STARLIGHT GROUP PROPERTY HOLDINGS INC.

1637 – 1645 BATHURST STREET

CITY OF TORONTO

PRELIMINARY STORMWATER MANAGEMENT AND SERVICING REPORT

LEA PROJECT No. 18093

FEBRUARY 09, 2018

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1 INTRODUCTION

1.1 SCOPE OF THE SWM AND SERVICING REPORT

LEA Consulting Ltd. has been retained by Starlight Group Property Holdings Inc. to prepare a Stormwater Management and Servicing Brief for the proposed 4-storey apartment development project in the City of Toronto. This stormwater management and servicing brief shall:

- Examine the potential water quality, quantity, and water balance impacts of the proposed development, and summarize how each will be addressed in accordance with the City of Toronto's *Wet Weather Flow Management Guidelines* (WWFMG).
- Review the water supply, storm and sanitary servicing requirement of the proposed residential development, and propose a preliminary site servicing plan.

1.2 SITE LOCATION

The proposed development site, encompassing five existing properties - 1637, 1639, 1641, 1643, and 1645 Bathurst Street, is bounded by Bathurst Street to the west, residential properties to the north, south and east. The site is located within the block bounded by Ardmore Road to the north and Burton Road to the south. Site access is via the private laneway off Bathurst Street. This report will focus on a 0.446 ha area as the development subject site.

1.3 STORMWATER MANAGEMENT PLAN OBJECTIVES

The objectives of the stormwater management plan are as follows:

- Determine site specific stormwater management requirements to ensure that the development project is in conformance with the *Wet Weather Flow Management Guidelines* (WWFMG) issued by the City of Toronto;
- Preparing a preliminary stormwater management plan documenting the strategy along with the technical information necessary for the sizing of the proposed stormwater management measures.

1.4 SWM DESIGN CRITERIA – CITY OF TORONTO

The City of Toronto has issued the Wet Weather Flow Management Guidelines (WWFMG, November 2006) to provide direction on how to manage rainfall and runoff inside the City's jurisdiction. A summary of the stormwater management criteria applicable to this project is as follows:

- Water Balance: The WWFMG requires a site to 'retain stormwater on-site, to the extent practicable, to achieve the same level of annual volume of overland runoff allowable from the development site under pre-development conditions'. Typically, the minimum on-site runoff retention will require the site to retain all runoff from a 5mm storm event through infiltration, evapotranspiration or rainwater reuse.
- Water Quality: Under the Wet Weather Flow Management Guidelines, the site is required to

provide a long-term removal of 80% of total suspended solids (TSS) on an average annual basis.

- Erosion Control: As indicated in WWFMG, 'For small infill/redevelopment sites < 2.0 ha, erosion control in the form of stormwater detention is normally not required, provided the on-site minimum runoff retention from a small design rainfall event (typically 5mm) is achieved under the Water Balance Criteria.'
- Water Quantity Control and Discharge to Municipal Infrastructure: Runoff from the 2-year to 100-year design storms must not exceed the peak runoff rate from the site under pre-development conditions. The allowable release rate to the municipal storm sewer system from the development site is the 2-year pre-development flow rate based on a maximum runoff coefficient value of 0. 50.

2 EXISTING CONDITIONS

2.1 GENERAL

The site is currently occupied entirely by five existing residential buildings, a paved private lane with access off Bathurst Street, and associated landscaping and concrete walkways. The total drainage area is 0.446 ha, and a runoff coefficient of 0.70 is estimated for existing conditions. The existing site imperviousness is greater than 50%. The current site does not accept any external drainage. Overland flow routes, grading and land use details under existing conditions are illustrated in Figure 1, Appendix F.

2.2 RAINFALL INFORMATION

The rainfall intensity for the site is calculated using the following equation:

Rational Formula: $Q = 2.78CIA$ (L/s)

Where: C: runoff coefficient

I: rainfall intensity (mm/hr)

A: drainage area (ha)

IDF Curve Equation: $I = aT^{C}$ (for the City of Toronto)

Where: I: rainfall intensity (mm/hr)

T: time of concentration (hour)

a, c: parameters

The parameters (a and c) recommended for use in the City of Toronto are defined in section 3.1 of the WWFM Guidelines, and are summarized in Table 1

Table 1: Values of a and c parameters for the City of Toronto

Return Period	*a*	*c*
2-year	21.8	-0.78
5-year	32.0	-0.79
50-year	53.5	-0.80
100-year	59.7	-0.80

An initial time of concentration, T, of 10 minutes (or 0.167 hours) is recommended in the WWFMG document.

2.3 ALLOWABLE FLOW RATE

The site will have different land-uses, including residential apartments, private terraces, and residential parking. Relevant policies from the WWFMG restrict flow rates on this site to the allowable flow rates for discharge to municipal sewers. According to the WWFMG, Section 2.2.3.8, the allowable release rate to the municipal storm sewer system from the proposed 0.446 ha redevelopment is 54.67 L/s, based on the 2-year pre-development flow rate calculated with a runoff coefficient value of 0.50.

The calculated peak flow rates for the site in the pre-development condition are summarized below in Table 2. Detailed calculations are provided in Appendix A.

Table 2: Pre-Development Peak Flow Rates (L/s)

Return Period (Year)	Rainfall Intensity (mm/hr)	Peak Flow Rate (L/s)	Allowable Release Rate (L/s)
2	88.19	54.67	54.67
5	131.79	81.70	
50	224.32	139.06	
100	250.32	155.18	

3 POST-DEVELOPMENT CONDITIONS

3.1 GENERAL

The proposed development consists of a 4-storey residential building with a below-grade parking garage. The roof of the 4th floor will have private terraces and planters. Figure 02, in Appendix F, shows the location of the proposed building, as well as other features of the site.

Base on the proposed development site condition, two sub-catchment areas are delineated as follow:

Sub-catchment #1: This sub-catchment consists of the private laneway, loading dock and side yard at the northwest corner. Landuses include permeable paving and landscape area. During rainfall events surface rainfall runoff from this sub-catchment area will be captured by existing catchbasins and discharge into existing storm sewers within the laneway. Refer to Figure 2 in Appendix F for details of proposed development drainage condition. Due to the constraint of existing storm and sanitary sewer configuration (sanitary sewer located on top of storm sewers with concrete encasement), rainfall runoff flow from this sub-catchment will be drained to the municipal sewers without control under post-development condition.

Based on the proposed land use, the composite runoff coefficient is estimated at 0.48 for this sub-catchment. Refer to Appendix A for details.

The areas of different land uses are provided in Table 3 for comparison between existing and proposed condition.

Sub-catchment #2: This sub-catchment consists of a 4-storey apartment with 321m^2 of green roof area, a below grade parking and landscape area. Surface rainfall runoff will be collected by area drains in the landscape area and building roof leaders, conveyed through proposed internal storm pipes to the proposed storage cistern and outlets to the municipal sewer manhole No.1 in the Bathurst Street. Figure 02, in Appendix F, shows the location of the proposed building, as well as other features of the site.

Based on the proposed land use, the composite runoff coefficients are estimated at 0.75 for this sub-catchment. Refer to Appendix A for details.

The land use is provided below in Table 3 for comparison between existing and proposed condition.

TABLE 3: LAND-USE AREA BREAKDOWN

Land-Use	Area (m^2)			Coverage (%)		
	Existing Condition	Proposed Condition		Existing Condition	Proposed Condition	
		SC #1	SC #2		SC #1	SC #2
Building	1507	0	2256	33.8	0	50.6
Green Roof	0	0	321	0	0	7.2
At-Grade Impervious Surface	1605	292	0	35.9	6.5	0
At-Grade Permeable Paving	0	785	0	0	17.6	0
At-Grade Landscaped Area	1351	446	363	30.3	10	8.1
Total	4463	1523	2940	100	34.1	65.9

3.2 PEAK FLOW RATES UNDER PROPOSED CONDITION

Based on the proposed site condition and rainfall parameters, the Rational Method is adopted to calculate peak flows at different design storm events.

The calculated peak flow rates for the two sub-catchment areas in the post-development condition are summarized in Table 4. Detailed calculations are provided in Appendix A.

TABLE 4: POST-DEVELOPMENT PEAK FLOW RATES (L/s)

Sub-Catchment No.	2 - Yr	5 - Yr	50 - Yr	100 - Yr
1	17.82	26.66	45.37	50.63
2	53.93	80.66	137.28	153.19
Total	71.76	107.31	182.65	203.82

4 PROPOSED SWM PLAN

4.1 WATER BALANCE REQUIREMENT

Based on the water balance criteria, the minimum on-site runoff retention requires retaining all runoff of the first 5mm from each rainfall through infiltration, evapo-transpiration or rainwater reuse. To satisfy the water balance criteria, an on-site storage volume of approximate 6.2 m^3 is required. Refer to Appendix A for details of calculations.

The potential methods to address the water balance criteria are outlined as follows:

- Green roof: For the purpose of capture and evapo-transpiration of the 5mm rainfall over the roof.
- Rainwater harvesting: Re-use of rainwater for grey water toilet.
- Irrigation of trees, plants and green roof on the property

The exact application and consumption rates will be determined at the next design stage in consultation with project design team architect and mechanical engineer.

4.2 WATER QUANTITY CONTROL REQUIREMENT

As noted in Section 2.3, the allowable discharge rate to the municipal sewer system from the site is estimated to be 54.67 L/s as per the City's WWFM Guidelines, which is equivalent to the peak runoff rate under pre-development conditions during a 2-year design storm event with a maximum runoff coefficient of 0.50. The quantity control scheme for both sub-catchment areas are:

Sub-Catchment #1: Laneway, Loading Dock area:

Based on record drawings, the existing 375mm (15") dia. storm sewer is located on top of 225mm (9") dia. sanitary sewer with concrete encasement between manholes, and are separated at manholes for maintenance access. It is not feasible to break the encasement and storm sewer, make new connection between manholes, divert stormwater to the proposed storage cistern. Therefore, runoff flow from sub-catchment #1 outlets to the existing municipal sewers without any control.

Sub-Catchment #2: Proposed Building and Front Yards:

Stormwater from this sub-catchment area will be collected by area drains and roof drains, piped to the proposed storage cistern and outlets to municipal storm sewer at or below the allowable release rate. Since it is not feasible to implement discharge control for Sub-Catchment #1, the discharge from this sub-catchment will be overcontrolled to satisfy the City's discharge control criteria.

Based on post-development conditions, the discharge rates and stormwater detention requirements for sub-catchment #2 at different storm events are estimated in Appendix A and summarized in Table 5

TABLE 5: REQUIRED STORMWATER STORAGE VOLUMES

Sub-Catchment #2.	2 - Yr	5 - Yr	50 - Yr	100 - Yr
Allowable flow rate (L/s)	36.85	28.01	9.30	4.04
Required Storage (m^3)	10.25	31.55	86.30	121.93

A Stormwater storage cistern is provided in the underground pit for quantity control purpose. The cistern, approximately 10.4m x 8.3m x 2.5m(H), will provide a total storage volume of 216 m^3. Exact location of the cistern, related pump, piping and detail of orifice plate will be determined by the mechanical designer during the detailed design. It is recommended that the following measures will be included in the mechanical design:

- Backflow check valve on the storm service connection;
- Emergency overflow for the cistern;
- Maintenance access for the cistern;

4.3 WATER QUALITY CONTROL

Under the post-development conditions, multi-components – rooftop, soft landscaped area, will remove TSS from the rainfall runoff. TSS removal efficiencies for different stormwater management measures are provided in the City's WWFM Guidelines.

Sub-Catchment #1: Laneway, Loading Dock Area:

The proposed land uses include permeable pavers, impervious parking stalls and landscaped areas.

TABLE 6: TSS REMOVAL ASSESSMENT – SUB-CATHMENT #1

Land Use	Area (m^2)	TSS Removal Efficiency (%)	Composite TSS Removal Efficiency (%)
At-Grade Impervious Surface	292	0	0
At-Grade Permeable Paving	785	80	41.2
At-Grade Landscape Area	446	80	23.4
Oil/Grit Separator (sub-catchment #1)	-	-	50.0
Total	1523	-	>80.0

To achieve a TSS removal of 80%, a Stormwater quality treatment facility (Stormceptor STC300) is proposed. Sizing details are provided in Appendix E. Due to the constraints of existing storm and sanitary sewers in the laneway, the location of this treatment facility is provided upstream of EX.STM.MH.2. Refer to Dwg. C-01 for details.

Sub-Catchment #2: Proposed Building Area:

The proposed land uses include green roof, cool roof and landscaped areas. The building roof areas are not subject to vehicular traffic, as well as the application of sand and de-icing salt constituents, petroleum hydrocarbons and heavy metals. Therefore, the stormwater generated from the roof area is considered clean for the purposes of the WWFMG water quality control. On the other hand, soft landscaping will allow for infiltration, and removal of the Total Suspended Solids (TSS) and other nutrients.

Table 7 below provides a preliminary estimate of the TSS removal level of stormwater leaving the site.

TABLE 7: TSS REMOVAL ASSESSMENT – SUB-CATCHMENT #2

Land Use	Area (m^2)	TSS Removal Efficiency (%)	Composite TSS Removal Efficiency (%)
Impervious Roof	2256	80	61.4
Green Roof	321	80	8.7
At-Grade Landscape Area	363	80	9.9
Total	2940	-	80.0

As indicated above, the overall TSS removal efficiency will satisfy the City's target of 80%, and therefore, no separate Stormwater treatment facility is required for this sub-catchment area.

4.4 EROSION CONTROL

As mentioned in Section 1.4, this development is a small footprint redevelopment. According to the WWFMG, 'For small infill/redevelopment sites < 2.0 ha, erosion control in the form of stormwater detention is normally not required, provided the on-site minimum runoff retention from a small design rainfall event (typically 5mm) is achieved under the Water Balance Criteria.

The total site area for this application is 0.446 ha, which is well below the 2.0 ha guideline, and water balance concerns have been addressed in Section 3.2; therefore, additional measures to address erosion control are not recommended.

5 EROSION AND SEDIMENT CONTROL DURING CONSTRUCTION

During site construction, it is recommended that all erosion and sediment control Best Management Practices (BMPs) shall be constructed and maintained in accordance with the Greater Golden Horseshoe Area Conservation Authorities' (GGHA CAs) Erosion & Sediment Control Guidelines for Urban Construction (December 2006). In brief, the measures below are proposed to be provided on site during the entire period of construction:

- Siltation control fence along the perimeter of the construction site before commencement of construction;

- Sediment control measures to prevent silt entry at all the existing catch basins;
- Granular mud-mats at all construction egress locations (see mud-mat details);
- An inspection and monitoring program following the GGHA CA's Erosion and Sediment Control Guidelines for Urban Construction (December 2006).

6 SITE SERVICING

The purpose of this site servicing report is to review the site servicing requirement of the proposed redevelopment, and propose a site servicing plan, including water supply, sanitary and storm services. Refer to Dwg. C01 - Site Servicing Plan for details of the proposed site service connections.

6.1 SANITARY SEWAGE

Base on the survey and City's records, the existing underground sanitary sewers are summarized below:

- A 225mm concrete sanitary sewer running in a northerly direction on the private laneway;
- A 225mm sanitary sewer running in a westerly direction on the private laneway; and
- A 225mm clay sanitary sewer on Bathurst Street.

<u>Design Parameters</u>

The sanitary demands for the proposed site are based on the following municipal design criteria:

- Sanitary demand rate of 250 L/person/day.
- Population densities of 1.4 ppu for studio and 1-bedroom units.
- Population densities of 2.1 ppu for 2-bedroom units.
- Population densities of 3.1 ppu for 3-bedroom units.
- Infiltration Allowance of 0.26 L/s/ha.
- Peaking Factor of residential – Harmon Equation.

The demand and peaking factors are based on the City of Toronto's Design Criteria for Sewers and Watermain, November 2009.

<u>Sanitary Flows</u>

From the site statistics of the 4-storey apartment building provided by the architect, the population is estimated to be 173 persons. Based on the City's design criteria and the population, the sanitary flow generated from the building is estimated to be 2.2 L/s. Details for the sanitary flow calculations are shown in Appendix B.

The sanitary service connection for proposed development will be provided by two existing sanitary services those are connected to the existing 225mm sanitary sewer on the private laneway, which ultimately connects to the 225mm sanitary sewer on Bathurst Street. Refer to Dwg. C01 for details of the proposed sanitary service connection.

Analysis of Existing Municipal Sanitary Sewers

The City of Toronto provided copies of the City's sanitary sewer network modeling data (Dorsch Model) for the sanitary sewers on Bathurst Street and in the vicinity of the site. Refer to Appendix C for details of the Dorsch model.

Table 8 lists the existing hydraulic conditions of the sanitary sewers on Bathurst Street near the site.

