621 DUNDAS STREET EAST
Dundas Street East at Haig Road, City of Belleville

FUNCTIONAL SERVICING REPORT

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van MEER limited
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December 5, 2024 Issued for ZBA

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1.0 INTRODUCTION

This Functional Servicing Report is prepared in support of an application for Draft Plan of Subdivision and Rezoning approval for a residential subdivision in the City of Belleville.

The subject property is located at 621 Dundas Street East and the Haig Road intersection.

The property is located within Part of Lot 13, Concession 1, Part of the Road Allowance between the Broken Front Concession and Concession 1, Part of Lots 12 and 13, Broken Front Concession, Township of Thurlow, now in the City of Belleville, County of Hastings as illustrated in Figure 1- Key Plan.

The property has a frontage along Dundas Street East for access.

The site is bounded by the Bay of Quinte to the south; the Canadian Pacific Railway (CP Rail) and Dundas Street East to the north; commercial and residential developments to the east; and Parkland/Open Space to the west.

The site has approximately 16.17 hectares of developable land with a provincial significant wetland along the shore of the Bay of Quinte.

The property was the location of the former Bakelite operation and used by Union Carbide of Canada as a chemical manufacturing and resin (Bakelite) production facility. Environmental Site Assessments were completed as there were potential for impacts on the property as a result of historical activities on the property.

There is also a requirement to provide municipal water to four (4) existing residences located along the shore of the Bay of Quinte to the east of the subject property being described as Osprey Shores East Subdivision.

An Emergency Access Road is proposed to be developed through this adjacent residential and industrial lands to the east. The residential lands will have a potential residential development of 12 Townhouses, 6 Single Detached and 3 existing dwellings for a total of 21 units.

The residential development is proposed to consist of the following:

621 Dundas Street		
Apartments	162 units	
Stacked Townhouses	242 units	
Townhouses	133 units	
Single Detached	42 units	
	Subtotal	**579 units**
Osprey Shores East Subdivision		
Townhouses	12 units	
Single Detached	9 units	
	Subtotal	**21 units**
	Total	**600 units**

The proposed Draft Plan of Subdivision indicated the type of land use to the respective Blocks.

With a potential of 600 various types of units, the anticipated population would be 1,526 persons.

A proposed Site Plan for the development prepared by Cynthia Zahoruk Architects has been included in Appendix A.

Figure 1 - Key Plan

2.0 SITE DESCRIPTION

The previous development and use of the property defined the various services and facilities on the property.

Access was a driveway from Dundas Street East at the northeast corner of the property.

The previous use of the property had its own water supply from the Bay of Quinte, there was no indication if a municipal water service and sanitary building sewer connection was provided to the property.

A 600mm diameter trunk sanitary sewer is located in an easement on the property located along the west and north boundaries of the property.

A 300mm diameter watermain is located on the south side of Dundas Street East and connects with the 300mm diameter watermain located on Haig Road.

The property falls gradually to the south and sheet drains into the existing wetland and Bay of Quinte. The rail spur lines and driveways previously on the property have created four separate sub-catchments as shown on the Pre-Development Overland Flow Route. Sub-catchment 100 along the east side of the property also receives the runoff conveyed from the storm sewer on Haig Road. The storm sewer on Haig Road outlets on the south side of Dundas Street East into a ditch along the east boundary of the property and discharges to the Bay of Quinte. Sub-catchment 200, located through the middle of the property was also defined by the existing rail spur bed and driveway to the pump house discharges to the Bay of Quinte via a short drainage ditch. Sub-catchment 300 drains westerly along a minor drainage course/ditch to the Bay of Quinte. Sub-catchment 400 also drains westerly onto adjacent lands into a pond before outlasting through a culvert under a former railway bed, which is now used as a multi-purpose trail and a trunk sanitary sewer to the wastewater treatment plan. There are two large sub-catchments north of Dundas Street East - the Bradgate and Farley Sub-catchments that outlet into ditches on the south side of the Canadian Pacific Railway (CP Rail) and also discharges into the existing pond to the west of the property and on the north side of the multi-purpose trail.

The property has approximately 180m of frontage along Dundas Street East. Dundas Street East, formerly Highway 2, is a divided highway with two lanes in each direction. For this section, the road drainage is addressed with roadside ditches. Haig Road also connects to Dundas Street East from the north at the northeast corner of the property. The CP Rail crosses at two locations - Dundas Street East approximately 140m to the west from the Haig Road intersection, and then crosses Haig Road approximately 50m north of Dundas Street East.

The City of Belleville has developed multi-purpose trails along the Bay of Quinte which loop back around to the west property boundary. These trails consist of a 3m wide asphalt trail and a 3m wide ski/snowshoe trail with light standards installed in between the trails.

Electrical services are available with Elexicon Energy.

Natural gas can be provided by Enbridge Gas.

Communications, telephone, television and internet is available from Bell Canada and Cogeco.

3.0 SITE SERVICING

3.1 Sanitary Sewer Design

3.1.1 Existing Services

An existing 600mm diameter trunk sanitary sewer at 0.16% grade is presently located on the easement along the west side of the property with the lowest point approximately 130m south of the northwest corner of the property. The depth of the sanitary sewer is only 2.1m at this location. Any development south of this point across the property would require to be serviced with a sewage lift station.

3.1.2 Proposed Servicing

A proposed 200mm diameter PVC sanitary sewer connected into the 600mm diameter trunk sanitary sewer will be able to service all the lots/units within the proposed development.

Extending the sanitary sewer easterly at a minimum 0.4% slope will raise the invert of the pipe too high to the proposed grading at the east limit of the property. Therefore, it is proposed that the lots/units at the east end of the centre driveway will also need to be connected to the sewage lift station with the lots/units along the southerly east-west leg of Road “A”.

The sewage lift station would serve 51 single detached units and 86 townhouse units with a population of 386 persons. The lands that can be serviced directly with a gravity sewer to the Keegan Parkway Sanitary Trunk Sewer would serve 463 units with a population of 1,158 persons. The areas/units to be serviced with a sewage lift station are shown in green and the areas/units to be serviced with a gravity sanitary is shown in magenta, as shown in Fig 2.

Proposed throughout the development are 200mm dia. PVC sanitary sewer mains with a minimum full-flow pipe velocity of 0.6m/s.

Residential design parameters for the development include 350 L/cap/day, residential densities of 3 persons per lot, 2.5 persons per unit and extraneous flows of 0.28 L/sec/ha.

Design flow calculations and the accompanying Sanitary Drainage Area Plan are included in Appendix B.

The ultimate peak design flow for the sewage lift station would be 8.4 L/s.

The sewage lift station will consist of two submersible pumps, sized for capacity with one unit out-of-service.

The forcemain would be sized for a cleansing velocity between 0.6m/s and 1.2m/s with the maximum velocity limited to 3m/s. A 100mm dia. forcemain would maintain a velocity of 0.69m/s.

The pumping station design would be based on system-head calculation and curves using the appropriate Hasen-Williams factor “C” as follows:

- (a) Low sewage level in the wet well, C = 120;
- (b) Median sewage level over the normal operating range in the wet well, C = 130; and
- (c) Overflow sewage level in the wet well, C = 140.

Future sanitary sewer servicing for lands to the east of this development, the Osprey Shores East Subdivision including the existing four (4) dwellings, cannot be provided with a gravity sanitary sewer connection, but would require a sewage lift station or individual low pressure sewer system such as an E/One.

There should also be the option to service parts of the development area that require the Sewage Lift Station with a Low-Pressure Sewer System having E-One pumps installed in each unit. This option could be more beneficial for Block G on the Proposed Site Plan where habitable spaces in the dwellings will need to be above the high water level of the Bay of Quinte

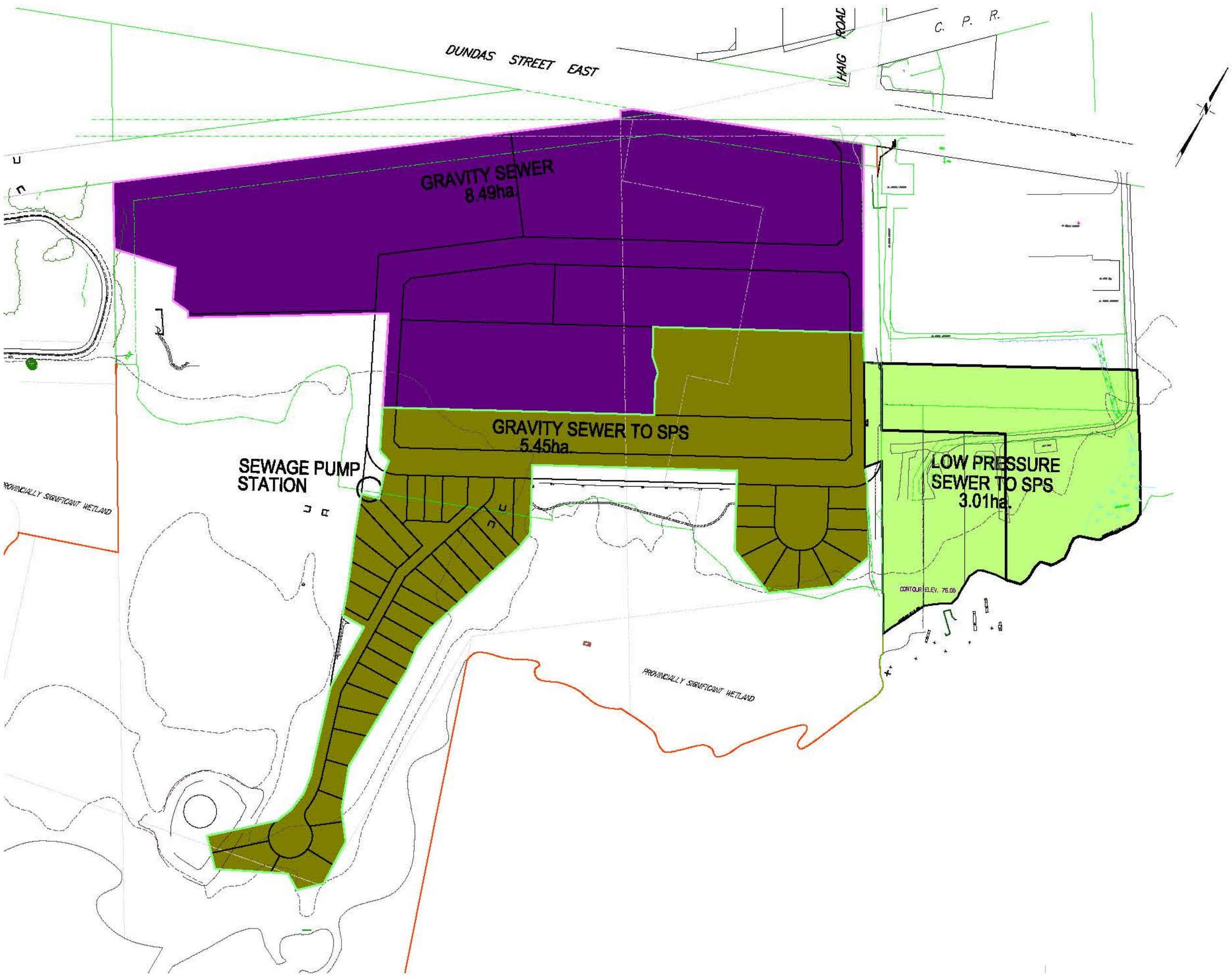


Figure 2 Sanitary Sewer Areas

3.2 Watermain Distribution System

3.2.1 Existing Services

There is an existing 300mm dia. watermain on Dundas Street East and Haig Road that supplies domestic water and fire flow for this area. This existing watermain on Dundas Street East will be utilized to connect the proposed development into the system.

Fire Hydrant Flow Test data was available for an existing hydrant located at 665 Dundas Street East; copy provided in Appendix C. It was calculated that the available fire flow at 20psi residual pressure ranges from 470 to 500 L/s (28,200 to 30,000 L/min).

The flows and corresponding pressure from the Hydrant Flow Test would be used to calibrate the Bentley WaterCAD V8i Watermain Model.

3.2.2 Proposed Servicing

The proposed watermain will be PVC DR 18, class 150 and range in size from 200mm to 250mm diameter.

Two (2) 250mm dia. watermains will be installed on Road “A” from Dundas Street East southerly to the first Road “A” Tee intersection. This will provide a looped water supply to the development.

A 200mm dia. watermain would be installed on the P-Crescent of Road “A”. A 200mm dia. watermain would also be installed to provide fire flows to Blocks “F” and “G”.

A 200mm dia. watermain would also be installed along the driveway through the centre of Block “E” to supply water and fire protection for the 2-storey Townhouses. This watermain would either be installed in an easement for ownership and maintenance of the watermain and provide individual services to the units or be part of a Block development with a private service.

A 200mm dia. watermain is also included to supply municipal water to the four (4) existing dwellings along the bay shore immediately to the east of this development, being the proposed Osprey Shores East Subdivision.

It was determined that the Maximum Day Demand would be 11.1 L/s.

The Required Fire Flow, based on Water Supply for Public Fire Protection – A Guide to Recommended Practice in Canada – 2020 by Fire Underwriters Survey would range from 6,000 L/min to 15,000 L/min. It is expected the effective building area of the townhouse blocks will be reduced so that the fire flow requirements can be limited to 8,000 L/min when provisions for firewalls are incorporated between some of the units.

The Maximum Day Demand was incorporated into the Bentley WaterCAD V8i Watermain Model. The modelling was completed with only one (1) 250mm dia. watermain supplying water from Dundas Street East. Also, a possible watermain loop connection along the internal driveway through the centre of Block “E” was not considered for the model.

The Demands applied to the various junctions in the watermain distribution system are provided in the Junction Table. A Pipe Table is also provided indicating the various pipe lengths, diameters, Hazen-Williams C Coefficients, Flows, Velocities and Head loss.

Available Fire Flows were calculated during the Maximum Day Demand for various building types and sideyards. For example, the Available Fire Flow at Hydrant H-4 located at the westerly end of Block “F” was determined to be 8,040 L/min with a Residual pressure of 140kPa for 3-Storey Stacked Townhouses with lower level being at least 50% below grade allowing the Building Floor Area to be reduced accordingly.

The following table summarizes available fire flows at select hydrants in the system:

Fire Hydrant No.	Location	Location Description	Available Fire Flow (L/min.)	Residual Pressure
H-5	Block “F”	Westerly end of Block “F”	8,040	140 kPa
H-6	Block “A”	Road “A”, in front of apartment block	13,200	140 kPa
H-8	Block “F”	Road “A”, in front of townhouse block	10,980	140 kPa
H-18	Osprey Shores East	Existing dwellings east of development	10,080	141 kPa
H-19	Block “F”	South Driveway Servicing Detached Units	7,200	143 kPa

Table 1 – HYDRANT TABLE MAXIMUM DAY DEMAND AND FIRE FLOW

Supporting calculations and drawings for the above have been provided in Appendix C.

3.3 Storm Sewer Design

3.3.1 Existing Services

The property grades gradually to the south and sheet drains into the existing wetland and Bay of Quinte. The rail spur lines and driveways previously on the property have created four separate sub-catchments as shown on the Pre-Development Overland Flow Route, Drawing Dun/621-St3 included in Appendix D.

Sub-catchment 100 along the east side of the property also receives the runoff conveyed from the storm sewer on Haig Road. The storm sewer on Haig Road outlets at the south side of Dundas Street East into a ditch along the east boundary of the property and discharges to the Bay of Quinte.

Sub-catchment 200, located through the middle of the property is defined by the existing rail spur bed and roadway to the pumphouse and discharges to the Bay of Quinte via a short drainage ditch.

Sub-catchment 300 drains westerly along a minor drainage course/ditch to the Bay of Quinte.

Sub-catchment 400 also drains westerly onto adjacent lands then into a pond before outletting through a culvert under a former railway bed, which now uses as a multi-purpose trail and a trunk sanitary sewer to the wastewater treatment plan.

The two large sub-catchments north of Dundas Street East, the Bradgate and Farley Sub-catchments, outlet into ditches on the south side of the Canadian Pacific Railway (CP Rail) and discharges into the existing pond to the west of the property on the north side of the multi-purpose trail.

3.3.2 Proposed Services

Stormwater will be directed into the storm sewer system in two manners; the streets are proposed to be constructed to allow stormwater to convey along the road to the sewer system, and grassed swales located in the rear yards will direct the surface flows into catchbasins or ditch inlets and into the storm sewer system. The pipe network will be designed to accommodate 1:5 year storm events.

Rainfall Intensity Duration Frequency (IDF) data for Belleville is as follows:

5-Year Storm	$I = 26.4\ t^{-0.677}$
100-Year Storm	$I = 45.6\ t^{-0.699}$

The weighted average of the Runoff Coefficient for the overall development was determined to be 0.67 but was rounded to 0.70.

The sections of storm sewer connecting to an ADS Treatment Train Oil-Grit Separator (OGS) have a steep slope as the inlet to the OGS is constructed lower than the outlet resulting in this section of pipe being submerged. The length of pipe is short to minimize the amount of pipe submerged. The velocity of flow in the pipe would be comparable to the flow in the outlet pipe, that is, less than 6m/s.

Storms in excess in excess of a 1:5 year event would result in surcharging of the storm sewer system and conveyance during these major events will be overland along the roads and swales towards a stormwater relief system.

Detailed storm sewer calculations have been provided in Appendix D.

3.4 Storm Water Management

3.4.1 Stormwater Quantity Control

With the property being adjacent to the Bay of Quinte to discharge the stormwater runoff, no quantity controls measures will be required.

3.4.2 Stormwater Quality

Stormwater from the development will be collected and treated on site such that the final outflow will meet Ministry of Environment, Conservation Authority, Bay of Quinte Remedial Action Plan and City of Belleville approvals. Stormwater management facilities (SWM) will be constructed to provide end of pipe quality control where necessary.

Considering the Bay of Quinte Remedial Action Plan, Level 1 Enhance Quality Treatment as outlined in the Ministry of Environment, Conservation and Parks (MECP) Stormwater Management Planning and Design Manual (March 2003) will need to be provided. Treatment will be required to achieve the MECP Level 1 threshold of 80% Total Suspended Solids (TSS) removal of materials 50 microns in size.

Maintaining small sub-catchment areas will also permit the ADS StormTech Treatment Train to be utilized in series with vegetated spreader berms to treat stormwater in lieu of detention ponds as the end-of-pipe treatment method. Runoff would then sheet flow over the vegetated spreader berms and disperse into the existing wetland.

The ADS StormTech Treatment Train is both a NJCAT and ETV verified water quality treatment device achieving over 81% TSS removal per the ISO 14034:2016 ETV standard AND THE Canadian Environmental Technology Verification Process.

A stormwater quality treatment unit (Downstream Defender) will be in line with a StormTech Isolator Row Plus chamber. A splitter structure will be installed between the stormwater quality treatment unit and the isolator row to by-pass any excess flow exceeding the flow for a quality storm event. The release flow from the isolator row will be control to the quality storm event.

The patented FLAMP (Flared End Ramp) provides a smooth transition from pipe invert to fabric bottom. The FLAMP improves chamber function over time by distributing sediment and debris that would otherwise collect at the inlet. It also serves to improve the fluid and solid flow back into the inlet pipe during maintenance and cleaning,

The proprietary ADS Plus fabric maintains durability and sediment removal while allowing for higher water quality flow rates.

Based on the 5-year storm sewer design, six (6) separate sub-catchments ranging in area from 0.77 ha. to 3.58 ha. can be treated with oil grit separators, such as the DownStream Defender in series with an ADS StormTech Isolator Row Plus, to provide over 90% Total Net Annual Removal Efficiency of the Total Suspended Solids (TSS). The Downstream Defender can also be sized to provide a lower level of treatment during the 5-year storm event. The separate sub-catchments have been highlighted in colour in Figure 3.

The existing runoff from Haig Road would not require quality treatment by the Developer as a requirement for this development.

The overland flow will be directed along the streets to the midpoint of the southerly East-West section of Road “A” and sheet flow over Vegetated Spreader Berm 100 having a length of 170 m. The runoff during a 100-year storm event includes the area along Haig Road north of Dundas Street East. The overland flow to Vegetated Spreader Berm 100 will be the runoff during the 100-year storm event less the 5-year storm event from the Haig Road and 100 Series Sub-catchments, which will outlet from the storm sewer treated directly to the Bay of Quinte. The overland flow to Vegetated Spreader Berm 100 was calculated to be 2.36m^3/s, having a depth of flow 02 28m and velocity of only 0.28m/s.

Runoff from Block “F” will be directed to the wetland and Bay of Quinte through a Downstream Quality Treatment Unit in series with the ADS Storm Tech Isolator Row Plus and sheet flow over Vegetated Spreader Berm 400 having a length of 40 m. The flow over this Vegetated Spreader Berm would be 0.14 m^3/s and 0.30 m^3/s during the 5-year and 100-year storm events respectively. Depth of flow would be 28 mm at a velocity of 0.28 m/s

Quality Treatment Unit in series with the ADS Storm Tech Isolator Row Plus and sheet flow over Vegetated Spreader Berm 400 having a length of 40 m. The flow over this Vegetated Spreader Berm would be 0.12 m^3/s and 0.26 m^3/s during the 5-year and 100-year storm events respectively. Depth of flow would be 25 mm at a velocity of 0.26 m/s

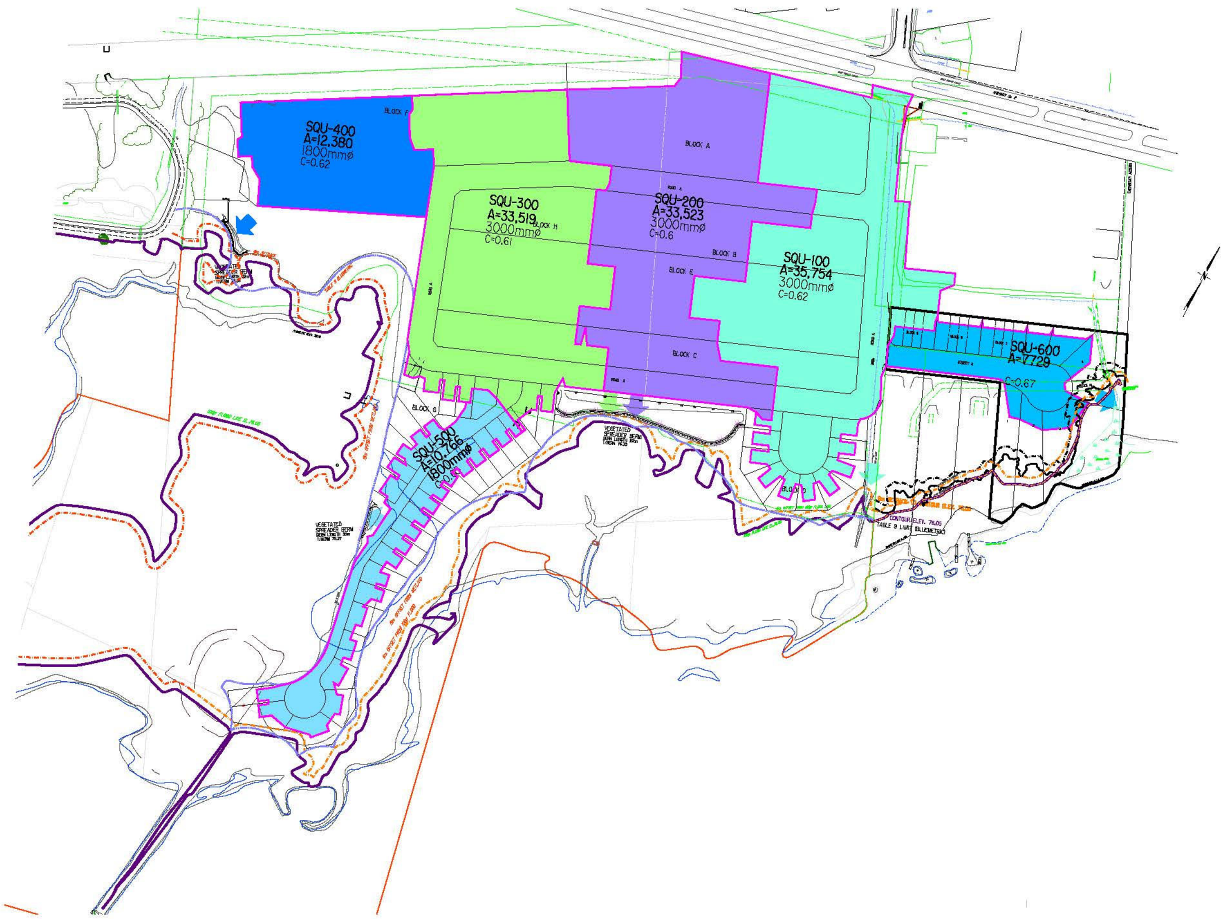


Figure 3 Storm Treatment Areas

Runoff from Block "G" will also be directed to the wetland and Bay of Quinte through a Downstream

The calculations for the overland flows are included in Appendix E.

It is also proposed all roof area will be directed towards the streets and driveways to be directed to the respecting Treatment Train. With Low Impact Development (LID), the swales and sheet flow will provide at least 50% reduction in TSS for any uncontrolled runoff into the wetlands. This is being considered with the percentage of Net Annual Removal Efficiency of the TSS reduction during the Quality Storm Event with the developed portions of the subdivision to calculate that 90.3% Total Net Annual Removal Efficiency will still be provided.

Considering the storm sewer design is based on the Rational Method, the runoff for the Storm Quality Event 25mm Intensity was determined based on equation 4.9 MECP Manual being:

$$i = 43C + 5.9$$

where, i = rainfall intensity (mm/h)
C = runoff coefficient

The average runoff coefficient (C) was rounded to 0.70 for the overall development.

The Ministry of the Environment (MOE) Quality Event Calculations are included in Appendix E.

The Downstream Defender is being considered to provide removal of the larger suspended solids before discharging into the ADS StormTech Isolator Row Plus for more readily cleaning of the systems. This also allows for the Total Suspended Solids Removal being considered for both the quality storm event and the 5-year storm event when the storm sewer would be flowing at capacity into the quality treatment units.

The Water Quality Flow Rate Worksheets for Water Quality Flow and Peak Storm Flow are included in Appendix "E" for each of the Quality Treatment Train Units.

The following Table 2 summarizes the levels of TSS Removal for the Water Quality Flow and Peak Storm Flow for the respective Stormwater Quality Treatment Units:

	TREATMENT UNIT SPECIFICATIONS					QUALITY		5 YEAR		
SQU No	DIA	PEAK FLOW	SEDIMENT STORAGE	OIL STORAGE	AREA	FLOW	TSS Removal	FLOW	TSS Removal	NET ANNUAL
			m^3	litres	hectares	L/s	%	L/s	%	%
100	3000	708	19.45	3,975	3.58	167.9	80.2%	426.5	59.0%	91.8%
200	3000	708	19.45	3,975	3.35	177.1	80.5%	335.3	60.0%	92.1%
300	3000	708	19.45	3,975	3.35	188.0	80.4%	327.2	60.0%	92.0%
400	1800	227.0	6.71	818	1.24	69.4	80.5%	140.6	58.0%	91.5%
500	1800	227.0	6.71	818	1.24	65.8	80.1%	123.6	58.0%	91.2%
600	1800	227.0	6.71	818	0.77	49.9	80.8%	89.7	61.0%	92.3%
					13.53		80.38%			91.87%
	Uncontrolled Area (Rear Yards)				1.14		50.00%			50.00%
					14.67		78.02%			88.62%

Table 2 - SUMMARY of TSS REMOVAL of QUALITY TREATMENT UNITS (Downstream Defender)

During Peak Flow in the storm sewer, the Downstream Defender OGS are still able to provide from 60% to 82% TSS Removal Efficiency depending on the flows at the respective Quality Treatment Units.

