19.22	0	01:13	1.00
ST639A-O	ORIFICE	29.48	0	01:20	1.00
ST639A-O1	ORIFICE	29.48	0	01:20	1.00
ST639B-O	ORIFICE	34.74	0	01:10	1.00
ST639C-O	ORIFICE	93.91	0	01:10	1.00
ST639E-O	ORIFICE	15.61	0	01:10	1.00
ST639F-O	ORIFICE	30.48	0	01:01	1.00
ST639G-O	ORIFICE	19.81	0	01:09	1.00
ST641A-O	ORIFICE	32.26	0	01:12	1.00
ST641A-O1	ORIFICE	32.26	0	01:12	1.00
ST641B-O	ORIFICE	20.40	0	01:11	1.00
ST642A-O	ORIFICE	63.79	0	01:21	1.00
ST642A-O1	ORIFICE	63.79	0	01:21	1.00
ST643A-O	ORIFICE	28.75	0	01:11	1.00
ST643A-O1	ORIFICE	28.75	0	01:11	1.00
ST644A-O	ORIFICE	32.23	0	01:12	1.00
ST644A-O1	ORIFICE	32.23	0	01:12	1.00
ST645A-O	ORIFICE	44.20	0	01:12	1.00
ST645A-O1	ORIFICE	44.20	0	01:12	1.00
ST645B-O	ORIFICE	51.19	0	01:10	1.00
ST646A-O	ORIFICE	18.81	0	01:12	1.00

ST646A-O1	ORIFICE	18.81	0	01:12			1.00
ST648A-O	ORIFICE	19.50	0	01:16			1.00
ST648A-O1	ORIFICE	19.50	0	01:16			1.00
20	WEIR	4.35	0	01:15			0.07
21	WEIR	24.42	0	01:10			0.23
ST634A-S-O	WEIR	31.58	0	01:14			0.41
ST634A-S-W	WEIR	31.58	0	01:14			0.41
Weir1	WEIR	0.00	0	00:00			0.00
C104A-IC	DUMMY	6.21	0	01:10			
C104B-IC	DUMMY	6.15	0	01:10			
C106A-IC	DUMMY	6.17	0	01:15			
C106B-IC	DUMMY	6.17	0	01:15			
EX101-O	DUMMY	26.00	0	01:01			
EX104-O	DUMMY	15.20	0	01:01			
EXT2-O	DUMMY	142.67	0	01:01			
ST601A-O	DUMMY	293.91	0	01:01			
ST605A-O	DUMMY	163.98	0	01:01			
ST605B-O	DUMMY	147.17	0	01:01			
ST605C-O	DUMMY	250.91	0	01:01			
ST616B-O	DUMMY	55.00	0	01:02			
ST623B-O	DUMMY	299.41	0	01:01			
ST632B-O	DUMMY	269.82	0	01:01			
ST633B-O	DUMMY	327.64	0	01:01			
ST648B-O	DUMMY	308.47	0	01:01			
ST904-O	DUMMY	27.84	0	01:10			

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Flow Classification Summary
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Conduit	Adjusted /Actual Length	---------- Fraction of Time in Flow Class ---------- Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
14	1.00	0.03	0.00	0.00	0.02	0.00	0.00	0.95	0.01	0.00
15	1.00	0.03	0.00	0.00	0.01	0.00	0.00	0.96	0.01	0.00
16	1.00	0.03	0.00	0.00	0.01	0.00	0.00	0.96	0.00	0.00
18	1.00	0.03	0.00	0.00	0.03	0.00	0.00	0.94	0.01	0.00
19	1.00	0.03	0.00	0.00	0.03	0.00	0.00	0.94	0.03	0.00
9	1.00	0.01	0.00	0.00	0.03	0.00	0.00	0.96	0.00	0.00
C1	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C10	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C11	1.00	0.03	0.97	0.00	0.00	0.00	0.00	0.00	0.97	0.00
C12	1.00	0.03	0.00	0.00	0.95	0.01	0.00	0.00	0.00	0.00
C13	1.00	0.99	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
C14	1.00	0.98	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00
C15	1.00	0.99	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
C16	1.00	0.03	0.97	0.00	0.00	0.00	0.00	0.00	0.97	0.00
C17	1.00	0.99	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
C18	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C19	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C2	1.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C20	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C21	1.00	0.99	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
C22	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C23	1.00	0.03	0.97	0.00	0.00	0.00	0.00	0.00	0.97	0.00
C24	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C25	1.00	0.99	0.00	0.00	0.00	0.00	0.00	0.00	0.97	0.00
C26	1.00	0.99	0.00	0.00	0.00	0.00	0.00	0.00	0.97	0.00
C27	1.00	0.99	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
C28	1.00	0.98	0.01	0.00	0.01	0.00	0.00	0.00	0.97	0.00
C29	1.00	0.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C3	1.00	0.01	0.00	0.00	0.01	0.00	0.00	0.98	0.00	0.00
C30	1.00	0.03	0.97	0.00	0.00	0.00	0.00	0.00	0.97	0.00
C304_1	1.00	0.01	0.00	0.00	0.35	0.00	0.00	0.64	0.05	0.00
C304_3	1.00	0.02	0.00	0.00	0.52	0.00	0.00	0.46	0.22	0.00
C304_4	1.00	0.02	0.00	0.00	0.15	0.00	0.00	0.83	0.03	0.00
C305_1	1.00	0.02	0.00	0.00	0.34	0.00	0.00	0.64	0.05	0.00
C305_3	1.00	0.02	0.00	0.00	0.34	0.00	0.00	0.64	0.04	0.00
C305_4	1.00	0.02	0.00	0.00	0.56	0.00	0.00	0.41	0.24	0.00
C306_1	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.00	0.00
C31	1.00	0.03	0.97	0.00	0.00	0.00	0.00	0.00	0.97	0.00
C32	1.00	0.03	0.97	0.00	0.00	0.00	0.00	0.00	0.97	0.00
C33	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C34	1.00	0.03	0.00	0.00	0.97	0.00	0.00	0.00	0.97	0.00
C35	1.00	0.98	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00

C36	1.00	0.03	0.97	0.00	0.00	0.00	0.00	0.00	0.97	0.00
C37	1.00	0.00	0.00	0.00	0.99	0.00	0.00	0.01	0.00	0.00
C38	1.00	0.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C39	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C4	1.00	0.03	0.00	0.00	0.01	0.00	0.00	0.96	0.01	0.00
C40	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C41	1.00	0.98	0.00	0.00	0.02	0.00	0.00	0.00	0.97	0.00
C42	1.00	0.98	0.01	0.00	0.01	0.00	0.00	0.00	0.97	0.00
C43	1.00	0.01	0.00	0.00	0.01	0.97	0.00	0.00	0.10	0.00
C44	1.00	0.03	0.00	0.00	0.97	0.00	0.00	0.00	0.97	0.00
C46	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.00	0.00
C47	1.00	0.03	0.00	0.00	0.00	0.00	0.00	0.97	0.00	0.00
C48	1.00	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C49	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C5	1.00	0.99	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
C50	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C51	1.00	0.03	0.00	0.00	0.01	0.00	0.00	0.96	0.01	0.00
C52	1.00	0.99	0.00	0.00	0.00	0.00	0.00	0.00	0.97	0.00
C53	1.00	0.03	0.00	0.00	0.97	0.00	0.00	0.00	0.97	0.00
C54	1.00	0.03	0.00	0.00	0.01	0.00	0.00	0.96	0.01	0.00
C55	1.00	0.03	0.00	0.00	0.03	0.00	0.00	0.94	0.01	0.00
C56	1.00	0.03	0.00	0.00	0.01	0.00	0.00	0.96	0.00	0.00
C57	1.00	0.02	0.10	0.00	0.89	0.00	0.00	0.00	0.94	0.00
C58	1.00	0.02	0.00	0.00	0.01	0.00	0.00	0.98	0.00	0.00
C59	1.00	0.00	0.00	0.00	0.98	0.02	0.00	0.00	0.00	0.00
C6	1.00	0.99	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
C60	1.00	0.03	0.96	0.00	0.01	0.00	0.00	0.00	0.97	0.00
C61	1.00	0.99	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
C62	1.00	0.01	0.00	0.00	0.13	0.00	0.00	0.86	0.00	0.00
C7	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C7_1	1.00	0.03	0.00	0.00	0.01	0.00	0.00	0.96	0.00	0.00
C7_2	1.00	0.03	0.00	0.00	0.02	0.00	0.00	0.96	0.01	0.00
C72	1.00	0.00	0.02	0.00	0.98	0.00	0.00	0.00	0.00	0.00
C8	1.00	0.97	0.01	0.00	0.01	0.00	0.00	0.00	0.97	0.00
C9	1.00	0.99	0.00	0.00	0.00	0.00	0.00	0.00	0.97	0.00
EXT-11-S0-O_2	1.00	0.03	0.00	0.00	0.97	0.00	0.00	0.00	0.97	0.00
EXT-4-S0-O_1	1.00	0.03	0.00	0.00	0.00	0.00	0.00	0.97	0.00	0.00
EXT-4-S0-O_3	1.00	0.03	0.00	0.00	0.97	0.00	0.00	0.00	0.97	0.00
EXT-6-S-O_3	1.00	0.03	0.00	0.00	0.97	0.00	0.00	0.00	0.94	0.00

EXT-6-S-O_4	1.00	0.03	0.00	0.00	0.97	0.00	0.00	0.00	0.97	0.00
EXT-9-S0-O_2	1.00	0.03	0.00	0.00	0.97	0.00	0.00	0.00	0.96	0.00
N73-O	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe_-_(100)	1.00	0.01	0.00	0.00	0.01	0.00	0.00	0.98	0.00	0.00
Pipe_-_(101)	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.98	0.00	0.00
Pipe_-_(102)	1.00	0.01	0.00	0.00	0.02	0.00	0.00	0.96	0.00	0.00
Pipe_-_(103)	1.00	0.01	0.00	0.00	0.23	0.00	0.00	0.75	0.07	0.00
Pipe_-_(104)	1.00	0.01	0.00	0.00	0.02	0.00	0.00	0.97	0.00	0.00
Pipe_-_(105)	1.00	0.01	0.00	0.00	0.01	0.00	0.00	0.97	0.00	0.00
Pipe_-_(106)	1.00	0.01	0.00	0.00	0.01	0.00	0.00	0.98	0.00	0.00
Pipe_-_(107)	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.98	0.00	0.00
Pipe_-_(108)	1.00	0.01	0.00	0.00	0.01	0.00	0.00	0.97	0.00	0.00
Pipe_-_(109)	1.00	0.03	0.00	0.00	0.01	0.00	0.00	0.96	0.00	0.00
Pipe_-_(110)	1.00	0.03	0.00	0.00	0.01	0.00	0.00	0.96	0.00	0.00
Pipe_-_(111)	1.00	0.01	0.00	0.00	0.02	0.00	0.00	0.97	0.01	0.00
Pipe_-_(174)	1.00	0.01	0.00	0.00	0.02	0.00	0.00	0.96	0.00	0.00
Pipe_-_(64)	1.00	0.01	0.00	0.00	0.08	0.00	0.00	0.91	0.00	0.00
Pipe_-_(65)	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
Pipe_-_(66)	1.00	0.01	0.00	0.00	0.01	0.00	0.00	0.97	0.00	0.00
Pipe_-_(67)	1.00	0.01	0.00	0.00	0.03	0.00	0.00	0.95	0.00	0.00
Pipe_-_(69)	1.00	0.01	0.00	0.00	0.38	0.00	0.00	0.61	0.14	0.00
Pipe_-_(70)	1.00	0.01	0.00	0.00	0.39	0.00	0.00	0.59	0.00	0.00
Pipe_-_(71)	1.00	0.01	0.00	0.00	0.01	0.00	0.00	0.98	0.00	0.00
Pipe_-_(72)	1.00	0.01	0.00	0.00	0.01	0.00	0.00	0.98	0.00	0.00
Pipe_-_(73)	1.00	0.01	0.00	0.00	0.38	0.00	0.00	0.61	0.11	0.00
Pipe_-_(74)	1.00	0.01	0.00	0.00	0.04	0.00	0.00	0.94	0.00	0.00
Pipe_-_(75)	1.00	0.01	0.00	0.00	0.01	0.00	0.00	0.97	0.00	0.00
Pipe_-_(76)	1.00	0.01	0.00	0.00	0.02	0.00	0.00	0.97	0.00	0.00
Pipe_-_(77)	1.00	0.01	0.00	0.00	0.01	0.00	0.00	0.98	0.00	0.00
Pipe_-_(78)	1.00	0.01	0.00	0.00	0.02	0.00	0.00	0.96	0.00	0.00
Pipe_-_(79)	1.00	0.01	0.00	0.00	0.02	0.00	0.00	0.96	0.00	0.00
Pipe_-_(80)	1.00	0.01	0.00	0.00	0.01	0.00	0.00	0.97	0.00	0.00
Pipe_-_(81)	1.00	0.03	0.00	0.00	0.01	0.00	0.00	0.96	0.00	0.00
Pipe_-_(82)	1.00	0.01	0.00	0.00	0.01	0.00	0.00	0.98	0.00	0.00
Pipe_-_(83)	1.00	0.01	0.00	0.00	0.01	0.00	0.00	0.97	0.00	0.00
Pipe_-_(84)	1.00	0.01	0.00	0.00	0.02	0.00	0.00	0.96	0.01	0.00
Pipe_-_(85)	1.00	0.01	0.00	0.00	0.02	0.00	0.00	0.97	0.00	0.00
Pipe_-_(86)	1.00	0.01	0.00	0.00	0.28	0.00	0.00	0.71	0.18	0.00
Pipe_-_(87)	1.00	0.01	0.00	0.00	0.01	0.00	0.00	0.98	0.00	0.00

Pipe_-_(88)	1.00	0.01	0.00	0.00	0.01	0.00	0.00	0.97	0.01	0.00
Pipe_-_(89)	1.00	0.01	0.00	0.00	0.01	0.00	0.00	0.97	0.00	0.00
Pipe_-_(90)	1.00	0.01	0.00	0.00	0.10	0.01	0.00	0.88	0.00	0.00
Pipe_-_(91)	1.00	0.01	0.00	0.00	0.04	0.02	0.00	0.94	0.00	0.00
Pipe_-_(92)	1.00	0.01	0.00	0.00	0.02	0.00	0.00	0.96	0.00	0.00
Pipe_-_(93)	1.00	0.01	0.00	0.00	0.02	0.00	0.00	0.96	0.00	0.00
Pipe_-_(94)	1.00	0.01	0.00	0.00	0.28	0.00	0.00	0.71	0.12	0.00
Pipe_-_(95)	1.00	0.03	0.00	0.00	0.01	0.00	0.00	0.96	0.00	0.00
Pipe_-_(96)	1.00	0.01	0.00	0.00	0.19	0.00	0.00	0.80	0.01	0.00
Pipe_-_(97)	1.00	0.01	0.00	0.00	0.01	0.00	0.00	0.98	0.00	0.00
Pipe_-_(98)	1.00	0.01	0.00	0.00	0.01	0.00	0.00	0.97	0.00	0.00
Pipe_-_(99)	1.00	0.01	0.00	0.00	0.02	0.00	0.00	0.97	0.01	0.00
Pipe_2	1.00	0.02	0.00	0.00	0.01	0.00	0.00	0.98	0.00	0.00
Pipe_6	1.00	0.01	0.00	0.00	0.01	0.00	0.00	0.98	0.00	0.00
Pipe_7	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pipe_8	1.00	0.92	0.02	0.00	0.05	0.00	0.00	0.00	0.96	0.00
ST602A-S0-O	1.00	0.03	0.00	0.00	0.01	0.00	0.00	0.96	0.01	0.00
ST602A-S-O	1.00	0.03	0.00	0.00	0.01	0.00	0.00	0.96	0.01	0.00
ST603A-S0-O	1.00	0.03	0.00	0.00	0.01	0.00	0.00	0.96	0.01	0.00
ST606A-S-O	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST610A-S0-O	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST610A-S-O	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST611A-S0-O	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST611A-S-O	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST611C-S0-O	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST612A-S0-O	1.00	0.03	0.00	0.00	0.01	0.00	0.00	0.96	0.01	0.00
ST612A-S-O	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST613A-S0-O	1.00	0.03	0.00	0.00	0.01	0.00	0.00	0.96	0.01	0.00
ST613A-S-O	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST615A-S0-O	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST616A-S0-O	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST616A-S1-O	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST616A-S-O	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST617A-S0-O	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST617A-S-O	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST620A-S0-O_1	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST620A-S-O	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST621A-S0-O	1.00	0.03	0.00	0.00	0.01	0.00	0.00	0.95	0.01	0.00
ST621A-S-O	1.00	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00

ST624A-S0-O_1	1.00	0.03	0.00	0.00	0.97	0.00	0.00	0.00	0.97	0.00
ST624A-S-O	1.00	0.03	0.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST625B-S0-O	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST625B-S-O	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST628A-S0-O_1	1.00	0.03	0.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST628A-S0-O_2	1.00	0.03	0.00	0.00	0.02	0.00	0.00	0.95	0.02	0.00
ST628A-S-O	1.00	0.03	0.00	0.00	0.02	0.00	0.00	0.95	0.02	0.00
ST630B-S0-O	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST630B-S-O	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST631A-S0-O	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST631A-S-O	1.00	0.03	0.00	0.00	0.00	0.00	0.00	0.97	0.00	0.00
ST633A-S0-O	1.00	0.03	0.00	0.00	0.01	0.00	0.00	0.96	0.01	0.00
ST633A-S-O	1.00	0.03	0.00	0.00	0.01	0.00	0.00	0.96	0.01	0.00
ST634A-S0-O	1.00	0.03	0.00	0.00	0.01	0.00	0.00	0.96	0.01	0.00
ST634A-S1-O	1.00	0.98	0.00	0.00	0.01	0.00	0.00	0.00	0.96	0.00
ST635A-S0-O	1.00	0.03	0.01	0.00	0.01	0.00	0.00	0.96	0.01	0.00
ST635A-S-O	1.00	0.03	0.00	0.00	0.01	0.00	0.00	0.96	0.01	0.00
ST637A-S0-O	1.00	0.03	0.00	0.00	0.01	0.00	0.00	0.96	0.01	0.00
ST637A-S-O	1.00	0.03	0.01	0.00	0.00	0.00	0.00	0.96	0.00	0.00
ST638A-S-O	1.00	0.03	0.00	0.00	0.01	0.00	0.00	0.96	0.01	0.00
ST639A-S0-O	1.00	0.03	0.01	0.00	0.02	0.00	0.00	0.95	0.02	0.00
ST639A-S-O	1.00	0.03	0.00	0.00	0.02	0.00	0.00	0.95	0.02	0.00
ST641A-S0-O_1	1.00	0.03	0.00	0.00	0.97	0.00	0.00	0.00	0.97	0.00
ST641A-S0-O_2	1.00	0.03	0.00	0.00	0.01	0.00	0.00	0.96	0.00	0.00
ST641A-S-O	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST642A-S0-O	1.00	0.03	0.00	0.00	0.02	0.00	0.00	0.95	0.02	0.00
ST642A-S-O	1.00	0.03	0.01	0.00	0.01	0.00	0.00	0.95	0.01	0.00
ST643A-S0-O	1.00	0.03	0.00	0.00	0.00	0.00	0.00	0.96	0.00	0.00
ST643A-S1-O	1.00	0.03	0.00	0.00	0.01	0.00	0.00	0.96	0.01	0.00
ST643A-S-O	1.00	0.03	0.00	0.00	0.01	0.00	0.00	0.96	0.01	0.00
ST644A-S-O	1.00	0.03	0.00	0.00	0.01	0.00	0.00	0.96	0.01	0.00
ST645A-S-O	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST646A-S-O	1.00	0.03	0.00	0.00	0.01	0.00	0.00	0.96	0.01	0.00
ST648A-S0-O_1	1.00	0.03	0.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ST648A-S0-O_4	1.00	0.03	0.00	0.00	0.02	0.00	0.00	0.95	0.02	0.00
ST648A-S-O	1.00	0.03	0.00	0.00	0.02	0.00	0.00	0.95	0.02	0.00

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Conduit Surcharge Summary
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Conduit	Hours Full Both Ends	Hours Full Upstream	Hours Full Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
14	0.01	0.01	0.21	0.01	0.01
9	0.23	0.23	0.25	0.01	0.01
C3	0.20	0.22	0.20	0.01	0.20
C37	4.93	5.03	5.67	0.53	0.14
C51	0.01	0.01	0.10	0.01	0.01
C62	0.22	0.22	0.23	0.01	0.01
C7_2	0.01	0.01	0.10	0.01	0.01
C72	3.50	3.75	5.03	0.54	0.28
C8	0.01	0.01	34.80	0.01	0.01
Pipe_-_(100)	0.06	0.06	0.15	0.01	0.01
Pipe_-_(101)	0.01	0.01	0.06	0.01	0.01
Pipe_-_(102)	0.24	0.24	0.24	0.01	0.08
Pipe_-_(103)	0.24	0.24	0.24	0.01	0.02
Pipe_-_(104)	0.23	0.23	0.24	0.18	0.20
Pipe_-_(105)	0.23	0.23	0.23	0.21	0.17
Pipe_-_(106)	0.22	0.22	0.23	0.14	0.13
Pipe_-_(107)	0.01	0.01	0.10	0.01	0.01
Pipe_-_(108)	0.19	0.19	0.23	0.01	0.01
Pipe_-_(109)	0.18	0.18	0.19	0.01	0.01
Pipe_-_(110)	0.01	0.01	0.17	0.01	0.01
Pipe_-_(111)	0.01	0.01	0.22	0.01	0.01
Pipe_-_(174)	0.22	0.22	0.24	0.01	0.01
Pipe_-_(66)	0.01	0.13	0.01	0.28	0.01
Pipe_-_(67)	0.13	0.20	0.13	0.35	0.13
Pipe_-_(69)	0.20	0.21	0.20	0.43	0.20
Pipe_-_(70)	0.21	0.23	0.21	0.43	0.21
Pipe_-_(71)	0.20	0.20	0.23	0.01	0.05
Pipe_-_(72)	0.19	0.20	0.20	0.32	0.19
Pipe_-_(73)	0.23	0.24	0.23	0.41	0.23
Pipe_-_(74)	0.23	0.23	0.24	0.01	0.01
Pipe_-_(75)	0.22	0.23	0.23	0.30	0.22
Pipe_-_(76)	0.23	0.23	0.23	0.20	0.17
Pipe_-_(77)	0.19	0.19	0.23	0.01	0.01
Pipe_-_(78)	0.23	0.25	0.23	0.01	0.23
Pipe_-_(79)	0.23	0.23	0.25	0.01	0.01
Pipe_-_(80)	0.18	0.18	0.23	0.01	0.01
Pipe_-_(81)	0.01	0.01	0.18	0.01	0.01
Pipe_-_(82)	0.23	0.24	0.23	0.01	0.11
Pipe_-_(83)	0.22	0.22	0.24	0.01	0.01
Pipe_-_(84)	0.19	0.19	0.22	0.01	0.01
Pipe_-_(85)	0.22	0.23	0.23	0.25	0.20
Pipe_-_(86)	0.22	0.22	0.23	0.01	0.01
Pipe_-_(87)	0.07	0.07	0.22	0.01	0.01
Pipe_-_(88)	0.01	0.01	0.07	0.01	0.01
Pipe_-_(89)	0.22	0.22	0.22	0.01	0.21
Pipe_-_(90)	0.21	0.21	0.22	0.01	0.01
Pipe_-_(91)	0.20	0.20	0.21	0.01	0.01
Pipe_-_(92)	0.24	0.26	0.24	0.01	0.24
Pipe_-_(93)	0.26	0.26	0.26	0.27	0.24
Pipe_-_(94)	0.26	0.26	0.26	0.13	0.17
Pipe_-_(95)	0.01	0.01	0.23	0.01	0.01
Pipe_-_(96)	0.25	0.25	0.25	0.13	0.16
Pipe_-_(97)	0.18	0.18	0.25	0.01	0.01
Pipe_-_(98)	0.22	0.22	0.25	0.01	0.01
Pipe_-_(99)	0.16	0.16	0.22	0.01	0.01
Pipe_2	0.01	0.01	0.12	0.01	0.01
Pipe_6	0.19	0.19	0.23	0.01	0.01
Pipe_8	0.04	0.04	0.17	0.01	0.01
ST639A-S0-O	0.01	0.01	0.28	0.01	0.01
ST639A-S-O	0.01	0.01	0.29	0.01	0.01
ST648A-S0-O_4	0.01	0.01	0.33	0.01	0.01
ST648A-S-O	0.01	0.01	0.31	0.01	0.01

Analysis begun on: Thu Jun 10 12:49:49 2021
Analysis ended on: Thu Jun 10 12:49:56 2021
Total elapsed time: 00:00:07

C.4 STANTEC CONSULTING LTD. EUC - PHASE 1B, 2A AND 2B STORM EXCERPTS

3.0 STORM DRAINAGE

The following sections describe the stormwater management (SWM) design for the Ashcroft EUC Subdivision Phases 1B, 2A and 2B in the context of the background documents and governing criteria.

3.1 PROPOSED CONDITIONS

The proposed development will consist of townhomes, semi-detached homes, and single family homes complete with associated transportation and servicing infrastructure. Site sewers will outlet to the proposed Interim SWM Pond 2. Inlet control devices at road low points will be used to restrict inflow rates to the sewer and to provide attenuating surface storage. Major system flow from the site is divided between two outlets. Major system flow from the eastern portion of the site is tributary to the EUC Pond 2 and the western portion of the site is tributary to EUC Pond 3 (see **Drawing OSD-1** for the location of the major system divide). However, in the interim condition, until the downstream major system flow paths are constructed, major system flow from the western half of the proposed subdivision has been directed to a culvert crossing the existing Navan Road tributary to the downstream Mud Creek and the eastern half of the subdivision maintains an overland flow outlet via a grassed interceptor swale east of the future Belcourt Boulevard. Discharge from the grassed swale is captured into the minor system and conveyed to the Interim SWM pond (Pond 2 tributary area).

Quality and quantity control of runoff is provided by the proposed Interim SWM Pond 2 as discussed in the report "*East Urban Community Pond 2 Interim Facility Design Brief*" prepared by Stantec Consulting Ltd., dated June 26, 2015. As such, no additional on-site quality control measures are required within the subdivision.

Interim drainage from existing drains will be captured into the minor system through ICDs connected to ditch inlet catchbasins sized to restrict peak flows to the ultimate condition minor system capacity as construction phasing progresses.

3.2 DESIGN METHODOLOGY

The design methodology for the SWM component of the development is as follows:

- Restrict inflows to the sewer to the 5-year rate in all areas except arterial roadways which are to capture the 10-year runoff, as per City of Ottawa Design Guidelines and interim pond 2 requirements.
- Produce a PCSWMM model that generates major and minor system hydrographs and that routes the hydrographs through a hydraulic model

- Ensure that the resulting 100-year hydraulic grade line does not encroach within 0.30 m of the proposed underside of footings (USF) for the units in the ultimate development scenario.
- Ensure that total dynamic and static surface ponding depths do not exceed 0.30 m during the 100-year storm scenario.
- Confirm that climate change storm simulation does not result in flooding of properties.

The site is designed using the "dual drainage" principle, whereby the minor (pipe) system is designed to convey the peak rate of runoff from the 5-year design storm and runoff from larger events is conveyed by both minor (pipe) and major (overland) channels, such as roadways and walkways, safely off site without impacting proposed or existing downstream properties.

In keeping with the 5-year inlet restriction criterion, IPEX Inlet Control Devices (ICDs) or orifice plates have been specified for all street and rear-yard catchbasins to limit the inflow to the minor system. Restricted inlet rates to the sewer are necessary to prevent the hydraulic grade line from surcharging storm sewers into basements during major storms. Rear-yard catchbasins will have inlet controls placed at the downstream-most structure before entering the storm sewer. Solid covers will be installed on all manholes located in ponding areas to limit inflows to the minor system to that of the ICD.

Drawings SD-1, SD-2 and **OSD-1** outline the proposed storm sewer alignment, ICD locations, ponding areas, and drainage divides and labels. The major flow generated from larger events will be safely conveyed by engineered (overland) channels such as roadways and walkways. Ultimately, the major system flow will be conveyed to EUC Pond 2 or Pond 3, however, the proposed development is located at the upstream end of the ultimate drainage area and must therefore be accommodated with temporary minor system capture areas until the downstream system is constructed. Details of the Interim SWM Pond 2 can be found in the East Urban Community Interim Pond 2 Facility Design Brief (Stantec, June 26, 2015) submitted under separate cover.

All storm sewers were sized for the ultimate development condition as outlined in the 2013 ISSU. Detailed storm sewer design sheets for the interim and ultimate condition scenarios are included in **Appendix B.1**.

3.3 DEVIATIONS FROM 2013 ISSU AND EMP

The 2013 ISSU specified an overland flow corridor (Green Corridor) along Belcourt Blvd. Detailed design analysis has demonstrated that sufficient surface ponding and street conveyance of major flow is available to meet maximum dynamic ponding depth criteria without providing the additional overland flow corridor (see **Section 3.6.3** for discussion). Detailed design grading of future development blocks will need to ensure that maximum allowable dynamic ponding depths are not exceeded within their respective areas.

The 2013 ISSU also specifies an ultimate pond normal water level of 78.50 m. However, in order to eliminate the submerged pond inlet pipe and reduce HGLs in the proposed and future subdivisions, it is proposed to lower the ultimate pond water level to 78.00 m. Detailed discussion and analysis summary is included in the report East Urban Community Phases 1A, 2A & 2B Serviceability Brief in Support of Changes to Master Servicing Study (Stantec Consulting, June 26, 2015).

The proposed changes to the ISSU and EMP were included in all interim and ultimate conditions modelling for the subdivision SWM design.