Table 8: Dorsch Model Data Summary-Sanitary

Sewer Segment	Pipe Size (mm)	Full Flow Capacity QF (L/s)	Peak Wet Weather Flow QLM (L/s)	Spare Flow Capacity (L/s)
1514	225	108	0	108
1515	225	64	2	62

As shown on Dwg. C-01 in Appendix C, a 200mm sanitary service is provided for the proposed 4-storey apartment building, discharging to the existing sanitary sewer in the private lane and ultimately connecting to the 225mm clay sanitary sewer on Bathurst Street (Segment No. 1514).

From the Dorsch Model, the existing sanitary sewer on Bathurst Street (Segment No. 1514) has spare flow capacity larger than the sanitary flow of 2.2 L/s from the proposed development. As such, the existing 225mm sanitary sewer on Bathurst Street and downstream sewers are adequate to support the proposed development.

6.2 STORM DRAINAGE

Base on the survey and City's records, the existing underground storm sewers are summarized below:

- A 375mm diameter storm sewer running in a northerly direction on the private laneway;
- A 375mm diameter storm sewer running in a westerly direction on the private laneway;
- A 300mm diameter clay storm sewer on Bathurst Street; and
- A 1350mm diameter storm sewer along Bathurst Street.

Pre-Development Storm Flow

Under the existing conditions, the development site drains through existing catchbasins and area drains into the storm sewers on the laneway. The runoff coefficient under existing conditions is 0.70, but a coefficient of 0.5 was used in the calculations as per the City of Toronto's Wet Weather Flow Management Guidelines.

Post-Development Storm Flow

As noted in Section 2.3, the allowable discharge rate from the development site is 54.67 L/s, which is the peak runoff rate under pre-development conditions during a 2-year design storm event with a runoff coefficient of 0.5.

Through the implementation of stormwater quantity control devices, the stormwater discharge rate from the site is 54.67 L/s.

Analysis of Existing Municipal Storm Sewers

City of Toronto provided copies of the City's storm sewer network modeling data (Dorsch Model) for the storm sewers on Bathurst Street and near the site. Refer to Appendix C for details of the Dorsch model.

Based on the existing storm sewer network modeling data, Table 9 on the following page lists the existing hydraulic conditions of storm sewers on Bathurst Street and near the site.

Table 9: Dorsch Model Data Summary-Storm

Sewer Segment	Pipe Size (mm)	Full Flow Capacity QF (L/s)	Peak Wet Weather Flow QLM (L/s)	Spare Flow Capacity (L/s)
4008	1350	1173	3885	-2711
1626	1050	7608	3904	3704

As shown on Dwg. C-01 in Appendix F, a 200mm storm service is provided for the proposed 4-storey apartment building, discharging to the proposed catchbasin manhole (CB.MH.1) that is connected to the existing 375mm storm sewers on the private lane and outletting to the 1350mm storm sewer on Bathurst Street (Segment No. 4008).

From the Dorsch Model, it can be seen that the existing storm sewer on Bathurst Street (Segment No. 4008) is surcharged under existing conditions, and the downstream sewer (Segment No. 1626) has adequate capacity to support the flow of 54.67 L/s from the proposed development. Since Stormwater quantity control will be implemented, will reduce the stormwater discharge from the site and improve the current hydraulic condition of storm drainage system. A backflow check valve will be required to prevent any potential backflow from the street.

6.3 WATER SUPPLY

Base on the survey and City's records, the existing underground watermain are summarized below:

- A 150mm watermain on the laneway;
- A 300mm watermain on the west side of Bathurst Street.

The site is serviced by a private 150mm watermain running along the private laneway, which is connected to the watermains on Richview Avenue and Bathurst Street.

Design Parameters

The domestic water demands for the proposed site are based on the following municipal design criteria:

- Water demand rate of 191 L/person/day.
- Population densities of 1.4 ppu for studio and 1-bedroom units.
- Population densities of 2.1 ppu for 2-bedroom units.
- Population densities of 3.1 ppu for 3-bedroom units.
- Peaking Factor of residential – 2.5 (Peak Hour) and 1.3 (Maximum Day).

The demand and peaking factors are based on City of Toronto, *Design Criteria for Sewers and Watermain, November 2009*.

Water Demands

Based on the City's design criteria, the domestic water demand (maximum day) is estimated to be 0.50 L/s, as shown in Appendix B.

The calculation of the required fire flow using the Fire Underwriters Survey (FUS) method is completed in Appendix B. A fire flow of 106.7 L/s (or 1,691 USGPM) is required to meet the FUS requirement.

Therefore, the projected water demand from the development is 107.2 L/s (or 1,698.6 USGPM).

Proposed Water Service Connections

Based on the City's design criteria and the proposed height, a 150mm combined water and fire service connection is proposed to connect to the existing 150mm watermain along the private laneway. Refer to Dwg. C-01 in Appendix F for locations of the proposed water service connection.

In order to evaluate the adequacy of the existing watermain located on Richview Avenue, a hydrant flow test was conducted by Classic Fire Protection on July 20, 2017. Test results are included in Appendix D

As shown by the test readings, the available water pressure ranges from 50 psi with a flow of 558 US GPM to 48 psi with a flow of 730 US GPM during the flow test with a static pressure of 60 psi. At the design water demand of 107.2 L/s (or 1698.6 US GPM) generated from the development, the extrapolated flow test results show a residual pressure of 36.8 psi, which is greater than the minimum requirement of 20 psi (150 kPa). Therefore, adequate water supply and pressure are available to serve the proposed development

7 CONCLUSIONS

7.1 STORMWATER MANAGEMENT PLAN

- Water Balance: An on-site storage volume of approximately 6.2 m^3 will will be provided for retention of the first 5mm rainfall runoff as required to achieve the WWFMG water balance criteria.

- Water Quantity: An on-site storage volume of approximately 121.93 m^3 will be required in order to control the post-development stormwater flows to pre-development levels. A cistern is provided to satisfy the on-site storage requirement as shown on Dwg. C-01.
- Water Quality: In addition to landscaped areas, permeable paving, green roof and clean roof, will be sufficient to satisfy the water quality control requirement, i.e. 80% of TSS removal.

Temporary Erosion and Sediment Control during Construction

- Temporary erosion and sediment control measures should be provided before construction and maintained during construction in accordance with the GGHA CA's Erosion & Sediment Control Guidelines for Urban Construction and other requirements.

7.2 SITE SERVICING REQUIREMENT

- Sanitary Service: The proposed sanitary service connection for the site will reutilize the two existing sanitary connections connected to the existing 225mm dia. sanitary sewer on the private laneway which ultimately connects to the 225mm sanitary sewer on Bathurst Street. Based on the sanitary sewer network model, there is sufficient flow capacity within the existing sanitary sewers on Bathurst Street to accommodate the proposed development.
- Storm Service: The proposed storm service connection for this site will be a 200mm dia. in size that connects to the proposed catchbasin manhole No. CBMH.1 on the driveway, which ultimately drains to the 1350mm storm sewer on Bathurst Street. The implementation of SWM plan will improve the existing hydraulic condition. A backflow check valve will be required.
- Water Services: The proposed development will be fed by the existing 150mm watermain along the private laneway, which is connected to the 150mm watermain along the west side of Richview Avenue. New water service for the site will consist of a 150mm combined domestic water and fire service connection. The total water demand for the development is 107.2 L/s (or 1,698.6 USGPM).

Prepared By:

LEA Consulting Ltd.

Municipal Engineer

Appendix A

Stormwater Peak Flow and Storage Calculations

LEA Consulting Ltd. Consulting Engineers and Planners	Land Use			
	Prepared:	F.M.	Page No.	A-01
	Checked:	M.D.		
Project: 1637-1645 Bathurst St.	Proj. #	18093		
City of Toronto	Date:	Sep. 25/17		

EXISTING CONDITIONS:

Existing Land Use	Area (m^2)
3-Storey Brick Apartment Buildings	1507
Asphalt Driveways and Concrete Walkways	1605
Landscaped Area	1351
Total Site Area:	**4463**

PROPOSED DEVELOPMENT:

Proposed Land Use	Area (m^2)
Sub-catchment #1	
Asphalt	292
Green Roof	0
Permeable pavers	785
Landscaped Area	446
Total Area:	**1523**
Sub-catchment #2	
Building	2256
Green Roof	321
Permeable pavers	0
Landscaped Area	363
Total Area:	**2940**
Total site Area	
Building & Asphalt	2548
Green Roof	321
Permeable pavers	785
Landscaped Area	809
Total Site Area:	**4463**

LEA Consulting Ltd. Consulting Engineers and Planners	Composite "C" Calculation			
	Prepared:	F.M.	Page No.	A-02
	Checked:	M.D.		
Project: 1637-1645 Bathurst St.	Proj. #	18093		
City of Toronto	Date:	Sep. 25/17		

Pre-Development Composite Runoff Coefficient "C"

Land Use	Area (ha)	C	Composite "C"	
Building	0.151	0.90		
Asphalt and Concrete	0.161	0.90		
Landscaped Area	0.135	0.25		
Total	**0.446**		**0.70**	
			0.50	max. by WWFMG
Imperviousness Percent:			**0.70**	

Post-Development Composite Runoff Coefficient "C"

Sub-catchment #1

Land Use	Area (ha)	C	Composite "C"
Asphalt	0.029	0.90	
Green Roof	0.000	0.25	
Permeable pavers	0.079	0.45	
Landscaped Area	0.045	0.25	
Total Area:	**0.152**		**0.48**
Imperviousness Percent:			**0.19**

Sub-catchment #2

Land Use	Area (ha)	C	Composite "C"
Building	0.226	0.90	
Green Roof	0.032	0.25	
Permeable pavers	0.000	0.45	
Landscaped Area	0.036	0.25	
Total Area:	**0.294**		**0.75**
Imperviousness Percent:			**0.77**

Total site Area

Land Use	Area (ha)	C	Composite "C"
Building & Asphalt	0.255	0.90	
Green Roof	0.032	0.25	
Permeable pavers	0.079	0.45	
Landscaped Area	0.081	0.25	
Total Site Area:	**0.446**		**0.66**
Imperviousness Percent:			**0.57**

LEA Consulting Ltd. Consulting Engineers and Planners	5mm Rainfall Retention Volume (Water Balance)			
	Prepared:	F.M.	Page No.	A-03
	Checked:	M.D.		
Project: 1637-1645 Bathurst St.	Proj. #	18093		
City of Toronto	Date:	Sep. 25/17		

According to the WWFM Guidelines, in order to achieve the water balance target, it is required to retain all runoff from a small event - typically 5mm (in Toronto, storms with 24 hour volumes of 5mm or less contribute about 50% of the total average annual rainfall volume) through infiltration, evapotranspiration & rainwater reuse.

Site Area:	0.446	ha
Runoff Coefficient :	0.66	Post-development site conditions

Runoff volume from 5mm rainfall event on site:

V = 0.446 x 10 x 5 =22.32

Initial Abstraction:

Paved area:	2548 x 1 mm /1000	=2.55	m^3
Landscaped area:	1915 x 5 mm /1000	=9.58	m^3
Permeable pavers:	790 x 5 mm/1000	=3.95	m^3

Required on-site retention volume for 5mm rainfall event: 6.2 m^3

LEA Consulting Ltd. Consulting Engineers and Planners	Pre-Development Peak Flow Rates Calculation			
	Prepared:	F.M.	Page No.	A-04
	Checked:	M.D.		
Project: 1637-1645 Bathurst St.	Proj. #	18093		
City of Toronto	Date:	Sep. 25/17		

Rational Formulae: Q = 2.78 CIA (L/s)

Site Area:	0.446	ha
Time of Concentration:	10	minutes as per WWFM Guidelines
Runoff Coefficient :	0.50	Pre-development condition

Rainfall Intensity: $I = aT^c$

Return Period:	2-yr	5-yr	50-yr	100-yr
Rainfall Intensity (mm/hr):	88.19	131.79	224.32	250.32

Peak Flow Rate (L/s):

Return Period:	2-yr	5-yr	50-yr	100-yr
Under existing site conditions (L/s):	54.67	81.70	139.06	155.18

Allowable discharge rate into municipal storm sewer as per WWFM Guideline:

Since the stormwater from the sub-catchment #1 is not controlled due to the site constraint, the stormwater discharge from Sub-Catchment #2 will be overcontrolled, i.e. allowable discharge flow rates from two catchments areas:

Sub-Catchment #1 (100-yr storm):	50.63	L/s
Sub-Catchment #2 (overcontrolled):	4.04	L/s
Total	54.67	L/s - 2-Yr Pre-Development

LEA Consulting Ltd. Consulting Engineers and Planners	Post-Development Peak Flow Rates Calculation (Uncontrolled)			
	Prepared:	F.M.	Page No.	A-05
	Checked:	M.D.		
Project: 1637-1645 Bathurst St.	Proj. #	18093		
City of Toronto	Date:	Sep. 25/17		

Rational Formulae: Q = 2.78 CIA (L/s)

Rainfall Intensity: I = aT^c

Return Period:	2-yr	5-yr	50-yr	100-yr
Rainfall Intensity (mm/hr):	88.19	131.79	224.32	250.32

Sub-catchment #1

Site Area: 0.152 ha
Time of Concentration: 10 minutes as per WWFM Guidelines
Runoff Coefficient : 0.48 Post-development

Peak Flow Rate (L/s):

Return Period:	2-yr	5-yr	50-yr	100-yr
Under post-development conditions (L/s):	17.82	26.66	45.37	50.63

Sub-catchment #2

Site Area: 0.294 ha
Time of Concentration: 10 minutes as per WWFM Guidelines
Runoff Coefficient : 0.75 Post-development

Peak Flow Rate (L/s):

Return Period:	2-yr	5-yr	50-yr	100-yr
Under post-development conditions (L/s):	53.93	80.66	137.28	153.19

Total site Area

Site Area: 0.446 ha
Time of Concentration: 10 minutes as per WWFM Guidelines
Runoff Coefficient : 0.66 Post-development

Peak Flow Rate (L/s):

Return Period:	2-yr	5-yr	50-yr	100-yr
Under post-development conditions (L/s):	71.76	107.31	182.65	203.82

LEA Consulting Ltd. Consulting Engineers and Planners	**On-Site Storage Calculation (2-Year Storm)**			
	Prepared:	F.M.	Page No.	A-06
	Checked:	M.D.		
Project: 1637-1645 Bathurst St.	Proj. #	18093		
City of Toronto	Date:	Sep. 25/17		

Sub-Catchment #2 Drainage Area (ha) = 0.294 ha

Sub-Catchment #1 Composite C = 0.75

*Allowable Release Rate = 36.85 L/s Overcontrolled

Return Period = 2 Year

Site storage Requirement:

Time (minutes)	Rainfall Intensity (mm/hr)	Peak Flow (L/s)	Storm Runoff Volume (m^3)	Release Rate (L/s)	Release Flow Volume (m^3)	Required Storage Volume (m^3)
10	88.19	53.93	32.36	36.85	22.11	10.25
15	64.28	39.31	35.38	36.85	33.16	2.22
20	51.36	31.41	37.69	36.85	44.21	-6.52
25	43.15	26.39	39.59	36.85	55.27	-15.68
30	37.43	22.89	41.21	36.85	66.32	-25.11
35	33.19	20.30	42.63	36.85	77.37	-34.74
40	29.91	18.29	43.90	36.85	88.43	-44.53
45	27.28	16.69	45.05	36.85	99.48	-54.43
50	25.13	15.37	46.11	36.85	110.54	-64.43
55	23.33	14.27	47.08	36.85	121.59	-74.51
60	21.80	13.33	47.99	36.85	132.64	-84.65
65	20.48	12.52	48.85	36.85	143.70	-94.85
70	19.33	11.82	49.65	36.85	154.75	-105.10
75	18.32	11.20	50.41	36.85	165.80	-115.39
80	17.42	10.65	51.13	36.85	176.86	-125.73
85	16.61	10.16	51.82	36.85	187.91	-136.09

Required Storage Volume = 10.25 m^3

LEA Consulting Ltd. Consulting Engineers and Planners	On-Site Storage Calculation (5-Year Storm)			
	Prepared:	F.M.	Page No.	A-07
	Checked:	M.D.		
Project: 1637-1645 Bathurst St.	Proj. #	18093		
City of Toronto	Date:	Sep. 25/17		

Sub-Catchment #2 Drainage Area (ha) = 0.294 ha
Sub-Catchment #1 Composite C = 0.75

*Allowable Release Rate = 28.01 L/s Overcontrolled
Return Period = 5 Year

Site storage Requirement:

Time (minutes)	Rainfall Intensity (mm/hr)	Peak Flow (L/s)	Storm Runoff Volume (m^3)	Release Rate (L/s)	Release Flow Volume (m^3)	Required Storage Volume (m^3)
10	131.79	80.60	48.36	28.01	16.81	31.55
15	95.67	58.51	52.66	28.01	25.21	27.45
20	76.22	46.61	55.94	28.01	33.62	22.32
25	63.90	39.08	58.62	28.01	42.02	16.60
30	55.33	33.84	60.91	28.01	50.42	10.49
35	48.99	29.96	62.91	28.01	58.83	4.08
40	44.08	26.96	64.70	28.01	67.23	-2.53
45	40.17	24.56	66.32	28.01	75.64	-9.32
50	36.96	22.60	67.80	28.01	84.04	-16.24
55	34.28	20.96	69.17	28.01	92.44	-23.27
60	32.00	19.57	70.45	28.01	100.85	-30.40
65	30.04	18.37	71.64	28.01	109.25	-37.61
70	28.33	17.33	72.77	28.01	117.66	-44.89
75	26.83	16.41	73.83	28.01	126.06	-52.23
80	25.49	15.59	74.84	28.01	134.46	-59.62
85	24.30	14.86	75.80	28.01	142.87	-67.07
90	23.23	14.21	76.71	28.01	151.27	-74.56
95	22.26	13.61	77.59	28.01	159.68	-82.09
100	21.37	13.07	78.43	28.01	168.08	-89.65

Required Storage Volume = 31.55 m^3

LEA Consulting Ltd. Consulting Engineers and Planners	On-Site Storage Calculation (50-Year Storm)			
	Prepared:	F.M.	Page No.	A-08
	Checked:	M.D.		
Project: 1637-1645 Bathurst St.	Proj. #	18093		
City of Toronto	Date:	Sep. 25/17		

Sub-Catchment #2 Drainage Area (ha) = 0.294 ha
Sub-Catchment #1 Composite C = 0.75
*Allowable Release Rate = 9.3 L/s Overcontrolled
Return Period = 50 Year

Site storage Requirement:

Time (minutes)	Rainfall Intensity (mm/hr)	Peak Flow (L/s)	Storm Runoff Volume (m^3)	Release Rate (L/s)	Release Flow Volume (m^3)	Required Storage Volume (m^3)
10	224.32	137.18	82.31	9.30	5.58	76.73
15	162.18	99.18	89.26	9.30	8.37	80.89
20	128.84	78.79	94.55	9.30	11.16	83.39
25	107.78	65.91	98.87	9.30	13.95	84.92
30	93.15	56.97	102.54	9.30	16.74	85.80
35	82.34	50.36	105.75	9.30	19.53	86.22
40	74.00	45.25	108.61	9.30	22.31	86.30
45	67.34	41.18	111.20	9.30	25.10	86.10
50	61.90	37.86	113.57	9.30	27.89	85.68
55	57.36	35.08	115.75	9.30	30.68	85.07
60	53.50	32.72	117.78	9.30	33.47	84.31
65	50.18	30.69	119.69	9.30	36.26	83.43
70	47.29	28.92	121.47	9.30	39.05	82.42
75	44.75	27.37	123.16	9.30	41.84	81.32
80	42.50	25.99	124.76	9.30	44.63	80.13
85	40.49	24.76	126.28	9.30	47.42	78.86
90	38.68	23.65	127.73	9.30	50.21	77.52
95	37.04	22.65	129.12	9.30	53.00	76.12
100	35.55	21.74	130.45	9.30	55.79	74.66
105	34.19	20.91	131.73	9.30	58.58	73.15
110	32.94	20.15	132.96	9.30	61.37	71.59
115	31.79	19.44	134.15	9.30	64.16	69.99

Required Storage Volume = 86.30 m^3

LEA Consulting Ltd. Consulting Engineers and Planners	On-Site Storage Calculation (100 - Year Storm)			
	Prepared:	F.M.	Page No.	A-09
	Checked:	M.D.		
Project: 1637-1645 Bathurst St.	Proj. #	18093		
City of Toronto	Date:	Sep. 25/17		

Sub-Catchment #2 Drainage Area (ha) = 0.294 ha
Sub-Catchment #1 Composite C = 0.75
*Allowable Release Rate = 4.04 L/s Overcontrolled
Return Period = 100 Year

Site storage Requirement:

Time (minutes)	Rainfall Intensity (mm/hr)	Peak Flow (L/s)	Storm Runoff Volume (m^3)	Release Rate (L/s)	Release Flow Volume (m^3)	Required Storage Volume (m^3)
10	250.32	153.08	91.85	4.04	2.42	89.43
20	143.77	87.92	105.51	4.04	4.85	100.66
30	103.94	63.57	114.42	4.04	7.27	107.15
40	82.57	50.50	121.20	4.04	9.69	111.51
50	69.07	42.24	126.73	4.04	12.12	114.61
60	59.70	36.51	131.43	4.04	14.54	116.89
70	52.77	32.27	135.55	4.04	16.97	118.58
80	47.43	29.00	139.22	4.04	19.39	119.83
90	43.16	26.40	142.54	4.04	21.81	120.73
100	39.67	24.26	145.57	4.04	24.24	121.33
105	38.15	23.33	147.00	4.04	25.45	121.55
110	36.76	22.48	148.37	4.04	26.66	121.71
115	35.48	21.70	149.70	4.04	27.87	121.83
120	34.29	20.97	150.98	4.04	29.08	121.90
125	33.19	20.30	152.22	4.04	30.29	121.93
130	32.16	19.67	153.41	4.04	31.51	121.90
135	31.21	19.08	154.58	4.04	32.72	121.86
140	30.31	18.54	155.71	4.04	33.93	121.78
145	29.47	18.02	156.80	4.04	35.14	121.66
150	28.68	17.54	157.87	4.04	36.35	121.52
155	27.94	17.09	158.91	4.04	37.57	121.34
160	27.24	16.66	159.92	4.04	38.78	121.14
165	26.58	16.25	160.91	4.04	39.99	120.92

Required Storage Volume = 121.93 m^3

Appendix B

Sanitary and Water Demand Calculations

LEA Consulting Ltd. Consulting Engineers and Planners	Sanitary Flow Rate Calculation			
	Prepared:	F.M.	Page No.	B-01
	Checked:	M.D.		
Project: 1637-1645 Bathurst St.	Proj. #	18093		
City of Toronto	Date:	Sep. 25/17		

4-STOREY APARTMENT BUILDING

POPULATION CALCULATION

(Based on the Architect Statistics dated June 27, 2017)

Site Area	4161.0 m^2
Proposed Total GFA	8240.0 m^2

Proposed Units		**Density**	**Population**
Type	Units	(P.P.U)	
1 Bedroom	8	1.4	11
2 Bedroom	21	2.1	44
3 Bedroom	38	3.1	118
Total	**67**		**173**

SANITARY FLOW CALCULATION

Harmon Peaking Factor: $M=1+14/(4+(P/1000)^{0.5})$

Peaking Factor	4.17	
Average Daily Wastewater Flow	250	L/cap/day
Total Domestic Flow	2.09	L/sec
Infiltration Allowance (@ 0.26 L/sec/ha)	0.11	L/sec
Design Flow	**2.20**	L/sec

4-STOREY APARTMENT BUILDING

This calculation is following the "Water Supply for Public Fire Protection" by Fire Underwriters Survey.

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

where F = the required fire flow in litres per minute
C = coefficient related to the type of construction.
= 0.6 for fire resistive construction
A = the total floor area in square metres. For fire resistive buildings, consider only the area of the largest floor plus 25% of each of the two immediately adjoining floors.

According the building stats,

		Area (m2)
G Floor	adjoining	2039
2nd Floor	largest	2128
3rd Floor	adjoining	2079
A		3158

Therefore, F = 7400 **l/min**

Occupancy reduction:

For occupancies with a low contents fire hazard, the reduction rate is 25%,
Therefore: F = 5600 l/min

Reduction for sprinkler protection:

Using the NFPA sprinkler system, a reduction rate of 30% is used.
Therefore: F = 3900 l/min

Separation charge:

Charge for the separations on each side:

Separation	Charge	
0 to 3 m	25%	South
3.1 m to 10 m	20%	North
10.1 to 20 m	15%	East
30.1 to 45 m	5%	West

Total charge in % 65%
Total charge in l/min 2500

Required Fire Flow: 6400 l/min
or 106.67 l/s
or 1691 US GPM

LEA Consulting Ltd. Consulting Engineers and Planners	**Water Demand Calculation**			
	Prepared:	F.M.	Page No.	B-03
	Checked:	M.D.		
Project: 1637-1645 Bathurst St.	Proj. #	18093		
City of Toronto	Date:	Sep. 25/17		

4-STOREY APARTMENT BUILDING

Total Population: **173** (See Page B-01)

Peak Hour Demand Calculation:

Residential Per Capita Demand (multi-unit)	191	L/cap/day
Peaking Factor	2.50	
Peak Hour Demand	**0.96**	L/sec

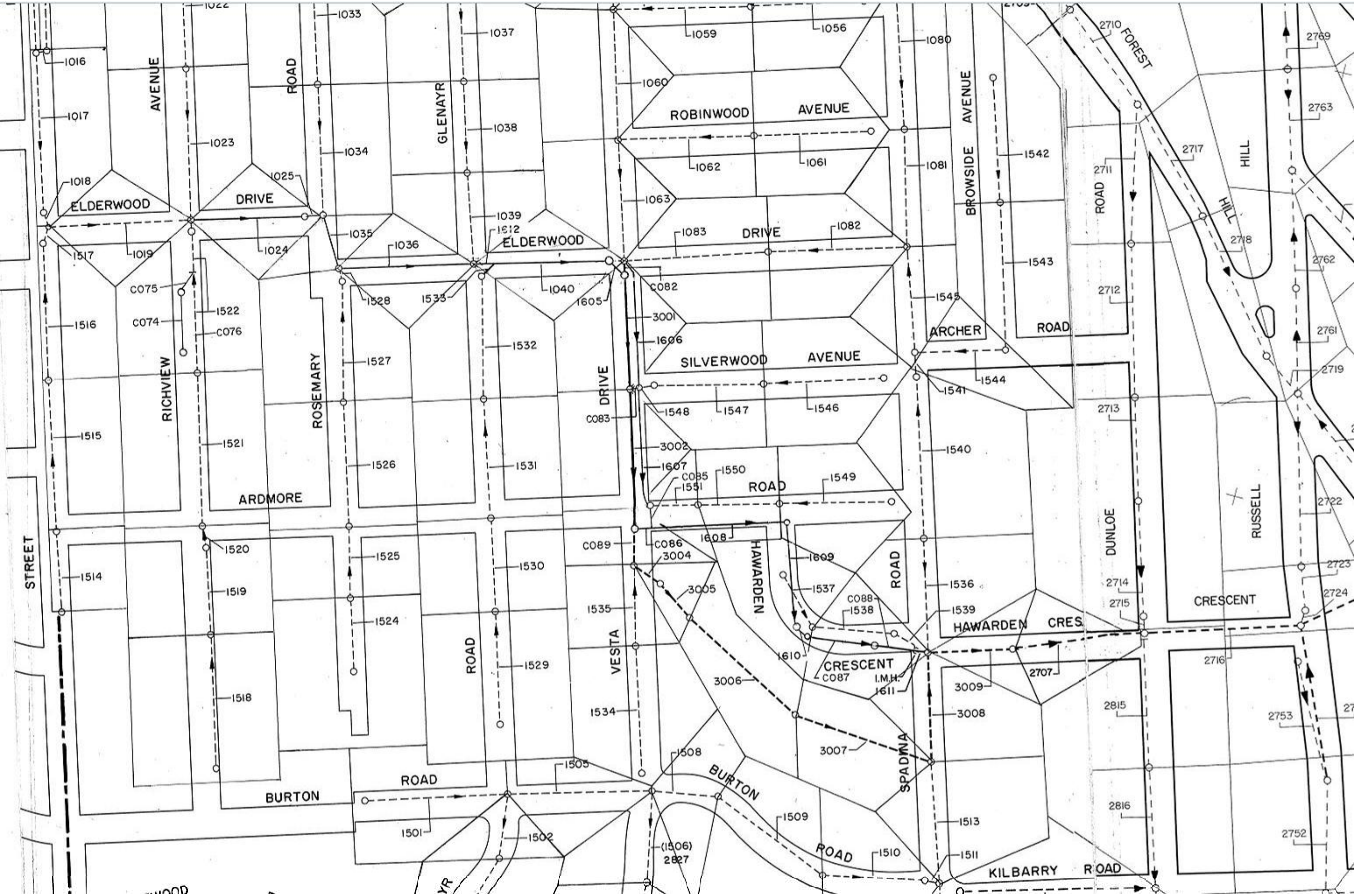
Maximum Day Demand Calculation:

Residential Per Capita Demand (multi-unit)	191	L/cap/day
Peaking Factor	1.30	
Maximum Day Demand	**0.50**	L/sec
Fire Flow for High Rise Residential:	106.7	L/sec
Max. Day Demand plus Fire Flow:	**107.2**	L/sec
Design Water Demand	**107.2**	L/sec
	1698.6	**US GPM**