To minimize impact on the wetlands, vegetated spreader berms will also be constructed downstream of the storm sewer outlets and the overland discharge locations. The MOE Manual recommends a depth of flow of 50-100mm through the vegetation during a 10mm storm. The depth of flow is calculated based on:

$$Q = a\,L\,H^{1.5}$$

where, Q = discharge
a = coefficient
L = length of crest of weir
H = head

A coefficient of 1.67 was used to calculate the depth of flow (Head) for the respective discharge and length of crest of the weir and are summarized in the following Table 3:

Vegetated Spreader Berm Weir Flow

MOE SWM Planning & Design Manual Equation 4.4: Weir Flow					
$Q = aLH^{1.5}$					
Spreader Berm Filter Strip Outlet Weir (Subcatchment Haig, 100, 200, 300)					
	5_{yr}		100_{yr}		
100-year Peak Flow			2.36		
Less 5-year Outlet to Bay (ST-A6 to Outlet)			0.72		
Less 5-year to SQU-100 to Outlet			0.33		
Q =	0.72	m^3/s	1.32	m^3/s	Flow Volume
a =	1.67		1.67		Broad Crested Weir Coefficient
L =	170	m	170	m	
H =	18.5	mm	27.8	mm	Flow Depth (max)
V =	0.23	m/s	0.28	m/s	Velocity
Spreader Berm Filter Strip Outlet Weir (Subcatchment 400)					
	5_{yr}		100_{yr}		
Q =	0.14	m^3/s	0.30	m^3/s	Flow Volume
a =	1.67		1.67		Broad Crested Weir Coefficient
L =	40	m	40	m	
H =	16.3	mm	27.5	mm	Flow Depth (max)
V =	0.21	m/s	0.28	m/s	Velocity
Spreader Berm Filter Strip Outlet Weir (Subcatchment 500)					
	5_{yr}		100_{yr}		
Q =	0.12	m^3/s	0.26	m^3/s	Flow Volume
a =	1.67		1.67		Broad Crested Weir Coefficient
L =	40	m	40	m	
H =	15.0	mm	24.5	mm	Flow Height (max)
V =	0.20	m/s	0.26	m/s	Velocity

Table 3 - VEGETATED SPREADER BERM WEIR FLOW (Berm Nos. 100/200/300, 400 and 500)

During a major storm event, the depth of flow over the Vegetated Spreader Berm will range from only 24mm to 38mm with velocities ranging from 0.26m/s to 0.33m/s; being less than 0.5m/s which is considered acceptable for flow in a grassed swale.

The SWM facilities in conjunction with lot level controls, sedimentation and erosion control practices during construction of the roads and services, as well as the dwellings, will provide protection to the Bay of Quinte. The placement of the Vegetated Spreader Berms has also been shown on the Engineering Drawings.

3.5 Utility Servicing

3.5.1 Services

Utility services to the area have been provided to date by Elexicon Energy, Bell Canada, Cogeco and Enbridge Gas for electricity, telephone/internet communication, cable television and natural gas respectively and will be available for this development.

The utilities will be installed underground in a combined utility trench. Electricity will be supplied from pad mount transformers. The electrical design is coordinated with Elexicon Energy.

3.6 Roadwork

3.6.1 Existing

Dundas Street East, formerly Highway 2, is a divided 4-lane street along the limited frontage of the parcel land. Haig Road also connects to Dundas Street East at this location while immediately to the west the CP Rail crosses Dundas Street East and to the immediate north crosses Haig Road.

There is also a driveway immediately to the east of the property that may cause traffic conflicts.

3.6.2 Proposed

This new development will have direct access to Dundas Street East, which is maintained on a year-round basis by the Municipality. It is proposed to provide a divided 5-lane entrance, 2 inbound and 3 outbound, for turning lane movements. The divided lane can also provide a second emergency access.

There will be a conflict with traffic movement between the proposed intersection and the existing driveway to the immediate east. This driveway should be able to be relocated further easterly. This property also has a major entrance further to the east for larger trucks to access.

A Traffic Impact Statement is being prepared by others to address the intersection requirements.

Osprey Shores East Subdivision is proposed to also be developed in the near future. Four of the existing dwellings on this property are to be serviced with a watermain as a condition for the site clean up. A maintenance road will be required to access the watermain. This maintenance road will be extended easterly and then north to connect to Dundas Street East through the maintained parking lot / driveway of the industrial building for a secondary emergency access road. This maintenance road would be built to the requirements for a fire route, being 6m wide and granular road base to support emergency vehicles similar to a municipal street.

With the secondary access road being available through the proposed Osprey Shores East Subdivision, limiting the number of units to be developed as the initial phase should not be required.

A 3m wide paved multi-use trail will also be provided to connect from the existing Bay Shore Trail to the west through the subdivision to Dundas Street East.

The street within the development will be constructed with a 20m road allowance to City of Belleville current standards for a 20m road cross-section. A sidewalk or the multi-purpose trail will be provided along one side of the street. The street will also be part of the street scape, designed using 20m wide cross sections.

4.0 EROSION AND SEDIMENT CONTROL DURING CONSTRUCTION

A number of erosion and sediment control measures can be established during construction. These measures are as follows:

- Minimize the area of soil exposed at any time;
- Apply soil cover as soon as possible after soil is disturbed;
- Sediment will be intercepted as close to the source as possible. Proposed sediment control would include covering catchbasins and ditch inlets with a filter cloth, installing straw bale check dams or crushed stone filter berms in drainage swales, and installing sediment control fences around disturbed areas of building lots before construction begins;
- Ensure the sediment control structures are properly constructed, inspected and maintained during its use;
- Control dust during construction with application of dust suppressants to gravel roads as required, and periodic sweeping of paved roads;
- If dewatering is required, pumped water to be discharged to sediment traps to reduce the amount of sediment sent to storm sewers and ditch inlets;
- Stockpiles expected to remain for a significant length of time should be temporarily covered with a vegetative mulch,
- Inspect and remove sediment from sumps in downstream catchbasins and ditch inlets within the development as required,
- Stormwater Treatment Train should be installed in the respective subcatchment that development and servicing is in progress for ant phase of the development,
- Stormwater Treatment Train to be monitored, maintained and cleaned out during construction of the services and development of the property

5.0 PHASING

Considering the size and scope of this development, it is anticipated the project will be phased.

The sanitary sewer connection is at the west side of the property, watermain connection and road connection will be at the northeast corner of the property, and storm sewer outlets will be along the south boundary.

A secondary emergency access will be required when development of the property would exceed 100 units.

The various types of dwelling units should assist with the absorption of the units in the market.

There would be two options to phase the development:

Option1: Extend the sanitary sewer from the west property limit to Street A and construct the north leg of Street A to Dundas Street East intersection utilizing the proposed gravity sanitary sewer. Temporary turn-around would be provided at any temporary street terminations. If number of units exceeds 100, a temporary secondary emergency access would be constructed if the road network has not been completed.

Option 2: Extend the sanitary sewer from the west property limit to Street A, construct the south leg of Street A to Dundas Street East intersection, construct the sewage lift station with forcemain to the gravity sanitary sewer, and standby generator, Temporary turn-around would be provided at any temporary street terminations. If number of units exceeds 100, a temporary secondary emergency access would be constructed if the road network has not been completed.

6.0 SUMMARY

This design brief has been prepared to assist in municipal approvals for this development and is to be read in conjunction with Engineering Drawings prepared by van MEER limited included in Appendix F.

van **MEER** limited

Arnold H. Vandermeer, P.Eng.
Pres.

APPENDIX A

Conceptual Site Plan

Proposed Site Plan (Cynthia Zahoruk Architects) Drawing A0.1
December 5, 2024 – Issued for ZBA

PROPOSED SITE PLAN
SCALE: 1:800

PROPOSED LAND USE LEGEND

- CONDO APARTMENTS
- CONDO STACKED TOWNHOUSES (2½ STOREY)
- CONDO TOWNHOUSES
- CONDO DETACHED SINGLE FAMILY HOUSES (2 STOREY)
- CONDO DETACHED SINGLE FAMILY HOUSES (2 STOREY)
- CONDO TOWNHOUSES
- CONDO STACKED TOWNHOUSES (2½ STOREY)
- PARKLAND DEDICATION
- OPEN SPACE AREA
- FIRE ROUTE
- ZONING BY-LAW COMPLIANT PARKING SPACES

621 DUNDAS STREET - BELLEVILLE			December 5, 2024
PROJECT DATA CHART			
DEVELOPABLE AREA (AS PER QCA DEVELOPMENT LIMIT)			**AREAS (Ha)**
MUNICIPAL ROAD ALLOWANCE (EXCLUDING TRAIL) AREA OF EXISTING EASEMENT INCLUDED = 0.01 Ha			**2.04**
AREA OF TRAIL WITHIN ROAD ALLOWANCE			**0.21**
ENVIRONMENTALLY PROTECTED LAND WITHIN DEVELOPABLE AREA AREA OF EXISTING EASEMENT INCLUDED = 0.07 Ha			**0.26**
SEWAGE LIFT STATION AREA			**0.04**
PARKLAND DEDICATION (INCLUDING 3.0 M TRAIL)			**0.75**
VEGETATED SPREADER BERM			**0.58**
BLOCKS	**DESCRIPTION**	**REQUIRED**	**PROVIDED**
BLOCK - A	**APARTMENTS**		
	BLOCK AREA AREA OF EXISTING EASEMENT INCLUDED = 0.10 Ha	N/A	1.94
	UNITS		162
	VEHICULAR PARKING SPACES	0.75 space per dwelling unit for residents (122 Spaces) and 0.20 space per dwelling unit for visitors (33 Spaces)	201
	BIKE SPACES	0.50 space per dwelling unit (81 Spaces)	93
BLOCK - B	**STACKED TOWNHOUSES (2½ STOREY)**		
	BLOCK AREA	N/A	0.97
	UNITS		80
	VEHICULAR PARKING SPACES	0.75 space per dwelling unit for residents (60 Spaces) and 0.20 space per dwelling unit for visitors (16 Spaces)	88
	BIKE SPACES	0.50 space per dwelling unit (40 Spaces)	40
BLOCK - C	**TOWNHOUSES**		
	BLOCK AREA	N/A	1.00
	UNITS		37
	VEHICULAR PARKING SPACES (INCLUDING GARAGES)	1.0 space per dwelling unit for residents (37 Spaces)	74
BLOCK - D	**DETACHED SINGLE FAMILY HOUSES (2 STOREY)**		
	BLOCK AREA	N/A	0.68
	UNITS		10
	PARKING SPACES (INCLUDING GARAGES)	1.0 space per dwelling unit (10 Spaces) and 1.0 space for every 5 units (2 Spaces)	30
BLOCK - E	**TOWNHOUSES**		
	BLOCK AREA	N/A	2.18
	UNITS		81
	VEHICULAR PARKING SPACES (INCLUDING GARAGES)	1.0 space per dwelling unit for residents (81 Spaces)	162
	VISITORS PARKING SPACES	Not Required	14
BLOCK - F	**STACKED TOWNHOUSES (2½ STOREY)**		
	BLOCK AREA AREA OF EXISTING EASEMENT INCLUDED = 0.51 Ha	N/A	2.75
	UNITS		162
	VEHICULAR PARKING SPACES	0.75 space per dwelling unit for residents (122 Spaces) and 0.20 space per dwelling unit for visitors (33 Spaces)	186
	BIKE SPACES	0.50 space per dwelling unit (81 Spaces)	81
BLOCK - G	**DETACHED SINGLE FAMILY HOUSES (2 STOREY)**		
	BLOCK AREA	N/A	2.20
	UNITS		32
	VEHICULAR PARKING SPACES (INCLUDING GARAGES)	1.0 space per dwelling unit for residents (32 Spaces)	96
	VISITORS PARKING SPACES	Not Required	2
BLOCK - H	**TOWNHOUSES**		
	BLOCK AREA	N/A	0.43
	UNITS		15
	VEHICULAR PARKING SPACES (INCLUDING GARAGES)	1.0 space per dwelling unit for residents (15 Spaces)	30
TOTAL NUMBER OF UNITS			**579**
TOTAL DEVELOPABLE AREA (A)			**16.03**
UNDEVELOPABLE AREA			**AREAS (Ha)**
TABLE 9 LANDS, BUFFER, AND SETBACKS			**12.29**
AREA OF WETLANDS			**9.02**
TOTAL UNDEVELOPABLE AREA (B)			**21.31**
TOTAL PROPERTY AREA (A+B)			**37.34**

AREA FOR E-FILE COMMENTS

CYNTHIA ZAHORUK ARCHITECTS
3077 NEW STREET, SUITE 201
BURLINGTON, ON L7N1M6
905.331.4480

ONTARIO ASSOCIATION OF ARCHITECTS
CYNTHIA ZAHORUK
LICENCE
4488
ONTARIO ASSOCIATION OF ARCHITECTS

NOTES:
1.THE CONTRACTOR OR PROJECT MANAGER WILL CHECK AND VERIFY ALL DIMENSIONS AND JOB CONDITIONS ON THE JOB AND REPORT ANY DISCREPANCIES TO THE ARCHITECT PRIOR TO THE COMMENCEMENT OF CONSTRUCTION. COORDINATION OF WORK IS THE RESPONSIBILITY OF THE CONTRACTOR OR OWNER/CONTRACTOR
2.THIS DRAWING MUST NOT BE USED FOR CONSTRUCTION PURPOSES UNTIL SIGNED BY THE ARCHITECT.
3.ALL DRAWINGS ARE THE PROPERTY OF THE ARCHITECT AND MAY NOT BE COPIED, REPRODUCED OR ALTERED WITHOUT WRITTEN PERMISSION FROM THE ARCHITECT.
4.DO NOT SCALE THE DRAWINGS.

DD/MM/YY	REVISION
19/04/2023	ISSUED FOR PRE-CONSULTATION
28/11/2023	ISSUED FOR COORDINATION
19/11/2024	ISSUED FOR REVIEW

SCALE: AS NOTED
DRAWN BY: KA
PRINT DATE: 05/12/2024

621 DUNDAS STREET BELLEVILLE

PROPOSED DEVELOPMENT
DUNDAS STREET EAST
BELLEVILLE, ONTARIO

PROPOSED SITE PLAN

A0.1

APPENDIX B

Sanitary Sewer Design

Sanitary Sewer Design Sheet

Sanitary Sewer Design	Drainage Area Plan & Pipe Network	Drawing DUN/621-Sa1

SANITARY SEWER DESIGN SHEET

P = Persons / ha   3 Persons / Lot 2.5 Persons/Unit
q = 350 l/capita/day
I = 0.28 l/sec/ha
$M = 1+(14/(4+P^{0.5}))$

LOCATION				INDIVIDUAL				CUMULATIVE				Peaking Factor	Pop. Flow	Peak Extraneous Flow	Peak Design Flow		PROPOSED SEWER						
STREET	AREA	FROM	TO	RESIDENTIAL				RESIDENTIAL									Length	Pipe Size	Type of Pipe	Grade	Capacity (L/s)	Velocity	
				Lots	Units	Pop.	Areas	Lots	Units	Pop.	Areas		(l/s)	(l/s)	(l/s)	(% Cap)	(m)	(mm)		%	n= 0.013	Full Flow (m/s)	Actual (m/s)
ROAD A																							
North Leg																							
Block A		SA 101	SA 102		129	323	1.94		129	323	1.94	4.06	5.31	0.54	5.85	18.8%	116.3	200	DR 35	0.90%	31.1	0.99	0.77
		SA 102	SA 103		114	285	1.84		243	608	3.78	3.93	9.67	1.06	10.73	51.7%	115.0	200	DR 35	0.40%	20.7	0.66	0.66
		SA 103	SA 104		6	15	0.19		249	623	3.97	3.92	9.89	1.11	11.01	53.1%	35.1	200	DR 35	0.40%	20.7	0.66	0.67
Block F (East Portion)		SA-F1E	SA 104		18	45	0.28		18	45	0.28	4.32	0.79	0.08	0.87	2.6%	40.4	200	DR 35	1.00%	32.8	1.04	0.48
		SA 104	SA 105		31	78	0.88		298	745	5.13	3.88	11.71	1.44	13.14	63.4%	58.1	200	DR 35	0.40%	20.7	0.66	0.69
		SA 105	SA 106		12	30	0.88		310	775	6.01	3.87	12.15	1.68	13.83	59.6%	8.7	200	DR 35	0.50%	23.2	0.74	0.77
		SA 106	SA 107						310	775	6.01	3.87	12.15	1.68	13.83	66.7%	28.9	200	DR 35	0.40%	20.7	0.66	0.70
MIDDLE DRIVEWAY																							
West Portion		SA 201	SA 202		17	43	0.54		17	43	0.54	4.33	0.75	0.15	0.90	3.3%	81.8	200	DR35	0.70%	27.4	0.87	0.40
		SA 202	SA 203		27	68	0.76		44	110	1.30	4.23	1.89	0.36	2.25	10.8%	120.0	200	DR35	0.40%	20.7	0.66	0.44
		SA 203	SA 107						44	110	1.30	4.23	1.89	0.36	2.25	10.8%	38.5	200	DR35	0.40%	20.7	0.66	0.44
MIDDLE DRIVEWAY																							
East Portion		SA 201	SA 301		23	58	0.57		23	58	0.57	4.30	1.00	0.16	1.16	3.5%	84.7	200	DR35	1.00%	32.8	1.04	0.48
		SA 301	SA 302		14	35	0.44		37	93	1.01	4.25	1.59	0.28	1.88	9.0%	68.1	200	DR35	0.40%	20.7	0.66	0.42
ROAD A																							
		SA 302	SA 303						37	92.5	1.01	4.25	1.59	0.28	1.88	4.8%	28.0	200	DR35	1.40%	38.8	1.24	0.65
STREET A (Osprey Shores East Subdivision)																							
Low Flow Pressure Sewer		SaCO	SA 303	9	12	57	3.01	9	12	57	3.01	4.30	0.99	0.84	1.84		154.0	75	HDPE	Low Pressure Sewer			
ROAD A																							
South Portion		SA 303	SA 304						93	260	5.32	4.10	4.31	1.49	5.80	28.0%	37.7	200	DR35	0.40%	20.7	0.66	0.57
		SA 304	SA 305						93	260	5.32	4.10	4.31	1.49	5.80	28.0%	13.3	200	DR35	0.40%	20.7	0.66	0.57
		SA 305	SA 306		4	10	0.19		97	270	5.51	4.10	4.47	1.54	6.02	29.0%	35.4	200	DR35	0.40%	20.7	0.66	0.58
BLOCK D		SA 401	SA 306	10		30	0.79	42	53	190	5.00	4.16	3.19	1.40	4.59	16.7%	48.4	200	DR35	0.70%	27.4	0.87	0.66
		SA 306	SA 307		13	33	0.45	19	66	222	5.46	4.13	3.72	1.53	5.24	25.3%	114.4	200	DR35	0.40%	20.7	0.66	0.55
		SA 307	SA 308	2	12	36	0.58	21	55	201	5.47	4.15	3.37	1.53	4.90	23.6%	114.4	200	DR35	0.40%	20.7	0.66	0.55
SOUTH DRIVEWAY (Blk G)																							
		SA 501	SA 502	6		18	0.51	6		18	0.51	4.39	0.32	0.14	0.46	1.7%	46.7	200	DR35	0.70%	27.4	0.87	0.30
		SA 502	SA 503	3		9	0.20	9		27	0.71	4.36	0.48	0.20	0.68	3.3%	72.5	200	DR35	0.40%	20.7	0.66	0.30
		SA 503	SA 504	9		27	0.51	18		54	1.22	4.31	0.94	0.34	1.28	6.2%	97.9	200	DR35	0.40%	20.7	0.66	0.38
		SA 504	SA 405	8		24	0.52	26		78	1.73	4.27	1.35	0.49	1.84	8.8%	87.6	200	DR35	0.40%	20.7	0.66	0.41
		SA 505	SA 308					26		78	1.73	4.27	1.35	0.49	1.84	8.8%	23.3	200	DR35	0.40%	20.7	0.66	0.41
ROAD A																							
South Leg		SA 308	SA 309	4	8	32	0.69	51	86	368	8.46	4.04	6.02	2.37	8.39	40.4%	76.0	200	DR35	0.40%	20.7	0.66	0.63
SEWAGE LIFT STATION																							
		SA 309	SL STN					51	86	368	8.46	4.04	6.02	2.37	8.39	40.4%	15.8	200	DR35	0.40%	20.7	0.66	0.63
SANITARY EASEMENT																							
		SA 107	SA 108		21	53	0.26	51	461	1,306	16.03	3.72	19.69	4.49	24.17	64.3%	74.2	250	DR 35	0.40%	37.6	0.77	0.80
		SA 108	SA 109		24	60	0.22	51	485	1,366	16.25	3.71	20.51	4.55	25.07	66.6%	74.2	250	DR35	0.40%	37.6	0.77	0.81
BLOCK F (West Portion)																							
		SA 601	SA 602		54	135	1.26		54	135	1.26	4.21	2.30	0.35	2.65	9.7%	105.3	200	DR35	0.70%	27.4	0.87	0.57
		SA 602	SA 109		9	23	0.10		63	158	1.35	4.18	2.67	0.38	3.05	13.1%	48.1	200	DR35	0.50%	23.2	0.74	0.52
SANITARY EASEMENT																							
		SA 109	SA 110					51	548	1,523	17.60	3.67	22.67	4.93	27.60	73.4%	46.4	250	DR35	0.40%	37.6	0.77	0.84
KEEGAN PARKWAY SANITARY TRUNK SEWER																							
															27.60	13.6%		600	CP	0.11%	203.6	0.72	0.51
															27.60	4.8%		900	CP	0.10%	572.5	0.90	0.45

LEGEND
Existing works shown in Italics — *SA1* / SA1

Commercial Design Flows 1.05 l/ha.sec(includes infiltration)
Extraneous Flows 0.28 l/ha.sec

PREPARED BY: SDS
CHECKED BY: AHV

DATE: November 8, 2023
Rev: Feb 6-25

van MEER limited

621 DUNDAS STREET EAST
CITY of BELLEVILLE

SHEET 1 of 1

VAN MEER LIMITED
LAND DEVELOPMENT · PROJECT MANAGEMENT · ENGINEERING
83 North Park Street, Belleville, Ont. K8P 2Y6 Tel. 613-969-0171

621 DUNDAS STREET EAST
WEST OF HAIG ROAD
CITY OF BELLEVILLE

Date	Description	By	Chk'd By
DEC. 13/24	REVISED SITE LAYOUT FROM ARCHITECT 24-12-05	S.D.S.	
JAN. 18/24	REVISED SITE LAYOUT FROM ARCHITECT 24-01-17	S.D.S.	
JAN. 8/24	REVISED SITE LAYOUT FROM ARCHITECT 24-01-04	S.D.S.	
DEC. 20/23	UNDERLAY 23-12-15 SITE LAYOUT FROM ARCHITECT	S.D.S.	
NOV. 8/23	REVISED SITE LAYOUT FROM ARCHITECT	S.D.S.	

REVISIONS

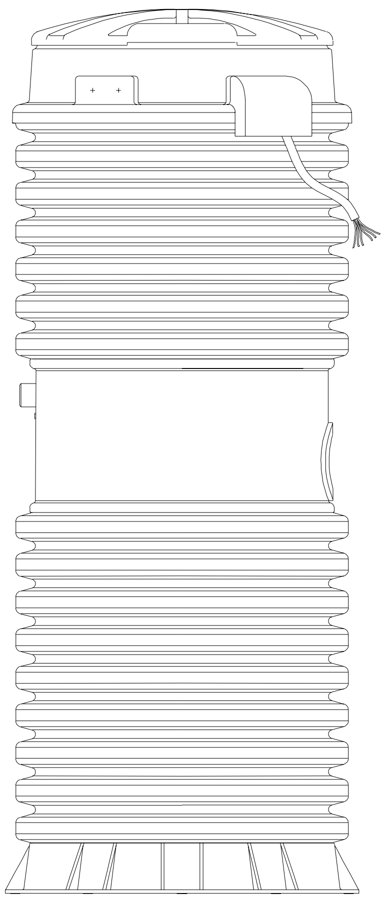
SCALE: 1:1250
DESIGNED: A.H.V.
DRAWN: S.D.S.
DATE: /07
COMPUTER \Drawings\BELLEVILLE\ \Dundas St\621 Bakelite Property\

REGISTERED PROFESSIONAL ENGINEER A. H. VANDERMEER Dec. 13/24 PROVINCE OF ONTARIO

SANITARY SEWER DESIGN
DRAINAGE AREA PLAN & PIPE NETWORK
DRAWING Dun/621-Sa1

DRAWING: 621 Dundas St_24-12-05.dwg

E/ONE EXTREME SERIES



Low Pressure Sewer Systems Using Environment One Grinder Pumps

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Introduction

E/One low pressure sewer (LPS) systems offer the designer new freedom in solving many problem situations that have defied reasonably economical solutions using the conventional approach.

Each LPS system design should be considered on the basis of its own unique circumstances. On such a basis, a sound choice between gravity and low pressure systems can be made.

General criteria aid the engineer in making a preliminary choice between several alternative systems: entirely low pressure, entirely gravity, entirely vacuum or a combination of systems. These criteria are presented and are intended to serve as a general guide. The final decision and design are the responsibility of the project consulting engineer, whose knowledge of local conditions, including construction costs, regulatory requirements and the client's particular needs, become vital to the preparation of the final designs and specifications.

Advantages of LPS Systems

LPS systems have low initial (front end) cost compared to gravity systems, which have nearly all the total investment allocated in the first stage. With the LPS system, grinder pump costs are incurred only as construction progresses. These costs will be deferred for many years in certain types of development programs.

An LPS system is not subject to infiltration from ground water or from surface storm water entering through leaking pipe joints and manholes. With zero infiltration, treatment plants need not be sized to handle the peak flow rates caused by infiltration. Treatment efficiencies can be more consistent, and treatment plant operating costs decrease.

An LPS system may become the critical factor in determining whether "marginal" land can be economically developed. Many attractive sites have been considered unsuitable for development because of the excessive costs typically associated with conventional sewer systems — sites with hilly terrain, land with negligible slope, high water tables, poor percolation characteristics, rock, seasonal occupancy or low population density.

Many communities are planning to convert from septic tanks to central sewage collection and treatment systems to minimize health hazards and/or environmental deterioration. The major reduction in cost and the simplicity of installation of an LPS system have strong appeal for such community improvement programs. Small-diameter pipe pressure mains can be laid along existing roadways with minimum disruption to streets, sidewalks, lawns, driveways and underground utilities. Surface restoration costs are similarly minimized. Sewage delivered to the treatment plant (because it contains no infiltration) is more uniform in "strength," the volume is smaller, and peaks are greatly reduced.

Description and Operation

Grinder pumps of approved design accomplish all pumping and sewage-grinding processes for small-diameter LPS systems.

The system consists of conventional drain, waste and vent (DWV) piping within the residence connected to the grinder pump inlet. The grinder pump may be installed above or below grade, indoors or outdoors. Depending on flow factors and model used, it may serve one or more residences, or several families in the case of apartment buildings.

Grinder pumps discharge a finely ground slurry into small–diameter pressure piping. In a completely pressurized collection system, all the piping downstream from the grinder pump (including laterals and mains) will normally be under low pressure. Pipe sizes will start at 1 1/4 inches for house connections (compared to 4 or 6 inches in gravity systems) and will be proportionally smaller than the equivalent gravity pipeline throughout the system. All pipes are arranged as zone networks without loops.

Depending on topography, size of the system and planned rate of buildout, appurtenances may include valve boxes, flushing arrangements, air release valves at significant high points, check valves and full-ported stops at the junction of each house connection with the low pressure sewer main.

Pump Operation

Low pressure sewer systems have become feasible with the availability of the Environment One grinder pump, the reliability of which has been proven in almost 40 years of service. The grinder pump station provides adequate holding capacity, reliable grinding and pressure transport of a fine slurry to an existing gravity sewer, pump station or directly to a wastewater treatment plant.

In operation, the grinder pump station will handle sewage and many items that should not, but often do, appear in domestic wastewater. For example, plastic, wood, rubber and light metal objects can be routinely handled without jamming the grinder or clogging the pump or piping system. The grinder pump will discharge this slurry at a maximum rate of 15 gpm or 11 gpm at a pressure of 40 psig. Transporting sewage several thousand feet to a discharge point at a higher elevation is possible as long as the sum of the static and friction losses does not exceed design limits of 185 feet TDH (80 psig).

The grinder pump is actuated when the depth of the sewage in the tank reaches a predetermined “turn-on” level, and pumping continues until the “turn off” level is reached. The pump’s running time is short, power consumption is low, and long pump life is ensured. The unit is protected against backflow from discharge lines by an integral check valve. Several grinder pump station models are available to satisfy various total and peak demand conditions.

