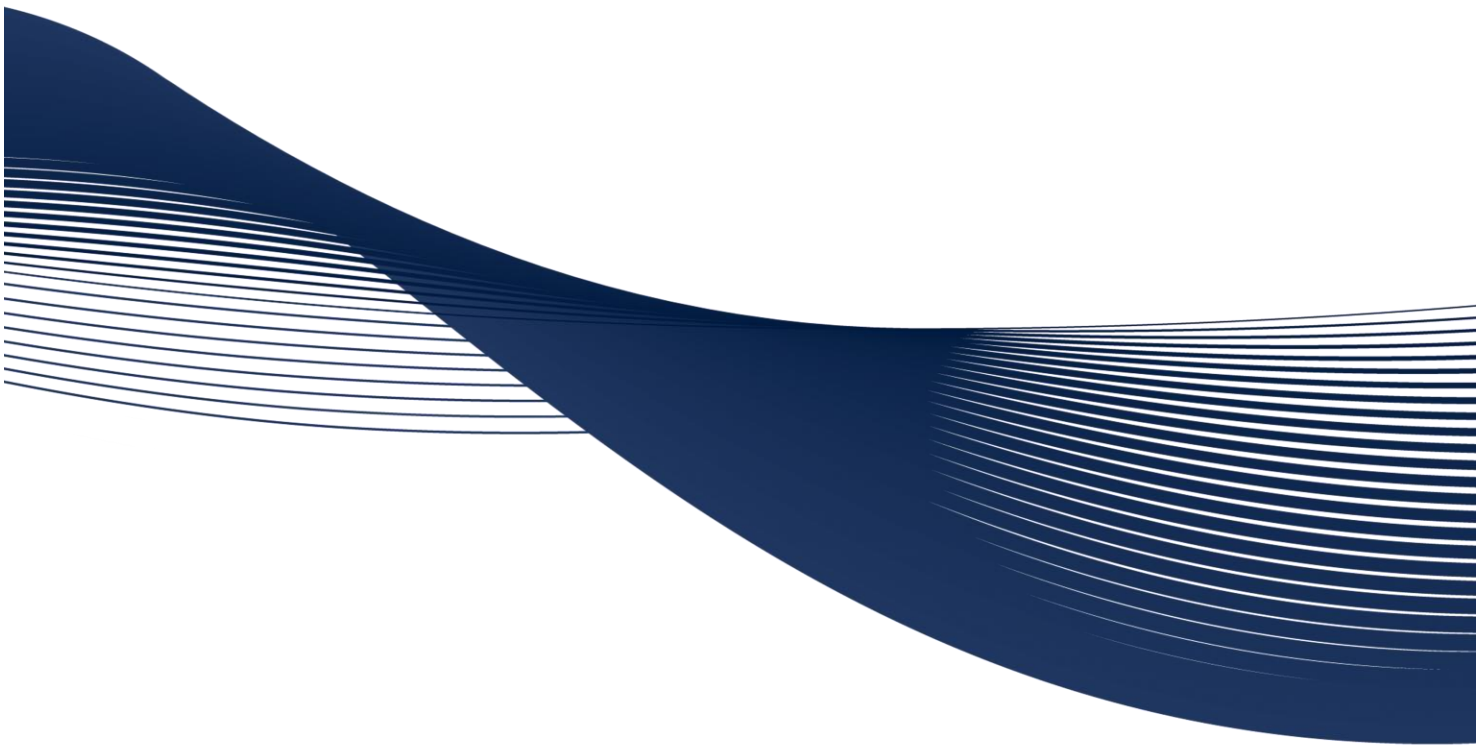
EVENDALE DEVELOPMENTS LTD.

FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT

Brock Street East Development, Township of Uxbridge

Project No.: 2017-0569



December 2017

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Issues and Revisions Registry

Identification	Date	Description of issued and/or revision
Final Report	December 2017	1st Submission

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1 Introduction

1.1 Background

Cole Engineering Group Ltd. (COLE) was retained by Evendale Developments Ltd. to prepare a Functional Servicing Report in support of Zoning By-law amendment for a proposed residential and commercial development located on part of Lot 31, Concession 7, in the Township of Uxbridge (the "Township"), Regional Municipality of Durham (the "Region"). The development comprises of 94 townhouses, a future development block, a commercial block containing five (5) residential units above and eight (8) semi-detached freehold homes. The purpose of this report is to provide site-specific information for the Township and Region to review with respect to the infrastructure required to support the proposed development regarding storm drainage, water supply, and sanitary discharge. More specifically, the report will present the following:

- Identify sanitary servicing opportunities and constraints, including:
  - Calculation of existing and proposed sanitary flows;
  - Review the capacity of the existing sanitary service connections; and,
  - Ensure that there is enough capacity within the receiving Regional sewers to accommodate the additional sanitary flows from the proposed development.
- Evaluate the existing Regional water system, including:
  - Calculation of the proposed domestic water and firefighting supply needs; and,
  - Confirm adequate flow exists to meet the additional required domestic and fire flow demands for the proposed development.
- Evaluate on a preliminary basis the Stormwater Management (SWM) opportunities and constraints, including:
  - Calculation of allowable and proposed runoff rates for the development;
  - Evaluate suitable methods for attenuation and treatment of stormwater runoff;
  - Develop and propose on-site control measures and examine theoretical performance; and,
  - Demonstrate compliance of the proposed stormwater control measures with the Township, the conservation authorities, the Ministries of the Environment and Climate Change (MOECC) and the Ministry of Natural Resources and Forestry (MNRF).

The following documents were reviewed during the preparation of this report:

- Stormwater Management Pond, As-built drawing, Prepared by Sernas and Associates Ltd., Drawing Number AB-102, dated March 3, 2003;
- Servicing, Grading, Stormwater Management and Erosion and Sediment Control drawings of Barton Farm Subdivision, Prepared by Sernas and Associates Ltd., Drawing Numbers, CD-002, SWM-001 to 004, ES-001 to 005, G-102 to 103 and DP-1, dated July 12, 1993;
- Stormwater Management Report Phase I, Prepared by Sernas and Associates Ltd., dated July 21, 2008;
- Stormwater Management Facility Phosphorous Removal Analysis for Barton Farm Phase IV, Prepared by Sernas and Associates Ltd., dated April 24, 2008;

- Stormwater Management Facility Retrofit Analysis for Barton Farm IV, Prepared by Sernas and Associates Ltd., dated February 21, 2000;
- Preliminary Engineering Report for Barton Farm Subdivision Phase IV, Prepared by Sernas and Associates Ltd., dated October 12, 1999; and,
- Stormwater Management Report for Barton Farm Plan of Subdivision 18T-87061, Prepared by Sernas and Associates, dated December 22, 1992.

1.2 Site Description

The subject site is located at the northwest corner of Brock Street East and Donland Lane in the Township of Uxbridge, Regional Municipality of Durham. The existing site is approximately 4.971ha in size which is occupied by Donland Lane and the east-west section of Herrema Boulevard. The legal description is as follows: Part of Lot 31, Concession 7, Township of Uxbridge.

The site is bound by a residential subdivision to the west, Brock Street East to the south, a wetland to the east, and a residential subdivision to the north. Refer to **Figures FIG 1** and **Figure FIG 2** following the report for location plan and aerial map of the site location.

2 Site Proposal

The proposed development consists of four (4) parcels. The Townhouse Development (Townhouse Block) is 3.043ha in size composed of 94 Condominium townhouse units. The access to the townhouses will be through two (2) private entrances from Brock Street East and Herrema Boulevard. The Commercial Block is 0.286ha in size composed of two (2) buildings (GFA 0.047ha) with five (5) residential units above and a parking lot. The access to the commercial block will be through one private entrance from Herrema Boulevard. The Freehold development (Freehold Block) is 0.315ha in size composed of eight (8) semi-detached units. The access to each unit will be through one private entrance for each unit from Low Boulevard. The Future Development Block is 0.330ha in size with future access off Herrema Boulevard. Refer to **Appendix A** for details.

3 Terms of Reference and Methodology

3.1 Terms of Reference

Design criteria for the municipal services will be in accordance with the Region, Township, and MOECC:

- Post-development peak flows for all events from the site should be controlled to the peak flow resulting from the pre-development conditions;
- Stormwater should be treated to Enhanced Protection (Level 1) as defined in the MOECC Stormwater Management Planning & Design (SWMPD) Manual (2003); and,
- The Township's intensity-duration-frequency (IDF) data was used for the quantity control analysis.

3.2 Methodology: Stormwater Drainage and Management

The SWM portion of this report demonstrates that the required SWM controls will be achieved as per the provincial, conservation authority and municipal standards. The SWM standards applied are summarized below.

Water Quality

As per MOECC SWMPD Manual (2003), Level 1 (enhanced) quality control (i.e. long-term average removal of 80% of the total suspended solids (TSS) on an annual loading basis) shall be achieved.

Water Quantity

Post- to-Pre- peak flow attenuation up to and including 100-year storm shall be achieved. In this case, on-site control is proposed using underground storage (i.e. super pipes / storage chambers) in conjunction with the existing SWM pond designed to receive flows from the subject site. The release rates will be controlled using a flow regulation device (i.e. orifice plate). The Modified Rational Method is applied for sizing the storage volume using the IDF curves specified in the Township standards.

Water Balance

Post- to Pre- water balance shall be achieved as per the Lake Simcoe Region Conservation Authority (LSRCA)'s Stormwater Management Guidelines.

Phosphorous Removal

Post-development phosphorus annual loading will be mitigated to the pre-development level as per the Lake Simcoe Region Conservation Authority (LSRCA)'s Stormwater Management Guidelines.

3.3 Methodology: Sanitary Discharge

The sanitary sewage discharge from the proposed site was determined using sanitary sewer design sheets based on Region's Design Standards that consider the land use and building statistics as supplied by the design team. The calculated values provide peak sanitary flow discharge with infiltration considerations.

The estimated sanitary discharge flows from the existing site as well as the proposed site will be calculated based on the criteria shown in **Table 3.1** below.

Table 3.1 Sanitary Flows

Usage	Design Flow	Units	Persons
Existing Residential	364	Litres / person / day	Single Family Dwelling: 3.5 Persons / Unit
Residential	364	Litres / person / day	Single & Semi: 3.5 Persons / Unit Townhouses 3.0 Persons / Unit 1 bedroom Apartment: 1.5 Persons / Unit 2 bedroom Apartment: 2.5 Persons / Unit
Commercial	180,000	Litres / ha / day	86 Persons / ha

Based on the calculated peak flows, the adequacy of the existing infrastructure to support the proposed development will be discussed.

3.4 Methodology: Water Usage

The proposed watermain system will be designed in accordance with the following guidelines and standards:

- Region of Durham's Design Specifications, dated April 2014;
- The MOECC Design Guidelines for Drinking-Water Systems, dated 2008; and,
- Fire Underwriters Survey (FUS), Water Supply for Public Fire Protection, dated 1999.

The system design pressure and demand requirements for the subject development are summarized in **Table 3.2** below.

Table 3.2 Water Supply Design Criteria

Design Criteria	Requirement
Domestic Demand	Average daily demand of 364 litres / capita / day
Residential Population Density	3.5 persons per unit (ppu) for single family and semi-detached; 3.0 persons per unit (ppu) for townhouses; 2.5 ppu for 2 bedroom apartment units; and, 1.5 ppu for 1 bedroom apartment units.
Peaking Factor	Maximum Day = 2.75 and Peak Hour = 4.13 for population less than 1,000 for the subject development (MOECC, 2008)
Fire Flow	Calculated as per Water Supply for Public Fire Protection (FUS, 1999)
System Pressure	Minimum Pressure = 275kPa (40 psi) under normal operating condition; Minimum Pressure = 140kPa (20 psi) during Maximum Day + Fire Flow; and, Maximum Pressure = 700kPa (100 psi) under any flow scenario.
Pipeline Sizing	Minimum size of 150mm diameter in residential areas; 300 mm diameter in commercial, industrial and institutional areas.
"C" Factor	C=100 for 150mm diameter watermain; C=110 for 200 to 300mm diameter watermain; and, C=120 for 350 to 600mm diameter watermain.

Fire suppression flow calculations were undertaken in accordance with Region Fire Suppression Standards. This requirement will be compared to the existing conditions to determine the adequacy of the water infrastructure to support the proposed development.

4 Stormwater Management and Drainage

4.1 Design Criteria

As previously mentioned, the proposed SWM scheme is proposed to meet the MOECC SWMPD Manual (2003), LSRCA's Technical Guidelines and Township standards. The following design criteria will be applied:

- Quality Control: Level 1 Enhanced Level protection, i.e., annually 80% TSS removal, as defined in the MOECC SWMPD Manual (2003);
- Quantity Control: Post- to Pre- peak flow attenuation up to and including 1:100 year design storm events. The Township's IDF data to be used for analysis;
- Water Balance: Post-development to Pre-development water balance; and,
- Phosphorus Removal: Post-development phosphorus annual loading will be mitigated to the pre-development level.

4.2 Existing Conditions

The existing site land use and land cover is open space with the existence of stockpiles and some completed site grading. The site is generally flat and slopes from the south-west to north-east, with an average elevation of 270.0m at the south and 267.0m at the north border. An existing south-north channel and a temporary pond is located at the east quadrant of the site. There is no engineering designed outlet structure for the temporary pond. During major storm events, the runoff generated on-site flows from south to the north as overland flow in general, with some areas draining to the existing pond via the site channel, and discharging into the existing ditch to the north of the site. The pre-development drainage area plan **Figure DAP-1** can be found in **Appendix B**.

The subject site has been included in the Barton Farm Subdivision Plan and subsequent SWM Pond design as a proposed future development with an assumed impervious value of 0.35. As such, the requires SWM quantity, quality and erosions controls for the subject site may be achieved entirely through the use of the existing SWM pond if the impervious value from the site does not exceed the original target of 0.35. If the impervious value of the site exceeds 0.35, additional SWM controls may be required.

4.3 Proposed Storm Drainage System

The proposed development will consist of the construction of 94 condominium townhouse units, two (2) commercial building with residential units above, eight (8) semi-detached freehold units, as well as multiple laneways and parking areas. Based on the proposed grading scheme of the site, the development will be comprised of a total of seven (7) internal drainage areas. Drainage Area A2 – A6 Post will be conveyed at a controlled rate into the existing Barton Farm SWM pond. Drainage Area A1 Post will discharge uncontrolled from the site and be conveyed also into the existing SWM pond. Drainage Area A7 Post will discharge uncontrolled to Brock Street located to the south of the site. The post-development drainage area plan **Figure DAP-2** can be found in **Appendix B**.

Composite runoff coefficients were calculated for each drainage areas using a runoff coefficient of 0.90 for impervious areas and 0.25 for pervious areas. Additionally, runoff coefficients were increased for storm events greater than 10-year storm events and a minimum time of concentration of 10 minutes was used as per the Town's standards. Post-development drainage areas and runoff coefficients are illustrated in **Figure DAP-2** found in **Appendix B**. The relevant drainage parameters of the post-development drainage areas are provided in **Table 4.1** below.

Table 4.1 Post-Development Drainage Parameters

Catchment	Drainage Area (ha)	2-, 5-, 10-Year Runoff Coefficient "C"	25-Year Runoff Coefficient "C"	100-Year Runoff Coefficient "C"	Time of Concentration (mins)
A1 Post	0.46	0.69	0.76	0.87	10
A2 Post	0.69	0.90	0.99	1.00	
A3 Post	0.36	0.83	0.92	1.00	
A4 Post	0.41	0.90	0.99	1.00	
A5 Post	2.35	0.65	0.72	0.82	
A6 Post	0.36	0.55	0.61	0.69	
A7 Post	0.76	0.87	0.95	1.00	

4.4 Stormwater Management Controls

As previously noted, the post-development imperviousness that was calculated for the subject site was determined to be greater than the original value of 0.35 used in the original design for the Barton Farm SWM Pond. Therefore, on-site SWM controls will be required in addition to the existing SWM pond to ensure that quantity, quality, water balance, and phosphorous removal criteria are met. With the on-site control, the site will perform exactly as what was assumed for sizing the existing SWM pond.

The existing Stormwater Management Report which outlines the design of the existing SWM pond was reviewed to assess if the existing SWM pond will achieve the required quantity, quality, and phosphorous removal requirements for the subject site. Results of this review indicate that the existing SWM pond will provide some quantity, quality, and phosphorous removal, for the site imperviousness up to 35%, however additional on-site controls will be required to compensate for the increase in impervious area, beyond 35%, within the site.

4.4.1 Additional Quantity Controls

Target release rates from the subject site to the Barton Farms SWM Pond were calculated using the Rational Method for the 2- to 100-year storm events based on the runoff coefficient calculated using the original impervious value specified for future developments in the Barton Farm Subdivision Phase IV Stormwater Management Facility Retrofit Analysis Report. This value ensures that the design will be compatible with the capacity of the existing SWM Pond. The target release rates are summarized in **Table 4.2** below with the detailed calculations provided in **Appendix B.**

Table 4.2 Target Release Rates

Drainage Area ID	Flow Targets (L/s)				
	2-Year Storm Event	5-Year Storm Event	10-Year Storm Event	25-Year Storm Event	100-Year Storm Event
A1 Pre	473.1	659.4	1567.2	952.9	1236.4

Post-development release rates from the subject site were then calculated using the Rational Method for the 2- to 100-year storm event based on the revised runoff coefficients for the proposed development on site, Post-development release rates from the site are summarized in **Table 4.3** below.

Table 4.3 Post-Development Peak Flows

Drainage Area ID	Post-Development Peak Flows (L/s)				
	2-Year Storm Event	5-Year Storm Event	10-Year Storm Event	25-Year Storm Event	100-Year Storm Event
A1 Post	68.1	94.9	111.8	150.8	222.4
A2 Post	132.7	185.0	218.0	294.1	385.5
A3 Post	63.3	88.2	103.9	140.2	198.3
A4 Post	79.3	110.5	130.2	175.7	230.2
A5 Post	326.4	455.0	536.0	723.2	1066.3
A6 Post	42.3	59.0	69.5	93.8	138.3
A7 Post	55.8	77.8	91.6	123.6	168.0
Total	**767.9**	**1070.4**	**1169.4**	**1701.5**	**2186.6**

As the Barton Farms SWM Pond was designed to have capacity to provide quantity control from the subject site at the target release rates provided in **Table 4.3** above, additional SWM quantity controls will be required to compensate for the increase in peak flows resulting from the increase in impervious areas on the subject site. In order to meet the target release rates provided in the Facility Retrofit Analysis Report, runoff from the subject site must discharge at a maximum rates of 1236.4L/s during the 100-year storm event. Three (3) separate quantity controls systems with be provided on site based on the delineated drainage areas outlined in **Figure DAP-2**.

Quantity control will be provided in Drainage Area A2 Post through the use of 155 StormTech SC-740 underground chambers with a total available storage volume of 303.89m^3. The proposed underground chambers will received stormwater from the commercial building and adjacent parking area, and will therefore need to be wrapped in impermeable membrane in order to ensure stormwater contaminated with oil and grit does not infiltrate below that system. Discharge from the underground chamber system into the storm sewer located below Herrema Boulevard will be controlled using a 125mm orifice plate (Orifice #1) which will installed on the downstream side of MH15. The resulting runoff release rates and required storage volumes for Drainage Area A2 Post are summarized in **Table 4.4** below. Detailed calculations related to the underground chambers and orifice control sizing are provided in **Appendix B**.

Table 4.4 Drainage Area A2 Post Quantity Control

Catchment	Storm Event	Catchment Release Rate (L/s)	Required Storage Volume (m^3)	Provided Storage Volume (m^3)
A2 Post	2- Year	15.9	96.2	303.89
	5- Year	19.0	142.3	
	10-Year	21.7	169.7	
	25-Year	25.9	227.4	
	100-Year	33.98	301.8	

Stormwater runoff captured within Drainage Area A4 Post (0.41ha) will be stored within 80 StormTech SC-740 underground chambers with a total available storage volume of 154.65m^3. Similar to the storage facility provided in Drainage Area A2 Post, the underground storage facility will receive stormwater from the second commercial building and parking area and therefore will be required to be wrapped in impermeable membrane to insure no contaminated water is infiltrated below the chambers. Discharge from the underground chamber system into the storm sewer on Herrema Boulevard will be controlled using a 120mm orifice plate (Orifice #2) which will be installed on the downstream side of DCBMH1. The resulting runoff release rates and required storage volumes for Drainage Area A4 Post are summarized in **Table 4.5** below.

Table 4.5 Drainage Area A4 Post Quantity Control

Catchment	Storm Event	Catchment Release Rate (L/s)	Required Storage Volume (m^3)	Provided Storage Volume (m^3)
A4 Post	2- Year	13.7	48.7	154.65
	5- Year	17.6	70.4	
	10-Year	19.6	85.1	
	25-Year	23.9	114.6	
	100-Year	31.3	152.7	

Drainage Area A6 Post consists of a portion of the roof area and rear yards of the central townhouse blocks located on the subject site. A separate underground storage system, consisting of 174 StormTech SC-310 underground chambers, will be used to store the resulting runoff from A6 Post. The contributing runoff to this underground system is considered 'clean' as it is free from oil and grit, and therefore can be infiltrated below the chamber system. Details regarding infiltration below the chambers for use in achieving water balance on site will be discussed further in **Section 4.4.3** below. Discharge from the StormTech SC-310 system will be controlled using a 75mm orifice plate (Orifice #3) prior to connecting into the storm sewer network located in Drainage Area A3 Post and A5 Post.

Quantity control will be provided in Drainage Area A3 Post and A5 Post through the use of two (2) separate underground chambers systems. A total of 93 StormTech MC-3500 underground storage chambers will be utilized within the two (2) systems to provide a total storage capacity of 503.9m^3. Discharge from the storm sewer network within Drainage Area A3 Post and A5 Post into the storm sewer on Herrema Bouelvard will be controlled using a 425mm orifice plate (Orifice #4) which will be located on the downstream side of DCBMH2. The resulting release rates and required storage volumes for Drainage Area A3 Post and A5 Post are summarized in **Table 4.6** below.

Table 4.6 Drainage Area A3 Post & A5 Post Quantity Control

Catchment	Storm Event	Catchment Release Rate (L/s)	Required Storage Volume (m^3)	Total Provided Storage Volume (m^3)
A3 Post & A5 Post	2- Year	263.2	78.1	503.9
	5- Year	309.0	143.3	
	10-Year	332.0	187.8	
	25-Year	392.8	286.2	
	100-Year	499.8	464.2	

Drainage Area A1 Post, consisting of eight (8) semi-detached freehold units, will release stormwater uncontrolled at a maximum release rate of 222.4L/s during a 100-year storm event. The uncontrolled runoff will be captured within rear lot catch basins and conveyed to the storm sewer on Herrema Boulevard prior to discharging into the existing SWM Pond.

The final Drainage Area, A7 Post, will discharged uncontrolled to Brock Road located to the south of the site at a maximum release rate of 168L/s during a 100-year storm event. A summary of the provided quantity control measures provided onsite and the resulting release flows for a 100-year storm event have been summarized in **Table 4.7** below.

Table 4.7 Quantity Control Summary Table

Drainage Area	Destination	Flow Type	Control Device	Method of Storage	Storage Required (m^3)	Storage Provide (m^3)	Release Rate (L/s)
A1 Post	Existing SWM Pond	Uncontrolled	N/A	N/A	N/A	N/A	222.4
A2 Post	Existing SWM Pond	Controlled	125mm Orifice Plate	SC-740 StormTech Underground Chambers	301.8	303.89	33.98
A3 & A5 Post	Existing SWM Pond	Controlled	425mm Orifice Plate	MC-3500 StormTech Underground Chambers	464.2	503.9	499.8
A4 Post	Existing SWM Pond	Controlled	120mm Orifice Plate	SC-740 StormTech Underground Chambers	152.7	154.65	31.3
A6 Post	Existing SWM Pond	Controlled	75mm Orifice Plate	SC-310 StormTech Underground Chambers	120.3	142.71	8.9
A7 Post	Brock Street	Uncontrolled	N/A	N/A	N/A	N/A	168.0
Total Site Post-Development Release Rate							**955.5**
Total Site Pre-Development Target							**1236.4**

4.4.2 Stormwater Quality Control

Stormwater treatment must meet Enhanced (Level 1) Protection as defined by the Ministry of Environment and Climate Change's (MOECC) 2003 Stormwater Management Planning and Design (SWMPD) manual. Quality control for the subject site is to be provided by a combination of rooftop and landscaped areas, as well as three (3) OGS units and the existing SWM pond in order to treat flows from the site to the required criteria.

As detailed in the 2002 'Barton Farm Subdivision Phase IV Stormwater Management Facility Retrofit Analysis' prepared by G.M. Sernas, the proposed SWM pond within the Barton Farm Subdivision was designed to provide the required 80% TSS removal for the total SWM pond contributing area. In order to compensate for the increase in impervious area resulting from the proposed development, additional treatment units are proposed onsite.

The proposed additional treatment, Contech CDS units, will be used in a treatment train in combination with the existing SWM pond to provide the required TSS removal in order to meet MOECC standards. The proposed units will be placed following the orifice control locations at three (3) of the four (4) service connections to the storm sewer on Herrema Boulevard. The remaining service connection, from Drainage Area A1 Post, will strictly be treated using the existing SWM pond. A summary of the proposed additional treatment units at each storm sewer servicing connections are provided in **Table 4.8** below.

Table 4.8 Additional Onsite Treatment Units

Catchment	Area (ha)	Runoff Coefficient	Additional Treatment Units
A1 Post	0.46	0.69	N/A
A2 Post	0.69	0.90	CDS Unit PMSU2015-4
A4 Post	0.41	0.90	CDS Unit PMSU2015-4
A3 Post & A5 Post & A6 Post	3.07	0.66	CDS Unit PMSU4040-8

Runoff from rooftops and landscaped areas are considered inherently 'clean' as these areas do not contain oil or grit. The combination of clean rooftop and landscaped areas, and the proposed treatment train which includes CDS units and the existing SWM pond will provide an overall TSS removal of 81% for the subject site.

4.4.3 Water Balance

The LSRCA's Stormwater Management Guidelines require post-development infiltration volumes to best match pre-development levels on an annual basis. In completing the water balance assessment, an annual pre-development infiltration volume of 7658m^3 was determined. Under post-development conditions prior to the implementation of mitigation measures, an infiltration volume of 2098m^3 was calculated for the subject site resulting in an overall decrease in infiltration of 73%. To compensate for the decrease in annual infiltration, additional infiltration on site will be provided through the 0.35m stone depth underlying the SC-310 StormTech underground chambers located in Drainage Area A6 Post. The proposed underground chambers will strictly receive runoff from inherently clean roof and landscaped areas therefore only clean water will be infiltrated. The proposed infiltration through the underlying stone depth will increase the overall infiltration on the subject site to 7845m^3 therefore exceeding the minimum criteria as required by the LSRCA. Water balance assessment calculations are provided in **Appendix B**.

4.4.4 Phosphorous Loading

As required in the 2009 Lake Simcoe Protection Plan (LSPP) implemented by the LSRCA, new developments within the Lake Simcoe Watershed must adopt Best Management Practices (BMPs) and LID techniques in order to achieve sustainable development practices that will reduces the phosphorous loading resulting from new development to pre-development levels.

A phosphorous loading analysis was completed for the subject site using the MOECC Lake Simcoe Phosphorous Loading Development Tool. Under pre-development conditions, total phosphorous loading from the subject site was determined to be 0.33kg/year based on a combined land use type of 'Hay-Pasture' and 'Forest'. The post-development conditions were simulated by applying a land use type of 'High Intensity Development' for the residential component of the site (3.83ha) and 'High Intensity – Commercial/Industrial' for the proposed commercial components of the site (1.1ha). The new annual phosphorus loading was estimated to be 7.06kg/year. In applying the proposed LIDs for the subject site, which include the existing SWM pond, proposed underground storage and infiltration below the chambers, the mitigated annual phosphorous loading was significantly reduced to 3.13kg/year in post-development conditions.

The 'Barton Farm Subdivision Phase IV Stormwater Management Facility Retrofit Analysis' prepared by G.M. Sernas in 2002, outlined the existing and target conditions for phosphorous loading within the overall Barton Farms development. As detailed within the 2002 report, the proposed SWM pond was designed to provide the required phosphorous removal for the total development area, including the current 4.93 ha proposed development. Therefore, the existing SWM pond in combination with the additional LIDs on the subject site will greatly reduce phosphorous loading from the subject site in post-development conditions.

5 Sanitary Drainage System

5.1 Existing System

According to the plan and profile drawings from the Township and the Region, there is an existing 200mm diameter sanitary sewer on a 6m wide easement within the subject lands between Low Boulevard and Brock Street / Nelkydd Lane. Additionally there is an existing 200mm sanitary sewer on Herrema Boulevard.

5.2 Existing Sanitary Flows

According to the reviewed information, the current land is vacant and there is no municipal sanitary service connection for the existing site.

5.3 Proposed Sanitary Flows

The proposed sanitary discharge flows from the site were calculated based on the proposed building and site statistics, using the criteria listed in **Section 3.3**. Peaking factors were applied using the Harmon Peaking Factor as per the Region standards. The number of proposed residential and commercial units were considered in the analysis in order to evaluate the adequacy of the existing municipal infrastructure. The design inputs for the site is shown in **Table 5.1** and **Table 5.2** on the following page.

Table 5.1 Equivalent Population Calculations (Residential)

Unit Size	Number of Units	Persons (ppu)	Total Persons
Townhouses	94	3	282
Future Development Block	10	1.5	15
Future Development Block	24	2.5	60
Semi-Detached Free Hold	8	3.5	28
Commercial Building	5	2.5	13

Table 5.2 Post Development Input Parameters (Commercial)

Usage	Area (m^2)	Floor Area (ha)
Commercial	469.45	0.0469

The sanitary discharge flow was calculated using the Region's guidelines as detailed in **Section 3.3, Table 3.1**. Based on this criteria, a total design flow of 7.74L/s was calculated for the proposed development. According to the Region, there is adequate capacity in the existing sanitary sewer to permit the proposed development consisting of 94 townhouses, eight (8) semi-detached freehold units, a commercial block with five (5) apartment units above and an allowance for the future development block.

5.4 Proposed Sanitary Connection

The sanitary servicing of this site shall be provided by sanitary sewers located in the municipal right of way of Herrema Boulevard and Low Boulevard with connections made to the individual blocks or individual lots. A preliminary sanitary servicing layout is available in **Appendix E.**

5.4.1 Townhouse Block

A 200mm diameter sanitary sewer connection and control manhole shall be provided at the northwest corner of the site connecting to the proposed sanitary sewer extension on Herrema Boulevard. Internal to the Townhouse block, the sanitary sewer configuration shall have a minimum diameter of 200mm diameter. Individual house service connections shall be 100mm diameter per Region of Durham standards.