Appendix C

Existing Sewer Network Plans and Dorsch Model Data

SANITARY SEWER MODEL OUTPUT



TORONTO SEWER SYSTEM STUDY AREA 8
FOREST HILL SANITARY & STORM

```
1019  CIRCULAR          0.30/0.30  INFLOW  1018  1517         OUTFLOW  1024        B.NO.  27790                EXIST. SAN.    1019
      YU 159.654  YL 156.990  QF   170  DQ        6  QDLM   35  VNIGHT1.03  DUC  -0.08  DLC  -0.07   QLM    146  CAP      24
      SU 164.232  SL 160.944  AF 0.071  DQD     0.2  HDLM 0.11  HNIGHT0.04  DUS  -4.36  DLS  -3.73   RAIN   FOR.  QLM/QF 0.86
      RES    975  A     0.02  VF  2.41  GAMMA 1.00  VDLM 1.92  VNORM 0.0    HUM   0.22  HLM   0.23   QRQLM  104   DY     2.66
      IW     0.0  L     85.6  S 1/  32  N   0.0130  SCOD FH11  DWB   0.02   YUM 159.87  YLM 157.22   VLM   2.59   DH    -0.01

1024  CIRCULAR          0.60/0.60  INFLOW  1019  1023  1522   OUTFLOW  1025        B.NO.  27780                EXIST. SAN.    1024
      YU 156.990  YL 156.440  QF   490  DQ        0  QDLM   39  VNIGHT0.58  DUC  -0.37  DLC  -0.36   QLM    166  CAP     324
      SU 161.180  SL 160.070  AF 0.282  DQD     0.0  HDLM 0.11  HNIGHT0.04  DUS  -3.96  DLS  -3.39   RAIN   FOR.  QLM/QF 0.34
      RES      0  A      0.0  VF  1.74  GAMMA 0.0   VDLM 1.06  VNORM 0.0    HUM   0.23  HLM   0.24   QRQLM  116   DY     0.55
      IW     0.0  L     86.0  S 1/ 156  N   0.0130  SCOD  DWF  DWB   0.0    YUM 157.22  YLM 156.68   VLM   1.58   DH    -0.01

1025  CIRCULAR          0.60/0.60  INFLOW  1024               OUTFLOW  1035        B.NO.  27780                EXIST. SAN.    1025
      YU 156.430  YL 156.360  QF   476  DQ        0  QDLM   39  VNIGHT0.56  DUC  -0.36  DLC  -0.36   QLM    167  CAP     309
      SU 160.070  SL 159.850  AF 0.282  DQD     0.0  HDLM 0.11  HNIGHT0.04  DUS  -3.40  DLS  -3.25   RAIN   FOR.  QLM/QF 0.35
      RES      0  A      0.0  VF  1.69  GAMMA 0.0   VDLM 1.04  VNORM 0.0    HUM   0.24  HLM   0.24   QRQLM  117   DY     0.07
      IW     0.0  L     11.6  S 1/ 166  N   0.0130  SCOD  DWF  DWB   0.0    YUM 156.67  YLM 156.60   VLM   1.54   DH     0.00

1035  CIRCULAR          0.68/0.68  INFLOW  1025  1034         OUTFLOW  1036        B.NO. 763                   EXIST. SAN.    1035
      YU 156.280  YL 156.200  QF   402  DQ        0  QDLM   43  VNIGHT0.40  DUC  -0.36  DLC  -0.34   QLM    180  CAP     222
      SU 159.850  SL 159.220  AF 0.357  DQD     0.0  HDLM 0.15  HNIGHT0.05  DUS  -3.25  DLS  -2.69   RAIN   FOR.  QLM/QF 0.45
      RES      0  A      0.0  VF  1.13  GAMMA 0.0   VDLM 0.75  VNORM 0.0    HUM   0.32  HLM   0.33   QRQLM  124   DY     0.08
      IW     0.0  L     34.8  S 1/ 435  N   0.0130  SCOD 400   DWB   0.0    YUM 156.60  YLM 156.53   VLM   1.10   DH    -0.02

1036  CIRCULAR          0.68/0.68  INFLOW  1035  1528         OUTFLOW  1612        B.NO.  27770                EXIST. SAN.    1036
      YU 156.180  YL 156.000  QF   365  DQ        0  QDLM   45  VNIGHT0.38  DUC  -0.32  DLC  -0.24   QLM    188  CAP     177
      SU 159.210  SL 158.670  AF 0.357  DQD     0.0  HDLM 0.16  HNIGHT0.05  DUS  -2.68  DLS  -2.23   RAIN   FOR.  QLM/QF 0.51
      RES      0  A      0.0  VF  1.02  GAMMA 0.0   VDLM 0.71  VNORM 0.0    HUM   0.35  HLM   0.44   QRQLM  128   DY     0.18
      IW     0.0  L     95.0  S 1/ 528  N   0.0130  SCOD  DWF  DWB   0.0    YUM 156.53  YLM 156.44   VLM   1.02   DH    -0.08

1040  CIRCULAR          0.68/0.68  INFLOW  1612  1533         OUTFLOW  1605        B.NO.  27760                EXIST. SAN.    1040
      YU 155.970  YL 155.810  QF   364  DQ        0  QDLM   47  VNIGHT0.39  DUC  -0.21  DLC  -0.10   QLM    210  CAP     154
      SU 158.610  SL 158.720  AF 0.357  DQD     0.0  HDLM 0.17  HNIGHT0.05  DUS  -2.17  DLS  -2.33   RAIN   FOR.  QLM/QF 0.58
      RES      0  A      0.0  VF  1.02  GAMMA 0.0   VDLM 0.72  VNORM 0.0    HUM   0.47  HLM   0.58   QRQLM  143   DY     0.16
      IW     0.0  L     84.8  S 1/ 530  N   0.0130  SCOD FH11  DWB   0.00   YUM 156.44  YLM 156.39   VLM   1.00   DH    -0.11

1514  CIRCULAR          0.23/0.23  INFLOW                     OUTFLOW  1515        B.NO.   5140                EXIST. SAN.    1514
      YU 164.836  YL 161.940  QF   108  DQ        0  QDLM    0  VNIGHT0.41  DUC  -0.22  DLC  -0.22   QLM      0  CAP     108
      SU 168.661  SL 166.015  AF 0.041  DQD     0.2  HDLM 0.01  HNIGHT0.00  DUS  -3.81  DLS  -4.07   RAIN   FOR.  QLM/QF 0.00
      RES     52  A     0.29  VF  2.61  GAMMA 0.74  VDLM 0.55  VNORM 0.0    HUM   0.01  HLM   0.01   QRQLM    0   DY     2.90
      IW     0.0  L     55.8  S 1/  19  N   0.0130  SCOD  DWF  DWB   0.00   YUM 164.85  YLM 161.95   VLM   0.57   DH     0.00

1515  CIRCULAR          0.23/0.23  INFLOW  1514               OUTFLOW  1516        B.NO.   5150                EXIST. SAN.    1515
      YU 161.940  YL 160.020  QF    64  DQ        0  QDLM    0  VNIGHT0.25  DUC  -0.22  DLC  -0.20   QLM      2  CAP      62
      SU 166.015  SL 162.974  AF 0.041  DQD     0.3  HDLM 0.02  HNIGHT0.01  DUS  -4.06  DLS  -2.93   RAIN   FOR.  QLM/QF 0.03
      RES     52  A     0.53  VF  1.54  GAMMA 0.49  VDLM 0.49  VNORM 0.0    HUM   0.01  HLM   0.03   QRQLM    0   DY     1.92
      IW     0.0  L    106.7  S 1/  56  N   0.0130  SCOD  DWF  DWB   0.01   YUM 161.95  YLM 160.05   VLM   0.72   DH    -0.02

1516  CIRCULAR          0.23/0.23  INFLOW  1515               OUTFLOW  1517        B.NO.   5150                EXIST. SAN.    1516
      YU 160.020  YL 159.715  QF    26  DQ        9  QDLM    1  VNIGHT0.16  DUC  -0.19  DLC  -0.05   QLM      8  CAP      17
      SU 162.974  SL 164.232  AF 0.041  DQD     0.3  HDLM 0.03  HNIGHT0.01  DUS  -2.91  DLS  -4.33   RAIN   FOR.  QLM/QF 0.33
      RES    938  A     0.03  VF  0.62  GAMMA 1.00  VDLM 0.29  VNORM 0.0    HUM   0.04  HLM   0.18   QRQLM    8   DY     0.31
      IW     0.0  L    103.6  S 1/ 340  N   0.0130  SCOD FH11  DWB   0.00   YUM 160.06  YLM 159.90   VLM   0.45   DH    -0.14

1517  CIRCULAR          0.30/0.30  INFLOW  1516               OUTFLOW  1019        B.NO.   5150                EXIST. SAN.    1517
      YU 159.715  YL 159.685  QF    91  DQ        0  QDLM    1  VNIGHT0.23  DUC  -0.12  DLC  -0.09   QLM      9  CAP      83
      SU 164.232  SL 164.232  AF 0.071  DQD     0.0  HDLM 0.06  HNIGHT0.01  DUS  -4.33  DLS  -4.33   RAIN   FOR.  QLM/QF 0.09
      RES     52  A      0.0  VF  1.29  GAMMA 0.49  VDLM 0.08  VNORM 0.43   HUM   0.18  HLM   0.21   QRQLM    8   DY     0.03
      IW     0.0  L      3.4  S 1/ 112  N   0.0130  SCOD  DWF  DWB   0.04   YUM 159.90  YLM 159.90   VLM   0.27   DH    -0.03
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      YU 155.140  YL 155.080   QF   393   DQ        0   QDLM   61  VNIGHT0.35   DUC   0.25   DLC   0.28    QLM     338   CAP       55
      SU 161.600  SL 162.200   AF 0.441   DQD     0.0   HDLM 0.30  HNIGHT0.07   DUS  -5.46   DLS  -6.09    RAIN   FOR.   QLM/QF 0.86
      RES      0  A      0.0   VF  0.89   GAMMA 0.0     VDLM 0.36  VNORM 0.66   HUM   1.00   HLM   1.03    QRQLM   266   DY      0.06
      IW     0.0  L     48.0   S 1/ 800   N   0.0130    SCOD 400   DWB    0.11  YUM 156.14   YLM 156.11    VLM    0.77   DH     -0.02

C088  CIRCULAR          0.75/0.75  INFLOW  C087              OUTFLOW  1611        B.NO. 822                     EXIST. SAN.    3088
      YU 155.070  YL 155.030   QF   372   DQ        0   QDLM   61  VNIGHT0.16   DUC   0.29   DLC   0.30    QLM     338   CAP       35
      SU 162.200  SL 161.995   AF 0.441   DQD     0.0   HDLM 0.35  HNIGHT0.12   DUS  -6.09   DLS  -5.92    RAIN   FOR.   QLM/QF 0.91
      RES      0  A      0.0   VF  0.84   GAMMA 0.0     VDLM 0.30  VNORM 0.63   HUM   1.04   HLM   1.05    QRQLM   261   DY      0.04
      IW     0.0  L     35.6   S 1/ 890   N   0.0130    SCOD 400   DWB    0.14  YUM 156.11   YLM 156.08    VLM    0.77   DH     -0.01

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

3092  CIRCULAR          0.30/0.30  INFLOW                    OUTFLOW  3093        B.NO.  514                    EXIST. STORM   3092
      YU 165.293  YL 162.397   QF   220   DQ       56   QDLM    0  VNIGHT0.49   DUC  -0.25   DLC  -0.20    QLM      55   CAP      164
      SU 168.661  SL 166.015   AF 0.071   DQD     0.1   HDLM 0.01  HNIGHT0.00   DUS  -3.32   DLS  -3.52    RAIN   8MS2   QLM/QF 0.25
      RES     52  A     0.25   VF  3.11   GAMMA 0.74    VDLM 0.49  VNORM 0.0    HUM   0.05   HLM   0.10    QRQLM    55   DY      2.90
      IW     0.0  L     55.8   S 1/  19   N   0.0130    SCOD FH01  DWB    0.0   YUM 165.34   YLM 162.50    VLM    2.61   DH     -0.05

3093  CIRCULAR          0.30/0.30  INFLOW  3092              OUTFLOW  3094        B.NO.  515                    EXIST. STORM   3093
      YU 161.407  YL 159.487   QF   129   DQ       70   QDLM    0  VNIGHT0.29   DUC  -0.16   DLC  -0.03    QLM     119   CAP       10
      SU 166.015  SL 162.974   AF 0.071   DQD     0.3   HDLM 0.01  HNIGHT0.00   DUS  -4.47   DLS  -3.22    RAIN   8MS2   QLM/QF 0.92
      RES     52  A     0.48   VF  1.83   GAMMA 0.49    VDLM 0.45  VNORM 0.0    HUM   0.14   HLM   0.27    QRQLM   118   DY      1.92
      IW     0.0  L    106.7   S 1/  56   N   0.0130    SCOD FH02  DWB    0.0   YUM 161.54   YLM 159.75    VLM    1.93   DH     -0.13

3094  CIRCULAR          0.46/0.46  INFLOW  3093              OUTFLOW  4010        B.NO.  515                    EXIST. STORM   3094
      YU 159.410  YL 159.106   QF   164   DQ       60   QDLM    1  VNIGHT0.15   DUC  -0.12   DLC  -0.05    QLM     159   CAP        4
      SU 162.974  SL 164.269   AF 0.166   DQD     0.2   HDLM 0.02  HNIGHT0.01   DUS  -3.22   DLS  -4.75    RAIN   8MS2   QLM/QF 0.97
      RES     52  A     0.41   VF  0.99   GAMMA 0.49    VDLM 0.26  VNORM 0.0    HUM   0.34   HLM   0.41    QRQLM   159   DY      0.30
      IW     0.0  L    103.3   S 1/ 340   N   0.0130    SCOD FH02  DWB    0.0   YUM 159.75   YLM 159.52    VLM    1.05   DH     -0.07

4010  CIRCULAR          1.07/1.07  INFLOW  3094              OUTFLOW  4011        B.NO.  2779                   EXIST. STORM   4010
      YU 158.466  YL 155.844   QF  5001   DQ       49   QDLM    1  VNIGHT0.87   DUC  -0.94   DLC  -0.78    QLM     197   CAP     4805
      SU 164.269  SL 161.056   AF 0.898   DQD     0.2   HDLM 0.02  HNIGHT0.00   DUS  -5.68   DLS  -4.92    RAIN   8MS2   QLM/QF 0.04
      RES     52  A     0.42   VF  5.57   GAMMA 0.39    VDLM 0.87  VNORM 0.0    HUM   0.13   HLM   0.29    QRQLM   195   DY      2.62
      IW     0.0  L     85.9   S 1/  33   N   0.0130    SCOD FH02  DWB    0.01  YUM 158.59   YLM 156.13    VLM    1.00   DH     -0.16

4011  CIRCULAR          1.22/1.22  INFLOW  3017  3099  4010  OUTFLOW  4012        B.NO.  2778                   EXIST. STORM   4011
      YU 155.844  YL 155.521   QF  2372   DQ       33   QDLM    1  VNIGHT0.32   DUC  -0.93   DLC  -0.76    QLM     304   CAP     2067
      SU 161.056  SL 159.770   AF 1.167   DQD     0.2   HDLM 0.03  HNIGHT0.00   DUS  -4.92   DLS  -3.79    RAIN   8MS2   QLM/QF 0.13
      RES     52  A     0.32   VF  2.03   GAMMA 0.34    VDLM 0.32  VNORM 0.0    HUM   0.29   HLM   0.46    QRQLM   303   DY      0.32
      IW     0.0  L     94.8   S 1/ 293   N   0.0130    SCOD FH02  DWB    0.01  YUM 156.14   YLM 155.98    VLM    0.77   DH     -0.16

4012  CIRCULAR          1.22/1.22  INFLOW  4011  3027        OUTFLOW  4013        B.NO.  2778                   EXIST. STORM   4012
      YU 155.521  YL 155.421   QF  1995   DQ       16   QDLM    2  VNIGHT0.27   DUC  -0.76   DLC  -0.71    QLM     443   CAP     1552
      SU 159.770  SL 159.148   AF 1.167   DQD     0.1   HDLM 0.03  HNIGHT0.01   DUS  -3.79   DLS  -3.21    RAIN   8MS2   QLM/QF 0.22
      RES     52  A     0.20   VF  1.71   GAMMA 0.26    VDLM 0.33  VNORM 0.0    HUM   0.46   HLM   0.51    QRQLM   440   DY      0.10
      IW     0.0  L     41.4   S 1/ 415   N   0.0130    SCOD FH02  DWB    0.01  YUM 155.98   YLM 155.93    VLM    0.97   DH     -0.06
```

Contractions used in HVM output...

1st line: pipe number, cross-section, pipe size...width/height(m), inflow and outflow pipes, block number, sewer type, pipe no.

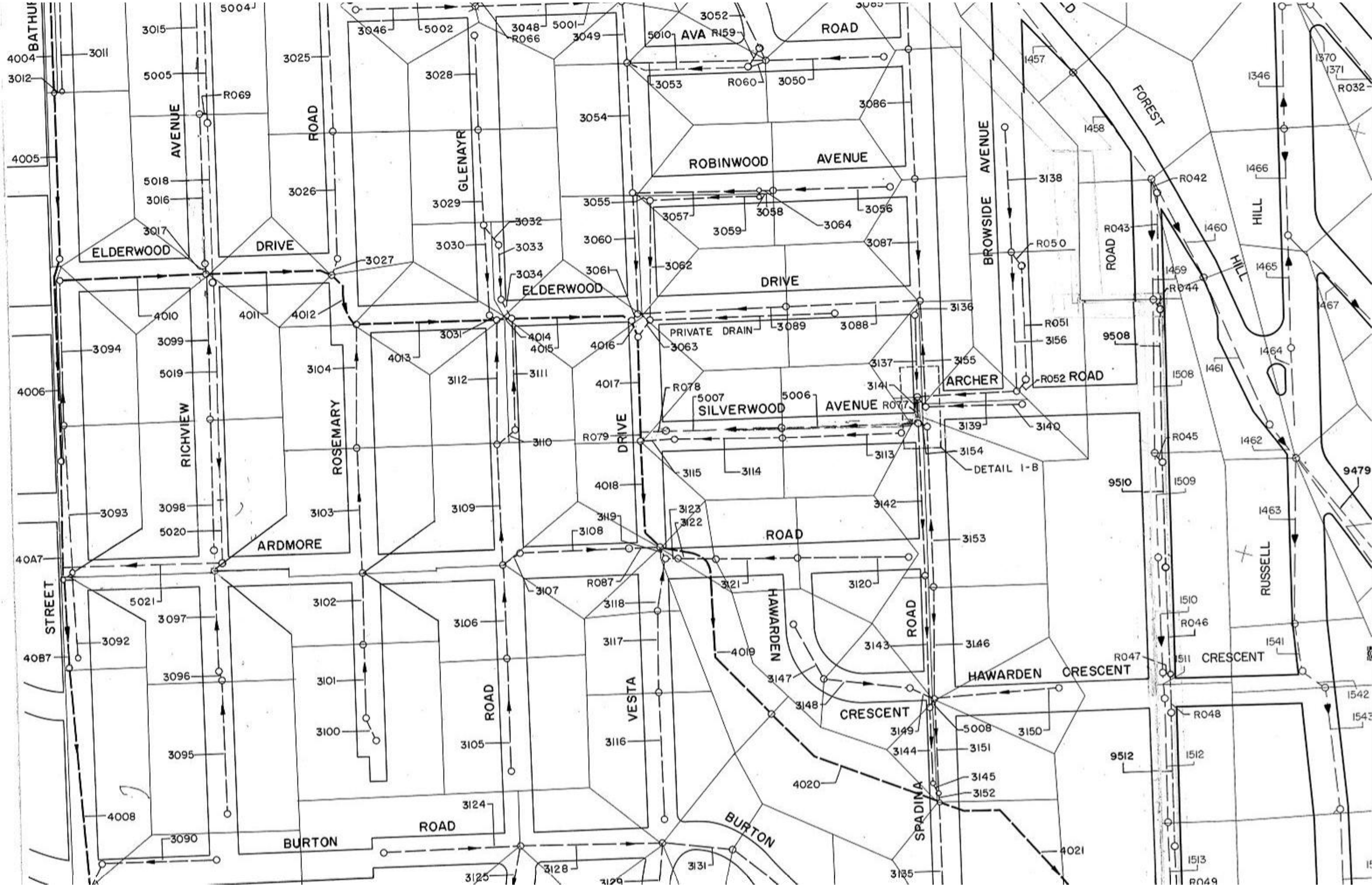
2nd line: YU, YL = upper and lower invert elevations (m)
QF = full flow capacity (L/sec)
DQ = maximum storm runoff from tributary area (L/sec)
QDLM = peak DWF at lower end (L/sec)
VNIGHT = night DWF velocity (m/sec)
DUC, DLC = difference between maximum HGL elevation and section crown elevation at upper and lower ends (m)
(-ve means partial fill)
QLM = maximum flow rate at lower end (L/sec) under a 2yr storm
CAP = free capacity at lower end when loaded by QLM