Pump Type

The semi-positive displacement pump in the grinder pump station has a nearly vertical H-Q curve. This is the best type of pump for successful parallel operation of many pumps into a system of common low pressure mains. Since each pump will be located at a different point along common low pressure mains and at various elevations, each pump should operate in an efficient and predictable manner, whether one pump or numerous pumps are operating at a given moment; the pumps in such a system do not have a single fixed “operating point,” but must operate consistently over a wide range of heads that are continually, and often rapidly, changing.

The Environment One grinder pump has the capability of operating above the LPS system design criteria of 80 psig, or 185 feet (Figure 1). Based on the maximum daily number of pumps operating simultaneously (Table 3) versus the number of pumps connected to the system at the design pressure of 185 feet, the capability to operate significantly above the system’s design pressure is mandatory in order for the system to operate properly during the approximately bimonthly peaks when the “absolute maximum” numbers of pumps are operating. This feature also ensures that pumping will continue under those conditions when higher–than–normal pressure occurs in the pipeline.

System designs with calculated heads approaching the upper limits of recommended heads should be reviewed by Environment One application specialists. Contact your local Environment One Regional Sales Office or authorized distributor for a no-cost, computerized review of your design.

Occasionally during “normal” operation, there will be short periods when higher-than-design pressures will be experienced. These can result from a variety of causes including solids buildup (obstructions) or air bubbles.

Deposits of solids or air accumulation will be purged from the line since the pump continues to produce an essentially constant flow, even though the cross section of the pipeline has temporarily been reduced. Higher velocities through the reduced cross section will provide the scouring action needed to correct such conditions as soon as they start to appear.

These higher–than–expected pressure conditions are transitory occurrences. The only requirement is that no damage be done to the pumping equipment, pipelines or appurtenances during these occasional short periods. Environment One grinder pumps are driven by motors rated for continuous operation at 104 F/40 C above ambient temperature. They can operate at 50 percent above rated pressure for at least 5 minutes without excessive temperature rise. Based on the Albany, New York, demonstration project[4], for this type of overload to last even as long as one minute would be rare.

Motor Selection

A grinder pump station is an electromechanical system that depends on electric power for its operating, control and alarm functions. The design and selection of Environment One’s pump, motor, grinder and level–sensing controls were accomplished by optimizing the wastewater transport function of the unit within the necessary constraints for unattended, trouble–free operation in a residential environment.

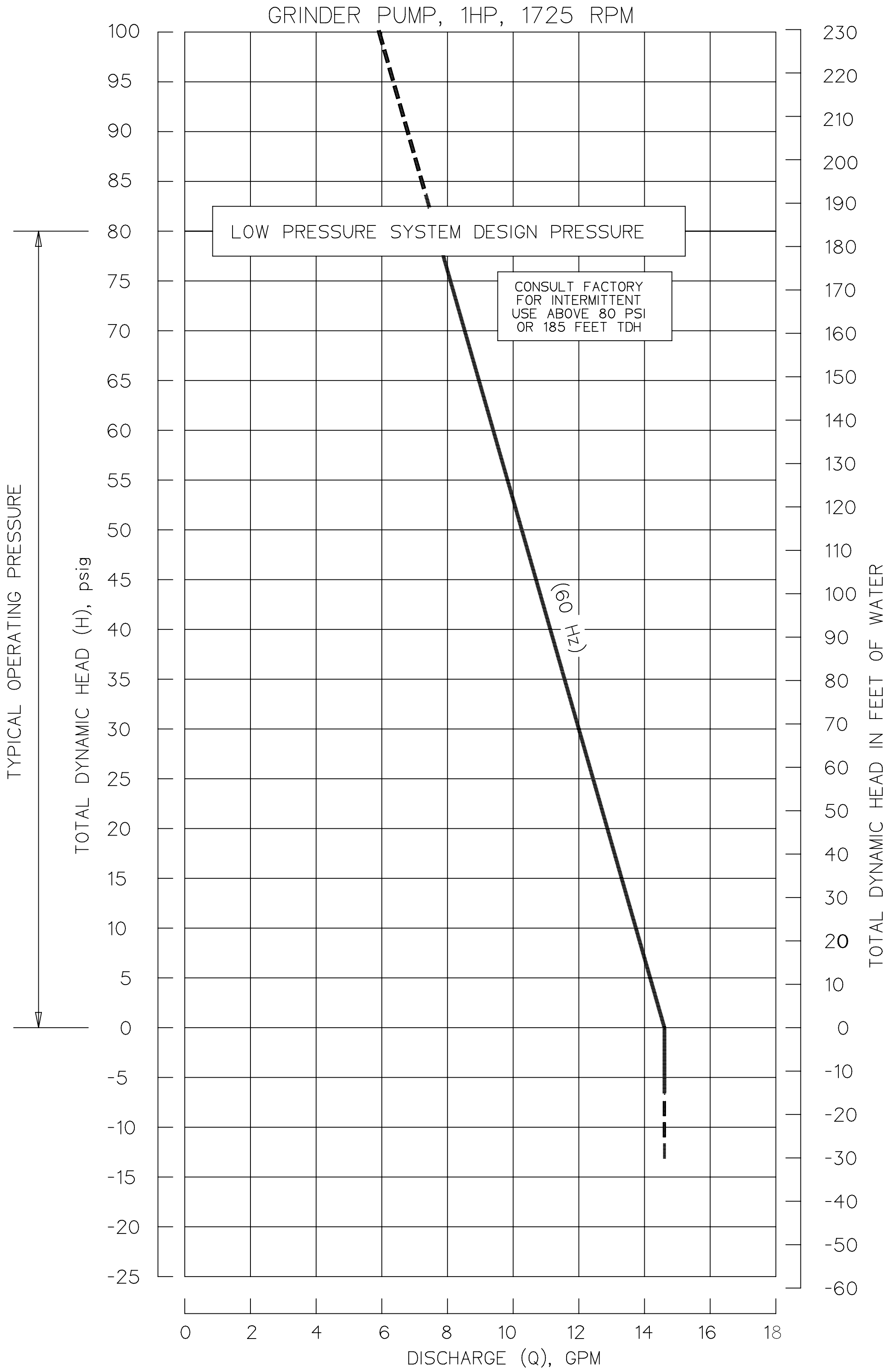
A single grinder pump core is common to all models of Environment One grinder pumps (models DH071, DH151, DH152, DH272 and DH502). This central core contains all of the working and control elements of the unit and is powered by a 1 hp, 240v (or 120v), 1,725 rpm capacitor start, thermally protected induction motor. Each of these motor features was carefully considered in the design of the grinder pump station.

The pump should be considered as a residential appliance. For this reason, performing the grinding and pumping functions using no more than 1 hp to permit occasional use at 120v in older homes not wired for 240v is desirable. In order to achieve the high heads desired and provide constant flow at varying heads, the 1-hp motor is coupled to a pump of semi-positive displacement design (Figure 1).

At a rating of 1 hp and 1,725 rpm, the Environment One grinder pump develops more than 8.4 foot-pounds of torque. Motors used to drive centrifugal pumps are often rated at 2.0 hp at 3,450 rpm and may produce less torque. When handling residential sewage, grinding torque may be demanded during any portion of the starting or running cycle. When the pump stops (controlled by level) in the midst of grinding hard objects (e.g. tongue depressors, plastic items, etc.), it must, upon restarting, be able to provide sufficient torque to the grinder to overcome the resistance of any object remaining from the previous cycle.

Figure 1

Grinder Pump Performance Characteristics



Power Outages

Environment One grinder pump stations have adequate excess holding capacity to provide wastewater storage during most electrical power outages (Figure 2). This excess holding capacity is shown on curve A. Data from the Federal Power Commission on national electrical power outages is plotted as a cumulative distribution function (curve B). Note that only volume above the normal “turn-on” level was counted as available storage. The average flow of 1.54 gallons/hour/person is based on the actual measured flow over a one-year period at the Albany Demonstration Project[4].

The local electrical power utility should be contacted to obtain a history on the power interruptions of the feeder(s) scheduled to serve the low pressure sewer site. From this data, curve B should be replotted to reflect local conditions. In those rare local areas where the frequency and/or the duration of outages exceed 7.5 hours, the use of Model DH151, with its greater holding capacity than that of the DH071, could be considered.

When power has been restored after a power outage, it is likely that nearly all the pumps in the system will try to operate simultaneously. Under these conditions, the dynamic head loss component of the total head will rise significantly. A number of pumps in the system would see a total back pressure high enough to cause the thermal overload protectors to automatically trip in a few minutes. Operation under conditions that could cause damage to the pumps or the system would be avoided. While these pumps are offline, other pumps in the system would be able to empty their tanks. After one to two minutes, the group that tripped off on thermal overload would cool and restart. The system back pressure would have been reduced and the group would be able to pump down normally. This process repeats itself automatically under the influence of each unit’s own thermal protector, reliably restoring the system to normal operation.

Power Consumption

Monthly power consumption of a residential grinder pump station is substantially less than that of other major appliances. The power consumption will vary based on the system operating parameters. The monthly cost can be approximated using the following equation and operating data:

$$\frac{{}^{*}\,\text{Watts} \times \text{GPD} \times \text{Days/Mo}}{{}^{**}\,\text{GPM} \times 60\text{ min} \times 1000} = \text{kwhr per month}$$

Discharge Pressure (PSI)	0	25	60	80
* Watts	690	770	1100	1400
** Flow (GPM)	15	12.4	9.3	7.7

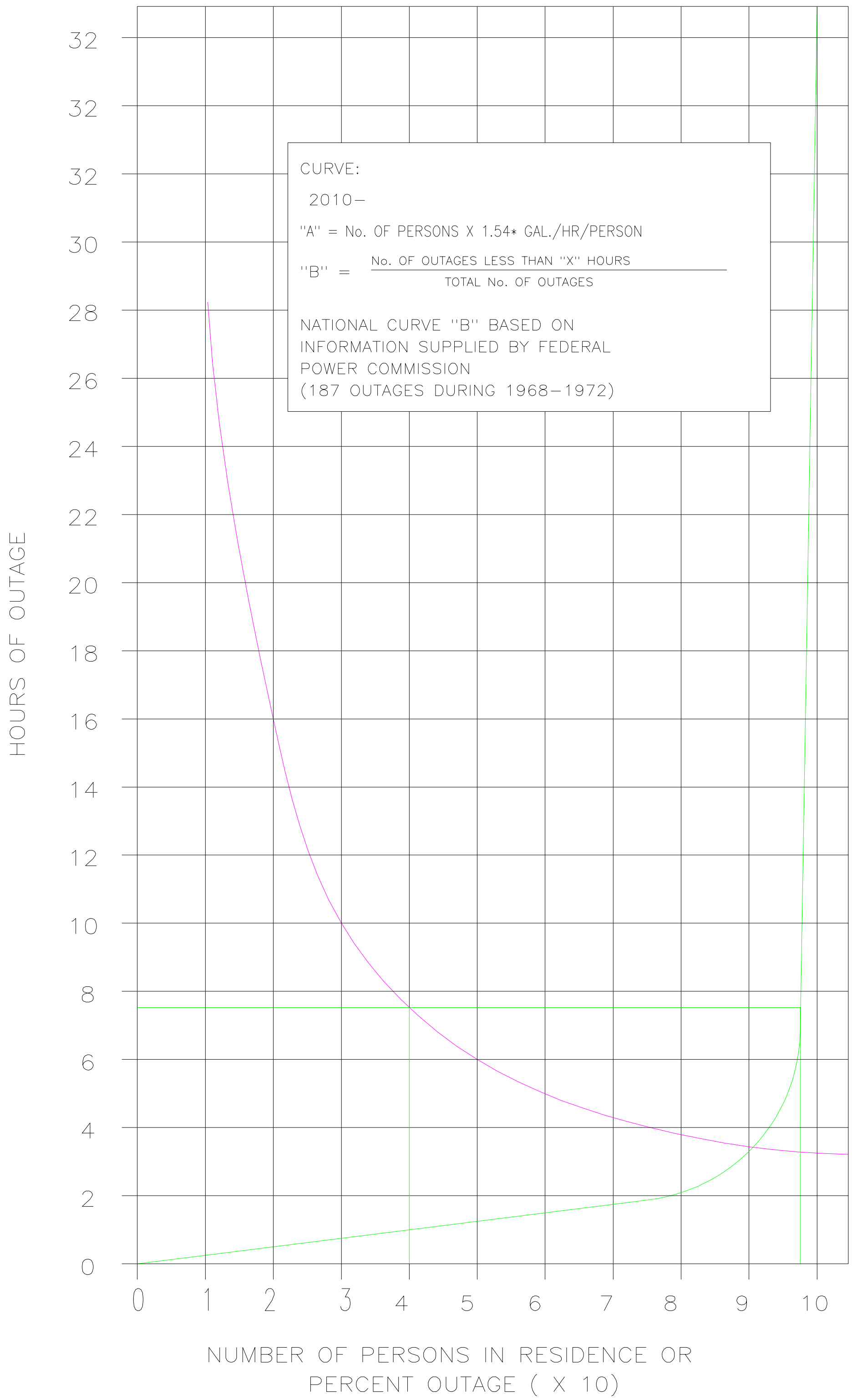
As an example of the calculation for a typical single-family home using 250 GPD, pumping at 25 psi is:

$$\frac{770\text{ W} \times 250\text{ GPD} \times 30\text{ Days}}{12.4\text{ GPM} \times 60\text{ min} \times 1000} = 7.76\text{ kwhr per month}$$

Then, multiply the kilowatt hours by the current cost of electricity and you will have an approximate monthly cost of running the unit.

Figure 2

Relationship of GP Storage Capacity to Power Outage Experience



EXAMPLE:

1. GP 2010 INSTALLED
2. FOUR PERSONS IN RESIDENCE
3. FOLLOW VERTICAL LINE 4 UPWARD TO CURVE "A" FOR GP 2010
4. HORIZONTALLY LEFT SHOWS 7–1/2 HOURS OF STORAGE CAPACITY
5. HORIZONTALLY RIGHT TO CURVE "B"
6. VERTICALLY DOWN SHOWS 97% OF THE NATIONS OUTAGES ARE SATISFIED

LPS System Design

Once the initial analysis of a project has confirmed the feasibility of using the low-pressure approach, the completion of a preliminary system design is straightforward. This is primarily a result of two characteristics of E/One's semi-positive displacement pump: near-constant flow over the entire range of operating pressures and the ability of the pump to handle transient overpressures.

The balance of this section outlines a systematic approach to LPS system design, leading from pump model and pipe selection to a detailed zone and system analysis.

Information Required

The information that should be assembled prior to initiation of the LPS system design includes:

- Topography map
- Soil conditions
- Climatic conditions (frost depth, low temperature and duration)
- Water table
- Applicable codes
- Discharge location
- Lot layout (with structures shown, if available)
- Total number of lots
- Dwelling type(s)
- Use and flow factors (seasonal occupancy or year-round, appliances, water supply sources)
- Area development sequence and timetable

Grinder Pump Station Size Selection

Use this table to select grinder pump models for the types of occupancy to be served.

Model	Recommended Flow (gpd)	Adequate for Managing …
DH071	up to 700	Flow from one average single-family home, and up to two average, single-family homes where codes allow and with consent of the factory.
DH151	up to 1,500	Flow from up to two average single-family homes, and up to six average, single-family homes where codes allow and with consent of the factory.
DH152	up to 3,000	Flow from up to four average single-family homes, and up to 12 average, single-family homes with consent of the factory.
DH272	up to 5,000	Flow from up to six average single-family homes, and up to 20 average, single-family homes with consent of the factory.
DH502	up to 6,000	Flow from up to nine average single-family homes,

and up to 24 average, single-family homes with consent of the factory.

Considerations include:

- Wetwell and discharge piping must be protected from freezing
- Model and basin size must be appropriate for incoming flows, including peak flows
- Appropriate alarm device must be used
- Suitable location

Daily flows above those recommended may exceed the tank's peak flow holding capacity and/or shorten the interval between pump overhauls. The company should be consulted if higher inflows are expected.

The final selection will have to be determined by the engineer on the basis of actual measurements or best estimates of the expected sewage flow.

Grinder Pump Placement

The most economical location for installation of the grinder pump station is in the basement of the building it will serve. However, due consideration must be given when choosing an indoor location. If there is a risk of damage to items located in the basement level, other provisions should be made during basement installation or an outdoor unit should be considered.

Considerations such as ownership of the pumps by a municipality or private organization and/or the need for outdoor accessibility frequently dictate outdoor, in-ground installations. For outdoor installations, all GP models are available with high density polyethylene (HDPE) integral accessways ranging in height up to 10 feet. By keeping the unit as close as possible to the building, the lengths of gravity sewer and wiring will be minimized, keeping installation costs lower while reducing the chances of infiltration in the gravity flow section.

AC power from the building being served should be used for the grinder pump. Separate power sources add to installation and O&M costs, decrease overall reliability and frequently represent an aesthetic issue.

When two dwellings are to be served by a single unit, the station is usually placed in a position requiring the shortest gravity drains from each home. With multi-family buildings, more than one grinder pump may be required.

Pipe Selection

The final determination of the type of pipe to be used is the responsibility of the consulting engineer. In addition, the requirements of local codes, soil, terrain, water and weather conditions that prevail will guide this decision.

Although pipe fabricated from any approved material may be used, most LPS systems have been built with PVC and HDPE pipe. Continuous coils of small-diameter, HDPE pipe can be installed with automatic trenching machines and horizontal drilling machines to sewer areas at lower cost.

Table 1 **PIPE WATER CAPACITY** *Gallons/100 feet of Pipe Length*			
Nominal Pipe Size (in.)	Sch 40 PVC	SDR 21 PVC	SDR 11 HDPE
1 1/4	7.8	9.2	7.4
1 1/2	10.6	12.1	9.9
2	17.4	18.8	15.4
2 1/2	23.9	27.6	—
3	38.4	40.9	33.5
4	66.1	67.5	55.3
5	103.7	103.1	84.5
6	150.0	146.0	119.9
8	260.0	249.0	203.2

Table 2 **PVC PIPE COMPARISONS** *Nominal Pipe Size = 2 in.*		
Parameter	**Sch 40**	**SDR 21**
Wall Thickness, in.	0.154	0.113
Inside Diameter, in.	2.067	2.149
50 gpm Friction Loss, ft/100 ft	4.16	3.44

Table 1 compares the water capacity of two types of PVC pipe commonly used: SDR-21 and Sch 40, and one type of HDPE, SDR-11. All three have adequate pressure ratings for low pressure sewer service.

Although both types of PVC pipes are suitable, the three parameters compared in Table 2 illustrate why SDR-21 is suggested as a good compromise between capacity, strength, friction loss characteristics and cost.

System Layout

A preliminary sketch of the entire pressure sewer system should be prepared (Figure 3). Pump models should be selected and their location (elevation) should be noted. The location and direction of flow of each lateral, zone and main, and the point of discharge should be shown.

The system should be designed to give the shortest runs and the fewest abrupt changes in direction. “Loops” in the system must be avoided as they lead to unpredictable and uneven distribution of flow.

Although not shown in Figure 3, the elevation of the shutoff valve of the lowest-lying pump in each zone should be recorded and used in the final determination of static head loss. Since Environment One grinder pumps are semi-positive displacement and relatively insensitive to changes in head, precisely surveyed profiles are unnecessary.

Air/vacuum valves, air release valves and combination air valves serve to prevent the concentration of air at high points within a system. This is accomplished by exhausting large quantities of air as the system is filled and also by releasing pockets of air as they accumulate while the system is in operation and under pressure. Air/vacuum valves and combination air valves also serve to prevent a potentially destructive vacuum from forming.

Air/vacuum valves should be installed at all system high points and significant changes in grade. Combination air valves should be installed at those high points where air pockets can form. Air release valves should be installed at intervals of 2,000 to 2,500 feet on all long horizontal runs that lack a clearly defined high point.

Air relief valves should be installed at the beginning of each downward leg in the system that exhibits a 30-foot or more drop. Trapped pockets of air in the system not only add static head, but also increase friction losses by reducing the cross sectional area available for flow. Air will accumulate in downhill runs preceded by an uphill run.

Long ascending or descending lines require air and vacuum or dual-function valves placed at approximately 2000-foot intervals. Long horizontal runs require dual function valves placed at approximately 2000-foot intervals.

Pressure air release valves allow air and/or gas to continuously and automatically released from a pressurized liquid system. If air or gas pockets collect at the high points in a pumped system, then those pressurized air pockets can begin to displace usable pipe cross section. As the cross section of the pipe artificially decreases, the pump sees this situation as increased resistance to its ability to force the liquid through the pipe.

Air relief valves at high points may be necessary, depending on total system head, flow velocity and the particular profile. The engineer should consult Environment One in cases where trapped air is considered a potential problem.

Cleanout and flushing stations should be incorporated into the pipe layout. In general, cleanouts should be installed at the terminal end of each main, every 1,000 to 1,500 feet on straight runs of pipe, and whenever two or more mains come together and feed into another main.

Zone Designations

The LPS system illustrated in Figure 3 contains 72 pumps and is divided into 14 individually numbered zones. Division into zones facilitates final selection of pipe sizes, which are appropriate in relation to the requirements that flow velocity in the system is adequate and that both static and dynamic head losses are within design criteria. Assignment of individual zones follows from the relationship between the accumulating total number of pumps in a system to the predicted number that will periodically operate simultaneously (Table 3).

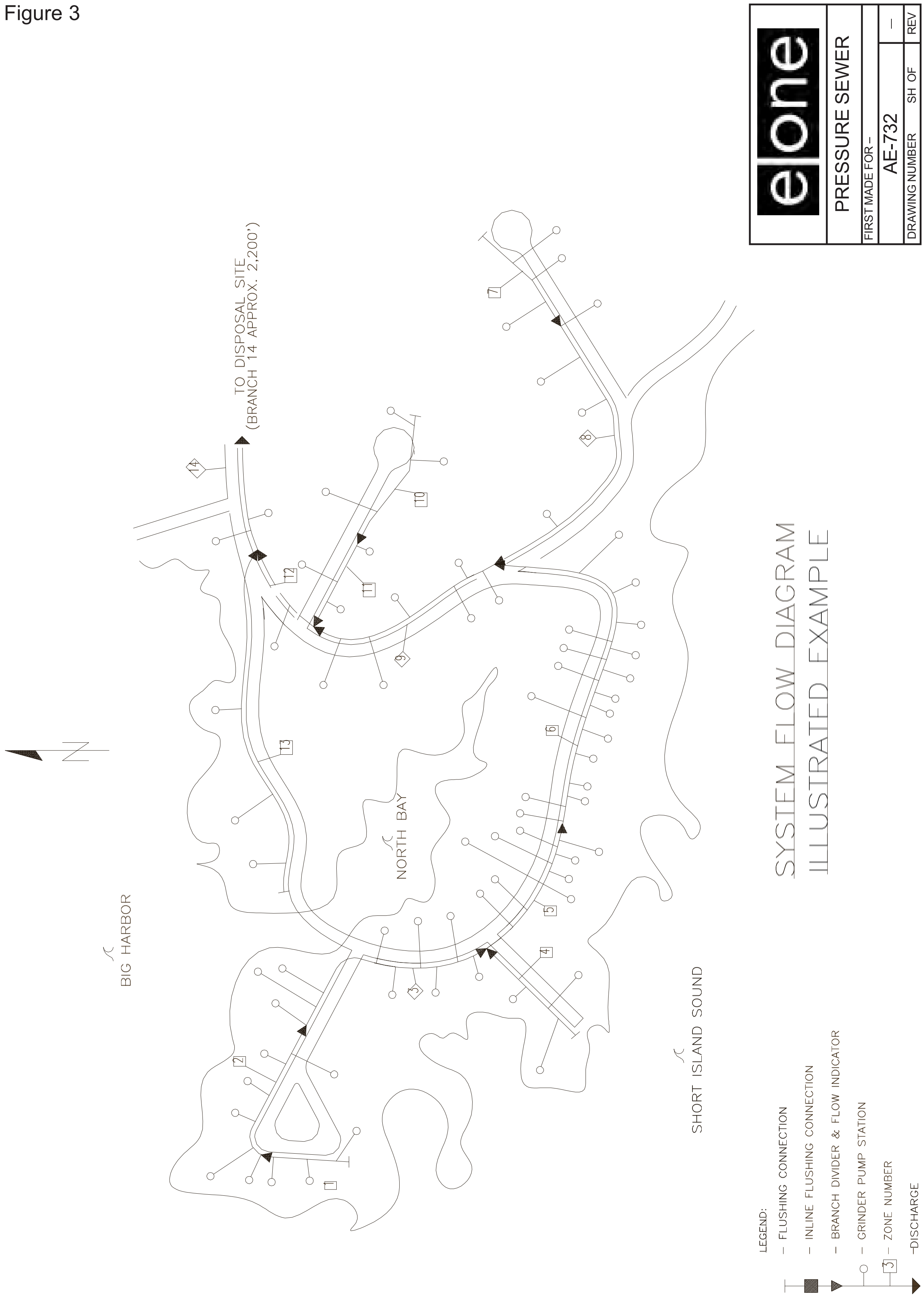
Table 4 was initially developed after careful analysis of more than 58,000 pump events in a 307-day period during the Albany project (4). It was extended for larger systems by application of probability theory. The validity of this table has since been confirmed by actual operating experience with thousands of large and small LPS systems during a 34-year period.

Using Figure 3, the actual exercise of assigning zones is largely mechanical. The single pump farthest from the discharge point in any main or lateral constitutes a zone. This and downstream pumps along the main are accumulated until their aggregate number is sufficient to increase the number of pumps in simultaneous operations by one, i.e., until the predicted maximum flow increases by 11 gpm.

Figure 3 shows that zones 1, 2 and 3 end when the number of pumps connected total 3, 6 and 9, and the number of pumps in daily simultaneous operation are 2, 3 and 4, respectively.

Any place where two or more sections of main join, or where the outfall is reached, also determines the end of a zone. This design rule takes precedence over the procedure stated above, as seen in

Figure 3



e|one
PRESSURE SEWER
FIRST MADE FOR –
AE-732
DRAWING NUMBER
SH OF
REV
SYSTEM FLOW DIAGRAM
ILLUSTRATED EXAMPLE
TO DISPOSAL SITE
(BRANCH 14 APPROX. 2,200')
N
BIG HARBOR
NORTH BAY
SHORT ISLAND SOUND
LEGEND:
– FLUSHING CONNECTION
– INLINE FLUSHING CONNECTION
– BRANCH DIVIDER & FLOW INDICATOR
– GRINDER PUMP STATION
3 – ZONE NUMBER
–DISCHARGE

zones 3, 4, 6, 8, 9, 11, 12, 13 and 14.

Completion of Pipe Schedule and Zone Analysis

The data recorded on the System Flow Diagram (Figure 3) is then transferred to Table 4.

Table 4 Column No.	Designation
1	Zone Number
2	Connects to Zone
3	Number of Pumps in Zone
4	Accumulated Pumps in Zone
11	Length of Main this Zone in Feet

Column 4 is completed by referring to Table 3, where the maximum number of pumps in simultaneous operation is given as a function of the number of pumps upstream from the end of the particular zone. The output of each zone will vary slightly with head requirements, but under typical conditions, the flow is approximately 11 gpm. Calculate the maximum anticipated flow for each zone by multiplying the number of simultaneous operations in Column 7 by 11 gpm and record the results in Column 8.

To complete columns 9, 10, 12 and 13, refer to Flow Velocity and Friction Head Loss table for the type of pipe selected — in this case, Table 5 for SDR-21. It will be seen that the engineer will frequently be presented with more than one option when selecting pipe size. Sometimes a compromise in pipe size will be required to meet present needs as well as planned future development. As a general rule, pipe sizes should be selected to minimize friction losses while keeping velocity near or above 2 feet per second.