3.4 MODELING RATIONALE

A comprehensive hydrologic modeling exercise was completed with PCSWMM, accounting for the estimated 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. The following assumptions were applied to the detailed model:

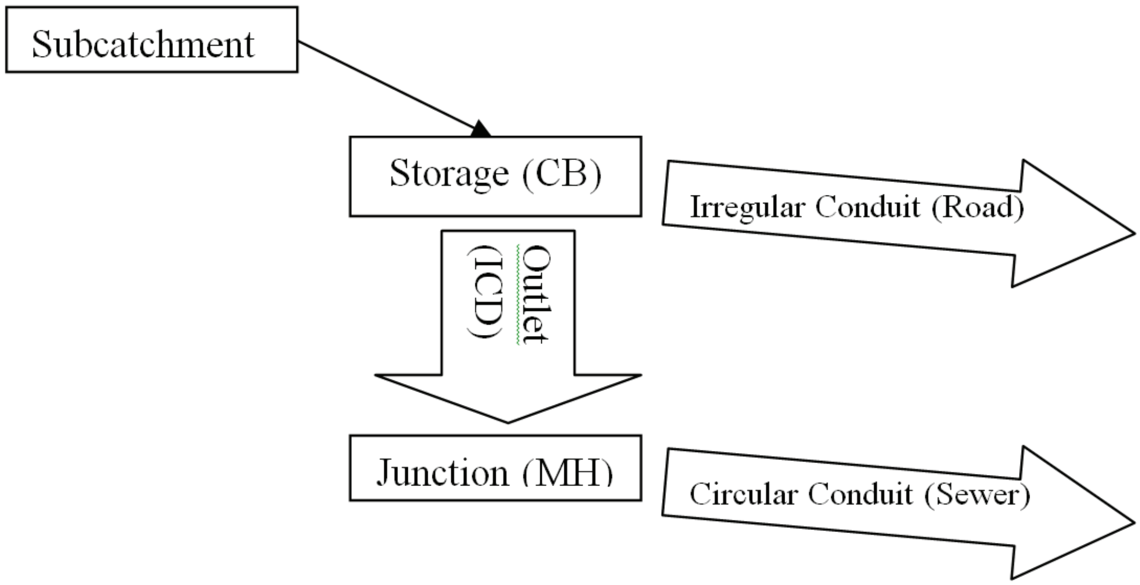
- Hydrologic parameters as per Ottawa Sewer Design Guidelines, including Horton infiltration, Manning's 'n', and depression storage values.
- 3-hour Chicago Storm distribution for 5-year and 100-year analysis.
- To 'stress test' the system a 'climate change' scenario was created by adding 20% of the individual intensity values of the 100-year storm at their specified time step.
- Percent imperviousness calculated based on actual soft and hard surfaces on each subarea within the proposed phases, converted to equivalent Runoff Coefficient using the relationship C = (Imp. x 0.7) + 0.2.
- Percent imperviousness for future development catchments was obtained from the Gloucester EUC Phase 2 ISSU.
- Subcatchment areas are defined from high-point to high-point where sags occur and detailed grading is available.
- Width parameter was taken as twice the length of the street/swale segment for two-sided catchments and as the length of the street/swale segment for one-sided catchments.
- Where detailed grading was not available, subcatchment areas were defined by the limits of the future development blocks and the width of the subcatchment was defined as 225 m/ha as per the City of Ottawa Sewer Design Guidelines.

- Ultimate conditions modelling, which includes all future EUC Phase 2 development, was used to verify ultimate HGLs and surface ponding within the proposed development. Future drainage areas, sewers and ultimate SWM facility stage-storage-discharge relationships were defined as per the 2013 EUC Phase 2 ISSU and EMP with adjustments where areas overlapped proposed development areas.
- Catchbasin inflow restricted with inlet-control devices (ICDs) as necessary to maintain 5-year inflow target rate.
- Surface ponding in sag storage calculated based on grading plans (**Drawings GP-1** - **GP-6**).
- Different segment cross-section types defined, accounting for varying right-of-way widths, swales and spillways.
- Minor system peak flows from a portion of the existing Phase 1A (see catchments ST639E, ST639F and ST639G on **Drawing SD-1**), which are currently directed to a temporary swale and ultimately directed to the EUC Pond 3 through the storm system in Phase 1A, will be connected to the proposed storm sewer system on Esselmont Street through the Future Multi-block "C". As a result, the proposed units 155 to 163 fronting Markinch Road where the temporary swale is located cannot be built until such time as the storm sewer system on Esselmont Street is built and a storm sewer connection is provided for EXMH904.
- Minor system peak flows from existing Phase 1A catchments ST639E, ST639F and ST639G are restricted to approximately 29.0 L/s through an existing ICD in EXMH904 as per the Ashcroft Eastboro Phase 1 Lands, Detailed Stormwater Management Report (Stantec April 1, 2010).

3.4.1 SWMM Dual Drainage Methodology

The proposed subdivision is modeled in one modeling program as a dual conduit system (see **Figure 3.1**), with: 1) circular conduits representing the sewers & junction nodes representing manholes; 2) irregular conduits using street-shaped cross-sections to represent the sawtoothed overland road network from high-point to low-point and storage nodes representing catchbasins and high points. The dual drainage systems are connected via outlet link objects from storage node (i.e. CB) to junction (i.e. 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 3.1: Schematic Representing Model Object Roles



Storage nodes are used in the model to represent catchbasins as well as 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 is the top of the CB. The storage value assigned to the storage node represents only the volume available within the structure. If the available storage volume in a storage node is exceeded, flows spill above the storage node and into the sag in the irregular conduits (representing roads). The volume stored within the road sags is represented as flood volume in the model and includes the total dynamic volume and the ponded depth above the node representing the dynamic flow depth. Flow storage volumes exceeding the sag storage available in the transect (roadway) will spill at the downstream highpoint into the next sag and continue routing through the system until ultimately flows either re-enter the minor system or reach the outfall of the major system. Storages representing major system junctions are assigned both an invert and a rim elevation equal to the transect invert (spill elevation at edge of pavement). Storage values assigned to these nodes must be non-zero for model processing purposes, but are assigned a negligible area of 0.001 m^2 for linear volume calculations. No storage has been accounted for within storage nodes at high points. In this manner, storage will accumulate according to the actual ponding depths before spilling along the roadway conduit, and to the next downstream road conduit.

Storage nodes in future development areas or site plan multi-blocks within the subdivision were assigned a storage curve assuming a maximum storage of 50 m^3/ha. Storage curves in PCSWMM are required to be input as depth-area curves; as such an equivalent area was calculated for each depth along the curve. All storage was assumed to be above the rim of the storage node.

Inlet control devices are represented by orifices or outflow links which use a user-specified depth-discharge curve taken from manufacturer's specifications for the chosen ICD model. For future development areas, capture curves were defined to restrict outlet link flows to the 5-year rate as per the 2013 ISSU.

Subarea routing in rear-yard areas and future development blocks has been set to route 25% of the impervious area in each subcatchment through the pervious area of the subcatchment, in order to account for directly connected imperviousness.

3.4.2 Boundary Conditions

The detailed PCSWMM hydrology and the proposed storm sewers were used to assess the peak inflows and hydraulic grade line (HGL) in the subdivision. Since trunk sewers in Navan Road are proposed to service the subdivision, they were sized to accommodate the estimated ultimate condition peak flows based on detailed design and ISSU assumptions. The ultimate conditions modeling was used to assess the final anticipated HGL for the subdivision and incorporates the EMP assumptions for the ultimate Pond 2 storage and discharge rates. The Ultimate Pond 2 outlet is assumed to be free flowing.

3.5 INPUT PARAMETERS

Drawings SD-1 and **SD-2** summarize the discretized subcatchments used in the analysis of the proposed Phases 2A & 2B, and outlines the major overland flow paths. **Drawing OSD-1** summarizes the proposed and future development areas considered in the ultimate conditions model. All parameters are assigned as per applicable OSDG, MOECC and background report requirements. Note that only the parameters applicable to the proposed development area are tabulated in this report. Parameters for future development areas used in the ultimate conditions modelling are summarized in the report East Urban Community Phases 1A, 2A & 2B Serviceability Brief in Support of Changes to Master Servicing Study, prepared by Stantec Consulting dated June 26, 2015.

Appendix B.2 includes excerpts from the detailed Phase 1A design which were used to determine input parameters for the existing development area. Key parameters for the subject area are summarized below; an example input file is provided for the 100-year, 3hr Chicago storm which indicates all other parameters. For all other input files and results of storm scenarios, please examine the electronic model files located on the CD 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 5.0.022.

3.5.1 Hydrologic Parameters

Table 3.1 presents the general subcatchment parameters used:

Table 3.1: General Subcatchment Parameters

Subcatchment 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 Imperv	0.013
N Perv	0.25
Dstore Imperv (mm)	1.57
Dstore Perv (mm)	4.67
Zero Imperv (%)	0

Table 3.2 presents the individual parameters that vary for each of the proposed subcatchments.

Table 3.2: Individual Proposed and Existing Subcatchment Parameters

Area ID	Area (ha)	Width (m)	Slope (%)	% Impervious	Runoff Coefficient
EX_ST101	0.18	99.0	1	68.5	0.68
EX_ST104	0.18	128.7	1	47.1	0.53
EXT-1	0.18	113.0	1	64.3	0.65
EXT-2	1.13	254.3	1	37.9	0.47
EXT-3	0.06	19.4	2	68.6	0.68
ST601A	1.22	274.5	1	78.6	0.75
ST602A	0.45	137.8	2	54.3	0.58
ST602B	0.03	10.6	1	85.7	0.80
ST603A	0.36	162.8	2	68.6	0.68
ST603B	0.15	85.6	1	35.7	0.45
ST605A	0.68	151.7	1	78.7	0.75
ST605B	0.61	137.3	1	78.7	0.75
ST605C	1.04	234.0	1	78.7	0.75
ST605D	0.17	97.7	1	41.4	0.49
ST606A	0.27	89.3	2	68.6	0.68
ST607A	0.28	130.6	2	62.9	0.64
ST608A	0.19	91.4	1	41.4	0.49
ST609A	0.49	220.6	2	67.1	0.67
ST610A	0.34	135.0	2	68.6	0.68
ST610B	0.44	298.6	1	35.7	0.45

Area ID	Area (ha)	Width (m)	Slope (%)	% Impervious	Runoff Coefficient
ST610C	0.17	115.2	1	41.4	0.49
ST611A	0.37	195.6	2	68.6	0.68
ST611B	0.22	109.4	1	28.6	0.40
ST612A	0.40	203.7	2	61.4	0.63
ST612B	0.30	123.0	1	41.4	0.49
ST615A	0.29	105.9	2	57.1	0.60
ST615B	0.20	136.4	1	39.1	0.47
ST616A	0.24	69.3	2	64.3	0.65
ST616B	1.20	270.0	1	10.0	0.27
ST617A	0.43	167.2	2	71.4	0.70
ST619A	0.15	106.0	1	39.1	0.47
ST620A	0.42	137.6	2	71.4	0.70
ST621A	0.17	79.4	2	54.3	0.58
ST622A	0.19	127.8	1	38.6	0.47
ST623A	0.23	100.8	1	37.1	0.46
ST623B	1.24	279.6	1	78.6	0.75
ST624A	0.31	128.0	2	65.7	0.66
ST624B	0.18	118.3	1	41.4	0.49
ST625A	0.29	129.5	2	65.7	0.66
ST625B	0.41	127.3	2	64.3	0.65
ST628A	0.30	126.1	2	64.3	0.65
ST628B	0.25	139.3	1	34.3	0.44
ST628C	0.31	181.4	1	37.1	0.46
ST629A	0.34	105.1	1	37.1	0.46
ST630A	0.25	100.7	2	64.3	0.65
ST630B	0.28	135.6	2	67.1	0.67
ST631A	0.31	152.8	2	71.4	0.70
ST632A	0.11	76.5	1	41.4	0.49
ST632B	1.12	252.0	1	78.6	0.75
ST633A	0.18	71.6	2	67.1	0.67
ST633B	1.36	306.0	1	78.6	0.75
ST634A	0.23	90.6	2	67.1	0.67
ST635A	0.29	83.0	2	65.7	0.66
ST637A	0.19	93.2	2	67.1	0.67

Area ID	Area (ha)	Width (m)	Slope (%)	% Impervious	Runoff Coefficient
ST638A	0.14	50.0	2	85.7	0.80
ST639A	0.23	85.6	2	67.1	0.67
ST639B	0.27	120.3	1	34.3	0.44
ST639C	0.40	311.4	1	44.3	0.51
ST639D	0.77	174.1	1	78.6	0.75
ST639E	0.27	182.6	2	68.6	0.68
ST639F	0.22	118.8	2	68.6	0.68
ST639G	0.05	31.7	1	47.1	0.53
ST641A	0.28	125.6	2	68.6	0.68
ST641B	0.09	41.7	1	25.7	0.38
ST642A	0.47	131.6	2	67.1	0.67
ST643A	0.22	98.4	2	68.6	0.68
ST644A	0.25	116.9	2	68.6	0.68
ST645A	0.39	125.6	2	68.6	0.68
ST645B	0.31	118.6	1	22.9	0.36
ST646A	0.09	43.1	2	68.6	0.68
ST648A	0.18	84.7	2	62.9	0.64
ST648B	1.28	288.0	1	78.6	0.75

Table 3.3 summarizes the storage node parameters used in the model. All catchbasins have been modeled as having an outlet invert as depicted on **Drawings SSP1-6**. No surface storage was assumed within the rear-yard areas for modeling purposes. Future development areas are modeled assuming catchbasin depths of 1.8m for street catchbasins, 1.5m for rear yard catchbasins, both of which include a static surface ponding depth of 0.20m and an additional 0.15m depth allowance for dynamic flow depth, if any. Static ponding depths, areas, and volumes within the proposed development area are as per **Drawings SD-1** and **SD-2**, but are not explicitly included in the PCSWMM model as per methodology presented in **Section 3.4.1**. Approximately 1,805 m^3 of surface storage have been provided in the proposed Phases 1B, 2A and 2B, which correspond to approximately 72 m^3/ha. Future private blocks within the proposed development have been assumed to provide 50 m^3/ha of storage at a depth of 0.20m as per the recommendation of the ISSU. As PCSWMM storage volume calculation requires the use of a function relative to the depth of water experienced at a particular storage node, additional storage was assumed where limiting private block discharge to the 5-year event produced depth values in excess of 0.20m (assumed as additional storage available at the given dynamic flow depth). Storage parameter information for Phase 1A areas was obtained from the

approved detailed design report Ashcroft Eastboro Phase 1 Lands City of Ottawa, Detailed Stormwater Management Report (Stantec, April 2010).

Table 3.3: Storage Node Parameters

Storage Node	Invert Elevation (m)	Rim Elevation (m)	Total Depth (m)
EX_ST101-S	84.49	86.71	2.22
EX_ST104-S	84.74	86.66	1.92
EXT2-S	85.11	87.26	2.15
ST601A-S	84.15	86.30	2.15
ST602A-S	83.87	86.02	2.15
ST602A-S0	86.03	86.38	0.35
ST603A-S	84.29	86.02	1.73
ST603A-S0	85.97	86.32	0.35
ST603B-S	83.68	86.06	2.38
ST605A-S	84.25	86.40	2.15
ST605B-S	84.51	86.66	2.15
ST605C-S	84.40	86.55	2.15
ST605D-S	83.96	86.16	2.20
ST606A-S	84.34	86.07	1.73
ST606A-S1	86.08	86.43	0.35
ST607A-S	84.07	86.22	2.15
ST608B-S	84.00	86.30	2.30
ST609A-S	84.08	86.23	2.15
ST610A-S	84.36	86.09	1.73
ST610A-S0	86.11	86.46	0.35
ST610B-S	83.75	86.11	2.36
ST610C-S	84.08	86.40	2.32
ST611A-S	83.93	86.08	2.15
ST611B-S	83.78	86.12	2.34
ST611C-S0	86.08	86.43	0.35
ST612A-S	84.03	86.18	2.15
ST612A-S0	86.21	86.56	0.35
ST612B-S	83.86	86.32	2.46
ST613A-S0	86.17	86.52	0.35
ST614A-S0	86.17	86.52	0.35

Storage Node	Invert Elevation (m)	Rim Elevation (m)	Total Depth (m)
ST615A-S	84.22	86.37	2.15
ST615A-S0	86.40	86.75	0.35
ST615B-S	84.22	86.54	2.32
ST616A-S	84.33	86.48	2.15
ST616A-S0	86.38	86.73	0.35
ST616B-S	84.63	86.78	2.15
ST617A-S	84.22	86.37	2.15
ST617A-S0	86.27	86.62	0.35
ST619A-S	84.25	86.38	2.13
ST620A-S	84.18	86.33	2.15
ST621A-S	84.38	86.53	2.15
ST621A-S0	86.45	86.80	0.35
ST622A-S	84.28	86.46	2.18
ST623A-S	84.36	86.67	2.31
ST623B-S	84.95	87.10	2.15
ST624A-S	84.40	86.55	2.15
ST624A-S0	86.56	86.91	0.35
ST624A-S1	86.38	86.73	0.35
ST624B-S	84.25	86.58	2.33
ST625A-S	84.49	86.64	2.15
ST625B-S	84.51	86.66	2.15
ST625B-S0	86.56	86.91	0.35
ST628A-S	84.51	86.66	2.15
ST628A-S0	87.19	87.54	0.35
ST628A-S1	87.06	87.41	0.35
ST628B-S	84.51	87.01	2.50
ST628C-S	84.48	86.82	2.34
ST629A-S	84.95	87.33	2.38
ST630A-S	84.61	86.76	2.15
ST630B-S	84.70	86.85	2.15
ST630B-S0	86.69	87.04	0.35
ST630B-S1	86.69	87.04	0.35
ST631A-S	84.27	86.00	1.73
ST631A-S0	85.97	86.32	0.35

Storage Node	Invert Elevation (m)	Rim Elevation (m)	Total Depth (m)
ST632A-S	83.71	86.13	2.42
ST632B-S	84.10	86.25	2.15
ST633A-S	83.83	85.98	2.15
ST633A-S0	85.89	86.24	0.35
ST633B-S	84.15	86.30	2.15
ST634A-S	83.78	85.93	2.15
ST634A-S0	85.77	86.12	0.35
ST634A-S1	85.75	86.10	0.35
ST635A-S	83.94	86.09	2.15
ST637A-S	84.00	86.15	2.15
ST637A-S0	86.06	86.41	0.35
ST638A-S	84.06	86.21	2.15
ST639A-S	83.94	86.09	2.15
ST639A-S0	86.00	86.35	0.35
ST639B-S	83.83	86.20	2.37
ST639C-S	83.83	86.19	2.36
ST639D-S	84.15	86.30	2.15
ST639E-S	84.33	86.58	2.25
ST639F-S	84.77	86.73	1.96
ST639G-S	84.85	87.00	2.15
ST641A-S	84.17	86.32	2.15
ST641A-S0	86.15	86.50	0.35
ST641A-S1	86.09	86.44	0.35
ST641B-S	84.07	86.48	2.41
ST642A-S	83.95	86.10	2.15
ST642A-S0	86.13	86.48	0.35
ST643A-S	84.18	86.33	2.15
ST643A-S0	86.26	86.61	0.35
ST643A-S1	86.13	86.48	0.35
ST644A-S	84.19	86.34	2.15
ST645A-S	84.29	86.44	2.15
ST645A-S0	87.15	87.50	0.35
ST645A-S1	86.28	86.63	0.35
ST645B-S	84.13	86.74	2.61

Storage Node	Invert Elevation (m)	Rim Elevation (m)	Total Depth (m)
ST646A-S	84.22	86.37	2.15
ST648A-S	84.21	86.46	2.25
ST648A-S0	86.42	86.77	0.35
ST648A-S1	86.28	86.63	0.35
ST648B-S	84.57	86.72	2.15

3.5.2 Hydraulic Parameters

As per the OSDG 2012, Manning's roughness values of 0.013 were used for sewer modeling and overland flow corridors representing roadways. Any grassed swales were modeled using Manning's roughness values of 0.25.

Storm sewers were modeled to confirm flow capacities and hydraulic grade lines (HGLs) in the ultimate condition with consideration of the ultimate pond backwater acting on the sewers. The detailed ultimate condition storm sewer design sheet is included in **Appendix B.1**.

Table 3.4 below presents the parameters for the outlet link objects in the model, which represent ICDs. Catchbasin leads modeled as orifices were assigned a discharge coefficient of 0.61; otherwise, a coefficient of 0.572 was applied to conform to head/discharge curves as supplied by the manufacturer for IPEX Tempest HF model ICDs.

Table 3.4: Outlet Link Parameters

Outlet/Orifice Name(s)	Tributary Area ID	Minor System Node	ICD Type
C45	ST303-1A-S	602	300mm Circular Orifice
ST602A-O, ST602A-O1	ST602A	602	2 x IPEX TEMPEST HF (127mm ORIFICE)
ST603A-O, ST603A-O1	ST603A	603	2 x IPEX TEMPEST HF (152mm ORIFICE)
ST603B-O	ST603B	603	1 x IPEX TEMPEST HF (95mm ORIFICE)
ST605D-O	ST605D	605	1 x IPEX TEMPEST HF (108mm ORIFICE)
ST606A-O, ST606A-O1	ST606A	606	2 x IPEX TEMPEST HF (127mm ORIFICE)
ST607A-O, ST607A-O1	ST607A	607	2 x IPEX TEMPEST HF (108mm ORIFICE)
ST608B-O	ST608B	608	1 x IPEX TEMPEST HF (108mm ORIFICE)
ST609A-O, ST609A-O1	ST609A	609	2 x IPEX TEMPEST HF (152mm ORIFICE)
ST610A-O, ST610A-O1	ST610A	610	2 x IPEX TEMPEST HF (152mm ORIFICE)
ST610B-O	ST610B	610	1 x IPEX TEMPEST HF (178mm ORIFICE)
ST610C-O	ST610C	610	1 x IPEX TEMPEST HF (102mm ORIFICE)
ST611A-O, ST611A-O1	ST611A	611	2 x IPEX TEMPEST HF (127mm ORIFICE)

Outlet/Orifice Name(s)	Tributary Area ID	Minor System Node	ICD Type
ST611B-O	ST611B	611	1 x IPEX TEMPEST HF (95mm ORIFICE)
ST612A-O, ST612A-O1	ST612A	612	2 x IPEX TEMPEST HF (127mm ORIFICE)
ST612B-O	ST612B	612	1 x IPEX TEMPEST HF (127mm ORIFICE)
ST615A-O, ST615A-O1	ST615A	615	2 x IPEX TEMPEST HF (102mm ORIFICE)
ST615B-O	ST615B	615	1 x IPEX TEMPEST HF (108mm ORIFICE)
ST616A-O, ST616A-O1	ST616A	616	2 x IPEX TEMPEST HF (95mm ORIFICE)
ST617A-O, ST617A-O1	ST617A	617	2 x IPEX TEMPEST HF (152mm ORIFICE)
ST619A-O	ST619A	619	1 x IPEX TEMPEST HF (95mm ORIFICE)
ST620A-O, ST620A-O1	ST620A	620	2 x IPEX TEMPEST HF (152mm ORIFICE)
ST621A-O, ST621A-O1	ST621A	621	2 x IPEX TEMPEST HF (83mm ORIFICE)
ST622A-O	ST622A	622	1 x IPEX TEMPEST HF (108mm ORIFICE)
ST623A-O	ST623A	623	1 x IPEX TEMPEST HF (108mm ORIFICE)
ST624A-O, ST624A-O1	ST624A	624	2 x IPEX TEMPEST HF (108mm ORIFICE)
ST624B-O	ST624B	624	1 x IPEX TEMPEST HF (102mm ORIFICE)
ST625A-O, ST625A-O1	ST625A	625	2 x IPEX TEMPEST HF (108mm ORIFICE)
ST625B-O, ST625B-O1	ST625B	625	2 x IPEX TEMPEST HF (127mm ORIFICE)
ST628A-O, ST628A-O1	ST628A	628	2 x IPEX TEMPEST HF (108mm ORIFICE)
ST628B-O	ST628B	628	1 x IPEX TEMPEST HF (95mm ORIFICE)
ST628C-O	ST628C	628	1 x IPEX TEMPEST HF (127mm ORIFICE)
ST629A-O	ST629A	629	1 x IPEX TEMPEST HF (127mm ORIFICE)
ST630A-O, ST630A-O1	ST630A	630	2 x IPEX TEMPEST HF (102mm ORIFICE)
ST630B-O, ST630B-O1	ST630B	630	2 x IPEX TEMPEST HF (108mm ORIFICE)
ST631A-O, ST631A-O1	ST631A	631	2 x IPEX TEMPEST HF (152mm ORIFICE)
ST632A-O	ST632A	632	1 x IPEX TEMPEST HF (83mm ORIFICE)
ST633A-O, ST633A-O1	ST633A	633	2 x IPEX TEMPEST HF (95mm ORIFICE)
ST634A-O, ST634A-O1	ST634A	634	2 x IPEX TEMPEST HF (102mm ORIFICE)
ST635A-O, ST635A-O1	ST635A	635	2 x IPEX TEMPEST HF (108mm ORIFICE)
ST637A-O, ST637A-O1	ST637A	637	2 x IPEX TEMPEST HF (95mm ORIFICE)
ST638A-O, ST638A-O1	ST638A	611	2 x IPEX TEMPEST HF (83mm ORIFICE)
ST639A-O, ST639A-O1	ST639A	639	2 x IPEX TEMPEST HF (102mm ORIFICE)
ST639B-O	ST639B	639	1 x IPEX TEMPEST HF (108mm ORIFICE)
ST639C-O	ST639C	639	1 x IPEX TEMPEST HF (178mm ORIFICE)
ST641A-O, ST641A-O1	ST641A	641	2 x IPEX TEMPEST HF (108mm ORIFICE)

Outlet/Orifice Name(s)	Tributary Area ID	Minor System Node	ICD Type
ST641B-O	ST641B	641	1 x IPEX TEMPEST HF (83mm ORIFICE)
ST642A-O, ST642A-O1	ST642A	642	2 x IPEX TEMPEST HF (152mm ORIFICE)
ST643A-O, ST643A-O1	ST643A	643	2 x IPEX TEMPEST HF (102mm ORIFICE)
ST644A-O, ST644A-O1	ST644A	644	2 x IPEX TEMPEST HF (108mm ORIFICE)
ST645A-O, ST645A-O1	ST645A	645	2 x IPEX TEMPEST HF (127mm ORIFICE)
ST645B-O	ST645B	644	1 x IPEX TEMPEST HF (127mm ORIFICE)
ST646A-O, ST646A-O1	ST646A	646	2 x IPEX TEMPEST HF (83mm ORIFICE)
ST648A-O, ST648A-O1	ST648A	648	2 x IPEX TEMPEST HF (83mm ORIFICE)

3.6 MODELS RESULTS AND DISCUSSION

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 B.3** and the electronic model files on the enclosed CD.

3.6.1 Hydrology

Table 3.5 summarizes the outlet link maximum flow rates and head across the outlet for the 100-year design storm event.