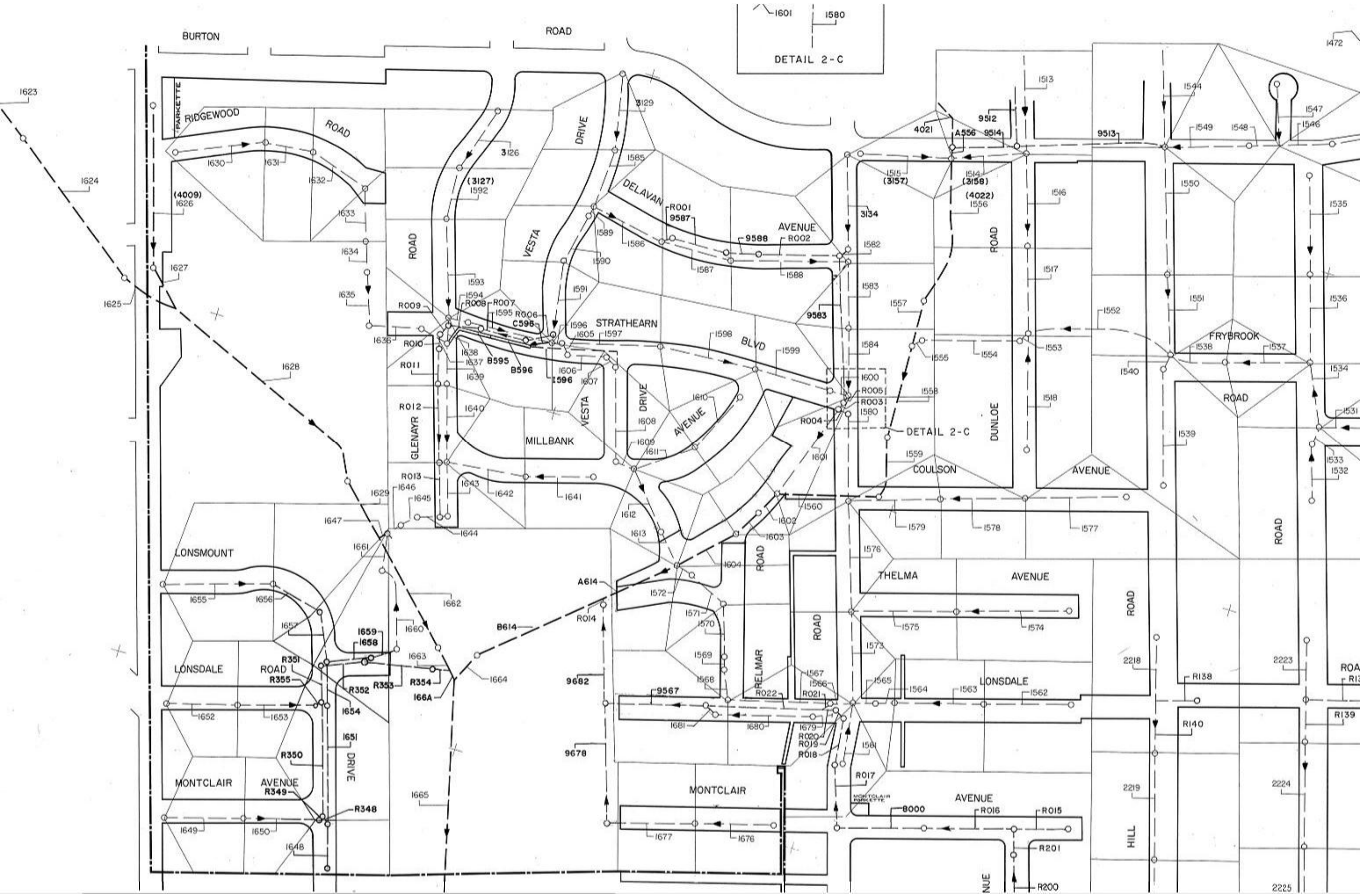
```
3rd line: SU, SL = upper and lower surface elevations (m)
          AF = cross-sectional area (m2)
          DQD = DWF from tributary area (L/sec)
          HDLM = flow depth corresponding to QDLM (m)
          HNIGHT = night DWF depth (m)
          RAIN = storm corresponding to QLM... 8MS2 = 8th Study Area, 2yr model storm
          QLM/QF = ratio of maximum flow rate at lower end to full-flow capacity

4th line: RES = population density (residents/ha)
          A = tributary area (ha)
          VF = flow velocity corresponding to QF (m/sec)
          GAMMA = imperviousness ratio
          VDLM = flow velocity corresponding to QDLM (m/sec)
          VNORM = normal flow velocity for QDLM (m/sec)
          HUM, HLM = maximum flow depths above invert at upper and lower ends
          QRQLM = portion of strom flow within QLM (L/sec)
          DY = difference between upper and lower invert elevations (m)

5th line: IW = industrial/large water inflow (L/sec)
          L = segment length (m)
          S = slope of pipe
          N = Manning's n
          SCOD = surface code of tributary area
          DWB = backwater build-up under QDLM (m)
          YUM, YLM = maximum HGL elevations at upper and lower ends
          VLM = flow velocity corresponding to QLM (m/sec)
          DH = indicator whether HGL is steeper or flatter than pipe slope
             = (YUM-YLM) - DY
```

STORM SEWER MODEL OUTPUT





BURTON
ROAD
DETAIL 2-C
RIDGEWOOD
ROAD
PARKETTE
ROAD
VESTA
DRIVE
DELAVAN
AVENUE
STRATHEARN
BLVD
ROAD
DUNLOE
FRYBROOK
ROAD
ROAD
GLENAYR
MILLBANK
VESTA
DRIVE
AVENUE
DETAIL 2-C
COULSON
AVENUE
LONSMOUNT
THELMA
AVENUE
ROAD
ROAD
ROAD
RELMAR
ROAD
LONSDALE
ROAD
LONSDALE
MONTCLAIR
AVENUE
DRIVE
MONTCLAIR
MONTCLAIR PARKETTE
AVENUE
HILL
ROAD

TORONTO SEWER SYSTEM STUDY AREA 8 - FOREST HILL INDEPENDENT STORM

```
40A7  CIRCULAR          1.37/1.37  INFLOW  4006              OUTFLOW  40B7          B.NO.   515                 EXIST. STORM   40A7
      YU 156.500  YL 155.850  QF  4928  DQ        6  QDLM    3  VNIGHT0.52  DUC   0.62  DLC   1.10    QLM   2505   CAP    2423
      SU 163.162  SL 166.238  AF 1.472  DQD     0.0  HDLM 0.07  HNIGHT0.02  DUS  -4.67  DLS  -7.91    RAIN  8MS2   QLM/QF 0.51
      RES     52  A     0.04  VF  3.35  GAMMA 0.49   VDLM 0.10  VNORM 0.52  HUM   1.99  HLM   2.47    QRQLM 2501   DY     0.65
      IW     0.0  L     82.0  S 1/ 126  N   0.0130   SCOD FH02  DWB   0.05  YUM 158.49  YLM 158.32    VLM   1.70   DH    -0.48

40B7  CIRCULAR          1.37/1.37  INFLOW  40A7  5021        OUTFLOW  4008                                     EXIST. STORM   40B7
      YU 155.850  YL 155.780  QF  1876  DQ        6  QDLM   10  VNIGHT0.20  DUC   0.91  DLC   0.69    QLM   3802   CAP   -1925
      SU 166.238  SL 168.914  AF 1.472  DQD     0.0  HDLM 0.09  HNIGHT0.03  DUS  -8.11  DLS -11.08    RAIN  8MS2   QLM/QF 2.03
      RES      0  A     0.04  VF  1.27  GAMMA 0.49   VDLM 0.38  VNORM 0.0   HUM   2.28  HLM   2.06    QRQLM 3787   DY     0.07
      IW     0.0  L     61.0  S 1/ 871  N   0.0130   SCOD FH02  DWB   0.02  YUM 158.13  YLM 157.84    VLM   2.58   DH     0.22

4008  CIRCULAR          1.37/1.37  INFLOW  40B7              OUTFLOW  1626          B.NO.   514                 EXIST. STORM   4008
      YU 155.780  YL 155.710  QF  1173  DQ      174  QDLM   11  VNIGHT0.15  DUC   0.69  DLC   0.0     QLM   3885   CAP   -2711
      SU 168.914  SL 168.996  AF 1.472  DQD     0.5  HDLM 0.09  HNIGHT0.03  DUS -11.08  DLS -11.92    RAIN  8MS2   QLM/QF 3.31
      RES     52  A     0.79  VF  0.80  GAMMA 0.74   VDLM 0.27  VNORM 0.0   HUM   2.06  HLM   1.37    QRQLM 3864   DY     0.07
      IW     0.0  L    155.7  S 1/2225  N   0.0130   SCOD FH02  DWB   0.0   YUM 157.84  YLM 157.08    VLM   2.64   DH     0.69

1626  CIRCULAR          1.07/1.07  INFLOW  4008  3091        OUTFLOW  1627          B.NO.  05125                EXIST. STORM   1626
      YU 155.690  YL 144.070  QF  7608  DQ        0  QDLM   11  VNIGHT1.32  DUC  -0.52  DLC  -0.52    QLM   3904   CAP    3704
      SU 168.990  SL 147.390  AF 0.898  DQD     0.0  HDLM 0.03  HNIGHT0.00  DUS -12.75  DLS  -2.77    RAIN  8MS2   QLM/QF 0.51
      RES      0  A     0.0   VF  8.48  GAMMA 0.0    VDLM 1.75  VNORM 0.0   HUM   0.55  HLM   0.55    QRQLM 3880   DY    11.62
      IW     0.0  L    164.6  S 1/  14  N   0.0130   SCOD 313   DWB   0.0   YUM 156.24  YLM 144.62    VLM   8.50   DH     0.00

1627  CIRCULAR          1.37/1.37  INFLOW  1626              OUTFLOW  1628          B.NO.   5125                EXIST. STORM   1627
      YU 140.340  YL 139.660  QF  7424  DQ        0  QDLM   11  VNIGHT0.79  DUC  -0.66  DLC  -0.55    QLM   3872   CAP    3552
      SU 147.390  SL 144.480  AF 1.472  DQD     0.0  HDLM 0.04  HNIGHT0.01  DUS  -6.34  DLS  -4.00    RAIN  8MS2   QLM/QF 0.52
      RES      0  A     0.0   VF  5.04  GAMMA 0.0    VDLM 1.05  VNORM 0.0   HUM   0.71  HLM   0.82    QRQLM 3847   DY     0.68
      IW     0.0  L     37.8  S 1/  56  N   0.0130   SCOD 319   DWB   0.0   YUM 141.05  YLM 140.48    VLM   4.84   DH    -0.11

1628  STRAIGHT SIDE     3.20/3.81  INFLOW  1625  1627        OUTFLOW  1629          B.NO.  9100                 EXIST. STORM   1628
      YU 138.820  YL 138.010  QF 39661  DQ        0  QDLM   11  VNIGHT0.63  DUC  -2.15  DLC  -2.16    QLM  15792   CAP   23869
      SU 144.480  SL 144.170  AF 9.605  DQD     0.0  HDLM 0.03  HNIGHT0.00  DUS  -4.00  DLS  -4.51    RAIN  8MS2   QLM/QF 0.40
      RES      0  A     0.0   VF  4.13  GAMMA 0.0    VDLM 0.63  VNORM 0.0   HUM   1.66  HLM   1.65    QRQLM 15763  DY     0.81
      IW     0.0  L    231.6  S 1/ 286  N   0.0130   SCOD 319   DWB   0.0   YUM 140.48  YLM 139.66    VLM   3.93   DH     0.01

1629  STRAIGHT SIDE     3.20/3.81  INFLOW  1628              OUTFLOW  1662          B.NO.  9100                 EXIST. STORM   1629
      YU 138.010  YL 137.230  QF 56947  DQ        0  QDLM   11  VNIGHT0.90  DUC  -2.48  DLC  -2.48    QLM  15713   CAP   41235
      SU 144.170  SL 144.180  AF 9.605  DQD     0.0  HDLM 0.02  HNIGHT0.00  DUS  -4.83  DLS  -5.62    RAIN  8MS2   QLM/QF 0.28
      RES      0  A     0.0   VF  5.93  GAMMA 0.0    VDLM 0.90  VNORM 0.0   HUM   1.33  HLM   1.33    QRQLM 15681  DY     0.78
      IW     0.0  L    108.2  S 1/ 139  N   0.0130   SCOD 319   DWB   0.0   YUM 139.34  YLM 138.56    VLM   5.16   DH     0.00

1662  STRAIGHT SIDE     3.20/3.81  INFLOW  1629  1647        OUTFLOW  1663          B.NO.  9100                 EXIST. STORM   1662
      YU 137.230  YL 135.090  QF 86718  DQ        0  QDLM   11  VNIGHT1.38  DUC  -2.73  DLC  -2.36    QLM  16286   CAP   70432
      SU 144.180  SL 142.190  AF 9.605  DQD     0.0  HDLM 0.02  HNIGHT0.00  DUS  -5.87  DLS  -5.65    RAIN  8MS2   QLM/QF 0.19
      RES      0  A     0.0   VF  9.03  GAMMA 0.0    VDLM 1.38  VNORM 0.0   HUM   1.08  HLM   1.45    QRQLM 16252  DY     2.14
      IW     0.0  L    128.0  S 1/  60  N   0.0130   SCOD 319   DWB   0.00  YUM 138.31  YLM 136.54    VLM   4.84   DH    -0.37

1663  CIRCULAR          3.81/3.81  INFLOW  1662              OUTFLOW  166A          B.NO.  9100                 EXIST. STORM   1663
      YU 135.090  YL 134.980  QF 66570  DQ        0  QDLM   11  VNIGHT0.91  DUC  -2.36  DLC  -2.32    QLM  16275   CAP   50295
      SU 142.190  SL 140.970  AF11.382  DQD     0.0  HDLM 0.03  HNIGHT0.00  DUS  -5.65  DLS  -4.50    RAIN  8MS2   QLM/QF 0.24
      RES      0  A     0.0   VF  5.85  GAMMA 0.0    VDLM 0.91  VNORM 0.0   HUM   1.45  HLM   1.49    QRQLM 16241  DY     0.11
      IW     0.0  L     17.8  S 1/ 162  N   0.0130   SCOD 319   DWB   0.01  YUM 136.54  YLM 136.47    VLM   4.00   DH    -0.05

166A  CIRCULAR          3.81/3.81  INFLOW  1663  R354        OUTFLOW  1665          B.NO.  9100                 EXIST. STORM   166A
      YU 134.980  YL 134.960  QF169271  DQ        0  QDLM   11  VNIGHT2.32  DUC  -2.32  DLC  -2.30    QLM  16483   CAP  152788
      SU 140.970  SL 140.970  AF11.382  DQD     0.0  HDLM 0.05  HNIGHT0.01  DUS  -4.50  DLS  -4.50    RAIN  8MS2   QLM/QF 0.10
      RES      0  A     0.0   VF 14.87  GAMMA 0.0    VDLM 0.34  VNORM 2.32  HUM   1.49  HLM   1.51    QRQLM 16448  DY     0.02
      IW     0.0  L      0.5  S 1/  25  N   0.0130   SCOD 319   DWB   0.04  YUM 136.47  YLM 136.47    VLM   3.98   DH    -0.02

1665  CIRCULAR          3.81/3.81  INFLOW  166A  1664        OUTFLOW  1666          B.NO.    91                 EXIST. STORM   1665
      YU 134.960  YL 133.340  QF 71602  DQ        0  QDLM   33  VNIGHT0.98  DUC  -2.30  DLC  -2.30    QLM  23793   CAP   47809
```

```
SU 140.970  SL 155.450   AF11.382   DQD    0.0   HDLM 0.05  HNIGHT0.01   DUS  -4.50   DLS -20.60    RAIN   8MS2   QLM/QF 0.33
RES      0  A     0.0    VF  6.29   GAMMA 0.0    VDLM 0.98  VNORM 0.0    HUM   1.51   HLM   1.51    QRQLM 23727   DY     1.62
IW     0.0  L    226.5   S 1/ 140   N   0.0130   SCOD 319   DWB   0.0    YUM 136.47   YLM 134.85    VLM    5.68   DH     0.01
```