For example, Zone 1 has a maximum of two pumps running (Column 7). Table 5 offers a choice of 1.25-inch, 1.5-inch or 2-inch pipe. 1.5-inch pipe is selected since flow velocity equals

Table 3
MAXIMUM NUMBER OF GRINDER PUMP CORES OPERATING DAILY

Number of Grinder Pump Cores Connected	Maximum Daily Number of Grinder Pump Cores Operating Simultaneously
1	1
2–3	2
4–9	3
10–18	4
19–30	5
31–50	6
51–80	7
81–113	8
114–146	9
147–179	10
180–212	11
213–245	12
246–278	13
279–311	14
312–344	15
345–377	16
378–410	17
411–443	18
444–476	19
477–509	20
510–542	21
543–575	22
576–608	23
609–641	24
642–674	25
675–707	26
708–740	27
741–773	28
774–806	29
807–839	30
840–872	31
873–905	32
906–938	33
939–971	34
972–1,004	35

BY:

DATE:

PIPE: SDR 21 PVC

PREPARED FOR:

PRELIMINARY LOW-PRESSURE SEWER SYSTEM PIPE SCHEDULE AND ZONE ANALYSIS OF:

Illustrated Example
Table 4

Environment/One
CORPORATION

AE

SHEET NO. OF

REV

1 ZONE NO.	2 CONN. TO ZONE	3 NO. PUMPS IN ZONE	4 ACCUM. PUMPS IN ZONE	5 GAL/DAY PER CORE	6 MAX. FLOW PER CORE	7 MAX. SIM OPS	8 MAX. FLOW (gpm)	9 PIPE SIZE (in)	10 MAX. VELOCITY (FPS)	11 LENGTH OF MAIN THIS ZONE	12 FRICTION LOSS FACTOR (ft/100 ft)	13 FRICTION LOSS THIS ZONE	14 ACCUM. FRICTION LOSS (ft)	15 MAX. MAIN ELEV.	16 MIN. PUMP ELEV.	17 STATIC HEAD (ft)	18 TOTAL DYNAMIC HEAD (ft)
1	2	3	3	200	11	2	22	1.5	3.04	205	2.15	4.41	73.41	40	10	30	103.41
2	3	6	9	200	11	3	33	2.0	2.92	380	1.54	5.86	69.00	40	10	30	99.00
3	5	9	18	200	11	4	44	2.0	3.89	630	2.63	16.56	63.14	40	5	35	98.14
4	5	3	3	200	11	2	22	1.5	3.04	310	2.15	8.46	53.25	40	5	35	88.25
5	6	9	30	200	11	5	55	3.0	2.24	800	0.60	4.83	46.58	40	5	35	81.58
6	9	17	47	200	11	6	66	3.0	2.69	1,000	0.85	8.46	41.75	40	5	35	76.75
7	8	3	3	200	11	2	22	1.5	3.04	175	2.15	3.77	49.56	40	5	35	84.56
8	9	4	7	200	11	3	33	2.0	2.92	810	1.54	12.50	45.80	40	30	10	55.80
9	12	6	60	200	11	7	77	3.0	3.14	520	1.12	5.85	33.30	40	10	30	63.30
10	11	3	3	200	11	2	22	1.5	3.04	230	2.15	4.95	37.03	40	10	30	67.03
11	12	3	6	200	11	3	33	2.0	2.92	300	1.54	4.63	32.08	40	10	30	62.08
12	14	1	67	200	11	7	77	3.0	3.14	240	1.12	2.70	27.45	40	10	30	57.45
13	14	3	3	200	11	2	22	1.5	3.04	985	2.15	21.19	45.94	40	5	35	80.94
14	14	2	72	200	11	7	77	3.0	3.14	2,200	1.12	24.75	24.75	40	30	10	34.75

3.04 ft/sec and friction loss equals 2.15 ft/100 ft. Since the zone is 205 feet in length (Column 11), the total friction loss (Column 13) is:

HF = (2.15 ft/100 ft)(205 ft) = 4.41 ft

For Zone 14, with 72 upstream pumps, it is seen that a maximum of seven pumps can be running simultaneously. Table 5 provides options of:

3-inch pipe: V = 3.14 ft/sec; HF = 1.12 ft/100 ft

or

4-inch pipe: V = 1.90 ft/sec; HF = 0.33 ft/100 ft

The smaller-diameter 3-inch pipe is selected because of the increased velocities, especially with the TDH below 185 feet. A choice of 3-inch pipe would lead to a friction loss in this zone of:

HF = (1.12 ft/100 ft) (2200 ft) = 24.75 ft

Accumulated friction loss (Column 14) for each zone is next determined by adding the friction loss for each zone from the system outfall (Zone 14) to the zone in question. Thus, from Figure 3 it is seen that the accumulated friction loss for Zone 1 is:

Zone Number	Friction Loss (ft)
14	24.75
12	2.70
9	5.85
6	8.46
5	4.83
3	16.56
2	5.86
1	4.41

73.41 ft = Accumulated friction loss, Zone 1

The same summation is completed for each zone.

To complete the hydraulic analysis, refer to the drawing contours and record in Column 15 the maximum line elevation between the point of discharge and the zone under consideration. In Column 16, record the elevation of the lowest pump in the zone. Subtract the values in Column 16 from those in Column 15 and record only positive elevation differentials in Column 17. Add the values in Column 14 to those in Column 17 and record the total in Column 18 to show the maximum combination of friction and static head a pump will experience at any given point in the system.

Review

The accumulated data in Table 4 should finally be reviewed for conformity with the criteria of flow velocity greater than or equal to 2.0 ft/sec and total design head less than or equal to 185 feet. If the system pressure exceeds 92 feet, the number of cores operating will remain the same and the flow from each pump will be reduced from 11 gpm to 9 gpm.

Data should be reviewed to determine whether system improvements could result from construction modifications. As an example, deeper burial of pipe in one or two critical high-elevation zones might bring the entire system into compliance with design criteria. Environment One should be consulted in marginal cases and/or concerning:

- Odor control issues
- Frost protection issues
- Excessive static head conditions
- Excessive total dynamic head conditions
- Unusual applications

Table 5
SDR 21 PVC PIPE

Flow Velocity and Friction Head Loss *vs* Pumps in Simultaneous Operation (C = 150)

	1 1/4 in.		1 1/2 in.		2 in.		2 1/2 in.		3 in.		4 in.		5 in.		6 in.		8 in.		
N	V	H_F	V	H_F	V	H_F	V	H_F	V	H_F	V	H_F	V	H_F	V	H_F	V	H_F	N
1	1.99	1.15	1.52	0.60															1
2	3.99	4.16	3.04	2.15	1.95	0.73													2
3	5.98	8.82	4.56	4.56	2.92	1.54	1.99	0.61											3
4	7.97	15.02	6.08	7.77	3.89	2.63	2.66	1.04	1.79	0.40									4
5					4.87	3.97	3.32	1.57	2.24	0.60									5
6					5.84	5.57	3.99	2.20	2.69	0.85									6
7					6.81	7.41	4.65	2.93	3.14	1.12	1.90	0.33							7
8							5.32	3.75	3.59	1.44	2.17	0.42							8
9							5.98	4.66	4.04	1.79	2.44	0.53							9
10							6.64	5.67	4.49	2.18	2.71	0.64							10
11									4.93	2.60	2.98	0.76	1.95	0.27					11
12									5.38	3.05	3.25	0.90	2.13	0.32					12
13									5.83	3.54	3.52	1.04	2.31	0.37					13
14									6.28	4.06	3.80	1.19	2.48	0.43					14
15											4.07	1.36	2.66	0.48	1.88	0.21			15
16											4.34	1.53	2.84	0.55	2.00	0.23			16
17											4.61	1.71	3.02	0.61	2.13	0.26			17
18											4.88	1.90	3.19	0.68	2.25	0.29			18
19											5.15	2.10	3.37	0.75	2.38	0.32			19
20											5.42	2.31	3.55	0.82	2.50	0.35			20
21											5.69	2.53	3.73	0.90	2.63	0.39			21
22											5.96	2.76	3.90	0.98	2.75	0.42			22
23											6.24	2.99	4.08	1.07	2.88	0.46			23
24													4.26	1.16	3.00	0.49			24
25													4.44	1.25	3.13	0.53			25
26													4.61	1.34	3.25	0.57			26
27													4.79	1.44	3.38	0.61	1.99	0.17	27
28													4.97	1.54	3.50	0.66	2.07	0.18	28
29													5.15	1.64	3.63	0.70	2.14	0.19	29
30													5.32	1.75	3.75	0.75	2.21	0.21	30
31													5.50	1.86	3.88	0.79	2.29	0.22	31
32													5.68	1.97	4.01	0.84	2.36	0.23	32
33													5.86	2.08	4.13	0.89	2.44	0.25	33
34													6.03	2.20	4.26	0.94	2.51	0.26	34
35													6.21	2.32	4.38	0.99	2.58	0.28	35
36															4.51	1.05	2.66	0.29	36
37															4.63	1.10	2.73	0.30	37
38															4.76	1.16	2.81	0.32	38
39															4.88	1.21	2.88	0.34	39
40															5.01	1.27	2.95	0.35	40
41															5.13	1.33	3.03	0.37	41
42															5.26	1.39	3.10	0.39	42
43															5.38	1.45	3.17	0.40	43
44															5.51	1.52	3.25	0.42	44
45															5.63	1.58	3.32	0.44	45
46															5.76	1.65	3.40	0.46	46
47															5.88	1.72	3.47	0.47	47
48															6.01	1.78	3.54	0.49	48
49															6.13	1.85	3.62	0.51	49
50															6.26	1.92	3.69	0.53	50

Head Loss Calculations
From Modified Hazen - Williams Formula

$$H_F = .2083 \left[\left(\frac{100}{C}\right)^{1.852} \times \frac{q^{1.852}}{d^{4.8655}} \right]$$

$$V = .3208 \frac{q}{A}$$

$$A = \frac{d^2\pi}{4}$$ = cross-sectional flow, sq. in.

C = 150
q = flow in gallons per minute
d = I.D. of pipe in inches =
[average O.D. - (2 x min. wall thickness]

N = Number of pumps operating at 11 gpm
V = Flow velocity in ft/sec
H_F = Friction head loss in ft/100 ft of pipe

Table 6
SCHEDULE 40 PVC PIPE

Flow Velocity and Friction Head Loss *vs* Pumps in Simultaneous Operation (C = 150)

	1 1/4 in.		1 1/2 in.		2 in.		2 1/2 in.		3 in.		4 in.		5 in.		6 in.		8 in.		
N	**V**	**H_F**	**V**	**H_F**	**V**	**H_F**	**V**	**H_F**	**V**	**H_F**	**V**	**H_F**	**V**	**H_F**	**V**	**H_F**	**V**	**H_F**	**N**
1	2.36	**1.74**	1.73	**0.82**	1.05	**0.24**													**1**
2	4.72	**6.28**	3.47	**2.97**	2.10	**0.88**	1.47	**0.37**											**2**
3	7.08	**13.31**	5.20	**6.29**	3.15	**1.86**	2.21	**0.79**											**3**
4			6.93	**10.71**	4.21	**3.18**	2.95	**1.34**	1.91	**0.46**									**4**
5					5.26	**4.80**	3.68	**2.02**	2.39	**0.70**									**5**
6					6.31	**6.73**	4.42	**2.83**	2.87	**0.99**									**6**
7							5.16	**3.77**	3.34	**1.31**	1.94	**0.35**							**7**
8							5.89	**4.83**	3.82	**1.68**	2.22	**0.45**							**8**
9							6.63	**6.01**	4.30	**2.09**	2.49	**0.56**							**9**
10									4.78	**2.54**	2.77	**0.68**							**10**
11									5.25	**3.03**	3.05	**0.81**	1.94	**0.27**					**11**
12									5.73	**3.56**	3.33	**0.95**	2.12	**0.32**					**12**
13									6.21	**4.13**	3.60	**1.10**	2.29	**0.37**					**13**
14											3.88	**1.26**	2.47	**0.42**					**14**
15											4.16	**1.43**	2.65	**0.48**					**15**
16											4.44	**1.62**	2.82	**0.54**	1.95	**0.22**			**16**
17											4.71	**1.81**	3.00	**0.60**	2.08	**0.25**			**17**
18											4.99	**2.01**	3.17	**0.67**	2.20	**0.27**			**18**
19											5.27	**2.22**	3.35	**0.74**	2.32	**0.30**			**19**
20											5.54	**2.44**	3.53	**0.81**	2.44	**0.33**			**20**
21											5.82	**2.67**	3.70	**0.89**	2.56	**0.36**			**21**
22											6.10	**2.91**	3.88	**0.97**	2.69	**0.40**			**22**
23													4.06	**1.05**	2.81	**0.43**			**23**
24													4.23	**1.14**	2.93	**0.47**			**24**
25													4.41	**1.23**	3.05	**0.50**			**25**
26													4.59	**1.32**	3.17	**0.54**			**26**
27													4.76	**1.42**	3.30	**0.58**			**27**
28													4.94	**1.52**	3.42	**0.62**	1.98	**0.16**	**28**
29													5.11	**1.62**	3.54	**0.66**	2.05	**0.17**	**29**
30													5.29	**1.72**	3.66	**0.70**	2.12	**0.19**	**30**
31													5.47	**1.83**	3.79	**0.75**	2.19	**0.20**	**31**
32													5.64	**1.94**	3.91	**0.79**	2.26	**0.21**	**32**
33													5.82	**2.06**	4.03	**0.84**	2.33	**0.22**	**33**
34													6.00	**2.17**	4.15	**0.89**	2.40	**0.23**	**34**
35													6.17	**2.29**	4.27	**0.94**	2.47	**0.25**	**35**
36															4.40	**0.99**	2.54	**0.26**	**36**
37															4.52	**1.04**	2.61	**0.27**	**37**
38															4.64	**1.09**	2.68	**0.29**	**38**
39															4.76	**1.15**	2.75	**0.30**	**39**
40															4.88	**1.20**	2.82	**0.32**	**40**
41															5.01	**1.26**	2.89	**0.33**	**41**
42															5.13	**1.31**	2.96	**0.35**	**42**
43															5.25	**1.37**	3.03	**0.36**	**43**
44															5.37	**1.43**	3.11	**0.38**	**44**
45															5.49	**1.49**	3.18	**0.39**	**45**
46															5.62	**1.56**	3.25	**0.41**	**46**
47															5.74	**1.62**	3.32	**0.43**	**47**
48															5.86	**1.68**	3.39	**0.44**	**48**
49															5.98	**1.75**	3.46	**0.46**	**49**
50															6.11	**1.81**	3.53	**0.48**	**50**

Head Loss Calculations
From Modified Hazen - Williams Formula

$$H_F = .2083 \left[\left(\frac{100}{C}\right)^{1.852} \times \frac{q^{1.852}}{d^{4.8655}} \right]$$

$$V = .3208 \frac{q}{A}$$

$$A = \frac{d^2\pi}{4}$$ = cross-sectional flow, sq. in.

C = 150
q = flow in gallons per minute
d = I.D. of pipe in inches =
[average O.D. - (2 x min. wall thickness]

N = Number of pumps operating at 11 gpm
V = Flow velocity in ft/sec
H_F = Friction head loss in ft/100 ft of pipe

Table 7
SDR 11 HDPE PIPE

Flow Velocity and Friction Head Loss *vs* Pumps in Simultaneous Operation (C = 155)

	1 1/4 in.		1 1/2 in.		2 in.		3 in.		4 in.		5 in.		6 in.		8 in.		
N	**V**	**H_F**	**V**	**H_F**	**V**	**H_F**	**V**	**H_F**	**V**	**H_F**	**V**	**H_F**	**V**	**H_F**	**V**	**H_F**	**N**
1	2.47	**1.84**	1.86	**0.92**													**1**
2	4.95	**6.63**	3.72	**3.32**	2.38	**1.12**											**2**
3	7.42	**14.04**	5.58	**7.03**	3.57	**2.37**	1.64	**0.36**									**3**
4			7.44	**11.98**	4.76	**4.04**	2.19	**0.61**									**4**
5					5.95	**6.11**	2.74	**0.92**									**5**
6					7.14	**8.56**	3.29	**1.30**	1.99	**0.38**							**6**
7							3.83	**1.72**	2.32	**0.51**							**7**
8							4.38	**2.21**	2.65	**0.65**							**8**
9							4.93	**2.75**	2.98	**0.81**	1.95	**0.29**					**9**
10							5.48	**3.34**	3.31	**0.98**	2.17	**0.35**					**10**
11							6.03	**3.98**	3.65	**1.17**	2.39	**0.42**					**11**
12									3.98	**1.38**	2.60	**0.49**					**12**
13									4.31	**1.60**	2.82	**0.57**	1.99	**0.24**			**13**
14									4.64	**1.83**	3.04	**0.65**	2.14	**0.28**			**14**
15									4.97	**2.08**	3.25	**0.74**	2.29	**0.32**			**15**
16									5.30	**2.35**	3.47	**0.84**	2.45	**0.36**			**16**
17									5.63	**2.63**	3.69	**0.94**	2.60	**0.40**			**17**
18									5.97	**2.92**	3.90	**1.04**	2.75	**0.44**			**18**
19									6.30	**3.23**	4.12	**1.15**	2.90	**0.49**			**19**
20											4.34	**1.27**	3.06	**0.54**			**20**
21											4.56	**1.39**	3.21	**0.59**			**21**
22											4.77	**1.51**	3.36	**0.64**	1.98	**0.18**	**22**
23											4.99	**1.64**	3.52	**0.70**	2.08	**0.19**	**23**
24											5.21	**1.77**	3.67	**0.76**	2.17	**0.21**	**24**
25											5.42	**1.91**	3.82	**0.82**	2.26	**0.23**	**25**
26											5.64	**2.06**	3.98	**0.88**	2.35	**0.24**	**26**
27											5.86	**2.21**	4.13	**0.94**	2.44	**0.26**	**27**
28											6.07	**2.36**	4.28	**1.01**	2.53	**0.28**	**28**
29													4.43	**1.08**	2.62	**0.30**	**29**
30													4.59	**1.15**	2.71	**0.32**	**30**
31													4.74	**1.22**	2.80	**0.34**	**31**
32													4.89	**1.29**	2.89	**0.36**	**32**
33													5.05	**1.37**	2.98	**0.38**	**33**
34													5.20	**1.44**	3.07	**0.40**	**34**
35													5.35	**1.52**	3.16	**0.42**	**35**
36													5.50	**1.60**	3.25	**0.44**	**36**
37													5.66	**1.69**	3.34	**0.47**	**37**
38													5.81	**1.77**	3.43	**0.49**	**38**
39													5.96	**1.86**	3.52	**0.52**	**39**
40													6.12	**1.95**	3.61	**0.54**	**40**
41															3.70	**0.57**	**41**
42															3.79	**0.59**	**42**
43															3.88	**0.62**	**43**
44															3.97	**0.65**	**44**
45															4.06	**0.67**	**45**
46															4.15	**0.70**	**46**
47															4.24	**0.73**	**47**
48															4.33	**0.76**	**48**
49															4.42	**0.79**	**49**
50															4.51	**0.82**	**50**

Head Loss Calculations
From Modified Hazen - Williams Formula

$$H_F = .2083 \left[\left(\frac{100}{C}\right)^{1.852} \times \frac{q^{1.852}}{d^{4.8655}} \right]$$

$$V = .3208 \frac{q}{A}$$

$$A = \frac{d^2\pi}{4} = \text{cross-sectional flow, sq. in.}$$

C = 150

q = flow in gallons per minute

d = I.D. of pipe in inches =
[average O.D. - (2 x min. wall thickness)]

N = Number of pumps operating at 11 gpm

V = Flow velocity in ft/sec

H_F = Friction head loss in ft/100 ft of pipe

References

1. Carcich, I., Hetling, L.J., and Farrell, R.P. “A Pressure Sewer System Demonstration,” EPA-R2-72-091, Office of Research and Monitoring, U.S. Environmental Protection Agency, Washington, D.C., November 1972.

2. Farrell, R.P. “Long-Term Observation of Wastewater Observation Stations,” TM-2, American Society of Civil Engineers, April 1968.

3. “Handbook of PVC Pipe: Design and Construction,” Uni-Bell PVC Pipe Association, Dallas, Texas, Second Edition, 1982.

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6. Tucker, L.S. “Hydraulics of a Pressurized Sewerage System and Use of Centrifugal Pumps,” TM-6, American Society of Civil Engineers, 1967.

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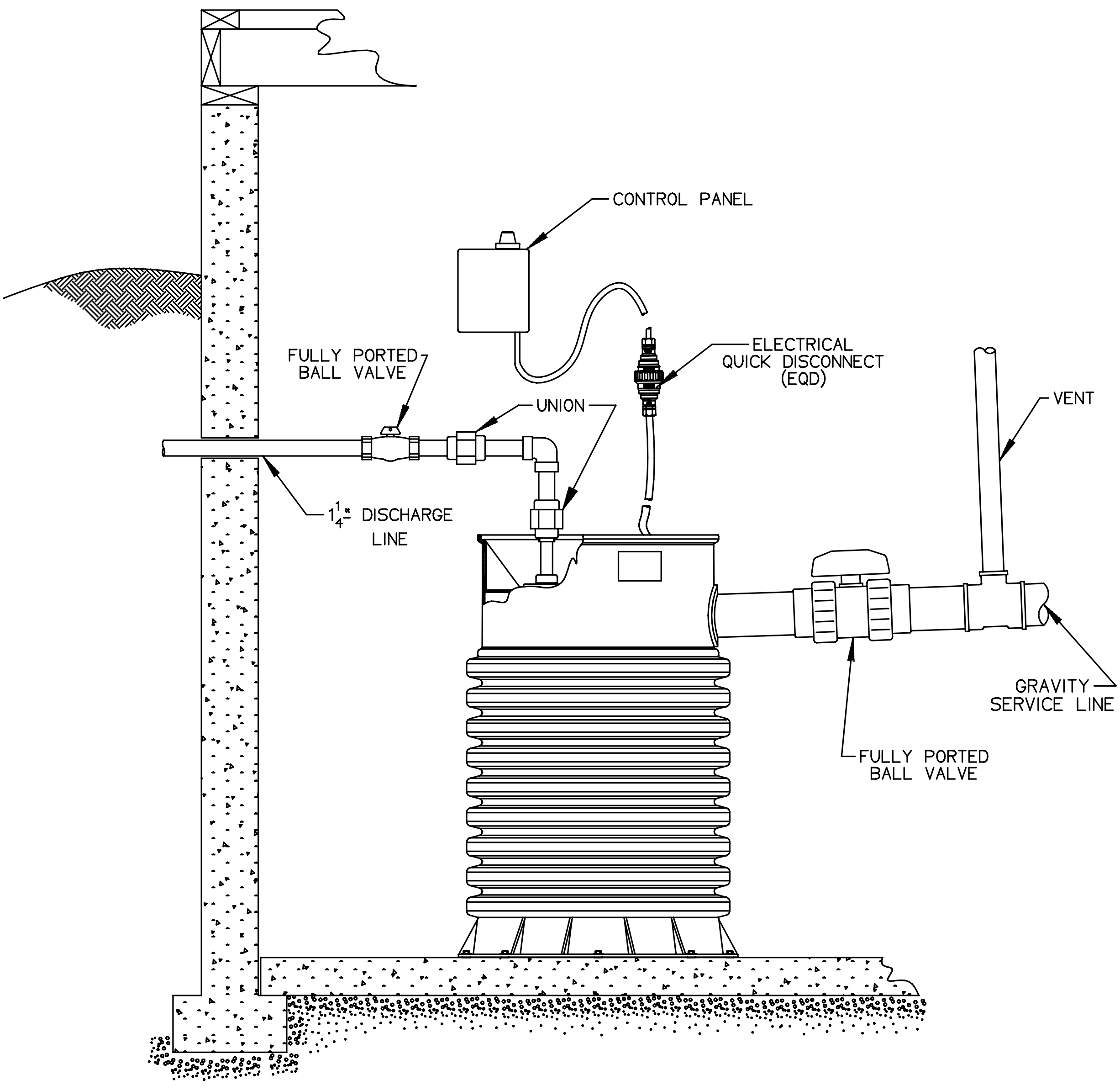
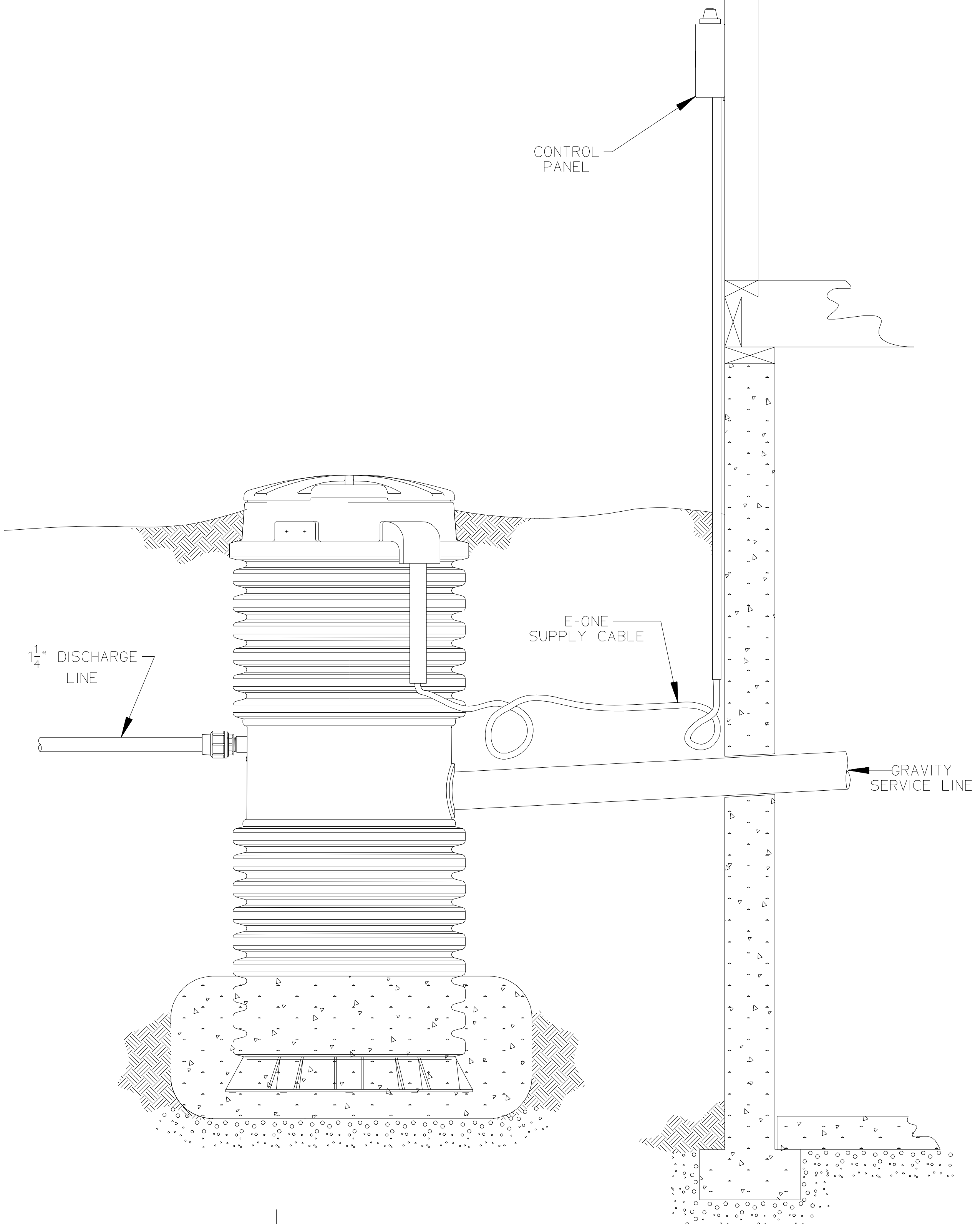
8. Waller, D.H. “Peak Flow of Sewage from Individual Homes,” TM-9, American Society of Civil Engineers, January 1968.