5.4.2 Commercial Block

A 200mm diameter sanitary sewer connection and control manhole shall be provided at the northwest corner of the site connecting to the proposed sanitary sewer extension on Herrema Boulevard. Internal to the commercial block the sanitary sewer configuration shall have a minimum diameter of 200mm diameter. A sanitary stub shall be provided near the proposed buildings for servicing.

5.4.3 Future Development Block

A 200mm diameter sanitary sewer connection and control manhole shall be provided at the northeast corner of the site connecting to the proposed sanitary sewer extension on Herrema Boulevard. Internal to the commercial block, the sanitary sewer configuration shall have a minimum diameter of 200mm diameter.

5.4.4 Semi-Detached Units

The semi-detached units on the Low Boulevard extension shall have individual 100mm sanitary connections connecting to the 200mm diameter sanitary sewer on Low Boulevard which conveys flows to the Herrema Boulevard sanitary sewer.

6 Water Supply System

6.1 Existing Water System

Based on the review of the Region's water supply system, the subject site is located within the pressure Zone 1 of the Uxbridge Water System. The water supply is from two (2) municipal wells (Wells No. 5 and No. 6). The existing Quaker Hill reservoir provides water storage and maintains system pressure for the Zone 1 water system. The reservoir is located at Concession Road 6, south of Bolton Drive. The Top Water Level (TWL) in the existing reservoir is 331m and Low Water Level (LWL) is assumed 328m, approximately 0.65 above the bottom of the reservoir.

According to the reviewed information (Region of Durham Water supply system map), the existing property is surrounded by the following water infrastructure:

- 300mm watermain on Brock Street;
- 200mm watermain on Herrema Boulevard; and,
- 150mm watermain on Low Boulevard.

For the purpose of confirming general supply and water pressure in the vicinity of the site, three (3) hydrant flow tests were performed on-site on October 27, 2017 by COLE.

The results of the first test on Brock Street E. (north west corner of Brock Street East and Nelkydd Lane) indicates that 366L/s (5,800 USGPM) is available at a pressure of 150kPa (20PSI).

The results of the second test on south west corner of Low Boulevard and Donland Lane indicate that 202L/s (3,200 USGPM) is available at a pressure of 150kPa (20PSI).

The results of the third test on Herrema Boulevard, south side of Maunder Crescent indicate that 322L/s (5,100 USGPM) is available at a pressure of 150kPa (20PSI). Please refer to **Appendix D** for detailed calculations.

6.2 Proposed Water Supply Requirements

The estimated water consumption for the proposed development was calculated based on the occupancy rates shown in **Table 3.1**, based on the City's Design Criteria for Sewers and Watermain revised in November 2009 and the Ontario Building Code. The Water Supply for Public Fire Protection was calculated based on the guidelines provided by the FUS, to demonstrate that the existing flows and pressure are adequate to meet the minimum requirement for fire suppression outlined in the FUS.

The average domestic water consumption rates for the proposed development are anticipated to be approximately 146,692.00L/d (1.70L/s), a maximum daily consumption of 425,406.80L/d, a minimum hourly demand of 2,414.53L/hr and a peak hourly demand of 26,282.32L/hr. Detailed calculations are provided in **Appendix D** and summarized in **Table 6.1** below. According to our calculations, a minimum fire suppression flow of approximately 3,180L/min (1,050 USGPM) at a pressure of 140kPa (20PSI) will be required for the proposed site. Refer to the detailed calculations found in **Appendix D**. The results from the hydrant flow test taken within the vicinity of the proposed development on Brock Street shows an available flow rate of 5,800 USGPM from the system and pressure is in the area of 140kPa (20PSI). Based on the above, there are sufficient flows and pressures within the existing municipal water distribution system to accommodate the proposed development.

Table 6.1 Water Demand

Flow	Townhouse Block	Freehold Semi Detached	Future Development Block	Commercial Block	Total Flow
Average Day (L/d)	102,648.00	10,192.00	27,300.00	6,552.00	146,692.00
Average Day (L/s)	1.19	0.12	0.32	0.08	1.70
Max. Day (L/min)	206.72	20.53	54.98	13.20	295.42
Peak Hour (L/hr)	18,391.10	1,826.07	4,891.25	1,173.90	26,282.32
Peak Hour (L/s)	5.11	0.51	1.36	0.33	7.30

6.3 Proposed Watermain Connections

A total of 94 townhouse units, eight (8) freehold semi bungalows with loft, two (2) commercial buildings with five (5) apartment units and residential within the Future Development Block are proposed.

The proposed water servicing of the site shall comprise of extending existing watermains located around the site and providing individual service connections to the blocks or lots.

There is an existing 300mm diameter watermain located on Brock Street with a 200mm diameter stub at the intersection of Brock Street and proposed Herrema Boulevard. This 200mm diameter watermain will be extended north connecting to the 200mm stub located at the south end of existing Herrema Boulevard. There is an existing 150mm watermain located on Low Boulevard which will be extended east and connected to the proposed 200mm watermain located on proposed Herrema Boulevard. A preliminary water servicing layout is available in **Appendix E.**

6.3.1 Townhouse Block

The townhouse block shall have a private domestic and fire service through a connection to the proposed 200mm watermain on Herrema Boulevard. Connection shall be in accordance with Region of Durham standards and be monitored through a water meter room equipped with back flow preventers. Internal to the site, townhouses shall have individual connections for each unit per Region standards.

6.3.2 Commercial Block

The commercial block shall have private domestic and fire services through a connection to the proposed 200mm watermain on Herrema Boulevard. Water service shall be metered and equipped with back flow preventers located in one (1) of the commercial buildings.

6.3.3 Future Development Block

The Future Development Block shall have private domestic and fire services through a connection to the proposed 200mm watermain on Herrema Boulevard. Water services shall be metered and equipped with a backflow preventer located in a single common water meter room / building depending on the ultimate development concept.

6.3.4 Semi-Detached Units

The semi-detached units on the Low Boulevard extension shall have individual water service connections for each unit connecting to the existing 150mm diameter watermain on Low Boulevard.

7 Site Grading

7.1 Existing Grades

The existing site topography generally has two (2) drainage patterns, namely an eastern and a western separated by a high area located in the eastern portion of the site.

The eastern drainage pattern slopes from the south to north and northeast via overland flow to an existing ditch which conveys drainage from south of Brock Street. Drainage is conveyed to the existing channel to the east of the property or to the lands to the north.

The western drainage pattern slopes from the south to north and northwest via overland flow or man-made ditches along the existing Donland Lane. These flows are collected by a temporary ditch inlet catchbasin and conveyed to the existing stormwater management facility or via sheet flow to the lands to the north.

7.2 Proposed Grades

The proposed grading of the site will match existing grades where possible and will provide an emergency overland flow route to Herrema Boulevard located at the north end of the site. The site has been graded in accordance with Town Standards and adheres to road grades of 0.5% -5.0% and lot grades of 2.0% to 5.0% and has been designed such that as much drainage as possible from the townhouse block, commercial block, future development block and semi-detached units are able to be controlled and conveyed to the existing sewers on Herrema Boulevard. Grading along the south limit of the site, will be governed by the Brock Street Urbanization and will be coordinated to match the proposed grades. There is proposed sloping on the adjacent lands to the north, to avoid the construction of a retaining wall; it is our understanding that the lands to the north, may be developed at a future date and the sloping can be modified or removed accordingly to facility the future development.

When the development proceeds, the existing Donland Lane will be removed and replaced with the Herrema Boulevard extension connected to Brock Street across from existing Nelkydd Lane. Low Boulevard will be extended to the Herrema Boulevard extension, with all associated drainage and grading accommodated for in the detailed engineering drawings. It is envisioned that flows from the south will be captured and conveyed to the existing channel east of the site through storm sewer improvements made in conjunction with the proposed Brock Street urbanization.

8 Conclusions and Recommendations

Based on our investigation, we conclude and recommend the following:

Storm Drainage

Three (3) quantity control systems will be provided on site to achieve the target flow rate during a 100-year storm event. For the two (2) proposed commercial developments, a total of 235 Stormtech SC-740 chambers placed below two (2) surface parking areas will provide 458.54m^3 of storage. The residential development will require 93 Stormtech MC-3500 underground storage chambers with a capacity of 503.9m^3. These drainage areas will release using orifice plates to the existing SWM pond. 174 Stormtech SC-310 underground chambers will be used to infiltrate inherently clean water from the roofs and backyards in the residential development. One (1) uncontrolled drainage area will be conveyed to the existing SWM pond, and an additional uncontrolled drainage area will discharge uncontrolled to Brock Street.

The 100-year storm release rate that will be generated from all drainage areas is 955.5L/s. Quality control measures consist of three (3) OGS units and the existing SWM pond, resulting in an overall TSS removal of 81%. Based on the post-development analysis of this site, it is concluded that the proposed development will not adversely affect the stormwater infrastructure downstream.

Sanitary Sewers

A total net design flow of 7.74L/s was calculated for the proposed development. The sanitary servicing of this site shall be provided by a sanitary sewers located in the municipal right of way of Herrema Boulevard and Low Boulevard with connections made to the individual blocks or individual lots. According to the Region, there is adequate capacity in the existing sanitary sewer to permit the proposed development.

Water Supply

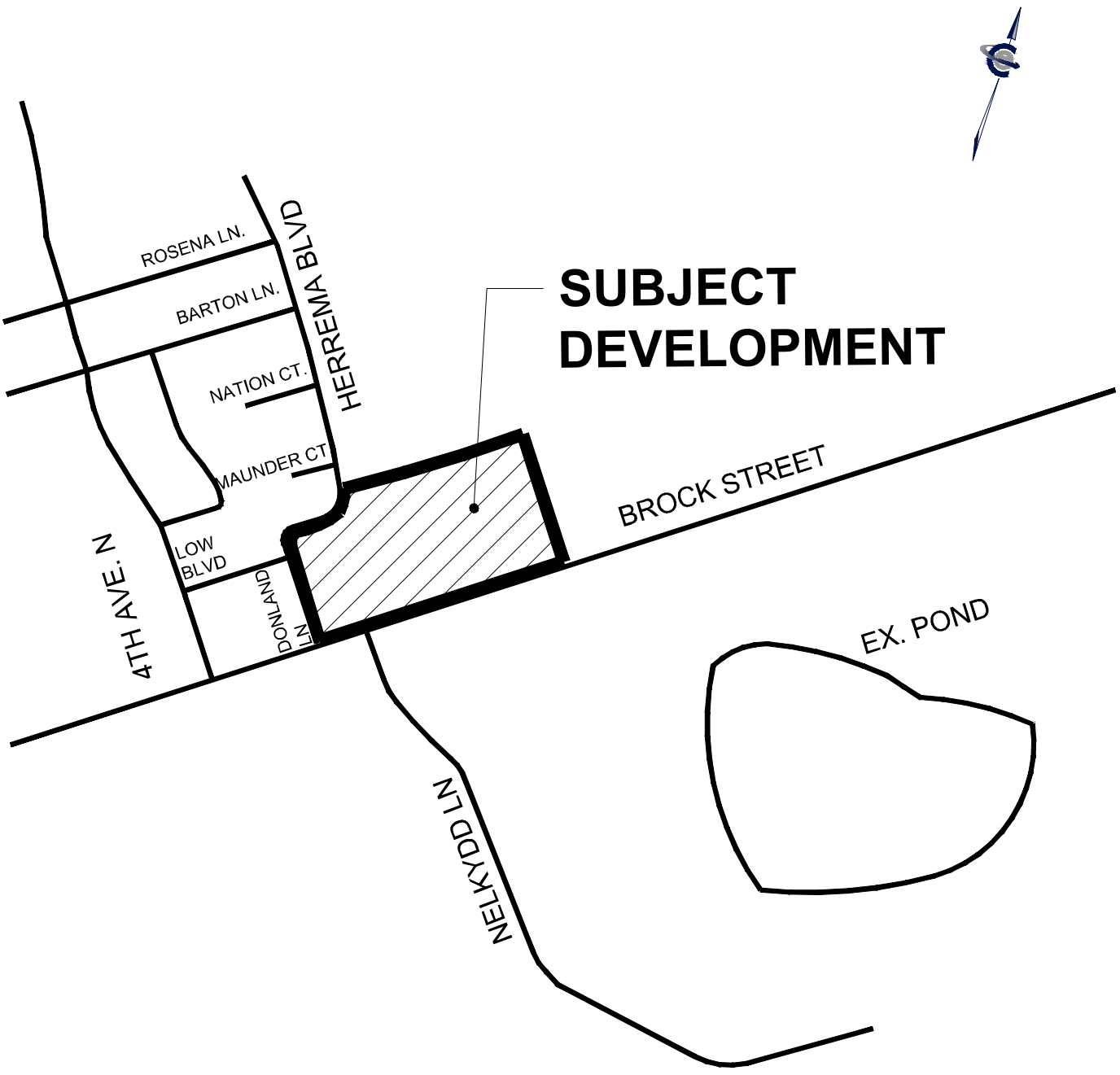
Based on the results of the water system hydraulic analysis, the anticipated system pressures within the subject site meet the Region's pressure requirements between 275kPa and 700kPa under the normal

operations. The minimum system pressure of 140kPa under fire flow condition as per the Region's requirement can be maintained within the subject site.

The proposed water servicing of the site shall comprise of extending existing watermains located around the site and providing individual service connections to the blocks or lots.

Site Grading

The proposed grading of the site will match the existing grades where possible and provide a safe overland flow route to the existing Herrema Boulevard. The site has been graded to drain as much of the site as possible to the existing Herrema Boulevard to limit the amount of uncontrolled flow to the surrounding areas. Grading of the site will be in accordance with the Town Standards including but not limited to road grading, lot grading, swales and retaining walls. The south limit of the site will be designed to be compatible with the ultimate street line elevations from the urbanization of Brock Street.



COLE ENGINEERING
70 VALLEYWOOD DRIVE, MARKHAM, ON L3R 4T5
T:416.987.6161 / 905.940.6161 F:905.940.2064

LOCATION PLAN

BROCK STREET DEVELOPMENT

DATE:	DECEMBER 2017	PROJECT No.	2017-0569
SCALE:	N.T.S.	FIGURE No.	FIG 1

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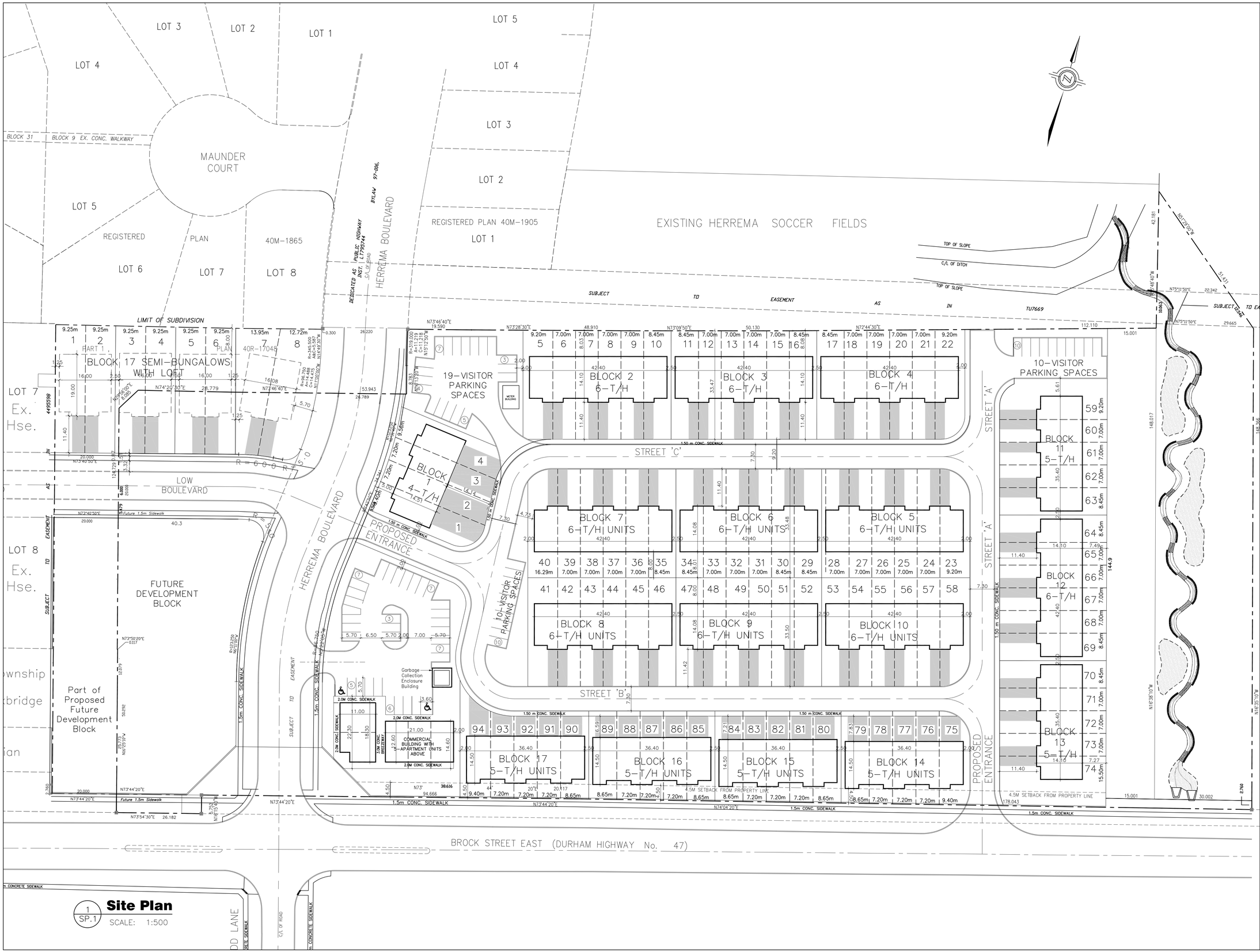
AERIAL PLAN

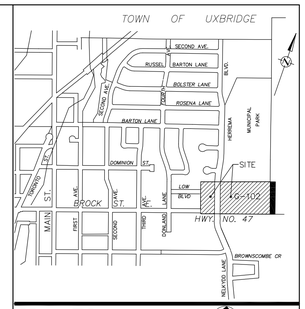
BROCK STREET DEVELOPMENT

DATE:	DECEMBER 2017	PROJECT No.	2017-0569
SCALE:	N.T.S.	FIGURE No.	FIG 2

APPENDIX A
Background Information



1 SP.1 **Site Plan**
SCALE: 1:500



Key Plan N.T.S.

AREA SUMMARY:
CONDOMINIUM TOWNHOUSE BLOCK:

LOT AREA		= 49,714.57 m²	=	12.28 ACRES (100.0 %)
EASEMENT	A	= 1,361.38 m²	=	0.336 AC.
EASEMENT	B	= 813.44 m²	=	0.200 AC.
EASEMENT	C	= 511.40 m²	=	0.126 AC
LOW AVENUE		= 1,420.30 m²	=	0.351 AC
HERREMA AVE		= 3,661.77 m²	=	0.905 AC
HERREMA AVE (ENTRY BLVD)		= 683.80 m²	=	0.170 AC.
COMMERCIAL BLOCK		= 2,921.82 m²	=	0.722 AC.
CONDOMINIUM BLOCK		= 4,753.30 m²	=	1.175 AC.
SEMI – BUNGALOW LOT AREA		= 3,152.89 m²	=	0.779 AC.
TOTAL AREA		= 19,280.10 m²	=	4.764 AC.

TOTAL RES. CONDOMINIUM TOWNHOUSE USABLE AREA:
(49,714.57 m² – 19,280.10 m²)= 30,434.47 m² = 7.52 AC.

UNIT DISTRIBUTION:
24 – 7.2M WIDE TOWN HOUSE UNITS
70 – 7.0M WIDE TOWN HOUSE UNITS

TOTAL UNITS **94 UNITS**

DENSITY: = 94 UNITS / 7.69 ACRES OR
94 UNITS / 3.11 Ha.
94/3.11
30.22 units / Hectares

COMMERCIAL BLOCK SUMMARY:

COMMERCIAL BLOCK / WITH 5– RESIDENTIAL UNITS ABOVE

LOT AREA:	=	2,861.41 m²	= 0.71 ACRES
BUILDING AREA:			
COMMERCIAL GROUND FLOOR AREA	=	469.45 m²	
PARKING PROVIDED 795 m²			
5.5 CARS/100 m²	=	26 PARKING SPACES	
RESIDENTIAL PARKING SPACES			
PROVIDED (1.5 SPACES/UNIT)=		8 PARKING SPACES	
TOTAL PARKING SPACES PROVIDE	=	34 PARKING SPACES	

DATE	REVISIONS

icr associates incorporated
207 Edgeley Boulevard, Ste. 18 Concord, On. L4K 4B5
Tel.(905) 738-8500, Fax(905) 738-2227

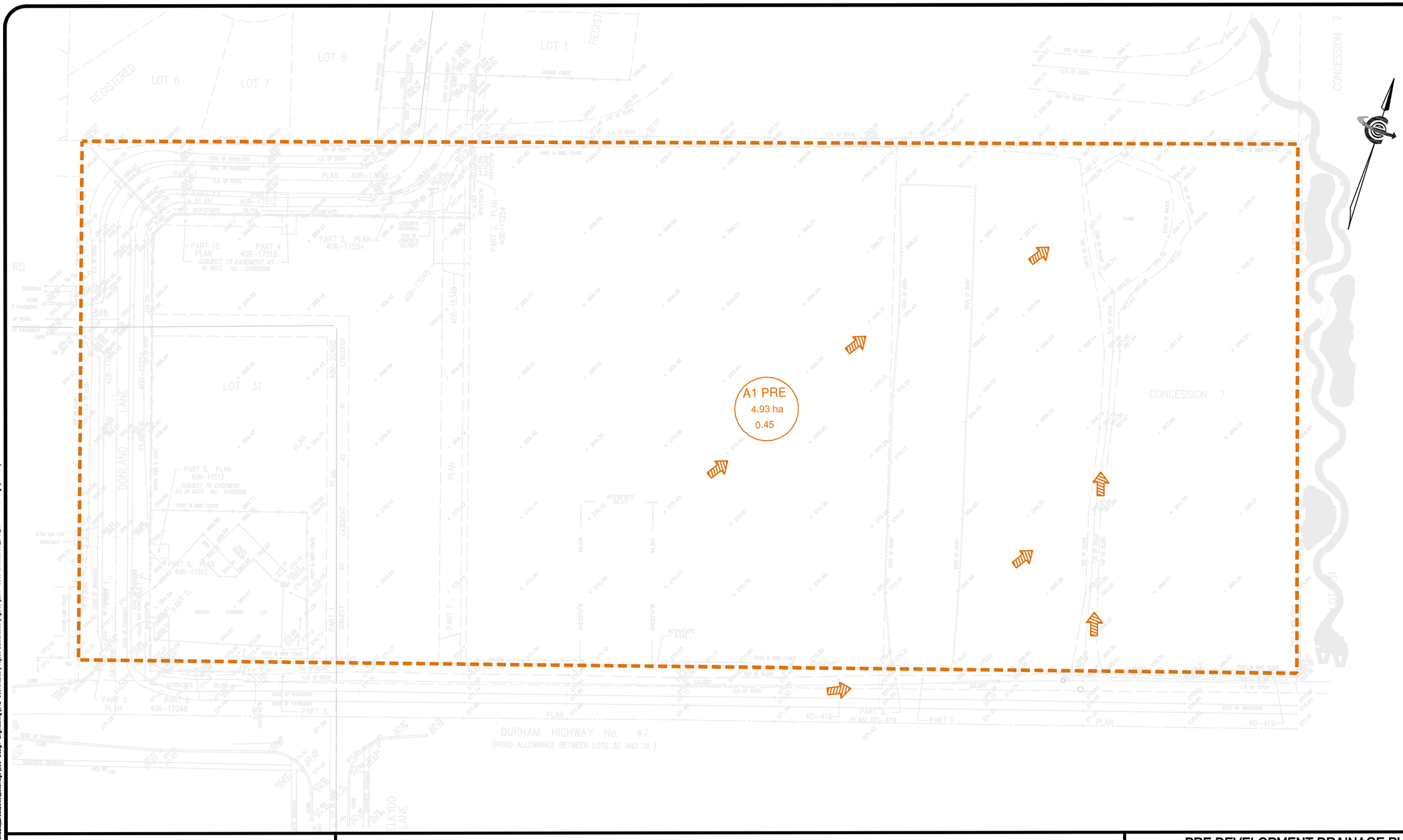
Evendale Developments Ltd.
BROCK STREET DEVELOPMENT
UXBRIDGE, ONTARIO

Proposed Brock Street Development

DATE	AUG. 2017
SCALE	1:500
DRAWN BY	B.M.
JOB NO	217–000

A.1

APPENDIX B
Stormwater Data Analysis



S:\2017 Projects\VC\2017-0569 Evandale_BrockStreet_Uxbridge\300-Design-Engineering\312-Deliverables\Project Deliverables\Figures\2017-0569 BrockStreet_DAP_SR- NOV 28.dwg (DAP-01)

COLE ENGINEERING
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LEGEND

- PRE-DEVELOPMENT STORM DRAINAGE AREA
- DRAINAGE AREA (ha)
- CATCHMENT ID
- RUN-OFF COEFFICIENT
- OVERLAND FLOW PATH

PRE DEVELOPMENT DRAINAGE PLAN

EVANDALE DEVELOPMENTS LTD.
BROCK STREET DEVELOPMENT
TOWN OF UXBRIDGE
REGIONAL MUNICIPALITY OF DURHAM

DATE:	DECEMBER 2017	PROJECT No.:	2017-0569
SCALE:	1:300	FIGURE No.:	DAP-01

COLE ENGINEERING

Prepared By: Kirsten MacMillan, EIT

Pre-Development Rational Method
Target Flow Calculations

Brock Street East Development
File No. 2017-0569
November 2017

Time of Concentration Calculation

Area Number	Description	Area (ha)	C	Time of Concentration (min)
A1 Pre	**To Existing Pond**	**4.93**	**0.45**	**10**

Formula: $I = A/(T+B)^C$

	A,B,C	Constants
	T	Time of concentration (h)
	I	Rainfall intensity (mm/h)

Rational Method Calculation

Event 2 yr
IDF Data Set Town of Uxbridge
a = 645.0
b = 5.0
c = 0.786

Area Number	A (ha)	C	AC	Time of Concentration (min)	I (mm/h)	Q (m^3/s)	Q (L/s)
A1 Pre	4.93	0.45	2.22	10.00	76.8	0.473	473.1

Event 5 yr
IDF Data Set Town of Uxbridge
a = 904.0
b = 5.0
c = 0.788

Area Number	A (ha)	C	AC	Time of Concentration (min)	I (mm/h)	Q (m^3/s)	Q (L/s)
A1 Pre	4.93	0.45	2.22	10.00	107.0	0.659	659.4

Event 10 yr
IDF Data Set Town of Uxbridge
a = 1065.0
b = 5.0
c = 0.788

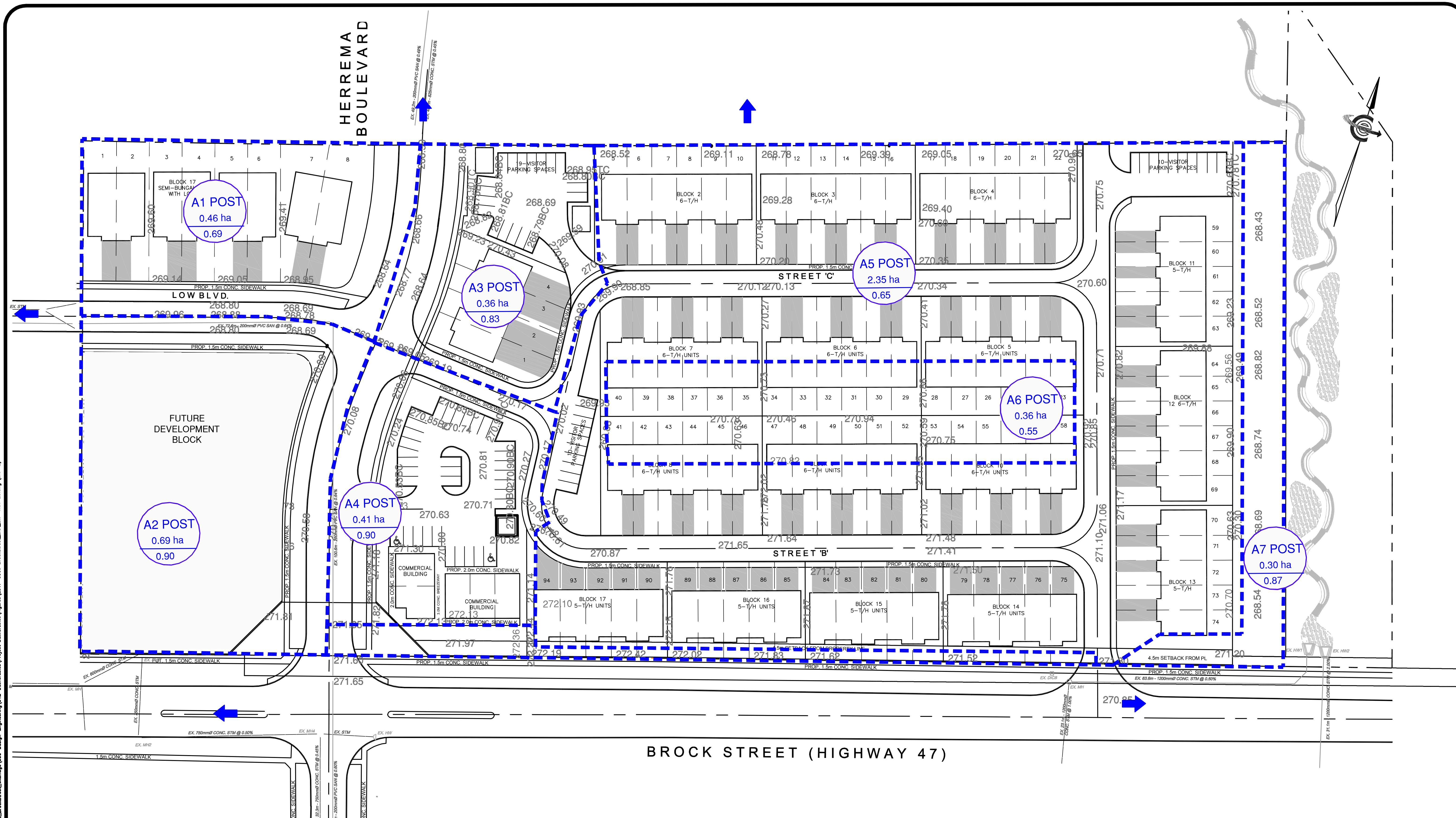
Area Number	A (ha)	C	AC	Time of Concentration (min)	I (mm/h)	Q (m^3/s)	Q (L/s)
A1 Pre	4.93	0.45	2.22	10.00	126.1	0.777	776.9