Contractions used in HVM output...

```
1st line: pipe number, cross-section, pipe size...width/height(m), inflow and outflow pipes, block number, sewer type, pipe no.

2nd line: YU, YL = upper and lower invert elevations (m)
          QF = full flow capacity (L/sec)
          DQ = maximum storm runoff from tributary area (L/sec)
          QDLM = peak DWF at lower end (L/sec)
          VNIGHT = night DWF velocity (m/sec)
          DUC, DLC = difference between maximum HGL elevation and section crown elevation at upper and lower ends (m)
                     (-ve means partial fill)
          QLM = maximum flow rate at lower end (L/sec) under a 2yr storm
          CAP = free capacity at lower end when loaded by QLM

3rd line: SU, SL = upper and lower surface elevations (m)
          AF = cross-sectional area (m2)
          DQD = DWF from tributary area (L/sec)
          HDLM = flow depth corresponding to QDLM (m)
          HNIGHT = night DWF depth (m)
          RAIN = storm corresponding to QLM... 8MS2 = 8th Study Area, 2yr model storm
          QLM/QF = ratio of maximum flow rate at lower end to full-flow capacity

4th line: RES = population density (residents/ha)
          A = tributary area (ha)
          VF = flow velocity corresponding to QF (m/sec)
          GAMMA = imperviousness ratio
          VDLM = flow velocity corresponding to QDLM (m/sec)
          VNORM = normal flow velocity for QDLM (m/sec)
          HUM, HLM = maximum flow depths above invert at upper and lower ends
          QRQLM = portion of strom flow within QLM (L/sec)
          DY = difference between upper and lower invert elevations (m)

5th line: IW = industrial/large water inflow (L/sec)
          L = segment length (m)
          S = slope of pipe
          N = Manning's n
          SCOD = surface code of tributary area
          DWB = backwater build-up under QDLM (m)
          YUM, YLM = maximum HGL elevations at upper and lower ends
          VLM = flow velocity corresponding to QLM (m/sec)
          DH = indicator whether HGL is steeper or flatter than pipe slope
             = (YUM-YLM) - DY
```

Appendix D

Hydrant Flow Test data and

Water mains Adequacy Assessment

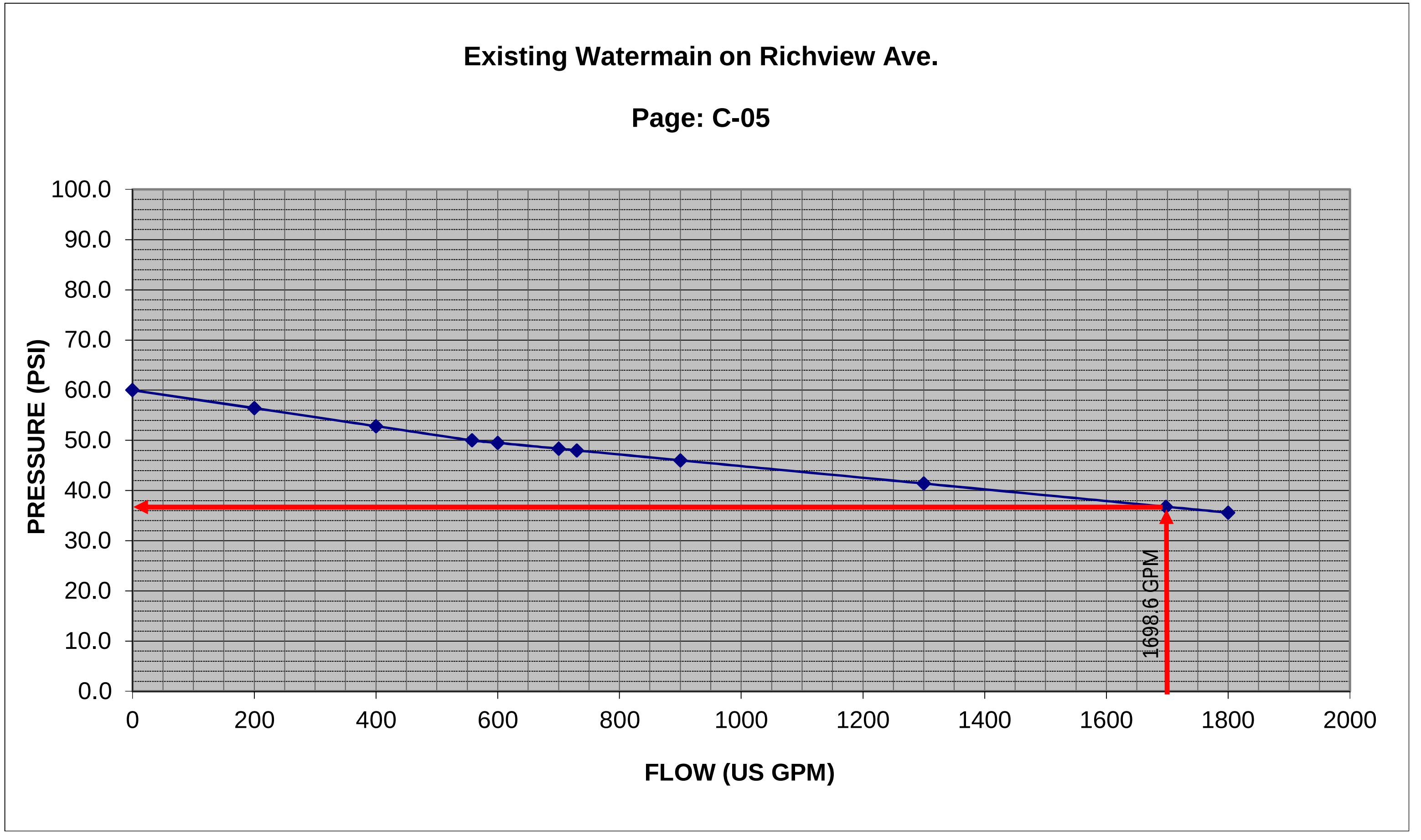
LEA Consulting Ltd. Consulting Engineers and Planners	Residual Pressure			
	Prepared:	F.M.	Page No.	C-04
	Checked:	M.D.		
Project: 1637-1645 Bathurst St. City of Toronto	Proj. #	18093		
	Date:	Sep. 25/17		

Hydrant Test Readings (watermain, Richview Ave.)

Flow		Residual Pressure	
0	US GPM	60	psi
558	US GPM	50	psi
730	US GPM	48	psi

Interpolated

Flow (US GPM)	Residual Pressure (psi)
0	60.0
200	56.4
400	52.8
558	50.0
600	49.5
700	48.3
730	48.0
900	46.0
1300	41.4
1698	**36.8**
1800	35.6


Existing Watermain on Richview Ave.
Page: C-05
PRESSURE (PSI)
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
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400
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800
1000
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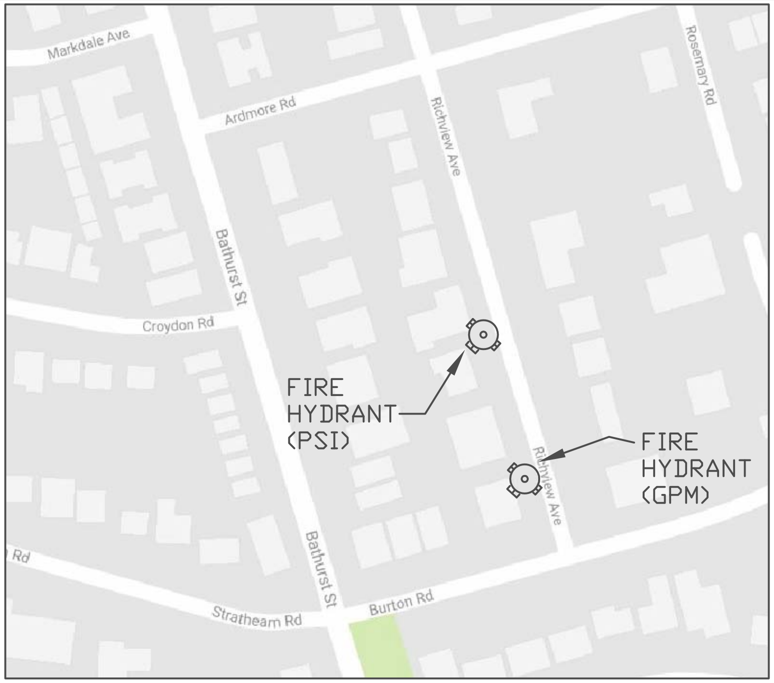
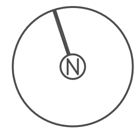
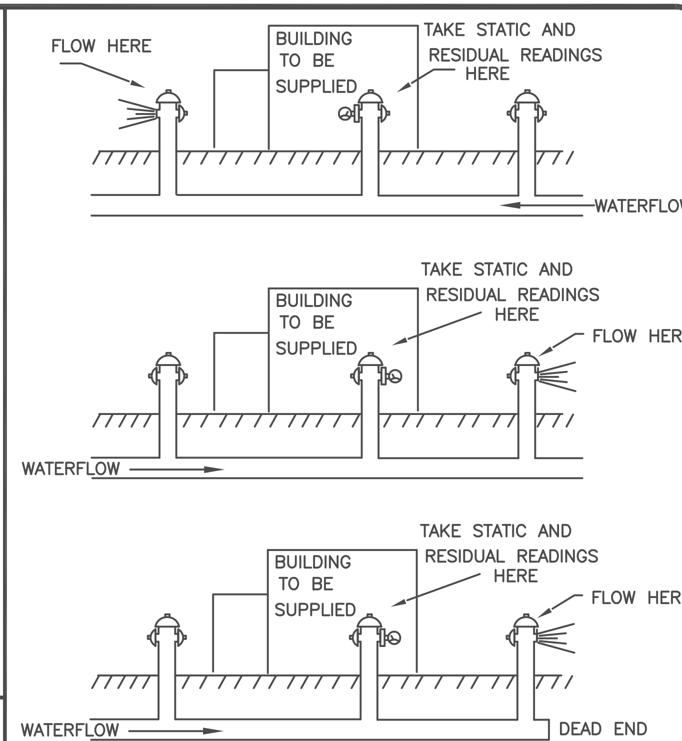
1600
1800
2000
1698.6 GPM
FLOW (US GPM)

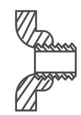


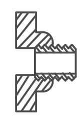


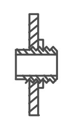


TEST:	PLAY PIPE	C=	STATIC(PSI)	RESIDUAL(PSI)	PITOT(PSI)	FLOW(USGPM)
	1x1 1/8					
	2x1 1/8					
	3x1 1/8					
	4x1 1/8					
	1x1 3/4					
	2x1 3/4					
	3x1 3/4					
	4x1 3/4					
	HYDRANT BUTT					
1	1x2 1/2	.80	60	50	14	558
2	2x2 1/2	.80	60	48	6	730
	3x2 1/2					
	4x2 1/2					
	FM NOZZLE					
	1x2 1/4	.88				
	2x2 1/4	.88				
	3x2 1/4	.88				
	4x2 1/4	.88				

OUTLET TYPE

☐ 
COEF.=0.90
OUTLET SMOOTH
AND WELL ROUNDED

☒ 
COEF.=0.80
OUTLET SQUARE
AND SHARP

☐ 
COEF.=0.70
OUTLET SQUARE
AND PROJECTING
INTO BARREL

Client:

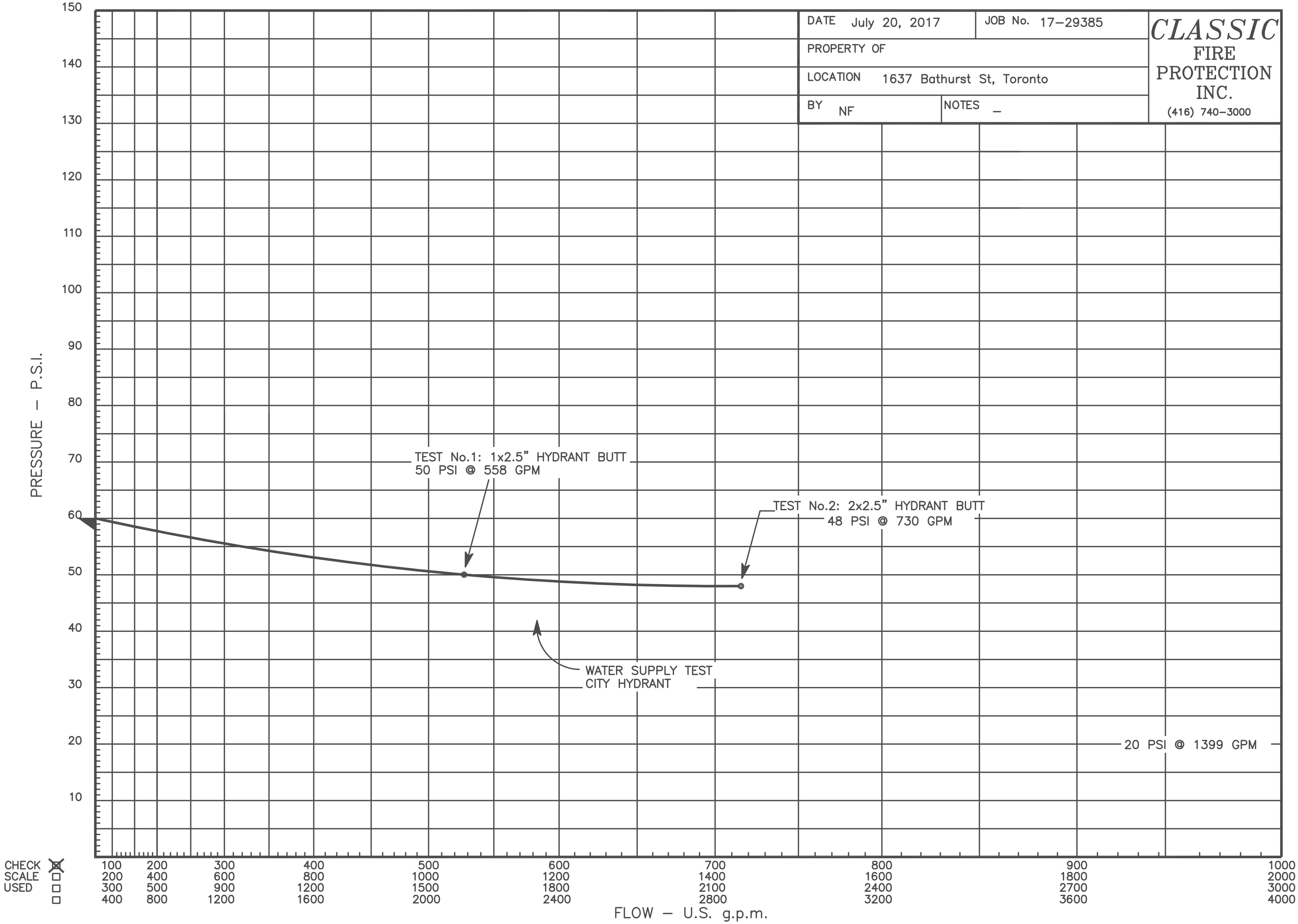
Location:

1637 Bathurst St

Toronto, ON

DEDICATED SERVICE SINCE 1988
CLASSIC FIRE PROTECTION INC.
645 GARYRAY DR.
North York, ON
M9L 1P9
(416) 740-3000
Web: www.classicfire.com

WATER SUPPLY GRAPH



Appendix E

Stormwater Treatment System Details and Sizing

Stormceptor®

FORTERRA™

Brief Stormceptor Sizing Report - 1637 Bathurst st.

Project Information & Location			
Project Name	1637 Bathurst Street	**Project Number**	18093
City	Toronto	**State/ Province**	Ontario
Country	Canada	**Date**	11/27/2017
Designer Information		**EOR Information (optional)**	
Name	Farshid Morshedi	**Name**	
Company	Lea consulting inc.	**Company**	
Phone #	647-870-5250	**Phone #**	
Email	fmorshedi@LEA.ca	**Email**	

Stormwater Treatment Recommendation

The recommended Stormceptor Model(s) which achieve or exceed the user defined water quality objective for each site within the project are listed in the below Sizing Summary table.