TYPICAL INDOOR INSTALLATION

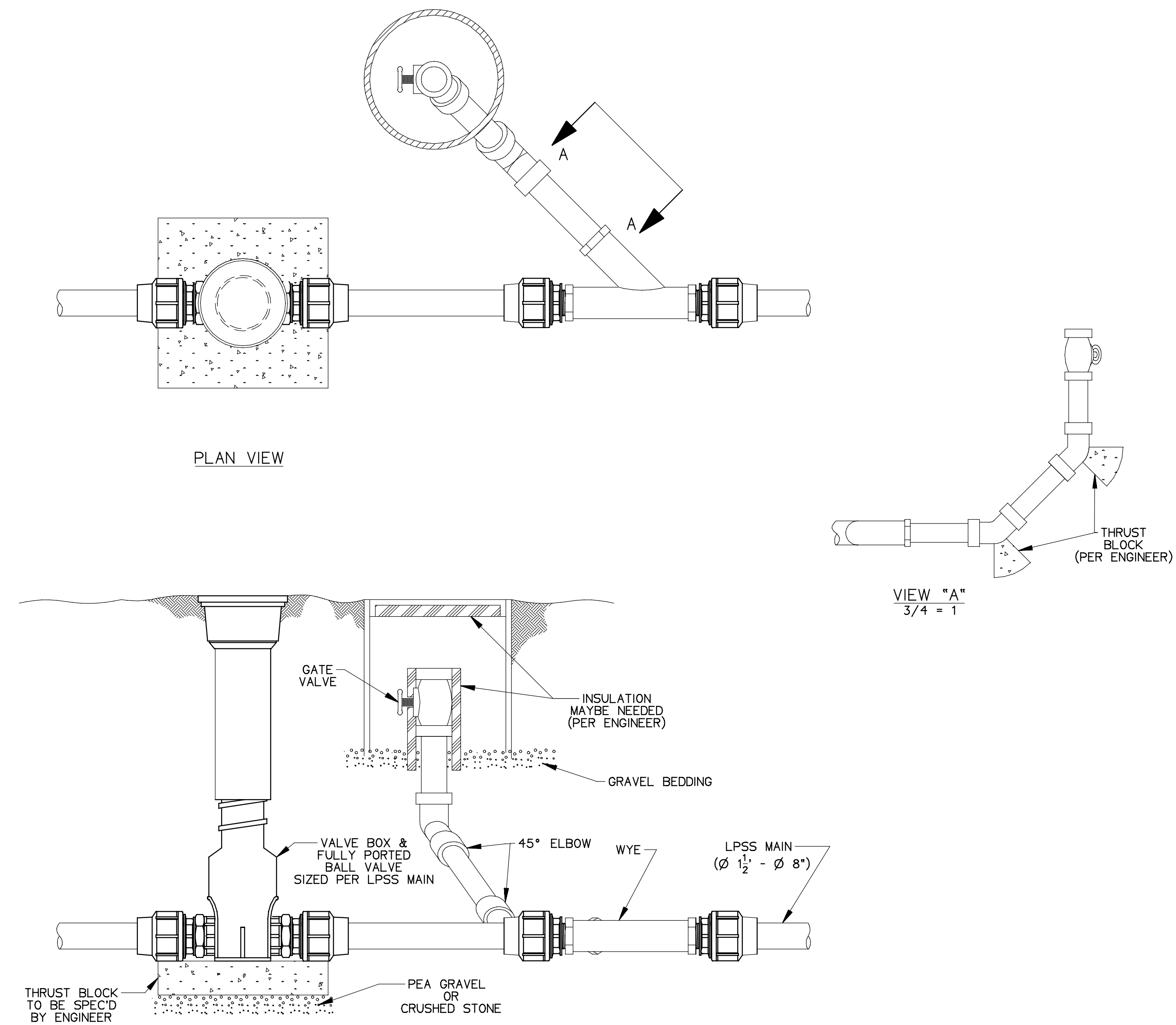


TYPICAL OUTDOOR INSTALLATION



environment | one
CORPORATION

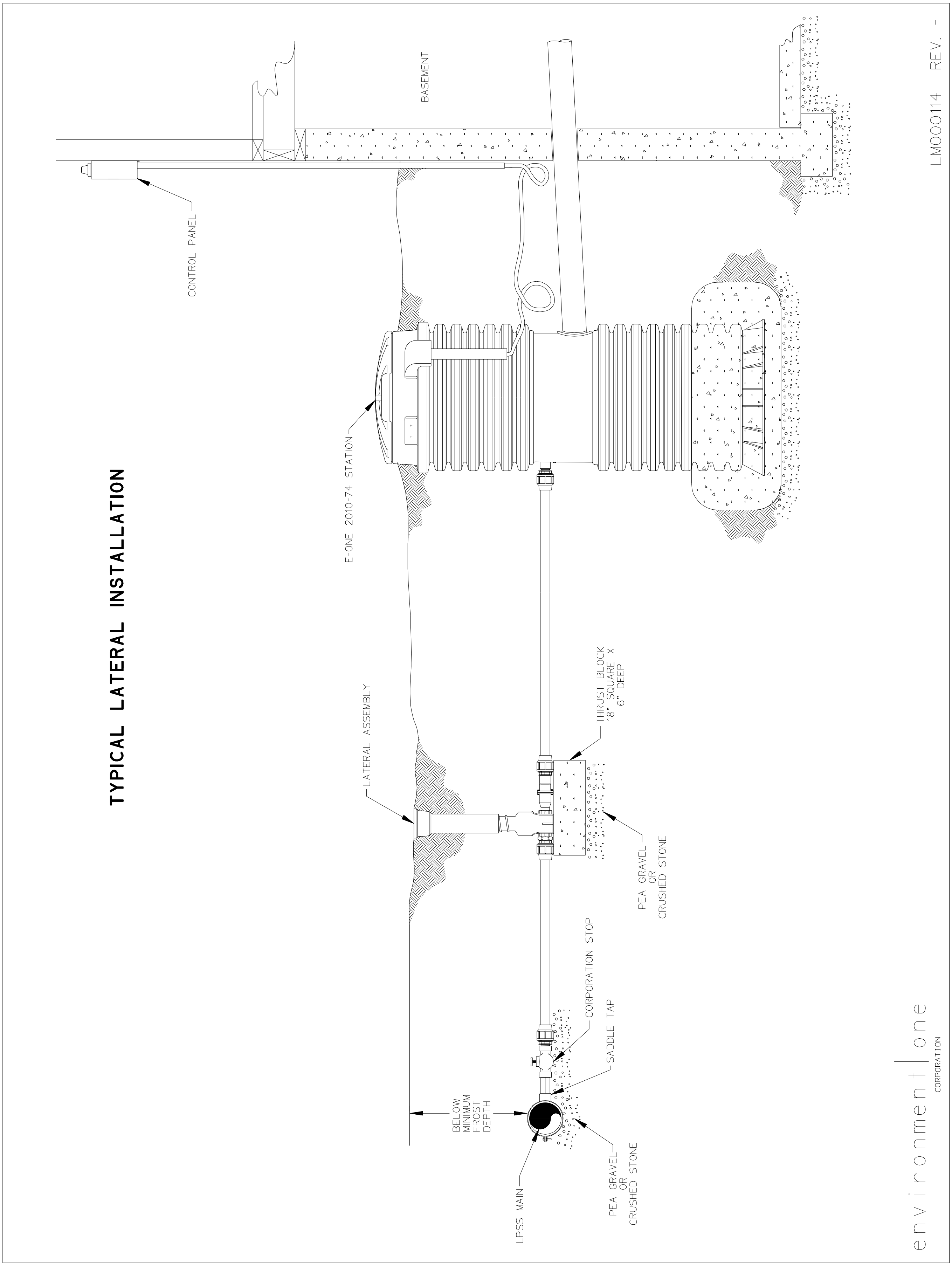
LM000112 REV. A



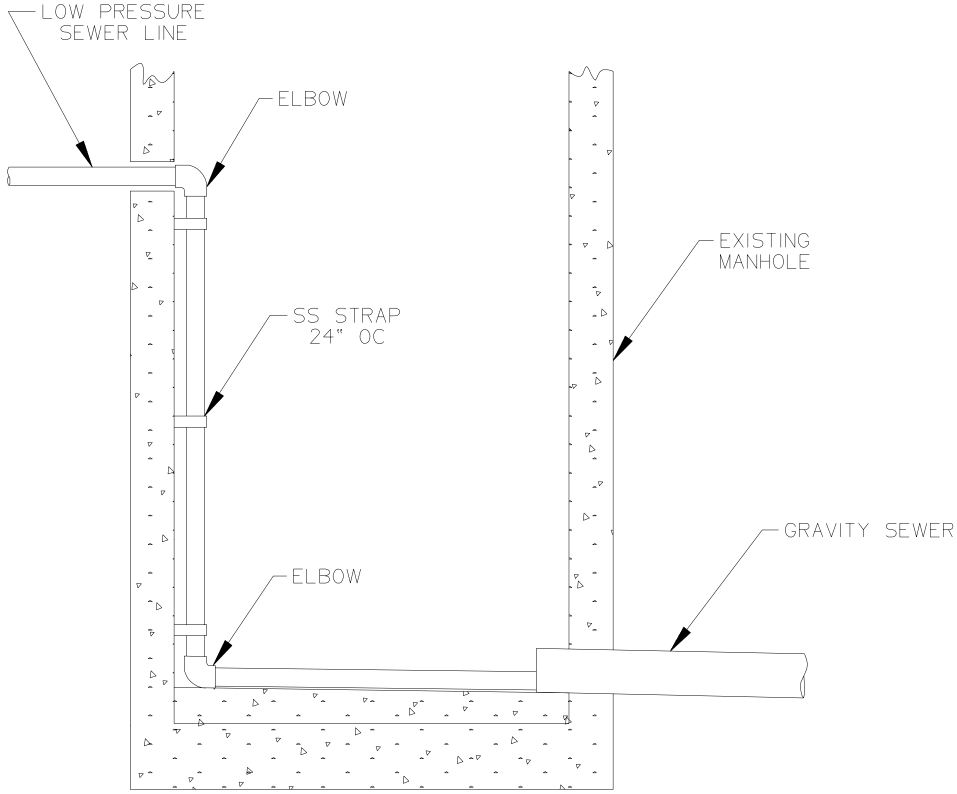
TYPICAL FLUSHING CONNECTION ON LPSS MAIN

environment|one
CORPORATION

LM000113 REV. A


TYPICAL LATERAL INSTALLATION
BASEMENT
CONTROL PANEL
E-ONE 2010-74 STATION
LATERAL ASSEMBLY
THRUST BLOCK 18" SQUARE X 6" DEEP
PEA GRAVEL OR CRUSHED STONE
CORPORATION STOP
SADDLE TAP
BELOW MINIMUM FROST DEPTH
LPSS MAIN
PEA GRAVEL OR CRUSHED STONE
LM000114 REV. -
environment one CORPORATION

TYPICAL DROP CONNECTION
LPSS IN EXISTING MANHOLE



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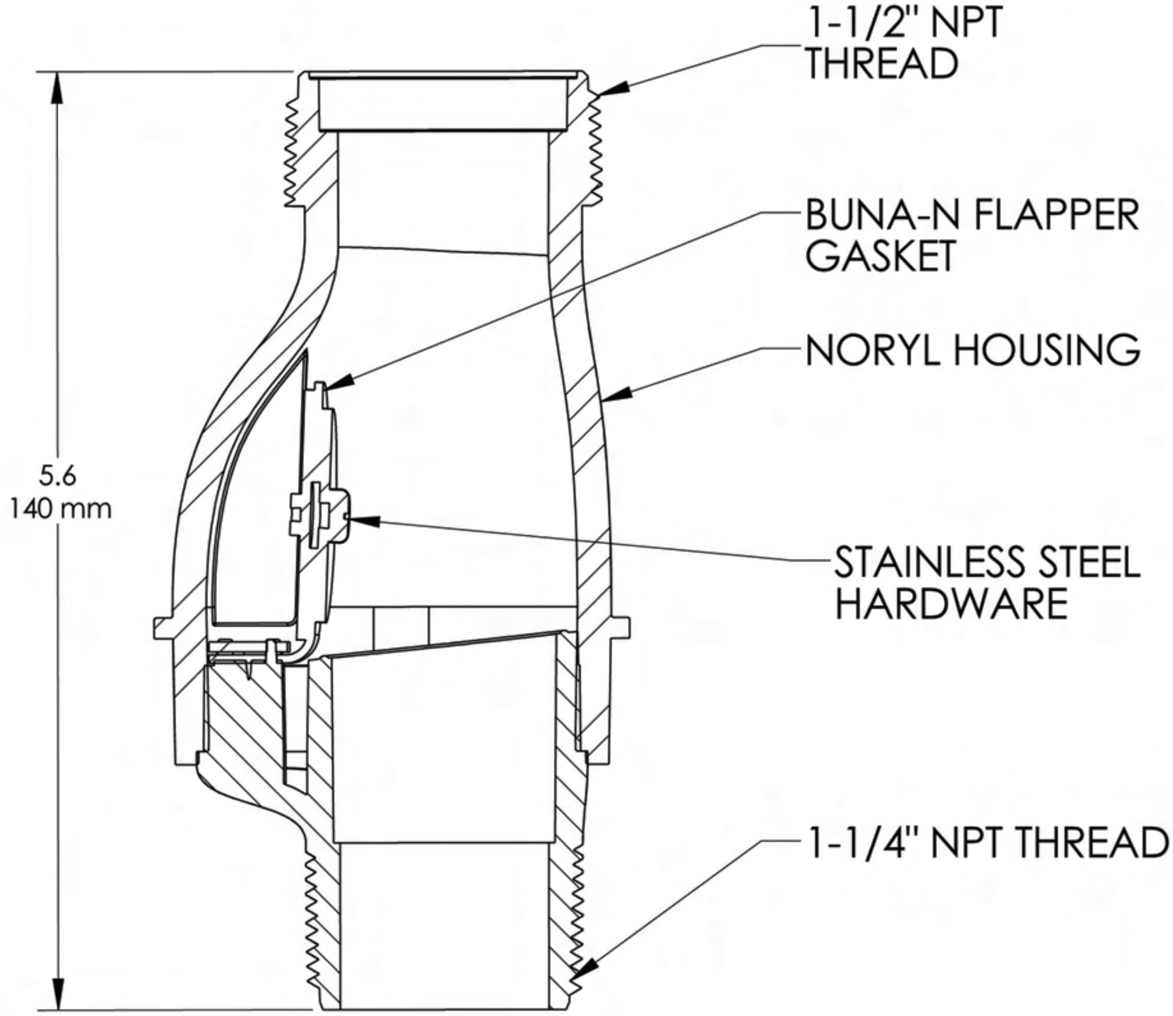
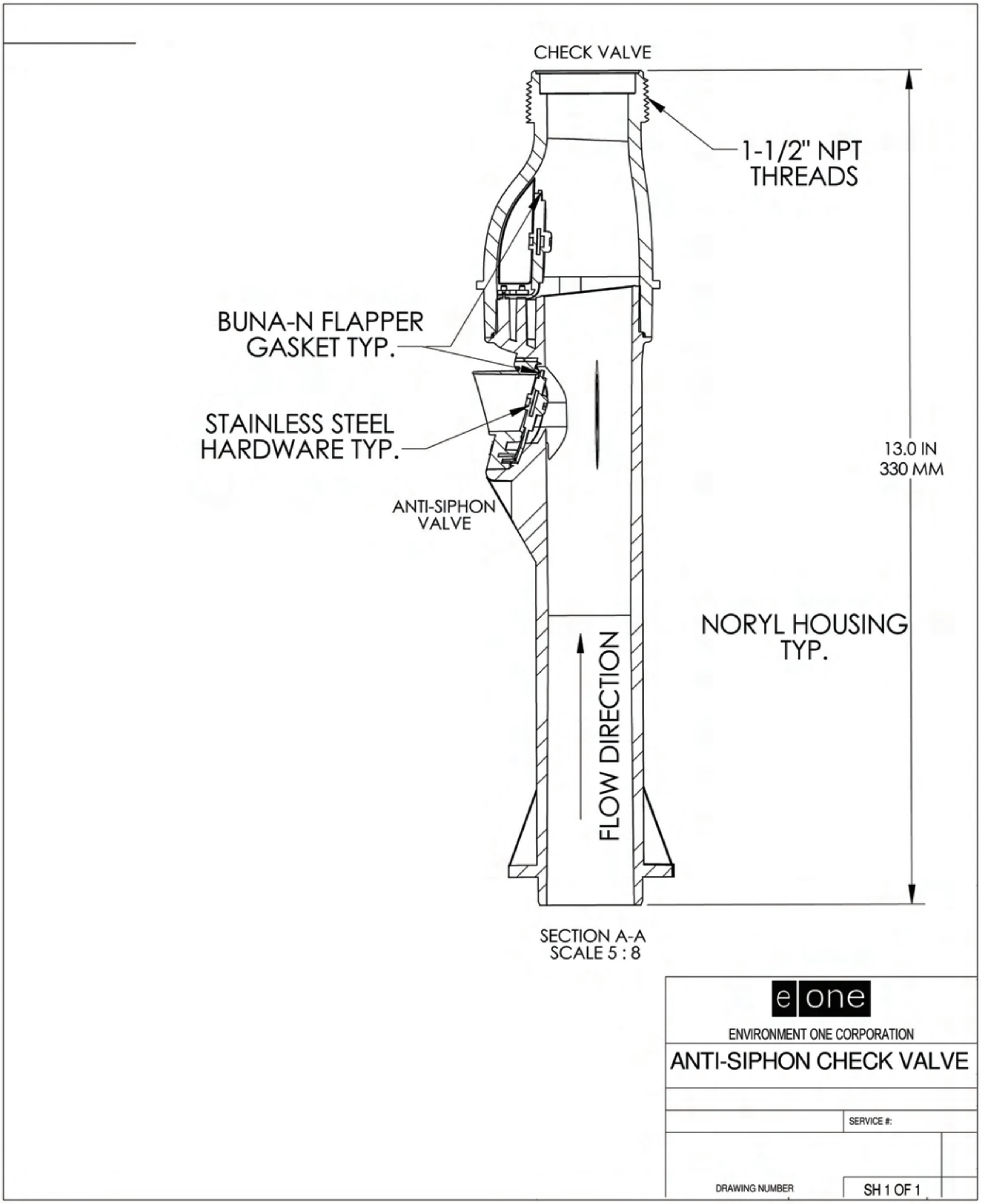
CORPORATION

LM000115 REV. -



e one ENVIRONMENT ONE CORPORATION	
REDUNDANT CHECK VALVE	
ENG MODEL: US Assembly K7	SERVICE #:
DRAWING NUMBER	SH 1 OF 1


CHECK VALVE
1-1/2" NPT THREADS
BUNA-N FLAPPER GASKET TYP.
STAINLESS STEEL HARDWARE TYP.
ANTI-SIPHON VALVE
13.0 IN 330 MM
NORYL HOUSING TYP.
FLOW DIRECTION
SECTION A-A
SCALE 5 : 8
e one
ENVIRONMENT ONE CORPORATION
ANTI-SIPHON CHECK VALVE
SERVICE #:
DRAWING NUMBER
SH 1 OF 1

Manufacturer Evaluation List

General Requirements for Low Pressure Sewer Systems

Service and Maintenance Check List

- Local fast-response service and maintenance organization has been designated
- Manufacturers of all equipment specified for the system have supplied all installation details
- Warranties for all equipment specified for the system have been evaluated
- Fast replacement parts availability for all equipment in the system has been ensured by each equipment manufacturer
- User instructions have been supplied to homeowners

Grinder Pump

- Designated for the specific purpose of grinding and pumping domestic wastewater
- Suitable for parallel operation in a system containing thousands of pumps connected to a common discharge line
- Has a history of reliable operation
- Compatible with existing power sources and provides economical operation
- Simple to service and troubleshoot, easily accessible for removal of grinder pump core; designed with simple wiring and controls; easily disassembled and reassembled
- Warranty covering parts and labor for a reasonable length of time
- Supported by a thoroughly detailed installation manual, service manual and facilities for service training

Certifications

- Canadian Standards Association
- Underwriters Laboratories, Inc.
- National Sanitation Foundation

Required Features

- Non-clogging pump
- Non-jamming grinder
- Anti-siphon valve integral with grinder pump
- All valves of non-clogging design: integral check valve, anti-siphon valve and redundant check valve
- High-level warning alarm

Motor

- Low rpm (1,725)
- Overload protection, built-in, automatic reset
- High torque, low starting current

Tank

- Self scouring
- Completely sealed
- Non-corroding material

Level Sensing Control

- Non-fouling type
- No moving parts in contact with sewage

Motor Controls

- Completely protected
- Simple to service or replace
- UL-listed alarm panel

A Precision Castparts Company

Environment One Corporation
2773 Balltown Road
Niskayuna, New York USA 12309–1090

Voice: (01) 518.346.6161
Fax: 518.346.6188

www.eone.com

LM000353 Rev. A
060208

APPENDIX C

Watermain Design

Hydrant Flow Test – Flow at 20 psi Residual Calculation
Fire Hydrant Flow Test (614 Dundas St E.)
Domestic Water Demand
Fire Flow Requirements
Junction Table – Maximum Day Demand
Pipe Table – Maximum Day Demand
Hydrant Table – Watermain Model Calibration
Hydrant Table (H-5) Maximum Day Demand and Fire Flow
Hydrant Table (H-6) Maximum Day Demand and Fire Flow
Hydrant Table (H-14) Maximum Day Demand and Fire Flow
Hydrant Table (H-18) Maximum Day Demand and Fire Flow
Hydrant Table (H-19) Maximum Day Demand and Fire Flow
Watermain Design – Pipe Network Drawing DUN/621-W1

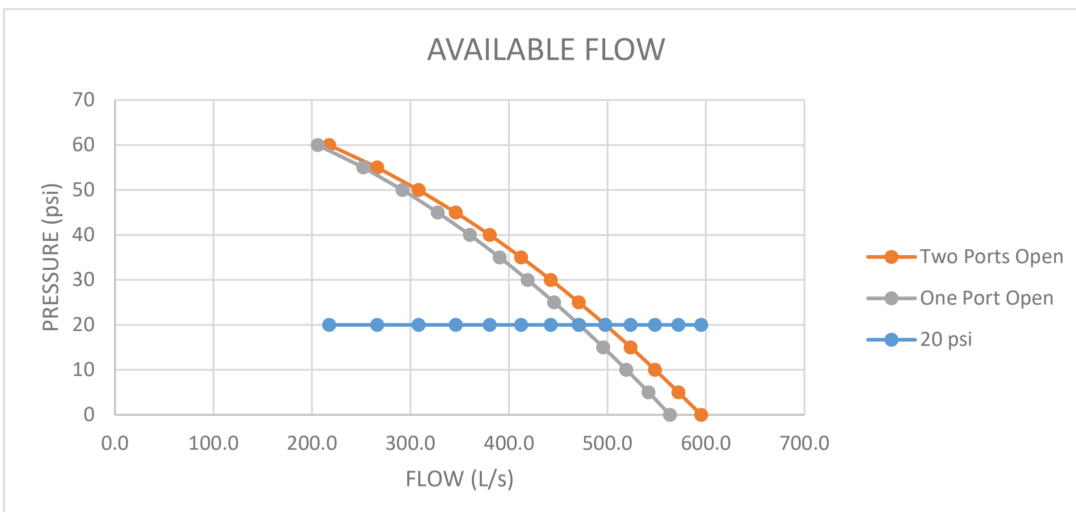
HYDRANT FLOW TEST - Flow at 20 psi Residual Calculation

Hydrant 665 South side of Dundas Street, Belleville

Size of Watermain 300 mm	Comments:
☐ Dead End ☒ Two Way ☐ Loop	
Flow Hydrant Location:	South Side of Dundas Street East, No 665
Residual Hydrant Location:	North Side of Dundas Street East, No 614

Static Pressure: 71 psi	Date: November 19, 2019	Time:

Test No.	No. of Outlets	Orifice Size (in.)	Orifice Coef	Pitot Reading (psi)	Equivalent Flow gpm (U.S.)	Total Flow gpm (U.S.)	Residual Pressure (psi)	Comments
1	1	2.287	0.9	60	1087.7	1087.7	69	
2	2	2.287	0.9	45	942.0	1883.9	66	
3								
4								

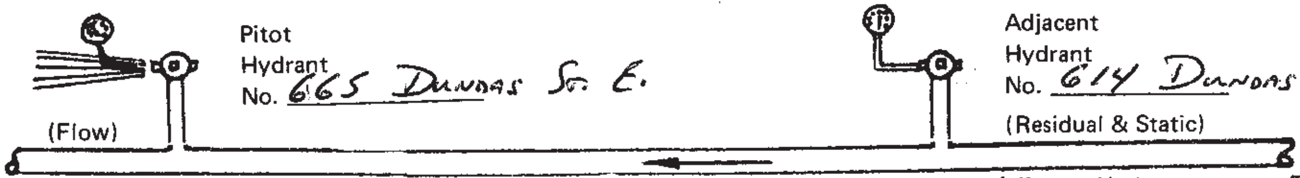


Routing
White - 1. Op. Mgr. 2. Draft. 3. FF bk.
Pink - File 842
Canary - Originator

Belleville Utilities Commission
459 SIDNEY STREET
P.O. BOX 939
BELLEVILLE, ONT., K8N 5B6
(613) 968-3651

Date: Nov. 27/19
Time: ______
Performed by TM, CM
File: 842

FIRE HYDRANT FLOW TEST



Pitot Hydrant No. 665 Dundas St. E.
(Flow)

Adjacent Hydrant No. 614 Dundas St. E.
(Residual & Static)

Adjacent Hydrant ______ Ft.
Above or Below Pitot Hydrant

Street Name Dundas St. E.
Location on St.
or name of Bldg. ______

Provide Four Pressure Readings:
Select outlets to give 10 psi
drop at adjacent hydrant if possible

		OUTLETS one - 1"	one - 1 1/8"	one - 1½"	one - 2½"	two - 2½"	
Step One -	Adjacent Hydrant				71	71	psi (static)
Step Two -	Pitot Hydrant				60	45	psi (flow)
Step Three -	Adjacent Hydrant				69	66	psi (residual)
Step Four -	Adjacent Hydrant				71	71	psi (static check)

low with 20 psi residual at adjacent hydrant

$$= \text{measured flow} \left(\frac{\text{available drop}}{\text{test drop}}\right)^{.54}$$

Available drop is static less 20
Test drop is static less residual

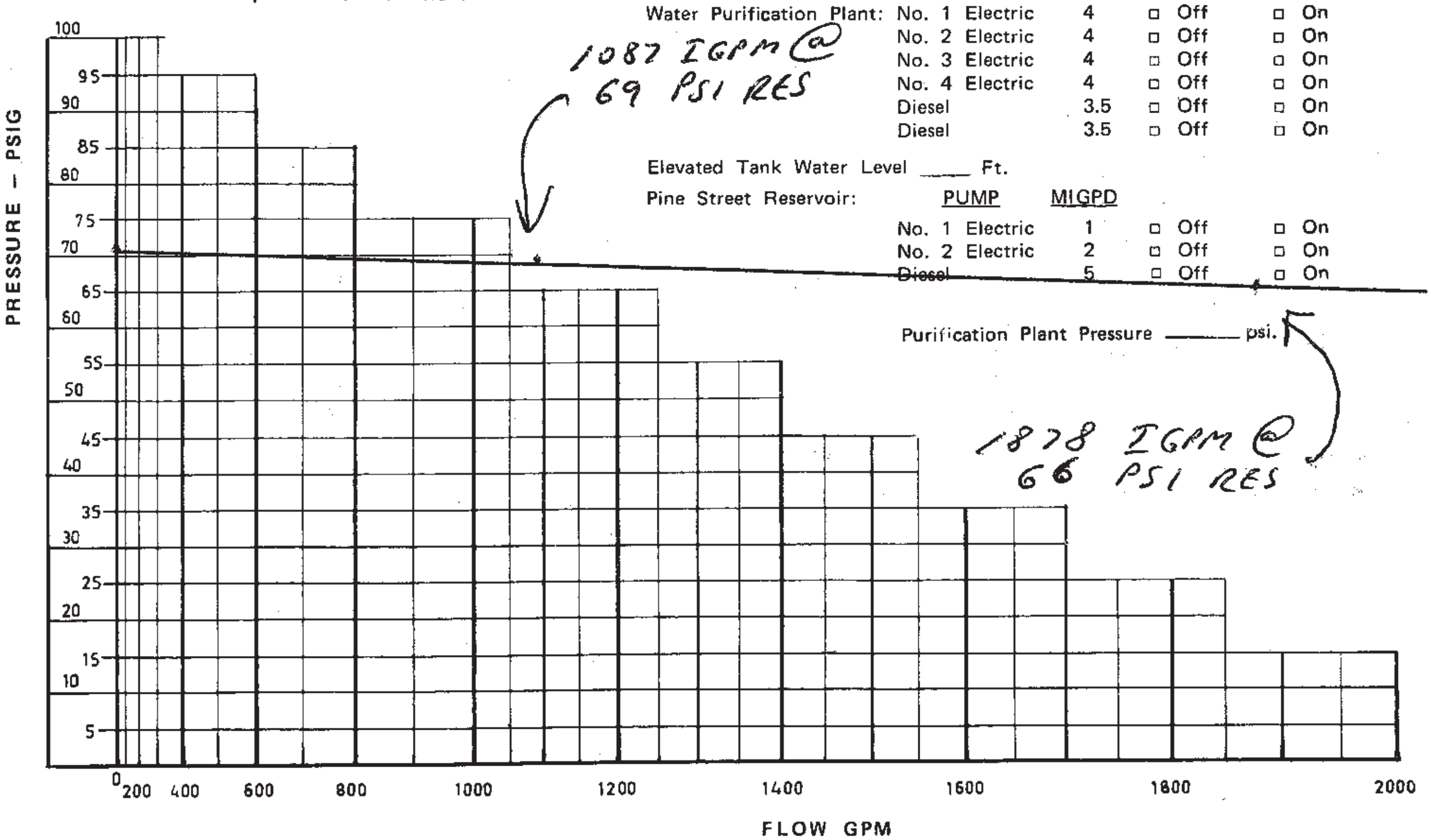
Information below can be obtained at a later date from records at Water Purification Plant.