Event 25 yr
IDF Data Set Town of Uxbridge
a = 1234.0
b = 4.0
c = 0.787

Area Number	A (ha)	C	AC	Time of Concentration (min)	I (mm/h)	Q (m^3/s)	Q (L/s)
A1 Pre	4.93	0.45	2.22	10.00	154.6	0.953	952.9

Event 100 yr
IDF Data Set Town of Uxbridge
a = 1799.0
b = 5.0
c = 0.810

Area Number	A (ha)	C	AC	Time of Concentration (min)	I (mm/h)	Q (m^3/s)	Q (L/s)
A1 Pre	4.93	0.45	2.22	10.00	200.6	1.236	1236.4



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LEGEND

- POST-DEVELOPMENT STORM DRAINAGE AREA
- A7 POST — CATCHMENT ID; 0.3 ha — DRAINAGE AREA (ha); 0.87 — 2-YEAR RUN-OFF COEFFICIENT
- OVERLAND FLOW PATH

POST DEVELOPMENT DRAINAGE PLAN

EVANDALE DEVELOPMENTS LTD.
BROCK STREET DEVELOPMENT
TOWN OF UXBRIDGE
REGIONAL MUNICIPALITY OF DURHAM

DATE:	DECEMBER 2017	PROJECT No.:	2017-0569
SCALE:	1:300	FIGURE No.:	DAP-02

COLE ENGINEERING

Prepared By: Kirsten MacMillan, EIT

Post Development Composite Runoff Coefficient

Brock Street East Development
File No.: 2017-0569
November 2017

Drainage Area ID	Total Area (ha)	Impervious Area (ha)	Pervious Area (ha)	Percent Impervious	2 Year Runoff Coefficient	5 Year Runoff Coefficient	10 Year Runoff Coefficient	25 Year Runoff Coefficient	100 Year Runoff Coefficient
Controlled Drainage Areas									
A2 Post	0.69	0.69	0.00	100%	0.90	0.90	0.90	0.99	1.00
A3 Post	0.36	0.32	0.04	90%	0.83	0.83	0.83	0.92	1.00
A4 Post	0.41	0.41	0.00	100%	0.90	0.90	0.90	0.99	1.00
A5 Post	2.35	1.45	0.89	62%	0.65	0.65	0.65	0.72	0.82
A6 Post	0.36	0.17	0.19	47%	0.55	0.55	0.55	0.61	0.69
Total Controlled	**4.17**	**3.04**	**1.12**	**73%**	**0.73**	**0.73**	**0.78**	**0.81**	**0.86**
Uncontrolled Drainage Areas									
A1 Post	0.46	0.31	0.15	68%	0.69	0.69	0.69	0.76	0.87
A7 Post	0.30	0.29	0.02	95%	0.87	0.87	0.87	0.95	1.00
Total Uncontrolled	**0.76**	**0.60**	**0.16**	**79%**	**0.76**	**0.76**	**0.81**	**0.83**	**0.88**

COLE ENGINEERING

Prepared By: Kirsten MacMillan, EIT

Modified Rational Method - Two Year Storm
Site Flow and Storage Summary
Brock Street East Development
File No. 2017-0569
November 2017

Uncontrolled- To Brock Street

Drainage Areas	A7 Post		
Area =	**0.30**	ha	
"C" =	**0.87**		
AC7 =	**0.26**		
Tc =	**10.0**	min	
Time Increment =	**5**	min	
Release Rate (R7) =	**55.8**	L/s	

Uncontrolled- To Existing Pond

Drainage Areas	A1 Post		
Area =	**0.76**	ha	
"C" =	**0.69**		
AC1 =	**0.53**		
Tc =	**10.0**	min	
Time Increment =	**5**	min	
Release Rate (R1) =	**112.4**	L/s	

Controlled- To Existing Pond

Drainage Areas	A2 Post		
Area =	**0.69**	ha	
"C" =	**0.90**		
AC2 =	**0.62**		
Tc =	**10.0**	min	
Time Increment =	**5.0**	min	
Allowable Release Rate (R2) = (From Orifice #1)	**15.9**	L/s	
Max. Required Storage Volume =	**96.2**	m^3	
Max. Storage in Chambers =	**303.89**	m^3	

Controlled- To Existing Pond

Drainage Areas	A4 Post		
Area =	**0.41**	ha	
"C" =	**0.90**		
AC4 =	**0.37**		
Tc =	**10.0**	min	
Time Increment =	**5.0**	min	
Allowable Release Rate (R4) = (From Orifice #2)	**13.7**	L/s	
Max. Required Storage Volume =	**48.7**	m^3	
Max. Storage in Chambers =	**154.65**	m^3	

Controlled- To Drainage Area A5 Post

Drainage Areas	A6 Post		
Area =	**0.36**	ha	
"C" =	**0.55**		
AC6 =	**0.20**		
Tc =	**10.0**	min	
Time Increment =	**5.0**	min	
Allowable Release Rate (R6) = (From Orifice #3)	**3.8**	L/s	
Max. Required Storage Volume =	**34.5**	m^3	
Max. Storage in Chambers =	**142.71**	m^3	

Controlled- To Existing Pond

Drainage Areas	A3 Post + A5 Post		
Area =	**2.70**	ha	
"C" =	**0.68**		
AC35 =	**1.83**		
Tc =	**10.0**	min	
Time Increment =	**5.0**	min	
Controlled Release Rate (R35)= (From Orifice #4)	**263.2**	L/s	
Max. Required Storage Volume =	**78.1**	m^3	
Max. Storage Volume in Chambers =	**503.9**	m^3	

Target Release Rate =	**473.1**	L/s
Uncontrolled Release Rate =	**168.2**	L/s
Controlled Release Rate =	**292.8**	L/s
Total Site Release Rate =	**461.0**	L/s

100-Year Design Storm

A=	645.0
B=	5.0
C=	0.786
I =	I = A/(T+B)^C

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)
Time	**Rainfall Intensity**	**Storm Runoff**	**Runoff Volume**	**Storm Runoff**	**Runoff Volume**	**Storm Runoff**	**Runoff Volume**	**Allowable Released Volume**	**Storage Volume**	**Storm Runoff**	**Runoff Volume**	**Allowable Released Volume**	**Storage Volume**	**Storm Runoff**	**Runoff Volume**	**Allowable Released Volume**	**Storage Volume**	**Storm Runoff**	**Runoff Volume**	**Total Runoff Volume**	**Allowable Released Volume**	**Storage Volume**
(min)	(mm/hr)	(m^3/s)	(m^3)	(m^3/s)	(m^3)	(m^3/s)	(m^3)	(m^3)	(m^3)	(m^3/s)	(m^3)	(m^3)	(m^3)	(m^3/s)	(m^3)	(m^3)	(m^3)	(m^3/s)	(m^3)	(m^3)	(m^3)	(m^3)
	I = A/(T+B)^C	**(3) = [(2)*AC7] / 360**	**(4) = (3)*(1)*60**	**(5) = [(2)*AC1] / 360**	**(6) = (5)*(1)*60**	**(7) = [(2)*AC2] / 360**	**(8) = (7)*(1)*60**	**(9) = [(R2) / 1000]*(1)*60**	**(10) = (8)-(9)**	**(11) = [(2)*AC4] / 360**	**(12) = (11)*(1)*60**	**(13) = [(R4) / 1000]*(1)*60**	**(14) = (12)-(13)**	**(15) = [(2)*AC6] / 360**	**(16) = (15)*(1)*60**	**(17) = [(R6) / 1000]*(1)*60**	**(18) = (16)-(17)**	**(19) = [(2)*AC35] / 360**	**(20) = (19)*(1)*60**	**(21) = (17) + (20)**	**(22) = [(R35) / 1000]*(1)*60**	**(23) = (20)-(22)**
10.0	76.8	0.056	33.5	0.112	67.5	0.133	79.6	9.5	70.1	0.079	47.6	8.2	39.4	0.042	25.4	2.3	23.1	0.390	233.8	236.1	157.9	78.1
15.0	61.2	0.044	40.0	0.090	80.7	0.106	95.3	14.3	81.0	0.063	56.9	12.3	44.6	0.034	30.4	3.4	27.0	0.311	279.7	283.1	236.9	46.2
20.0	51.4	0.037	44.8	0.075	90.3	0.089	106.6	19.1	87.5	0.053	63.7	16.4	47.3	0.028	34.0	4.5	29.5	0.261	313.0	317.5	315.8	1.6
25.0	44.5	0.032	48.5	0.065	97.8	0.077	115.5	23.9	91.6	0.046	69.0	20.5	48.5	0.025	36.8	5.7	31.2	0.226	339.0	344.6	394.8	0.0
30.0	39.4	0.029	51.6	0.058	104.0	0.068	122.8	28.6	94.1	0.041	73.3	24.6	48.7	0.022	39.2	6.8	32.4	0.200	360.3	367.1	473.8	0.0
35.0	35.5	0.026	54.2	0.052	109.2	0.061	128.9	33.4	95.6	0.037	77.0	28.7	48.3	0.020	41.1	7.9	33.2	0.180	378.5	386.4	552.7	0.0
40.0	32.4	0.024	56.5	0.047	113.8	0.056	134.3	38.2	96.2	0.033	80.2	32.8	47.4	0.018	42.8	9.1	33.8	0.164	394.3	403.4	631.7	0.0
45.0	29.8	0.022	58.5	0.044	117.8	0.052	139.1	42.9	96.2	0.031	83.1	36.9	46.2	0.016	44.4	10.2	34.2	0.151	408.4	418.6	710.6	0.0
50.0	27.6	0.020	60.3	0.040	121.5	0.048	143.4	47.7	95.7	0.029	85.7	41.0	44.7	0.015	45.7	11.3	34.4	0.140	421.0	432.3	789.6	0.0
55.0	25.8	0.019	61.9	0.038	124.8	0.045	147.3	52.5	94.9	0.027	88.0	45.1	42.9	0.014	47.0	12.5	34.5	0.131	432.5	444.9	868.6	0.0
60.0	24.2	0.018	63.4	0.036	127.8	0.042	150.9	57.2	93.7	0.025	90.1	49.2	40.9	0.013	48.1	13.6	34.5	0.123	443.0	456.6	947.5	0.0
65.0	22.9	0.017	64.8	0.033	130.6	0.040	154.3	62.0	92.2	0.024	92.1	53.3	38.8	0.013	49.2	14.7	34.5	0.116	452.8	467.5	1026.5	0.0
70.0	21.7	0.016	66.1	0.032	133.3	0.037	157.4	66.8	90.6	0.022	94.0	57.4	36.6	0.012	50.2	15.9	34.3	0.110	461.9	477.7	1105.4	0.0
75.0	20.6	0.015	67.3	0.030	135.7	0.036	160.3	71.6	88.7	0.021	95.7	61.5	34.2	0.011	51.1	17.0	34.1	0.105	470.4	487.4	1194.4	0.0
80.0	19.6	0.014	68.5	0.029	138.0	0.034	163.0	76.3	86.7	0.020	97.3	65.6	31.7	0.011	52.0	18.1	33.9	0.100	478.4	496.5	1263.4	0.0
85.0	18.8	0.014	69.6	0.027	140.2	0.032	165.6	81.1	84.5	0.019	98.9	69.7	29.2	0.010	52.8	19.3	33.6	0.095	486.0	505.2	1342.3	0.0
90.0	18.0	0.013	70.6	0.026	142.3	0.031	168.0	85.9	82.1	0.019	100.3	73.8	26.5	0.010	53.6	20.4	33.2	0.091	493.2	513.5	1421.3	0.0
95.0	17.3	0.013	71.6	0.025	144.3	0.030	170.3	90.6	79.7	0.018	101.7	77.9	23.8	0.010	54.3	21.5	32.8	0.088	500.0	521.5	1500.2	0.0
100.0	16.6	0.012	72.5	0.024	146.1	0.029	172.5	95.4	77.1	0.017	103.1	82.0	21.1	0.009	55.0	22.6	32.4	0.084	506.5	529.1	1579.2	0.0
105.0	16.0	0.012	73.4	0.023	147.9	0.028	174.7	100.2	74.5	0.017	104.3	86.1	18.2	0.009	55.7	23.8	31.9	0.081	512.7	536.5	1658.2	0.0
110.0	15.5	0.011	74.3	0.023	149.7	0.027	176.7	105.0	71.8	0.016	105.5	90.2	15.3	0.009	56.4	24.9	31.4	0.079	518.7	543.6	1737.1	0.0
115.0	15.0	0.011	75.1	0.022	151.3	0.026	178.7	109.7	68.9	0.015	106.7	94.3	12.4	0.008	57.0	26.0	30.9	0.076	524.4	550.5	1816.1	0.0
120.0	14.5	0.011	75.9	0.021	152.9	0.025	180.5	114.5	66.0	0.015	107.8	98.4	9.4	0.008	57.6	27.2	30.4	0.074	530.0	557.1	1895.0	0.0
125.0	14.1	0.010	76.6	0.021	154.4	0.024	182.4	119.3	63.1	0.015	108.9	102.5	6.4	0.008	58.2	28.3	29.8	0.071	535.3	563.6	1974.0	0.0
130.0	13.6	0.010	77.4	0.020	155.9	0.024	184.1	124.0	60.1	0.014	110.0	106.6	3.4	0.008	58.7	29.4	29.3	0.069	540.4	569.9	2053.0	0.0
135.0	13.3	0.010	78.1	0.019	157.4	0.023	185.8	128.8	57.0	0.014	111.0	110.7	0.3	0.007	59.3	30.6	28.7	0.067	545.4	576.0	2131.9	0.0
140.0	12.9	0.009	78.8	0.019	158.7	0.022	187.4	133.6	53.9	0.013	112.0	114.8	0.0	0.007	59.8	31.7	28.1	0.066	550.2	581.9	2210.9	0.0
145.0	12.6	0.009	79.4	0.018	160.1	0.022	189.0	138.3	50.7	0.013	112.9	118.9	0.0	0.007	60.3	32.8	27.4	0.064	554.9	587.7	2289.8	0.0
150.0	12.2	0.009	80.1	0.018	161.4	0.021	190.6	143.1	47.5	0.013	113.8	123.0	0.0	0.007	60.8	34.0	26.8	0.062	559.4	593.4	2368.8	0.0
155.0	11.9	0.009	80.7	0.017	162.7	0.021	192.1	147.9	44.2	0.012	114.7	127.1	0.0	0.007	61.3	35.1	26.2	0.061	563.8	598.9	2447.8	0.0
160.0	11.7	0.008	81.3	0.017	163.9	0.020	193.5	152.7	40.9	0.012	115.6	131.2	0.0	0.006	61.7	36.2	25.5	0.059	568.1	604.3	2526.7	0.0
165.0	11.4	0.008	81.9	0.017	165.1	0.020	194.9	157.4	37.5	0.012	116.4	135.3	0.0	0.006	62.2	37.4	24.8	0.058	572.2	609.6	2605.7	0.0

COLE ENGINEERING

Prepared By: Kirsten MacMillan, EIT

Modified Rational Method - Hundred Year Storm
Site Flow and Storage Summary
Brock Street East Development
File No. 2017-0569
November 2017

100-Year Design Storm

A=	904.0
B=	5.0
C=	0.788
I =	I = A/(T+B)^C

Uncontrolled- To Brock Street

Drainage Areas	A7 Post	
Area =	**0.30**	ha
"C" =	**0.87**	
AC7 =	**0.26**	
Tc =	**10.0**	min
Time Increment =	**5**	min
Release Rate (R7) =	**77.8**	L/s

Uncontrolled- To Existing Pond

Drainage Areas	A1 Post	
Area =	**0.76**	ha
"C" =	**0.69**	
AC1 =	**0.53**	
Tc =	**10.0**	min
Time Increment =	**5**	min
Release Rate (R1) =	**156.7**	L/s

Controlled- To Existing Pond

Drainage Areas	A2 Post	
Area =	**0.69**	ha
"C" =	**0.90**	
AC2 =	**0.62**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min
Allowable Release Rate (R2) = (From Orifice #1)	**19.0**	L/s
Max. Required Storage Volume =	**142.3**	m^3
Max. Storage in Chambers =	**303.89**	m^3

Controlled- To Existing Pond

Drainage Areas	A4 Post	
Area =	**0.41**	ha
"C" =	**0.90**	
AC4 =	**0.37**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min
Allowable Release Rate (R4) = (From Orifice #2)	**17.6**	L/s
Max. Required Storage Volume =	**70.4**	m^3
Max. Storage in Chambers =	**154.65**	m^3

Controlled- To Drainage Area A5 Post

Drainage Areas	A6 Post	
Area =	**0.36**	ha
"C" =	**0.55**	
AC6 =	**0.20**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min
Allowable Release Rate (R6) = (From Orifice #3)	**4.6**	L/s
Max. Required Storage Volume =	**50.3**	m^3
Max. Storage in Chambers =	**142.71**	m^3

Controlled- To Existing Pond

Drainage Areas	A3 Post + A5 Post	
Area =	**2.70**	ha
"C" =	**0.68**	
AC35 =	**1.83**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min
Controlled Release Rate (R35)= (From Orifice #4)	**309.0**	L/s
Max. Required Storage Volume =	**143.3**	m^3
Max. Storage Volume in Chambers =	**503.9**	m^3

Target Release Rate =	**659.4**	L/s
Uncontrolled Release Rate =	**234.5**	L/s
Controlled Release Rate =	**345.6**	L/s
Total Site Release Rate =	**580.1**	L/s

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)
Time	**Rainfall Intensity**	**Storm Runoff**	**Runoff Volume**	**Storm Runoff**	**Runoff Volume**	**Storm Runoff**	**Runoff Volume**	**Allowable Released Volume**	**Storage Volume**	**Storm Runoff**	**Runoff Volume**	**Allowable Released Volume**	**Storage Volume**	**Storm Runoff**	**Runoff Volume**	**Allowable Released Volume**	**Storage Volume**	**Storm Runoff**	**Runoff Volume**	**Total Runoff Volume**	**Allowable Released Volume**	**Storage Volume**
(min)	(mm/hr)	(m^3/s)	(m^3)	(m^3/s)	(m^3)	(m^3/s)	(m^3)	(m^3)	(m^3)	(m^3/s)	(m^3)	(m^3)	(m^3)	(m^3/s)	(m^3)	(m^3)	(m^3)	(m^3/s)	(m^3)	(m^3)	(m^3)	(m^3)
	I = A/(T+B)^C	**(3) = [(2)*AC7] / 360**	**(4) = (3)*(1)*60**	**(5) = [(2)*AC1] / 360**	**(6) = (5)*(1)*60**	**(7) = [(2)*AC2] / 360**	**(8) = (7)*(1)*60**	**(9) = [(R2) / 1000]*(1)*60**	**(10) = (8)-(9)**	**(11) = [(2)*AC4] / 360**	**(12) = (11)*(1)*60**	**(13) = [(R4) / 1000]*(1)*60**	**(14) = (12)-(13)**	**(15) = [(2)*AC6] / 360**	**(16) = (15)*(1)*60**	**(17) = [(R6) / 1000]*(1)*60**	**(18) = (16)-(17)**	**(19) = [(2)*AC35] / 360**	**(20) = (19)*(1)*60**	**(21) = (17) + (20)**	**(22) = [(R35) / 1000]*(1)*60**	**(23) = (20)-(22)**
10.0	107.0	0.078	46.7	0.157	94.0	0.185	111.0	11.4	99.6	0.111	66.3	10.5	55.8	0.059	35.4	2.8	32.6	0.543	325.9	328.7	185.4	143.3
15.0	85.3	0.062	55.8	0.125	112.4	0.148	132.8	17.1	115.6	0.088	79.3	15.8	63.5	0.047	42.3	4.2	38.2	0.433	389.7	393.9	278.1	115.7
20.0	71.5	0.052	62.4	0.105	125.7	0.124	148.5	22.9	125.6	0.074	88.7	21.1	67.6	0.039	47.4	5.5	41.8	0.363	435.8	441.4	370.8	70.5
25.0	62.0	0.045	67.5	0.091	136.1	0.107	160.7	28.6	132.2	0.064	96.0	26.3	69.7	0.034	51.3	6.9	44.3	0.315	471.9	478.8	463.5	15.2
30.0	54.9	0.040	71.8	0.080	144.7	0.095	170.8	34.3	136.5	0.057	102.0	31.6	70.4	0.030	54.5	8.3	46.2	0.279	501.5	509.8	556.3	0.0
35.0	49.4	0.036	75.4	0.072	151.9	0.085	179.4	40.0	139.4	0.051	107.2	36.9	70.3	0.027	57.2	9.7	47.5	0.251	526.6	536.3	649.0	0.0
40.0	45.0	0.033	78.5	0.066	158.2	0.078	186.9	45.7	141.1	0.047	111.6	42.1	69.5	0.025	59.6	11.1	48.5	0.229	548.5	559.6	741.7	0.0
45.0	41.4	0.030	81.3	0.061	163.8	0.072	193.5	51.4	142.0	0.043	115.6	47.4	68.2	0.023	61.7	12.5	49.2	0.210	567.9	580.4	834.4	0.0
50.0	38.4	0.028	83.8	0.056	168.9	0.066	199.4	57.1	142.3	0.040	119.1	52.7	66.4	0.021	63.6	13.9	49.7	0.195	585.3	599.2	927.1	0.0
55.0	35.9	0.026	86.1	0.053	173.5	0.062	204.8	62.9	142.0	0.037	122.3	57.9	64.4	0.020	65.3	15.3	50.1	0.182	601.2	616.5	1019.8	0.0
60.0	33.7	0.024	88.2	0.049	177.7	0.058	209.8	68.6	141.2	0.035	125.3	63.2	62.1	0.019	66.9	16.6	50.3	0.171	615.8	632.4	1112.5	0.0
65.0	31.8	0.023	90.1	0.047	181.5	0.055	214.4	74.3	140.1	0.033	128.0	68.5	59.6	0.018	68.4	18.0	50.3	0.161	629.2	647.3	1205.2	0.0
70.0	30.1	0.022	91.9	0.044	185.2	0.052	218.6	80.0	138.6	0.031	130.6	73.7	56.9	0.017	69.7	19.4	50.3	0.153	641.8	661.2	1297.9	0.0
75.0	28.6	0.021	93.6	0.042	188.6	0.049	222.6	85.7	136.9	0.030	133.0	79.0	54.0	0.016	71.0	20.8	50.2	0.145	653.5	674.3	1390.6	0.0
80.0	27.3	0.020	95.1	0.040	191.7	0.047	226.4	91.4	135.0	0.028	135.2	84.3	51.0	0.015	72.2	22.2	50.0	0.138	664.6	686.8	1483.4	0.0
85.0	26.1	0.019	96.6	0.038	194.8	0.045	230.0	97.1	132.8	0.027	137.4	89.5	47.8	0.014	73.3	23.6	49.8	0.132	675.0	698.6	1576.1	0.0
90.0	25.0	0.018	98.1	0.037	197.6	0.043	233.3	102.9	130.5	0.026	139.4	94.8	44.6	0.014	74.4	25.0	49.5	0.127	684.9	709.9	1668.8	0.0
95.0	24.0	0.017	99.4	0.035	200.3	0.041	236.5	108.6	128.0	0.025	141.3	100.1	41.2	0.013	75.4	26.4	49.1	0.122	694.3	720.7	1761.5	0.0
100.0	23.1	0.017	100.7	0.034	202.9	0.040	239.6	114.3	125.3	0.024	143.1	105.3	37.8	0.013	76.4	27.7	48.7	0.117	703.3	731.0	1854.2	0.0
105.0	22.3	0.016	101.9	0.033	205.4	0.038	242.5	120.0	122.5	0.023	144.9	110.6	34.3	0.012	77.3	29.1	48.2	0.113	711.9	741.0	1946.9	0.0
110.0	21.5	0.016	103.1	0.031	207.8	0.037	245.3	125.7	119.6	0.022	146.5	115.9	30.7	0.012	78.2	30.5	47.7	0.109	720.1	750.6	2039.6	0.0
115.0	20.8	0.015	104.2	0.030	210.0	0.036	248.0	131.4	116.6	0.021	148.1	121.1	27.0	0.011	79.1	31.9	47.2	0.106	728.0	759.9	2132.3	0.0
120.0	20.1	0.015	105.3	0.029	212.2	0.035	250.6	137.1	113.5	0.021	149.7	126.4	23.3	0.011	79.9	33.3	46.6	0.102	735.6	768.9	2225.0	0.0
125.0	19.5	0.014	106.4	0.029	214.4	0.034	253.1	142.9	110.2	0.020	151.2	131.7	19.5	0.011	80.7	34.7	46.1	0.099	743.0	777.6	2317.7	0.0
130.0	18.9	0.014	107.4	0.028	216.4	0.033	255.5	148.6	106.9	0.020	152.6	136.9	15.7	0.010	81.5	36.1	45.4	0.096	750.0	786.1	2410.5	0.0
135.0	18.4	0.013	108.4	0.027	218.4	0.032	257.8	154.3	103.6	0.019	154.0	142.2	11.8	0.010	82.2	37.4	44.8	0.093	756.9	794.3	2503.2	0.0
140.0	17.9	0.013	109.3	0.026	220.3	0.031	260.1	160.0	100.1	0.018	155.4	147.5	7.9	0.010	83.0	38.8	44.1	0.091	763.5	802.3	2595.9	0.0
145.0	17.4	0.013	110.2	0.026	222.1	0.030	262.3	165.7	96.6	0.018	156.7	152.7	3.9	0.010	83.7	40.2	43.4	0.088	769.9	810.1	2688.6	0.0
150.0	17.0	0.012	111.1	0.025	223.9	0.029	264.4	171.4	93.0	0.018	157.9	158.0	0.0	0.009	84.3	41.6	42.7	0.086	776.2	817.8	2781.3	0.0
155.0	16.6	0.012	112.0	0.024	225.7	0.029	266.5	177.1	89.3	0.017	159.2	163.3	0.0	0.009	85.0	43.0	42.0	0.084	782.2	825.2	2874.0	0.0
160.0	16.2	0.012	112.8	0.024	227.4	0.028	268.5	182.9	85.6	0.017	160.4	168.5	0.0	0.009	85.6	44.4	41.2	0.082	788.1	832.5	2966.7	0.0
165.0	15.8	0.011	113.6	0.023	229.0	0.027	270.4	188.6	81.9	0.016	161.5	173.8	0.0	0.009	86.3	45.8	40.5	0.080	793.8	839.6	3059.4	0.0

COLE ENGINEERING

Prepared By: Kirsten MacMillan, EIT

Modified Rational Method - Hundred Year Storm
Site Flow and Storage Summary
Brock Street East Development
File No. 2017-0569
November 2017

Uncontrolled- To Brock Street

Drainage Areas	A7 Post	
Area =	**0.30**	ha
"C" =	**0.87**	
AC7 =	**0.26**	
Tc =	**10.0**	min
Time Increment =	**5**	min
Release Rate (R7) =	**91.6**	L/s

Uncontrolled- To Existing Pond

Drainage Areas	A1 Post	
Area =	**0.76**	ha
"C" =	**0.69**	
AC1 =	**0.53**	
Tc =	**10.0**	min
Time Increment =	**5**	min
Release Rate (R1) =	**184.6**	L/s

Controlled- To Existing Pond

Drainage Areas	A2 Post	
Area =	**0.69**	ha
"C" =	**0.90**	
AC2 =	**0.62**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min
Allowable Release Rate (R2) = (From Orifice #1)	**21.7**	L/s
Max. Required Storage Volume =	**169.7**	m^3
Max. Storage in Chambers =	**303.89**	m^3

Controlled- To Existing Pond

Drainage Areas	A4 Post	
Area =	**0.41**	ha
"C" =	**0.90**	
AC4 =	**0.37**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min
Allowable Release Rate (R4) = (From Orifice #2)	**19.6**	L/s
Max. Required Storage Volume =	**85.1**	m^3
Max. Storage in Chambers =	**154.65**	m^3

Controlled- To Drainage Area A5 Post

Drainage Areas	A6 Post	
Area =	**0.36**	ha
"C" =	**0.55**	
AC6 =	**0.20**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min
Allowable Release Rate (R6) = (From Orifice #3)	**5.06**	L/s
Max. Required Storage Volume =	**60.9**	m^3
Max. Storage in Chambers =	**142.71**	m^3

Controlled- To Existing Pond

Drainage Areas	A3 Post + A5 Post	
Area =	**2.70**	ha
"C" =	**0.68**	
AC35 =	**1.83**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min
Controlled Release Rate (R35)= (From Orifice #4)	**332.0**	L/s
Max. Required Storage Volume =	**187.8**	m^3
Max. Storage Volume in Chambers =	**503.9**	m^3

Target Release Rate =	**776.9**	L/s
Uncontrolled Release Rate =	**276.2**	L/s
Controlled Release Rate =	**373.3**	L/s
Total Site Release Rate =	**649.5**	L/s