Site Name	1637 Bathurst st.
Target TSS Removal (%)	80
TSS Removal (%) Provided	92
Recommended Stormceptor Model	STC 300

The recommended Stormceptor Model achieves the water quality objectives based on the selected inputs, historical rainfall records and selected particle size distribution.

Stormceptor Sizing Summary	
Stormceptor Model	**% TSS Removal Provided**
STC 300	92
STC 750	96
STC 1000	97
STC 1500	97
STC 2000	98
STC 3000	98
STC 4000	99
STC 5000	99
STC 6000	99
STC 9000	99
STC 10000	99
STC 14000	100
StormceptorMAX	Custom

Sizing Details

Drainage Area	
Total Area (ha)	0.029
Imperviousness %	100.0

Water Quality Objective	
TSS Removal (%)	80.0
Runoff Volume Capture (%)	
Oil Spill Capture Volume (L)	
Peak Conveyed Flow Rate (L/s)	
Water Quality Flow Rate (L/s)	

Rainfall	
Station Name	TORONTO CENTRAL
State/Province	Ontario
Station ID #	0100
Years of Records	18
Latitude	45°30'N
Longitude	90°30'W

Up Stream Storage	
Storage (ha-m)	Discharge (cms)
0.000	0.000

Up Stream Flow Diversion	
Max. Flow to Stormceptor (cms)	

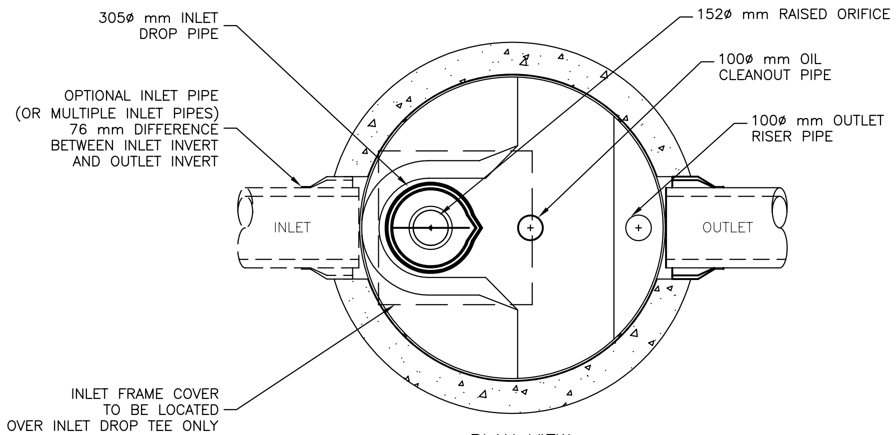
Particle Size Distribution (PSD) The selected PSD defines TSS removal		
City of Toronto PSD		
Particle Diameter (microns)	Distribution %	Specific Gravity
10.0	20.0	2.65
30.0	10.0	2.65
50.0	10.0	2.65
95.0	20.0	2.65
265.0	20.0	2.65
1000.0	20.0	2.65

Notes

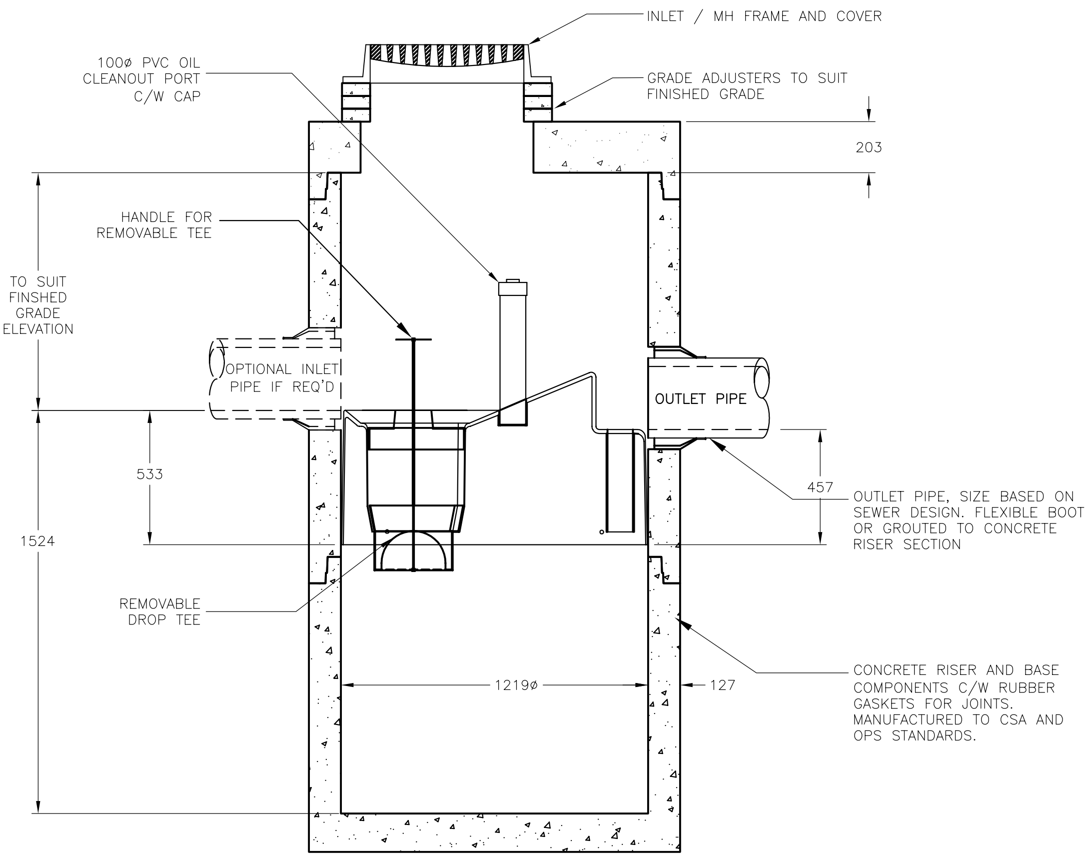
- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules.
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal defined by the selected PSD, and based on stable site conditions only, after construction is completed.
- For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.

For Stormceptor Specifications and Drawings Please Visit:
http://www.imbriumsystems.com/technical-specifications

DRAWING NOT TO BE USED FOR CONSTRUCTION



PLAN VIEW



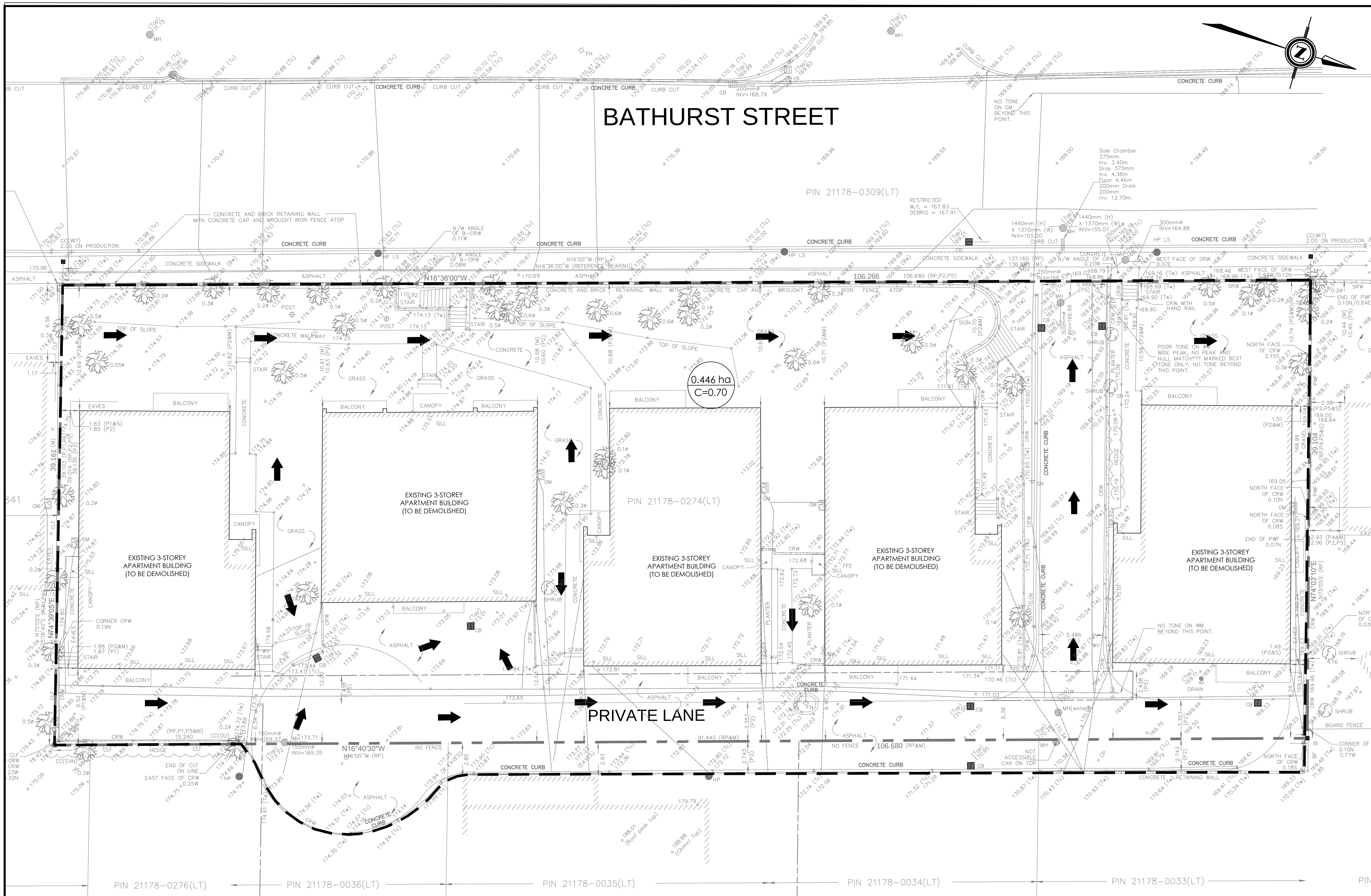
SECTION VIEW

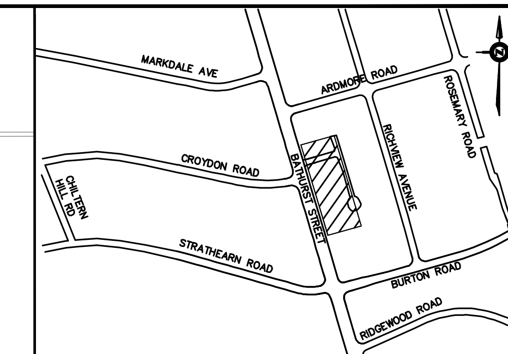
THE STORMCEPTOR SYSTEM IS PROTECTED BY ONE OR MORE OF THE FOLLOWING PATENTS
Australia Patent No. 693,164 • 707,133 • 729,096 • 779401 | Austrian Patent No. 289,647 |
Canadian Patent No. 2,009,280 • 2,137,942 • 2,175,277 • 2,180,305 • 2,180,383 • 2,206,338 • 2,327,768 (Pending) |
China Patent No. 1,168,439 | Denmark DK 711,879 | German DE 69,534,021 | Indonesian Patent No 16,688 | Japan Patent No. 9-11476 (Pending) |
Korea Patent No. 10-2000-0026101 (Pending) | Malaysia Patent No. P19701737 (Pending) | New Zealand Patent No. 314646 |
United States Patent No. 4,985,148 • 5,498,331 • 5,725,760; 5,753,115 • 5,849,181 • 6,068,765 • 6,371,690

STORMCEPTOR STC INLET MODEL STC 300i	SCALE 1:30							Stormceptor STC
								FILE: **stc300.dwg**
								DRAWN BY: **B.L.**
								DATE: **15 Aug 07** — 1 OF 1
	REV	Y	M	D	DRN	CHK	DESCRIPTION	REV.:

Appendix F

Figures and Drawings





LEGEND

➡	OVERLAND FLOW DIRECTION
— — —	EXISTING DRAINAGE BOUNDARY
◦	EXISTING AREA DRAIN
■	EXISTING CATCHBASIN
———	PROPERTY LINE
0.416 ha C=0.69	STORM DRAINAGE AREA AVERAGE RUNOFF COEFFICIENT

No.	DATE	DESCRIPTION

625 Cochrane Drive, Suite 900
Markham, Ontario
L3R 9R9, Canada
Tel: (905)470-0015. Fax: (905)470-0030

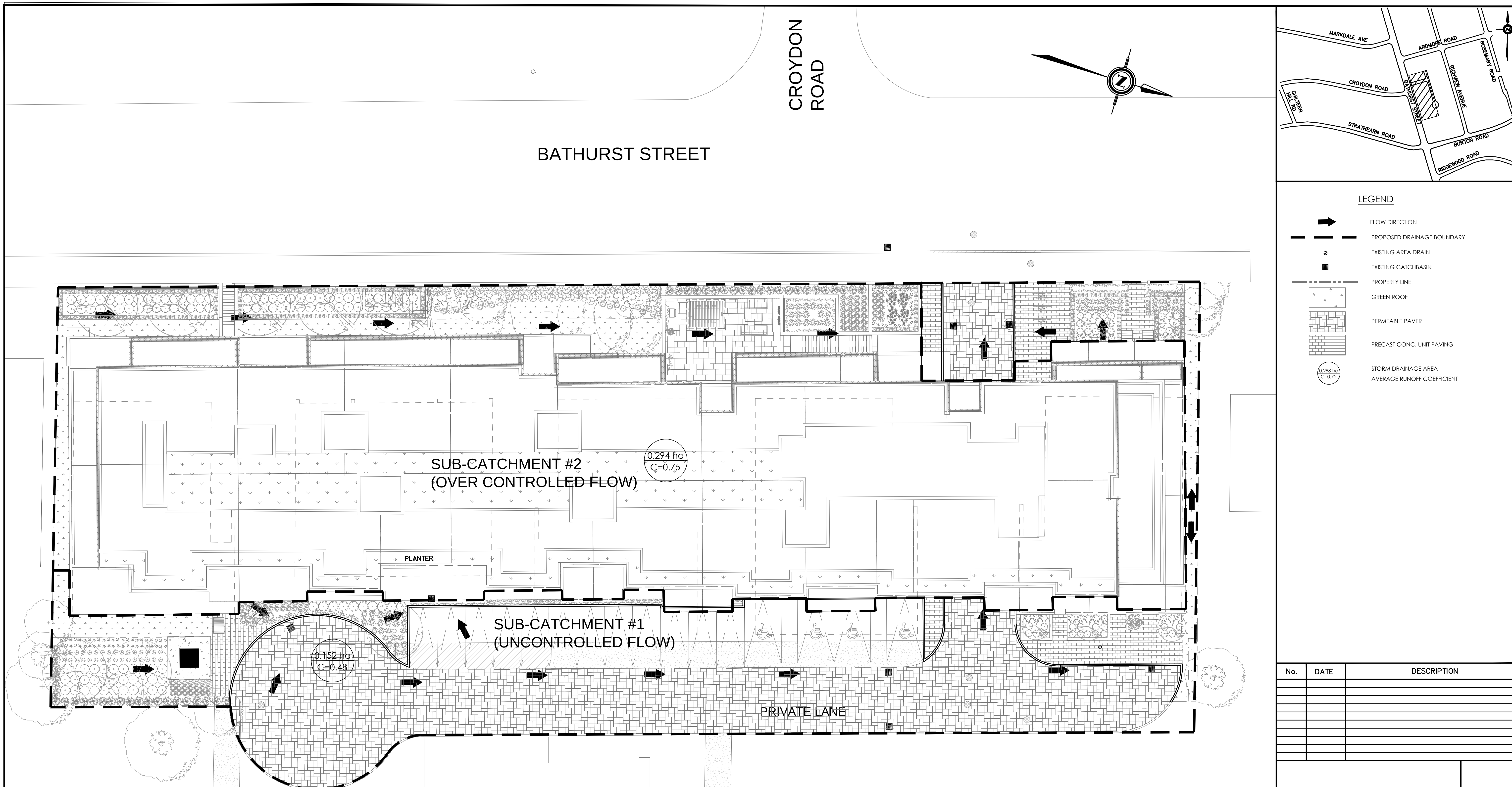
LEA Consulting Ltd.
Consulting Engineers and Planners
www.LEA.ca

1637 BATHURST STREET

EXISTING CONDITIONS

DESIGN	F.M.	DRAWN	F.M.	CHECKED	M.D.	CONTRACT No. 18093
SCALE:	1:350			DRAWING NUMBER	FIGURE 01	
DATE:	JULY 4, 2017					

DRAWING NAME: F:\18093 – 1637 Bathurst St\Drafting\Contract Drawings\Fig1– Existing Drainage Area.dwg