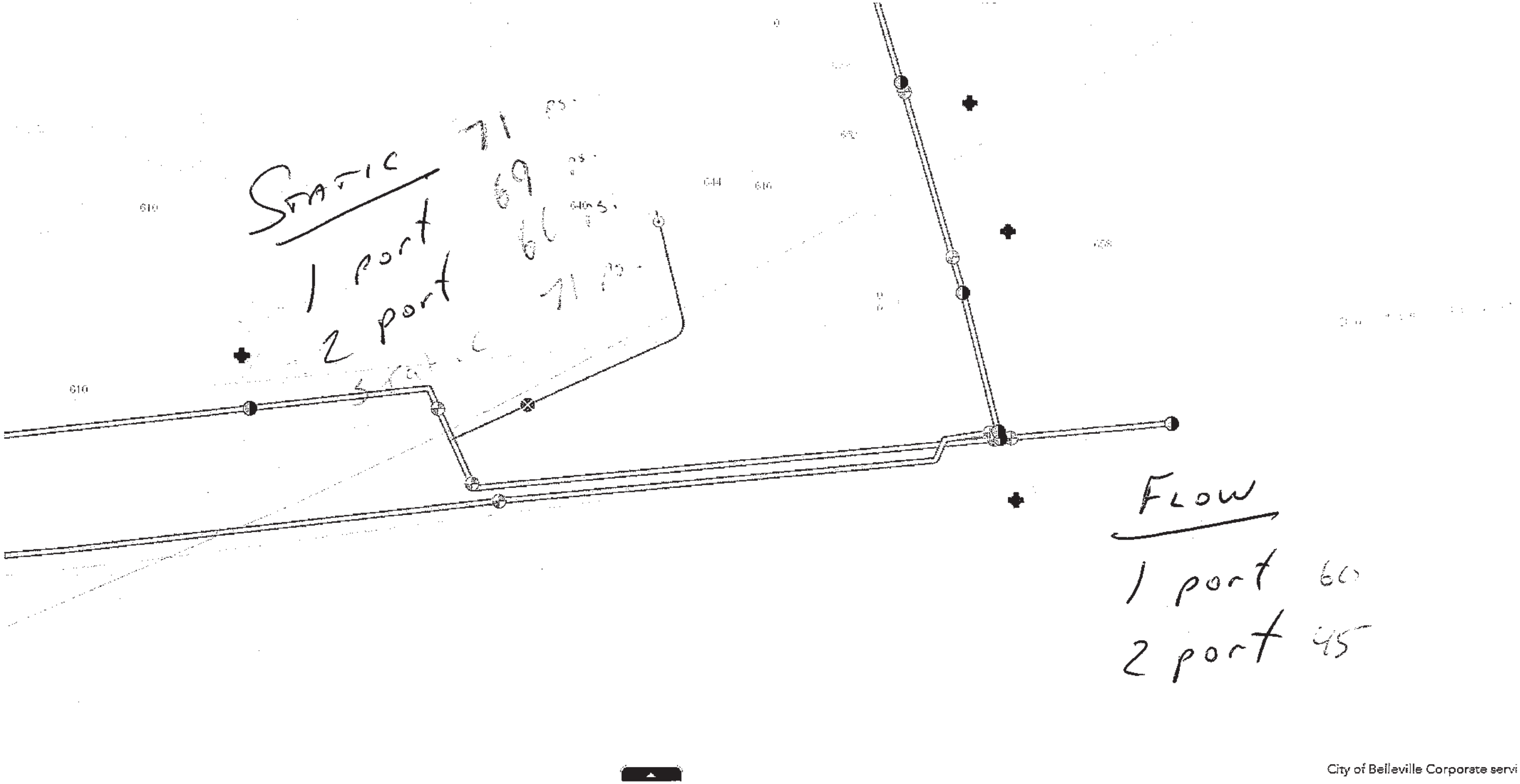
	PUMP	MIGPD		
Water Purification Plant:	No. 1 Electric	4	☐ Off	☐ On
	No. 2 Electric	4	☐ Off	☐ On
	No. 3 Electric	4	☐ Off	☐ On
	No. 4 Electric	4	☐ Off	☐ On
	Diesel	3.5	☐ Off	☐ On
	Diesel	3.5	☐ Off	☐ On

Elevated Tank Water Level ____ Ft.

	PUMP	MIGPD		
Pine Street Reservoir:	No. 1 Electric	1	☐ Off	☐ On
	No. 2 Electric	2	☐ Off	☐ On
	Diesel	5	☐ Off	☐ On

Purification Plant Pressure ______ psi.





Static
1 port 69
2 port 60
71
Flow
1 port 60
2 port 45
City of Belleville Corporate servi

DOMESTIC WATER DEMAND

621 DUNDAS STREET EAST at Haig Road, Belleville
Includes Osprey Shores West Subdivision

Number of Single Detached Lots		51	
Number of Persons / Lot		3	
Number of Townhouses		145	
Number of Persons / Unit		2.5	
Number of Stacked Townhouses		242	
Number of Persons / Unit		2.5	
Number of Apartment Units		162	
Number of Persons / Unit		2.5	
Total Number of Units		**600**	
Total Number of Persons		**1525.5**	
Average Consumption	350 l/cap.day	**6.180**	l/s

Peaking Factors (Per Table 3-1)

Local Minimum Hour	0.45	2.781	l/s	1,001 - 2,000 Population
Local Maximum Day	2.50	15.449	l/s	
Local Peak Hour	3.75	23.174	l/s	
Minimum Hour	0.65	4.017	l/s	25,001 - 50,000 Population
Maximum Day	1.8	11.123	l/s	
Peak Hour	2.7	16.685	l/s	

Extended Period Simulation Demand Pattern - Residential

TIME FROM	TIME TO	MULTIPLIER	FLOW		DURATION
12:00 am	1:00 am	0.45	2.781	l/s	1
1:00 am	2:00 am	0.45	2.781	l/s	1
2:00 am	3:00 am	0.45	2.781	l/s	1
3:00 am	4:00 am	0.45	2.781	l/s	1
4:00 am	5:00 am	0.6	3.708	l/s	1
5:00 am	6:00 am	0.6	3.708	l/s	1
6:00 am	7:00 am	2.5	15.449	l/s	1
7:00 am	8:00 am	1	6.180	l/s	1
8:00 am	9:00 am	1	6.180	l/s	1
9:00 am	10:00 am	0.45	2.781	l/s	1
10:00 am	11:00 am	0.45	2.781	l/s	1
11:00 am	12:00 pm	1	6.180	l/s	1
12:00 pm	1:00 pm	1	6.180	l/s	1
1:00 pm	2:00 pm	1	6.180	l/s	1
2:00 pm	3:00 pm	1	6.180	l/s	1
3:00 pm	4:00 pm	0.6	3.708	l/s	1
4:00 pm	5:00 pm	2.5	15.449	l/s	1
5:00 pm	6:00 pm	3.75	23.174	l/s	1
6:00 pm	7:00 pm	1	6.180	l/s	1
7:00 pm	8:00 pm	1	6.180	l/s	1
8:00 pm	9:00 pm	1	6.180	l/s	1
9:00 pm	10:00 pm	0.65	4.017	l/s	1
10:00 pm	11:00 pm	0.65	4.017	l/s	1
11:00 pm	12:00 am	0.45	2.781	l/s	1
					24 hr

FIRE FLOW REQUIRED — 1-Storey Detached

621 DUNDAS STREET EAST at Haig Road, Belleville

REQUIRED FIRE FLOW (L/min)

(Per Fire Underwriters Survey)

$$RFF = 220\ C\ A^{1/2}$$

F = the required fire flow in litres per minute

C = Coefficient related to type of construction
- = 1.5 for wood frame construction (stucture essentialy all combustible)
- = 1.0 for ordinary construction (brick or other masonry, combustible floor and interior)
- = 0.8 for non-combustible (unprotected metal structural componets, masonry or metal walls)
- = 0.6 for fire-resistive construction (fully protected frame, floors, roof)

A = the total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building being considered.

						Detached Dwelling One Storey	
Building Floor Area (A) =						240 m^2	2,600 ft^2
Type V Wood Frame Construction					C =	1.5	
					F =	220 C $A^{1/2}$	
					=	5,112 L/min	
					Rounded to	5,000 L/min	
Occupancy Consideration							
Limited Combustible Content	Table 3					-15%	
						-750 L/min	
						4,250 L/min	
Automatic Sprinkler Consideration	No Sprinklers					0%	
						0 L/min	
Exposure Adjustment Charges (Table 6)	BLOCK "E"						
	Front	Side 1	Side 2	Rear			
Distance to Exposure (m)	30	23	2.4	10			
Height of Exposed Exposed Building (Stories)	1	1	1	1			
Length of Exposed Building Facing Wall (m)	9	15	15	9			
Length-Height Factor	9	15	15	9			
Exposure Adjustment Charge	0%	0%	20%	15%		35%	
						1,750 L/min	
					RFF =	6,000 L/min	
					Rounded to	6,000 L/min	
Required Duration of Fire Flow	Table 1					2.00 hours	
Standard Hydrant Distribution	Table 2						
					Average Area per Hydrant	14,000 m^2	
					Maximum Recommended Spacing	150 m	
					Maximum Distance from Any Point on Street or Road Frontage to a Hydrant	75 m	
					Minimum Number of Hydrants (total available)	1	
					Per Note a. Reduce Maximum Hydrant Spacing by 30m for Dead End Streets or Roads	120 m	
					Per Note d. Reduce Maximum Distance from Any Point on Street by 15m for Dead End Streets or Roads	60 m	

FIRE FLOW REQUIRED 2-Storey Detached

621 DUNDAS STREET EAST at Haig Road, Belleville

REQUIRED FIRE FLOW (L/min)

(Per Fire Underwriters Survey)

$$RFF = 220\ C\ A^{1/2}$$

F = the required fire flow in litres per minute

C = Coefficient related to type of construction
- = 1.5 for wood frame construction (stucture essentialy all combustible)
- = 1.0 for ordinary construction (brick or other masonry, combustible floor and interior)
- = 0.8 for non-combustible (unprotected metal structural componets, masonry or metal walls)
- = 0.6 for fire-resistive construction (fully protected frame, floors, roof)

A = the total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building being considered.

			Detached Dwelling One Storey		
Building Floor Area (A) =			300	m^2	3,250 ft^2
Type V Wood Frame Construction		C =	1.5		
		F =	$220\ C\ A^{1/2}$		
		=	5,716	L/min	
		Rounded to	6,000	L/min	
Occupancy Consideration					
Limited Combustible Content	Table 3		-15%		
			-900	L/min	
			5,100	L/min	
Automatic Sprinkler Consideration	No Sprinklers		0%		
			0	L/min	

Exposure Adjustment Charges (Table 6)	BLOCK "E"					
	Front	Side 1	Side 2	Rear		
Distance to Exposure (m)	20	3	3	>30m		
Height of Exposed Exposed Building (Stories)	2	2	2	2		
Length of Exposed Building Facing Wall (m)	9	15	15	9		
Length-Height Factor	18	30	30	18		
Exposure Adjustment Charge	10%	21%	21%	9%	61%	
					3,660	L/min
				RFF =	8,760	L/min
				Rounded to	9,000	L/min

Required Duration of Fire Flow	Table 1		2.00	hours
Standard Hydrant Distribution	Table 2			
		Average Area per Hydrant	12,500	m^2
		Maximum Recommended Spacing	135	m
		Maximum Distance from Any Point on Street or Road Frontage to a Hydrant	70	m
		Minimum Number of Hydrants (total available)	3	
		Per Note a. Reduce Maximum Hydrant Spacing by 30m for Dead End Streets or Roads	105	m
		Per Note d. Reduce Maximum Distance from Any Point on Street by 15m for Dead End Streets or Roads	55	m

FIRE FLOW REQUIRED 2-Storey Detached

621 DUNDAS STREET EAST at Haig Road, Belleville

REQUIRED FIRE FLOW (L/min)

(Per Fire Underwriters Survey)

$$RFF = 220\ C\ A^{1/2}$$

F = the required fire flow in litres per minute

C = Coefficient related to type of construction
- = 1.5 for wood frame construction (stucture essentialy all combustible)
- = 1.0 for ordinary construction (brick or other masonry, combustible floor and interior)
- = 0.8 for non-combustible (unprotected metal structural componets, masonry or metal walls)
- = 0.6 for fire-resistive construction (fully protected frame, floors, roof)

A = the total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building being considered.

						Detached Dwelling One Storey		
Building Floor Area (A) =						300	m^2	3,250 ft^2
Type V Wood Frame Construction					C =	1.5		
					F =	$220\ C\ A^{1/2}$		
					=	5,716	L/min	
					Rounded to	6,000	L/min	
Occupancy Consideration								
Limited Combustible Content	Table 3					-15%		
						-900	L/min	
						5,100	L/min	
Automatic Sprinkler Consideration	No Sprinklers					0%		
						0	L/min	
Exposure Adjustment Charges (Table 6)	BLOCK "E"							
	Front	Side 1	Side 2	Rear				
Distance to Exposure (m)	30	23	3	10				
Height of Exposed Exposed Building (Stories)	2	2	2	2				
Length of Exposed Building Facing Wall (m)	9	15	15	9				
Length-Height Factor	18	30	30	18				
Exposure Adjustment Charge	0%	2%	21%	15%		38%		
						2,280	L/min	
					RFF =	7,380	L/min	
					Rounded to	7,000	L/min	
Required Duration of Fire Flow	Table 1					2.00	hours	
Standard Hydrant Distribution	Table 2							
					Average Area per Hydrant	13,500	m^2	
					Maximum Recommended Spacing	142	m	
					Maximum Distance from Any Point on Street or Road Frontage to a Hydrant	72	m	
					Minimum Number of Hydrants (total available)	2		
					Per Note a. Reduce Maximum Hydrant Spacing by 30m for Dead End Streets or Roads	112	m	
					Per Note d. Reduce Maximum Distance from Any Point on Street by 15m for Dead End Streets or Roads	57	m	

FIRE FLOW REQUIRED — TOWNHOUSE BLOCK - 2-Storey

621 DUNDAS STREET EAST at Haig Road, Belleville

REQUIRED FIRE FLOW (L/min)

(Per Fire Underwriters Survey)

$$RFF = 220\ C\ A^{1/2}$$

F = the required fire flow in litres per minute

C = Coefficient related to type of construction
= 1.5 for wood frame construction (stucture essentialy all combustible)
= 1.0 for ordinary construction (brick or other masonry, combustible floor and interior)
= 0.8 for non-combustible (unprotected metal structural componets, masonry or metal walls)
= 0.6 for fire-resistive construction (fully protected frame, floors, roof)

A = the total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building being considered.

			Townhouse Two Storey		
Building Floor Area (A) =	Bsmt Area Included		1540	m^2	16,686 ft^2
Type V Wood Frame Construction		C =	1.5		
		F =	$220\ C\ A^{1/2}$		
		=	12,950	L/min	
		Rounded to	13,000	L/min	
Occupancy Consideration					
Limited Combustible Content	Table 3		-15%		
			-1,950	L/min	
			11,050	L/min	
Automatic Sprinkler Consideration	No Sprinklers		0%		
			0	L/min	

Exposure Adjustment Charges (Table 6)	BLOCK "E" Front	Side 1	Side 2	Rear		
Distance to Exposure (m)	36	5	5	>30		
Height of Exposed Exposed Building (Stories)	2	2	2	2		
Length of Exposed Building Facing Wall (m)	48	16	16	48		
Length-Height Factor	96	32	32	96		
Exposure Adjustment Charge	0%	16%	16%	0%	32%	
					4,160	L/min
				RFF =	15,210	L/min
				Rounded to	15,000	L/min

Required Duration of Fire Flow	Table 1		3.50	hours
Standard Hydrant Distribution	Table 2			
		Average Area per Hydrant	9,500	m^2
		Maximum Recommended Spacing	90	m
		Maximum Distance from Any Point on Street or Road Frontage to a Hydrant	55	m
		Minimum Number of Hydrants (total available)	5	
		Per Note a. Reduce Maximum Hydrant Spacing by 30m for Dead End Streets or Roads	60	m
		Per Note d. Reduce Maximum Distance from Any Point on Street by 15m for Dead End Streets or Roads	40	m

FIRE FLOW REQUIRED

TOWNHOUSE BLOCK - 2-Storey
with vertical firewall with a fire-resistance rating of not less than 2 hours

621 DUNDAS STREET EAST at Haig Road, Belleville

REQUIRED FIRE FLOW (L/min)

(Per Fire Underwriters Survey)

$$RFF = 220\ C\ A^{1/2}$$

F = the required fire flow in litres per minute

C = Coefficient related to type of construction
= 1.5 for wood frame construction (stucture essentialy all combustible)
= 1.0 for ordinary construction (brick or other masonry, combustible floor and interior)
= 0.8 for non-combustible (unprotected metal structural componets, masonry or metal walls)
= 0.6 for fire-resistive construction (fully protected frame, floors, roof)

A = the total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building being considered.

			Townhouse with Fire Wall Two Storey		
Building Floor Area (A) =	Bsmt Area Included		770	m^2	8,343 ft^2
Type V Wood Frame Construction		C =	1.5		
		F =	$220\ C\ A^{1/2}$		
		=	9,157	L/min	
		Rounded to	9,000	L/min	
Occupancy Consideration					
Limited Combustible Content	Table 3		-15%		
			-1,350	L/min	
			7,650	L/min	
Automatic Sprinkler Consideration	No Sprinklers		0%		
			0	L/min	

Exposure Adjustment Charges (Table 6)	BLOCK "E"					
	Front	Side 1	Side 2	Rear		
Distance to Exposure (m)	36	0	5	>30		
Height of Exposed Exposed Building (Stories)	2	2	2	2		
Length of Exposed Building Facing Wall (m)	48	16	16	48		
Length-Height Factor	96	32	32	96		
Exposure Adjustment Charge	0%	0%	16%	0%	16%	
					1,440	L/min
				RFF =	9,090	L/min
				Rounded to	9,000	L/min

Required Duration of Fire Flow	Table 1		2.00	hours
Standard Hydrant Distribution	Table 2			
		Average Area per Hydrant	12,000	m^2
		Maximum Recommended Spacing	135	m
		Maximum Distance from Any Point on Street or Road Frontage to a Hydrant	70	m
		Minimum Number of Hydrants (total available)	3	
		Per Note a. Reduce Maximum Hydrant Spacing by 30m for Dead End Streets or Roads	105	m
		Per Note d. Reduce Maximum Distance from Any Point on Street by 15m for Dead End Streets or Roads	55	m

FIRE FLOW REQUIRED

TOWNHOUSE BLOCK - 2-Storey with vertical firewalls with a fire-resistance rating of not less than 2 hours. Reduced Floor Area

621 DUNDAS STREET EAST at Haig Road, Belleville

REQUIRED FIRE FLOW (L/min)

(Per Fire Underwriters Survey)

$$RFF = 220\ C\ A^{1/2}$$

F = the required fire flow in litres per minute

C = Coefficient related to type of construction
= 1.5 for wood frame construction (stucture essentialy all combustible)
= 1.0 for ordinary construction (brick or other masonry, combustible floor and interior)
= 0.8 for non-combustible (unprotected metal structural componets, masonry or metal walls)
= 0.6 for fire-resistive construction (fully protected frame, floors, roof)

A = the total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building being considered.

			Townhouse with Fire Wall3 Two Storey	
Building Floor Area (A) =	Bsmt Area Included		540 m^2	5,851 ft^2
Type V Wood Frame Construction		C =	1.5	
		F =	$220\ C\ A^{1/2}$	
		=	7,669 L/min	
		Rounded to	8,000 L/min	
Occupancy Consideration				
Limited Combustible Content	Table 3		-15%	
			-1,200 L/min	
			6,800 L/min	
Automatic Sprinkler Consideration	No Sprinklers		0%	
			0 L/min	

Exposure Adjustment Charges (Table 6)	BLOCK "E"				
	Front	Side 1	Side 2	Rear	
Distance to Exposure (m)	36	0	5	>30	
Height of Exposed Exposed Building (Stories)	2	2	2	2	
Length of Exposed Building Facing Wall (m)	48	16	16	48	
Length-Height Factor	96	32	32	96	
Exposure Adjustment Charge	0%	0%	16%	0%	16%
					1,280 L/min

		RFF =	8,080 L/min
		Rounded to	8,000 L/min
Required Duration of Fire Flow	Table 1		2.00 hours
Standard Hydrant Distribution	Table 2		
		Average Area per Hydrant	13,000 m^2
		Maximum Recommended Spacing	135 m
		Maximum Distance from Any Point on Street or Road Frontage to a Hydrant	70 m
		Minimum Number of Hydrants (total available)	2
		Per Note a. Reduce Maximum Hydrant Spacing by 30m for Dead End Streets or Roads	105 m
		Per Note d. Reduce Maximum Distance from Any Point on Street by 15m for Dead End Streets or Roads	55 m

FIRE FLOW REQUIRED — STACKED TOWNHOUSE - 3-Storey

621 DUNDAS STREET EAST at Haig Road, Belleville

REQUIRED FIRE FLOW (L/min)

(Per Fire Underwriters Survey)

$$RFF = 220\ C\ A^{1/2}$$

F = the required fire flow in litres per minute

C = Coefficient related to type of construction
- = 1.5 for wood frame construction (stucture essentialy all combustible)
- = 1.0 for ordinary construction (brick or other masonry, combustible floor and interior)
- = 0.8 for non-combustible (unprotected metal structural componets, masonry or metal walls)
- = 0.6 for fire-resistive construction (fully protected frame, floors, roof)

A = the total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building being considered.

			Stacked Townhouse Three Storey		
Building Floor Area (A) =	Bsmt Area Excluded		1000	m^2	10,835 ft^2
Type V Wood Frame Construction		C =	1.5		
		F =	$220\ C\ A^{1/2}$		
		=	10,436	L/min	
		Rounded to	10,000	L/min	
Occupancy Consideration					
Limited Combustible Content	Table 3		-15%		
			-1,500	L/min	
			8,500	L/min	
Automatic Sprinkler Consideration	No Sprinklers		0%		
			0	L/min	

Exposure Adjustment Charges (Table 6)

BLOCK "E"	Front	Side 1	Side 2	Rear	
Distance to Exposure (m)	>30	4	4	>30	
Height of Exposed Exposed Building (Stories)	3	3	3	3	
Length of Exposed Building Facing Wall (m)	36	14	14	36	
Length-Height Factor	108	42	42	108	
Exposure Adjustment Charge	0%	17%	17%	0%	34%
					3,400 L/min

		RFF =	11,900	L/min
		Rounded to	12,000	L/min
Required Duration of Fire Flow	Table 1		2.50	hours
Standard Hydrant Distribution	Table 2			
		Average Area per Hydrant	11,000	m^2
		Maximum Recommended Spacing	120	m
		Maximum Distance from Any Point on Street or Road Frontage to a Hydrant	70	m
		Minimum Number of Hydrants (total available)	3	
		Per Note a. Reduce Maximum Hydrant Spacing by 30m for Dead End Streets or Roads	90	m
		Per Note d. Reduce Maximum Distance from Any Point on Street by 15m for Dead End Streets or Roads	55	m

FIRE FLOW REQUIRED APARTMENT BUILDING

621 DUNDAS STREET EAST at Haig Road, Belleville

REQUIRED FIRE FLOW (L/min)

(Per Fire Underwriters Survey)

$$RFF = 220\ C\ A^{1/2}$$

F = the required fire flow in litres per minute

C = Coefficient related to type of construction
- = 1.5 for wood frame construction (stucture essentialy all combustible)
- = 1.0 for ordinary construction (brick or other masonry, combustible floor and interior)
- = 0.8 for non-combustible (unprotected metal structural componets, masonry or metal walls)
- = 0.6 for fire-resistive construction (fully protected frame, floors, roof)

A = the total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building being considered.