Table 3.5: Outlet Link Results

Catchbasin ID(s)	Tributary Area ID	ICD Type	5yr Head (m)	100yr Head (m)	5yr Flow (L/s)	100yr Flow (L/s)
CB602A-1, -2	ST602A	2 x IPEX TEMPEST HF (127mm ORIFICE)	1.67	1.99	40.7	44.5
CB603A-1, -2	ST603A	2 x IPEX TEMPEST HF (152mm ORIFICE)	0.88	1.53	41.2	55.4
CB603B-1	ST603B	1 x IPEX TEMPEST HF (95mm ORIFICE)	1.04	2.29	17.9	26.9
CB605D-1	ST605D	1 x IPEX TEMPEST HF (108mm ORIFICE)	1.16	2.17	24.4	33.8
CB606A-1, -2	ST606A	2 x IPEX TEMPEST HF (127mm ORIFICE)	0.93	1.55	30.0	39.2
CB607A-1, -2	ST607A	2 x IPEX TEMPEST HF (108mm ORIFICE)	1.70	1.90	29.7	31.6
CB608B-1	ST608B	1 x IPEX TEMPEST HF (108mm ORIFICE)	1.36	2.28	26.5	34.6
CB609A-1, -2	ST609A	2 x IPEX TEMPEST HF (152mm ORIFICE)	1.52	2.00	55.3	63.8
CB610A-1, -2	ST610A	2 x IPEX TEMPEST HF (152mm ORIFICE)	0.77	1.61	38.3	56.9
CB610B-1	ST610B	1 x IPEX TEMPEST HF (178mm ORIFICE)	1.04	2.30	61.5	93.9
CB610C-1	ST610C	1 x IPEX TEMPEST HF (102mm ORIFICE)	1.41	1.96	24.2	28.6
CB611A-1, -2	ST611A	2 x IPEX TEMPEST HF (127mm ORIFICE)	1.80	2.03	42.3	45.0

Catchbasin ID(s)	Tributary Area ID	ICD Type	5yr Head (m)	100yr Head (m)	5yr Flow (L/s)	100yr Flow (L/s)
CB611B-1	ST611B	1 x IPEX TEMPEST HF (95mm ORIFICE)	1.36	2.28	20.5	26.8
CB612A-1, -2	ST612A	2 x IPEX TEMPEST HF (127mm ORIFICE)	1.75	2.00	41.6	44.7
CB612B-1	ST612B	1 x IPEX TEMPEST HF (127mm ORIFICE)	1.50	2.41	38.5	49.2
CB615A-1, -2	ST615A	2 x IPEX TEMPEST HF (102mm ORIFICE)	1.80	2.00	27.4	28.9
CB615B-1	ST615B	1 x IPEX TEMPEST HF (108mm ORIFICE)	1.50	2.26	27.9	34.5
CB616A-1, -2	ST616A	2 x IPEX TEMPEST HF (95mm ORIFICE)	1.81	1.96	23.9	24.8
CB617A-1, -2	ST617A	2 x IPEX TEMPEST HF (152mm ORIFICE)	1.26	1.96	49.9	63.1
CB619A-1	ST619A	1 x IPEX TEMPEST HF (95mm ORIFICE)	1.36	2.11	20.6	25.8
CB620A-1, -2	ST620A	2 x IPEX TEMPEST HF (152mm ORIFICE)	1.18	1.94	48.3	62.7
CB621A-1, -2	ST621A	2 x IPEX TEMPEST HF (83mm ORIFICE)	1.33	1.95	15.6	18.9
CB622A-1	ST622A	1 x IPEX TEMPEST HF (108mm ORIFICE)	1.29	2.06	25.8	32.9
CB623A-1	ST623A	1 x IPEX TEMPEST HF (108mm ORIFICE)	1.38	2.16	26.7	33.7
CB624A-1, -2	ST624A	2 x IPEX TEMPEST HF (108mm ORIFICE)	1.51	2.06	28.0	32.9
CB624B-1	ST624B	1 x IPEX TEMPEST HF (102mm ORIFICE)	1.53	2.28	25.2	30.9
CB625A-1, -2	ST625A	2 x IPEX TEMPEST HF (108mm ORIFICE)	1.33	2.00	26.3	32.4
CB625B-1, -2	ST625B	2 x IPEX TEMPEST HF (127mm ORIFICE)	1.81	1.98	42.4	44.5
CB628A-1, -2	ST628A	2 x IPEX TEMPEST HF (108mm ORIFICE)	1.81	2.03	30.8	32.7
CB628B-1	ST628B	1 x IPEX TEMPEST HF (95mm ORIFICE)	2.16	2.21	26.1	26.4
CB628C-1	ST628C	1 x IPEX TEMPEST HF (127mm ORIFICE)	1.57	2.28	39.4	47.8
CB629A-1	ST629A	1 x IPEX TEMPEST HF (127mm ORIFICE)	1.38	2.32	36.8	48.2
CB630A-1, -2	ST630A	2 x IPEX TEMPEST HF (102mm ORIFICE)	1.63	1.93	26.0	28.4
CB630B-1, -2	ST630B	2 x IPEX TEMPEST HF (108mm ORIFICE)	1.79	1.98	30.6	32.2
CB631A-1, -2	ST631A	2 x IPEX TEMPEST HF (152mm ORIFICE)	0.73	1.48	37.0	54.6
CB6332-1	ST632A	1 x IPEX TEMPEST HF (83mm ORIFICE)	1.27	2.29	15.2	20.6
CB633A-1, -2	ST633A	2 x IPEX TEMPEST HF (95mm ORIFICE)	1.24	2.04	19.6	25.3
CB634A-1, -2	ST634A	2 x IPEX TEMPEST HF (102mm ORIFICE)	1.54	2.04	25.3	29.0
CB635A-1, -2	ST635A	2 x IPEX TEMPEST HF (108mm ORIFICE)	1.76	1.96	30.3	32.0
CB637A-1, -2	ST637A	2 x IPEX TEMPEST HF (95mm ORIFICE)	1.43	1.94	21.1	24.7
CB638A-1, -2	ST638A	2 x IPEX TEMPEST HF (83mm ORIFICE)	1.80	2.01	18.2	19.2
CB639A-1, -2	ST639A	2 x IPEX TEMPEST HF (102mm ORIFICE)	1.50	2.04	24.9	29.2
CB639B-1	ST639B	1 x IPEX TEMPEST HF (108mm ORIFICE)	1.64	2.29	29.3	34.7
CB639C-1	ST639C	1 x IPEX TEMPEST HF (178mm ORIFICE)	1.27	2.31	68.5	93.9
CB641A-1, -2	ST641A	2 x IPEX TEMPEST HF (108mm ORIFICE)	1.81	2.06	30.8	32.9

Catchbasin ID(s)	Tributary Area ID	ICD Type	5yr Head (m)	100yr Head (m)	5yr Flow (L/s)	100yr Flow (L/s)
CB641B-1	ST641B	1 x IPEX TEMPEST HF (83mm ORIFICE)	0.38	2.26	8.0	20.4
CB642A-1, -2	ST642A	2 x IPEX TEMPEST HF (152mm ORIFICE)	1.29	2.00	50.7	63.8
CB643A-1, -2	ST643A	2 x IPEX TEMPEST HF (102mm ORIFICE)	1.80	1.98	27.4	28.8
CB644A-1, -2	ST644A	2 x IPEX TEMPEST HF (108mm ORIFICE)	1.79	1.98	30.6	32.2
CB645A-1, -2	ST645A	2 x IPEX TEMPEST HF (127mm ORIFICE)	1.80	1.96	42.4	44.2
CB645B-1	ST645B	1 x IPEX TEMPEST HF (127mm ORIFICE)	0.60	2.30	25.1	51.2
CB646A-1, -2	ST646A	2 x IPEX TEMPEST HF (83mm ORIFICE)	0.80	1.92	12.0	18.8
CB648A-1, -2	ST648A	2 x IPEX TEMPEST HF (83mm ORIFICE)	1.81	2.06	18.2	19.5

The major system flow from the western half of the proposed subdivision has been directed to a culvert crossing the existing Navan Road tributary to the downstream Mud Creek per recommendations of the MVCA. The eastern half of the subdivision maintains an overland flow outlet via a grassed interceptor swale east of the future Belcourt Boulevard, which in turn is captured to the minor system via DICB at manhole 602, thereby making use of available capacity of the system until such time as Belcourt Boulevard is constructed to its ultimate condition.

3.6.2 Hydraulics

Table 3.6 summarizes the HGL results within the subdivision for the Ultimate Condition 100-year, 3 hour Chicago storm events and the largest HGL values for the 'climate change' scenario storm required by the City of Ottawa Sewer Design Guidelines (2012), where 100-year intensities are increased by 20%. Note that during the interim condition, HGLs within the subdivision will be much lower as the sewers within Navan Road will be oversized until the ultimate development condition is achieved.

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.

Table 3.6: Modeled Hydraulic Grade Line Results

STM MH	Adjacent USF (m)	100-year 3hr Chicago		100-year 3hr Chicago + 20%	
		HGL (m)	USF-HGL Clearance (m)	HGL (m)	Basement Slab (USF+0.2m)-HGL Clearance (m)
601	N/A	81.51	-	81.55	-
602	N/A	81.99	-	82.02	-
603	84.06	82.71	1.35	82.73	1.33

STM MH	Adjacent USF (m)	100-year 3hr Chicago		100-year 3hr Chicago + 20%	
		HGL (m)	USF-HGL Clearance (m)	HGL (m)	Basement Slab (USF+0.2m)-HGL Clearance (m)
605	84.06	83.02	1.04	83.06	1.00
606	N/A	83.14	-	83.17	-
607	84.29	83.25	1.04	83.29	1.00
608	84.30	83.59	0.71	83.64	0.66
609	84.51	83.95	0.56	83.98	0.53
610	84.29	83.45	0.84	83.49	0.80
611	84.30	83.66	0.64	83.71	0.59
612	84.28	83.73	0.55	83.79	0.49
613	84.33	83.78	0.55	83.85	0.48
614	84.60	84.20	0.40	84.37	0.23
615	84.39	83.91	0.48	83.97	0.42
616	84.63	84.01	0.62	84.07	0.56
617	84.55	83.99	0.56	84.06	0.49
618	84.55	84.02	0.53	84.09	0.46
619	84.47	84.05	0.42	84.12	0.35
620	84.47	84.09	0.38	84.16	0.31
621	N/A	83.93	-	83.99	-
622	N/A	83.96	-	84.03	-
623	84.80	84.02	0.78	84.10	0.70
624	84.86	84.13	0.73	84.21	0.65
625	84.70	84.35	0.35	84.43	0.27
626	84.70	84.35	0.35	84.48	0.22
627	84.87	84.36	0.51	84.48	0.39
628	84.90	84.37	0.53	84.48	0.42
629	85.06	84.41	0.65	84.55	0.51
630	85.18	84.71	0.47	85.05	0.13
631	84.35	83.54	0.81	83.59	0.76
632	N/A	83.68	-	83.72	-
633	N/A	83.73	-	83.77	-
634	N/A	84.13	-	84.14	-
635	84.31	83.63	0.68	83.68	0.63
636	84.16	83.72	0.44	83.77	0.39

STM MH	Adjacent USF (m)	100-year 3hr Chicago		100-year 3hr Chicago + 20%	
		HGL (m)	USF-HGL Clearance (m)	HGL (m)	Basement Slab (USF+0.2m)-HGL Clearance (m)
637	84.32	83.74	0.58	83.78	0.54
638	84.30	83.79	0.51	83.92	0.38
639	84.35	83.96	0.39	84.01	0.34
640	84.40	84.06	0.34	84.11	0.29
641	84.45	84.14	0.31	84.20	0.25
642	84.23	83.82	0.41	83.87	0.36
643	84.50	83.90	0.60	83.95	0.55
644	84.66	84.23	0.43	84.32	0.34
645	84.90	84.16	0.74	84.23	0.67
646	N/A	84.09	-	84.14	-
647	N/A	84.15	-	84.20	-
648	N/A	84.22	-	84.28	-

As is demonstrated in **Table 3.6**, the worst-case scenario results in HGL elevations that remain at least 0.30 m below the proposed underside of footings, and HGL elevations remain below the proposed basement slab elevations during the 20% increased intensity 'climate change' scenario.

3.6.3 Overland Flow

Overland flow from the site will be divided between the existing EUC Pond 3 and the Future EUC Ultimate Pond 2. Overland flow from the west and east halves of the development will ultimately be conveyed to the EUC Pond 3 and EUC Pond 2, respectively. However, until ultimate build-out is complete the overland flow corridors/pathways to these outlets are not available for the proposed development. In the interim, the major system flow from the western half of the proposed subdivision has been directed to a culvert crossing the existing Navan Road tributary to the downstream Mud Creek per recommendations of the RVCA. The eastern half of the subdivision maintains an overland flow outlet via a grassed interceptor swale east of the future Belcourt Boulevard, which in turn is captured to the minor system via DICB at manhole 602, thereby making use of available capacity of the system until such time as Belcourt Boulevard is constructed to its ultimate condition. See **Drawings SD-1** and **SD-2** for the proposed major overland flow route.

The proposed interim development stormwater management design includes major system drainage discharging from the future extension of Belcourt Blvd north of Street 5. It is proposed that in the interim condition, a temporary drainage swale be constructed to convey the major system runoff from the future extension areas and from the future Belcourt Blvd areas under existing conditions (see the interim drainage plan **Drawing INTSD-1**). The interim swale will have a V-shaped cross section with a minimum depth of 0.30 m, 3:1 side slopes, and a minimum longitudinal slope of 0.25% in order to safely convey the major system runoff from the climate change scenario.

Table 3.7 presents the maximum total surface water depths (static ponding depth + dynamic flow) above the top-of-grate of catchbasins for the 100-year design storm and climate change storm. Based on the model results, the total ponding depth (static + dynamic) does not exceed the required 0.35 m maximum during the 100-year event. Total ponding depths during the climate change scenario are well below lowest adjacent building openings and should not reach any adjacent buildings. As a result, the overland flow corridors proposed for the EUC Phase 2 area in the Infrastructure Servicing Study Update are not required within Phases 1B, 2A and 2B of the development. Detailed analysis of future EUC Phase 2 areas will need to assess the requirement for the downstream overland flow corridors.

Table 3.7: Maximum Static and Regular Storm Dynamic Surface Water Depths

Storage node ID	Structure ID	Rim Elevation (m)	100 year, 3 hour Chicago		100 year, 3 hour Chicago+20%	
			Max Surface HGL (m)	Total Surface Ponding Depth (m)	Max Surface HGL (m)	Total Surface Ponding Depth (m)
ST602A-S	CB 602A-1, -2	85.67	85.86	0.19	85.94	0.27
ST603A-S	CB 603A-1, -2	85.67	85.82	0.15	85.91	0.24
ST606A-S	CB 606A-1, -2	85.72	85.89	0.17	85.97	0.25
ST607A-S	CB 607A-1, -2	85.87	85.97	0.10	86.04	0.17
ST609A-S	CB 609A-1, -2	85.88	86.08	0.20	86.17	0.29
ST610A-S	CB 610A-1, -2	85.74	85.97	0.23	86.04	0.30
ST611A-S	CB 611A-1, -2	85.73	85.96	0.23	86.03	0.30
ST612A-S	CB 612A-1, -2	85.83	86.03	0.20	86.11	0.28
ST615A-S	CB 615A-1, -2	86.02	86.22	0.20	86.25	0.23
ST616A-S	CB 616A-1, -2	86.13	86.29	0.16	86.35	0.22
ST617A-S	CB 617A-1, -2	86.02	86.18	0.16	86.23	0.21
ST620A-S	CB 620A-1, -2	85.98	86.12	0.14	86.17	0.19
ST621A-S	CB 621A-1, -2	86.18	86.33	0.15	86.44	0.26
ST624A-S	CB 624A-1, -2	86.20	86.46	0.26	86.55	0.35
ST625A-S	CB 625A-1, -2	86.29	86.49	0.20	86.55	0.26
ST625B-S	CB 625B-1, -2	86.31	86.49	0.18	86.54	0.23
ST628A-S	CB 628A-1, -2	86.31	86.54	0.23	86.62	0.31
ST630A-S	CB 630A-1, -2	86.41	86.54	0.13	86.62	0.21

Storage node ID	Structure ID	Rim Elevation (m)	100 year, 3 hour Chicago		100 year, 3 hour Chicago+20%	
			Max Surface HGL (m)	Total Surface Ponding Depth (m)	Max Surface HGL (m)	Total Surface Ponding Depth (m)
ST630B-S	CB 630B-1, -2	86.50	86.68	0.18	86.71	0.21
ST631A-S	CB 631A-1, -2	85.65	85.75	0.10	85.84	0.19
ST633A-S	CB 633A-1, -2	85.63	85.87	0.24	85.92	0.29
ST634A-S	CB 634A-1, -2	85.58	85.82	0.24	85.92	0.34
ST635A-S	CB 635A-1, -2	85.74	85.9	0.16	85.96	0.22
ST637A-S	CB 637A-1, -2	85.80	85.94	0.14	86.08	0.28
ST638A-S	CB 638A-1, -2	85.86	86.07	0.21	86.1	0.24
ST639A-S	CB 639A-1, -2	85.74	85.98	0.24	86.08	0.34
ST641A-S	CB 641A-1, -2	85.97	86.23	0.26	86.28	0.31
ST642A-S	CB 642A-1, -2	85.75	85.95	0.20	86.08	0.33
ST643A-S	CB 643A-1, -2	85.98	86.16	0.18	86.22	0.24
ST644A-S	CB 644A-1, -2	85.99	86.17	0.18	86.22	0.23
ST645A-S	CB 645A-1, -2	86.09	86.25	0.16	86.3	0.21
ST646A-S	CB 646A-1, -2	86.02	86.14	0.12	86.24	0.22
ST648A-S	CB 648A-1, -2	86.01	86.27	0.26	86.41	0.40

3.6.4 Pond Inflow Rates

Table 3.8 presents the proposed interim EUC Pond 2 minor and major system inflow for the subject site, as obtained from the EUC Pond 2 Interim SWMF modelling completed by Stantec and summarized under separate cover.

Table 3.8: Interim EUC Pond 2 Peak Inflow

Storm Event	Total Inflow (m^3/s)
25mm	2.10
5yr, 3hrChicago	3.87
100yr, 3hrChicago	5.24
100yr, 6hrChicago	5.23
100yr, 12hrChicago	5.22
100yr, 12hrSCS	4.89
2yr, 12hrSCS	2.31
5yr, 12hrSCS	3.34
10yr, 12hrSCS	4.02
25yr, 12hrSCS	4.58

Storm Event	Total Inflow (m^3/s)
50yr, 12hrSCS	4.82
100yr, 3hrChicago+20%	5.34

Quality control, quantity control, and emergency overflow conveyance for the proposed site are to be provided as a result of the Interim EUC Pond 2 Design Brief under separate cover.

Appendix D GEOTECHNICAL INVESTIGATION

patersongroup

Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

Geotechnical Investigation

Proposed Residential Development
Eastboro - Phase 2 - MBLK A, B, C and F
Navan Road - Ottawa

Prepared For

Ashcroft Homes

October 15, 2014

Report: PG2444-2

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1.0 INTRODUCTION

Paterson Group (Paterson) was commissioned by Ashcroft Homes to conduct a geotechnical investigation for MBLK A, B, C and F within Phase 2 of the proposed Eastboro residential development to be located between Renaud Road, Navan Road and Mer Bleue Road, in the City of Ottawa, Ontario (refer to Figure 1 - Key Plan presented in Appendix 2).

The objective of the investigation was to:

- ❑ determine the subsurface soil and groundwater conditions by means of boreholes and available soils information.

- ❑ provide geotechnical recommendations for the design of the proposed development including construction considerations which may affect the design. These recommendations include, but are not limited to, foundation design and pavement design, and will address OBC Part 4 requirements.

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

Investigating the presence or potential presence of contamination on the proposed development was not part of the scope of work. Therefore, the present report does not address environmental issues.

2.0 PROPOSED DEVELOPMENT

The current phase of the proposed development consists of low rise residential dwellings, townhouse blocks, back-to-back style townhouse blocks, multi-unit residential buildings and commercial buildings. Local roadways, parking areas and landscaped areas are further anticipated for the current phase of the proposed development.

3.0 METHOD OF INVESTIGATION

3.1 Field Investigation

The field program for the current investigation was conducted on June 13, 16 and 17, 2014 and consisted of advancing seven boreholes to a maximum of 9.6 m depth. A previous investigation was conducted by Paterson for the overall development in September 2011 and November 2011. A total of 38 boreholes were located across the overall development. The locations of the boreholes completed for the current investigation and relevant boreholes from the previous investigations are presented on Drawing PG2444-3 - Test Hole Location Plan included in Appendix 2.

The boreholes were completed using a track-mounted auger drill rig operated by a two person crew. All fieldwork was conducted under the full-time supervision of personnel from our geotechnical division under the direction of a senior engineer. The testing procedure consisted of augering to the required depths and at the selected locations sampling the overburden. Sampling and testing the overburden was completed in general accordance with ASTM D5434-12 - Guide for Field Logging of Subsurface Explorations of Soil and Rock.

Sampling and In Situ Testing

Soil samples were collected from the boreholes using a 50 mm diameter split-spoon (SS) sampler, using 73 mm diameter thin walled (TW) Shelby tubes in conjunction with a piston sampler, or from the auger flights. The thin walled Shelby samples were done in general accordance with ASTM D1587-08 (2012)e1 - Standard Practice for Thin-Walled Tube Sampling of Soils for Geotechnical Purposes. The depths at which the split-spoon, Shelby tube and auger samples were recovered from the test holes are shown as SS, TW and AU, respectively, on the Soil Profile and Test Data sheets presented in Appendix 1.

A 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. This testing was done in general accordance with ASTM D1586-11 - Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils.

Undrained shear strength testing was conducted in cohesive soils using a field vane apparatus. Undrained shear strength testing in boreholes was completed using a MTO field vane apparatus. This testing was done in general accordance with ASTM D2573-08 - Standard Test Method for Field Vane Shear Test in Cohesive Soil.

Overburden thickness was evaluated during the course of the site investigation by dynamic cone penetration testing (DCPT) at three (3) of the borehole locations. The DCPT consists of driving a steel drill rod, equipped with a 50 mm diameter cone at the tip, using a 63.5 kg hammer falling from a height of 760 mm. The number of blows required to drive the cone into the soil is recorded for each 300 mm increment.

All soil samples were classified on site, placed in sealed plastic bags and were transported to our laboratory for visual inspection. Transportation of the samples was completed in general accordance with ASTM D4220-95 (2007) - Standard Practice for Preserving and Transporting Soil Samples.

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

Groundwater

Flexible standpipes were installed in BH 2-14, BH 3-14, BH 6-14 and BH 7-14 to monitor 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 the report. They will then be discarded unless we are otherwise directed.

3.2 Field Survey

The test holes were located in the field by Annis O'Sullivan Vollebekk. It is understood that the ground surface elevations are referenced to a geodetic datum. The ground surface elevation and location of the test holes are presented on Drawing PG2444-3 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

The soil samples recovered from the subject site were visually examined in our laboratory to review the results of the field logging. The subsurface soils were classified in general accordance with ASTM D2488-09a, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). Moisture content testing was completed on recovered soil samples and was performed in general accordance with D2216-10 - Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass. The results are presented in the Soil Profile and Test Data sheets presented in Appendix 1.

Six (6) Shelby tube samples were submitted for unidimensional consolidation and Atterberg limit testing from the current investigation. The testing was performed in general accordance with D2435–11 - Standard Test Method for One-Dimensional Consolidation Properties of Soils. The result of the consolidation testing is presented on the Unidimensional Consolidation Test sheet presented in Appendix 1 and are further discussed in Sections 4 and 5.

3.4 Analytical Testing

Two (2) soil samples were submitted for analytical testing to assess the corrosion potential for exposed ferrous metals and the potential of sulphate attacks against subsurface concrete structures. The samples were submitted to determine the concentration of sulphate and chloride, the resistivity and the pH of the sample. The results are presented in Appendix 1 and are discussed further in Subsection 6.7.

A silty clay and a silty sand soil sample was selected for analysis. It is expected that the selected soil samples are representative of the subsoils to be encountered at the subject site.

Paracel Laboratories (Paracel), of Ottawa, performed the laboratory analysis of the soil sample submitted for analytical testing. Paracel is a member of the Standards Council of Canada/Canadian Association for Environmental Analytical Laboratories (SCC/CAEAL). Paracel is accredited and certified by SCC/CAEAL for specific tests registered with the association.

The following testing guidelines were utilized for the submitted soil samples. The anions were analyzed using EPA 300.1, the pH was analyzed using EPA 150.1, the resistivity was analyzed using EPA 120.1, and the percent solids was determined using gravimetrics.

4.0 OBSERVATIONS

4.1 Surface Conditions

The majority of the subject site consists of former and active agricultural fields. The former agricultural fields are currently overgrown with brush and small trees. Heavily treed areas were noted within the north and southwest portions of the site. The general topography of the subject site is relatively flat with several ditches throughout.

4.2 Subsurface Profile

Subsoil Conditions

Generally, the soil conditions encountered at the test hole locations consist of a topsoil/organic layer followed by a silty sand and/or weathered brown silty clay crust overlying a soft to firm grey silty clay deposit extending to depths varying between 2 to 9.6 m below existing ground surface. Reference should be made to the Soil Profile and Test Data sheets in Appendix 1 for specific details of the soil profiles encountered at each test hole location.

Based on available geological mapping, the subject site is underlain by two (2) bedrock formations - limestone of the Lindsay Formation and shale of the Billings Formation with an overburden drift thickness between of 25 to 50 m depth.

Silty Clay

A total of six (6) of sensitive silty clay samples from the current investigation. The test results are presented in Subsection 5.3 and on the Consolidation Test sheets in Appendix 1. The consolidation test results indicate that the silty clay is overconsolidated with overconsolidation ratios (OCR) for the tested samples varying between 1.3 and 2.3. The OCR is the ratio of the preconsolidation pressure to the effective overburden pressure at the sample depth. This is further discussed in Subsection 5.3.

Two (2) silty clay samples were submitted for Atterberg Limits testing. The tested material was classified as Inorganic Clays of High Plasticity (CH). The results are summarized in Table 1 and presented on the Atterberg Limits Results sheet in Appendix 1.

Table 1 - Summary of Atterberg Limits Tests					
Sample	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index %	Classification
BH 1-14 - TW 3	25.2	77	26	52	CH
BH 4-14 - TW 2	21.2	74	21	53	CH

4.3 Groundwater

The groundwater levels in the boreholes are presented in Table 2. It is important to note that groundwater readings at piezometers can be influenced by surface water perched within the borehole backfill material. Groundwater conditions can also be estimated based on the observed colour and consistency of the recovered soil samples. Based on these observations, it is estimated that the long-term groundwater level can be expected between 0.5 to 1.5 m depth. Groundwater levels are subject to seasonal fluctuations and therefore could vary during time of construction.

Table 2 - Summary of Groundwater Level Readings				
Test Hole Number	Ground Elevation, m	Groundwater Levels, m		Recording Date
		Depth	Elevation	
BH 2-14	86.41	0.06	86.35	September 2, 2014
BH 3-14	86.56	0.29	86.27	September 2, 2014
BH 6-14	86.56	1.47	85.09	September 2, 2014
BH 7-14	86.15	0.89	85.26	September 2, 2014
BH 19	86.12	Damaged	-	January 9, 2012
BH 20	86.42	1.41	85.01	January 9, 2012
BH 21	86.32	0.75	85.57	January 9, 2012
BH 22	86.08	2.36	83.72	January 9, 2012
BH 23	86.54	1.96	84.58	January 9, 2012
BH 24	86.54	1.73	84.81	January 9, 2012
BH 25	86.13	1.61	84.52	January 9, 2012
BH 26	86.37	3.10	83.27	January 9, 2012
BH 27	87.01	1.85	85.16	January 9, 2012
Note: Ground surface elevations at the test hole locations were provided by Annis O'Sullivan Vollebekk.				

5.0 DISCUSSION

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is satisfactory for the current phase of the proposed development. However, due to the presence of the sensitive silty clay layer, the proposed development will be subjected to grade raise restrictions.

Permissible grade raise recommendations are discussed in Subsection 5.3 and recommended permissible grade raise areas are presented in Drawing PG2444-4 - Permissible Grade Raise Areas - Buildings in Appendix 2. If higher than permissible grade raises are required, preloading with or without a surcharge, lightweight fill and/or other measures should be investigated to reduce the risks of unacceptable long-term post construction total and differential settlements.

Excavation for the proposed services throughout the subject site will be completed mostly through OHSA Type 3 soils with a shallow groundwater table. It is anticipated that deep services may be placed at several locations across the subject site, and therefore the potential for basal heave should be reviewed for pipe placement.

The above and other considerations are further discussed in the following sections.

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, paved areas, pipe bedding and other settlement sensitive structures.

Fill Placement

Fill used for grading beneath the building areas should consist, unless otherwise specified, of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. Granular material should be tested and approved prior to delivery to the site. The fill should be placed in lifts of 300 mm thick or less and compacted using suitable compaction equipment for the lift thickness. Fill placed beneath the building areas should be compacted to at least 98% of the Standard Proctor Maximum Dry Density (SPMDD).

Non-specified existing fill along with site-excavated soil can be used as general landscaping fill and beneath parking areas where settlement of the ground surface is of minor concern. In landscaped areas, these materials should be spread in thin lifts and at least compacted 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 the SPMDD. Non-specified existing fill and site-excavated soils are not suitable for use as backfill against foundation walls unless a composite drainage blanket connected to a perimeter drainage system is provided.

5.3 Foundation Design

Based on the results of the geotechnical investigation, lightly loaded structures, such as the residential and slab on grade commercial buildings anticipated, could be founded by shallow footings bearing on compact silty sand or stiff to firm silty clay.

Bearing Resistance Values

Footings for the proposed buildings can be designed using the bearing resistance values presented in Table 3.

Table 3 - Bearing Resistance Values

Bearing Surface	Bearing Resistance Value at SLS (kPa)	Factored Bearing Resistance Value at ULS (kPa)
Compact Silty Sand	60	120
Soft Silty Clay	40	75
Firm Silty Clay	60	120

Note: Strip footings, up to 3 m wide, and pad footings, up to 5 m wide, can be designed using the above noted bearing resistance values placed over a silty clay bearing surface. A geotechnical resistance factor of 0.5 was applied to the above noted bearing resistance values at ULS.

The bearing resistance values are provided on the assumption that the footings will be placed on undisturbed soil bearing surfaces. An undisturbed soil bearing surface consists of one from which all topsoil and deleterious materials, such as loose, frozen or disturbed soil, whether in situ or not, have been removed, in the dry, prior to the placement of concrete for footings.

The bearing medium under footing-supported structures is required to be provided with adequate lateral support with respect to excavations and different foundation levels. Adequate lateral support is provided to the in-situ bearing medium soils above the groundwater table when a plane extending down and out from the bottom edge of the footing at a minimum of 1.5H:1V passes only through in situ soil of the same or higher capacity as the bearing medium soil.

Raft Foundation

Where founding buildings over a conventional shallow footing is not practical, the following parameters may be used for raft design over a soft silty clay bearing surface.

For design purposes, it was assumed that the base of the raft foundation will be located at a 2 to 3 m depth with one basement level.

The amount of settlement of the raft slab will be dependent on the sustained raft contact pressure. The bearing resistance value at SLS (contact pressure) of **60 kPa** will be considered acceptable. The loading conditions for the contact pressure are based on sustained loads, that are generally taken to be 100% Dead Load and 50% Live Load. The factored bearing resistance (contact pressure) at ULS can be taken as **90 kPa**. A geotechnical resistance factor of 0.5 was applied to the bearing resistance value at ULS.

The modulus of subgrade reaction was calculated to be **1.8 MPa/m** for a contact pressure of **60 kPa**. The raft foundation design is required to consider the relative stiffness of the reinforced concrete slab and the supporting bearing medium.

Based on the following assumptions for the raft foundation, buildings constructed over the silty clay deposit can be designed using the above parameters with a total and differential settlement of 25 and 15 mm, respectively.

Settlement/Grade Raise

Consideration must be given to potential settlements which could occur due to the presence of the silty clay deposit and the combined loads from the proposed footings, any groundwater lowering effects, and grade raise fill. The foundation loads to be considered for the settlement case are the continuously applied loads which consist of the unfactored dead loads and the portion of the unfactored live load that is considered to be continuously applied. For dwellings, a minimum value of 50% of the live load is recommended by Paterson.