No.	DATE	DESCRIPTION

625 Cochrane Drive, Suite 900
Markham, Ontario
L3R 9R9, Canada
Tel: (905)470-0015. Fax: (905)470-0030

LEA Consulting Ltd.
Consulting Engineers and Planners
www.LEA.ca

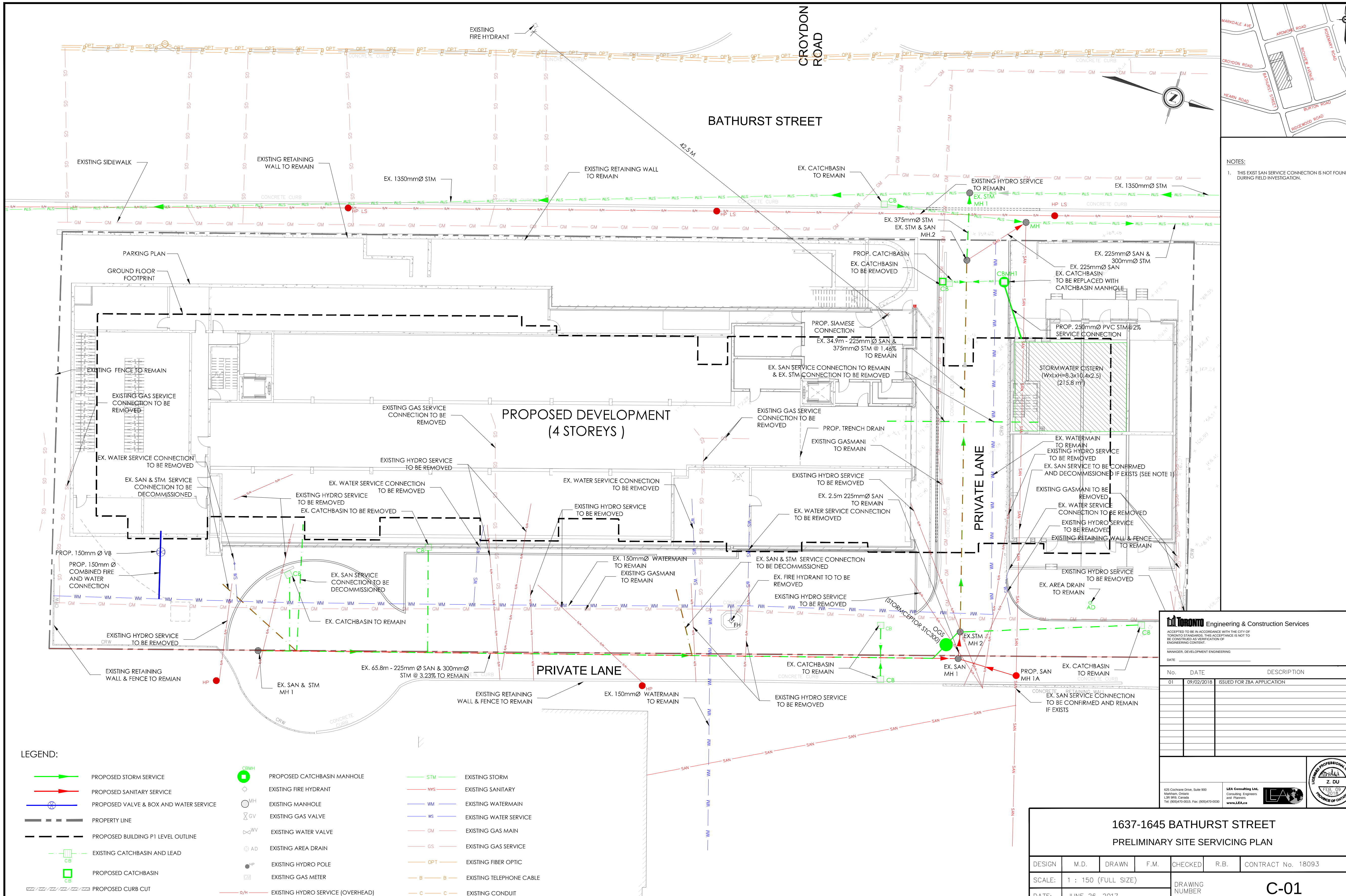
1637 BATHURST STREET

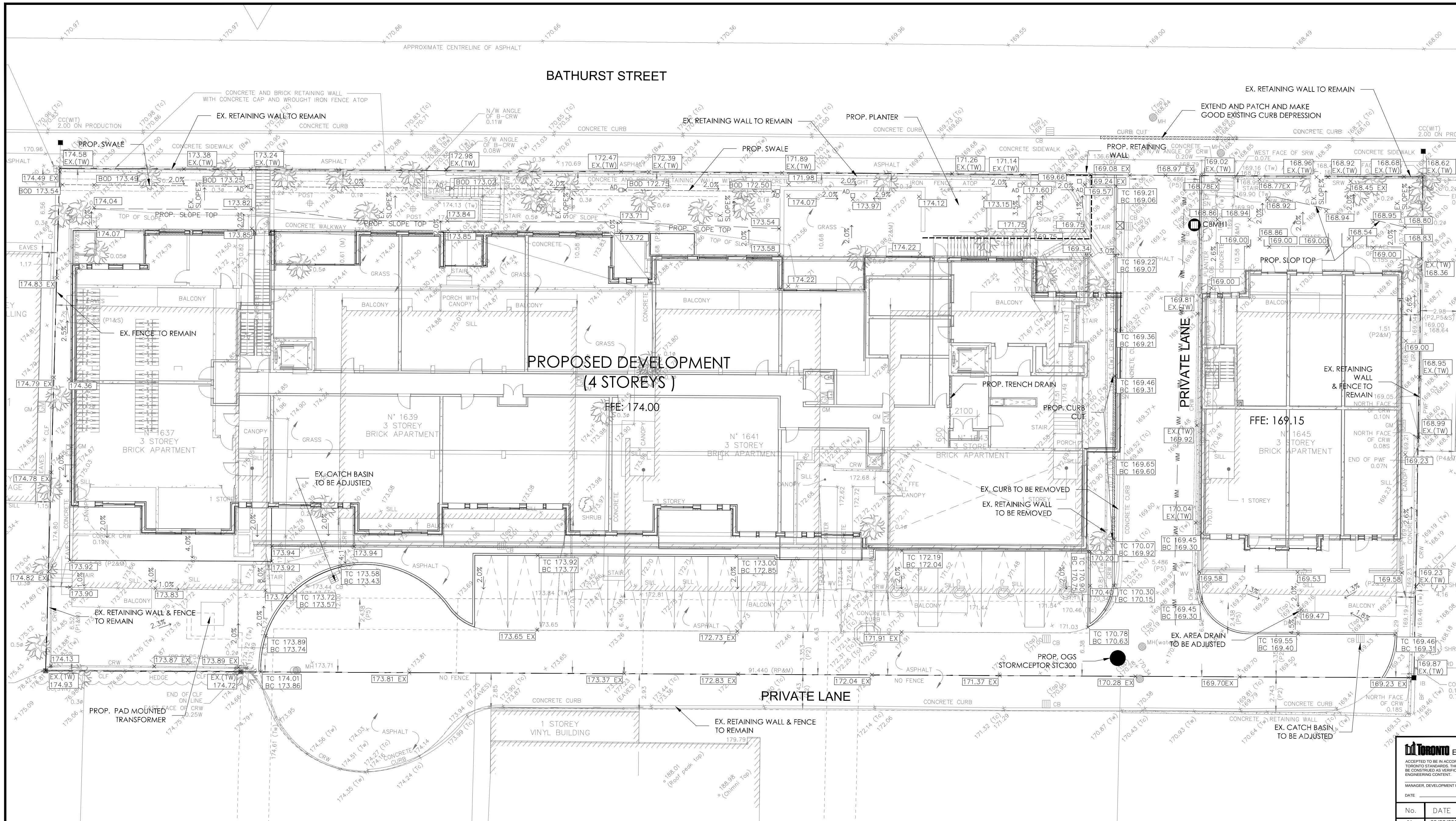
PROPOSED CONDITIONS

DESIGN	F.M.	DRAWN	F.M.	CHECKED	M.D.	CONTRACT No. 18093
SCALE:	1:350			DRAWING NUMBER		FIG. 2
DATE:	JULY 4, 2017					

DRAWING NAME: F:\18093 - 1637 Bathurst St\Drafting\Contract Drawings\Fig2- Proposed Drainage Area.dwg

Jan 10, 2018—10:42am


CROYDON ROAD
BATHURST STREET
PROPOSED DEVELOPMENT (4 STOREYS)
PRIVATE LANE
PRIVATE LANE
EXISTING FIRE HYDRANT
EXISTING SIDEWALK
EXISTING RETAINING WALL TO REMAIN
EX. 1350mmØ STM
EXISTING RETAINING WALL TO REMAIN
EX. CATCHBASIN TO REMAIN
EXISTING HYDRO SERVICE TO REMAIN
EX. 1350mmØ STM
EX. 375mmØ STM
EX. STM & SAN MH.2
PARKING PLAN
GROUND FLOOR FOOTPRINT
PROP. CATCHBASIN
EX. CATCHBASIN TO BE REMOVED
EX. 225mmØ SAN & 300mmØ STM
EX. 225mmØ SAN
EX. CATCHBASIN TO BE REPLACED WITH CATCHBASIN MANHOLE
PROP. SIAMESE CONNECTION
EX. 34.9m - 225mmØ SAN & 375mmØ STM @ 1.46% TO REMAIN
PROP. 250mmØ PVC STM@2% SERVICE CONNECTION
EXISTING FENCE TO REMAIN
EX. SAN SERVICE CONNECTION TO REMAIN & EX. STM CONNECTION TO BE REMOVED
STORMWATER CISTERN (WxLxH=8.3x10.4x2.5) (215.8 m³)
EXISTING GAS SERVICE CONNECTION TO BE REMOVED
EXISTING GAS SERVICE CONNECTION TO BE REMOVED
EXISTING GAS SERVICE CONNECTION TO BE REMOVED
PROP. TRENCH DRAIN
EXISTING GASMANI TO REMAIN
EX. WATERMAIN TO REMAIN
EXISTING HYDRO SERVICE TO BE REMOVED
EX. SAN SERVICE TO BE CONFIRMED AND DECOMMISSIONED IF EXISTS (SEE NOTE 1)
EX. WATER SERVICE CONNECTION TO BE REMOVED
EXISTING HYDRO SERVICE TO BE REMOVED
EX. SAN & STM SERVICE CONNECTION TO BE DECOMMISSIONED
EX. WATER SERVICE CONNECTION TO BE REMOVED
EXISTING HYDRO SERVICE TO BE REMOVED
EX. CATCHBASIN TO BE REMOVED
EX. WATER SERVICE CONNECTION TO BE REMOVED
EXISTING HYDRO SERVICE TO BE REMOVED
EXISTING HYDRO SERVICE TO BE REMOVED
EX. 2.5m 225mmØ SAN TO REMAIN
EX. WATER SERVICE CONNECTION TO BE REMOVED
EXISTING GASMANI TO BE REMOVED
EX. WATER SERVICE CONNECTION TO BE REMOVED
EXISTING HYDRO SERVICE TO BE REMOVED
EXISTING RETAINING WALL & FENCE TO REMAIN
PROP. 150mm Ø VB
PROP. 150mm Ø COMBINED FIRE AND WATER CONNECTION
EX. SAN SERVICE CONNECTION TO BE DECOMMISSIONED
EX. 150mmØ WATERMAIN TO REMAIN
EXISTING GASMANI TO REMAIN
EX. SAN & STM SERVICE CONNECTION TO BE DECOMMISSIONED
EX. FIRE HYDRANT TO TO BE REMOVED
EXISTING HYDRO SERVICE TO BE REMOVED
EXISTING HYDRO SERVICE TO BE REMOVED
EX. AREA DRAIN TO REMAIN
EX. CATCHBASIN TO REMAIN
EXISTING HYDRO SERVICE TO BE REMOVED
STORMCEPTOR STC300
OGS
EX. STM MH 2
EX. SAN MH 1
PROP. SAN MH 1A
EX. CATCHBASIN TO REMAIN
EX. CATCHBASIN TO REMAIN
EXISTING RETAINING WALL & FENCE TO REMIAN
EX. SAN & STM MH 1
EX. 65.8m - 225mm Ø SAN & 300mmØ STM @ 3.23% TO REMAIN
EXISTING RETAINING WALL & FENCE TO REMAIN
EX. 150mmØ WATERMAIN TO REMAIN
EXISTING HYDRO SERVICE TO BE REMOVED
EX. SAN SERVICE CONNECTION TO BE CONFIRMED AND REMAIN IF EXISTS
42.5 M
MARKDALE AVE
ARMOUR BOULEVARD
CROYDON ROAD
BATHURST STREET
HEARN ROAD
BURTON ROAD
RIDGEWOOD ROAD
NOTES:
1. THIS EXIST SAN SERVICE CONNECTION IS NOT FOUND DURING FIELD INVESTIGATION.
LEGEND:
PROPOSED STORM SERVICE
PROPOSED SANITARY SERVICE
PROPOSED VALVE & BOX AND WATER SERVICE
PROPERTY LINE
PROPOSED BUILDING P1 LEVEL OUTLINE
EXISTING CATCHBASIN AND LEAD
PROPOSED CATCHBASIN
PROPOSED CURB CUT
PROPOSED CATCHBASIN MANHOLE
EXISTING FIRE HYDRANT
EXISTING MANHOLE
EXISTING GAS VALVE
EXISTING WATER VALVE
EXISTING AREA DRAIN
EXISTING HYDRO POLE
EXISTING GAS METER
EXISTING HYDRO SERVICE (OVERHEAD)
EXISTING STORM
EXISTING SANITARY
EXISTING WATERMAIN
EXISTING WATER SERVICE
EXISTING GAS MAIN
EXISTING GAS SERVICE
EXISTING FIBER OPTIC
EXISTING TELEPHONE CABLE
EXISTING CONDUIT
TORONTO Engineering & Construction Services
No. DATE DESCRIPTION
01 09/02/2018 ISSUED FOR ZBA APPLICATION
LEA Consulting Ltd.
Z. DU
1637-1645 BATHURST STREET
PRELIMINARY SITE SERVICING PLAN
DESIGN M.D. DRAWN F.M. CHECKED R.B. CONTRACT No. 18093
SCALE: 1 : 150 (FULL SIZE)
DATE: JUNE 26, 2017
DRAWING NUMBER C-01



LEGEND:

162.25 EX	EXISTING GRADE	174.215	PROPOSED GRADE BY ARCHITECT
163.22 EX. (TW)	EXISTING TOP OF RETAINING WALL GRADE	162.25	PROPOSED GRADE
TC 163.22	EXISTING TOP OF CURB GRADE	TC 163.22	PROPOSED TOP OF CURB GRADE
BC 163.13	EXISTING BOTTOM OF CURB GRADE	BC 163.13	PROPOSED BOTTOM OF CURB GRADE
		BOD 163.13	PROPOSED BOTTOM OF SWALE GRADE
AD	EXISTING AREA DRAIN	AD	PROPOSED AREA DRAIN
CB	EXISTING CATCHBASIN		PROPOSED CATCHBASIN
MH	EXISTING MANHOLE		PROPOSED CURB CUT
	EXISTING FIRE HYDRANT		PROPERTY LINE
WV	EXISTING WATER VALVE		
GV	EXISTING GAS VALVE		

TORONTO Engineering & Construction Services

ACCEPTED TO BE IN ACCORDANCE WITH THE CITY OF TORONTO STANDARDS. THIS ACCEPTANCE IS NOT TO BE CONSTRUED AS VERIFICATION OF ENGINEERING CONTENT.

MANAGER, DEVELOPMENT ENGINEERING

DATE

No.	DATE	DESCRIPTION
01	09/02/2018	ISSUED FOR ZBA APPLICATION

625 Cochrane Drive, Suite 900
Markham, Ontario
L3R 9R9, Canada
Tel: (905)470-0015. Fax: (905)470-0030

LEA Consulting Ltd.
Consulting Engineers and Planners
www.LEA.ca

LICENSED PROFESSIONAL ENGINEER
Z. DU
FEB. 09 2018
PROVINCE OF ONTARIO

1637 BATHURST STREET

PRELIMINARY SITE GRADING PLAN

DESIGN	M.D.	DRAWN	J.W.	CHECKED	R.B.	CONTRACT No. 18093
SCALE:	1 : 150 (FULL SIZE)			DRAWING NUMBER	C-02	
DATE:	JUNE 26, 2017					

DRAWING NAME: F:\18093 - 1637 Bathurst St\Drafting\Contract Drawings\C-02 Site Grading Plan.dwg Jan 31, 2018-5:22pm