					Stacked Townhouse Three Storey			
Building Floor Area (A) =					2250	m^2	24,378 ft^2	
Type I Fire Resistive Construction				C =	0.6			
				F =	$220\ C\ A^{1/2}$			
				=	6,261	L/min		
				Rounded to	6,000	L/min		
Occupancy Consideration								
Limited Combustible Content	Table 3				-15%			
					-900	L/min		
					5,100	L/min		
Automatic Sprinkler Consideration	Installation per NFPA 13				15%			
	Consider 50% Building Coverage				900	L/min		
Exposure Adjustment Charges (Table 6)	BLOCK "E"							
	Front	Side 1	Side 2	Rear				
Distance to Exposure (m)	>30	>30	>30	>30				
Height of Exposed Exposed Building (Stories)	7	7	7	7				
Length of Exposed Building Facing Wall (m)	60	30	25	60				
Length-Height Factor	420	210	175	420				
Exposure Adjustment Charge	0%	0%	0%	0%	0%			
					0	L/min		
				RFF =	6,000	L/min		
				Rounded to	6,000	L/min		100
Required Duration of Fire Flow	Table 1				2.00	hours		
Standard Hydrant Distribution	Table 2							
				Average Area per Hydrant	14,000	m^2		
				Maximum Recommended Spacing	150	m		
				Maximum Distance from Any Point on Street or Road Frontage to a Hydrant	75	m		
				Minimum Number of Hydrants (total available)	1			
				Per Note a. Reduce Maximum Hydrant Spacing by 30m for Dead End Streets or Roads	N/A	m		
				Per Note d. Reduce Maximum Distance from Any Point on Street by 15m for Dead End Streets or Roads	N/A	m		

Junction Table - Maximum Day Demand

ID	Label	Elevation (m)	Demand (L/min)	Hydraulic Grade (m)	Pressure (kPa)
59	J-9	87.50	0	137.30	487
60	J-10	85.00	0	137.27	512
62	J-11	85.00	0	137.27	512
64	J-12	85.00	0	137.27	512
76	J-14	82.20	0	137.22	538
84	J-18	79.80	0	137.14	561
94	J-23	79.60	64	137.19	564
99	J-25	79.60	59	137.14	563
103	J-26	82.20	0	137.22	538
107	J-27	79.25	164	137.13	566
150	J-39	85.00	0	137.27	512
165	J-41	78.20	40	137.15	577
174	J-42	85.00	0	137.27	512
178	J-44	79.10	0	137.19	568
184	J-45	82.00	172	137.19	540
202	J-53	80.52	105	137.14	554
205	J-54	80.90	196	137.16	551
208	J-55	78.50	27	137.16	574
211	J-56	78.60	47	137.14	573
216	J-57	78.20	35	137.19	577
221	J-58	78.56	0	137.17	574
224	J-59	78.50	18	137.17	574

Pipe Table - Maximum Day Demand

Label	Start Node	Stop Node	Diameter (mm)	Material	Hazen-Williams C	Length (User Defined) (m)	Flow (L/min)	Velocity (m/s)	Hydraulic Grade (Start) (m)	Hydraulic Grade (Stop) (m)	Headloss (m)
P-10	J-9	J-10	297.0	PVC	120.0	119.10	950	0.23	137.30	137.27	0.03
P-11	J-10	J-11	297.0	PVC	120.0	7.00	479	0.12	137.27	137.26	0.00
P-16	H-1	J-42	297.0	PVC	120.0	50.00	0	0.00	137.26	137.26	0.00
P-29	J-23	H-11	204.0	PVC	110.0	89.00	-762	0.39	137.12	137.24	0.11
P-31	J-18	J-25	204.0	PVC	110.0	56.00	-491	0.25	136.65	136.68	0.03
P-34	H-11	J-26	204.0	PVC	110.0	9.00	-762	0.39	137.24	137.25	0.01
P-36	J-26	J-14	250.0	PVC	110.0	8.00	-283	0.10	137.25	137.25	0.00
P-37	J-18	J-27	204.0	PVC	110.0	86.00	146	0.07	136.65	136.65	0.01
P-43	H-5	J-27	204.0	PVC	110.0	77.00	-32	0.02	136.65	136.65	0.00
P-47	J-25	H-7	204.0	PVC	110.0	95.00	-554	0.28	136.68	136.75	0.07
P-53	R-9	PMP-3	1,000.0	PVC	120.0	0.01	950	0.02	87.50	87.50	0.00
P-54	PMP-3	J-9	297.0	PVC	120.0	10.00	950	0.23	137.30	137.30	0.00
P-58	H-13	J-12	204.0	PVC	110.0	2.00	0	0.00	137.26	137.26	0.00
P-59	H-12	H-13	204.0	PVC	110.0	216.00	0	0.00	137.26	137.26	0.00
P-60	H-13	J-39	204.0	PVC	110.0	10.00	0	0.00	137.26	137.26	0.00
P-61	J-14	J-10	250.0	PVC	110.0	92.00	-472	0.16	137.25	137.27	0.02
P-62	J-26	J-11	250.0	PVC	110.0	90.00	-478	0.16	137.25	137.26	0.02
P-63	J-11	J-12	297.0	PVC	120.0	6.30	0	0.00	137.26	137.26	0.00
P-68	J-41	H-8	204.0	PVC	110.0	87.00	-639	0.33	136.78	136.86	0.08
P-69	H-7	J-41	204.0	PVC	110.0	40.00	-554	0.28	136.75	136.78	0.03
P-71	J-23	H-15	204.0	PVC	110.0	235.00	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
P-72	H-15	J-25	204.0	PVC	110.0	120.00	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
P-75	H-9	J-44	204.0	PVC	110.0	27.00	-685	0.35	137.07	137.10	0.03
P-76	J-44	J-23	204.0	PVC	110.0	24.00	-692	0.35	137.10	137.12	0.03
P-77	J-44	H-18	204.0	PVC	110.0	103.00	7	0.00	137.10	137.10	0.00
P-78	J-14	J-45	204.0	PVC	110.0	45.55	188	0.10	137.25	137.24	0.00
P-79	J-45	H-6	204.0	PVC	110.0	55.00	0	0.00	137.24	137.24	0.00
P-80	H-14	J-46	204.0	PVC	110.0	10.00	-281	0.14	136.64	136.64	0.00
P-81	J-46	J-18	204.0	PVC	110.0	30.00	-345	0.18	136.64	136.65	0.01
P-82	H-5	J-49	204.0	PVC	110.0	48.00	32	0.02	136.65	136.65	0.00
P-83	J-49	H-4	204.0	PVC	110.0	32.00	-40	0.02	136.65	136.65	0.00
P-89	J-53	H-14	204.0	PVC	110.0	62.00	-281	0.14	136.63	136.64	0.01
P-90	H-6	J-54	204.0	PVC	110.0	121.00	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
P-91	J-54	J-53	204.0	PVC	110.0	88.14	-214	0.11	136.62	136.63	0.01
P-92	H-8	J-55	204.0	PVC	110.0	75.00	-639	0.33	136.86	136.92	0.07
P-93	J-55	H-9	204.0	PVC	110.0	143.00	-685	0.35	136.92	137.07	0.15
P-95	J-41	H-19	204.0	PVC	110.0	265.00	53	0.03	136.78	136.77	0.00
P-96	H-19	J-56	204.0	PVC	110.0	63.00	53	0.03	136.77	136.77	0.00
P-97	J-57	H-18	204.0	PVC	110.0	32.00	-7	0.00	137.10	137.10	0.00
P-99	J-27	H-4	204.0	PVC	110.0	51.00	40	0.02	136.65	136.65	0.00
P-100	J-12	H-1	295.0	PVC	120.0	37.00	0	0.00	137.26	137.26	0.00

Hydrant Table H-4 (100 L/s)

Label	Lateral Length (m)	Elevation (m)	Demand (L/min)	Hydraulic Grade (m)	Pressure (kPa)
H-1	6.10	85.93	0	133.37	464
H-4	6.10	79.50	6,000	111.03	309
H-6	6.10	81.80	0	128.99	462
H-7	6.10	78.50	0	124.95	455
H-8	6.10	78.50	0	126.59	471
H-9	6.10	78.60	0	129.29	496
H-11	6.10	81.80	0	130.42	476
H-12	6.10	86.00	0	133.37	464
H-13	6.10	85.77	0	133.37	466
H-14	6.10	80.30	0	123.44	422
H-15	6.10	80.30	(N/A)	(N/A)	(N/A)
H-18	6.10	78.50	0	129.59	500
H-19	6.10	78.00	0	125.59	466

Hydrant Table H-4 (140 kPa Residual)

Label	Lateral Length (m)	Elevation (m)	Demand (L/min)	Hydraulic Grade (m)	Pressure (kPa)
H-1	6.10	85.93	0	131.41	445
H-4	6.10	79.50	8,040	93.85	140
H-6	6.10	81.80	0	124.33	416
H-7	6.10	78.50	0	117.60	383
H-8	6.10	78.50	0	120.34	410
H-9	6.10	78.60	0	124.80	452
H-11	6.10	81.80	0	126.65	439
H-12	6.10	86.00	0	131.41	444
H-13	6.10	85.77	0	131.41	447
H-14	6.10	80.30	0	115.05	340
H-15	6.10	80.30	(N/A)	(N/A)	(N/A)
H-18	6.10	78.50	0	125.30	458
H-19	6.10	78.00	0	118.68	398

Hydrant Table H-6 (100 L/s)

Label	Lateral Length (m)	Elevation (m)	Demand (L/min)	Hydraulic Grade (m)	Pressure (kPa)
H-1	6.10	85.93	0	133.37	464
H-4	6.10	79.50	0	128.31	478
H-6	6.10	81.80	6,000	126.07	433
H-7	6.10	78.50	0	128.95	494
H-8	6.10	78.50	0	129.52	499
H-9	6.10	78.60	0	130.48	508
H-11	6.10	81.80	0	130.90	481
H-12	6.10	86.00	0	133.37	464
H-13	6.10	85.77	0	133.37	466
H-14	6.10	80.30	0	128.27	469
H-15	6.10	80.30	(N/A)	(N/A)	(N/A)
H-18	6.10	78.50	0	130.59	510
H-19	6.10	78.00	0	129.17	501

Hydrant Table H-6 (140kPa Residual)

Label	Lateral Length	Elevation	Demand	Hydraulic Grade	Pressure
H-1	6.10	85.93	0	125.30	385
H-4	6.10	79.50	0	106.56	265
H-6	6.10	81.80	13,200	96.12	140
H-7	6.10	78.50	0	109.10	299
H-8	6.10	78.50	0	111.23	320
H-9	6.10	78.60	0	114.72	353
H-11	6.10	81.80	0	116.18	336
H-12	6.10	86.00	0	125.30	385
H-13	6.10	85.77	0	125.30	387
H-14	6.10	80.30	0	106.34	255
H-15	6.10	80.30	(N/A)	(N/A)	(N/A)
H-18	6.10	78.50	0	115.11	358
H-19	6.10	78.00	0	109.93	313

Hydrant Table H-8 (180 L/s)

Label	Lateral Length (m)	Elevation (m)	Demand (L/min)	Hydraulic Grade (m)	Pressure (kPa)
H-1	6.10	85.93	0	128.34	415
H-4	6.10	79.50	0	109.77	296
H-6	6.10	81.80	0	119.20	366
H-7	6.10	78.50	0	103.87	248
H-8	6.10	78.50	10,800	94.11	153
H-9	6.10	78.60	0	113.12	338
H-11	6.10	81.80	0	118.80	362
H-12	6.10	86.00	0	128.34	414
H-13	6.10	85.77	0	128.34	417
H-14	6.10	80.30	0	110.46	295
H-15	6.10	80.30	(N/A)	(N/A)	(N/A)
H-18	6.10	78.50	0	114.66	354
H-19	6.10	78.00	0	101.95	234

Hydrant Table H-8 (140 kPa Residual)

Label	Lateral Length (m)	Elevation (m)	Demand (L/min)	Hydraulic Grade (m)	Pressure (kPa)
H-1	6.10	85.93	0	128.12	413
H-4	6.10	79.50	0	109.02	289
H-6	6.10	81.80	0	118.72	361
H-7	6.10	78.50	0	102.93	239
H-8	6.10	78.50	10,980	92.86	141
H-9	6.10	78.60	0	112.46	331
H-11	6.10	81.80	0	118.30	357
H-12	6.10	86.00	0	128.12	412
H-13	6.10	85.77	0	128.12	414
H-14	6.10	80.30	0	109.73	288
H-15	6.10	80.30	(N/A)	(N/A)	(N/A)
H-18	6.10	78.50	0	114.05	348
H-19	6.10	78.00	0	100.95	225

Hydrant Table H-18 (150 L/s)

Label	Lateral Length (m)	Elevation (m)	Demand (L/min)	Hydraulic Grade (m)	Pressure (kPa)
H-1	6.10	85.93	0	130.39	435
H-4	6.10	79.50	0	122.08	417
H-6	6.10	81.80	0	125.01	423
H-7	6.10	78.50	0	120.45	411
H-8	6.10	78.50	0	119.20	398
H-9	6.10	78.60	0	117.33	379
H-11	6.10	81.80	0	121.85	392
H-12	6.10	86.00	0	130.39	434
H-13	6.10	85.77	0	130.39	437
H-14	6.10	80.30	0	122.29	411
H-15	6.10	80.30	(N/A)	(N/A)	(N/A)
H-18	6.10	78.50	9,000	101.03	221
H-19	6.10	78.00	0	119.92	410

Hydrant Table H-18 (140 kPa Residual)

Label	Lateral Length (m)	Elevation (m)	Demand (L/min)	Hydraulic Grade (m)	Pressure (kPa)
H-1	6.10	85.93	0	129.18	423
H-4	6.10	79.50	0	119.16	388
H-6	6.10	81.80	0	122.70	400
H-7	6.10	78.50	0	117.14	378
H-8	6.10	78.50	0	115.59	363
H-9	6.10	78.60	0	113.26	339
H-11	6.10	81.80	0	118.78	362
H-12	6.10	86.00	0	129.18	423
H-13	6.10	85.77	0	129.18	425
H-14	6.10	80.30	0	119.42	383
H-15	6.10	80.30	(N/A)	(N/A)	(N/A)
H-18	6.10	78.50	10,080	93.13	143
H-19	6.10	78.00	0	116.48	377

Hydrant Table H-19 (117 L/s)

Label	Lateral Length (m)	Elevation (m)	Demand (L/min)	Hydraulic Grade (m)	Pressure (kPa)
H-1	6.10	85.93	0	132.44	455
H-4	6.10	79.50	0	122.40	420
H-6	6.10	81.80	0	127.69	449
H-7	6.10	78.50	0	119.24	399
H-8	6.10	78.50	0	120.29	409
H-9	6.10	78.60	0	125.82	462
H-11	6.10	81.80	0	128.11	453
H-12	6.10	86.00	0	132.44	455
H-13	6.10	85.77	0	132.44	457
H-14	6.10	80.30	0	122.78	416
H-15	6.10	80.30	(N/A)	(N/A)	(N/A)
H-18	6.10	78.50	0	126.44	469
H-19	6.10	78.00	7,000	94.75	164

Hydrant Table H-19 (140 kPa Residual)

Label	Lateral Length (m)	Elevation (m)	Demand (L/min)	Hydraulic Grade (m)	Pressure (kPa)
H-1	6.10	85.93	0	132.25	453
H-4	6.10	79.50	0	121.73	413
H-6	6.10	81.80	0	127.27	445
H-7	6.10	78.50	0	118.40	390
H-8	6.10	78.50	0	119.49	401
H-9	6.10	78.60	0	125.30	457
H-11	6.10	81.80	0	127.71	449
H-12	6.10	86.00	0	132.25	453
H-13	6.10	85.77	0	132.25	455
H-14	6.10	80.30	0	122.13	409
H-15	6.10	80.30	(N/A)	(N/A)	(N/A)
H-18	6.10	78.50	0	125.95	464
H-19	6.10	78.00	7,200	92.59	143

VAN MEER LIMITED
LAND DEVELOPMENT · PROJECT MANAGEMENT · ENGINEERING
83 North Park Street, Belleville, Ont. K8P 2Y6 Tel. 613-969-0171

621 DUNDAS STREET EAST
WEST OF HAIG ROAD
CITY OF BELLEVILLE

Date	Description	By	Chk'd By
JAN. 18/24	REVISED SITE LAYOUT FROM ARCHITECT 24-01-17	S.D.S.	
JAN. 8/24	REVISED SITE LAYOUT FROM ARCHITECT 24-01-04	S.D.S.	
DEC. 20/23	UNDERLAY 23-12-15 SITE LAYOUT FROM ARCHITECT	S.D.S.	
NOV. 8/23	REVISED SITE LAYOUT FROM ARCHITECT	S.D.S.	

R E V I S I O N S

SCALE: 1:1250
DESIGNED: A.H.V.
DRAWN: S.D.S.
DATE: /07
COMPUTER: \Drawings\BELLEVILLE\ \Dundas St\621 Bakelite Property\

REGISTERED PROFESSIONAL ENGINEER
A. H. VANDERMEER
Jan. 18/24
PROVINCE OF ONTARIO

WATERMAIN DESIGN
PIPE NETWORK
DRAWING Dun/621-WI

DRAWING: 621 Dundas St_24-01-08.dwg

APPENDIX D

Storm Sewer Design

Storm Sewer Design Sheets – 5-Year Storm Event

Storm Sewer Design Sheets – 100-Year Storm Event

Storm Sewer Design — Drawing DUN/621-St1
Drainage Area Plan & Pipe Network

Storm Sewer Design — Drawing DUN/621-St2
Haig Road Sub-catchment

Ontario IDF Curve Look-up

STORM SEWER DESIGN SHEET

5 Year Storm Event (Q=2.78 AIR, $I=27.7t^{-0.699}$)

EXTERNAL DRAINAGE AREAS
HAIG ROAD
INTERNAL AREAS

LOCATION			AREAS (ha)					Indiv.	Accum.	Time of	Rainfall	Peak	SEWER DATA								
STREET	FROM	TO	R=0.45	R=0.60	R=0.65	R=0.7	R=0.85	2.78AR	2.78AR	Conc. min.	Intensity I (mm/hr)	Flow Q_p(l/s)	DIA. (mm)	SLOPE (%)	LENGTH (m)	CAPACITY (Q_f) (l/s) n= 0.013	Qp/Qf	Vp/Vf	Vf (m/s)	Vp (m/s)	TIME of FLOW (min)
HAIG ROAD																					
100,101	*CB 8, CB 9*	*ST 5*	*0.44*					*0.547*	*0.547*	*15.00*	*73*	*39.9*	*300*	*1.00%*	*7.4*	*96.7 OK*	*0.41*	*0.96*	*1.37*	*1.31*	*0.09*
102 - 105	*ST 5*	*ST 4*	*0.47*					*0.586*	*1.133*	*15.09*	*73*	*82.4*	*375*	*0.35%*	*106.6*	*103.7 OK*	*0.79*	*1.11*	*0.94*	*1.04*	*1.70*
106 - 108	*ST 4*	*ST 3*	*0.47*					*0.582*	*1.715*	*16.80*	*67*	*115.7*	*375*	*0.35%*	*86.5*	*103.7 Surch*	*1.12*	*1.14*	*0.94*	*1.07*	*1.35*
110a	*EXCB*	*MAIN*		*1.38*				*2.303*	*2.303*	*15.00*	*73*	*168.1*	*300*	*0.50%*	*50.0*	*68.4 Surch*	*2.46*	*1.14*	*0.97*	*1.10*	*0.76*
109, 110	*ST 3*	*ST 2*	*0.26*					*0.326*	*4.344*	*18.14*	*64*	*277.6*	*525*	*0.60%*	*47.5*	*333.1 OK*	*0.83*	*1.12*	*1.54*	*1.72*	*0.46*
112a, 112b	*ST 2*	*ST 1*	*0.28*					*0.345*	*4.689*	*18.60*	*63*	*294.5*	*525*	*0.80%*	*21.6*	*384.7 OK*	*0.77*	*1.10*	*1.78*	*1.95*	*0.18*
111 -115	*ST 1*	*Headwall*	*0.98*					*1.224*	*5.913*	*18.79*	*62*	*368.8*	*750*	*0.20%*	*58.4*	*497.9 OK*	*0.75*	*1.10*	*1.13*	*1.24*	*0.79*
ROAD A	ST-A1	ST-A2							*5.913*	19.57	61	358.4	750	1.30%	23.6	1269.3 OK	0.28	0.87	2.87	2.50	0.16
	ST-A2	ST-A3							*5.913*	19.73	60	356.4	750	1.20%	70.4	1219.5 OK	0.29	0.88	2.76	2.42	0.49
	ST-A3	ST-A4							*5.913*	20.22	59	350.4	750	2.70%	79.5	1829.3 OK	0.19	0.78	4.14	3.23	0.41
	ST-A4	ST-A5							*5.913*	20.22	59	350.4	750	1.60%	71.8	1408.2 OK	0.25	0.83	3.19	2.65	0.45
	ST-A5	ST-A6							*5.913*	20.63	58	345.5	750	0.35%	46.5	658.6 OK	0.52	1.00	1.49	1.49	0.52
SQU-100																					
BLOCK A (East)																					
A-1E	CB A-1A	CB A-2E				0.29		0.556	0.556	15.00	73	40.6	300	0.50%	47.0	68.4 OK	0.59	1.03	0.97	1.00	0.79
A-2E	CB A-2E	ST-A100E				0.19		0.367	0.923	15.79	70	65.0	300	0.50%	22.9	68.4 OK	0.95	1.14	0.97	1.10	0.35
A-3E	BLDG	ST-1001				0.16		0.321	0.321	15.00	73	23.4	300	0.50%	15.0	68.4 OK	0.34	0.91	0.97	0.88	0.28
	ST-1001	ST-1002							1.243	16.13	69	86.3	375	2.10%	15.8	254.1 OK	0.34	0.90	2.30	2.07	0.13
	ST-1002	CB/MH 103							1.243	16.26	69	85.8	375	0.55%	50.8	130.0 OK	0.66	1.06	1.18	1.25	0.68
STREET A																					
101	CB 101	CB 102				0.16		0.314	0.314	15.00	73	23.0	300	9.30%	7.4	294.9 OK	0.08	0.59	4.17	2.46	0.05
102	CB 102	CB/MH 103				0.06		0.123	0.437	15.05	73	31.9	375	0.70%	9.3	146.7 OK	0.22	0.80	1.33	1.06	0.15
103	CB/MH 103	ST-1003				0.08		0.165	0.602	16.94	67	40.4	375	0.70%	9.3	146.7 OK	0.28	0.86	1.33	1.14	0.14
104	CB 104	ST-1003				0.11		0.220	0.220	15.00	73	16.1	300	0.50%	13.9	68.4 OK	0.23	0.82	0.97	0.79	0.29
BLOCK B																					
105	CB 105	CB 106				0.12		0.240	0.240	15.00	73	17.5	300	0.50%	39.1	68.4 OK	0.26	0.84	0.97	0.81	0.80
106	CB 106	CB/MH 107				0.12		0.233	0.472	15.80	70	33.2	300	1.30%	28.2	110.3 OK	0.30	0.88	1.56	1.37	0.34
107		CB/MH 107				0.20		0.393	0.865	16.14	69	60.0	300	7.80%	8.3	270.1 OK	0.22	0.81	3.82	3.09	0.04
108	CB 108	CB/MH 109				0.15		0.291	0.291	15.00	73	21.2	300	0.50%	7.7	68.4 OK	0.31	0.89	0.97	0.86	0.15
109	CB/MH 109	ST-1004				0.08		0.162	3.383	17.07	67	225.6	300	7.80%	8.3	270.1 OK	0.84	1.12	3.82	4.28	0.03

PREPARED BY: SDS

DATE:December 12, 2023
REV: December 13, 2024

van MEER limited

621 DUNDAS STREET EAST
CITY of BELLEVILLE
2255718 Ontario Inc. - OWNER

STORM SEWER DESIGN SHEET

5 Year Storm Event ($Q=2.78\ AIR$, $I=27.7t^{-0.699}$)

EXTERNAL DRAINAGE AREAS
HAIG ROAD
INTERNAL AREAS

LOCATION			AREAS (ha)					Indiv.	Accum.	Time of	Rainfall	Peak	SEWER DATA								
STREET	FROM	TO	R=0.45	R=0.60	R=0.65	R=0.7	R=0.85	2.78AR	2.78AR	Conc. min.	Intensity I (mm/hr)	Flow Q_p(l/s)	DIA. (mm)	SLOPE (%)	LENGTH (m)	CAPACITY (Q_f) (l/s) n= 0.013	Qp/Qf	Vp/Vf	Vf (m/s)	Vp (m/s)	TIME of FLOW (min)
BLOCK E																					
110	CB 110	CB/MH 111				0.30		0.587	0.587	15.00	73	42.8	300	0.80%	43.6	86.5 OK	0.50	1.00	1.22	1.22	0.60
111	CB/MH 111	ST-1004				0.14		0.271	0.857	15.60	71	60.9	300	2.20%	8.6	143.4 OK	0.42	0.96	2.03	1.95	0.07
112	DI 112	ST-1004		0.18				0.296	0.296	15.00	73	21.6	300	0.50%	18.8	68.4 OK	0.32	0.89	0.97	0.86	0.37
113		CB 113		0.33				0.551	0.551	15.00	73	40.2	300	6.50%	8.6	246.5 OK	0.16	0.74	3.49	2.58	0.06
	ST-1004	CB/MH 115							5.088	17.11	67	338.8	525	1.00%	47.6	430.1 OK	0.79	1.11	1.99	2.21	0.36
114	CB 114	CB/MH 115		0.09				0.143	0.143	15.00	73	10.5	300	0.90%	7.7	91.7 OK	0.11	0.67	1.30	0.87	0.15
115	CB/MH 115	DCB/MH 120		0.10				0.170	5.401	17.47	66	354.5	525	0.60%	29.1	333.1 OK	1.06	1.14	1.54	1.75	0.28
BLOCK D																					
116	CB 116	CB 117		0.40				0.662	0.662	15.00	73	48.3	300	1.10%	21.5	101.4 OK	0.48	0.99	1.43	1.41	0.25
117	CB 117	CB/MH 118		0.05				0.077	0.739	15.25	72	53.3	375	0.50%	7.8	124.0 OK	0.43	0.97	1.12	1.08	0.12
118	CB/MH 118	DCB/MH 119		0.11				0.181	0.920	15.37	72	66.0	375	0.50%	19.4	124.0 OK	0.53	1.01	1.12	1.13	0.29
119	DCB/MH 119	DCB/MH 120		0.07				0.125	1.045	15.66	71	74.0	375	0.50%	8.8	124.0 OK	0.60	1.03	1.12	1.16	0.13
120	DCB/MH 120	SQU-100		0.07				0.124	6.570	17.74	65	426.5	600	8.10%	10.9	1747.5 OK	0.24	0.83	6.18	5.13	0.04
	SQU-100	MC-3500							6.570	17.78	65	425.9	600	2.30%	3.2	931.2 OK	0.46	0.98	3.29	3.21	0.02
	MC-3500	ST-1005							6.570	17.79	65	425.6	600	11.00%	4.4	2036.4 OK	0.21	0.79	7.20	5.69	0.01
	ST-1005	ST-A6							6.570	17.81	65	425.4	600	0.55%	3.3	455.4 OK	0.93	1.14	1.61	1.84	0.03
STREET A																					
	ST-A6	OUTLET							12.483	21.15	57	716.8	750	0.40%	59.5	704.1 OK	1.02	1.14	1.59	1.82	0.55
SQU-200																					
201	CB 201	CB/MH 202		0.10				0.163	0.163	15.00	73	11.9	300	5.50%	7.8	226.8 OK	0.05	0.53	3.21	1.70	0.08
202	CB/MH 202	ST-2001		0.19				0.312	0.475	15.08	73	34.6	300	1.60%	35.0	122.3 OK	0.28	0.87	1.73	1.51	0.39
203	CB 203	CB/MH 204		0.10				0.172	0.172	15.00	73	12.6	300	0.50%	7.8	68.4 OK	0.18	0.77	0.97	0.74	0.18
204	CB/MH 204	ST-2001		0.16				0.259	0.431	15.18	72	31.2	300	0.50%	39.4	68.4 OK	0.46	0.98	0.97	0.94	0.70
A-1W	CB A-1W	CB/MH A-3W		0.21				0.344	0.344	15.00	73	25.1	300	0.50%	42.8	68.4 OK	0.37	0.92	0.97	0.89	0.80
A-2W	CB A-2W	CB/MH A-3W		0.31				0.523	0.523	15.00	73	38.2	300	2.50%	41.2	152.9 OK	0.25	0.83	2.16	1.80	0.38
	CB/MH A-3W	ST-A100W		0.16				0.259	1.126	15.38	72	80.8	375	0.50%	28.6	124.0 OK	0.65	1.06	1.12	1.19	0.40
A-3W	CB A-3W	CB A-4W		0.34				0.564	0.564	15.00	73	41.2	300	0.50%	57.0	68.4 OK	0.60	1.04	0.97	1.01	0.94
A-4W	CB A-4W	ST-A200W		0.12				0.193	0.757	15.94	70	52.9	300	0.50%	59.2	68.4 OK	0.77	1.10	0.97	1.06	0.93
A-5W	BLDG	ST-A200W		0.17				0.292	0.292	15.00	73	21.3	300	0.50%	2.0	68.4 OK	0.31	0.89	0.97	0.86	0.04

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621 DUNDAS STREET EAST
CITY of BELLEVILLE
2255718 Ontario Inc. - OWNER