Generally, the potential long term settlement is evaluated based on the compressibility characteristics of the silty clay. These characteristics are estimated in the laboratory by conducting unidimensional consolidation tests on undisturbed soil samples collected using Shelby tubes in conjunction with a piston sampler. Nine (9) site specific consolidation tests were conducted. The results of the consolidation tests are presented in Table 4 and in Appendix 1.

The value for p'_c is the preconsolidation pressure and p'_o is the effective overburden pressure of the test sample. The difference between these values is the available preconsolidation. The increase in stress on the soil due to the cumulative effects of the fill surcharge, the footing pressures, the slab loadings and the lowering of the groundwater should not exceed the available preconsolidation if unacceptable settlements are to be avoided.

The values for C_{cr} and C_c are the recompression and compression indices, respectively. These soil parameters are a measure of the compressibility due to stress increases below and above the preconsolidation pressures. The higher values for the C_c, as compared to the C_{cr}, illustrate the increased settlement potential above, as compared to below, the preconsolidation pressure.

Table 4 - Summary of Consolidation Test Results

Borehole No.	Sample	Depth (m)	p'_c (kPa)	p'_o (kPa)	C_{cr}	C_c	Q (*)
BH 1-14	TW3	2.74	75	35.1	0.040	4.332	A
BH 2-14	TW5	5.82	73	58.1	0.035	2.696	A
BH 4-14	TW2	2.64	58	32.6	0.046	4.502	A
BH 5-14	TW6	5.01	94	53.2	0.024	2.325	A
BH 6-14	TW7	5.06	106	53	0.025	4.203	A
BH 7A-14	TW1	4.3	109	47.8	0.036	3.654	A
BH 20	TW 5	4.32	90	54	0.030	4.358	G
BH 21	TW 5	6.6	159	67	0.025	8.018	A
BH 22	TW 5	3.56	60	38	0.038	4.296	A

* - Q - Quality assessment of sample - G: Good A: Acceptable P: Likely disturbed

The values of p'_c, p'_o, C_{cr} and C_c are determined using standard engineering testing procedures and are estimates only. Natural variations within the soil deposit will affect the results. The p'_o parameter is directly influenced by the groundwater level. Groundwater levels were measured during the site investigation. Groundwater levels vary seasonally which has an impact on the available preconsolidation. Lowering the groundwater level increases the p'_o and therefore reduces the available preconsolidation. Unacceptable settlements could be induced by a significant lowering of the groundwater level. To determine the p'_o values, the groundwater level is based on the colour and undrained shear strength profile of the silty clay.

The total and differential settlements will be dependent on characteristics of the proposed buildings. For design purposes, the total and differential settlements are estimated to be 25 and 20 mm, respectively. A post-development groundwater lowering of 0.5 m was assumed.

The potential post construction total and differential settlements are dependent on the position of the long term groundwater level when building are situated over deposits of compressible silty clay. Efforts can be made to reduce the impacts of the proposed development on the long term groundwater level by placing clay dykes in the service trenches, reducing the sizes of paved areas, leaving green spaces to allow for groundwater recharge or limiting planting of trees to areas away from the buildings. However, it is not economically possible to control the groundwater level.

To reduce potential long term liabilities, consideration should be given to accounting for a larger groundwater lowering and to provide means to reduce long term groundwater lowering (e.g. clay dykes, restriction on planting around the dwellings, etc). Buildings on silty clay deposits increases the likelihood of movements and therefore of cracking. The use of steel reinforcement in foundations placed at key structural locations will tend to reduce foundation cracking compared to unreinforced foundations.

The recommended permissible grade raise areas are defined in Drawing PG2444-4 - Permissible Grade Raise Areas - Buildings in Appendix 2.

If higher grade raises and/or higher loading conditions are required, post construction settlements can be reduced by several methods. The following options can be considered and are further discussed in Subsection 5.4:

❑ preloading and surcharging
❑ lightweight fill (LWF)

Bearing resistance values for footing designs should be determined on a per lot basis at the time of construction.

5.4 Foundation Options

Based on the above discussion, several options could be considered for the foundation support of the proposed buildings:

Scenario A

Where the grade raise is close to, but below, the maximum permissible grade raise, consideration should be given to using more reinforcement in the design of the foundation (footings and walls) to reduce the risks of cracking in the concrete foundation. The use of control joints within the brick work between the garage and basement area should also be considered.

Scenario B

Where the grade raise cannot be accommodated with soil fill, the following options could be used alone or in combination.

Option 1 - Use of Lightweight Fill

Lightweight fill (LWF) can be used, consisting of EPS (expanded polystyrene) Type 19 or 22 blocks or other light weight materials which allow for raising the grade without adding a significant load to the underlying soils. However, these materials are expensive and, in the case of the EPS, are more difficult to use under the groundwater level, as they are buoyant, and must be protected against potential hydrocarbon spills. Use lightweight fill within the interior of the garage and porch areas to reduce the fill-related loads.

Option 2 - Preloading or Surcharging

It is possible to preload or surcharge the subject site in localized areas provided sufficient time is available to achieve the desired settlements based on theoretical values from the settlement analysis. If this option is considered, a monitoring program using settlement plates and electronic piezometers will have to be implemented. This program will determine the amount of settlement in the preloaded or surcharged areas. Obviously, preloading to proposed finished grades will allow for consolidation of the underlying clays over a longer time period. Surcharging the site with additional fill above the proposed finished grade will add additional load to the underlying clays accelerating the consolidation process and allowing for accelerated settlements. Once the desired settlements are achieved, the site can be unloaded and the fill can be used elsewhere on site.

With both the preloading and surcharging methods, the loading period can be reduced by installing vertical wick drains or sand drains in the silty clay layer to promote the movement of groundwater towards the ground surface. However, vertical drains are expensive for this type of residential project.

Underground Utilities

The underground services may be subjected to unacceptable total or differential settlements. In particular, the joints at the interface building/soil may be subjected to excessive stress if the differential settlements between the building and the services are excessive. This should be considered in the design of the underground services.

Once the required grade raises are established, the above options could be further discussed along with further recommendations on specific requirements.

5.5 Design for Earthquakes

A seismic site response **Class E** is applicable for foundation design at the subject site. Foundations at the subject site should be designed according to Part 4 of the OBC 2012. The soils underlying the site are not susceptible to liquefaction.

5.6 Basement Slab/Slab on Grade Construction

With the removal of all topsoil and deleterious fill, containing organic matter, within the footprints of the proposed buildings, undisturbed native soil surface will be considered acceptable subgrade on which to commence backfilling for floor slab construction. Any soft areas should be removed and backfilled with appropriate backfill material. OPSS 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 19 mm clear crushed stone for a basement slab. The upper 150 to 200 mm of Granular A crushed stone is recommended for slab-on-grade construction.

5.7 Pavement Structure

For design purposes, the pavement structure presented in the following tables could be used for the design of car parking areas and access lanes/local residential streets. These guidelines should be reviewed once the details of the development are known.

Table 5 - Recommended Pavement Structure - Car 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 6 - Recommended Pavement Structure - Local Residential Roadways

Thickness (mm)	Material Description
40	**Wear Course -** Superpave 12.5 Asphaltic Concrete
50	**Binder Course -** Superpave 19.0 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
450	**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	

Table 7 - Recommended Pavement Structure - Roadways with Bus Traffic	
Thickness mm	**Material Description**
40	**Wear Course -** Superpave 12.5 Asphaltic Concrete
50	**Upper Binder Course** - Superpave 19.0 Asphaltic Concrete
50	**Lower Binder Course** - Superpave 19.0 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
600	**SUBBASE** - OPSS Granular B Type II
	SUBGRADE - Either in situ soil or OPSS Granular B Type II material placed over in situ soil

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 II material. Weak subgrade conditions may be experienced over service trench fill materials. This may require the use of a woven geotextile liner, such as Terrafix 270R or equivalent, and a biaxial geogrid layer, thicker subbase or other measures that can be recommended at the time of construction as part of the field observation program.

The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 100% of the material's SPMDD using suitable vibratory equipment.

Satisfactory performance of the pavement structure is largely dependent on 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 load carrying capacity.

Due to the low permeability of the subgrade materials consideration should be given to installing subdrains during the pavement construction as per City of Ottawa standards. The subdrain inverts should be approximately 300 mm below subgrade level. The subgrade surface should be crowned to promote water flow to the drainage lines.

6.0 DESIGN AND CONSTRUCTION PRECAUTIONS

6.1 Foundation Drainage and Backfill

A perimeter foundation drainage system is recommended for proposed structures. The system should consist of a 100 to 150 mm diameter, geotextile-wrapped, 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.

To ensure that the basement level remains dry during storm events or spring melt activities, a perimeter foundation drainage system should be provided along the proposed building's perimeter and connected to the storm sewer. Consideration should also be given to placing a 150 mm diameter perforated, corrugated PVC pipe wrapped in a geosock and surrounded by a clear crushed stone below the basement and garage floor slab at footing level. The sub-floor drain should be connected to the perimeter drainage pipe by a minimum 150 mm diameter sleeve through the footing and teed into the perimeter drainage pipe.

Backfill against the exterior sides of the foundation walls should consist of free-draining, non frost susceptible granular materials. The site materials will be frost susceptible and, as such, are not recommended for re-use as backfill unless a composite drainage system (such as system Platon or Miradrain G100N) connected to a drainage system is provided.

6.2 Protection Against Frost Action

Perimeter footings of heated structures are required to be insulated against the deleterious effect of frost action. A minimum 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.

6.3 Excavation Side Slopes

The excavation for the current phase of the proposed development will be mostly through silty sand and/or silty clay. Above the groundwater level, for excavations to depths of approximately 3 m, the excavation side slopes should be stable in the short term at 1H:1V. Flatter slopes could be required for deeper excavations or for excavation below the groundwater level. Where such side slopes are not permissible or practical, temporary shoring should be used. The subsoil at this site is considered to be mainly a Type 3 soil according to the Occupational Health and Safety Act and Regulations for Construction Projects.

The slope cross-sections recommended above are for temporary slopes. Excavated soil should not be stockpiled directly at the top of excavations and heavy equipment should be kept away from the excavation sides.

Slopes in excess of 3 m in height should be periodically inspected by the geotechnical consultant in order to detect if the slopes are exhibiting signs of distress.

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.

Excavation Base Stability

The base of supported excavations can fail by three (3) general modes:

- ❑ Shear failure within the ground caused by inadequate resistance to loads imposed by grade difference inside and outside of the excavation,
- ❑ Piping from water seepage through granular soils, and
- ❑ Heave of layered soils due to water pressures confined by intervening low permeability soils.

Shear failure of excavation bases is typically rare in granular soils if adequate lateral support is provided. Inadequate dewatering can cause instability in excavations made through granular or layered soils. The potential for base heave in cohesive soils should be determined for stability of flexible retaining systems.

The factor of safety with respect to base heave, FS_b, is:

$$FS_b = N_b s_u / \sigma_z$$

where:

N_b - stability factor dependent upon the geometry of the excavation and given in Figure 1 on the following page.
s_u - undrained shear strength of the soil below the base level
σ_z - total overburden and surcharge pressures at the bottom of the excavation

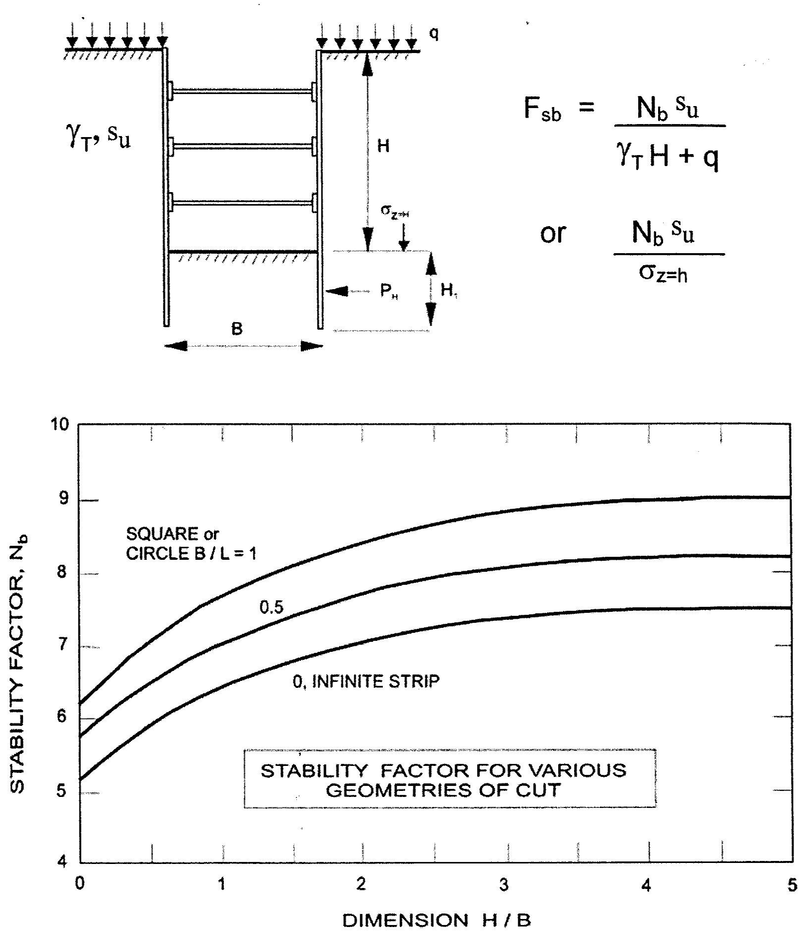

Figure 1 - Stability Factor for Various Geometries of Cut

In the case of soft to firm clays, a factor of safety of 2 is recommended for base stability.

6.4 Pipe Bedding and Backfill

Bedding and backfill materials should be in accordance with the most recent Material Specifications and Standard Detail Drawings from the City of Ottawa.

The pipe bedding for sewer and water pipes should consist of at least 150 mm of OPSS Granular A material. Where the bedding is located within the firm grey silty clay, the thickness of the bedding material should be increased to a minimum of 300 mm. The material should be placed in maximum 300 mm thick lifts and compacted to a minimum of 95% of its SPMDD. The bedding material should extent at least to the spring line of the pipe.

The cover material, which should consist of OPSS Granular A, should extend from the spring line of the pipe to at least 300 mm above the obvert of the pipe. The material should be placed in maximum 300 mm thick lifts and compacted to a minimum of 95% of its SPMDD.

Generally, it should be possible to re-use the moist (not wet) brown silty clay above the cover material if the excavation and filling operations are carried out in dry weather conditions. Wet silty clay materials will be difficult to re-use, as the high water contents make compacting impractical without an extensive drying period.

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.

To reduce long-term lowering of the groundwater level at this site, clay seals should be provided in the service trenches. The seals should be at least 1.5 m long (in the trench direction) and should extend from trench wall to trench wall. The seals should extend from the frost line and fully penetrate the bedding, subbedding and cover material. The barriers should consist of relatively dry and compactable brown silty clay placed in maximum 225 mm thick loose layers and compacted to a minimum of 95% of the SPMDD. The clay seals should be placed at the site boundaries and at strategic locations at no more than 60 m intervals in the service trenches.

6.5 Groundwater Control

Due to the relatively impervious nature of the silty clay materials, it is anticipated that groundwater infiltration into the excavations should be low and controllable using open sumps. A perched groundwater condition may be encountered within the silty sand deposit which may produce significant temporary groundwater infiltration levels. Pumping from open sumps should be sufficient to control the groundwater influx through the sides of shallow excavations.

A temporary MOE permit to take water (PTTW) will be required for this project if more than 50,000 L/day are to be pumped during the construction phase. At least 5 to 5 months should be allowed for completion of the application and issuance of the permit by the MOE.

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.

6.6 Winter Construction

The subsurface conditions at this site mostly consist of frost susceptible materials. In presence of water and freezing conditions ice could form within the soil mass. Heaving and settlement upon thawing could occur. Precautions should be taken if winter construction is considered for this project.

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, 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.

The trench excavations should be constructed in a manner that will avoid the introduction of frozen materials into the trenches. As well, pavement construction is difficult during winter. The subgrade consists of frost susceptible soils which will experience total and differential frost heaving as the work takes place. In addition, the introduction of frost, snow or ice into the pavement materials, which is difficult to avoid, could adversely affect the performance of the pavement structure. Additional information could be provided, if required.

6.7 Corrosion Potential and Sulphate

The analytical test results are presented in Table 8 along with industry standards for the applicable threshold values. The results are indicative that Type 10 Portland cement (Type GU).

Table 8 - Corrosion Potential

Parameter	Laboratory Results		Threshold	Commentary
	BH3-14 SS3	BH5-14 SS3		
Chloride	10 µg/g	<5 µg/g	Chloride content less than 400 mg/g	Negligible concern
pH	7.92	6.63	pH value less than 5.0	Neutral Soil
Resistivity	37.1 ohm.m	386 ohm.m	Resistivity greater than 1,500 ohm.cm	Moderate Corrosion Potential
Sulphate	134 µg/g	<5 µg/g	Sulphate value greater than 1 mg/g	Negligible Concern

6.8 Landscaping Considerations

Tree Planting Restrictions

The proposed residential dwellings are located in a high sensitivity area with respect to tree plantings over a silty clay deposit. It is recommended that trees placed within 7 m of the foundation wall should consist of low water demanding trees with shallow roots systems that extend less than 1.5 m below ground surface. Trees placed greater than 7 m from the foundation wall may consist of typical street trees, which are typically moderate water demand species with roots extending to a maximum depth of 2 m below ground surface.

It is well documented in the literature, and is our experience, that fast-growing trees located near buildings founded on cohesive soils that shrink on drying can result in long-term differential settlements of the structures. Tree varieties that have the most pronounced effect on foundations are seen to consist of poplars, willows and some maples (i.e. Manitoba Maples) and, as such, they should not be considered in the landscaping design.

Swimming Pools

The in-situ soils are considered to be acceptable for swimming pools. Above ground swimming pools must be placed at least 4 m away from the residence foundation and neighbouring foundations. Otherwise, pool construction is considered routine, and can be constructed in accordance with the manufacturer`s requirements.

Aboveground Hot Tubs

If consideration is given to construction of an aboveground hot tub, additional grading around the hot tub should not exceed permissible grade raises. Otherwise, hot tub construction is considered routine, and can be constructed in accordance with the manufacturer’s specifications.

Installation of Decks or Additions

If consideration is given to construction of a deck or addition, a geotechnical consultant should be retained by the homeowner to review the site conditions. Additional grading around proposed deck or addition should not exceed permissible grade raises. Otherwise, standard construction practices are considered acceptable.

7.0 RECOMMENDATIONS

It is recommended that the following be completed once the master plan and site development are determined:

❑ Review detailed grading plan(s) from a geotechnical perspective.

❑ Observation of all bearing surfaces prior to the placement of concrete.

❑ 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 placing backfilling materials.

❑ Field density tests to ensure that the specified level of compaction has been achieved.

❑ Sampling and testing of the bituminous concrete including mix design reviews.

❑ Suggest foundation alternatives based on the potential long term settlements.

A report confirming that these works have been conducted in general accordance with our recommendations could be issued upon request, following the completion of a satisfactory material testing and observation program by the geotechnical consultant.

8.0 STATEMENT OF LIMITATIONS

The recommendations made in this report are in accordance with Paterson's present understanding of the project. Paterson requests permission to review the grading plan once available. Our recommendations should be reviewed when the drawings and specifications are complete.

The client should be aware that any information pertaining to soils and all test hole logs are furnished as a matter of general information only. Test hole descriptions or logs are not to be interpreted as descriptive of conditions at locations other than those of the test holes.

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, Paterson requests to be notified immediately in order to permit reassessment of the 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 Ashcroft Homes 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.

LICENSED PROFESSIONAL ENGINEER
D. J. GILBERT
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PROVINCE OF ONTARIO

Faisal I. Abou-Seido, P.Eng. David J. Gilbert, P.Eng.

Report Distribution:

- ❏ Ashcroft Homes (3 copies)
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APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

CONSOLIDATION TEST RESULTS

ATTERBERG LIMITS' TESTING RESULTS

ANALYTICAL TEST RESULTS

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Dev.-Eastboro Phase 2-Navan Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Limited.

FILE NO. PG2444

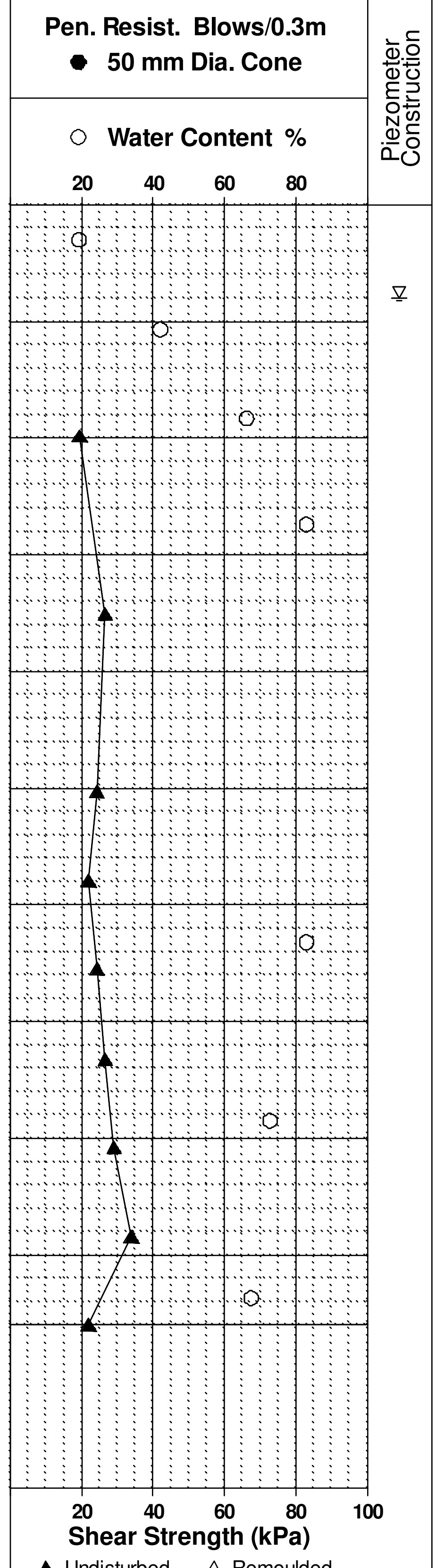
REMARKS

HOLE NO. BH 1-14

BORINGS BY CME 55 Power Auger

DATE June 17, 2014

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	87.74
Loose, brown **SILTY SAND**		AU	1				
		SS	2	67	4	1	86.74
1.37							
						2	85.74
Soft to firm, brown **SILTY CLAY**		TW	3	100			
- grey by 3.0m depth						3	84.74
		TW	4	100		4	83.74
						5	82.74
						6	81.74
						7	80.74
						8	79.74
						9	78.74
9.60							
End of Borehole							
(GWL @ 0.8m depth based on field observations)							



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Dev.-Eastboro Phase 2-Navan Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Limited.

FILE NO. PG2444

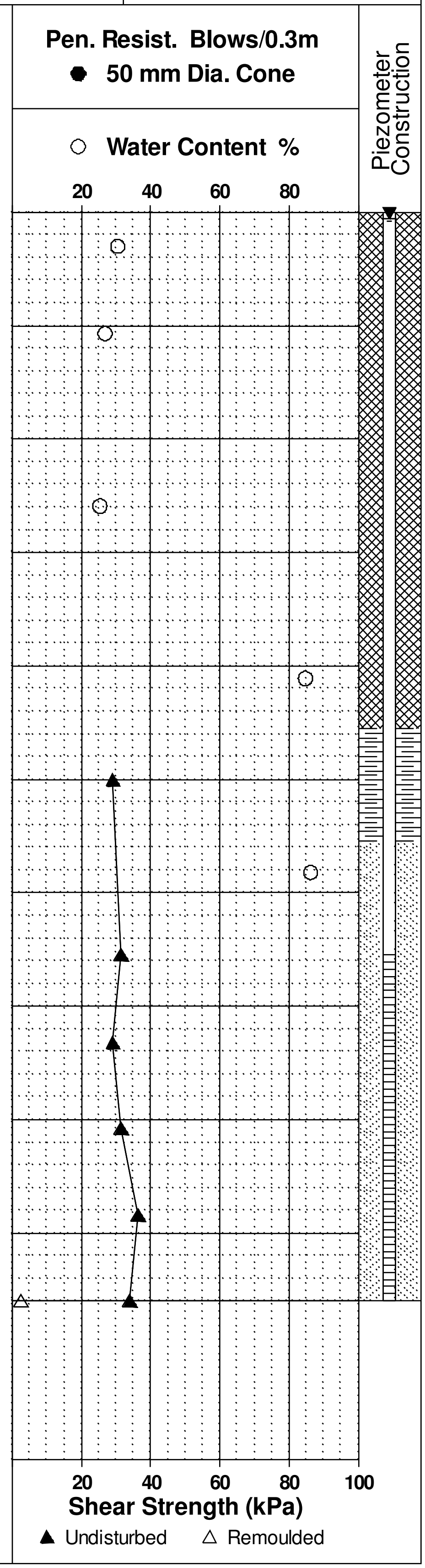
REMARKS

HOLE NO. BH 2-14

BORINGS BY CME 55 Power Auger

DATE June 13, 2014

SOIL DESCRIPTION	Layer depth (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	86.41
TOPSOIL	0.23	AU	1				
Loose to compact, brown to grey **SILTY SAND**		SS	2	67	8	1	85.41
						2	84.41
		SS	3	100	16		
	3.66					3	83.41
Firm, grey **SILTY CLAY**		SS	4			4	82.41
						5	81.41
		TW	5	100			
						6	80.41
						7	79.41
						8	78.41
	9.60					9	77.41
End of Borehole							
(GWL @ 0.06m-Sept. 2, 2014)							



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Dev.-Eastboro Phase 2-Navan Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Limited.

FILE NO. PG2444

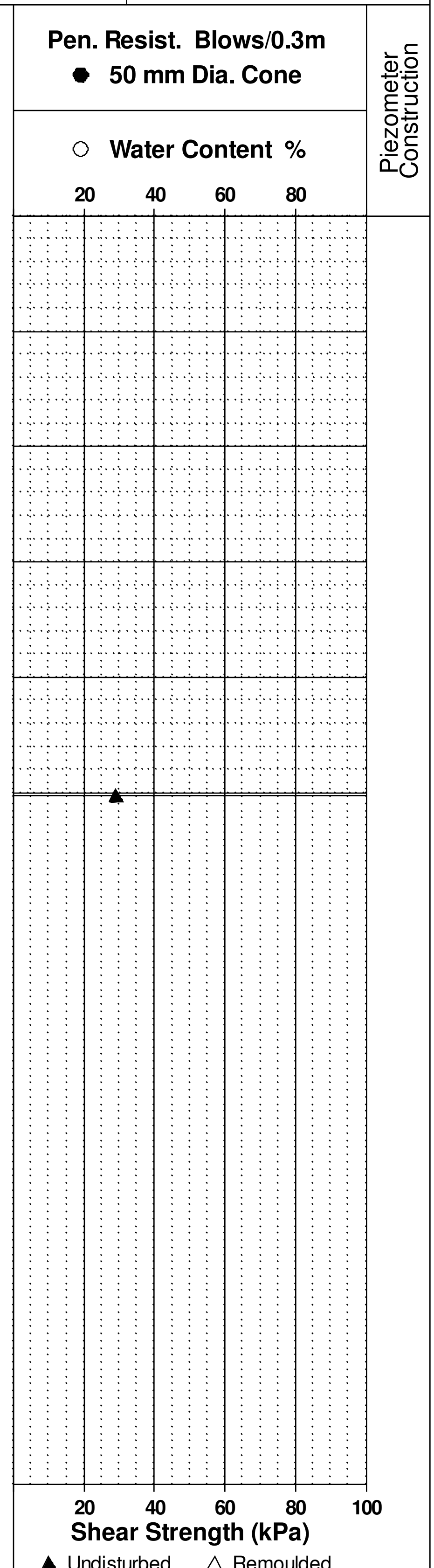
REMARKS

HOLE NO. BH 2A-14

BORINGS BY CME 55 Power Auger

DATE June 13, 2014

SOIL DESCRIPTION	Strata depth (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	86.41
TOPSOIL	0.23						
Loose to compact, brown to grey **SILTY SAND**	3.66					1	85.41
						2	84.41
						3	83.41
Firm, grey **SILTY CLAY**	5.03	TW	1	100		4	82.41
End of Borehole						5	81.41



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Dev.-Eastboro Phase 2-Navan Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Limited.

REMARKS

BORINGS BY CME 55 Power Auger

DATE June 16, 2014

FILE NO. PG2444

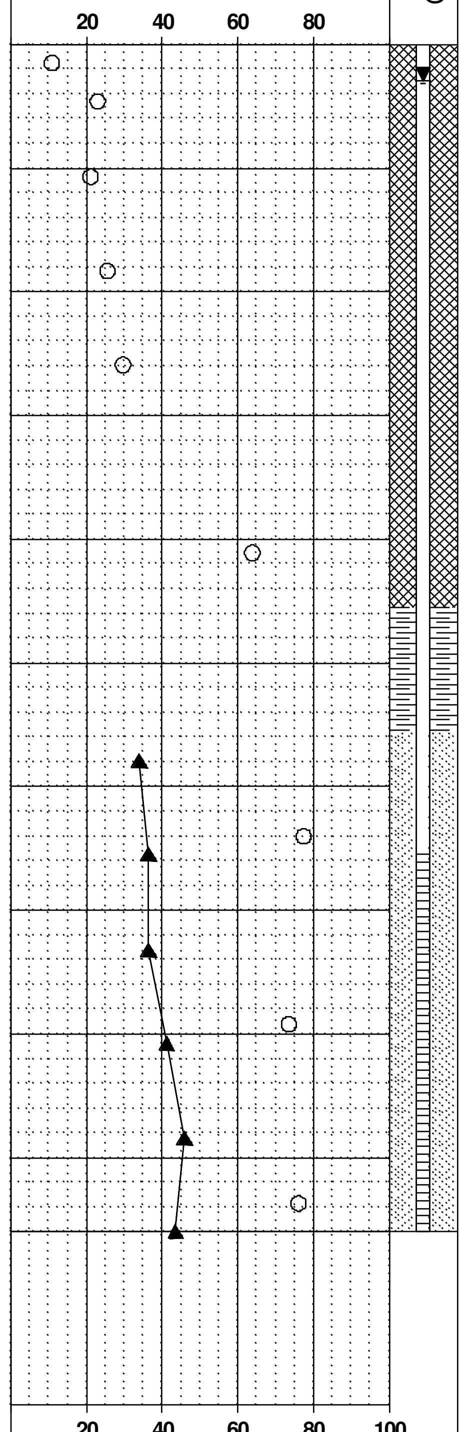
HOLE NO. BH 3-14

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	86.56
Compact, brown **SILTY SAND**		AU	1				
		AU	2				
		SS	3	83	12	1	85.56
		SS	4	83	14	2	84.56
		SS	5	88	12	3	83.56
3.66							
Firm, grey **SILTY CLAY**		SS	6		2	4	82.56
		TW	7	100		5	81.56
						6	80.56
						7	79.56
						8	78.56
						9	77.56
9.60							
End of Borehole							
(GWL @ 0.29m-Sept. 2, 2014)							

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

○ Water Content %

Piezometer Construction



Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Dev.-Eastboro Phase 2-Navan Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Limited.