100-Year Design Storm

A=	1065.0
B=	5.0
C=	0.788
I =	I = A/(T+B)^C

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)
Time	**Rainfall Intensity**	**Storm Runoff**	**Runoff Volume**	**Storm Runoff**	**Runoff Volume**	**Storm Runoff**	**Runoff Volume**	**Allowable Released Volume**	**Storage Volume**	**Storm Runoff**	**Runoff Volume**	**Allowable Released Volume**	**Storage Volume**	**Storm Runoff**	**Runoff Volume**	**Allowable Released Volume**	**Storage Volume**	**Storm Runoff**	**Runoff Volume**	**Total Runoff Volume**	**Allowable Released Volume**	**Storage Volume**
(min)	(mm/hr)	(m^3/s)	(m^3)	(m^3/s)	(m^3)	(m^3/s)	(m^3)	(m^3)	(m^3)	(m^3/s)	(m^3)	(m^3)	(m^3)	(m^3/s)	(m^3)	(m^3)	(m^3)	(m^3/s)	(m^3)	(m^3)	(m^3)	(m^3)
	I = A(T+B)^C	**(3) = [(2)*AC7] / 360**	**(4) = (3)*(1)*60**	**(5) = [(2)*AC1] / 360**	**(6) = (5)*(1)*60**	**(7) = [(2)*AC2] / 360**	**(8) = (7)*(1)*60**	**(9) = [(R2) / 1000]*(1)*60**	**(10) = (8)-(9)**	**(11) = [(2)*AC4] / 360**	**(12) = (11)*(1)*60**	**(13) = [(R4) / 1000]*(1)*60**	**(14) = (12)-(13)**	**(15) = [(2)*AC6] / 360**	**(16) = (15)*(1)*60**	**(17) = [(R6) / 1000]*(1)*60**	**(18) = (16)-(17)**	**(19) = [(2)*AC35] / 360**	**(20) = (19)*(1)*60**	**(21) = (17) + (20)**	**(22) = [(R35) / 1000]*(1)*60**	**(23) = (20)-(22)**
10.0	126.1	0.092	55.0	0.185	110.8	0.218	130.8	13.0	117.8	0.130	78.1	11.7	66.4	0.070	41.7	3.0	38.7	0.640	383.9	387.0	199.2	187.8
15.0	100.5	0.073	65.7	0.147	132.5	0.174	156.4	19.6	136.8	0.104	93.4	17.6	75.8	0.055	49.9	4.6	45.3	0.510	459.1	463.7	298.8	164.9
20.0	84.3	0.061	73.5	0.123	148.1	0.146	174.9	26.1	148.8	0.087	104.5	23.5	81.0	0.046	55.8	6.1	49.7	0.428	513.4	519.5	398.3	121.2
25.0	73.0	0.053	79.6	0.107	160.4	0.126	189.4	32.6	156.8	0.075	113.1	29.4	83.8	0.040	60.4	7.6	52.8	0.371	555.9	563.5	497.9	65.6
30.0	64.7	0.047	84.6	0.095	170.4	0.112	201.3	39.1	162.1	0.067	120.2	35.2	85.0	0.036	64.2	9.1	55.1	0.328	590.8	599.9	597.5	2.4
35.0	58.2	0.042	88.8	0.085	179.0	0.101	211.4	45.7	165.7	0.060	126.2	41.1	85.1	0.032	67.4	10.6	56.8	0.295	620.4	631.0	697.1	0.0
40.0	53.0	0.039	92.5	0.078	186.4	0.092	220.1	52.2	168.0	0.055	131.5	47.0	84.5	0.029	70.2	12.2	58.1	0.269	646.2	658.3	796.7	0.0
45.0	48.8	0.035	95.8	0.071	193.0	0.084	227.9	58.7	169.2	0.050	136.1	52.8	83.3	0.027	72.7	13.7	59.0	0.248	669.0	682.7	896.3	0.0
50.0	45.3	0.033	98.7	0.066	199.0	0.078	234.9	65.2	169.7	0.047	140.3	58.7	81.6	0.025	74.9	15.2	59.7	0.230	689.6	704.8	995.9	0.0
55.0	42.3	0.031	101.4	0.062	204.3	0.073	241.3	71.8	169.5	0.044	144.1	64.6	79.5	0.023	77.0	16.7	60.2	0.215	708.3	725.0	1095.4	0.0
60.0	39.7	0.029	103.9	0.058	209.3	0.069	247.1	78.3	168.9	0.041	147.6	70.4	77.2	0.022	78.8	18.2	60.6	0.202	725.4	743.7	1195.0	0.0
65.0	37.4	0.027	106.1	0.055	213.9	0.065	252.5	84.8	167.7	0.039	150.8	76.3	74.5	0.021	80.5	19.8	60.8	0.190	741.3	761.1	1294.6	0.0
70.0	35.5	0.026	108.2	0.052	218.1	0.061	257.6	91.3	166.3	0.037	153.8	82.2	71.7	0.020	82.2	21.3	60.9	0.180	756.1	777.4	1394.2	0.0
75.0	33.7	0.024	110.2	0.049	222.1	0.058	262.3	97.8	164.4	0.035	156.7	88.1	68.6	0.019	83.7	22.8	60.9	0.171	769.9	792.7	1493.8	0.0
80.0	32.1	0.023	112.1	0.047	225.9	0.056	266.7	104.4	162.4	0.033	159.3	93.9	65.4	0.018	85.1	24.3	60.8	0.163	782.9	807.3	1593.4	0.0
85.0	30.7	0.022	113.8	0.045	229.4	0.053	270.9	110.9	160.0	0.032	161.8	99.8	62.0	0.017	86.4	25.8	60.6	0.156	795.2	821.1	1693.0	0.0
90.0	29.4	0.021	115.5	0.043	232.8	0.051	274.9	117.4	157.5	0.030	164.2	105.7	58.5	0.016	87.7	27.3	60.3	0.149	806.9	834.2	1792.6	0.0
95.0	28.3	0.021	117.1	0.041	236.0	0.049	278.7	123.9	154.7	0.029	166.4	111.5	54.9	0.016	88.9	28.9	60.0	0.144	818.0	846.9	1892.1	0.0
100.0	27.2	0.020	118.6	0.040	239.0	0.047	282.3	130.5	151.8	0.028	168.6	117.4	51.2	0.015	90.0	30.4	59.6	0.138	828.6	858.9	1991.7	0.0
105.0	26.2	0.019	120.1	0.038	242.0	0.045	285.7	137.0	148.7	0.027	170.7	123.3	47.4	0.014	91.1	31.9	59.2	0.133	838.7	870.6	2091.3	0.0
110.0	25.3	0.018	121.5	0.037	244.8	0.044	289.0	143.5	145.5	0.026	172.6	129.1	43.5	0.014	92.2	33.4	58.8	0.129	848.4	881.8	2190.9	0.0
115.0	24.5	0.018	122.8	0.036	247.5	0.042	292.2	150.0	142.2	0.025	174.5	135.0	39.5	0.014	93.2	34.9	58.2	0.124	857.7	892.6	2290.5	0.0
120.0	23.7	0.017	124.1	0.035	250.0	0.041	295.2	156.6	138.7	0.024	176.3	140.9	35.5	0.013	94.2	36.5	57.7	0.120	866.6	903.1	2390.1	0.0
125.0	23.0	0.017	125.3	0.034	252.5	0.040	298.2	163.1	135.1	0.024	178.1	146.8	31.3	0.013	95.1	38.0	57.1	0.117	875.3	913.3	2489.7	0.0
130.0	22.3	0.016	126.5	0.033	254.9	0.039	301.0	169.6	131.4	0.023	179.8	152.6	27.2	0.012	96.0	39.5	56.5	0.113	883.6	923.1	2589.2	0.0
135.0	21.7	0.016	127.7	0.032	257.3	0.038	303.8	176.1	127.6	0.022	181.4	158.5	22.9	0.012	96.9	41.0	55.9	0.110	891.7	932.7	2688.8	0.0
140.0	21.1	0.015	128.8	0.031	259.5	0.036	306.4	182.6	123.8	0.022	183.0	164.4	18.7	0.012	97.7	42.5	55.2	0.107	899.5	942.0	2788.4	0.0
145.0	20.5	0.015	129.9	0.030	261.7	0.036	309.0	189.2	119.8	0.021	184.6	170.2	14.3	0.011	98.6	44.1	54.5	0.104	907.0	951.1	2888.0	0.0
150.0	20.0	0.015	130.9	0.029	263.8	0.035	311.5	195.7	115.8	0.021	186.1	176.1	10.0	0.011	99.4	45.6	53.8	0.102	914.4	960.0	2987.6	0.0
155.0	19.5	0.014	131.9	0.029	265.9	0.034	313.9	202.2	111.7	0.020	187.5	182.0	5.5	0.011	100.1	47.1	53.0	0.099	921.5	968.6	3087.2	0.0
160.0	19.1	0.014	132.9	0.028	267.9	0.033	316.3	208.7	107.6	0.020	188.9	187.8	1.1	0.011	100.9	48.6	52.3	0.097	928.5	977.1	3186.8	0.0
165.0	18.6	0.014	133.9	0.027	269.8	0.032	318.6	215.3	103.3	0.019	190.3	193.7	0.0	0.010	101.6	50.1	51.5	0.094	935.2	985.4	3286.3	0.0

COLE ENGINEERING

Prepared By: Kirsten MacMillan, EIT

Modified Rational Method - Hundred Year Storm
Site Flow and Storage Summary
Brock Street East Development
File No. 2017-0569
November 2017

Uncontrolled- To Brock Street

Drainage Areas	A7 Post	
Area =	**0.30**	ha
"C" =	**0.95**	
AC7 =	**0.29**	
Tc =	**10.0**	min
Time Increment =	**5**	min
Release Rate (R7) =	**123.6**	L/s

Uncontrolled- To Existing Pond

Drainage Areas	A1 Post	
Area =	**0.46**	ha
"C" =	**0.87**	
AC1 =	**0.40**	
Tc =	**10.0**	min
Time Increment =	**5**	min
Release Rate (R1) =	**171.4**	L/s

Controlled- To Existing Pond

Drainage Areas	A2 Post	
Area =	**0.69**	ha
"C" =	**0.99**	
AC2 =	**0.68**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min
Allowable Release Rate (R2) = (From Orifice #1)	**25.9**	L/s
Max. Required Storage Volume =	**227.4**	m^3
Max. Storage in Chambers =	**303.89**	m^3

Controlled- To Existing Pond

Drainage Areas	A4 Post	
Area =	**0.41**	ha
"C" =	**0.99**	
AC4 =	**0.41**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min
Allowable Release Rate (R4) = (From Orifice #2)	**23.9**	L/s
Max. Required Storage Volume =	**114.6**	m^3
Max. Storage in Chambers =	**154.65**	m^3

Controlled- To Drainage Area A5 Post

Drainage Areas	A6 Post	
Area =	**0.36**	ha
"C" =	**0.61**	
AC6 =	**0.22**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min
Allowable Release Rate (R6) = (From Orifice #3)	**6.32**	L/s
Max. Required Storage Volume =	**79.7**	m^3
Max. Storage in Chambers =	**142.71**	m^3

Controlled- To Existing Pond

Drainage Areas	A3 Post + A5 Post	
Area =	**2.70**	ha
"C" =	**0.74**	
AC35 =	**2.01**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min
Controlled Release Rate (R35)= (From Orifice #4)	**392.8**	L/s
Max. Required Storage Volume =	**286.2**	m^3
Max. Storage Volume in Chambers =	**503.9**	m^3

Target Release Rate =	**952.9**	L/s
Uncontrolled Release Rate =	**295.0**	L/s
Controlled Release Rate =	**442.5**	L/s
Total Site Release Rate =	**737.5**	L/s

100-Year Design Storm

A=	1234.0
B=	4.0
C=	0.787
I =	I = A/(T+B)^C

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)
Time	**Rainfall Intensity**	**Storm Runoff**	**Runoff Volume**	**Storm Runoff**	**Runoff Volume**	**Storm Runoff**	**Runoff Volume**	**Allowable Released Volume**	**Storage Volume**	**Storm Runoff**	**Runoff Volume**	**Allowable Released Volume**	**Storage Volume**	**Storm Runoff**	**Runoff Volume**	**Allowable Released Volume**	**Storage Volume**	**Storm Runoff**	**Runoff Volume**	**Total Runoff Volume**	**Allowable Released Volume**	**Storage Volume**
(min)	(mm/hr)	(m^3/s)	(m^3)	(m^3/s)	(m^3)	(m^3/s)	(m^3)	(m^3)	(m^3)	(m^3/s)	(m^3)	(m^3)	(m^3)	(m^3/s)	(m^3)	(m^3)	(m^3)	(m^3/s)	(m^3)	(m^3)	(m^3)	(m^3)
	I = A/(T+B)^C	**(3) = [(2)*AC7] / 360**	**(4) = (3)*(1)*60**	**(5) = [(2)*AC1] / 360**	**(6) = (5)*(1)*60**	**(7) = [(2)*AC2] / 360**	**(8) = (7)*(1)*60**	**(9) = [(R2) / 1000]*(1)*60**	**(10) = (8)-(9)**	**(11) = [(2)*AC4] / 360**	**(12) = (11)*(1)*60**	**(13) = [(R4) / 1000]*(1)*60**	**(14) = (12)-(13)**	**(15) = [(2)*AC6] / 360**	**(16) = (15)*(1)*60**	**(17) = [(R6) / 1000]*(1)*60**	**(18) = (16)-(17)**	**(19) = [(2)*AC35] / 360**	**(20) = (19)*(1)*60**	**(21) = (17) + (20)**	**(22) = [(R35) / 1000]*(1)*60**	**(23) = (20)-(22)**
10.0	154.6	0.124	74.2	0.171	102.8	0.294	176.5	15.5	160.9	0.176	105.4	14.3	91.1	0.094	56.3	3.8	52.5	0.863	518.1	521.8	235.7	286.2
15.0	121.6	0.097	87.5	0.135	121.3	0.231	208.2	23.3	184.9	0.138	124.3	21.5	102.9	0.074	66.4	5.7	60.7	0.679	611.1	616.8	353.5	263.3
20.0	101.2	0.081	97.1	0.112	134.6	0.192	231.0	31.1	199.9	0.115	137.9	28.6	109.3	0.061	73.7	7.6	66.1	0.565	677.9	685.5	471.3	214.2
25.0	87.2	0.070	104.5	0.097	144.9	0.166	248.7	38.8	209.9	0.099	148.6	35.8	112.8	0.053	79.3	9.5	69.9	0.487	730.2	739.6	589.2	150.5
30.0	76.9	0.061	110.7	0.085	153.5	0.146	263.4	46.6	216.8	0.087	157.3	43.0	114.3	0.047	84.0	11.4	72.6	0.429	773.1	784.5	707.0	77.5
35.0	69.0	0.055	115.9	0.077	160.7	0.131	275.8	54.4	221.4	0.078	164.7	50.1	114.6	0.042	88.0	13.3	74.7	0.386	809.6	822.9	824.8	0.0
40.0	62.8	0.050	120.5	0.070	167.0	0.119	286.7	62.2	224.5	0.071	171.2	57.3	113.9	0.038	91.4	15.2	76.3	0.351	841.5	856.6	942.7	0.0
45.0	57.7	0.046	124.5	0.064	172.7	0.110	296.3	69.9	226.4	0.066	177.0	64.4	112.5	0.035	94.5	17.1	77.5	0.322	869.8	886.8	1060.5	0.0
50.0	53.4	0.043	128.2	0.059	177.7	0.102	305.0	77.7	227.3	0.061	182.2	71.6	110.6	0.032	97.3	18.9	78.3	0.298	895.3	914.2	1178.3	0.0
55.0	49.8	0.040	131.5	0.055	182.3	0.095	312.9	85.5	227.4	0.057	186.9	78.8	108.1	0.030	99.8	20.8	79.0	0.278	918.5	939.4	1296.2	0.0
60.0	46.8	0.037	134.5	0.052	186.6	0.089	320.2	93.2	227.0	0.053	191.2	85.9	105.3	0.028	102.1	22.7	79.4	0.261	939.9	962.6	1414.0	0.0
65.0	44.1	0.035	137.4	0.049	190.5	0.084	326.9	101.0	225.9	0.050	195.3	93.1	102.2	0.027	104.3	24.6	79.6	0.246	959.7	984.3	1531.8	0.0
70.0	41.7	0.033	140.0	0.046	194.2	0.079	333.2	108.8	224.5	0.047	199.0	100.2	98.8	0.025	106.3	26.5	79.7	0.233	978.1	1004.7	1649.6	0.0
75.0	39.6	0.032	142.5	0.044	197.6	0.075	339.1	116.5	222.6	0.045	202.5	107.4	95.1	0.024	108.2	28.4	79.7	0.221	995.4	1023.9	1767.5	0.0
80.0	37.7	0.030	144.8	0.042	200.8	0.072	344.7	124.3	220.4	0.043	205.9	114.6	91.3	0.023	109.9	30.3	79.6	0.211	1011.7	1042.0	1885.3	0.0
85.0	36.1	0.029	147.0	0.040	203.9	0.069	349.9	132.1	217.8	0.041	209.0	121.7	87.3	0.022	111.6	32.2	79.4	0.201	1027.1	1059.4	2003.1	0.0
90.0	34.6	0.028	149.1	0.038	206.8	0.066	354.9	139.8	215.1	0.039	212.0	128.9	83.1	0.021	113.2	34.1	79.1	0.193	1041.8	1075.9	2121.0	0.0
95.0	33.2	0.027	151.1	0.037	209.6	0.063	359.6	147.6	212.0	0.038	214.8	136.0	78.8	0.020	114.7	36.0	78.7	0.185	1055.7	1091.7	2238.8	0.0
100.0	31.9	0.026	153.0	0.035	212.2	0.061	364.2	155.4	208.8	0.036	217.5	143.2	74.3	0.019	116.2	37.9	78.3	0.178	1069.0	1106.9	2356.6	0.0
105.0	30.8	0.025	154.9	0.034	214.7	0.058	368.5	163.2	205.4	0.035	220.1	150.4	69.7	0.019	117.5	39.8	77.7	0.172	1081.7	1121.5	2474.5	0.0
110.0	29.7	0.024	156.6	0.033	217.2	0.056	372.7	170.9	201.7	0.034	222.6	157.5	65.1	0.018	118.9	41.7	77.2	0.166	1093.9	1135.6	2592.3	0.0
115.0	28.7	0.023	158.3	0.032	219.5	0.055	376.7	178.7	198.0	0.033	225.0	164.7	60.3	0.017	120.1	43.6	76.6	0.160	1105.7	1149.2	2710.1	0.0
120.0	27.8	0.022	159.9	0.031	221.7	0.053	380.5	186.5	194.1	0.032	227.3	171.8	55.4	0.017	121.4	45.5	75.9	0.155	1117.0	1162.4	2828.0	0.0
125.0	26.9	0.022	161.5	0.030	223.9	0.051	384.2	194.2	190.0	0.031	229.5	179.0	50.5	0.016	122.5	47.4	75.2	0.150	1127.9	1175.2	2945.8	0.0
130.0	26.1	0.021	163.0	0.029	226.0	0.050	387.8	202.0	185.8	0.030	231.6	186.2	45.5	0.016	123.7	49.3	74.4	0.146	1138.4	1187.7	3063.6	0.0
135.0	25.4	0.020	164.4	0.028	228.0	0.048	391.3	209.8	181.5	0.029	233.7	193.3	40.4	0.015	124.8	51.2	73.6	0.142	1148.6	1199.7	3181.5	0.0
140.0	24.7	0.020	165.8	0.027	230.0	0.047	394.7	217.5	177.1	0.028	235.7	200.5	35.2	0.015	125.9	53.1	72.8	0.138	1158.4	1211.5	3299.3	0.0
145.0	24.0	0.019	167.2	0.027	231.9	0.046	397.9	225.3	172.6	0.027	237.7	207.6	30.0	0.015	126.9	55.0	72.0	0.134	1168.0	1223.0	3417.1	0.0
150.0	23.4	0.019	168.5	0.026	233.7	0.045	401.1	233.1	168.0	0.027	239.6	214.8	24.8	0.014	127.9	56.8	71.1	0.131	1177.3	1234.2	3535.0	0.0
155.0	22.8	0.018	169.8	0.025	235.5	0.043	404.2	240.8	163.3	0.026	241.4	222.0	19.4	0.014	128.9	58.7	70.2	0.128	1186.3	1245.1	3652.8	0.0
160.0	22.3	0.018	171.1	0.025	237.2	0.042	407.2	248.6	158.5	0.025	243.2	229.1	14.1	0.014	129.9	60.6	69.2	0.124	1195.1	1255.8	3770.6	0.0
165.0	21.8	0.017	172.3	0.024	238.9	0.041	410.1	256.4	153.7	0.025	244.9	236.3	8.6	0.013	130.8	62.5	68.3	0.122	1203.7	1266.2	3888.5	0.0

COLE ENGINEERING

Prepared By: Kirsten MacMillan, EIT

Modified Rational Method - Hundred Year Storm
Site Flow and Storage Summary
Brock Street East Development
File No. 2017-0569
November 2017

100-Year Design Storm

A=	1799.0
B=	5.0
C=	0.81
I =	I = A/(T+B)^C

Uncontrolled- To Brock Street

Drainage Areas	A7 Post		
Area =	**0.30**	ha	
"C" =	**1.00**		
AC7 =	**0.30**		
Tc =	**10.0**	min	
Time Increment =	**5**	min	
Release Rate (R7) =	**168.0**	L/s	

Uncontrolled- To Existing Pond

Drainage Areas	A1 Post		
Area =	**0.46**	ha	
"C" =	**0.87**		
AC1 =	**0.40**		
Tc =	**10.0**	min	
Time Increment =	**5**	min	
Release Rate (R1) =	**222.4**	L/s	

Controlled- To Existing Pond

Drainage Areas	A2 Post		
Area =	**0.69**	ha	
"C" =	**1.00**		
AC2 =	**0.69**		
Tc =	**10.0**	min	
Time Increment =	**5.0**	min	
Allowable Release Rate (R2) = (From Orifice #1)	**33.98**	L/s	
Max. Required Storage Volume =	**301.8**	m^3	
Max. Storage in Chambers =	**303.89**	m^3	

Controlled- To Existing Pond

Drainage Areas	A4 Post		
Area =	**0.41**	ha	
"C" =	**1.00**		
AC4 =	**0.41**		
Tc =	**10.0**	min	
Time Increment =	**5.0**	min	
Allowable Release Rate (R4) = (From Orifice #2)	**31.3**	L/s	
Max. Required Storage Volume =	**152.7**	m^3	
Max. Storage in Chambers =	**154.65**	m^3	

Controlled- To Drainage Area A5 Post

Drainage Areas	A6 Post		
Area =	**0.36**	ha	
"C" =	**0.69**		
AC6 =	**0.25**		
Tc =	**10.0**	min	
Time Increment =	**5.0**	min	
Allowable Release Rate (R6) = (From Orifice #3)	**8.9**	L/s	
Max. Required Storage Volume =	**120.3**	m^3	
Max. Storage in Chambers =	**142.71**	m^3	

Controlled- To Existing Pond

Drainage Areas	A3 Post + A5 Post		
Area =	**2.70**	ha	
"C" =	**0.84**		
AC35 =	**2.27**		
Tc =	**10.0**	min	
Time Increment =	**5.0**	min	
Controlled Release Rate (R35)= (From Orifice #4)	**499.8**	L/s	
Max. Required Storage Volume =	**464.2**	m^3	
Max. Storage Volume in Chambers =	**503.9**	m^3	

Target Release Rate =	**1236.4**	L/s
Uncontrolled Release Rate =	**390.4**	L/s
Controlled Release Rate =	**565.1**	L/s
Total Site Release Rate =	**955.5**	L/s

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)
Time	**Rainfall Intensity**	**Storm Runoff**	**Runoff Volume**	**Storm Runoff**	**Runoff Volume**	**Storm Runoff**	**Runoff Volume**	**Allowable Released Volume**	**Storage Volume**	**Storm Runoff**	**Runoff Volume**	**Allowable Released Volume**	**Storage Volume**	**Storm Runoff**	**Runoff Volume**	**Allowable Released Volume**	**Storage Volume**	**Storm Runoff**	**Runoff Volume**	**Total Runoff Volume**	**Allowable Released Volume**	**Storage Volume**
(min)	(mm/hr)	(m^3/s)	(m^3)	(m^3/s)	(m^3)	(m^3/s)	(m^3)	(m^3)	(m^3)	(m^3/s)	(m^3)	(m^3)	(m^3)	(m^3/s)	(m^3)	(m^3)	(m^3)	(m^3/s)	(m^3)	(m^3)	(m^3)	(m^3)
	I = A(T+B)^C	**(3) = [(2)*AC7] / 360**	**(4) = (3)*(1)*60**	**(5) = [(2)*AC1] / 360**	**(6) = (5)*(1)*60**	**(7) = [(2)*AC2] / 360**	**(8) = (7)*(1)*60**	**(9) = [(R2) / 1000]*(1)*60**	**(10) = (8)-(9)**	**(11) = [(2)*AC4] / 360**	**(12) = (11)*(1)*60**	**(13) = [(R4) / 1000]*(1)*60**	**(14) = (12)-(13)**	**(15) = [(2)*AC6] / 360**	**(16) = (15)*(1)*60**	**(17) = [(R6) / 1000]*(1)*60**	**(18) = (16)-(17)**	**(19) = [(2)*AC35] / 360**	**(20) = (19)*(1)*60**	**(21) = (17) + (20)**	**(22) = [(R35) / 1000]*(1)*60**	**(23) = (20)-(22)**
10.0	200.6	0.168	100.8	0.222	133.4	0.385	231.3	20.4	210.9	0.230	138.1	18.8	119.4	0.138	83.0	5.4	77.6	1.265	758.7	764.1	299.9	464.2
15.0	158.9	0.133	119.8	0.176	158.5	0.305	274.8	30.6	244.2	0.182	164.1	28.2	136.0	0.110	98.6	8.0	90.6	1.002	901.5	909.6	449.8	459.8
20.0	132.6	0.111	133.3	0.147	176.4	0.255	305.8	40.8	265.1	0.152	182.7	37.6	145.1	0.091	109.7	10.7	99.0	0.836	1003.3	1014.0	599.7	414.3
25.0	114.4	0.096	143.8	0.127	190.3	0.220	329.8	51.0	278.8	0.131	197.0	47.0	150.0	0.079	118.3	13.4	105.0	0.721	1081.9	1095.3	749.7	345.6
30.0	101.0	0.085	152.3	0.112	201.5	0.194	349.3	61.2	288.2	0.116	208.6	56.4	152.3	0.070	125.3	16.1	109.3	0.637	1145.9	1162.0	899.6	262.4
35.0	90.6	0.076	159.4	0.100	211.0	0.174	365.8	71.4	294.4	0.104	218.5	65.8	152.7	0.062	131.2	18.7	112.5	0.571	1199.8	1218.6	1049.5	169.0
40.0	82.4	0.069	165.6	0.091	219.2	0.158	380.0	81.5	298.4	0.095	227.0	75.2	151.8	0.057	136.3	21.4	114.9	0.519	1246.5	1267.9	1199.5	68.4
45.0	75.7	0.063	171.1	0.084	226.4	0.145	392.5	91.7	300.8	0.087	234.4	84.5	149.9	0.052	140.8	24.1	116.8	0.477	1287.6	1311.6	1349.4	0.0
50.0	70.0	0.059	176.0	0.078	232.9	0.135	403.7	101.9	301.8	0.080	241.1	93.9	147.2	0.048	144.9	26.8	118.1	0.441	1324.3	1351.1	1499.3	0.0
55.0	65.3	0.055	180.4	0.072	238.7	0.125	413.9	112.1	301.7	0.075	247.2	103.3	143.9	0.045	148.5	29.4	119.1	0.411	1357.6	1387.1	1649.2	0.0
60.0	61.2	0.051	184.4	0.068	244.1	0.118	423.1	122.3	300.8	0.070	252.7	112.7	140.0	0.042	151.8	32.1	119.7	0.386	1388.1	1420.2	1799.2	0.0
65.0	57.6	0.048	188.2	0.064	249.0	0.111	431.7	132.5	299.2	0.066	257.8	122.1	135.7	0.040	154.9	34.8	120.1	0.363	1416.2	1450.9	1949.1	0.0
70.0	54.5	0.046	191.6	0.060	253.6	0.105	439.6	142.7	296.9	0.063	262.6	131.5	131.1	0.038	157.7	37.5	120.3	0.343	1442.2	1479.6	2099.0	0.0
75.0	51.7	0.043	194.9	0.057	257.9	0.099	447.0	152.9	294.2	0.059	267.0	140.9	126.1	0.036	160.4	40.1	120.3	0.326	1466.5	1506.6	2249.0	0.0
80.0	49.2	0.041	197.9	0.055	261.9	0.095	454.0	163.1	290.9	0.056	271.2	150.3	120.9	0.034	162.9	42.8	120.1	0.310	1489.3	1532.1	2398.9	0.0
85.0	47.0	0.039	200.7	0.052	265.7	0.090	460.6	173.3	287.3	0.054	275.1	159.7	115.4	0.032	165.2	45.5	119.8	0.296	1510.8	1556.3	2548.8	0.0
90.0	45.0	0.038	203.4	0.050	269.3	0.086	466.7	183.5	283.3	0.052	278.8	169.1	109.7	0.031	167.5	48.2	119.3	0.284	1531.1	1579.3	2698.8	0.0
95.0	43.2	0.036	206.0	0.048	272.6	0.083	472.6	193.7	279.0	0.050	282.3	178.5	103.8	0.030	169.6	50.8	118.8	0.272	1550.4	1601.2	2848.7	0.0
100.0	41.5	0.035	208.5	0.046	275.9	0.080	478.2	203.9	274.4	0.048	285.6	187.9	97.8	0.029	171.6	53.5	118.1	0.261	1568.8	1622.3	2998.6	0.0
105.0	39.9	0.033	210.8	0.044	279.0	0.077	483.6	214.1	269.5	0.046	288.8	197.3	91.6	0.028	173.5	56.2	117.3	0.252	1586.3	1642.5	3148.6	0.0
110.0	38.5	0.032	213.0	0.043	281.9	0.074	488.7	224.2	264.4	0.044	291.9	206.7	85.2	0.027	175.3	58.9	116.5	0.243	1603.1	1661.9	3298.5	0.0
115.0	37.2	0.031	215.1	0.041	284.7	0.072	493.6	234.4	259.1	0.043	294.8	216.1	78.7	0.026	177.1	61.5	115.6	0.235	1619.1	1680.7	3448.4	0.0
120.0	36.0	0.030	217.2	0.040	287.5	0.069	498.3	244.6	253.7	0.041	297.6	225.5	72.2	0.025	178.8	64.2	114.6	0.227	1634.6	1698.8	3598.4	0.0
125.0	34.9	0.029	219.2	0.039	290.1	0.067	502.8	254.8	248.0	0.040	300.3	234.8	65.5	0.024	180.4	66.9	113.5	0.220	1649.5	1716.3	3748.3	0.0
130.0	33.8	0.028	221.1	0.038	292.6	0.065	507.2	265.0	242.2	0.039	302.9	244.2	58.7	0.023	182.0	69.6	112.4	0.213	1663.8	1733.3	3898.2	0.0
135.0	32.9	0.028	222.9	0.036	295.0	0.063	511.4	275.2	236.2	0.038	305.5	253.6	51.8	0.023	183.5	72.2	111.3	0.207	1677.6	1749.9	4048.1	0.0
140.0	31.9	0.027	224.7	0.035	297.4	0.061	515.5	285.4	230.1	0.037	307.9	263.0	44.9	0.022	185.0	74.9	110.1	0.201	1691.0	1765.9	4198.1	0.0
145.0	31.1	0.026	226.4	0.034	299.7	0.060	519.4	295.6	223.8	0.036	310.3	272.4	37.8	0.021	186.4	77.6	108.8	0.196	1704.0	1781.5	4348.0	0.0
150.0	30.3	0.025	228.1	0.034	301.9	0.058	523.3	305.8	217.5	0.035	312.5	281.8	30.7	0.021	187.8	80.3	107.5	0.191	1716.5	1796.8	4497.9	0.0
155.0	29.5	0.025	229.7	0.033	304.0	0.057	527.0	316.0	211.0	0.034	314.8	291.2	23.5	0.020	189.1	82.9	106.2	0.186	1728.7	1811.6	4647.9	0.0
160.0	28.8	0.024	231.3	0.032	306.1	0.055	530.6	326.2	204.4	0.033	316.9	300.6	16.3	0.020	190.4	85.6	104.8	0.181	1740.5	1826.1	4797.8	0.0
165.0	28.1	0.024	232.8	0.031	308.1	0.054	534.1	336.4	197.7	0.032	319.0	310.0	9.0	0.019	191.6	88.3	103.4	0.177	1752.0	1840.3	4947.7	0.0