REMARKS

BORINGS BY CME 55 Power Auger

DATE June 16, 2014

FILE NO. PG2444

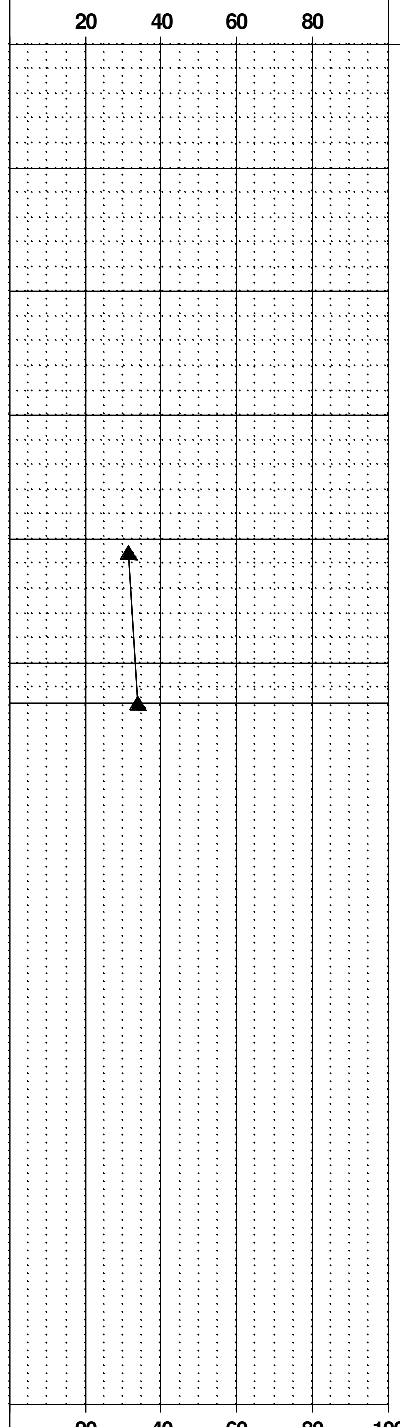
HOLE NO. BH 3A-14

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	86.56
Compact, brown **SILTY SAND**						1	85.56
						2	84.56
						3	83.56
3.66							
Firm, grey **SILTY CLAY**						4	82.56
		TW	1	100			
						5	81.56
5.33							
End of Borehole							

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

○ Water Content %

Piezometer Construction



Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Dev.-Eastboro Phase 2-Navan Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Limited.

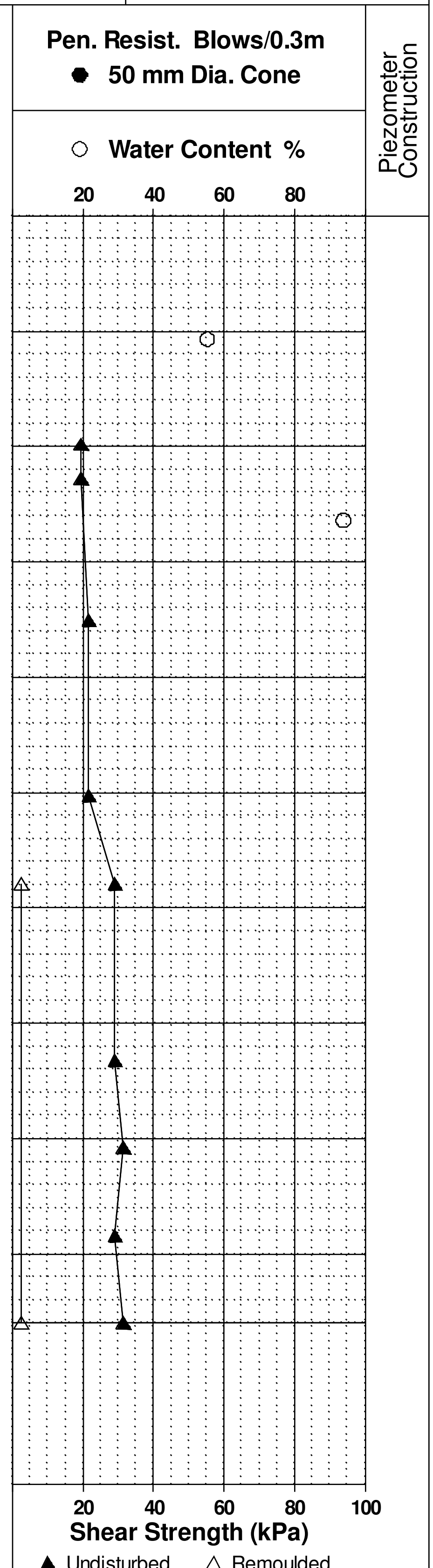
FILE NO. **PG2444**

REMARKS

HOLE NO. **BH 4-14**

BORINGS BY CME 55 Power Auger **DATE** June 13, 2014

SOIL DESCRIPTION		SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	86.04
TOPSOIL	0.25						
Brown SILTY SAND	0.79						
		SS	1			1	85.04
						2	84.04
		TW	2	100			
						3	83.04
		TW	3	100		4	82.04
Sof to firm, grey SILTY CLAY						5	81.04
						6	80.04
		TW	4	100			
						7	79.04
						8	78.04
						9	77.04
End of Borehole	9.60						



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Dev.-Eastboro Phase 2-Navan Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Limited.

FILE NO. PG2444

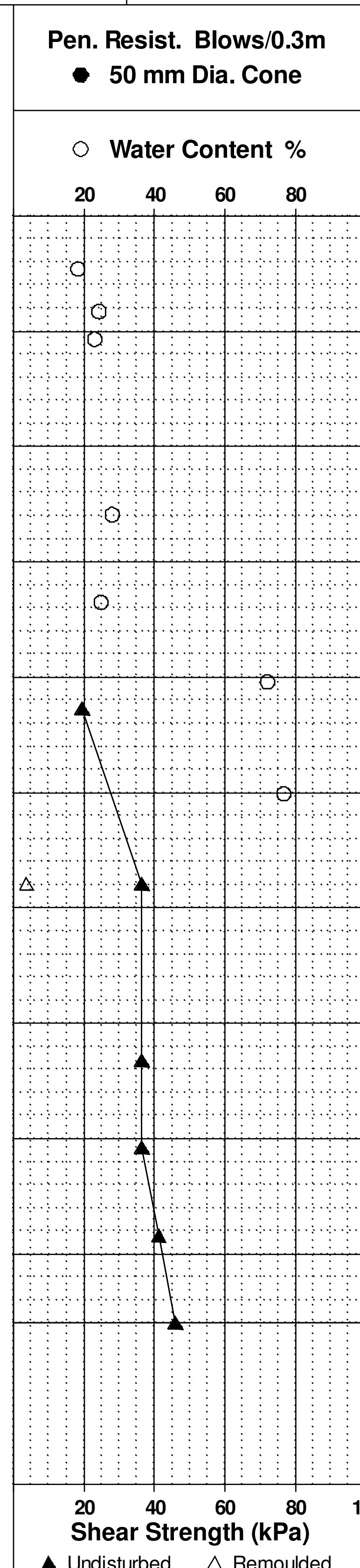
REMARKS

HOLE NO. BH 5-14

BORINGS BY CME 55 Power Auger

DATE June 16, 2014

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	86.37
TOPSOIL (to 0.20)		SS	5	83	13		
		AU	1				
Loose to compact, brown **SILTY SAND** (0.20 to 3.73)		SS	2	71	6	1	85.37
		SS	3	62	7	2	84.37
		SS	4	58	17	3	83.37
Soft to firm, grey **SILTY CLAY** (3.73 to 9.60)						4	82.37
		TW	6	100		5	81.37
		TW	7	100		6	80.37
						7	79.37
						8	78.37
						9	77.37
End of Borehole (9.60)							



Piezometer Construction

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Dev.-Eastboro Phase 2-Navan Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Limited.

FILE NO. PG2444

REMARKS

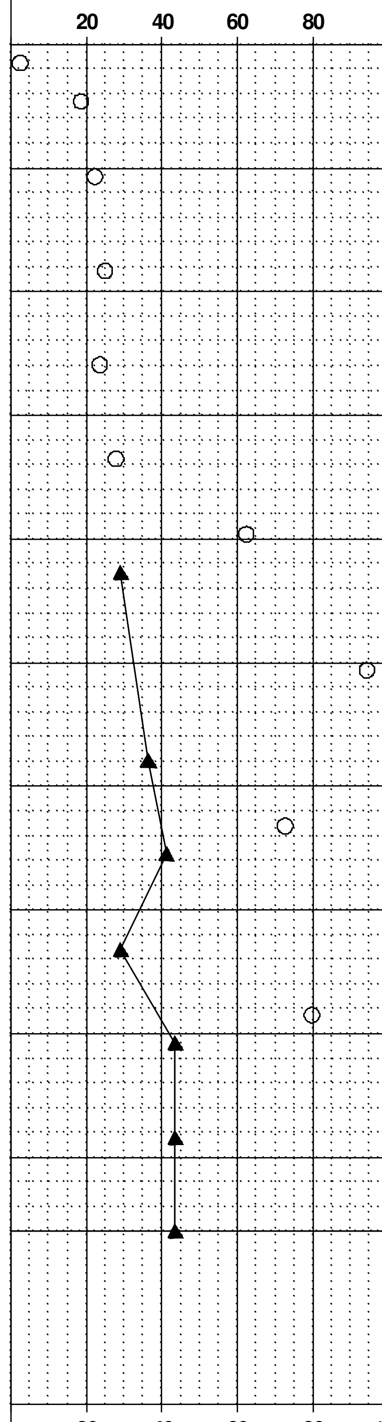
HOLE NO. BH 6-14

BORINGS BY CME 55 Power Auger **DATE** June 17, 2014

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	86.56
TOPSOIL 0.30		AU	1				
		AU	2				
Loose, brown **SILTY SAND**		SS	3	67	9	1	85.56
		SS	4	46	11	2	84.56
2.97		SS	5	62	6		
Firm, brown **SILTY CLAY** with sand seams 3.73		SS	6	100	2	3	83.56
						4	82.56
Firm, grey **SILTY CLAY**		TW	7	100		5	81.56
						6	80.56
						7	79.56
						8	78.56
9.60						9	77.56
End of Borehole							
(GWL @ 1.47m-Sept. 2, 2014)							

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

○ Water Content %



Shear Strength (kPa)
▲ Undisturbed △ Remoulded

Piezometer Construction

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Dev.-Eastboro Phase 2-Navan Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Limited.

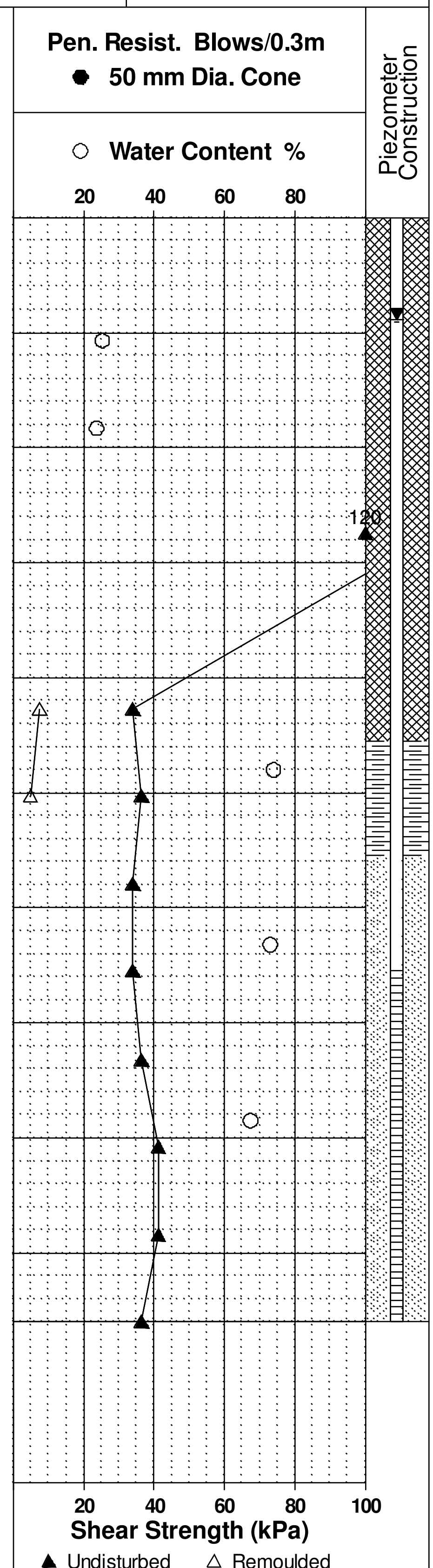
FILE NO. **PG2444**

REMARKS

HOLE NO. **BH 7-14**

BORINGS BY CME 55 Power Auger **DATE** June 17, 2014

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	86.15
TOPSOIL 0.23		TW	3	100			
Compact, brown **SILTY SAND**		SS	1	83	10	1	85.15
		SS	2		13	2	84.15
2.90						3	83.15
Firm, grey **SILTY CLAY**						4	82.15
						5	81.15
						6	80.15
						7	79.15
						8	78.15
						9	77.15
9.60							
End of Borehole							
(GWL @ 0.89m-Sept. 2, 2014)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Dev.-Eastboro Phase 2-Navan Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Limited.

FILE NO. **PG2444**

REMARKS

HOLE NO. **BH 7A-14**

BORINGS BY CME 55 Power Auger

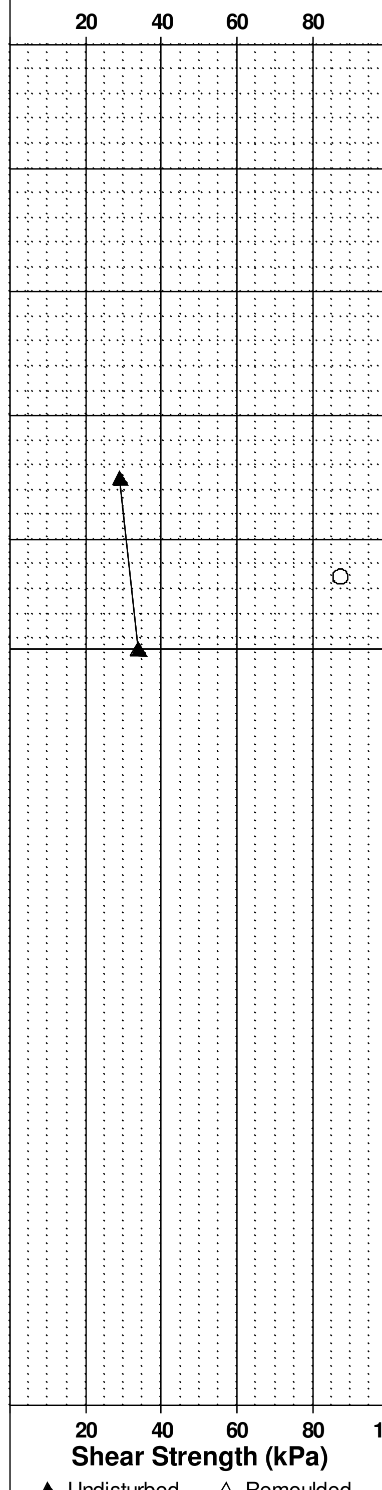
DATE June 17, 2014

SOIL DESCRIPTION	Depth to base (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	86.15
TOPSOIL	0.23						
Compact, brown **SILTY SAND**	2.90					1	85.15
						2	84.15
Firm, grey **SILTY CLAY**	4.88					3	83.15
		TW	1	100		4	82.15
End of Borehole							

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

○ Water Content %

Piezometer Construction



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Dev.-Eastboro Phase 2-Navan Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Limited.

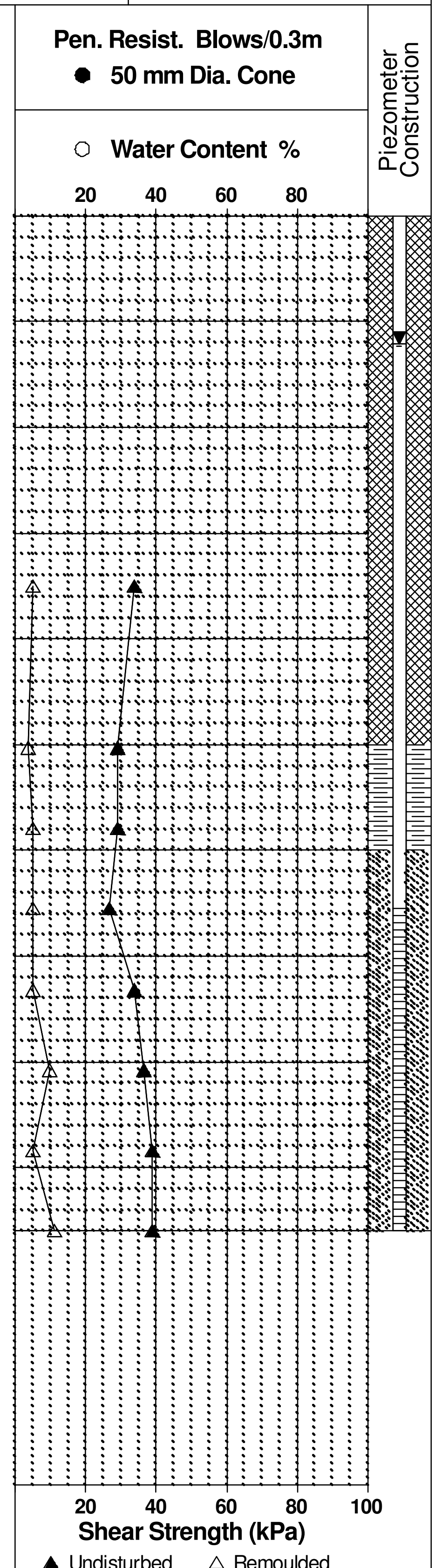
FILE NO. PG2444

REMARKS

HOLE NO. BH18

BORINGS BY CME 55 Power Auger **DATE** 15 November 2011

SOIL DESCRIPTION	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	85.96
Compact to very loose, brown **SILTY SAND**	AU	1				
	AU	2				
- grey by 1.45m depth	SS	3	50	21	1	84.96
	SS	4	4	1	2	83.96
2.21						
Firm, grey **SILTY CLAY**	SS	5	100	1	3	82.96
	TW	6			4	81.96
					5	80.96
					6	79.96
					7	78.96
					8	77.96
					9	76.96
9.60						
End of Borehole						
(GWL @ 1.21m-Jan. 9/12)						



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Dev.-Eastboro Phase 2-Navan Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Limited.

FILE NO. PG2444

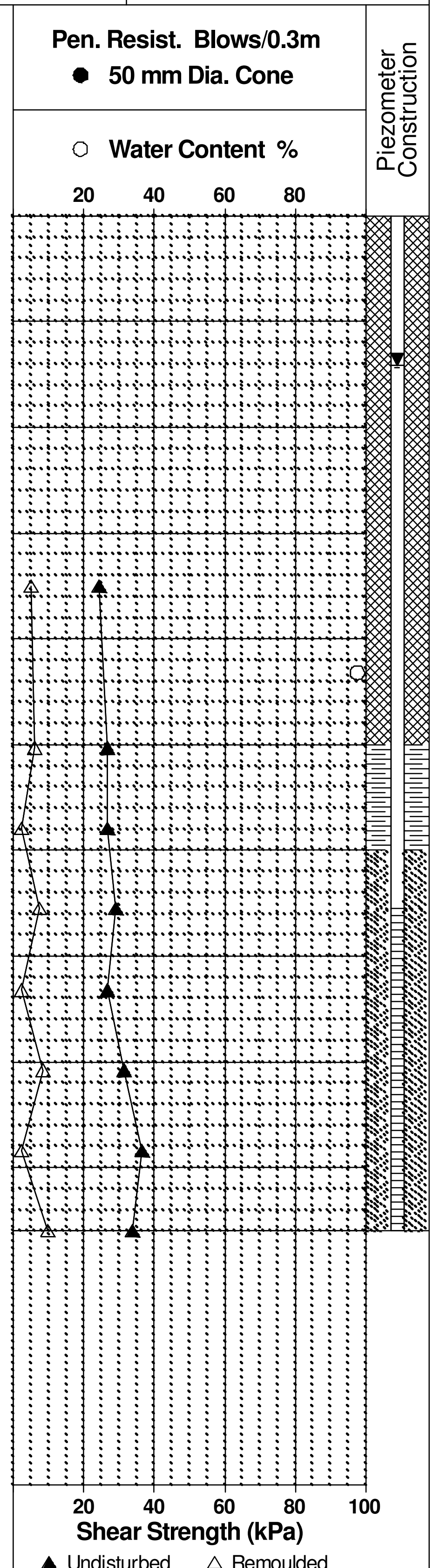
REMARKS

HOLE NO. BH20

BORINGS BY CME 55 Power Auger

DATE 16 November 2011

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	86.42
Compact, brown **SILTY SAND**		AU	1				
		SS	2	75	18	1	85.42
		SS	3	50	9	2	84.42
- loose and grey by 2.2m depth		SS	4	33	W		
2.97						3	83.42
Soft to firm, grey **SILTY CLAY**		TW	5	100		4	82.42
						5	81.42
						6	80.42
						7	79.42
						8	78.42
						9	77.42
9.60							
End of Borehole							
(GWL @ 1.41m-Jan. 9/12)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Dev.-Eastboro Phase 2-Navan Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Limited.

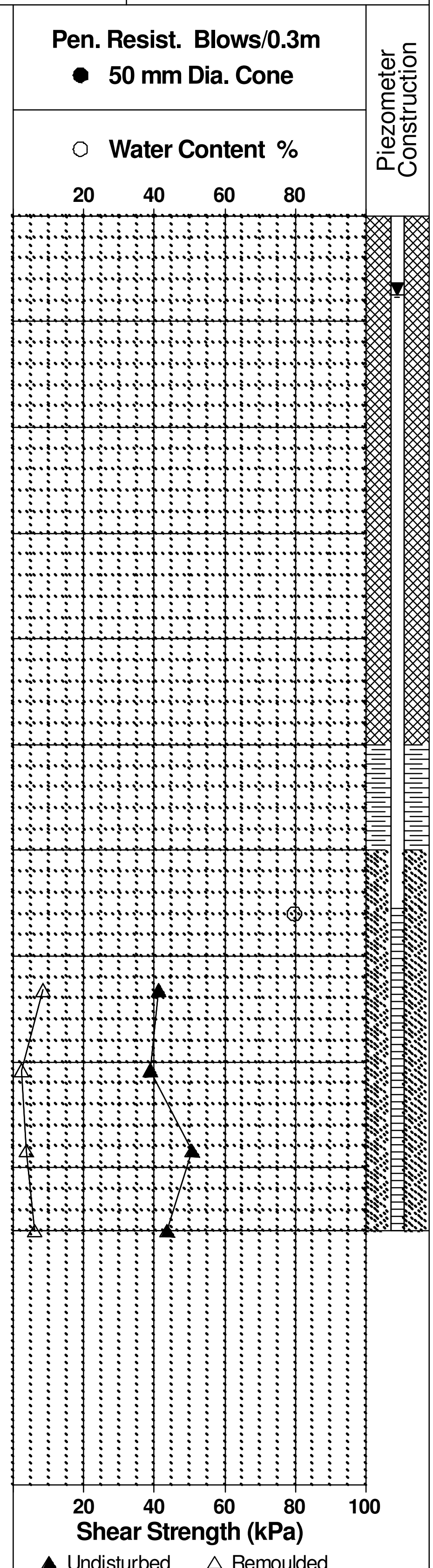
FILE NO. **PG2444**

REMARKS

HOLE NO. **BH21**

BORINGS BY CME 55 Power Auger **DATE** 17 November 2011

SOIL DESCRIPTION	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	86.32
Compact, brown **SILTY SAND**	AU	1				
	AU	2				
	SS	3	62	14	1	85.32
	SS	4	0	13	2	84.32
- loose and grey by 2.9m depth					3	83.32
					4	82.32
5.59					5	81.32
Firm, grey **SILTY CLAY**					6	80.32
	TW	5	100			
					7	79.32
					8	78.32
9.60					9	77.32
End of Borehole						
(GWL @ 0.75m-Jan. 9/12)						



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Dev.-Eastboro Phase 2-Navan Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Limited.

FILE NO. PG2444

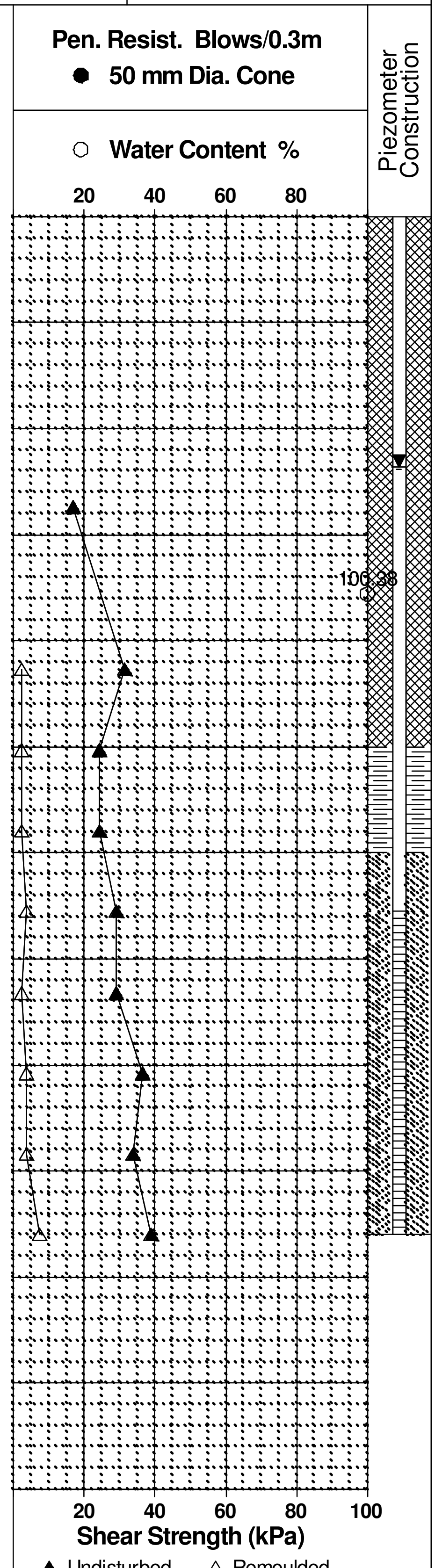
REMARKS

HOLE NO. BH22

BORINGS BY CME 55 Power Auger

DATE 17 November 2011

SOIL DESCRIPTION	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	86.08
TOPSOIL (to 0.48)	AU	1				
Compact, brown **SILTY SAND** (0.48 – 1.45)	AU	2				
	SS	3	71	10	1	85.08
Stiff, brown **SILTY CLAY,** trace sand (1.45 – 1.96)	SS	4		3	2	84.08
Firm, grey **SILTY CLAY** (1.96 – 9.60)					3	83.08
	TW	5	100			
					4	82.08
					5	81.08
					6	80.08
					7	79.08
					8	78.08
					9	77.08
Dynamic Cone Penetration Test commenced @ 9.60m depth. Cone pushed to 34.7m depth.					10	76.08
					11	75.08
					12	74.08



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Dev.-Eastboro Phase 2-Navan Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Limited.

REMARKS

BORINGS BY CME 55 Power Auger

DATE 17 November 2011

FILE NO. PG2444

HOLE NO. BH22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content % (20 40 60 80)	Piezometer Construction
GROUND SURFACE									
						12	74.08		
						13	73.08		
						14	72.08		
						15	71.08		
						16	70.08		
						17	69.08		
						18	68.08		
						19	67.08		
						20	66.08		
						21	65.08		
						22	64.08		
						23	63.08		
						24	62.08		

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Dev.-Eastboro Phase 2-Navan Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Limited.