COLE ENGINEERING

Prepared By: Kirsten MacMillan, EIT

Orifice Control Calculation

Brock Street East Development
File No. 2017-0569
November 2017

Orifice Equation

$$Q = C \times A \times \sqrt{2 \times g \times h}$$

Storm Event	Drainage Area ID	Orifice Name	Orifice Coefficient	Diameter of Orifice (mm)	Orifice Invert (m)	Headwater Elevation (m)	Total Head (m)	Area of Orifice (m^2)	Release Rate (L/s)
2-Year	A2 Post	Orifice #1	0.61	125	267.86	268.09	0.23	0.012	15.90
5-Year					267.86	268.19	0.33	0.012	19.05
10-Year					267.86	268.29	0.43	0.012	21.74
25-Year					267.86	268.47	0.61	0.012	25.90
100-Year					267.86	268.91	1.05	0.012	33.98
2-Year	A4 Post	Orifice #2	0.61	120	267.19	267.39	0.20	0.011	13.67
5-Year					267.19	267.52	0.33	0.011	17.55
10-Year					267.19	267.60	0.41	0.011	19.57
25-Year					267.19	267.80	0.61	0.011	23.87
100-Year					267.19	268.24	1.05	0.011	31.31
2-Year	A6 Post	Orifice #3	0.61	75	266.66	266.76	0.10	0.004	3.77
5-Year					266.66	266.81	0.15	0.004	4.62
10-Year					266.66	266.84	0.18	0.004	5.06
25-Year					266.66	266.94	0.28	0.004	6.32
100-Year					266.66	267.22	0.56	0.004	8.92
2-Year	A3 Post + A5 Post	Orifice #4	0.61	425	266.05	266.50	0.45	0.142	257.13
5-Year					266.05	266.70	0.65	0.142	309.03
10-Year					266.05	266.80	0.75	0.142	331.95
25-Year					266.05	267.10	1.05	0.142	392.77
100-Year					266.05	267.75	1.70	0.142	499.77

COLE ENGINEERING

Prepared By: S.Rayner, EIT

Stage- Storage Table

Brock Street East Development
File No. 2017-0569
November 2017

	Design Head (m)	Elevation (m)	Chamber Storage #1 (m³)	Chamber Storage #2 (m³)	Total Storage (m³)
	0.00	266.05	0.00	0.00	0.00
	0.05	266.10	0.00	0.00	0.00
	0.10	266.15	11.30	0.00	11.30
	0.15	266.20	22.52	0.00	22.52
	0.20	266.25	33.66	0.00	33.66
	0.25	266.30	44.73	0.00	44.73
	0.30	266.35	55.71	0.00	55.71
	0.35	266.40	66.59	0.00	66.59
	0.40	266.45	77.36	0.00	77.36
2 Yr	0.45	266.50	88.02	0.00	88.02
	0.50	266.55	98.55	0.00	98.55
	0.55	266.60	108.93	0.00	108.93
	0.60	266.65	119.16	0.00	119.16
5 Yr	0.65	266.70	129.21	11.13	140.34
	0.70	266.75	139.06	22.19	161.25
10 Yr	0.75	266.80	148.70	33.17	181.87
	0.80	266.85	158.11	44.07	202.18
	0.85	266.90	167.24	54.88	222.12
	0.90	266.95	176.09	65.60	241.69
	0.95	267.00	184.54	76.21	260.75
	1.00	267.05	188.62	86.70	275.32
25 Yr	1.05	267.10	196.41	97.05	293.46
	1.10	267.15	203.44	107.26	310.70
	1.15	267.20	209.69	117.31	327.00
	1.20	267.25	215.57	127.17	342.74
	1.25	267.30	221.26	136.84	358.10
	1.30	267.35	226.94	146.29	373.23
	1.35	267.40	232.63	155.50	388.13
	1.40	267.45	238.32	164.42	402.74
	1.45	267.50	244.00	173.03	417.03
	1.50	267.55	249.69	181.27	430.96
	1.55	267.60	255.38	185.23	440.61
	1.60	267.65	261.06	192.75	453.81
	1.65	267.70	261.06	199.49	460.55
100 Yr	1.70	267.75	261.06	205.39	466.45
	1.75	267.80	261.06	210.92	471.98
	1.80	267.85	261.06	216.24	477.30
	1.85	267.90	261.06	221.56	482.62
	1.90	267.95	261.06	226.88	487.94
	1.95	268.00	261.06	232.2	493.26
	2.00	268.05	261.06	237.52	498.58
	2.05	268.10	261.06	242.84	503.90

COLE ENGINEERING

Prepared by: S.Rayner, EIT

Water Balance Calculations

Barton Farm
File No. 2017-0569
November 2017

Based on MOE Table 3.1

Site Data

Hydrologic Soil group: B Silty Sand
Vegetation Cover: Urban Lawns
Precipitation Data from Town of Uxbridge Stormwater Master Plan

PRE-DEVELOPMENT WATER BALANCE

	Pervious Area	Impervious Area	Total
Area (ha)	4.71	0.22	4.93
Precipitation (mm)	831	831	
ET (mm)	560	83	
Surplus (mm)	271	748	
Infiltration (mm)	163	0	
Runoff (mm)	108	748	
ET (m^3)	26376	183	26559
Infiltration (m^3)	7658	0	7658
Runoff (m^3)	5106	1645	6751

POST-DEVELOPMENT WATER BALANCE (NO MITIGATION)

	Pervious Area	Impervious Area	Total
Area (ha)	1.29	3.64	0.45
Precipitation (mm)	831	831	
ET (mm)	560	83	
Surplus (mm)	271	748	
Infiltration (mm)	163	0	
Runoff (mm)	108	748	
ET (m^3)	7224	3025	10249
Infiltration (m^3)	2098	0	2098
Runoff (m^3)	1398	27224	28622

POST-DEVELOPMENT WATER BALANCE (WITH MITIGATION)

	Pervious Area	Impervious Area	Total
Area (ha)	1.29	3.64	0.45
Precipitation (mm)	831	831	
ET (mm)	560	83	
Surplus (mm)	271	748	
Infiltration (mm)	163	158	
Runoff (mm)	108	590	
ET (m^3)	7224	3025	10249
Infiltration (m^3)	2098	5747	7845
Runoff (m^3)	1398	21476	22875

54.6 m^3 of volume equals 1.5 mm of depth over the impervious area. 1.5 mm daily capture roughly equals 19% capture of the annual rainfall.

SUMMARY

	ET	Infiltration	Runoff
	m^3		
Pre	26559	7658	6751
w/o Mitigation	10249	2098	28622
	-61%	-73%	324%
w/ Mitigation	10249	7845	22875
	-61%	2%	239%

COLE ENGINEERING

Prepared By: S.Rayner, EIT

Infiltration Footprint

Barton Farms
File No. 2017-0569
November 2017

Water balance storage in stone below StormTech chambers		Infiltration Rate *	Maximum depth for 48hr drawdown	Proposed Depth	Minimum bottom area for 48hr drawdown	Minimum footprint	Provided footprint
	(m^3)	(mm/hr)	(m)	(m)	(m^2)	(m^2)	(m^2)
Stored Volume	54.6	15	1.80	0.35	189.58	390.00	445

* Infiltration rate assumed based on Sandy Silt conditions outlined in Preliminary Geotechincal Investigation prepared by G.H.Sernas & Associates Ltd in October 1999

CVC & TRCA LID SWM Guidelines (p.4-57)
(Used to calculate the maximum depth for infiltration with a 48hr drawdown time)

$$d = \frac{i \times ts}{1000 \times Vr}$$

where;

d = Maximum depth of Soakawy Pit
V = Runoff volume to be infiltrated (m^3)
ts = Drawdown time (s)

CVC & TRCA LID SWM Guidelines (p.4-58)
(Used to calculate the footprint of the Infiltration trenches)

$$A = \frac{WQV}{Dr * Vr}$$

where;

A = Bottom area of infiltration trench (m^2)
Vr = Void Space Ratio
Dr = Stone Reservoir Depth
WQV = Water volume (m^3)

COLE ENGINEERING

Prepared By: S.Rayner, EIT

Water Quality Calculations

Brock Street East Development
2017-0569
Nov-17

Surface	Method	Effective TSS Removal	Area (ha)	% Area of Site	Overall TSS Removal
Roof Area	Inherent	80%	1.16	23.5%	19%
Asphalt	Treated with Downstream Pond	80%	0.18	3.7%	3%
Asphalt	Treated with OGS and downstream pond	96%	1.87	37.9%	36%
Asphalt	Untreated	0%	0.29	5.8%	0%
Landscape	Inherent	80%	1.43	29.0%	23%
Total			4.928	100.0%	81%

Treatment Train Approach:

$$R = A + B - [(A \times B) / 100] \qquad \text{(Equation 4-1)}$$

Where:

R = Total TSS Removal Rate

A = TSS Removal Rate of the First or Upstream BMP

B = TSS Removal Rate of the Second or Downstream BMP

*As per 'New Jersey Stormwater Best Management Practices Manual'
Equation 4-1 (February 2004) - see attached

TSS Removal:
CDS Unit (Rate 1) = 80%
Existing Pond (Rate 2) = 80%

Removal for Treatment Train:
R_{tt} = Rate 1 + Rate 2 - [(Rate 1 x Rate 2)/100]
R_{inf} = 96%

CDS Average Annual Efficiency For TSS Removal & Total Annual Volume Treated

Area = 0.69 ha
Impervious: 100 %
CDS Model: PMSU2015_4
Flowrate: 20 l/s
IDF Data: Stouffville
PSD: FINE

Upstream Storage:
Storage 302 m^3

Engineer: **Cole Engineering Group Ltd.**
Contact: Kirsten MacMillan, EIT
Date: 28-Nov-17

Project: Brook Street East Development
Location: Uxbridge, ON
OGS ID: 1 (A2 Post)

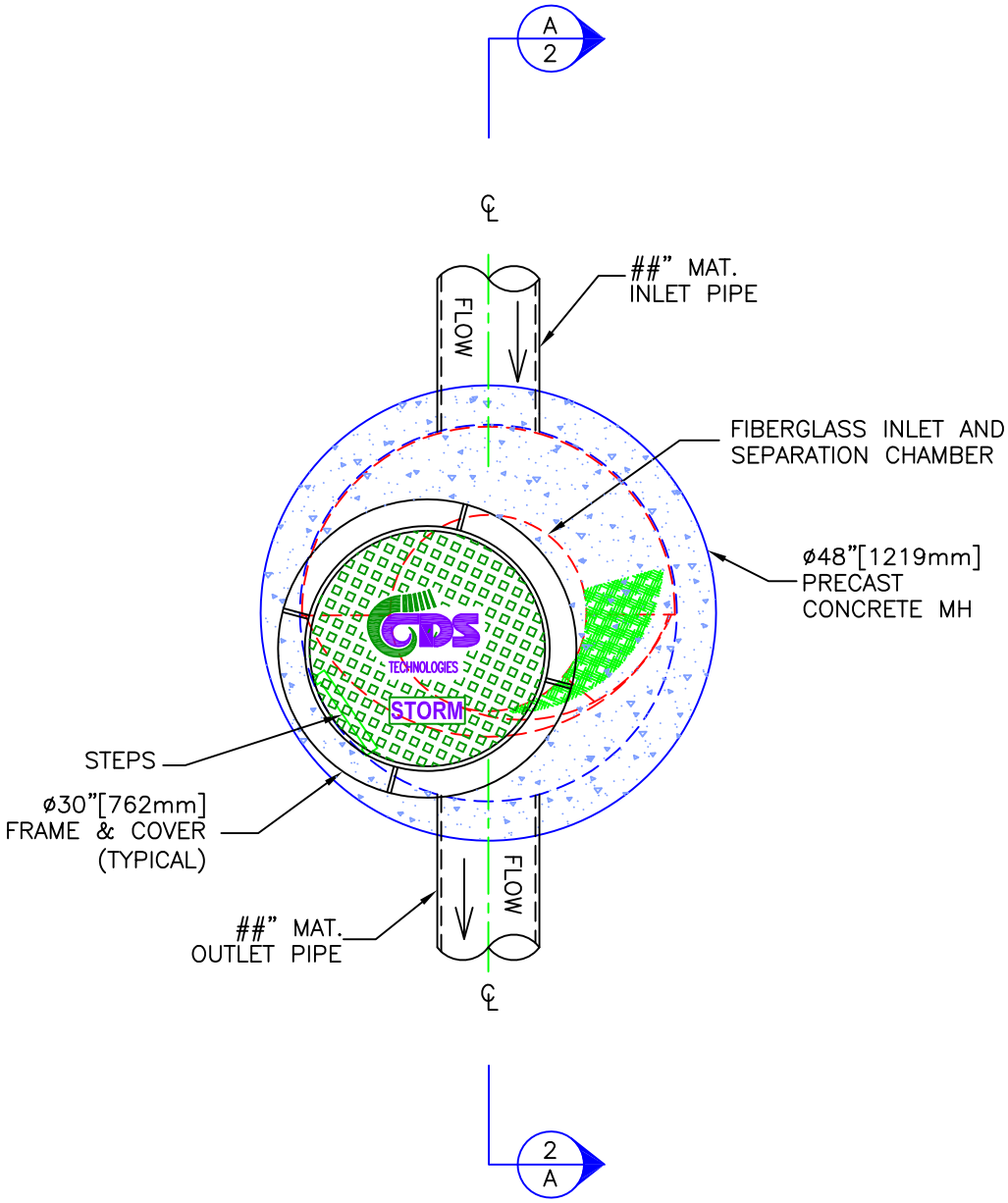
Return	Period	Peak Flow	TSS Percentage Captured	Treated Flow Volume	Total Flow Volume	Annual Exceedance Probability	System Flow	CDS Flow	By-Pass Flow	Volume Percentage Treated
month / yr	Yr	l/s	%	litres	litres	%	l/s	l/s	l/s	%
1-M	0.08	4.21	94.60	16476	16476	**100.00**	4.21	4.21	0.00	100.00
2-M	0.17	5.74	93.08	22318	22318	**99.75**	5.74	5.74	0.00	100.00
3-M	0.25	7.00	91.80	27213	27213	**98.17**	7.00	7.00	0.00	100.00
4-M	0.33	8.15	90.63	31689	31689	**95.04**	8.15	8.15	0.00	100.00
5-M	0.42	9.03	89.72	35174	35174	**90.91**	9.03	9.03	0.00	100.00
6-M	0.50	9.91	88.81	38660	38660	**86.47**	9.91	9.91	0.00	100.00
7-M	0.58	10.57	88.13	41295	41295	**82.01**	10.57	10.57	0.00	100.00
8-M	0.67	11.22	87.45	43930	43930	**77.67**	11.22	11.22	0.00	100.00
9-M	0.75	11.88	86.77	46565	46565	**73.64**	11.88	11.88	0.00	100.00
10-M	0.83	12.40	86.23	48657	48657	**69.90**	12.40	12.40	0.00	100.00
11-M	0.92	12.91	85.69	50749	50749	**66.40**	12.91	12.91	0.00	100.00
1-Yr	1	13.42	85.15	52841	52841	**63.21**	13.42	13.42	0.00	100.00
2-Yr	2	17.61	80.69	70326	70326	**39.35**	17.61	17.61	0.00	100.00
5-Yr	5	25.16	70.07	97056	103713	**18.13**	25.16	20.10	5.06	93.58
10-Yr	10	30.43	61.65	108936	128737	**9.52**	30.43	20.10	10.33	84.62
25-Yr	25	34.08	56.15	114989	147072	**3.92**	34.08	20.10	13.98	78.19
50-Yr	50	36.62	52.51	118224	160383	**1.98**	36.62	20.10	16.52	73.71
100-Yr	100	38.93	49.34	120407	172860	**1.00**	38.93	20.10	18.82	69.66
Average Annual TSS Removal Efficiency [%]:					**88.1**	Ave. Ann. T. Volume [%]:				**99.6**

Notes:
1) CDS Efficiency based on testing conducted at the University of Central Florida
2) CDS design flowrate and scaling based on standard manufacturer model & product specificiations

ECHELON ENVIRONMENTAL

CDS TECHNOLOGIES

PLAN VIEW

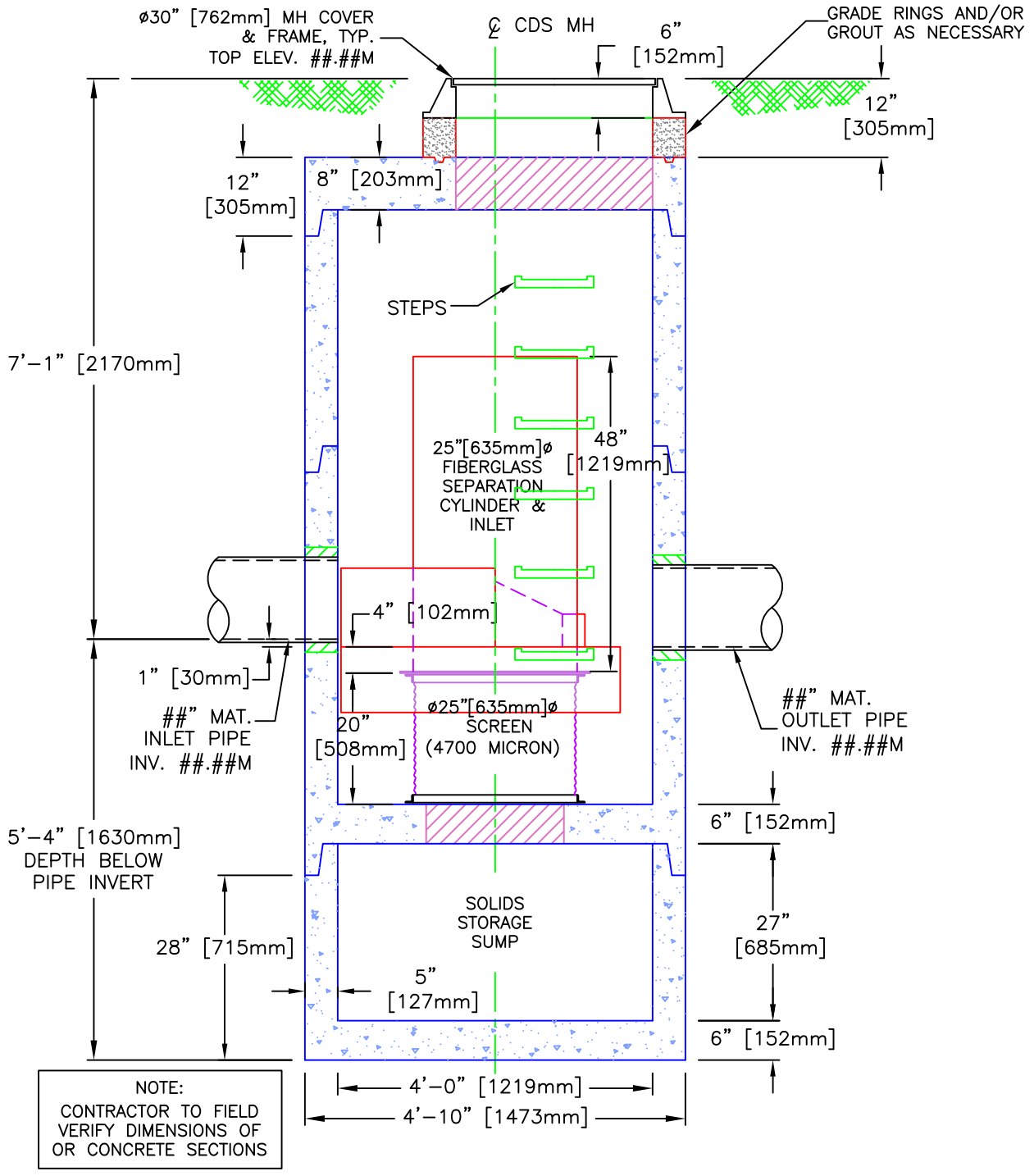


CDS MODEL PMSU20_15_4m
STORMWATER TREATMENT UNIT

CONTECH STORMWATER SOLUTIONS	PROJECT NAME CITY, STATE	JOB# XX-##-###	SCALE 1" = 2'
		DATE ##/##/##	SHEET 1
		DRAWN INITIALS	
		APPROV.	

Echelon Environmental 505 Hood Road, Unit 26, Markham, Ontario L3R 5V6 Tel: (905) 948-0000 Fax: (905) 948-0577
CONTECH Stormwater Solutions Inc. 930 Woodcock Road, Suite 101, Orlando, Florida 32803 Tel: (800) 848-9955

SECTION A–A
ELEVATION VIEW



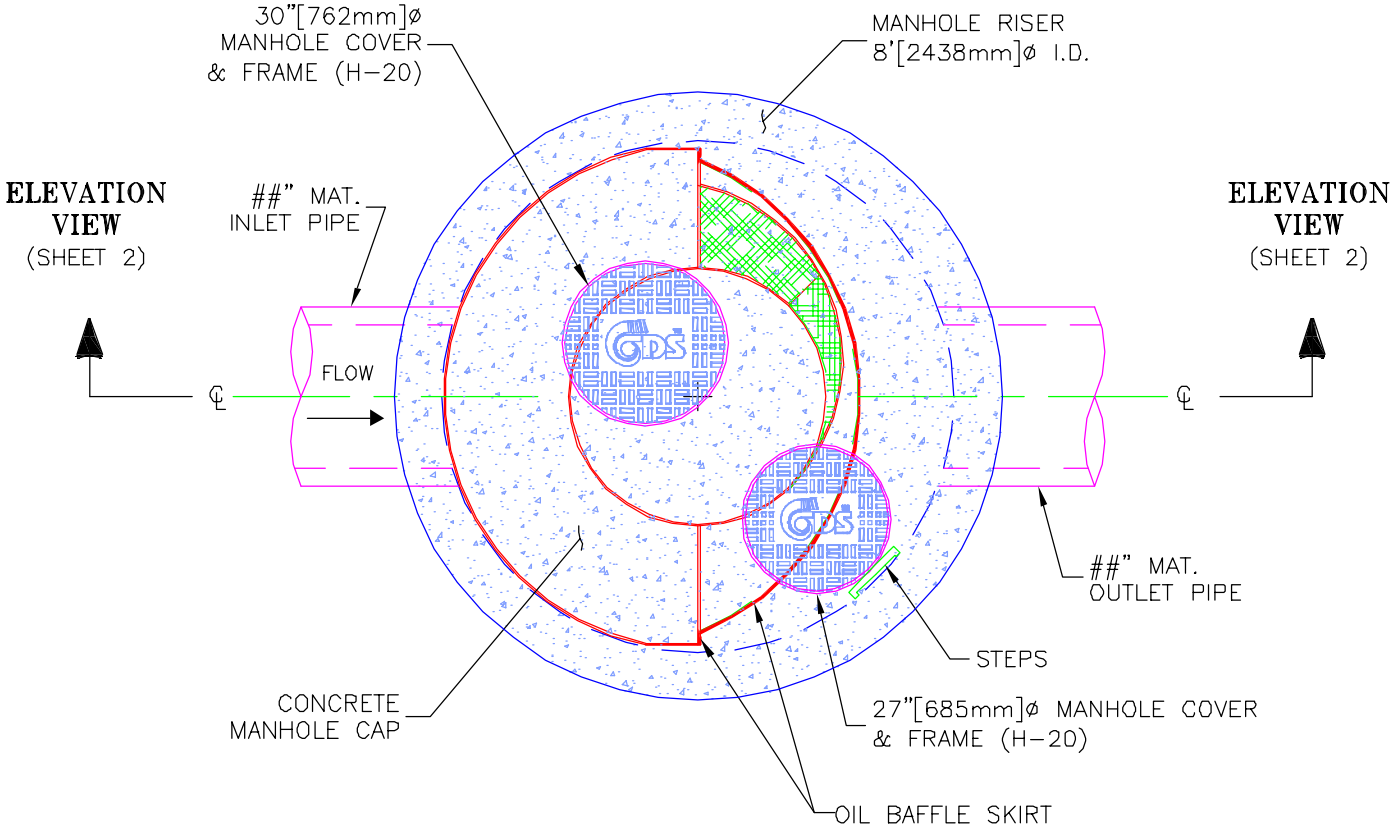
NOTE:
CONTRACTOR TO FIELD VERIFY DIMENSIONS OF OR CONCRETE SECTIONS

CDS MODEL PMSU20_15_4m
STORMWATER TREATMENT UNIT

CONTECH STORMWATER SOLUTIONS	PROJECT NAME CITY, STATE	JOB# XX–##–###	SCALE 1" = 2'
		DATE ##/##/##	SHEET 2
		DRAWN INITIALS	
		APPROV.	

Echelon Environmental 505 Hood Road, Unit 26, Markham, Ontario L3R 5V6 Tel: (905) 948-0000 Fax: (905) 948-0577
CONTECH Stormwater Solutions Inc. 930 Woodcock Road, Suite 101, Orlando, Florida 32803 Tel: (800) 848-9955

PLAN VIEW

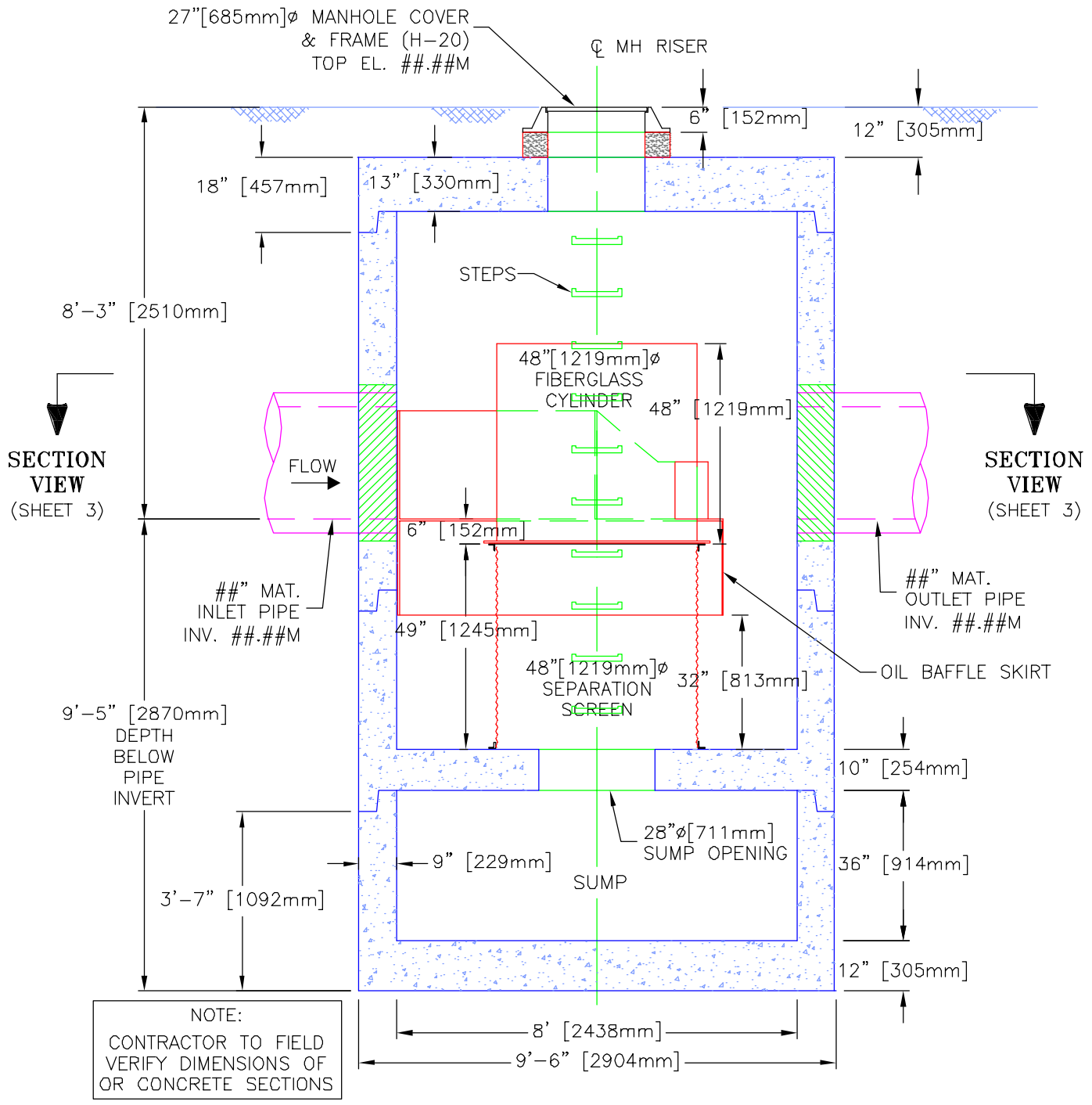


CDS MODEL PMSU40_40m, 6.0 CFS TREATMENT CAPACITY STORM WATER TREATMENT UNIT

CONTECH STORMWATER SOLUTIONS	PROJECT NAME CITY, STATE	JOB# XX-##-###	SCALE 1" = 3'
		DATE ##/##/##	SHEET 1
		DRAWN INITIALS	
		APPROV.	

Echelon Environmental 505 Hood Road, Unit 26, Markham, Ontario L3R 5V6 Tel: (905) 948-0000 Fax: (905) 948-0577
CONTECH Stormwater Solutions Inc. 930 Woodcock Road, Suite 101, Orlando, Florida 32803 Tel: (800) 848-9955

ELEVATION VIEW



NOTE:
CONTRACTOR TO FIELD VERIFY DIMENSIONS OF OR CONCRETE SECTIONS

CDS MODEL PMSU40_40m, 6.0 CFS TREATMENT CAPACITY STORM WATER TREATMENT UNIT

CONTECH STORMWATER SOLUTIONS	PROJECT NAME CITY, STATE	JOB# XX-##-###	SCALE 1" = 3'
		DATE ##/##/##	SHEET 2
		DRAWN INITIALS	
		APPROV.	

Echelon Environmental 505 Hood Road, Unit 26, Markham, Ontario L3R 5V6 Tel: (905) 948-0000 Fax: (905) 948-0577
CONTECH Stormwater Solutions Inc. 930 Woodcock Road, Suite 101, Orlando, Florida 32803 Tel: (800) 848-9955

CDS Average Annual Efficiency For TSS Removal & Total Annual Volume Treated

Area = 0.41 ha
Impervious: 100 %
CDS Model: PMSU2015_4
Flowrate: 20 l/s
IDF Data: Stouffville
PSD: FINE

Upstream Storage:
Storage 153 m^3

Engineer: **Cole Engineering Group Ltd.**
Contact: Kirsten MacMillan, EIT
Date: 28-Nov-17

Project: Brook Street East Development
Location: Uxbridge, ON
OGS ID: 2 (A4 Post)

Return	Period	Peak Flow	TSS Percentage Captured	Treated Flow Volume	Total Flow Volume	Annual Exceedance Probability	System Flow	CDS Flow	By-Pass Flow	Volume Percentage Treated
month / yr	Yr	l/s	%	litres	litres	%	l/s	l/s	l/s	%
1-M	0.08	3.72	95.28	11992	11992	**100.00**	3.72	3.72	0.00	100.00
2-M	0.17	5.05	94.04	16180	16180	**99.75**	5.05	5.05	0.00	100.00
3-M	0.25	6.17	92.99	19699	19699	**98.17**	6.17	6.17	0.00	100.00
4-M	0.33	7.18	92.03	22925	22925	**95.04**	7.18	7.18	0.00	100.00
5-M	0.42	7.97	91.28	25445	25445	**90.91**	7.97	7.97	0.00	100.00
6-M	0.50	8.75	90.53	27965	27965	**86.47**	8.75	8.75	0.00	100.00
7-M	0.58	9.33	89.97	29878	29878	**82.01**	9.33	9.33	0.00	100.00
8-M	0.67	9.92	89.40	31791	31791	**77.67**	9.92	9.92	0.00	100.00
9-M	0.75	10.50	88.84	33704	33704	**73.64**	10.50	10.50	0.00	100.00
10-M	0.83	10.96	88.39	35228	35228	**69.90**	10.96	10.96	0.00	100.00
11-M	0.92	11.42	87.94	36753	36753	**66.40**	11.42	11.42	0.00	100.00
1-Yr	1	11.88	87.50	38278	38278	**63.21**	11.88	11.88	0.00	100.00
2-Yr	2	15.64	83.79	51117	51117	**39.35**	15.64	15.64	0.00	100.00
5-Yr	5	22.55	75.86	74127	76042	**18.13**	22.55	20.10	2.44	97.48
10-Yr	10	27.46	68.49	85863	95159	**9.52**	27.46	20.10	7.36	90.23
25-Yr	25	30.92	63.61	92970	109441	**3.92**	30.92	20.10	10.81	84.95
50-Yr	50	33.35	60.36	97528	119974	**1.98**	33.35	20.10	13.25	81.29
100-Yr	100	35.58	57.52	101432	129987	**1.00**	35.58	20.10	15.47	78.03
Average Annual TSS Removal Efficiency [%]:					**89.5**	Ave. Ann. T. Volume [%]:				**99.7**

Notes:
1) CDS Efficiency based on testing conducted at the University of Central Florida
2) CDS design flowrate and scaling based on standard manufacturer model & product specificiations

ECHELON ENVIRONMENTAL

CDS TECHNOLOGIES

CDS Average Annual Efficiency For TSS Removal & Total Annual Volume Treated

Area = 2.70 ha
Impervious: 92 %
CDS Model: PMSU4040_8
Flowrate: 170 l/s
IDF Data: Stouffville
PSD: FINE

Upstream Storage:
Storage 465 m^3

Engineer: **Cole Engineering Group Ltd.**
Contact: Kirsten MacMillan, EIT
Date: 28-Nov-17

Project: Brook Street East Development
Location: Uxbridge, ON
OGS ID: 3 (A4+A5 Post)

Return	Period	Peak Flow	TSS Percentage Captured	Treated Flow Volume	Total Flow Volume	Annual Exceedance Probability	System Flow	CDS Flow	By-Pass Flow	Volume Percentage Treated
month / yr	Yr	l/s	%	litres	litres	%	l/s	l/s	l/s	%
1-M	0.08	19.15	96.67	21452	21452	**100.00**	19.15	19.15	0.00	100.00
2-M	0.17	48.46	93.55	54080	54080	**99.75**	48.46	48.46	0.00	100.00
3-M	0.25	71.13	91.05	81211	81211	**98.17**	71.13	71.13	0.00	100.00
4-M	0.33	91.86	88.78	106143	106143	**95.04**	91.86	91.86	0.00	100.00
5-M	0.42	107.47	87.04	125716	125716	**90.91**	107.47	107.47	0.00	100.00
6-M	0.50	123.08	85.31	145289	145289	**86.47**	123.08	123.08	0.00	100.00
7-M	0.58	134.57	84.02	160274	160274	**82.01**	134.57	134.57	0.00	100.00
8-M	0.67	146.07	82.73	175259	175259	**77.67**	146.07	146.07	0.00	100.00
9-M	0.75	157.57	81.45	190244	190244	**73.64**	157.57	157.57	0.00	100.00
10-M	0.83	166.60	80.24	201284	202303	**69.90**	166.60	166.60	0.00	99.55
11-M	0.92	175.63	79.04	212324	214363	**66.40**	175.63	169.90	5.73	99.10
1-Yr	1	184.66	77.83	223364	226423	**63.21**	184.66	169.90	14.76	98.65
2-Yr	2	258.25	65.78	285609	329614	**39.35**	258.25	169.90	88.34	86.65
5-Yr	5	337.45	54.83	330695	448771	**18.13**	337.45	169.90	167.55	73.69
10-Yr	10	372.96	50.76	346813	505108	**9.52**	372.96	169.90	203.06	68.66
25-Yr	25	423.44	45.62	366005	588604	**3.92**	423.44	169.90	253.54	62.18
50-Yr	50	469.41	41.59	382210	670220	**1.98**	469.41	169.90	299.50	57.03
100-Yr	100	505.08	38.74	393397	738387	**1.00**	505.08	169.90	335.17	53.28
Average Annual TSS Removal Efficiency [%]:					**83.3**	Ave. Ann. T. Volume [%]:				**98.2**

Notes:
1) CDS Efficiency based on testing conducted at the University of Central Florida
2) CDS design flowrate and scaling based on standard manufacturer model & product specificiations

ECHELON ENVIRONMENTAL

CDS TECHNOLOGIES

Ontario
MINISTRY OF THE ENVIRONMENT

Database Version: **V 2.0 Release Update**
Update Date: **30-Mar-12**

Project DEVELOPMENT Summary

DEVELOPMENT: Brock Street East Development (Barton Farms)
Subwatershed: Pefferlaw-Uxbridge Brook

Total Pre-Development Area (ha):	**4.9300**	Total Pre-Development Phosphorus Load (kg/yr):	**0.34**

Pre-Development Land Use	**Area (ha)**	**P coeff. (kg/ha)**	**P Load (kg/yr)**
Hay-Pasture	4.57	0.06	0.27
Low Intensity Development	0.23	0.13	0.03
Open Water	0.13	0.26	0.03

DEVELOPMENT: Brock Street East Development (Barton Farms)
Subwatershed: Pefferlaw-Uxbridge Brook

POST-DEVELOPMENT LOAD

Post-Development Land Use	Area (ha)	P coeff. (kg/ha)	Best Management Practice applied with P Removal Efficiency		P Load (kg/yr)
High Intensity - Comm/Industrial	1.1	1.82	Wet Detention Ponds	**65%**	0.70

Controlled drainage areas to existing pond. 65% rate chosen by existing report by GM Sernas evaluating the effiency of the pond.

NOTE: BMP efficiency has been adjusted from the reference provided value by 2% (from 63% to 65%)

High Intensity - Residential	0.76	1.32	NONE	0%	1.00

Uncontrolled drainage areas.

High Intensity - Residential	2.71	1.32	Wet Detention Ponds	**65%**	1.25

Controlled drainage areas to existing pond. 65% rate chosen by existing report by GM Sernas evaluating the effiency of the pond.

NOTE: BMP efficiency has been adjusted from the reference provided value by 2% (from 63% to 65%)

High Intensity - Residential	0.36	1.32	Perforated Pipe Infiltration/Exfiltration Systems	87%	0.06

Infiltration system for roof + backyards

		P Load (kg/yr)
Post-Development Area Altered:	**4.93**	
Total Pre-Development Area:	**4.93**	
Unaffected Area:	**0**	
Pre-Development:		**0.34**
Post-Development:		**7.06**
Change (Pre - Post):		**-6.72**
1989% Net Increase in Load		
Post-Development (with BMPs):		**3.02**
Change (Pre - Post):		**-2.68**
793.07% Net Increase in Load		

DEVELOPMENT: Brock Street East Development (Barton Farms)
Subwatershed: Pefferlaw-Uxbridge Brook

CONSTRUCTION PHASE LOAD

SUMMARY WITH IMPLEMENTATION OF BMPs	P Load (kg/yr)
Pre-Development:	**0.34**
Construction Phase Amortized Over 8 Years :	to be determined
Post-Development:	**3.02**
Post-Development + Amortized Construction:	**to be determined**
Pre-Development Load - Post-Development Load:	**-2.68**
Conclusion:	**793% Increase in Load**
Pre-Development Load - (Post-Development + Amortized Construction Load):	**to be determined**
Conclusion:	**to be determined**

Based on a comparison of Pre-Development and Post-Development loads, and in consideration of Construction Phase loads, the Ministry would encourage the Municipality to:

Not approve development as site specific appropriate

Project: 2017-0569 Area A2

Chamber Model -	SC-740	
Units -	**Metric**	Click Here for Imperial
Number of chambers -	155	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	0.00	m
Amount of Stone Above Chambers -	152	mm
Amount of Stone Below Chambers -	152	mm
	500	

☐ Include Perimeter Stone in Calculations

StormTech SC-740 Cumulative Storage Volumes

Height of System *(mm)*	Incremental Single Chamber *(cubic meters)*	Incremental Total Chamber *(cubic meters)*	Incremental Stone *(cubic meters)*	Incremental Ch & St *(cubic meters)*	Cumulative Chamber *(cubic meters)*	Elevation *(meters)*
1067	0.00	0.00	4.95	4.95	328.728	1.07
1041	0.00	0.00	4.95	4.95	323.783	1.04
1016	0.00	0.00	4.95	4.95	318.837	1.02
991	0.00	0.00	4.95	4.95	313.891	0.99
965	0.00	0.00	4.95	4.95	308.946	0.97
940	0.00	0.00	4.95	4.95	304.000	0.94
914	0.00	0.24	4.85	5.09	299.054	0.91
889	0.00	0.72	4.66	5.37	293.964	0.89
864	0.01	1.24	4.45	5.69	288.589	0.86
838	0.02	2.65	3.89	6.54	282.901	0.84
813	0.02	3.52	3.54	7.06	276.365	0.81
787	0.03	4.17	3.28	7.45	269.308	0.79
762	0.03	4.72	3.06	7.78	261.859	0.76
737	0.03	5.18	2.87	8.05	254.083	0.74
711	0.04	5.56	2.72	8.28	246.029	0.71
686	0.04	5.95	2.57	8.51	237.750	0.69
660	0.04	6.38	2.39	8.77	229.236	0.66
635	0.04	6.69	2.27	8.96	220.461	0.64
610	0.04	6.95	2.17	9.11	211.500	0.61
584	0.05	7.21	2.06	9.27	202.387	0.58
559	0.05	7.46	1.96	9.42	193.117	0.56
533	0.05	7.69	1.87	9.56	183.695	0.53
508	0.05	7.91	1.78	9.69	174.133	0.51
483	0.05	8.14	1.69	9.83	164.440	0.48
457	0.05	8.31	1.62	9.93	154.609	0.46
432	0.05	8.49	1.55	10.04	144.678	0.43
406	0.06	8.67	1.48	10.15	134.639	0.41
381	0.06	8.82	1.42	10.24	124.493	0.38
356	0.06	8.98	1.36	10.33	114.254	0.36
330	0.06	9.11	1.30	10.41	103.923	0.33
305	0.06	9.24	1.25	10.49	93.513	0.30
279	0.06	9.36	1.20	10.56	83.024	0.28
254	0.06	9.45	1.16	10.62	72.464	0.25
229	0.06	9.56	1.12	10.68	61.847	0.23
203	0.06	9.65	1.09	10.73	51.168	0.20
178	0.06	9.69	1.07	10.76	40.433	0.18
152	0.00	0.00	4.95	4.95	29.674	0.15
127	0.00	0.00	4.95	4.95	24.728	0.13
102	0.00	0.00	4.95	4.95	19.783	0.10
76	0.00	0.00	4.95	4.95	14.837	0.08
51	0.00	0.00	4.95	4.95	9.891	0.05
25	0.00	0.00	4.95	4.95	4.946	0.03

Project: **Area A3 & A5 Post- System #1**

Chamber Model -	MC-3500	
Units -	**Metric**	Click Here for Imperial
Number of Chambers -	45	
Number of End Caps -	14	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	266.10	m
Amount of Stone Above Chambers -	400	mm
Amount of Stone Below Chambers -	280	mm
	280	

☐ Include Perimeter Stone in Calculations

StormTech MC-3500 Cumulative Storage Volumes

Height of System *(mm)*	Incremental Single Chamber *(cubic meters)*	Incremental Single End Cap *(cubic meters)*	Incremental Chambers *(cubic meters)*	Incremental End Cap *(cubic meters)*	Incremental Stone *(cubic meters)*	Incremental Chamber, End Cap and Stone *(cubic meters)*	Cumulative System *(cubic meters)*	Elevation *(meters)*
1829	0.00	0.00	0.00	0.00	2.407	2.41	260.94	267.93
1803	0.00	0.00	0.00	0.00	2.407	2.41	258.54	267.90
1778	0.00	0.00	0.00	0.00	2.407	2.41	256.13	267.88
1753	0.00	0.00	0.00	0.00	2.407	2.41	253.72	267.85
1727	0.00	0.00	0.00	0.00	2.407	2.41	251.31	267.83
1702	0.00	0.00	0.00	0.00	2.407	2.41	248.91	267.80
1676	0.00	0.00	0.00	0.00	2.407	2.41	246.50	267.78
1651	0.00	0.00	0.00	0.00	2.407	2.41	244.09	267.75
1626	0.00	0.00	0.00	0.00	2.407	2.41	241.69	267.73
1600	0.00	0.00	0.00	0.00	2.407	2.41	239.28	267.70
1575	0.00	0.00	0.00	0.00	2.407	2.41	236.87	267.67
1549	0.00	0.00	0.00	0.00	2.407	2.41	234.46	267.65
1524	0.00	0.00	0.00	0.00	2.407	2.41	232.06	267.62
1499	0.00	0.00	0.00	0.00	2.407	2.41	229.65	267.60
1473	0.00	0.00	0.00	0.00	2.407	2.41	227.24	267.57
1448	0.00	0.00	0.00	0.00	2.407	2.41	224.83	267.55
1422	0.00	0.00	0.07	0.00	2.378	2.45	222.43	267.52
1397	0.01	0.00	0.25	0.01	2.305	2.56	219.98	267.50
1372	0.01	0.00	0.37	0.01	2.251	2.64	217.41	267.47
1346	0.01	0.00	0.51	0.02	2.193	2.73	214.77	267.45
1321	0.02	0.00	0.88	0.03	2.046	2.95	212.04	267.42
1295	0.03	0.00	1.31	0.03	1.869	3.21	209.10	267.40
1270	0.04	0.00	1.59	0.04	1.753	3.39	205.88	267.37
1245	0.04	0.00	1.81	0.05	1.662	3.52	202.49	267.34
1219	0.04	0.00	2.00	0.06	1.583	3.64	198.97	267.32
1194	0.05	0.00	2.18	0.06	1.511	3.75	195.32	267.29
1168	0.05	0.01	2.33	0.07	1.446	3.85	191.57	267.27
1143	0.05	0.01	2.47	0.08	1.388	3.94	187.72	267.24
1118	0.06	0.01	2.60	0.09	1.332	4.02	183.79	267.22
1092	0.06	0.01	2.72	0.09	1.282	4.10	179.77	267.19
1067	0.06	0.01	2.83	0.10	1.234	4.17	175.67	267.17
1041	0.07	0.01	2.94	0.11	1.189	4.23	171.51	267.14
1016	0.07	0.01	3.04	0.11	1.147	4.30	167.27	267.12
991	0.07	0.01	3.13	0.12	1.107	4.36	162.97	267.09
965	0.07	0.01	3.22	0.12	1.070	4.41	158.62	267.07
940	0.07	0.01	3.31	0.13	1.034	4.47	154.20	267.04
914	0.08	0.01	3.38	0.13	1.000	4.52	149.74	267.01
889	0.08	0.01	3.46	0.14	0.968	4.57	145.22	266.99
864	0.08	0.01	3.53	0.14	0.938	4.61	140.65	266.96
838	0.08	0.01	3.60	0.15	0.909	4.66	136.04	266.94
813	0.08	0.01	3.66	0.15	0.881	4.70	131.39	266.91
787	0.08	0.01	3.73	0.16	0.854	4.74	126.69	266.89
762	0.08	0.01	3.78	0.16	0.829	4.77	121.95	266.86
737	0.09	0.01	3.84	0.17	0.805	4.81	117.18	266.84
711	0.09	0.01	3.89	0.17	0.783	4.84	112.37	266.81
686	0.09	0.01	3.94	0.17	0.760	4.88	107.52	266.79
660	0.09	0.01	3.99	0.18	0.740	4.91	102.65	266.76
635	0.09	0.01	4.03	0.18	0.721	4.94	97.74	266.74
610	0.09	0.01	4.08	0.19	0.702	4.97	92.80	266.71
584	0.09	0.01	4.12	0.19	0.684	4.99	87.83	266.68
559	0.09	0.01	4.16	0.19	0.667	5.02	82.84	266.66
533	0.09	0.01	4.19	0.20	0.651	5.04	77.83	266.63
508	0.09	0.01	4.23	0.20	0.636	5.06	72.78	266.61
483	0.09	0.01	4.26	0.20	0.621	5.09	67.72	266.58
457	0.10	0.01	4.29	0.21	0.607	5.11	62.63	266.56
432	0.10	0.01	4.32	0.21	0.594	5.13	57.53	266.53
406	0.10	0.02	4.35	0.21	0.582	5.15	52.40	266.51
381	0.10	0.02	4.38	0.22	0.569	5.16	47.25	266.48
356	0.10	0.02	4.41	0.22	0.558	5.18	42.09	266.46
330	0.10	0.02	4.43	0.22	0.546	5.20	36.91	266.43
305	0.10	0.02	4.47	0.24	0.526	5.23	31.71	266.40
279	0.00	0.00	0.00	0.00	2.407	2.41	26.48	266.38
254	0.00	0.00	0.00	0.00	2.407	2.41	24.07	266.35
229	0.00	0.00	0.00	0.00	2.407	2.41	21.67	266.33
203	0.00	0.00	0.00	0.00	2.407	2.41	19.26	266.30
178	0.00	0.00	0.00	0.00	2.407	2.41	16.85	266.28
152	0.00	0.00	0.00	0.00	2.407	2.41	14.44	266.25
127	0.00	0.00	0.00	0.00	2.407	2.41	12.04	266.23
102	0.00	0.00	0.00	0.00	2.407	2.41	9.63	266.20
76	0.00	0.00	0.00	0.00	2.407	2.41	7.22	266.18
51	0.00	0.00	0.00	0.00	2.407	2.41	4.81	266.15
25	0.00	0.00	0.00	0.00	2.407	2.41	2.41	266.13

Project: **Area A3 & A5 Post- System #2**

Chamber Model -	MC-3500	
Units -	**Metric**	Click Here for Imperial
Number of Chambers -	48	
Number of End Caps -	6	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	266.65	m
Amount of Stone Above Chambers -	305	mm
Amount of Stone Below Chambers -	229	mm
	262	

☐ Include Perimeter Stone in Calculations

StormTech MC-3500 Cumulative Storage Volumes

Height of System *(mm)*	Incremental Single Chamber *(cubic meters)*	Incremental Single End Cap *(cubic meters)*	Incremental Chambers *(cubic meters)*	Incremental End Cap *(cubic meters)*	Incremental Stone *(cubic meters)*	Incremental Chamber, End Cap and Stone *(cubic meters)*	Cumulative System *(cubic meters)*	Elevation *(meters)*
1676	0.00	0.00	0.00	0.00	2.424	2.42	251.16	268.33
1651	0.00	0.00	0.00	0.00	2.424	2.42	248.74	268.30
1626	0.00	0.00	0.00	0.00	2.424	2.42	246.31	268.28
1600	0.00	0.00	0.00	0.00	2.424	2.42	243.89	268.25
1575	0.00	0.00	0.00	0.00	2.424	2.42	241.46	268.22
1549	0.00	0.00	0.00	0.00	2.424	2.42	239.04	268.20
1524	0.00	0.00	0.00	0.00	2.424	2.42	236.62	268.17
1499	0.00	0.00	0.00	0.00	2.424	2.42	234.19	268.15
1473	0.00	0.00	0.00	0.00	2.424	2.42	231.77	268.12
1448	0.00	0.00	0.00	0.00	2.424	2.42	229.34	268.10
1422	0.00	0.00	0.00	0.00	2.424	2.42	226.92	268.07
1397	0.00	0.00	0.00	0.00	2.424	2.42	224.50	268.05
1372	0.00	0.00	0.08	0.00	2.392	2.47	222.07	268.02
1346	0.01	0.00	0.26	0.00	2.317	2.58	219.60	268.00
1321	0.01	0.00	0.40	0.01	2.261	2.67	217.02	267.97
1295	0.01	0.00	0.55	0.01	2.201	2.76	214.35	267.95
1270	0.02	0.00	0.93	0.01	2.046	2.99	211.59	267.92
1245	0.03	0.00	1.40	0.01	1.859	3.27	208.60	267.89
1219	0.04	0.00	1.70	0.02	1.737	3.45	205.33	267.87
1194	0.04	0.00	1.93	0.02	1.642	3.60	201.88	267.84
1168	0.04	0.00	2.14	0.02	1.559	3.72	198.28	267.82
1143	0.05	0.00	2.32	0.03	1.485	3.83	194.56	267.79
1118	0.05	0.01	2.49	0.03	1.417	3.93	190.73	267.77
1092	0.05	0.01	2.63	0.03	1.357	4.02	186.79	267.74
1067	0.06	0.01	2.77	0.04	1.299	4.11	182.77	267.72
1041	0.06	0.01	2.90	0.04	1.247	4.19	178.66	267.69
1016	0.06	0.01	3.02	0.04	1.197	4.26	174.47	267.67
991	0.07	0.01	3.14	0.05	1.152	4.33	170.21	267.64
965	0.07	0.01	3.24	0.05	1.108	4.40	165.87	267.62
940	0.07	0.01	3.34	0.05	1.067	4.46	161.48	267.59
914	0.07	0.01	3.44	0.05	1.028	4.52	157.02	267.56
889	0.07	0.01	3.53	0.05	0.992	4.57	152.50	267.54
864	0.08	0.01	3.61	0.06	0.957	4.62	147.93	267.51
838	0.08	0.01	3.69	0.06	0.924	4.67	143.30	267.49
813	0.08	0.01	3.77	0.06	0.893	4.72	138.63	267.46
787	0.08	0.01	3.84	0.06	0.863	4.77	133.91	267.44
762	0.08	0.01	3.91	0.07	0.834	4.81	129.15	267.41
737	0.08	0.01	3.97	0.07	0.807	4.85	124.34	267.39
711	0.08	0.01	4.04	0.07	0.781	4.89	119.49	267.36
686	0.09	0.01	4.09	0.07	0.757	4.92	114.60	267.34
660	0.09	0.01	4.15	0.07	0.735	4.96	109.68	267.31
635	0.09	0.01	4.21	0.07	0.712	4.99	104.72	267.29
610	0.09	0.01	4.26	0.08	0.691	5.02	99.73	267.26
584	0.09	0.01	4.30	0.08	0.671	5.05	94.71	267.23
559	0.09	0.01	4.35	0.08	0.652	5.08	89.65	267.21
533	0.09	0.01	4.39	0.08	0.634	5.11	84.57	267.18
508	0.09	0.01	4.43	0.08	0.617	5.13	79.46	267.16
483	0.09	0.01	4.47	0.08	0.601	5.16	74.33	267.13
457	0.09	0.01	4.51	0.09	0.585	5.18	69.17	267.11
432	0.09	0.01	4.55	0.09	0.571	5.20	63.99	267.08
406	0.10	0.01	4.58	0.09	0.557	5.22	58.79	267.06
381	0.10	0.01	4.61	0.09	0.543	5.24	53.56	267.03
356	0.10	0.02	4.64	0.09	0.531	5.26	48.32	267.01
330	0.10	0.02	4.67	0.09	0.518	5.28	43.06	266.98
305	0.10	0.02	4.70	0.09	0.507	5.30	37.77	266.95
279	0.10	0.02	4.73	0.09	0.495	5.32	32.47	266.93
254	0.10	0.02	4.76	0.10	0.478	5.34	27.16	266.90
229	0.00	0.00	0.00	0.00	2.424	2.42	21.81	266.88
203	0.00	0.00	0.00	0.00	2.424	2.42	19.39	266.85
178	0.00	0.00	0.00	0.00	2.424	2.42	16.97	266.83
152	0.00	0.00	0.00	0.00	2.424	2.42	14.54	266.80
127	0.00	0.00	0.00	0.00	2.424	2.42	12.12	266.78
102	0.00	0.00	0.00	0.00	2.424	2.42	9.70	266.75
76	0.00	0.00	0.00	0.00	2.424	2.42	7.27	266.73
51	0.00	0.00	0.00	0.00	2.424	2.42	4.85	266.70
25	0.00	0.00	0.00	0.00	2.424	2.42	2.42	266.68

Project: **A4 Post**

Chamber Model -	SC-740	
Units -	**Metric**	Click Here for Imperial
Number of chambers -	80	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	0.00	m
Amount of Stone Above Chambers -	152	mm
Amount of Stone Below Chambers -	152	mm
	252	

Include Perimeter Stone in Calculations

StormTech SC-740 Cumulative Storage Volumes

Height of System *(mm)*	Incremental Single Chamber *(cubic meters)*	Incremental Total Chamber *(cubic meters)*	Incremental Stone *(cubic meters)*	Incremental Ch & St *(cubic meters)*	Cumulative Chamber *(cubic meters)*	Elevation *(meters)*
1067	0.00	0.00	2.55	2.55	169.666	1.07
1041	0.00	0.00	2.55	2.55	167.114	1.04
1016	0.00	0.00	2.55	2.55	164.561	1.02
991	0.00	0.00	2.55	2.55	162.008	0.99
965	0.00	0.00	2.55	2.55	159.456	0.97
940	0.00	0.00	2.55	2.55	156.903	0.94
914	0.00	0.12	2.50	2.63	154.351	0.91
889	0.00	0.37	2.40	2.77	151.723	0.89
864	0.01	0.64	2.30	2.94	148.949	0.86
838	0.02	1.37	2.01	3.37	146.013	0.84
813	0.02	1.82	1.83	3.64	142.640	0.81
787	0.03	2.15	1.69	3.84	138.998	0.79
762	0.03	2.43	1.58	4.01	135.153	0.76
737	0.03	2.67	1.48	4.16	131.140	0.74
711	0.04	2.87	1.41	4.27	126.983	0.71
686	0.04	3.07	1.32	4.39	122.710	0.69
660	0.04	3.29	1.23	4.53	118.315	0.66
635	0.04	3.45	1.17	4.63	113.786	0.64
610	0.04	3.58	1.12	4.70	109.161	0.61
584	0.05	3.72	1.06	4.78	104.458	0.58
559	0.05	3.85	1.01	4.86	99.673	0.56
533	0.05	3.97	0.96	4.94	94.811	0.53
508	0.05	4.08	0.92	5.00	89.875	0.51
483	0.05	4.20	0.87	5.07	84.872	0.48
457	0.05	4.29	0.84	5.13	79.798	0.46
432	0.05	4.38	0.80	5.18	74.673	0.43
406	0.06	4.47	0.76	5.24	69.491	0.41
381	0.06	4.55	0.73	5.28	64.254	0.38
356	0.06	4.63	0.70	5.33	58.970	0.36
330	0.06	4.70	0.67	5.37	53.638	0.33
305	0.06	4.77	0.65	5.41	48.265	0.30
279	0.06	4.83	0.62	5.45	42.851	0.28
254	0.06	4.88	0.60	5.48	37.401	0.25
229	0.06	4.93	0.58	5.51	31.921	0.23
203	0.06	4.98	0.56	5.54	26.409	0.20
178	0.06	5.00	0.55	5.55	20.868	0.18
152	0.00	0.00	2.55	2.55	15.316	0.15
127	0.00	0.00	2.55	2.55	12.763	0.13
102	0.00	0.00	2.55	2.55	10.210	0.10
76	0.00	0.00	2.55	2.55	7.658	0.08
51	0.00	0.00	2.55	2.55	5.105	0.05
25	0.00	0.00	2.55	2.55	2.553	0.03

Project: **A6 Post**

Chamber Model -	SC-310	
Units -	**Metric**	Click Here for Imperial
Number of chambers -	174	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	0.00	m
Amount of Stone Above Chambers -	152	mm
Amount of Stone Below Chambers -	350	mm
	443	

☐ Include Perimeter Stone in Calculations

StormTech SC-310 Cumulative Storage Volumes

Height of System *(mm)*	Incremental Single Chamber *(cubic meters)*	Incremental Total Chamber *(cubic meters)*	Incremental Stone *(cubic meters)*	Incremental Ch & St *(cubic meters)*	Cumulative Chamber *(cubic meters)*	Elevation *(meters)*
914	0.00	0.00	3.90	3.90	184.035	0.91
889	0.00	0.00	3.90	3.90	180.136	0.89
864	0.00	0.00	3.90	3.90	176.237	0.86
838	0.00	0.00	3.90	3.90	172.338	0.84
813	0.00	0.00	3.90	3.90	168.439	0.81
787	0.00	0.00	3.90	3.90	164.540	0.79
762	0.00	0.29	3.78	4.07	160.641	0.76
737	0.00	0.76	3.59	4.36	156.568	0.74
711	0.01	1.31	3.37	4.69	152.211	0.71
686	0.02	2.69	2.82	5.51	147.525	0.69
660	0.02	3.47	2.51	5.98	142.014	0.66
635	0.02	4.07	2.27	6.34	136.032	0.64
610	0.03	4.56	2.08	6.63	129.694	0.61
584	0.03	5.00	1.90	6.90	123.060	0.58
559	0.03	5.40	1.74	7.14	116.158	0.56
533	0.03	5.69	1.62	7.31	109.020	0.53
508	0.03	5.99	1.50	7.49	101.706	0.51
483	0.04	6.29	1.38	7.67	94.213	0.48
457	0.04	6.53	1.29	7.82	86.542	0.46
432	0.04	6.73	1.21	7.94	78.724	0.43
406	0.04	6.93	1.13	8.06	70.786	0.41
381	0.04	7.07	1.07	8.14	62.731	0.38
356	0.00	0.00	3.90	3.90	54.587	0.36
330	0.00	0.00	3.90	3.90	50.688	0.33
305	0.00	0.00	3.90	3.90	46.789	0.30
279	0.00	0.00	3.90	3.90	42.890	0.28
254	0.00	0.00	3.90	3.90	38.991	0.25
229	0.00	0.00	3.90	3.90	35.092	0.23
203	0.00	0.00	3.90	3.90	31.193	0.20
178	0.00	0.00	3.90	3.90	27.294	0.18
152	0.00	0.00	3.90	3.90	23.394	0.15
127	0.00	0.00	3.90	3.90	19.495	0.13
102	0.00	0.00	3.90	3.90	15.596	0.10
76	0.00	0.00	3.90	3.90	11.697	0.08
51	0.00	0.00	3.90	3.90	7.798	0.05
25	0.00	0.00	3.90	3.90	3.899	0.03

APPENDIX C
Sanitary Data Analysis

COLE ENGINEERING

TOWNSHIP OF UXBRIDGE

ENGINEERING AND PUBLIC WORKS DEPARTMENT

SANITARY SEWER DESIGN SHEET

RESIDENTIAL DEVELOPMENT

Sheet: 1 of 1
Prepared By: LZ
Date: 1-Dec-17
Project No.: UD16-0349

Residential Population Density:
Single Family Dwelling, Semi-Detached: 3.5 Persons/unit
Townhouses: 3.0 Persons/Unit
1 Bedroom Apartment: 1.5 Persons/Unit
2 Bedroom Apartment: 2.5 Persons/Unit

Infiltration: 22,500
Commercial 180,000

q = average daily flow per person 364 L/d

M = Peaking Factor (Residential)
M = 1 + 14/(4+P^.5)
where P = population in 1000's

Q (p) = peak population flow (L/s)
Q (I) = peak Infiltration flow (L/s)
Q (C) = peak flow from commercial area (L/s)
Q (d) = Total Peak flow (L/s) Q(d) = Q(p) + Q(I) +

LOCATION	SECTION AREA (ha.)	RESIDENTIAL NUMBER OF UNITS: Single Family Dwelling @ 3.5 ppu	Townhouse units @ 3 ppu	Future Development Block	Residential units above Commercial Block @ 2.5 ppu	SECTION POP. (persons)	NON-RESIDENTIAL: Office (ha)	COMMERCIAL (ha.)	INSTIT. (ha.)	SCHOOL @ 86 p/ha (ha.)	SECTION AREA (ha.)	SECTION POP. (persons)	SANITARY FLOW: TOTAL ACCUM. POP. (persons)	AVERAGE RESIDENTIAL FLOW @ 364 L/person/d (L/s)	HARMON PEAKING FACTOR	RES. PEAK FLOW (L/s)	INFILT. @ 22,500 L / ha / day (L/s)	Total Residential Flow	Toal COMMERCIAL FLOW @ 180,000 L/ha/day (L/s)	TOTAL SANITARY FLOW (L/s)
PRE-DEVELOPMENT	4.971					0							0	0.00	3.8	0.00	1.29	1.29	0.00	**1.29**
PROPOSED DEVELOPMENT	4.971	8	94	75	5	398		0.047					398	1.67	3.8	6.36	1.28	7.65	0.10	**7.74**

S:\2017 Projects\IC\2017-0569 Evendale_BrockStreet_Uxbridge\300-Design-Engineering\304-Calcs\Sanitary

APPENDIX D
Water Data Analysis

See Adjacent Page 59 Uxbridge West

Township of Uxbridge
Uxbridge East

The Regional Municipality of Durham
Works Department
WATER SUPPLY SYSTEM

This map has been produced from a variety of sources.
The Region of Durham does not make any representations concerning the accuracy, likely results, or reliability of the use of the materials. The Region hereby disclaims all representations and warranties.