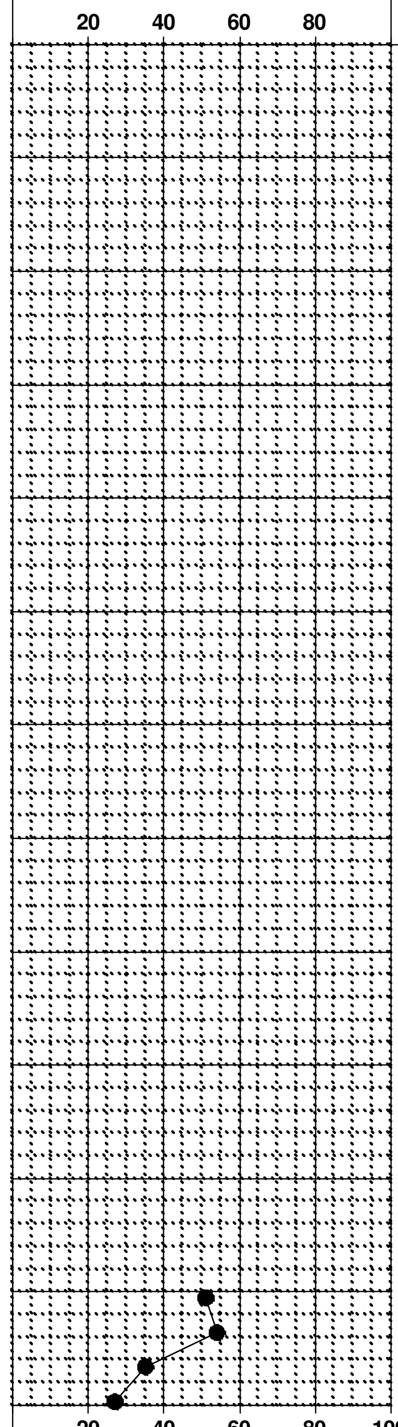
FILE NO. PG2444

REMARKS

HOLE NO. BH22

BORINGS BY CME 55 Power Auger **DATE** 17 November 2011

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE								20 40 60 80	
						24	62.08		
						25	61.08		
						26	60.08		
						27	59.08		
						28	58.08		
						29	57.08		
						30	56.08		
						31	55.08		
						32	54.08		
						33	53.08		
						34	52.08		
						35	51.08		
						36	50.08		



Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Dev.-Eastboro Phase 2-Navan Road
Ottawa, Ontario

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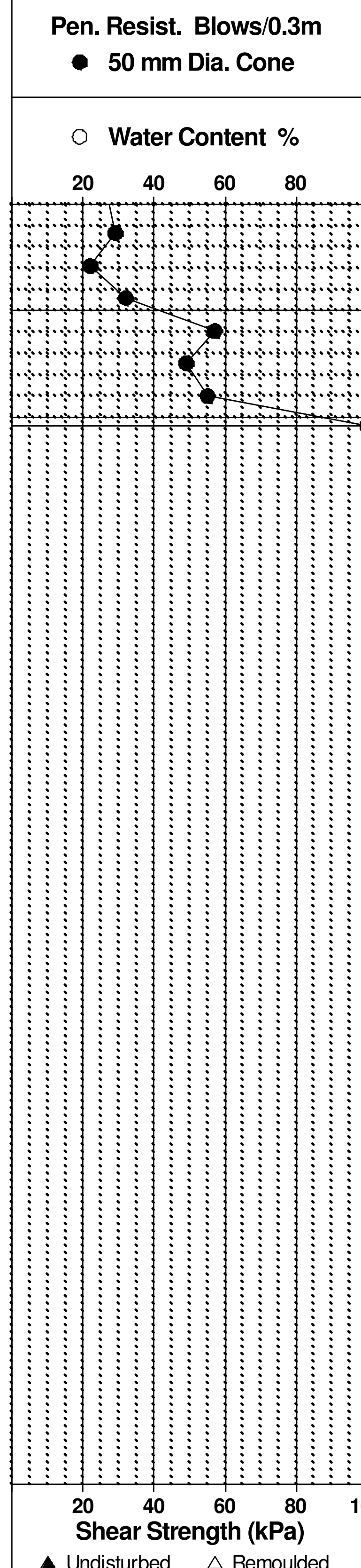
FILE NO. PG2444

REMARKS

HOLE NO. BH22

BORINGS BY CME 55 Power Auger **DATE** 17 November 2011

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						36	50.08
						37	49.08
38.08						38	48.08
End of Borehole Practical DCPT refusal @ 38.08m depth (GWL @ 2.36m-Jan. 9/12)							



Piezometer Construction

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Dev.-Eastboro Phase 2-Navan Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Limited.

FILE NO. PG2444

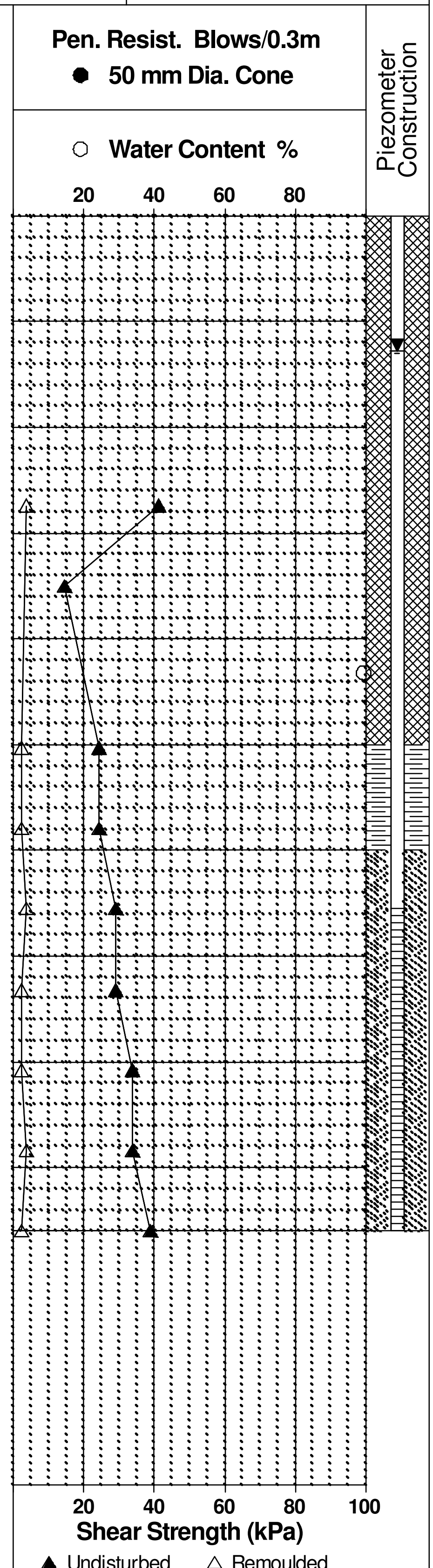
REMARKS

HOLE NO. BH28

BORINGS BY CME 55 Power Auger

DATE 22 November 2011

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	85.86
TOPSOIL (to 0.25)		AU	1				
Compact, brown **SILTY SAND,** trace clay		SS	2	50	18	1	84.86
- loose and grey by 1.45m depth (to 2.21)		SS	3	33	5	2	83.86
						3	82.86
Soft to firm, grey **SILTY CLAY** (to 9.60)		TW	4	100		4	81.86
						5	80.86
						6	79.86
						7	78.86
						8	77.86
						9	76.86
End of Borehole							
(GWL @ 1.28m-Jan. 9/12)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Dev.-Eastboro Phase 2-Navan Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Limited.

FILE NO. PG2444

REMARKS

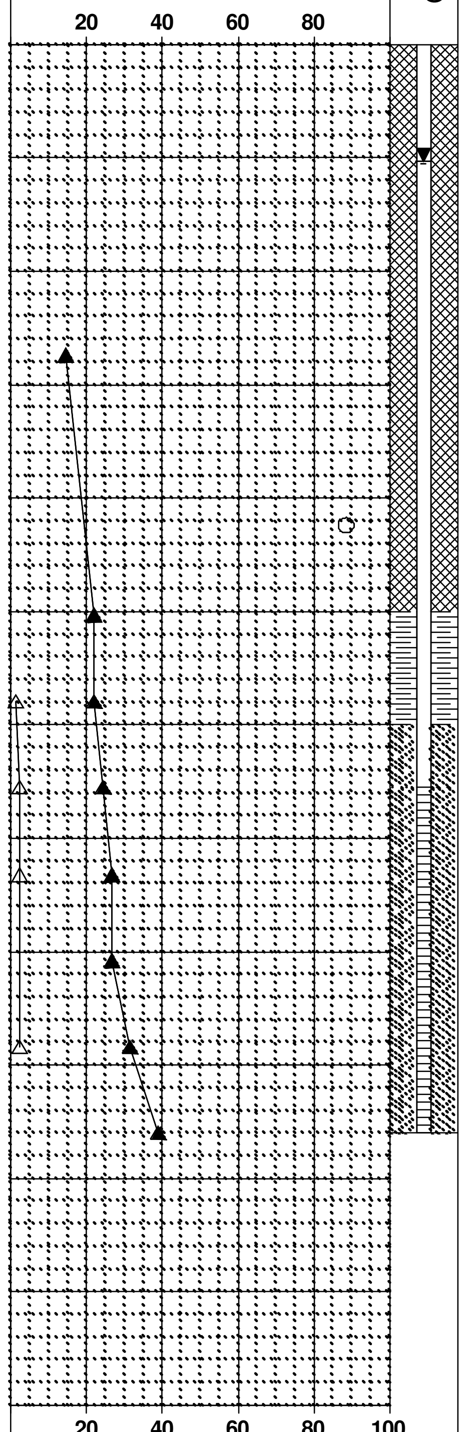
HOLE NO. BH29

BORINGS BY CME 55 Power Auger **DATE** 22 November 2011

SOIL DESCRIPTION	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	86.33
Compact, brown **SILTY SAND**	AU	1				
- grey by 1.45m depth	AU	2				
	SS	3	67	24	1	85.33
	SS	4	62	25	2	84.33
2.21						
Soft to firm, grey **SILTY CLAY**					3	83.33
	TW	5	0			
	TW	6	100		4	82.33
					5	81.33
					6	80.33
					7	79.33
					8	78.33
					9	77.33
9.60						
Dynamic Cone Penetration Test commenced @ 9.60m depth. Cone pushed to 33.1m depth.					10	76.33
					11	75.33
					12	74.33

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %

Piezometer Construction



Shear Strength (kPa)

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Dev.-Eastboro Phase 2-Navan Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Limited.

FILE NO. PG2444

REMARKS

HOLE NO. BH29

BORINGS BY CME 55 Power Auger **DATE** 22 November 2011

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content % (20 40 60 80)	Piezometer Construction
GROUND SURFACE						12	74.33		
						13	73.33		
						14	72.33		
						15	71.33		
						16	70.33		
						17	69.33		
						18	68.33		
						19	67.33		
						20	66.33		
						21	65.33		
						22	64.33		
						23	63.33		
						24	62.33		

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

patersongroup Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
East Urban Community-Phase I, Renaud Road
Ottawa, Ontario

DATUM Ground surface elevation at test pit locations provided by Annis, O'Sullivan, Vollebekk Ltd.

REMARKS

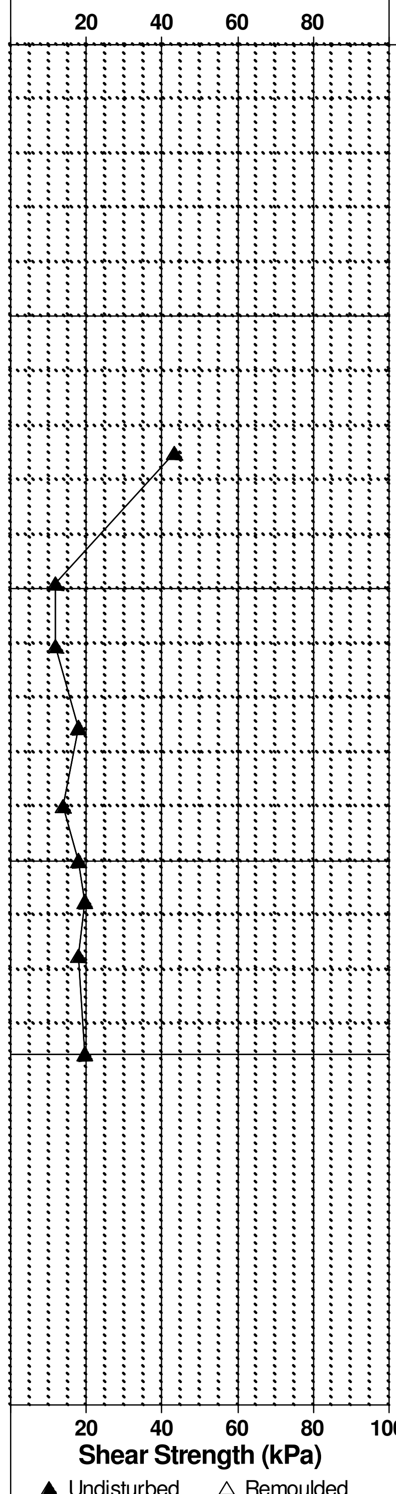
BORINGS BY Backhoe

DATE 17 Aug 09

FILE NO. PG1829

HOLE NO. TP 6-09

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	86.33		
TOPSOIL 0.15									
Brown **SILTY SAND** - grey by 0.9m depth 1.17						1	85.33		∇
Firm to soft, grey **SILTY CLAY** 3.71						2 3	84.33 83.33		
End of Test Pit (GWL @ 1.2m depth based on field observations)									



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28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
East Urban Community-Phase I, Renaud Road
Ottawa, Ontario

DATUM Ground surface elevation at test pit locations provided by Annis, O'Sullivan, Vollebekk Ltd.

REMARKS

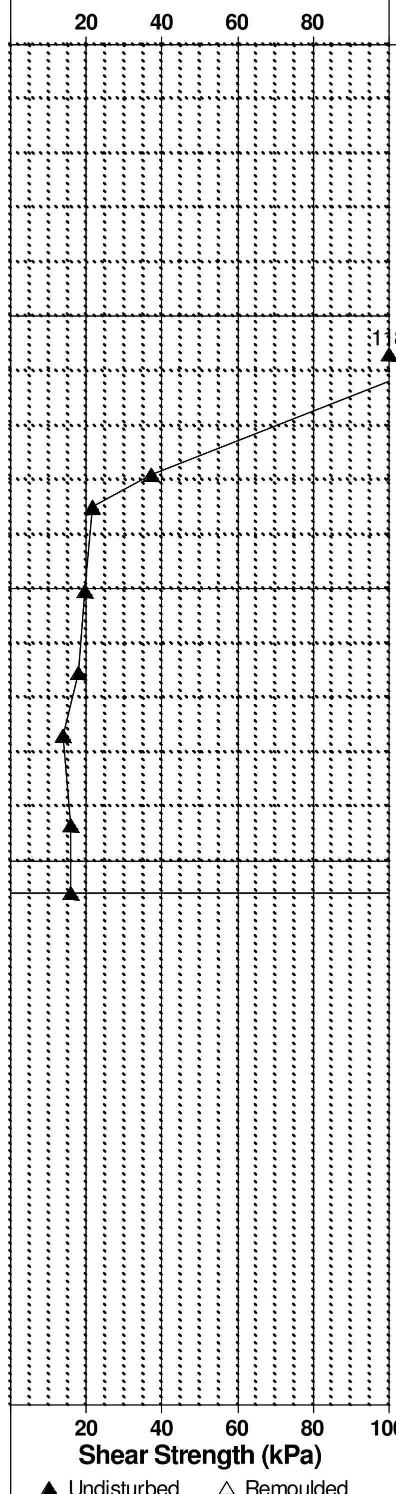
BORINGS BY Backhoe

DATE 17 Aug 09

FILE NO. PG1829

HOLE NO. TP 8-09

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	86.03		
TOPSOIL 0.18									
Brown **SILTY SAND** 1.07						1	85.03		∇
Very stiff to firm, red-brown **SILTY CLAY** - firm to soft and grey by 1.7m depth 3.12						2	84.03		
						3	83.03		
End of Test Pit (GWL @ 0.9m depth based on field observations)									



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28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
East Urban Community-Phase I, Renaud Road
Ottawa, Ontario

DATUM Ground surface elevation at test pit locations provided by Annis, O'Sullivan, Vollebekk Ltd.

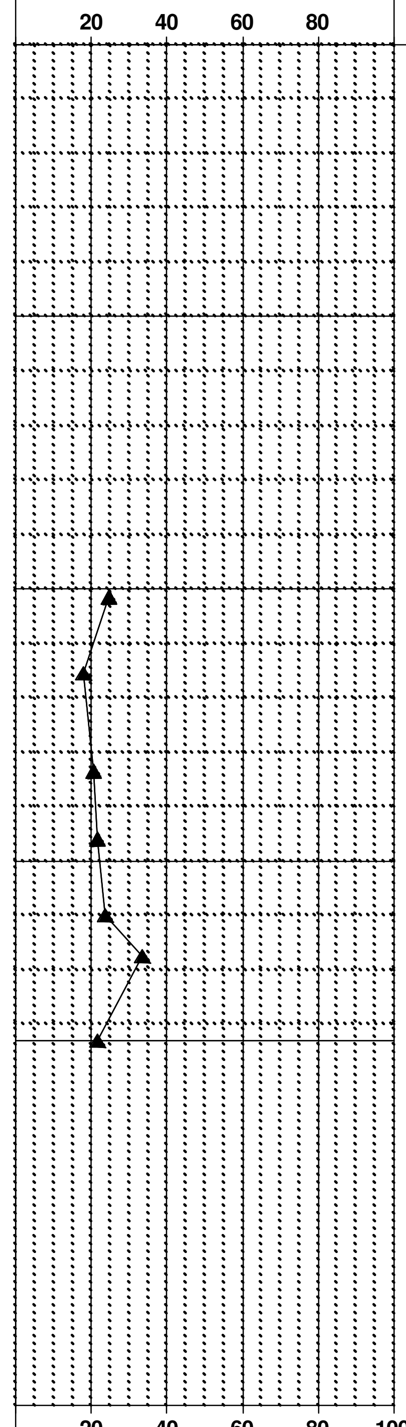
REMARKS

BORINGS BY Backhoe **DATE** 17 Aug 09

FILE NO. PG1829

HOLE NO. TP10-09

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	86.47		
TOPSOIL — 0.25									
Compact, red-brown **SILTY SAND** - grey by 1.5m depth — 1.98						1	85.47		▽
Red-brown **SILTY CLAY** - soft and grey by 2.3m depth — 3.66						2	84.47		
						3	83.47		
End of Test Pit (GWL @ 1.6m depth based on field observations)									



Shear Strength (kPa)

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
East Urban Community-Phase I, Renaud Road
Ottawa, Ontario

DATUM Ground surface elevation at test pit locations provided by Annis, O'Sullivan, Vollebekk Ltd.

REMARKS

BORINGS BY Backhoe

DATE 17 Aug 09

FILE NO. PG1829

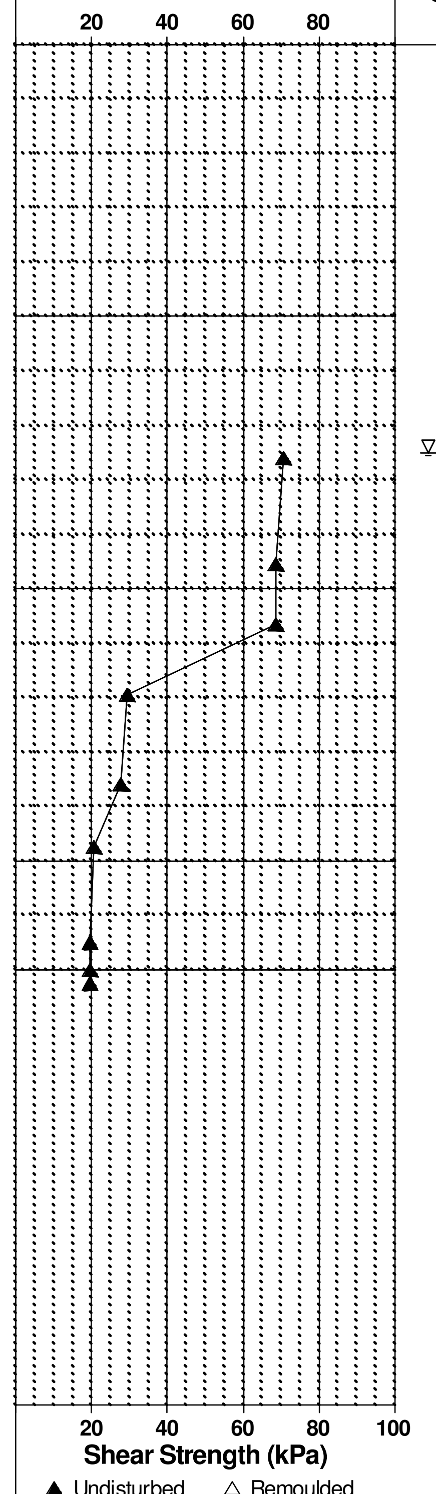
HOLE NO. TP11-09

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	86.11
TOPSOIL (to 0.28)							
Loose, brown **SILTY SAND** (0.28 to 1.07)						1	85.11
Stiff, grey-brown **SILTY CLAY,** trace sand - firm to soft and grey by 2.3m depth (1.07 to 3.40)						2	84.11
						3	83.11
End of Test Pit (GWL @ 1.5m depth based on field observations) (3.40)							

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

○ Water Content %

Piezometer Construction



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28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
East Urban Community - Renaud Road
Ottawa, Ontario

DATUM

REMARKS

BORINGS BY Hydraulic Shovel

DATE 28 Oct 09

FILE NO. PG1829

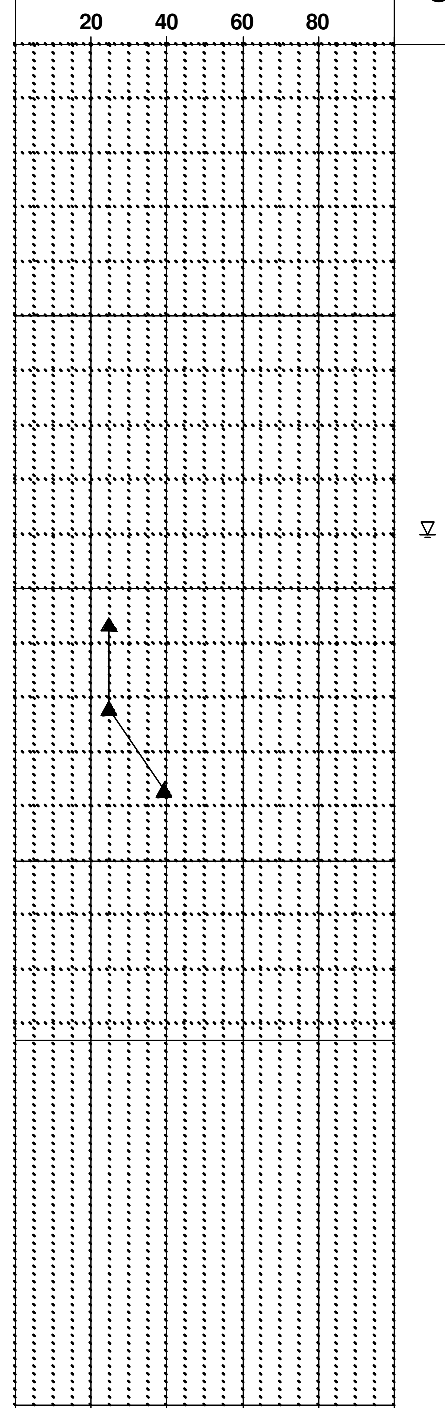
HOLE NO. TP15-09

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	
TOPSOIL (to 0.25)							
Red-brown **SILTY SAND** - grey by 0.7m depth (to 1.37)		G	1				
		G	2			1	
Soft to firm, brown **SILTY CLAY** - grey by 1.8m depth (to 3.66)						2	
						3	
End of Test Pit (Open hole GWL @ 1.8m depth)							

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

○ Water Content %

Piezometer Construction



Shear Strength (kPa)

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
East Urban Community - Renaud Road
Ottawa, Ontario

DATUM

REMARKS

BORINGS BY Hydraulic Shovel

DATE 28 Oct 09

FILE NO. PG1829

HOLE NO. TP16-09

SOIL DESCRIPTION	Depth to base (m)	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE						
TOPSOIL	0.10					
Brown **SILTY SAND** - grey by 0.7m depth	1.65		G G	1 2		
Soft to firm, grey **SILTY CLAY**	3.96					
End of Test Pit (Open hole GWL @ 1.8m depth)						

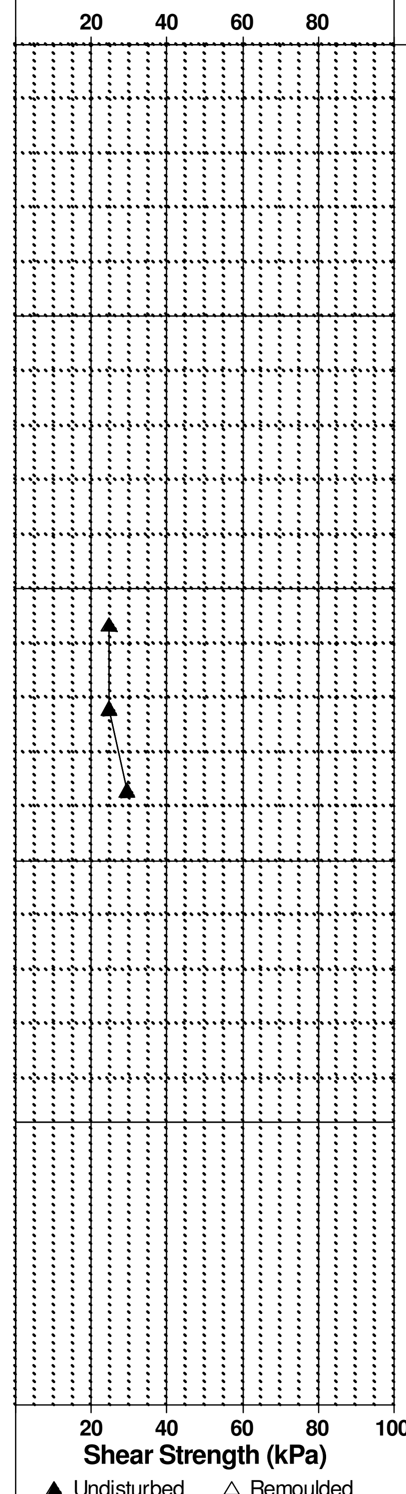
DEPTH (m): 0, 1, 2, 3

ELEV. (m)

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

○ Water Content %

Piezometer Construction



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28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
East Urban Community - Renaud Road
Ottawa, Ontario

DATUM

REMARKS

BORINGS BY Hydraulic Shovel

DATE 28 Oct 09

FILE NO. PG1829

HOLE NO. TP17-09

SOIL DESCRIPTION	Depth to base (m)	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE					
TOPSOIL	0.25				
Red-brown **SILTY SAND** - grey by 0.6m depth	1.83	G G	1 2		
Soft to firm, grey **SILTY CLAY**	3.66				
End of Test Pit (Open hole GWL @ 1.8m depth)					

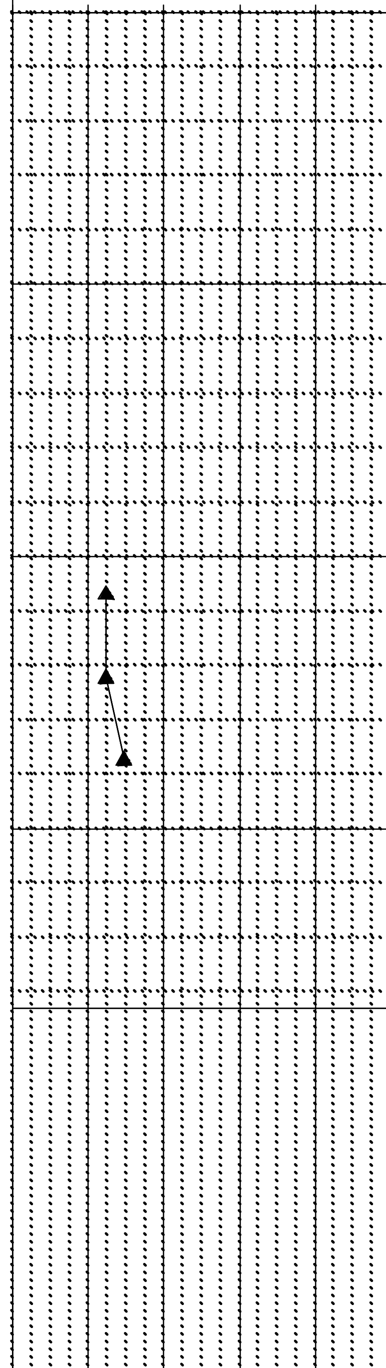
DEPTH (m): 0, 1, 2, 3

ELEV. (m)

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

○ Water Content %

20 40 60 80



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

Piezometer Construction

patersongroup Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

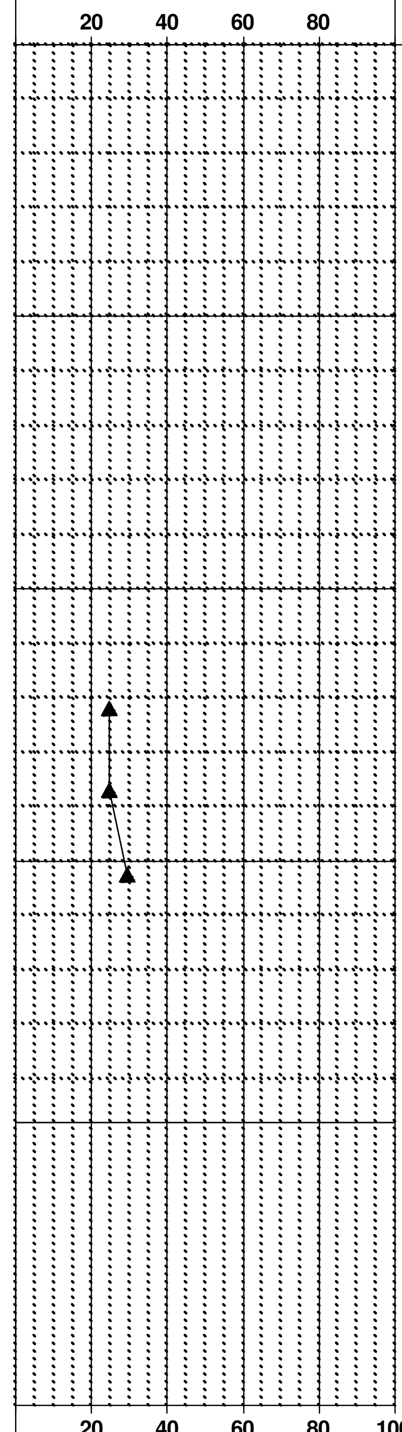
Geotechnical Investigation
East Urban Community - Renaud Road
Ottawa, Ontario

DATUM	**FILE NO.** PG1829
REMARKS	**HOLE NO.** TP18-09
BORINGS BY Hydraulic Shovel	**DATE** 28 Oct 09

SOIL DESCRIPTION	Depth to base (m)	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							0	
TOPSOIL	0.15							
Brown **SILTY SAND** - grey by 0.4m depth	1.98		G G	1 2			1	
Soft to firm, grey **SILTY CLAY**	3.96						2 3	
End of Test Pit (Open hole GWL @ 2.1m depth)								

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

○ Water Content %



Shear Strength (kPa)

▲ Undisturbed △ Remoulded

Piezometer Construction

patersongroup Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
East Urban Community - Renaud Road
Ottawa, Ontario

DATUM

REMARKS

BORINGS BY Hydraulic Shovel

DATE 28 Oct 09

FILE NO. PG1829

HOLE NO. TP19-09

SOIL DESCRIPTION	Depth to base (m)	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	
TOPSOIL	0.25						
Brown **SILTY SAND** - grey by 0.5m depth	2.74	G	1				
		G	2			1	
						2	
Soft to firm, grey **SILTY CLAY**	3.96	G	3			3	
End of Test Pit (Open hole GWL @ 2.7m depth)							

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

○ Water Content %

20 40 60 80

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

Piezometer Construction

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 strength of cohesionless soils is the relative density, 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.

Relative Density	‘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 vane tests, penetrometer tests, unconfined compression tests, or occasionally by Standard Penetration Tests.

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 is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil.

Terminology used for describing soil strata based upon texture, or the proportion of individual particle sizes present is provided on the Textural Soil Classification Chart at the end of this information package.

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 NXL size core. However, it can be used on smaller core sizes, such as BX, 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
PS	-	Piston sample
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size AXT, BXL, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

GRAIN SIZE DISTRIBUTION

MC%	-	Natural moisture 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 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 x 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

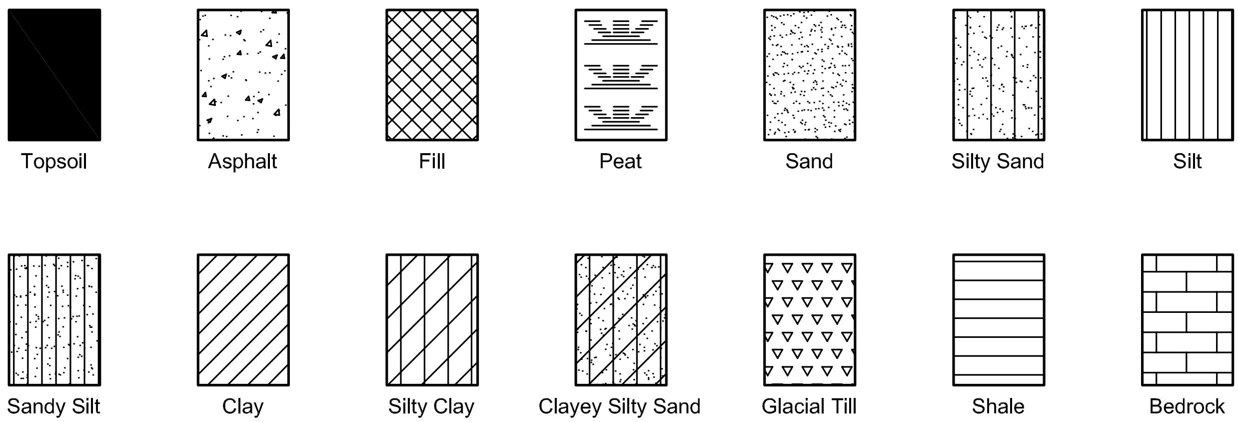
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void 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.

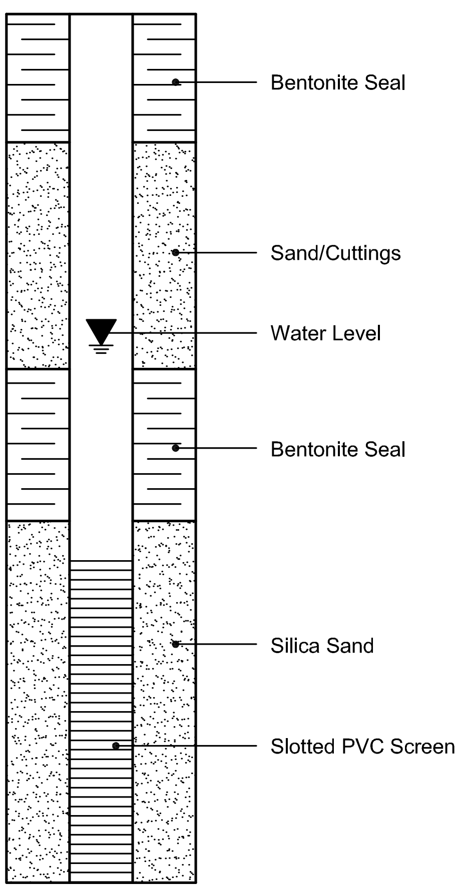
SYMBOLS AND TERMS (continued)

STRATA PLOT

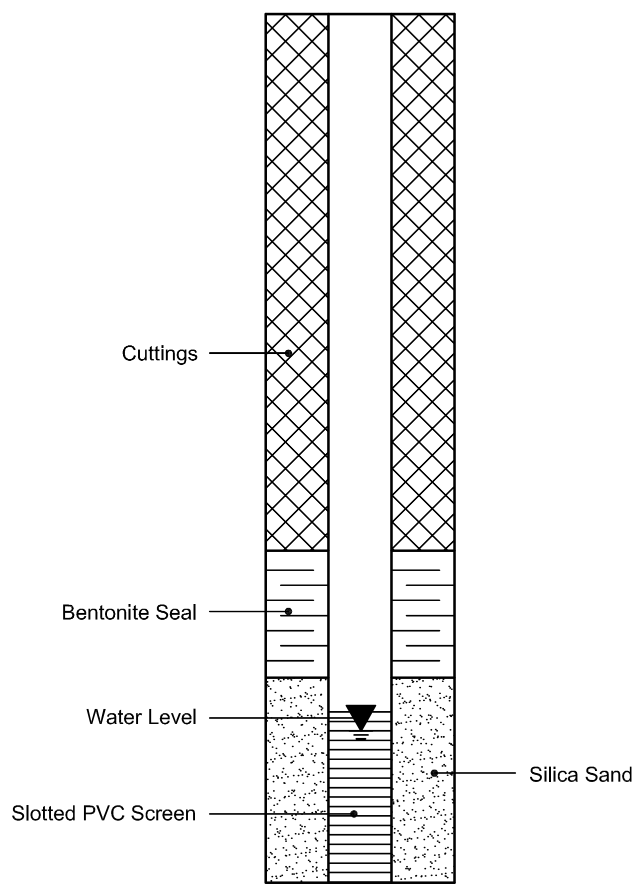


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



PROJECT: 07-1121-0129

RECORD OF BOREHOLE: 07-5

SHEET 1 OF 3

LOCATION: See Site Plan

BORING DATE: July 24, 2007

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE / SHEAR STRENGTH Cu, kPa (nat V. + Q - ●; rem V. ⊕ U - O)	HYDRAULIC CONDUCTIVITY k, cm/s / WATER CONTENT PERCENT (Wp, W, Wl)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		86.91							
0	Power Auger, 200mm Diam. (Hollow Stem)	Brown and grey brown silty sand, trace organic matter and gravel (FILL)		0.00	1	A.S.					
		TOPSOIL		86.23 / 0.68							
1		Loose grey brown very fine SAND, occasional silt layers		0.81	2	50 DO	7				
		Compact red orange to grey brown fine SAND, trace silt		85.69 / 1.22	3	50 DO	14				∇
2					4	50 DO	13				
3		Grey layered SILTY SAND, CLAYEY SILT and SILTY CLAY		84.01 / 2.90	5	50 DO	11				
		Firm grey SILTY CLAY		83.56 / 3.35				⊕ + ; ⊕ +			
4–5					6	73 TP	PH	⊕ + ; ⊕ +			
6					7	50 DO	PM	⊕ + ; ⊕ +			
7–11	60° Cone Penetration										Water level in open hole at 1.83m depth below ground surface upon completion of drilling
12–15		Probably grey Silty Clay		75.33 / 11.58							

CONTINUED NEXT PAGE

DEPTH SCALE 1 : 75

Golder Associates

LOGGED: P.A.H.

CHECKED: BDL

MIS-BHS 001 07-1121-0129.GPJ GAL-MISS.GDT 1/19/09 J.M.

PROJECT: 07-1121-0129

RECORD OF BOREHOLE: 07-5

LOCATION: See Site Plan

BORING DATE: July 24, 2007

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - ○ (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}); WATER CONTENT PERCENT Wp —○W— Wl (20 40 60 80)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		--- CONTINUED FROM PREVIOUS PAGE ---									
30	60° Cone Penetration	Probably loose Glacial Till		56.73 / 30.18							
33		End of Borehole		53.37 / 33.54							

DEPTH SCALE

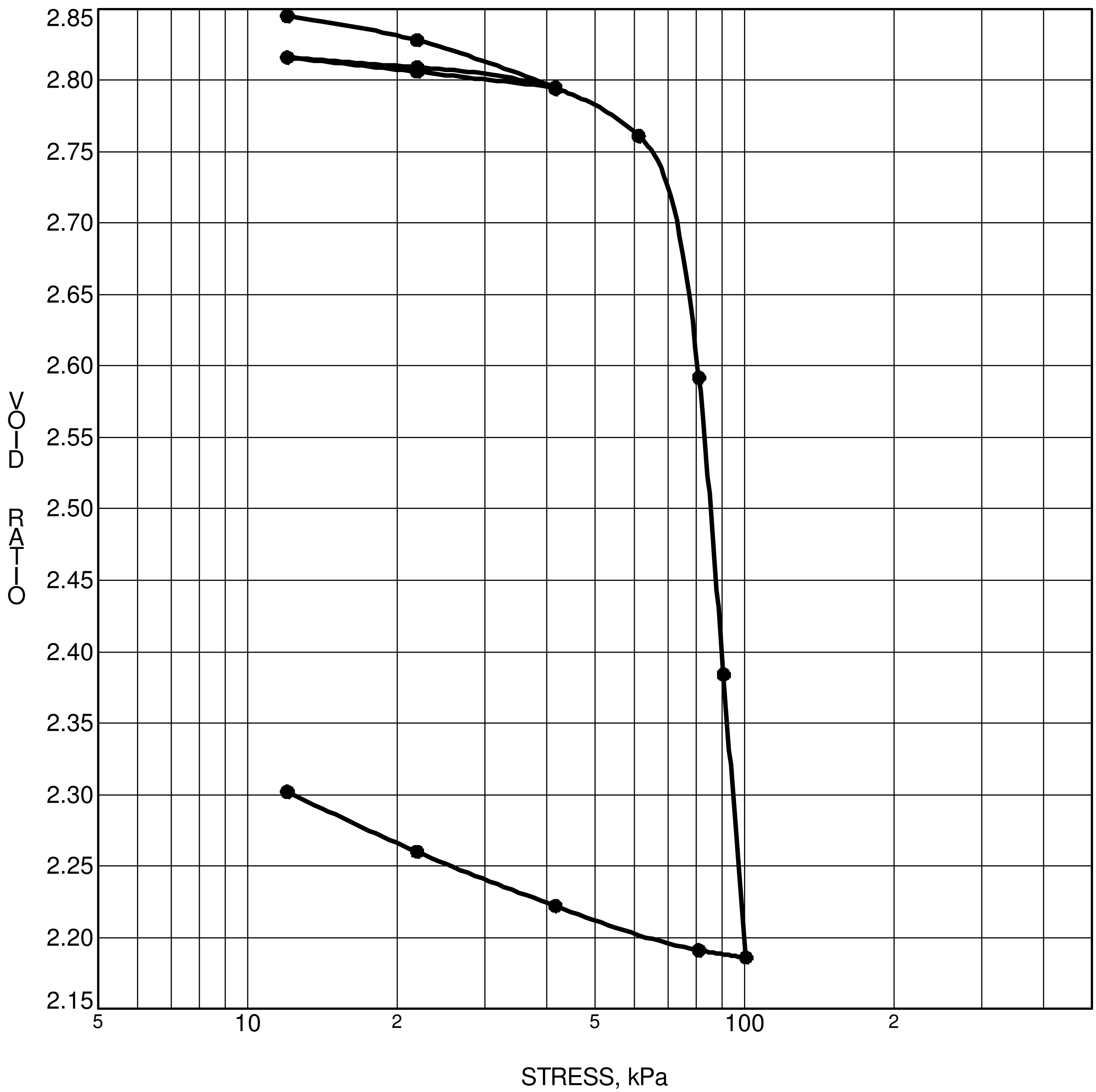
1 : 75

Golder Associates

LOGGED: P.A.H.

CHECKED: BAG

MIS-BHS 001 07-1121-0129.GPJ GAL-MISS.GDT 1/19/09 J.M.



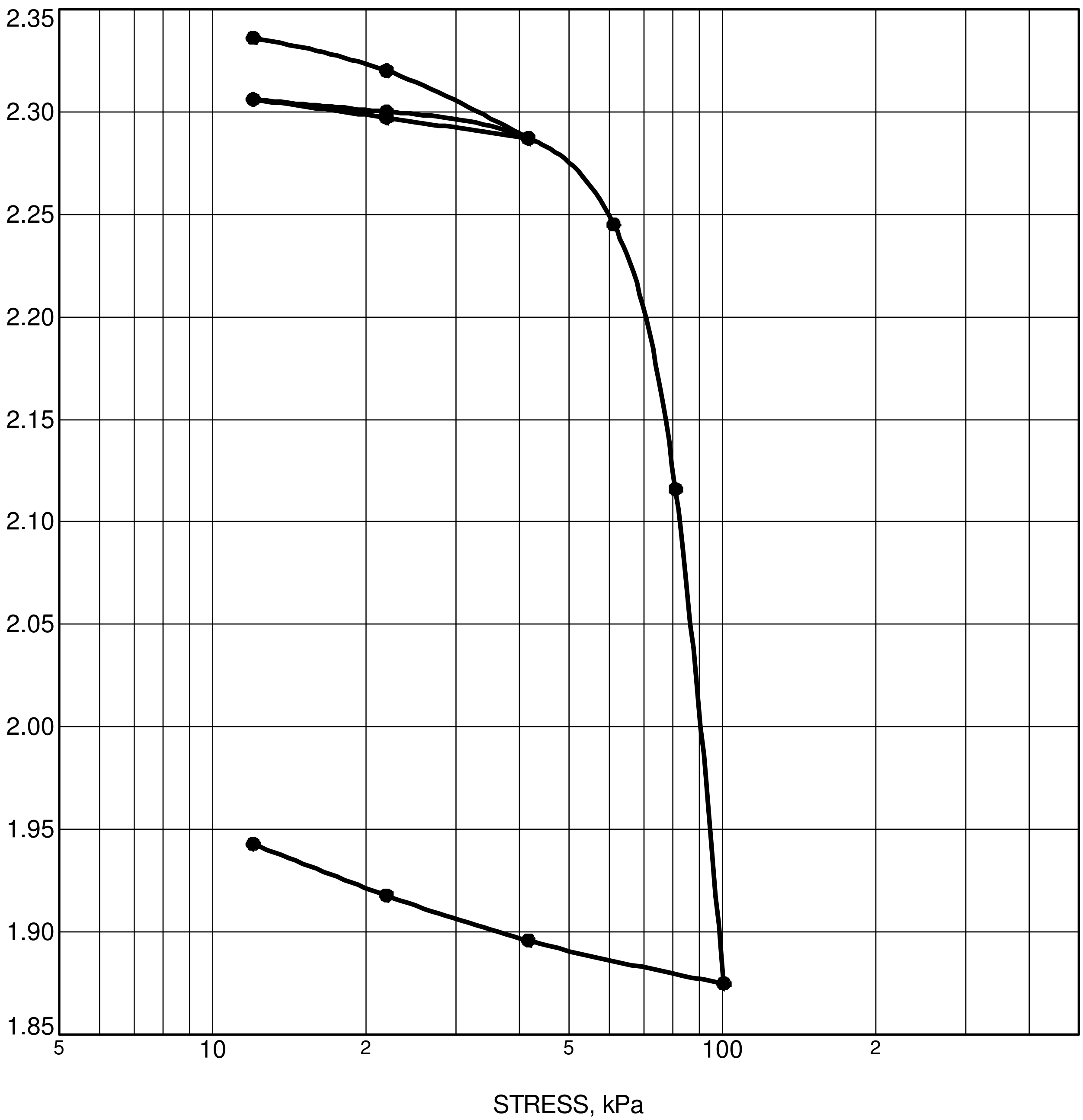
CONSOLIDATION TEST DATA SUMMARY					
Borehole No.	**BH 1-14**	p'_o	**35.1** kPa	Ccr	**0.040**
Sample No.	**TW 3**	p'_c	**75** kPa	Cc	**4.332**
Sample Depth	**2.74** m	OC Ratio	**2.1**	Wo	**83.0** %
Sample Elev.	**85.00** m	Void Ratio	**2.873**	Unit Wt.	**14.2** kN/m^3

CLIENT **Ashcroft Homes**
FILE NO. **PG2444**
PROJECT **Geotechnical Investigation - Prop. Residential Dev.-Eastboro Phase 2-Navan Road**
DATE **08/07/2014**

patersongroup **Consulting Engineers**

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

CONSOLIDATION TEST



CONSOLIDATION TEST DATA SUMMARY					
Borehole No.	BH 2-14	p'o	58.1 kPa	Ccr	0.035
Sample No.	TW 5	p'c	73 kPa	Cc	2.696
Sample Depth	5.82 m	OC Ratio	1.3	Wo	86.2 %
Sample Elev.	80.59 m	Void Ratio	2.371	Unit Wt.	14.9 kN/m^3

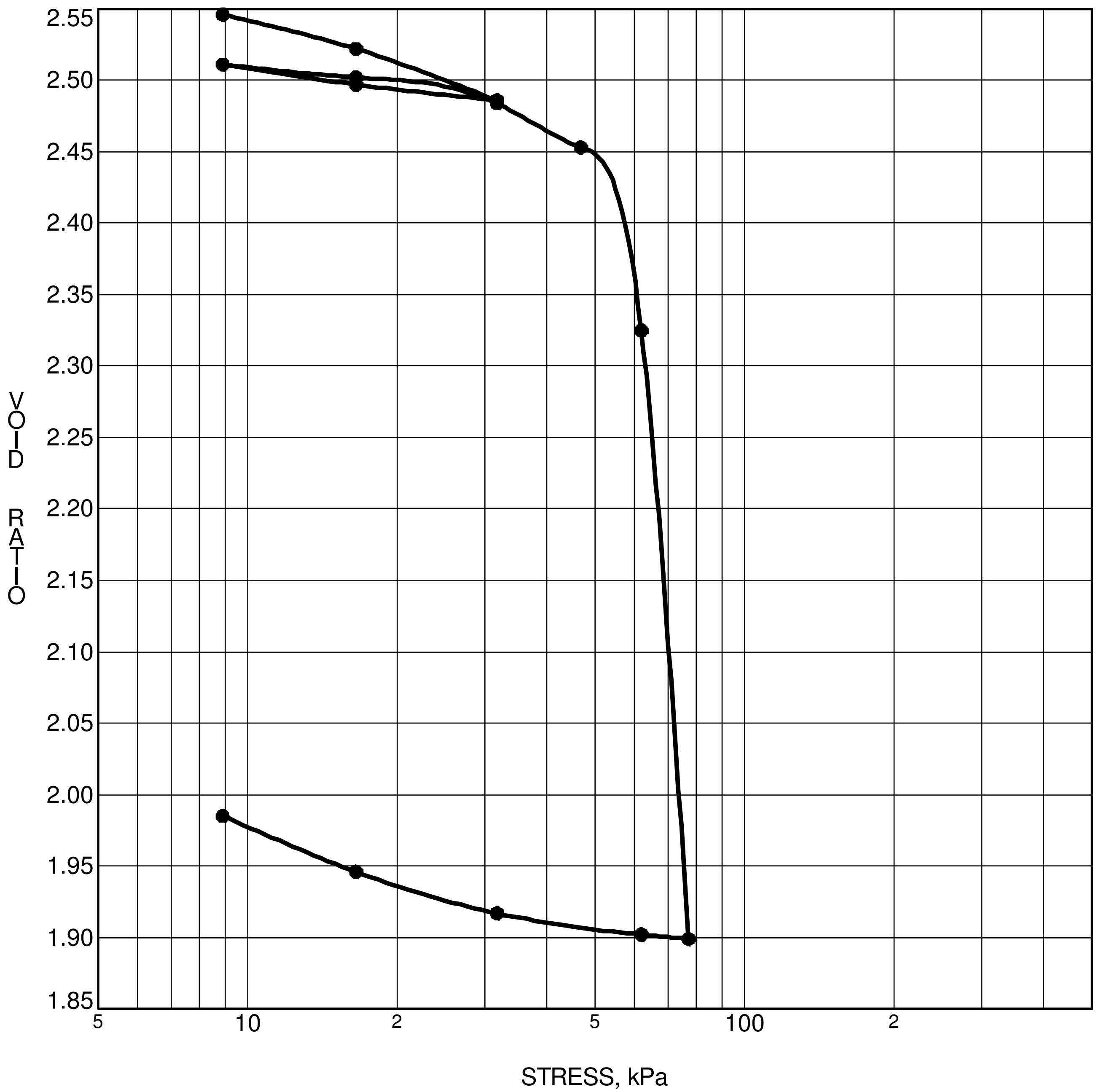
CLIENT **Ashcroft Homes** FILE NO. **PG2444**

PROJECT **Geotechnical Investigation - Prop. Residential Dev.-Eastboro Phase 2-Navan Road** DATE **23/06/2014**

patersongroup **Consulting Engineers**

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

CONSOLIDATION TEST



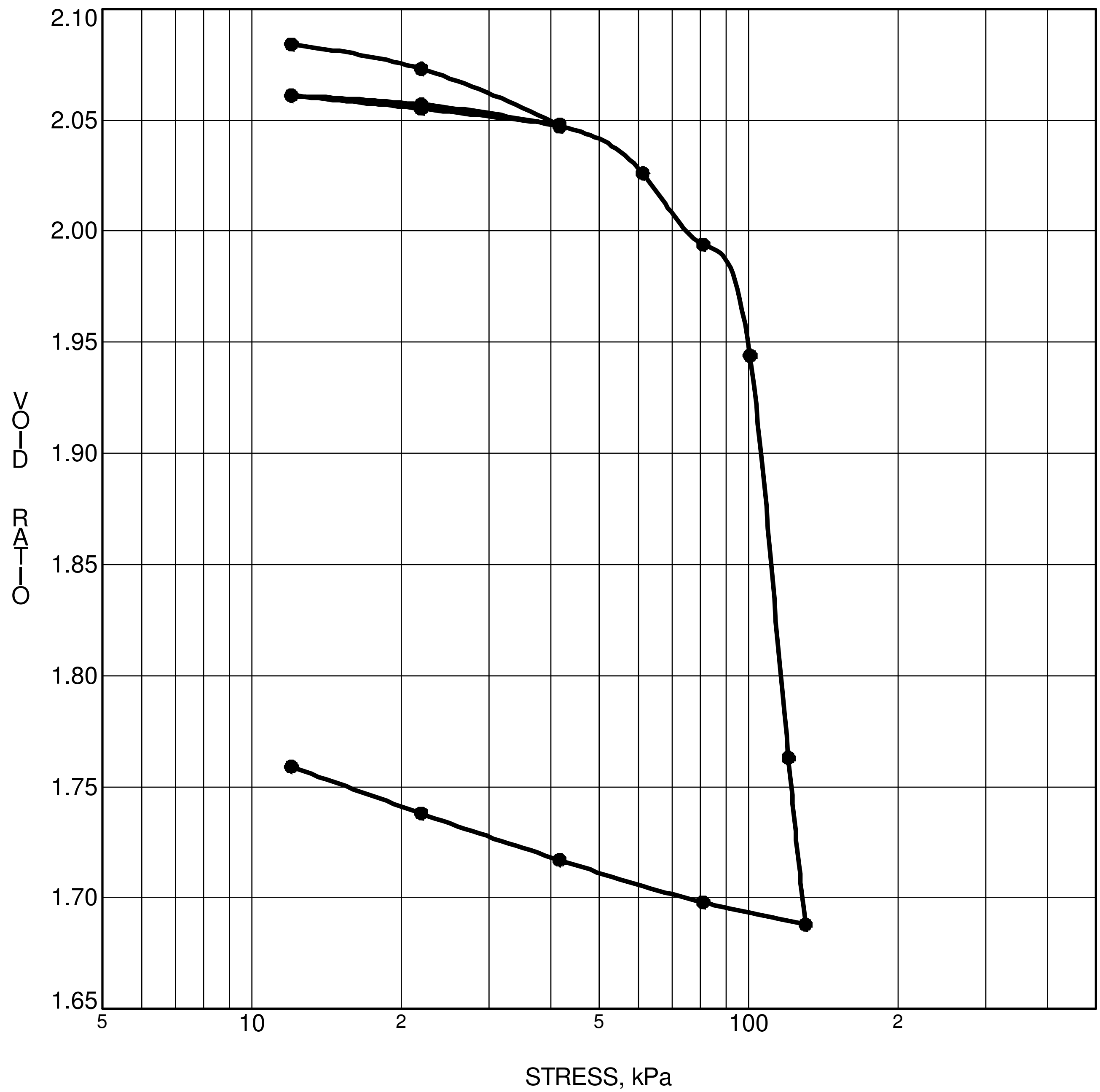
CONSOLIDATION TEST DATA SUMMARY					
Borehole No.	**BH 4-14**	p'_o	**32.6** kPa	Ccr	**0.046**
Sample No.	**TW 2**	p'_c	**58** kPa	Cc	**4.502**
Sample Depth	**2.64** m	OC Ratio	**1.8**	Wo	**93.8** %
Sample Elev.	**83.40** m	Void Ratio	**2.581**	Unit Wt.	**14.6** kN/m^3

CLIENT	**Ashcroft Homes**	FILE NO.	**PG2444**
PROJECT	**Geotechnical Investigation - Prop. Residential Dev.-Eastboro Phase 2-Navan Road**	DATE	**23/06/2014**

patersongroup **Consulting Engineers**

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

CONSOLIDATION TEST



CONSOLIDATION TEST DATA SUMMARY					
Borehole No.	**BH 5-14**	p'o	**53.2** kPa	Ccr	**0.024**
Sample No.	**TW 6**	p'c	**94** kPa	Cc	**2.325**
Sample Depth	**5.01** m	OC Ratio	**1.8**	Wo	**76.7** %
Sample Elev.	**81.36** m	Void Ratio	**2.108**	Unit Wt.	**15.3** kN/m 3

CLIENT **Ashcroft Homes** FILE NO. **PG2444**

PROJECT **Geotechnical Investigation - Prop. Residential Dev.-Eastboro Phase 2-Navan Road** DATE **23/06/2014**

patersongroup **Consulting Engineers**

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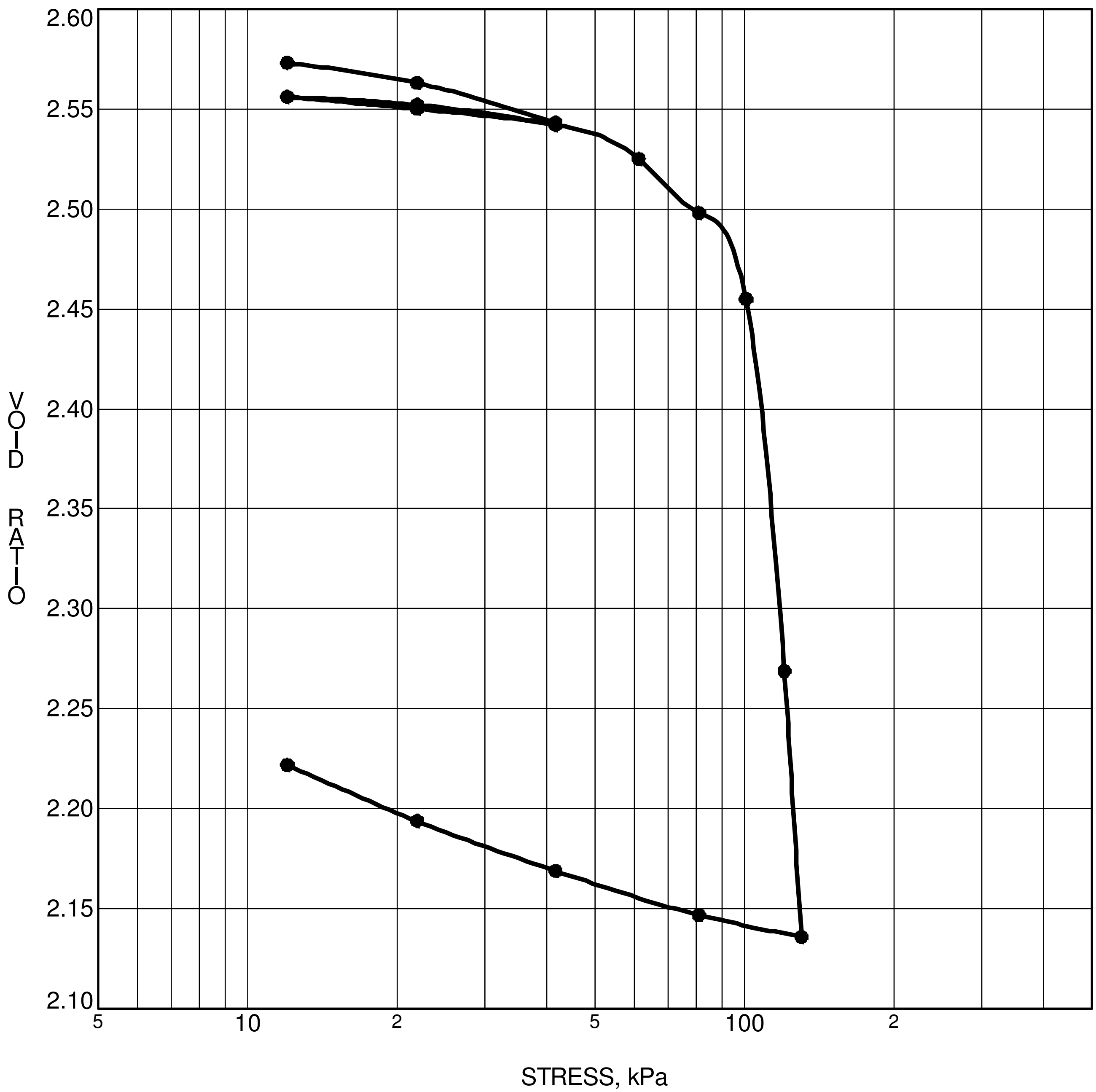
CONSOLIDATION TEST