Servicing Note: This map depicts proximity of services only. It is not to be used to determine individual site servicing or availability of capacity within the system.
For detailed site servicing information please contact the development approvals section of the works department,

Uxbridge Well No 7
Status: Not In Service
Rated Capacity: 4.32 ML/day

Uxbridge Well No 5
Status: In Service
Rated Capacity: 4.32 ML/day

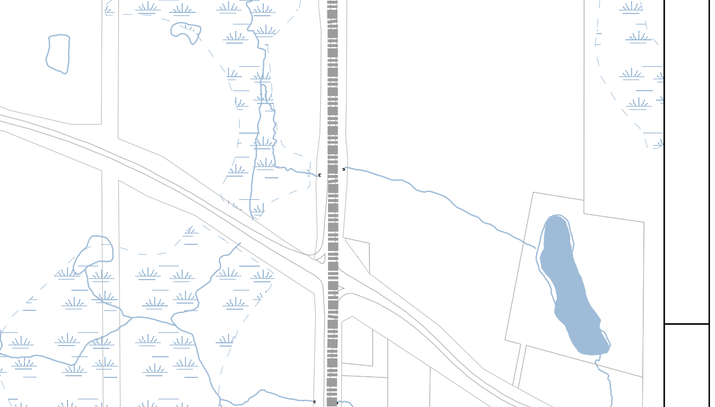
Refer to SANDY HOOK RD SSPS Regional Property Map Book
Refer to UXBRIDGE WPCP Regional Property Map Book

- Water Main - Assumed or In Service
- Water Main - Maintenance
- Water Main - Issued for Construction
- Water Main - Not In Service
- Feeder Main - Assumed or In Service
- Feeder Main - Maintenance
- Feeder Main - Issued for Construction
- Fireline
- Service
- Pressure Zone Edge
- Underground Pipelines
- Municipal Boundary

- Hydrant
- Flushing Hydrant
- Hydrant with Anti-tampering Device
- Flushing Hydrant with Anti-tampering Device
- Temporary Flushing Hydrant
- Temporary Flushing Hydrant with Anti-tampering Device
- Private Hydrant
- Water Pumping Station - Proposed
- Water Pumping Station - Not in Service
- Water Pumping Station - Not Applicable
- Water Pumping Station - Assumed/In Service/Maintenance
- Water Pumping Station - Abandoned

- Control Valve
- Curbstop Non Residential
- Zone Valve
- Blow Off
- Air Release, Check, Drain or Pressure Relief
- Municipal Well - In Service
- Municipal Well - Abandoned
- Municipal Well - Not in Service
- Municipal Well - Not Applicable
- Reservoir - In Service
- Reservoir - Not in Service
- Storage Tank - In Service
- Wet Well - Assumed

- Easement (Water)
- Easement (Combined)
- Regional Property



Scugog and Sunderland Depot

Water_5000_D.mxd
printed May-18-16

1:5000
0 50 100 200 300 400 500 Meters

AH12 AH13 AH14

AG12 AG13 AG14

AF12 AF13 AF14

AE12 AE13 AE14

AH AG AF AE

Centre Rd
Main St
Lormik Dr
Colby
Sandy Hook Rd
Maple Brook Dr
OS James Hunt Ct
Cyril Richardson Crt
Oakside Dr
Apple Tree Cres
North St
Harvey St
Bolton Dr
Carmody Lane
Sixth St
Fourth St
Second St
Young St
Symes St
Fifth St
Third St
Jonathan St
Byam Pl
Willis Pl
Maple St
Latcham Cr
Pine St
King St
Toronto St
Railway St
Spruce St
Albert St
Ash St
First Av
Cedar St
Victoria St
Beech St
Balsam St
Brock St
Mechanic St
Church St
Victoria Dr
Colborne St
Centennial Dr
Poplar St
Bascom St
Peel St
Perry St
Pond St
Mill St
Wilson St
James St
Isaac Ct
Water St
Marietta St
Joseph St
Button Cr
Keller La
Confederation Dr
Elgin Park Dr
Crosby Rd
Alsop Pl
Galloway Cr
Rachel Lee Ct
Colonel Sharpe Cr
Milne Ct
Quaker Village Dr
Widdifield Ct
Whaler Ct
Geo Izatt Dr
North Beech St
South Beech St
South Balsam St
Mcguire Cr
Meadows End Cres
Forsythe Dr
Turner Dr
Campbell Dr
Cemetary Rd
Kirton Ct
Toronto St South
Douglas Rd
Banff Rd
Welwood Dr
Concession 6
Hwy 47

Refer to QUAKER HILL RESERVOIR Regional Property Map Book
Quaker Hill Reservoir
Quaker Hill PS
Refer to UXBRIDGE WELL 1 Regional Property Map Book
Brock St Reservoir (not in service)
Refer to 20 PERRY ST - LOCAL HOUSING Regional Property Map B
Refer to UXBRIDGE WELL NO 6 (CAMPBELL DR) Regional Property Map Book
Uxbridge Well No 6
Status: In Service
Rated Capacity: 3.92 ML/day
Uxbridge Well No 6
Refer to UXBRIDGE WPCP Regional Property

U1 U2

See Adjacent Page 60 Uxbridge East

1:5000 Meters 0 50 100 200 300 400 500

Water_5000_D.mxd printed May-18-16

DURHAM REGION

The Regional Municipality of Durham
Works Department
WATER SUPPLY SYSTEM

Servicing Note: This map depicts proximity of services only. It is not to be used to determine individual site servicing or availability of capacity within the system. For detailed site servicing information please contact the development approvals section of the works department,

Township of Uxbridge
Uxbridge West

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- Flushing Hydrant
- Hydrant with Anti-tampering Device
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- Temporary Flushing Hydrant
- Temporary Flushing Hydrant with Anti-tampering Device
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- Municipal Well - Not Applicable
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- Reservoir - Not in Service
- Storage Tank - In Service
- Wet Well - Assumed

- Easement (Water)
- Easement (Combined)
- Regional Property

HYDRANT FLOW TEST FORM

Test # 1

COLE ENGINEERING
Experience Enhancing Excellence

Project No: 2017-0569 **Date:** October 27, 2017

Site Location: Brock St. E, Uxbridge, On. **Hydrants Opened by:** Durham Water

Tested By: Gordon M, Ryan B.

1) Required photos:

- [x] Site Id & Date
- [x] Location Overview
- [x] Other
- [x] Condition of Flow Hydrant
- [x] Condition of Residual Hydrant

2) Test Data

Time of Test: 1000

Location of Test: (Flow) At the top of Volkydal Ln, north side of Brock St. E

(Residual) At the SE corner of Brock St E, + Volkydal Ln.

Main Size: 200 mm

Static Pressure: 84 psi

	Number of Outlets & Orifice Size	Pitot Pressure	Flow (USGPM)	Residual Pressure
1	1 x 2.5"	64	1350	76
2	2 x 2.5"	36	2000	75
3				
4				

3) Calculations

$Q = 29.83\ cd^2\sqrt{p}$

Where c- cofficient of discharge (1 in smooth pipe)
d- pipe diameter (inches)
p- pitot reading (psi)
Q- flow (USGPM)

$Q_1 = (29.83)(0.9)(2.5")^2\sqrt{64}$

$= 1342.35$

$Q_1 = \sim 1350$ USGPM

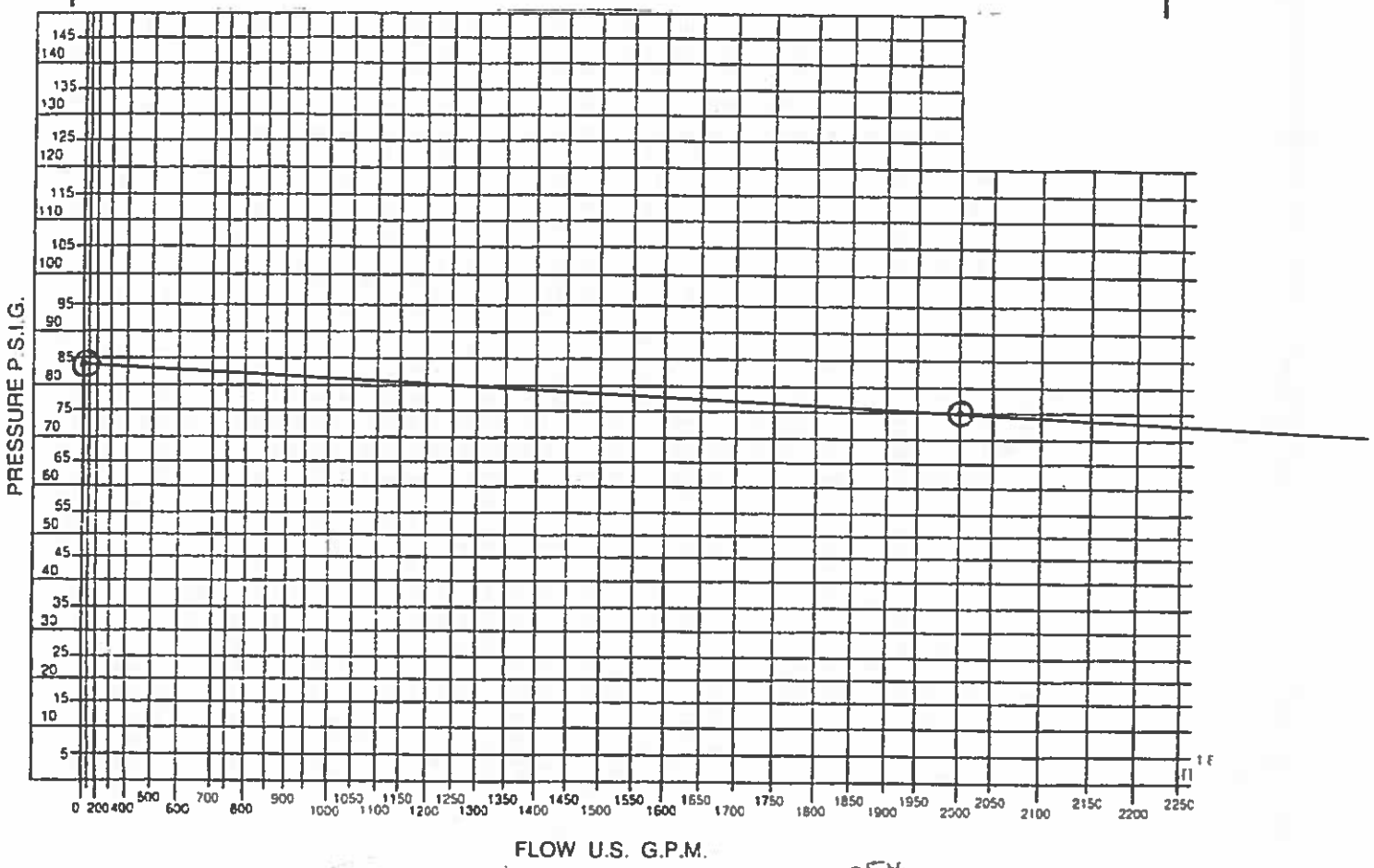
$Q_T = 2(29.83)(0.9)(2.5")^2\sqrt{36}$

$= 2013.53$

$Q_T = \sim 2000$ USGPM

Note: Hydrants tested according to NFPA 291: Recommended Practice for Fire Flow Testing and Marking of Hydrants

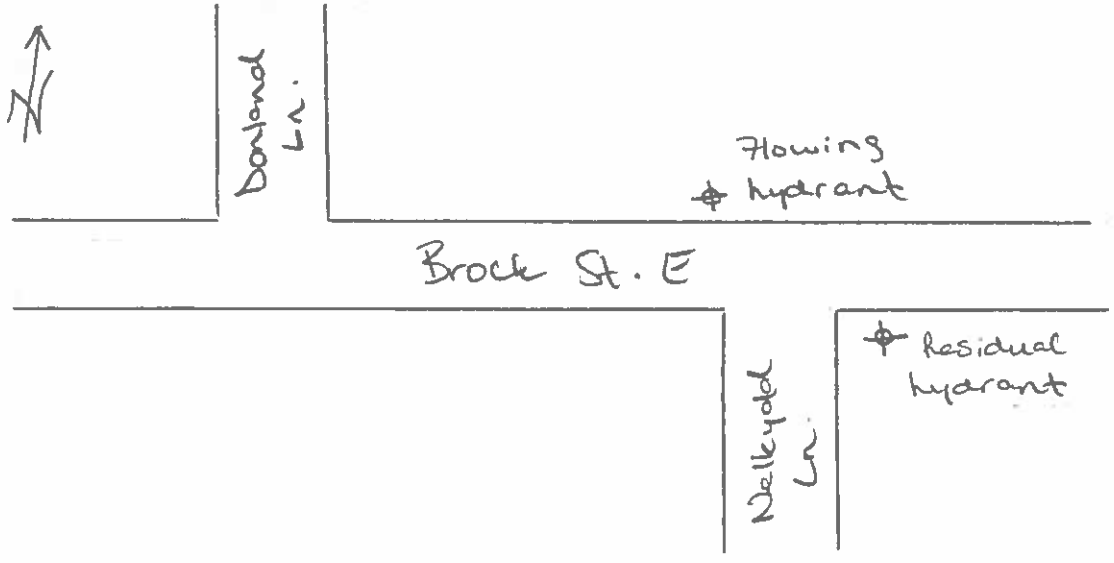
4) Plot



$$Q_{avail} @ 20\,psi = Q_t((P_S - P_A)/(P_S - P_R))^{0.54}$$
$$= 2013.53((84-20)/(84-75))^{0.54}$$
$$= 5907.69$$

$Q_{avail} = \sim 5800$ USGPM

5) Site sketch & Comments



HYDRANT FLOW TEST FORM — Test # 2

COLE ENGINEERING
Experience Enhancing Excellence

Project No: 2017-0569 **Date:** October. 27, 2017

Site Location: Brock St. E, Uxbridge, On. **Hydrants Opened by:** Durham water

Tested By: Gordon M, Ryan B.

1) Required photos:

- [x] Site Id & Date
- [x] Location Overview
- [x] Other
- [x] Condition of Flow Hydrant
- [x] Condition of Residual Hydrant

2) Test Data

Time of Test: 1100

Location of Test: (Flow) At SW corner of Low Blvd + Dorland Ln.

(Residual) In front of 6-8 Low Blvd, south side

Main Size: 150 mm

Static Pressure: 85 psi

	Number of Outlets & Orifice Size	Pitot Pressure	Flow (USGPM)	Residual Pressure
1	1 x 2.5"	56	1250	74
2	2 x 2.5"	32	1900	60
3				
4				

3) Calculations

$Q = 29.83\ cd^2\sqrt{p}$

Where c- cofficient of discharge (1 in smooth pipe)
d- pipe diameter (inches)
p- pitot reading (psi)
Q- flow (USGPM)

$Q_1 = (29.83)(0.9)(2.5")^2\sqrt{56}$

$= 1255.65$

$Q_1 = \sim 1250$ USGPM

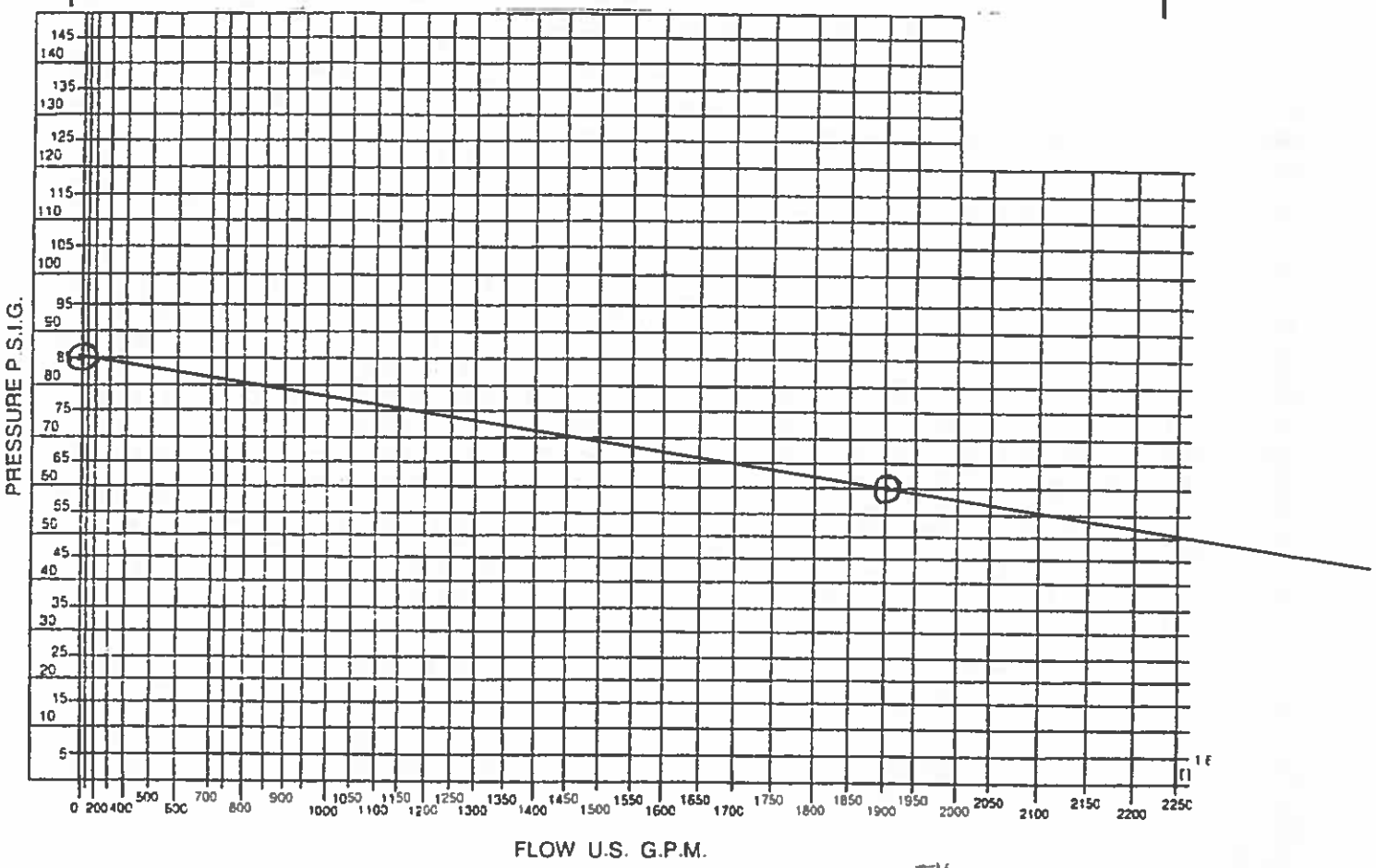
$Q_T = 2(29.83)(0.9)(2.5")^2\sqrt{32}$

$= 1898.37$

$Q_T = \sim 1900$ USGPM

Note: Hydrants tested according to NFPA 291: Recommended Practice for Fire Flow Testing and Marking of Hydrants

4) Plot



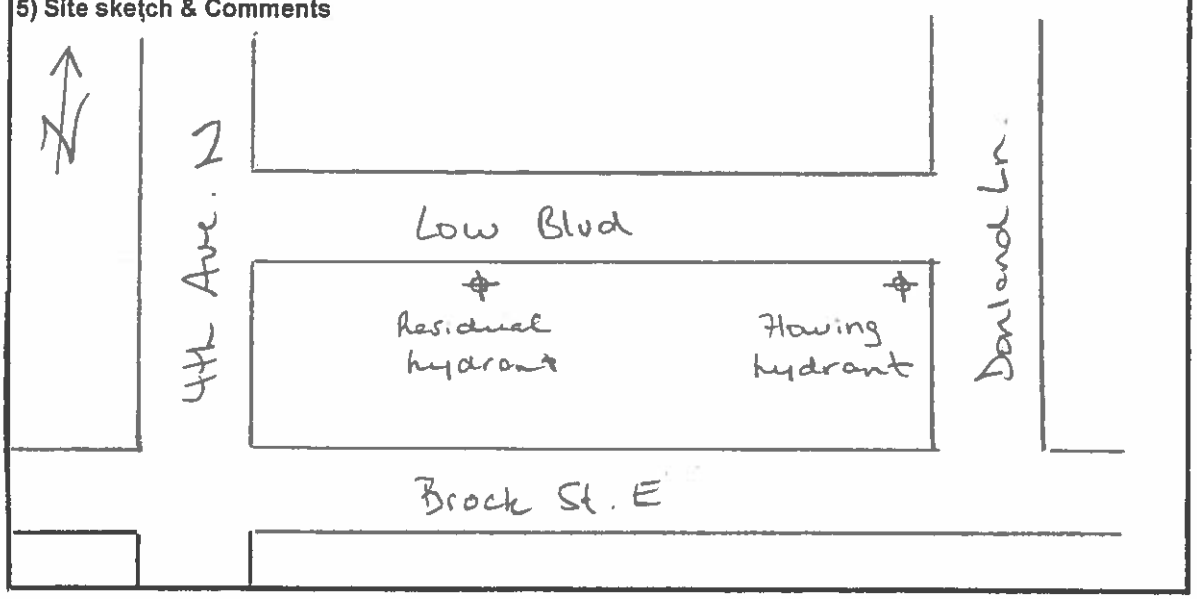
Q_{avail} @ 20 psi $= Q_t((P_s - P_A)/(P_s - P_R))^{0.54}$

$= 1898.37((85-20)/(85-60))^{0.54}$

$= 3180.29$

$Q_{avail} = \sim 3200$ USGPM

5) Site sketch & Comments



HYDRANT FLOW TEST FORM

Test #3

COLE ENGINEERING
Experience Enhancing Excellence

Project No: 2017-0569 **Date:** October 27, 2017

Site Location: Brock St. E, Uxbridge, On. **Hydrants Opened by:** Durham Water

Tested By: Gordon H, Ryan B.

1) Required photos:

- [x] Site Id & Date
- [x] Location Overview
- [x] Other
- [x] Condition of Flow Hydrant
- [x] Condition of Residual Hydrant

2) Test Data

Time of Test: 1130

Location of Test: (Flow) 1st hydrant south of Maunder Ct, on Herrema Blvd.

(Residual) 1st hydrant north of Maunder Ct, on Herrema Blvd.

Main Size: 200 mm

Static Pressure: 88 psi

	Number of Outlets & Orifice Size	Pitot Pressure	Flow (USGPM)	Residual Pressure
1	1 x 2.5"	62	1300	76
2	2 x 2.5"	42	2150	74
3				
4				

3) Calculations

$Q = 29.83\ cd^2\sqrt{p}$

Where c- cofficient of discharge (1 in smooth pipe)
d- pipe diameter (inches)
p- pitot reading (psi)
Q- flow (USGPM)

$Q_1 = (29.83)(0.9)(2.5")^2\sqrt{62}$

$= 1321.21$

$Q_1 = \sim 1300$ USGPM

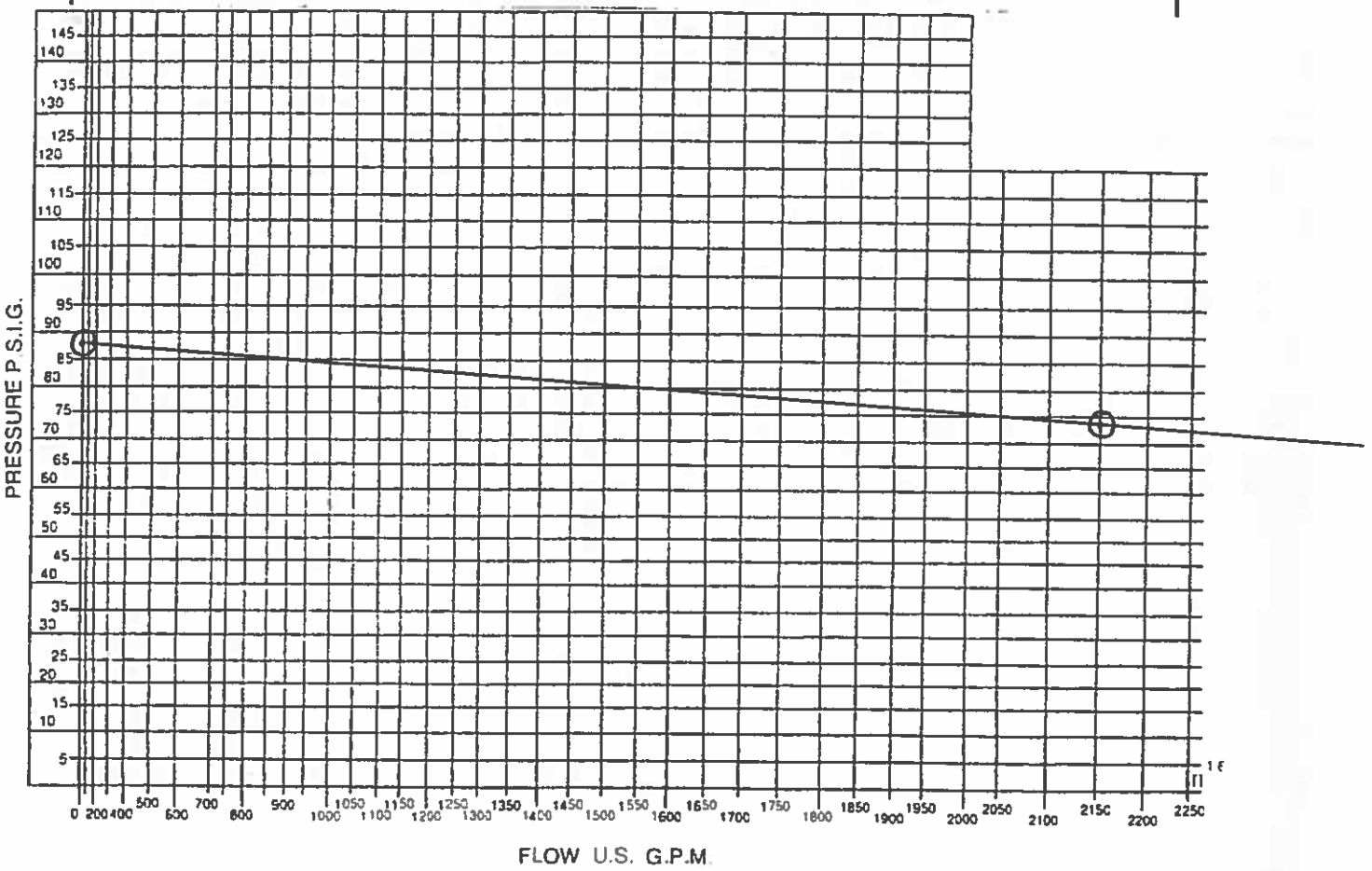
$Q_2 = 2(29.83)(0.9)(2.5")^2\sqrt{42}$

$= 2174.86$

$Q_2 = \sim 2150$ USGPM

Note: Hydrants tested according to NFPA 291: Recommended Practice for Fire Flow Testing and Marking of Hydrants

4) Plot



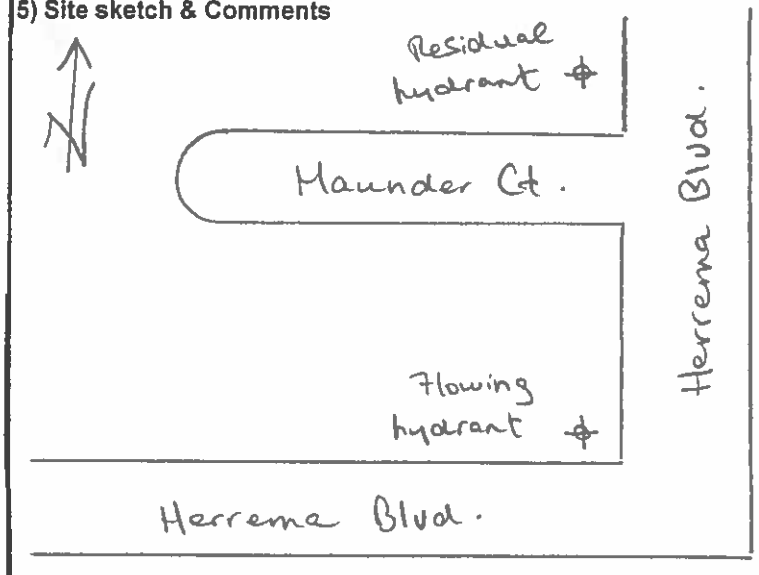
Q_{avail} @ 20 psi $= Q_t \left((P_S - P_A) / (P_S - P_R) \right)^{0.54}$

$= 2174.86 \left((88 - 20) / (88 - 74) \right)^{0.54}$

$= 5105.94$

$Q_{avail} = \sim 5100$ USGPM

5) Site sketch & Comments



COLE ENGINEERING
Experience Enhancing Excellence

DOMESTIC WATER DEMAND

Project:	Brock Street	Proj. #	2017-0569
Date:	December 2017		
Calc'ed by:	Leila Zavareh		

Note:
Based on the Region of Durham Standards, Ministry of the Environment and Climate Change Design Guidelines for Drinking-Water Systems 2008 Table 3-3 .