CONSOLIDATION TEST DATA SUMMARY					
Borehole No.	**BH 6-14**	p'_o	**53** kPa	Ccr	**0.025**
Sample No.	**TW 7**	p'_c	**106** kPa	Cc	**4.203**
Sample Depth	**5.06** m	OC Ratio	**2.0**	Wo	**94.3** %
Sample Elev.	**81.50** m	Void Ratio	**2.593**	Unit Wt.	**14.6** kN/m^3

CLIENT	**Ashcroft Homes**	FILE NO.	**PG2444**
PROJECT	**Geotechnical Investigation - Prop. Residential Dev.-Eastboro Phase 2-Navan Road**	DATE	**08/07/2014**

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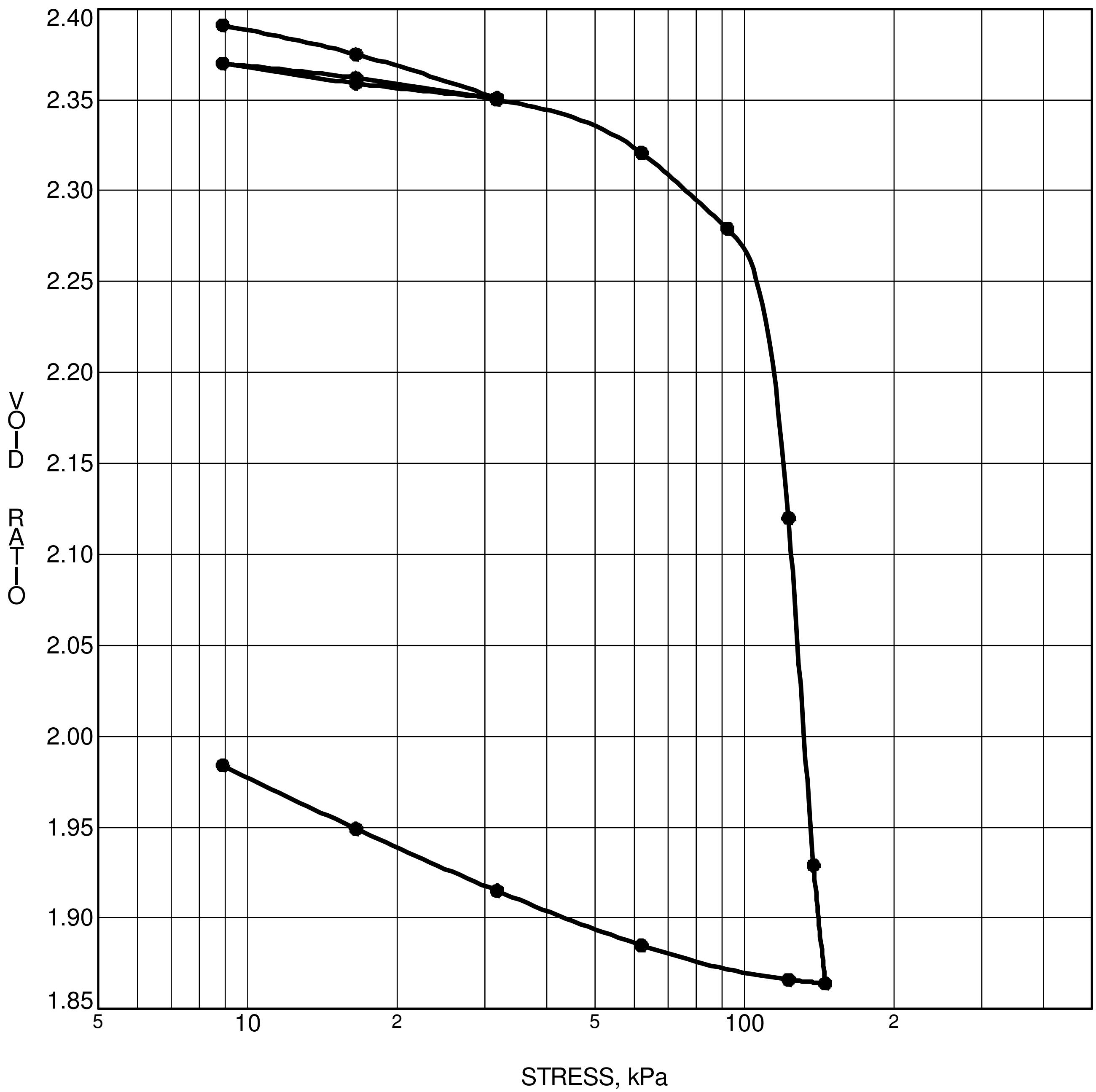
CONSOLIDATION TEST



CONSOLIDATION TEST DATA SUMMARY					
Borehole No.	BH 7A-14	p'_o	47.8 kPa	Ccr	0.036
Sample No.	TW 1	p'_c	109 kPa	Cc	3.654
Sample Depth	4.30 m	OC Ratio	2.3	Wo	87.3 %
Sample Elev.	81.85 m	Void Ratio	2.4	Unit Wt.	14.9 kN/m^3

CLIENT **Ashcroft Homes**

PROJECT **Geotechnical Investigation - Prop. Residential Dev.-Eastboro Phase 2-Navan Road**

FILE NO. **PG2444**

DATE **08/07/2014**

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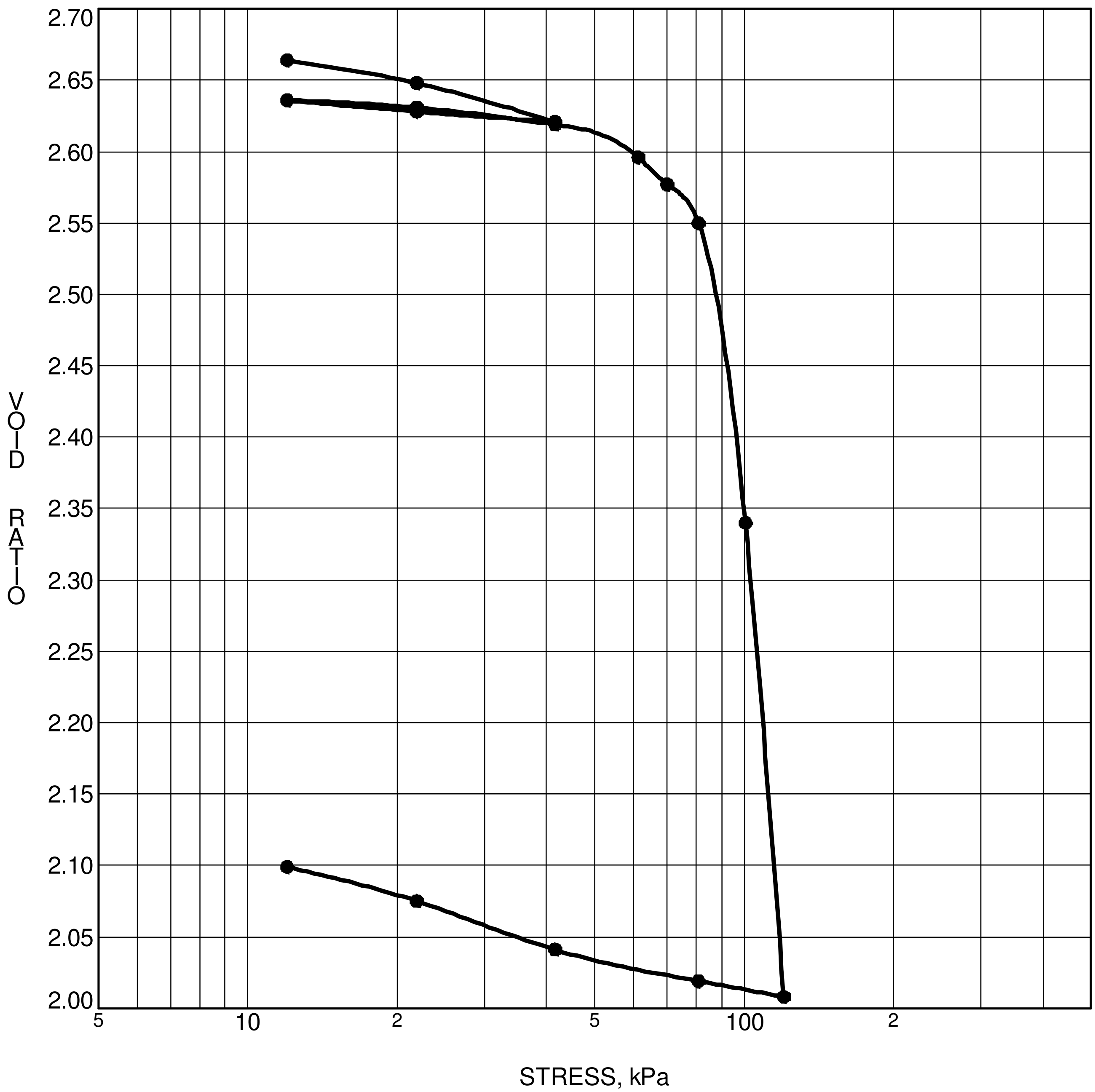
CONSOLIDATION TEST



CONSOLIDATION TEST DATA SUMMARY					
Borehole No.	**BH20**	p'o	**54** kPa	Ccr	**0.030**
Sample No.	**TW 5**	p'c	**90** kPa	Cc	**4.358**
Sample Depth	**4.32** m	OC Ratio	**1.7**	Wo	**97.7** %
Sample Elev.	**82.10** m	Void Ratio	**2.685**	Unit Wt.	**14.8** kN/m 3

CLIENT **Ashcroft Homes**

FILE NO. **PG2444**

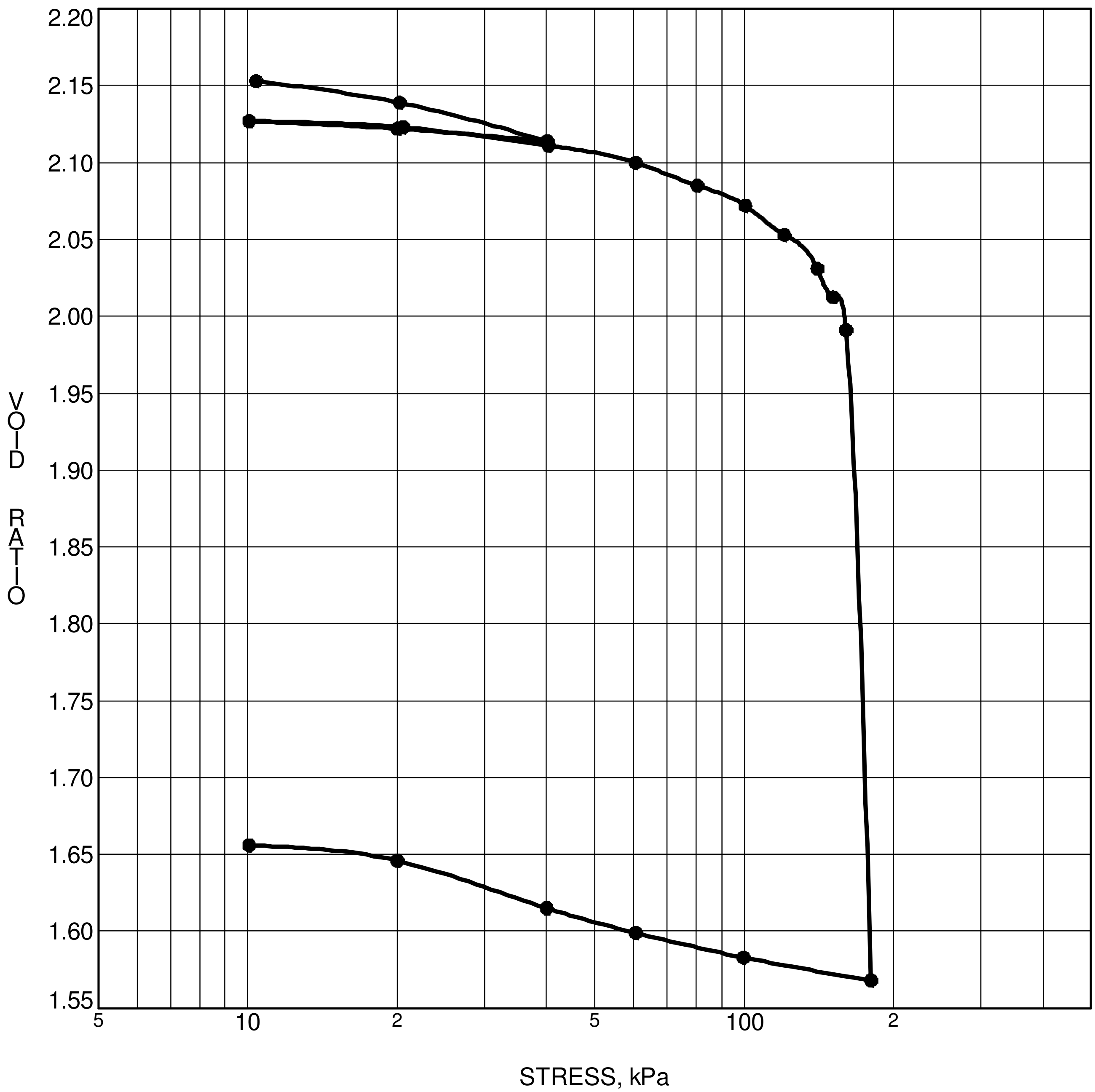
PROJECT **Geotechnical Investigation - Prop. Residential Dev.-Eastboro Phase 2-Navan Road**

DATE **12/5/2011**

patersongroup **Consulting Engineers**

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

CONSOLIDATION TEST



CONSOLIDATION TEST DATA SUMMARY					
Borehole No.	**BH21**	p'_o	**67** kPa	Ccr	**0.025**
Sample No.	**TW 5**	p'_c	**159** kPa	Cc	**8.018**
Sample Depth	**6.60** m	OC Ratio	**2.4**	Wo	**79.7** %
Sample Elev.	**79.72** m	Void Ratio	**2.193**	Unit Wt.	**15.7** kN/m^3

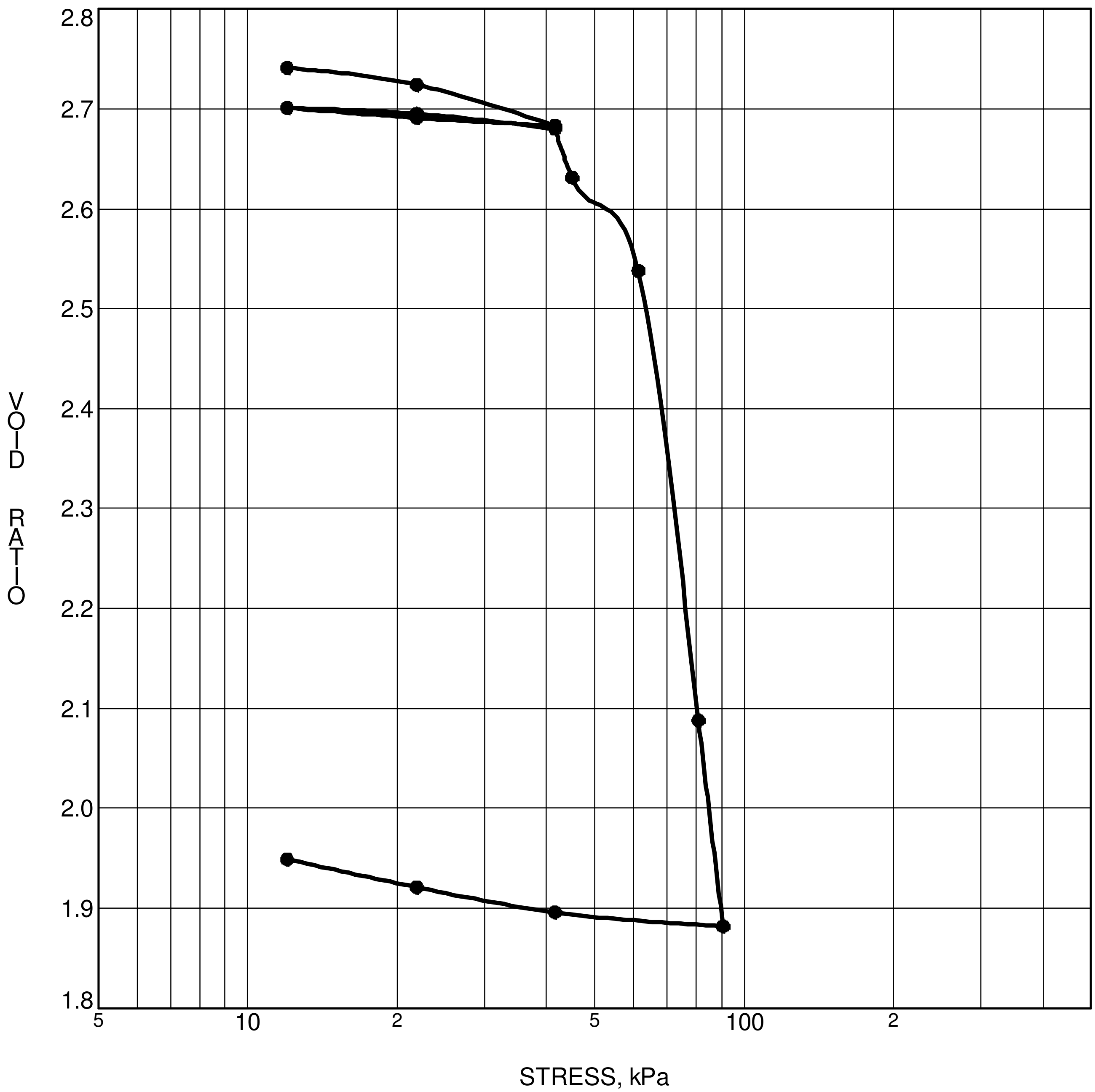
CLIENT **Ashcroft Homes** FILE NO. **PG2444**

PROJECT **Geotechnical Investigation - Prop. Residential Dev.-Eastboro Phase 2-Navan Road** DATE **12/6/2011**

patersongroup **Consulting Engineers**

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

CONSOLIDATION TEST



CONSOLIDATION TEST DATA SUMMARY					
Borehole No.	**BH22**	p'_o	**38** kPa	Ccr	**0.038**
Sample No.	**TW 5**	p'_c	**60** kPa	Cc	**4.296**
Sample Depth	**3.56** m	OC Ratio	**1.6**	Wo	**100.4** %
Sample Elev.	**82.52** m	Void Ratio	**2.76**	Unit Wt.	**14.8** kN/m^3

CLIENT **Ashcroft Homes** FILE NO. **PG2444**

PROJECT **Geotechnical Investigation - Prop. Residential Dev.-Eastboro Phase 2-Navan Road** DATE **12/12/2011**

patersongroup **Consulting Engineers**

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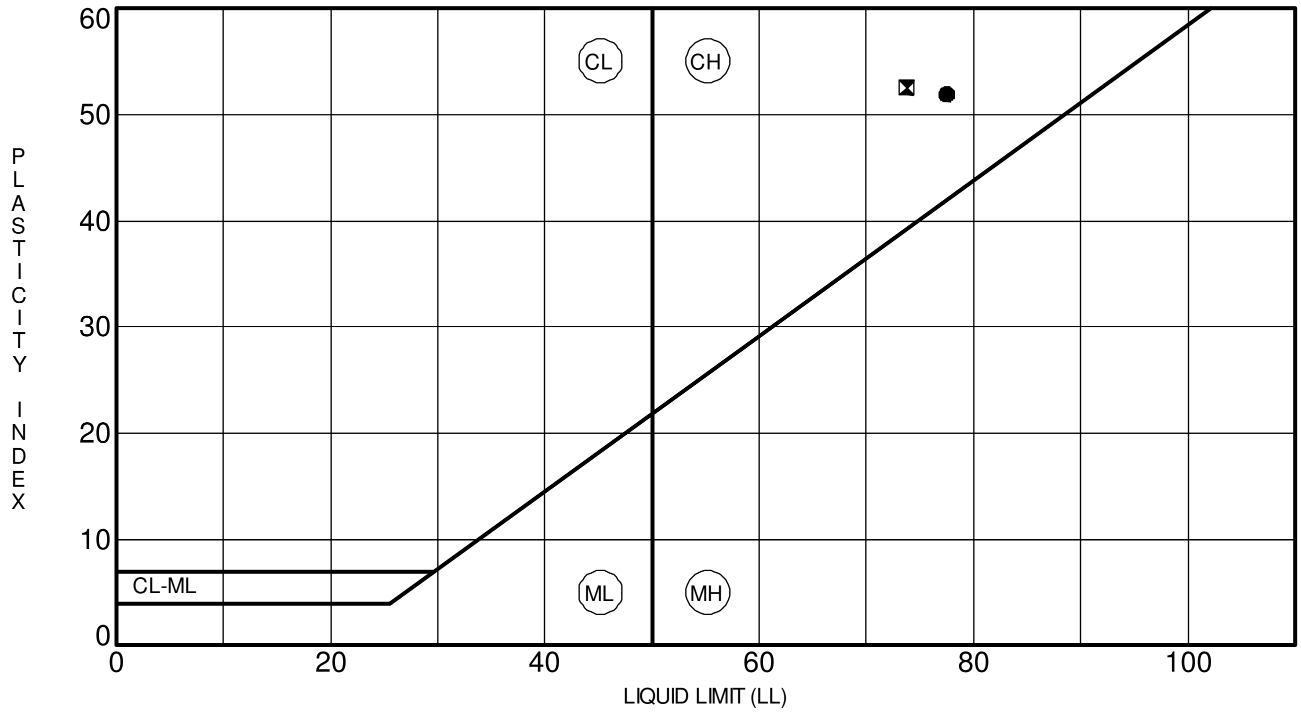
CONSOLIDATION TEST



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**BH 1-14**	**TW 3**	**77**	**26**	**52**		**CH - High plasticity inorganic clay**
⧗	**BH 4-14**	**TW 2**	**74**	**21**	**53**		**CH - High plasticity inorganic clay**

CLIENT **Ashcroft Homes**

FILE NO. **PG2444**

PROJECT **Geotechnical Investigation - Prop. Residential Dev.-Eastboro Phase 2-Navan Road**

DATE **13 Jun 14**

patersongroup **Consulting Engineers**

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

ATTERBERG LIMITS' RESULTS

PARACEL
LABORATORIES LTD.

Order #: 1436088

Certificate of Analysis

Report Date: 09-Sep-2014
Order Date:3-Sep-2014

Client: **Paterson Group Consulting Engineers**
Client PO: 16486
Project Description: PG2444

	Client ID:	BH3-14 SS6	BH5-14 SS4	-	-
	Sample Date:	16-Jun-14	16-Jun-14	-	-
	Sample ID:	1436088-01	1436088-02	-	-
	MDL/Units	Soil	Soil	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	62.0	78.5	-	-
General Inorganics					
pH	0.05 pH Units	7.92 [1]	6.63 [1]	-	-
Resistivity	0.10 Ohm.m	37.1	386	-	-
Anions					
Chloride	5 ug/g dry	10 [1]	<5 [1]	-	-
Sulphate	5 ug/g dry	134 [1]	<5 [1]	-	-

APPENDIX 2

FIGURE 1 - KEY PLAN

DRAWING PG2444-3 - TEST HOLE LOCATION PLAN

DRAWING PG2444-4 - PERMISSIBLE GRADE RAISE AREAS - BUILDINGS

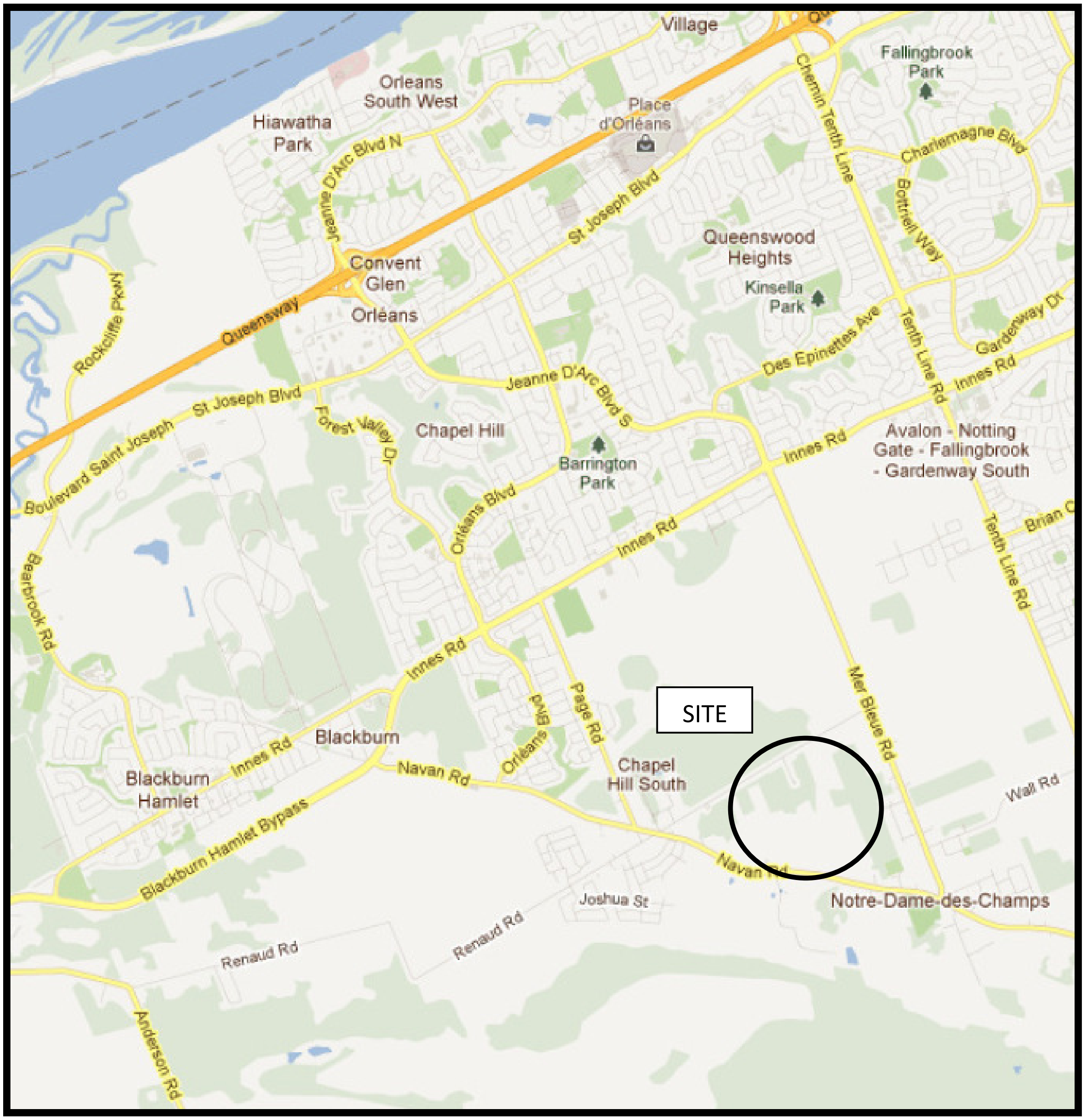


FIGURE 1

KEY PLAN

patersongroup

paterson group
consulting engineers

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

NO.	REVISIONS	DATE	INITIAL

ASHCROFT HOMES

GEOTECHNICAL INVESTIGATION
EASTBORO RESIDENTIAL DEVELOPMENT - PHASE 2 (A, B, C & F) - NAVAN ROAD
OTTAWA, ONTARIO

Title:
TEST HOLE LOCATION PLAN

Stamp:

Drawn by: MPG	Report No.: PG2444-2
Checked by: DJG	Drawing No.: PG2444-3
Scale: 1:1500	
Date: 09/2014	

paterson group
consulting engineers

154 Colonnade Road South
Ottawa, Ontario K2E 7J5
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NO.	REVISIONS	DATE	INITIAL

ASHCROFT HOMES

GEOTECHNICAL INVESTIGATION
EASTBORO RESIDENTIAL DEVELOPMENT - PHASE 2 (A, B, C & F) - NAVAN ROAD
OTTAWA, ONTARIO

Title:

PERMISSIBLE GRADE RAISE PLAN - BUILDINGS

Stamp:

Drawn by: MPG
Checked by: DJG
Scale: 1:1500
Date: 09/2014

Report No.: PG2444-2
Drawing No.: PG2444-4

Appendix E DRAWINGS