	Site Component	Townhouses	Single or Semi-Detached	Future Development Block	Commercial Block		
Residential Occupancy Data	Studio / 1 / 1+d bed units						
	People per unit	*1.5*	*1.5*	*1.5*	*1.5*		
	2 bed units / 2+D				5		
	People per unit	*2.5*	*2.5*	*2.5*	*2.5*		
	3 bed units						
	People per unit	*3.5*	*3.5*	*3.5*	*3.5*		
	Townhouse units	94					
	People per unit	*3.0*	*3.0*	*3.0*	*3.0*		
	Semi Detached or Single		8				
	Person per unit	*3.5*	*3.5*	*3.5*	*3.5*		
Commercial Occupancy Data	Commercial GFA (ha)				0.047		
	People per ha				*86.0*		
	blank						
	blank						

Unit Quantity by Site Component	Water Demand	Units	Equivalent Population (persons)					
Residential Occupancies								
Residential Occupancies	364	L/person/day	282.0	28.0	75.0	13.0	-	-
Commercial Occupancies			**Equivalent Poplutations (persons)**					
Commercial or Retail	364	L/person/day	-	-	-	5.0	-	-

		Daily Flow Rate (L/d)					
Residential Occupancies							
Residential Occupancies		144,872.00	102,648.00	10,192.00	27,300.00	4,732.00	0	0
Commercial Occupancies							
Commercial Occupancies		1,820.00	0	0	0	1,820.00	0	0
		Total Flow					
Average day (L/d)		**146,692.00**	102,648.00	10,192.00	27,300.00	6,552.00	0.00	0.00
Average day (L/s)		**1.70**	1.19	0.12	0.32	0.08	0.00	0.00
Max. day (L/d)		**425,406.80**	297,679.20	29,556.80	79,170.00	19,000.80	0.00	0.00
Max. day (L/min)		**295.42**	206.72	20.53	54.98	13.20	0.00	0.00
Min. hour (L/hr)		**2,414.53**	1,710.80	169.87	455.00	78.87	0.00	0.00
Peak hour (L/hr)		**26,282.32**	18,391.10	1,826.07	4,891.25	1,173.90	0.00	0.00
Peak hour (L/s)		**7.30**	5.11	0.51	1.36	0.33	0.00	0.00

Population density (people per unit), and 'Volume (L)' is based on the Region of Durham Design Criteria & Standard Drawings.Residential unit count are based on the project statistics prepared by Architect.

Peaking Factors			
Land Use	Minimum Hour	Peak Hour	Maximum Day
Residential	0.4	4.30	2.90
Commercial / Retail	0.4	4.30	2.90

FIRE FLOW CALCULATION

Project:	Brock Street	Project #	2017-0569
Date:	December 2017		
Calc'ed by:	Leila Zavareh		

Fire Resistive Construction:	NO	Site Component:	Townhouse Block	Semi-Detached or Single	Future Development Block	Commercial		
The following calculations are for the proposed townhouse development and are based on the largest townhouse area. The FUS requires that a minimum water supply source 'F' be provided at 150KPa. The minimum flow 'F' can be calculated as such:	**Total Floor Area**	Largest Floor Area	570.3	302.3	929.0	469.5		
		Area above (m2)	570.3	302.3	929.0	469.5		
		Area below (m2)	570.3	302.3	929.0	0.0		
		Total Floor Area (m2)	1710.8	906.9	1393.5	586.8		
	Flow (F)	C (dimensionless)	1.0	1.0	1.0	1.0		
		A (m2)	1711	907	1394	587		
		F (L/min)	9000	7000	8000	5000		
	Reduction Factor	F (L/min)	9000	7000	8000	5000		
		f_1 (dimensionless)	0.85	0.85	0.85	1.00		
		F' = F x f_f (L/min)	7650	5950	6800	5000		
		f_1 = occupancy factor; ie, Residential, f_1 = 0.85; for Retail or Commercial, f_1 = 1.00						
	Sprinkler and Exposure Increase or Decrease	f_2 (sprinkler factor)	0%	0%	30%	0%		
		North Side	15%	15%	0%	0%		
		East Side	10%	5%	5%	20%		
		South Side	10%	0%	0%	0%		
		West Side	25%	25%	5%	5%		
		f_3	60%	45%	10%	25%		
		f_3 = Exposure factor not to exceed 75%, determined as per FUS Guide Item 4, page 18)						

$$F = 220C\sqrt{A}$$

F = Required fire flow L/min

C = Coefficient related to construction

A = Total area in m^2

'Calculations, formulas and factors are as per Fire Underwriter's Survey (FUS) Water Supply for Public Fire Protection

F' (L/min)	**7650**	**5950**	**6800**	**5000**		
S = F' * *f_2 (L/min)*	**0**	**0**	**2040**	**0**		
E = F' * *f_3 (L/min)*	**4590**	**2677.5**	**680**	**1250**		

F''=F'-S+E (L/min) rounded to nearest 1,000	**12000**	**9000**	**5000**	**6000**		
F''(L/s)	**200**	**150**	**83**	**100**		
F''(USGPM)	**3180**	**2380**	**1330**	**1590**		

Table 1

Sprinkler Reduction Factor (f_2)		
No Sprkinkler System	Sprinklered	Sprink. + Supervised
0%	30%	50%

Table 2

Construction Type "C" Factor			
Wood Frame	Ordinary Construction	Non-Combustible	Fire Resistive
1.5	1	0.80	0.60

Table 3

Occupancy Factor (f_1)				
Rapid Burning	Free Burning	Combustible	Limited Combustible	Non-Combust.
25%	15%	0%	-15%	-25%

Table 4

Exposure Charge					
0 to 3m	3.1 to 10m	10.1 to 20m	20.1 to 30m	30.1 to 45m	> 45m
25%	20%	15%	10%	5%	0

APPENDIX E
Preliminary Engineering Plans

HERREMA BOULEVARD

HERREMA SOCCER FIELDS

CONCESSION 7

BROCK STREET (HIGHWAY 47)

NELKYDD LANE

EX. RESIDENTIAL

LOW BLVD.

HERREMA BLVD.

STREET 'A'

STREET 'B'

STREET 'C'

BLOCK 1 4–T/H

BLOCK 2 6–T/H

BLOCK 3 6–T/H

BLOCK 4 6–T/H

BLOCK 5 6–T/H UNITS

BLOCK 6 6–T/H UNITS

BLOCK 7 6–T/H UNITS

BLOCK 8 6–T/H UNITS

BLOCK 9 6–T/H UNITS

BLOCK 10 6–T/H

BLOCK 11 5–T/H

BLOCK 12 6–T/H

BLOCK 13 5–T/H

BLOCK 14 5–T/H UNITS

BLOCK 15 5–T/H UNITS

BLOCK 16 5–T/H UNITS

BLOCK 17 SEMI–DETACHED TOWNHOUSE UNITS

BLOCK 17 5–T/H UNITS

FUTURE DEVELOPMENT BLOCK

Part of Proposed Future Development Block

COMMERCIAL BUILDING

COMMERCIAL BUILDING

STOMTECH CHAMBERS (MC-350) OUTLINE

STOMTECH CHAMBERS (SC-740) OUTLINE

STOMTECH CHAMBERS (SC-310) OUTLINE

WATERMETER ROOM

PROP. RETAINING WALL

MATCH TO EXISTING WITH 4:1 SLOPE

MATCH TO EXISTING

PROP. 1.5m CONC. SIDEWALK

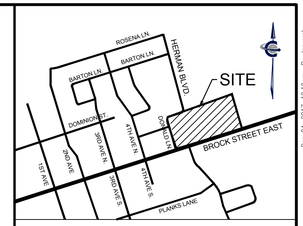
PROP. 2.0m CONC. SIDEWALK

FUT. 1.5m CONC. SIDEWALK

4.5m SETBACK FROM PROPERTY LINE

1.5m CONC. SIDEWALK

10 VISITOR PARKING SPACES



LOCATION PLAN
N.T.S.

LEGEND

- PROPERTY LINE
- PROPOSED GRADE ×149.50
- EXISTING GRADE × *149.33EX*
- PROPOSED GRADE (TOP OF CURB) ×149.65TC
- PROPOSED GRADE (BOTTOM OF CURB) ×149.50BC
- PROPOSED GRADE (BOTTOM OF SWALE) ×147.58SW
- PROPOSED SWALE
- PROPOSED STORM PIPE
- PROPOSED SANITARY PIPE
- PROPOSED SANITARY MANHOLE
- PROPOSED STORM MANHOLE
- PROPOSED CATCH BASIN MANHOLE
- PROPOSED DOUBLE CATCH BASIN MANHOLE
- PROPOSED CATCH BASIN
- PROPOSED DOUBLE CATCH BASIN
- EXISTING MANHOLE
- EXISTING CATCH BASIN
- PROPOSED VALVE AND BOX V&B
- PROPOSED FIRE HYDRANT FH
- PROPOSED SIAMESE CONNECTION
- EMERGENCY OVERLAND FLOW ROUTE
- EXISTING OVERLAND FLOW ROUTE
- SPLIT LOT DRAINAGE
- PROPOSED OGS

LIST OF DRAWINGS

SG-01 - SITE GRADING PLAN
SS-01 - SITE SERVICING PLAN

SITE PLAN INFORMATION
ICR ASSOCIATES INCORPORATED
207 EDGELEY BOULEVARD STE.
18 CONCORD, ONTARIO, L4K 5Y2
PHONE: (905) 738-8500
FAX: (905) 738-2227

SURVEYOR INFORMATION
JD BARNES LIMITED
110 SCOTIA COURT, #40
WHITBY, ON L1N 8Y7
PHONE: (905) 723-1212
FAX: (905) 723-4234

BENCHMARK INFORMATION:
MINISTRY OF TRANSPORTATION OF ONTARIO PRECISE BENCHMARK N° 008197784B7 (AKA 778487). TWO STOREY RED BRICK HOUSE ON SOUTH SIDE OF HIGHWAY 47 (BROCK STREET) IN THE TOWN OF UXBRIDGE, 118.9m EAST OF MARIETTA STREET, 18.4m WEST OF FRANKLIN STREET AND 15.9m SOUTH OF THE CENTRELINE OF HIGHWAY 47. TABLET IS SET HORIZONTALLY IN THE EAST FACE OF CONCRETE FOUNDATION, 3.9m SOUTH OF NORTHEAST CORNER, 30cm ABOVE GROUND LEVEL AND 34cm BELOW BRICKWORK. ELEVATION = 274.359m (GEODETIC)

NO.	REVISION	DATE	BY
1	ISSUED FOR ZBA APPLICATION	DEC 04, 2017	LZ

TOWN OF UXBRIDGE
REGIONAL MUNICIPALITY OF DURHAM

EVENDALE DEVELOPMENTS LTD.
BROCK STREET DEVELOPMENT
UXBRIDGE, ONTARIO

SITE GRADING PLAN

COLE ENGINEERING
75 VALLEYWOOD DRIVE, MARKHAM, ON L3R 4T5
T 416.987.8100 | 905.940.0181 F 905.940.2064

DESIGNED BY: AZ	DATE: NOVEMBER 2017	CHECKED BY:	
DRAWN BY: PS	PROJECT No. 2017-0569	DRAWING No. SG-01	
SCALE: 1:500			

5.0m 0 5.0m 10.0m 15.0m 20.0m 25.0m 30.0m

Dec 04, 2017 - 12:19pm By rcrowson
S:\2017 Projects\X\2017-0569 Evendale, BrockStreet, Uxbridge\400-CAD\401-CAD\1-Service Sector or IBI\Sheet\2017-0569 SC-01.dwg, [SC-01]

MAUNDER COURT

HERREMA BOULEVARD

HERREMA SOCCER FIELDS

CONCESSION 7

EX. RESIDENTIAL

LOW BLVD.

FUTURE DEVELOPMENT BLOCK

Part of Proposed Future Development Block

HERREMA BLVD.

NELKYDD LANE

BROCK STREET (HIGHWAY 47)

STREET 'A'

STREET 'B'

STREET 'C'

BLOCK 1 4-T/H

BLOCK 2 PROP. STORMTECH CHAMBERS (MC-3500) 93 UNITS VOL. REQUIRED: 464.2 m³ VOL. PROVIDED: 503.9 m³

BLOCK 3 6-T/H

BLOCK 4 6-T/H

BLOCK 5 6-T/H UNITS

BLOCK 6 6-T/H UNITS

BLOCK 7 6-T/H UNITS

BLOCK 8 6-T/H UNITS

BLOCK 9 6-T/H UNITS

BLOCK 10 6-T/H UNITS

BLOCK 11 5-T/H

BLOCK 12 6-T/H

BLOCK 13 5-T/H

BLOCK 14 5-T/H UNITS

BLOCK 15 5-T/H UNITS

BLOCK 16 5-T/H UNITS

BLOCK 17 SEMI-DETACHED TOWNHOUSE UNITS

PROP. STORMTECH CHAMBERS (SC-740) 80 UNITS VOL. REQUIRED: 152.8 m³ VOL. PROVIDED: 154.7 m³

PROP. STORMTECH CHAMBERS (SC-310) 174 UNITS VOL. REQUIRED: 120.3 m³ VOL. PROVIDED: 142.71 m³

COMMERCIAL BUILDING

COMMERCIAL BUILDING

IN-VISITOR PARKING SPACES

CONNECT TO EXISTING WATERMAIN STUB.

BREAK INTO EXISTING MANHOLE, CONNECT PROPOSED STORM SEWER AND REBENCH TO SUIT.

BREAK INTO EXISTING MANHOLE, CONNECT PROPOSED 200mmØ SANIRATY SEWER AND REBENCH TO SUIT.

WATERMETER ROOM

ORIFICE #4 425mmØ

ORIFICE #3 175mmØ

ORIFICE #2 120mmØ

ORIFICE 1 - 125mm Ø

CONNECT TO EXISTING WATERMAIN STUB.

150mmØ PVC WATERMAIN

PROP. 1.5m CONC. SIDEWALK

PROP. 2.0m CONC. SIDEWALK

2.0m CONC. SIDEWALK

REMOVE EX. 675mmØ

REMOVE EX. FH AND CONNECT TO EX. WATERMAIN

FUTURE BLOCK STORMWATER MANAGEMENT TO CONFORM TO APPROVED STORMWATER MANAGEMENT STRATEGY.

150mmØ PVC YM 200mmØ PVC FM SIAMESE CONNECTION

200mmØ FIRE 150mmØ DOMESTIC

150mmØ DOMESTIC 200mmØ FIRE

4.5m SETBACK FROM PROPERTY LINE

4.5m SETBACK FROM PL

25.6m–300mmø PVC STM @ 0.50%

38.4m–300mmø PVC STM @ 0.50%

12.1m–300mmø PVC STM @ 0.50%
21.4m–200mmø PVC SAN @ 0.50%

4.5m–250mmø PVC STM @ 1.00%

8.7m–525mmø CONC. STM @ 2.00%

14.0m–200mmø PVC SAN @ 2.00%

36.6m–75mmø PVC STM @ 0.50%

36.5m–75mmø PVC STM @ 0.50%

22.2m–450mmø CONC. STM @ 0.50%

63.2m–450mmø CONC. STM @ 0.50%

63.3m–200mmø PVC SAN @ 0.50%

74.5m–450mmø CONC. STM @ 0.50%

79.7m–200mmø PVC SAN @ 0.50%

79.8m–200mmø PVC SAN @ 1.00%

15.1m–200mmø PVC SAN @ 2.00%

17.6m–300mmø PVC STM @ 2.00%

39.8m–200mmø PVC SAN @ 0.50%

1.2m–300mmø PVC STM @ 0.50%

13.7m–300mmø PVC STM @ 0.50%

10.7m–300mmø PVC STM @ 0.50%

12.6m–300mmø PVC STM @ 0.50%

1.7m–200mmø PVC SAN @ 0.50%

2.3m–200mmø PVC SAN @ 0.50%

56.7m–750mmø CONC. STM @ 2.00%

10.5m–300mmø PVC STM @ 0.50%

15.0m–200mmø PVC SAN @ 0.50%

46.5m–300mmø PVC STM @ 2.50%

99.4m–300mmø PVC STM @ 1.00%

50.7m–200mmø PVC SAN @ 0.50%

99.7m–200mmø PVC SAN @ 1.00%

32.4m–300mmø PVC STM @ 1.00%

11.7m–250mmø PVC STM @ 1.00%

28.2m–300mmø PVC STM @ 1.00%

74.4m–300mmø PVC STM @ 0.50%

74.4m–200mmø PVC SAN @ 1.00%

38.9m–250mmø PVC STM @ 1.00%

38.7m–250mmø PVC STM @ 1.00%

25.4m–300mmø PVC STM @ 1.00%

2.3m–200mmø PVC SAN @ 1.00%

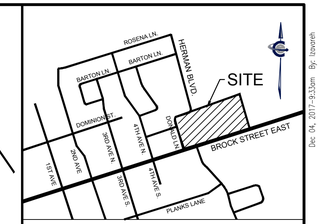
MH1 MH1A MH2 MH2A MH3 MH3A MH4 MH4A MH5 MH5A MH6 MH6A MH7 MH7A MH8 MH8A MH9 MH9A MH10 MH10A MH11 MH11A MH12 MH12A MH13 MH13A MH14 MH14A MH15 MH15A MH16 MH16A MH17 MH17A MH18 MH18A MH19 MH19A MH20 MH20A

CBMH1 CBMH2 DCBMH1 DCBMH2 DCBMH3 OGS1 OGS2 OGS3

RLCB1 RLCB2 RLCB3 RLCB4 RLCB5 RLCB6 RLCB7 RLCB8

FH

TOP OF SLOPE C/L OF DITCH



LOCATION PLAN
N.T.S.

LEGEND

- PROPERTY LINE
- PROPOSED STORM PIPE
- PROPOSED SANITARY PIPE
- PROPOSED SANITARY MANHOLE
- PROPOSED STORM MANHOLE
- PROPOSED CATCH BASIN MANHOLE
- PROPOSED DOUBLE CATCH BASIN MANHOLE
- PROPOSED CATCH BASIN
- PROPOSED DOUBLE CATCH BASIN
- PROPOSED OGS
- EXISTING MANHOLE
- EXISTING CATCH BASIN
- PROPOSED VALVE AND BOX (V&B)
- PROPOSED FIRE HYDRANT (FH)
- PROPOSED SIAMESE CONNECTION

LIST OF DRAWINGS

SG-01 - SITE GRADING PLAN
SS-01 - SITE SERVICING PLAN

SITE PLAN INFORMATION

ICR ASSOCIATES INCORPORATED
207 EDGELEY BOULEVARD STE.
18 CONCORD, ONTARIO, L4K 5Y2
PHONE: (905) 738-8500
FAX: (905) 738-2227

SURVEYOR INFORMATION

JD BARNES LIMITED
110 SCOTIA COURT, #40
WHITBY, ON L1N 8Y7
PHONE: (905) 723-1212
FAX: (905) 723-4234

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SITE SERVICING PLAN

COLE ENGINEERING
70 VALLEYWOOD DRIVE, MARKHAM, ON L3R 4T5
T 416.987.8787 | 905.940.8787 F 905.940.2064

DESIGNED BY:	AZ	DATE: NOVEMBER 2017	CHECKED BY:
DRAWN BY:	PS	PROJECT No: 2017-0569	DRAWING No. SS-01
SCALE:	1:500		

5.0m 0 5.0m 10.0m 15.0m 20.0m 25.0m 30.0m

SANITARY SEWER STRUCTURE INVENTORY

MH #	MH DIAMETER	MH OPSD	FRAME	TOP ELEV.	INVERTS
MH1A	1200mmØ	701.010	OPSD 401.010	270.53	N 267.62 (200mmø)
MH2A	1200mmØ	701.010	OPSD 401.010	271.16	S 267.39 (200mmø) N 267.36 (200mmø)
MH3A	1200mmØ	701.010	OPSD 401.010	270.62	S 266.99 (200mmø) N 266.97 (200mmø) W 266.89 (200mmø)
MH4A	1200mmØ	701.010	OPSD 401.010	270.70	S 267.16 (200mmø)
MH5A	1200mmØ	701.010	OPSD 401.010	270.26	E 266.49 (200mmø) W 266.46 (200mmø)
MH6A	1200mmØ	701.010	OPSD 401.010	277.38	S 276.57 (200mmø) E 266.14 (200mmø) NW 266.05 (200mmø)
MH7A	1200mmØ	701.010	OPSD 401.010	270.64	SE 267.99 (200mmø) N 276.90 (200mmø)
MH8A	1200mmØ	701.010	OPSD 401.010	270.87	E 268.16 (200mmø) NW 268.07 (200mmø)
MH9A	1200mmØ	701.010	OPSD 401.010	271.65	E 268.41 (200mmø) W 268.41 (200mmø)
MH10A	1200mmØ	701.010	OPSD 401.010	268.83	SE 265.90 (200mmø) W 267.73 (200mmø)

SANITARY SEWER STRUCTURE INVENTORY

MH #	MH DIAMETER	MH OPSD	FRAME	TOP ELEV.	INVERTS
MH11A	1200mmØ	701.010	OPSD 401.010	268.79	E 267.45 (200mmø) W 265.77 (200mmø)
MH12A	1200mmØ	701.010	OPSD 401.010	268.68	E 265.69 (200mmø) S 265.64 (200mmø) N 265.61 (200mmø)
MH13A	1200mmØ	701.010	OPSD 401.010	268.81	S 265.82 (200mmø) W 265.87 (200mmø) N 265.79 (200mmø)
MH14A	1200mmØ	701.010	OPSD 401.010	269.87	E 266.00 (200mmø) SW 266.06 (200mmø) N 265.93 (200mmø)
MH15A	1200mmØ	701.010	OPSD 401.010	270.02	NE 266.36 (200mmø)
MH16A	1200mmØ	701.010	OPSD 401.010	270.00	E 266.37 (200mmø) W 266.32 (200mmø)
MH17A	1200mmØ	701.010	OPSD 401.010	270.61	S 266.53 (200mmø) W 266.44 (200mmø)
MH18A	1200mmØ	701.010	OPSD 401.010	270.80	S 266.76 (200mmø) W 266.82 (200mmø) N 266.73 (200mmø)
MH20A	1200mmØ	701.010	OPSD 401.010	269.01	E 266.67 (200mmø)

STORM SEWER STRUCTURE INVENTORY

MH #	MH DIAMETER	MH OPSD	FRAME	TOP ELEV.	INVERTS
CBMH1	1200mmØ	701.010	OPSD 401.010 OPSD 400.020	269.03	W 265.80 (300mmø) E 265.79 (300mmø)
CBMH2	1200mmØ	701.010	OPSD 401.010 OPSD 400.020	270.63	E 267.00 (300mmø) S 267.00 (300mmø) N 265.93 (300mmø)
DCBMH1	1500mmØ	701.011	OPSD 401.010 OPSD 400.020	270.52	S 267.32 (300mmø) W 267.23 (300mmø)
DCBMH2	1500mmØ	701.011	OPSD 401.010 OPSD 400.020	268.69	E 266.18 (525mmø) W 266.15 (525mmø)
DCBMH3	1500mmØ	701.011	OPSD 401.010 OPSD 400.020	270.53	SE 267.87 (250mmø) W 267.79 (300mmø)
MH1	1200mmØ	701.010	OPSD 401.010	269.45	N 268.12 (300mmø)
MH2	1200mmØ	701.010	OPSD 401.010	271.13	W 266.83 (300mmø) S 267.87 (300mmø) N 267.79 (375mmø)
MH3	1200mmØ	701.010	OPSD 401.010	270.58	N 267.10 (300mmø) S 267.42 (375mmø) W 267.03 (450mmø)
MH4	1200mmØ	701.010	OPSD 401.010	270.65	E 267.46 (300mmø) S 267.38 (300mmø)
MH5	1200mmØ	701.010	OPSD 401.010	270.24	E 266.66 (450mmø) W 266.62 (450mmø)
MH6	1200mmØ	701.010	OPSD 401.010	269.96	E 266.30 (450mmø) S 266.44 (300mmø) NW 266.24 (450mmø)
MH7	1200mmØ	701.010	OPSD 401.010	270.57	SE 266.82 (300mmø) N 266.76 (300mmø)

STORM SEWER STRUCTURE INVENTORY

MH #	MH DIAMETER	MH OPSD	FRAME	TOP ELEV.	INVERTS
MH8	1200mmØ	701.010	OPSD 401.010	270.78	E 266.90 (300mmø) NW 266.87 (300mmø)
MH9	1200mmØ	701.010	OPSD 401.010	271.65	E 267.82 (300mmø) W 268.06 (300mmø)
MH10	1200mmØ	701.010	OPSD 401.010	268.79	E 265.88 (525mmø) W 265.98 (525mmø)
MH11	1500mmØ	701.011	OPSD 401.010	268.64	E 265.91 (525mmø) S 266.30 (750mmø) N 265.77 (825mmø)
MH12	1200mmØ	701.010	OPSD 401.010	268.57	W 265.66 (300mmø) NE 265.58 (300mmø)
MH13	1800mmØ	701.012	OPSD 401.010	270.07	S 266.66 (750mmø) W 267.08 (300mmø) E 267.05 (300mmø) N 266.59 (750mmø)
MH14	1200mmØ	701.010	OPSD 401.010	270.05	W 267.46 (300mmø) E 267.43 (300mmø)
MH17	1200mmØ	701.010	OPSD 401.010	270.10	E 267.15 (300mmø) W 267.32 (300mmø)
MH18	1200mmØ	701.010	OPSD 401.010	270.73	S 267.12 (300mmø) W 267.07 (300mmø)

Dec 04, 2017 - 9:53am By: bsmith

S:\2017 Projects\2017-0569 Evendale - Brock Street, Uxbridge\400-ENG\401 - CAD\1 - Service Sector or BU\Shell\2017-0569 - SS-01.dwg [SS-01]

APPENDIX F
Statement Of Limiting Conditions And Assumptions

Statement of Limiting Conditions and Assumptions

1. This Report/Study (the "Work") has been prepared at the request of, and for the exclusive use of, the Owner, and its affiliates (the "Intended Users"). No one other than the Intended Users has the right to use and rely on the Work without first obtaining the written authorization of Cole Engineering Group Ltd. (Cole Engineering) and its Owner.

2. Cole Engineering expressly excludes liability to any party except the Intended Users for any use of, and/or reliance upon, the Work.

3. Cole Engineering notes that the following assumptions were made in completing the Work:

   a) the land use description(s) supplied to us are correct;
   b) the surveys and data supplied to Cole Engineering by the Owner are accurate;
   c) market timing, approval delivery and secondary source information is within the control of Parties other than Cole Engineering; and
   d) there are no encroachments, leases, covenants, binding agreements, restrictions, pledges, charges, liens or special assessments outstanding, or encumbrances which would significantly affect the use or servicing.

   Investigations have not been carried out to verify these assumptions. Cole Engineering deems the sources of data and statistical information contained herein to be reliable, but we extend no guarantee of accuracy in these respects.

4. Cole Engineering accepts no responsibility for legal interpretations, questions of survey, opinion of title, hidden or inconspicuous conditions of the property, toxic wastes or contaminated materials, soil or sub-soil conditions, environmental, engineering or other factual and technical matters disclosed by the Owner, the Client, or any public agency, which by their nature, may change the outcome of the Work. Such factors, beyond the scope of this Work, could affect the findings, conclusions and opinions rendered in the Work. We have made disclosure of related potential problems that have come to our attention. Responsibility for diligence with respect to all matters of fact reported herein rests with the Intended Users.

5. Cole Engineering practices engineering in the general areas of infrastructure and transportation. It is not qualified to and is not providing legal or planning advice in this Work.

6. The legal description of the property and the area of the site were based upon surveys and data supplied to us by the Owner. The plans, photographs, and sketches contained in this report are included solely to aide in visualizing the location of the property, the configuration and boundaries of the site, and the relative position of the improvements on the said lands.

7. We have made investigations from secondary sources as documented in the Work, but we have not checked for compliance with by-laws, codes, agency and governmental regulations, etc., unless specifically noted in the Work.

8. Because conditions, including capacity, allocation, economic, social, and political factors change rapidly and, on occasion, without notice or warning, the findings of the Work expressed herein, are as of the date of the Work and cannot necessarily be relied upon as of any other date without subsequent advice from Cole Engineering.

9. The value of proposed improvements should be applied only with regard to the purpose and function of the Work, as outlined in the body of this Work. Any cost estimates set out in the Work are based on construction averages and subject to change.

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

11. The Work is only valid if it bears the professional engineer's seal and original signature of the author, and if considered in its entirety. Responsibility for unauthorized alteration to the Work is denied.