STORM SEWER DESIGN SHEET

5 Year Storm Event (Q=2.78 AIR, $I=27.7t^{-0.699}$)

EXTERNAL DRAINAGE AREAS
HAIG ROAD
INTERNAL AREAS

LOCATION			AREAS (ha)					Indiv.	Accum.	Time of	Rainfall	Peak	SEWER DATA									
STREET	FROM	TO	R=0.45	R=0.60	R=0.65	R=0.7	R=0.85	2.78AR	2.78AR	Conc. min.	Intensity I (mm/hr)	Flow Q_p(l/s)	DIA. (mm)	SLOPE (%)	LENGTH (m)	CAPACITY (Q_f) (l/s) n= 0.013		Qp/Qf	Vp/Vf	Vf (m/s)	Vp (m/s)	TIME of FLOW (min)
BLOCK A (West)	ST-A100W	ST-2001							3.081	16.87	67	207.2	450	0.50%	13.3	201.6	OK	1.03	1.14	1.27	1.45	0.15
	ST-2001	CB/MH 208							3.081	17.02	67	205.9	450	1.10%	54.0	299.0	OK	0.69	1.07	1.88	2.01	0.45
205	CB 205	CB/MH 208		0.24				0.394	0.394	15.00	73	28.8	300	2.50%	20.2	152.9	OK	0.19	0.77	2.16	1.65	0.20
206	CB 206	CB/MH 208		0.11				0.178	0.178	15.00	73	13.0	300	1.90%	51.2	133.3	OK	0.10	0.64	1.89	1.21	0.71
207		CB 207		0.06				0.100	0.100	15.00	73	7.3	300	1.00%	7.6	96.7	OK	0.08	0.59	1.37	0.81	0.16
208	CB/MH 208	ST-2001		0.25				0.410	4.164	17.47	66	273.2	450	1.00%	30.9	285.1	OK	0.96	1.14	1.79	2.04	0.25
209	CB 209	ST-2002		0.19				0.313	0.313	15.00	73	22.9	300	2.10%	27.4	140.1	OK	0.16	0.74	1.98	1.47	0.31
	ST-2002	ST-2003							4.477	17.72	65	290.9	525	2.00%	8.7	608.2	OK	0.48	0.99	2.81	2.77	0.05
	ST-2003	CB/MH 210							4.477	17.78	65	290.3	525	2.00%	34.2	608.2	OK	0.48	0.99	2.81	2.77	0.21
210	CB/MH 210	ST-2004		0.34					4.477	17.98	64	287.9	525	1.60%	35.7	544.0	OK	0.53	1.01	2.51	2.54	0.23
211	CB 211	CB/MH 212		0.05				0.076	0.076	15.00	73	5.6	300	0.50%	7.8	68.4	OK	0.08	0.62	0.97	0.60	0.22
212	CB/MH 212	ST-2004		0.11				0.192	0.268	15.22	72	19.4	300	0.50%	33.9	68.4	OK	0.28	0.87	0.97	0.84	0.67
	ST-2004	CB/MH 213							4.745	18.22	64	302.4	525	0.50%	11.6	304.1	OK	0.99	1.14	1.40	1.60	0.12
213	CB/MH 213	CB/MH 214		0.22				0.373	5.119	18.34	63	324.7	525	0.50%	7.6	304.1	OK	1.07	1.14	1.40	1.60	0.08
214	CB/MH 214	SQU-200		0.10				0.167	5.286	18.34	63	335.3	750	9.50%	8.6	3431.4	OK	0.10	0.64	7.77	4.97	0.03
	SQU-200	MC-3500							5.286	18.42	63	334.3	750	9.50%	5.4	3431.4	OK	0.10	0.64	7.77	4.97	0.02
	MC-3500	ST-2005							5.286	18.44	63	334.1	750	0.10%	2.6	352.0	OK	0.95	1.14	0.80	0.91	0.05
SQU-300																						
F-1E		CB F-1E		0.10				0.158	0.158	15.00	73	11.6	300	2.80%	15.3	161.8	OK	0.07	0.59	2.29	1.35	0.19
F-2E	CB F-2E	CB F-4E		0.15				0.248	0.407	15.19	72	29.4	300	0.50%	65.1	68.4	OK	0.43	0.97	0.97	0.93	1.16
F-3E	CB F-3E	CB F-4E		0.05				0.084	0.084	15.00	73	6.2	300	6.50%	15.4	246.5	OK	0.02	0.34	3.49	1.19	0.22
F-4E	CB F-4E	ST-3001		0.23				0.378	0.869	16.35	69	59.7	300	0.50%	31.2	68.4	OK	0.87	1.13	0.97	1.09	0.48
F-5E	CB F-5E	ST-3001		0.08				0.130	0.130	15.00	73	9.5	300	2.10%	32.9	140.1	OK	0.07	0.57	1.98	1.13	0.49
301		CB 301		0.07				0.117	0.117	15.00	73	8.6	300	0.50%	2.4	68.4	OK	0.13	0.69	0.97	0.67	0.06
BLOCK F (East)	ST-3001	CB/MH 303							1.116	16.83	67	75.2	375	0.50%	15.6	124.0	OK	0.61	1.04	1.12	1.17	0.22
302		CB 302		0.36				0.599	0.599	15.00	73	43.7	300	0.50%	43.8	68.4	OK	0.64	1.05	0.97	1.02	0.72
303	CB/MH 303	ST-3002		0.14				0.226	1.942	17.05	67	129.6	375	0.50%	56.4	124.0	OK	1.05	1.14	1.12	1.28	0.73
	ST-3002	CB/MH 306							1.942	17.79	65	125.8	375	0.50%	10.4	124.0	OK	1.01	1.14	1.12	1.28	0.14
304	CB 304	CB/MH 306		0.17				0.291	0.291	15.00	73	21.2	300	6.80%	7.8	252.2	OK	0.08	0.62	3.57	2.21	0.06
305		CB 305		0.08				0.136	0.136	15.00	73	9.9	300	7.40%	6.8	263.1	OK	0.04	0.46	3.72	1.71	0.07
306	CB/MH 306	CB/MH 310		0.14				0.233	2.601	17.92	64	167.7	450	0.70%	56.3	238.5	OK	0.70	1.08	1.50	1.62	0.58
307	CB 307	CB/MH 310		0.09				0.156	0.156	15.00	73	11.4	300	7.30%	6.1	261.3	OK	0.04	0.50	3.70	1.85	0.06
308	CB 308	CB/MH 310		0.06				0.095	0.095	15.00	73	6.9	300	7.80%	7.8	270.1	OK	0.03	0.34	3.82	1.30	0.10
309		CB 309		0.07				0.125	0.125	15.00	73	9.1	300	0.50%	7.0	68.4	OK	0.13	0.71	0.97	0.69	0.17
310	CB/MH 310	CB/MH 312		0.08				0.135	3.113	18.50	63	196.3	450	0.50%	61.5	201.6	OK	0.97	1.14	1.27	1.45	0.71
311	CB 311	CB/MH 312		0.06				0.105	0.105	15.00	73	7.6	300	0.50%	7.8	68.4	OK	0.11	0.67	0.97	0.65	0.20
312	CB/MH 312	ST-3003		0.11				0.176	3.393	19.21	61	208.4	450	0.50%	9.2	201.6	OK	1.03	1.14	1.27	1.45	0.11

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621 DUNDAS STREET EAST
CITY of BELLEVILLE
2255718 Ontario Inc. - OWNER

STORM SEWER DESIGN SHEET

5 Year Storm Event (Q=2.78 AIR, $I=27.7t^{-0.699}$)

EXTERNAL DRAINAGE AREAS
HAIG ROAD
INTERNAL AREAS

LOCATION			AREAS (ha)					Indiv.	Accum.	Time of	Rainfall	Peak	SEWER DATA									
STREET	FROM	TO	R=0.45	R=0.60	R=0.65	R=0.7	R=0.85	2.78AR	2.78AR	Conc. min.	Intensity I (mm/hr)	Flow Q_p(l/s)	DIA. (mm)	SLOPE (%)	LENGTH (m)	CAPACITY (Q_f) (l/s) n= 0.013		Qp/Qf	Vp/Vf	Vf (m/s)	Vp (m/s)	TIME of FLOW (min)
	ST-3003	CB/MH 314							3.393	19.32	61	207.6	450	0.50%	29.2	201.6	OK	1.03	1.14	1.27	1.45	0.34
313	CB 313	CB/MH 314		0.12				0.193	0.193	15.00	73	14.1	300	0.50%	7.8	68.4	OK	0.21	0.79	0.97	0.76	0.17
314	CB/MH 314	CB/MH 320		0.07				0.109	3.696	19.65	60	223.4	525	0.50%	38.6	304.1	OK	0.73	1.09	1.40	1.53	0.42
315	CB 315	DCB/MH 316		0.15				0.257	0.257	15.00	73	18.8	300	1.90%	26.2	133.3	OK	0.14	0.72	1.89	1.36	0.32
316	DCB/MH 316	CB/MH 317		0.20				0.332	0.589	15.32	72	42.4	375	1.70%	34.2	228.6	OK	0.19	0.77	2.07	1.58	0.36
317	CB/MH 317	CB/MH 320		0.24				0.400	0.989	15.68	71	70.0	375	2.00%	35.7	248.0	OK	0.28	0.87	2.25	1.95	0.30
318	CB 318	CB 319		0.06				0.101	0.101	15.00	73	7.4	300	0.50%	13.4	68.4	OK	0.11	0.65	0.97	0.63	0.36
319	CB 319	CB/MH 320		0.08				0.134	0.236	15.36	72	16.9	375	0.50%	7.8	124.0	OK	0.14	0.71	1.12	0.80	0.16
320	CB/MH 320	DCB/MH 321		0.09				0.152	5.073	20.07	60	302.1	525	0.50%	40.0	304.1	OK	0.99	1.14	1.40	1.60	0.42
321	DCB/MH 321	DCB/MH 322		0.19				0.318	5.391	20.49	59	316.4	525	0.50%	7.8	304.1	OK	1.04	1.14	1.40	1.60	0.08
322	DCB/MH 322	SQU-300		0.12				0.199	5.590	20.57	59	327.2	750	9.40%	9.4	3413.2	OK	0.10	0.64	7.73	4.94	0.03
	SQU-300	ST-2005						0.000	5.590	20.74	58	325.4	750	0.10%	9.4	352.0	OK	0.92	1.14	0.80	0.90	0.17
	ST-2005	OUTLET							10.876	20.91	58	629.3	750	0.35%	7.9	658.6	OK	0.96	1.14	1.49	1.70	0.08

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621 DUNDAS STREET EAST
CITY of BELLEVILLE
2255718 Ontario Inc. - OWNER

STORM SEWER DESIGN SHEET

5 Year Storm Event (Q=2.78 AIR, I=27.7t$^{-0.699}$)

EXTERNAL DRAINAGE AREAS
HAIG ROAD
INTERNAL AREAS

LOCATION			AREAS (ha)					Indiv.	Accum.	Time of	Rainfall	Peak	SEWER DATA									
STREET	FROM	TO	R=0.45	R=0.60	R=0.65	R=0.7	R=0.85	2.78AR	2.78AR	Conc. min.	Intensity I (mm/hr)	Flow Q_p(l/s)	DIA. (mm)	SLOPE (%)	LENGTH (m)	CAPACITY (Q_f) (l/s) n= 0.013		Qp/Qf	Vp/Vf	Vf (m/s)	Vp (m/s)	TIME of FLOW (min)
SQU-400																						
401	CB 401	ST-4001		0.18				0.293	0.293	15.00	73	21.4	300	0.50%	67.6	68.4	OK	0.31	0.89	0.97	0.86	1.32
402	CB 402	CB 403		0.11				0.184	0.184	15.00	73	13.5	300	0.50%	31.7	68.4	OK	0.20	0.78	0.97	0.75	0.70
403	CB 403	ST-4001		0.22				0.359	0.543	15.70	71	38.4	300	0.60%	16.1	74.9	OK	0.51	1.00	1.06	1.06	0.25
	ST-4001	CB/MH 406						0.000	0.836	15.95	70	58.5	300	1.10%	23.3	101.4	OK	0.58	1.03	1.43	1.48	0.26
404	CB 404	CB 405		0.17				0.280	0.280	15.00	73	20.4	300	1.00%	31.3	96.7	OK	0.21	0.80	1.37	1.09	0.48
405	CB 405	CB/MH 406		0.16				0.265	0.545	15.48	71	38.9	300	0.50%	19.4	68.4	OK	0.57	1.02	0.97	0.99	0.33
406	CB/MH 406	CB/MH 408		0.22				0.375	1.756	16.22	69	121.4	375	0.75%	33.2	151.8	OK	0.80	1.11	1.37	1.53	0.36
407	CB 407	CB/MH 408		0.10				0.169	0.169	15.00	73	12.3	300	3.70%	47.2	186.0	OK	0.07	0.57	2.63	1.50	0.52
408	CB/MH 408	SQU-400		0.08				0.140	2.065	16.58	68	140.6	450	11.50%	6.0	966.8	OK	0.15	0.72	6.08	4.38	0.02
	SQU-400	MC-3500							2.065	16.60	68	140.4	450	0.50%	13.7	201.6	OK	0.70	1.07	1.27	1.36	0.17
	MC-3500	ST-4002							2.065	16.77	68	139.4	450	1.00%	5.4	285.1	OK	0.49	0.99	1.79	1.77	0.05
	ST-4002	OUTLET							2.065	16.82	67	139.1	450	3.10%	33.3	502.0	OK	0.28	0.86	3.16	2.71	0.20
SQU-500																						
501	CB 501	SQU-500		0.38				0.638	0.638	15.00	73	46.6	450	1.80%	45.0	382.5	OK	0.12	0.69	2.41	1.66	0.45
502	CB 502	CB 503		0.32				0.531	0.531	15.00	73	38.8	300	0.50%	52.5	68.4	OK	0.57	1.02	0.97	0.99	0.89
503	CB 503	CB/MH 504		0.12				0.203	0.734	15.89	70	51.5	300	0.50%	32.2	68.4	OK	0.75	1.10	0.97	1.06	0.50
504	CB/MH 504	SQU-500		0.26				0.428	1.801	16.39	69	123.6	450	4.10%	15.6	577.3	OK	0.21	0.80	3.63	2.90	0.09
	SQU-500	MC-3500							1.801	16.48	68	123.1	450	0.45%	4.5	191.3	OK	0.64	1.05	1.20	1.26	0.06
	MC-3500	ST-5001							1.801	16.54	68	122.8	450	14.40%	2.3	1081.9	OK	0.11	0.67	6.80	4.56	0.01
	ST-5001	OUTLET							1.801	16.55	68	122.7	450	0.35%	9.1	168.7	OK	0.73	1.09	1.06	1.16	0.13
SQU-600																						
601	CB 601	ST-6001		0.07				0.111	0.111	15.00	73	8.1	300	0.50%	7.6	68.4	OK	0.12	0.67	0.97	0.65	0.20
602	CB 602	ST-6001		0.26				0.435	0.435	15.00	73	31.7	300	0.50%	3.1	68.4	OK	0.46	0.98	0.97	0.95	0.05
	ST-6001	DCB 603							0.546	15.20	72	39.5	300	0.50%	51.6	68.4	OK	0.58	1.03	0.97	1.00	0.86
603	DCB 603	SQU-600		0.45				0.744	1.289	16.06	70	89.7	450	5.40%	9.6	662.5	OK	0.14	0.71	4.17	2.96	0.05
	SQU-600	MC-3500							1.289	16.11	69	89.5	450	0.50%	4.0	201.6	OK	0.44	0.97	1.27	1.23	0.05
	MC-3500	OUTLET							1.289	16.17	69	89.3	450	4.70%	6.0	618.1	OK	0.14	0.72	3.89	2.80	0.04
	PROPOSED INFORMATION					Shown in VERTICAL TEXT																
	EXISTING INFORMATION					*Shown in ITALISIZED TEXT*																

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621 DUNDAS STREET EAST
CITY of BELLEVILLE
2255718 Ontario Inc. - OWNER

STORM SEWER DESIGN SHEET

100 Year Storm Event ($Q=2.78\ AIR$, $I=46.1t^{-0.699}$)

EXTERNAL DRAINAGE AREAS
HAIG ROAD
INTERNAL AREAS

LOCATION			AREAS (ha)					Indiv.	Accum.	Time of	Rainfall	Peak	SEWER DATA									
STREET	FROM	TO	R=0.45	R=0.60	R=0.65	R=0.7	R=0.85	2.78AR	2.78AR	Conc. min.	Intensity I (mm/hr)	Flow Q_p(l/s)	DIA. (mm)	SLOPE (%)	LENGTH (m)	CAPACITY (Q_f) (l/s) n= 0.013		Qp/Qf	Vp/Vf	Vf (m/s)	Vp (m/s)	TIME of FLOW (min)
HAIG ROAD																						
100,101	*CB 8, CB 9*	*ST 5*	*0.44*					*0.684*	*0.684*	*15.00*	*121*	*83.1*	*300*	*1.00%*	*7.4*	*96.7*	*OK*	*0.86*	*1.13*	*1.37*	*1.54*	*0.08*
102 - 105	*ST 5*	*ST 4*	*0.47*					*0.733*	*1.417*	*15.08*	*121*	*171.5*	*375*	*0.35%*	*106.6*	*103.7*	*Surch*	*1.65*	*1.14*	*0.94*	*1.07*	*1.66*
106 - 108	*ST 4*	*ST 3*	*0.47*					*0.727*	*2.144*	*16.74*	*113*	*241.2*	*375*	*0.35%*	*86.5*	*103.7*	*Surch*	*2.33*	*1.14*	*0.94*	*1.07*	*1.35*
110a	*EXCB*	*MAIN*		*1.38*				*2.878*	*2.878*	*15.00*	*121*	*349.7*	*300*	*0.50%*	*50.0*	*68.4*	*Surch*	*5.11*	*1.14*	*0.97*	*1.10*	*0.76*
109, 110	*ST 3*	*ST 2*	*0.26*					*0.408*	*5.430*	*18.09*	*107*	*578.8*	*525*	*0.60%*	*47.5*	*333.1*	*Surch*	*1.74*	*1.14*	*1.54*	*1.75*	*0.45*
112a, 112b	*ST 2*	*ST 1*	*0.28*					*0.431*	*5.862*	*18.54*	*105*	*614.2*	*525*	*0.80%*	*21.6*	*384.7*	*Surch*	*1.60*	*1.14*	*1.78*	*2.03*	*0.18*
111 -115	*ST 1*	*Headwall*	*0.98*					*1.530*	*7.391*	*18.71*	*104*	*769.3*	*750*	*0.20%*	*58.4*	*497.9*	*Surch*	*1.56*	*1.14*	*1.13*	*1.28*	*0.76*
ROAD A	ST-A1	ST-A2							*7.391*	19.47	101	748.2	750	1.30%	23.6	1269.3	OK	0.59	1.03	2.87	2.96	0.13
	ST-A2	ST-A3							7.391	19.60	101	744.7	750	1.20%	70.4	1219.5	OK	0.61	1.04	2.76	2.87	0.41
	ST-A3	ST-A4							7.391	20.01	99	734.0	750	2.70%	79.5	1829.3	OK	0.40	0.95	4.14	3.93	0.34
	ST-A4	ST-A5							7.391	20.35	98	725.5	750	1.60%	71.8	1408.2	OK	0.52	1.00	3.19	3.19	0.38
	ST-A5	ST-A6							7.391	20.73	97	716.3	750	0.35%	46.5	658.6	Surch	1.09	1.14	1.49	1.70	0.46
SQU-100																						
BLOCK A (East)																						
A-1E	CB A-1A	CB A-2E				0.29		0.744	0.744	15.00	121	90.4	300	0.50%	47.0	68.4	Surch	1.32	1.14	0.97	1.10	0.71
A-2E	CB A-2E	ST-A100E				0.19		0.492	1.236	15.71	118	145.4	300	0.50%	22.9	68.4	Surch	2.13	1.14	0.97	1.10	0.35
A-3E	BLDG	ST-1001				0.16		0.429	0.429	15.00	121	52.1	300	0.50%	15.0	68.4	OK	0.76	1.10	0.97	1.06	0.23
	ST-1001	ST-1002							1.665	16.06	116	192.9	375	2.10%	15.8	254.1	OK	0.76	1.10	2.30	2.53	0.10
	ST-1002	CB/MH 103							1.665	16.16	115	192.0	375	0.55%	50.8	130.0	Surch	1.48	1.14	1.18	1.34	0.63
STREET A																						
101	CB 101	CB 102				0.16		0.421	0.421	15.00	121	51.2	300	9.30%	7.4	294.9	OK	0.17	0.76	4.17	3.17	0.04
102	CB 102	CB/MH 103				0.06		0.165	0.586	15.04	121	71.1	375	0.70%	9.3	146.7	OK	0.48	0.99	1.33	1.31	0.12
103	CB/MH 103	ST-1003				0.08		0.221	0.807	16.79	112	90.6	375	0.70%	9.3	146.7	OK	0.62	1.04	1.33	1.38	0.11
104	CB 104	ST-1003				0.11		0.295	0.295	15.00	121	35.8	300	0.50%	13.9	68.4	OK	0.52	1.00	0.97	0.97	0.24
BLOCK B																						
105	CB 105	CB 106				0.12		0.321	0.321	15.00	121	39.0	300	0.50%	39.1	68.4	OK	0.57	1.02	0.97	0.99	0.66
106	CB 106	CB/MH 107				0.12		0.312	0.633	15.66	118	74.6	300	1.30%	28.2	110.3	OK	0.68	1.07	1.56	1.67	0.28
107		CB/MH 107				0.20		0.526	1.159	15.94	116	134.9	300	7.80%	8.3	270.1	OK	0.50	1.00	3.82	3.80	0.04
108	CB 108	CB/MH 109				0.15		0.390	0.390	15.00	121	47.3	300	0.50%	7.7	68.4	OK	0.69	1.07	0.97	1.04	0.12
109	CB/MH 109	ST-1004				0.08		0.217	4.531	16.90	112	506.4	300	7.80%	8.3	270.1	Surch	1.88	1.14	3.82	4.36	0.03

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621 DUNDAS STREET EAST
CITY of BELLEVILLE
2255718 Ontario Inc. - OWNER

STORM SEWER DESIGN SHEET

100 Year Storm Event (Q=2.78 AIR, $I=46.1t^{-0.699}$)

EXTERNAL DRAINAGE AREAS
HAIG ROAD
INTERNAL AREAS

LOCATION			AREAS (ha)					Indiv.	Accum.	Time of	Rainfall	Peak	SEWER DATA									
STREET	FROM	TO	R=0.45	R=0.60	R=0.65	R=0.7	R=0.85	2.78AR	2.78AR	Conc. min.	Intensity I (mm/hr)	Flow Q_p(l/s)	DIA. (mm)	SLOPE (%)	LENGTH (m)	CAPACITY (Q_f) (l/s) n= 0.013		Qp/Qf	Vp/Vf	Vf (m/s)	Vp (m/s)	TIME of FLOW (min)
BLOCK E																						
110	CB 110	CB/MH 111				0.30		0.786	0.786	15.00	121	95.5	300	0.80%	43.6	86.5	Surch	1.10	1.14	1.22	1.39	0.52
111	CB/MH 111	ST-1004				0.14		0.363	1.148	15.52	119	136.2	300	2.20%	8.6	143.4	OK	0.95	1.14	2.03	2.31	0.06
112	DI 112	ST-1004		0.18				0.369	0.369	15.00	121	44.9	300	0.50%	18.8	68.4	OK	0.66	1.06	0.97	1.03	0.31
113		CB 113		0.33				0.689	0.689	15.00	121	83.7	300	6.50%	8.6	246.5	OK	0.34	0.90	3.49	3.14	0.05
	ST-1004	CB/MH 115							6.738	16.94	112	752.0	525	1.00%	47.6	430.1	Surch	1.75	1.14	1.99	2.26	0.35
114	CB 114	CB/MH 115		0.09				0.179	0.179	15.00	121	21.8	300	0.90%	7.7	91.7	OK	0.24	0.82	1.30	1.06	0.12
115	CB/MH 115	DCB/MH 120		0.10				0.212	7.130	17.29	110	784.4	525	0.60%	29.1	333.1	Surch	2.35	1.14	1.54	1.75	0.28
BLOCK D																						
116	CB 116	CB 117		0.28				0.578	0.578	15.00	121	70.2	300	1.10%	21.5	101.4	OK	0.69	1.07	1.43	1.54	0.23
117	CB 117	CB/MH 118		0.05				0.096	0.674	15.23	120	81.0	375	0.50%	7.8	124.0	OK	0.65	1.06	1.12	1.19	0.11
118	CB/MH 118	DCB/MH 119		0.11				0.227	0.901	15.34	120	107.7	375	0.50%	19.4	124.0	OK	0.87	1.13	1.12	1.26	0.26
119	DCB/MH 119	DCB/MH 120		0.07				0.156	1.057	15.60	118	124.9	375	0.50%	8.8	124.0	OK	1.01	1.14	1.12	1.28	0.11
120	DCB/MH 120	SQU-100		0.07				0.155	8.341	17.56	109	907.6	600	8.10%	10.9	1747.5	OK	0.52	1.00	6.18	6.18	0.03
	SQU-100	MC-3500							8.341	17.59	109	906.5	600	2.30%	3.2	931.2	OK	0.97	1.14	3.29	3.75	0.01
	MC-3500	ST-1005							8.341	17.61	109	906.0	600	11.00%	4.4	2036.4	OK	0.44	0.97	7.20	6.99	0.01
	ST-1005	ST-A6							8.341	17.62	109	905.7	600	0.55%	3.3	455.4	Surch	1.99	1.14	1.61	1.84	0.03
STREET A																						
	ST-A6	OUTLET							15.732	21.18	95	1501.7	750	0.40%	59.5	704.1	Surch	2.13	1.14	1.59	1.82	0.55
SQU-200																						
201	CB 201	CB/MH 202		0.10				0.203	0.203	15.00	121	24.7	300	5.50%	7.8	226.8	OK	0.11	0.65	3.21	2.09	0.06
202	CB/MH 202	ST-2001		0.19				0.391	0.594	15.06	121	72.0	300	1.60%	35.0	122.3	OK	0.59	1.03	1.73	1.78	0.33
203	CB 203	CB/MH 204		0.10				0.215	0.215	15.00	121	26.1	300	0.50%	7.8	68.4	OK	0.38	0.94	0.97	0.91	0.14
204	CB/MH 204	ST-2001		0.16				0.324	0.539	15.14	121	65.0	300	0.50%	39.4	68.4	OK	0.95	1.14	0.97	1.10	0.60
A-1W	CB A-1W	CB/MH A-3W		0.21				0.430	0.430	15.00	121	52.3	300	0.50%	42.8	68.4	OK	0.76	1.10	0.97	1.06	0.67
A-2W	CB A-2W	CB/MH A-3W		0.31				0.654	0.654	15.00	121	79.5	300	2.50%	41.2	152.9	OK	0.52	1.00	2.16	2.16	0.32
	CB/MH A-3W	ST-A100W		0.16				0.324	1.408	15.32	120	168.6	375	0.50%	28.6	124.0	Surch	1.36	1.14	1.12	1.28	0.37
A-3W	CB A-3W	CB A-4W		0.34				0.705	0.705	15.00	121	85.7	300	0.50%	57.0	68.4	Surch	1.25	1.14	0.97	1.10	0.86
A-4W	CB A-4W	ST-A200W		0.12				0.241	0.946	15.86	117	110.6	300	0.50%	59.2	68.4	Surch	1.62	1.14	0.97	1.10	0.89
A-5W	BLDG	ST-A200W		0.17				0.364	0.364	15.00	121	44.3	300	0.50%	2.0	68.4	OK	0.65	1.05	0.97	1.02	0.03

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STORM SEWER DESIGN SHEET

100 Year Storm Event (Q=2.78 AIR, I=46.1t$^{-0.699}$)

EXTERNAL DRAINAGE AREAS
HAIG ROAD
INTERNAL AREAS

LOCATION			AREAS (ha)					Indiv.	Accum.	Time of	Rainfall	Peak	SEWER DATA								
STREET	FROM	TO	R=0.45	R=0.60	R=0.65	R=0.7	R=0.85	2.78AR	2.78AR	Conc. min.	Intensity I (mm/hr)	Flow Q_p(l/s)	DIA. (mm)	SLOPE (%)	LENGTH (m)	CAPACITY (Q_f) (l/s) n= 0.013	Qp/Qf	Vp/Vf	Vf (m/s)	Vp (m/s)	TIME of FLOW (min)
BLOCK A (West)	ST-A100W	ST-2001							3.851	16.76	112	433.1	450	0.50%	13.3	201.6 Surch	2.15	1.14	1.27	1.45	0.15
	ST-2001	CB/MH 208							3.851	16.91	112	430.3	450	1.10%	54.0	299.0 Surch	1.44	1.14	1.88	2.14	0.42
205	CB 205	CB/MH 208		0.24				0.493	0.493	15.00	121	59.9	300	2.50%	20.2	152.9 OK	0.39	0.95	2.16	2.04	0.16
206	CB 206	CB/MH 208		0.11				0.222	0.222	15.00	121	27.0	300	1.90%	51.2	133.3 OK	0.20	0.79	1.89	1.49	0.57
207		CB 207		0.06				0.125	0.125	15.00	121	15.2	300	1.00%	7.6	96.7 OK	0.16	0.73	1.37	1.00	0.13
208	CB/MH 208	ST-2001		0.25				0.513	5.205	17.33	110	571.7	450	1.00%	30.9	285.1 Surch	2.01	1.14	1.79	2.04	0.25
209	CB 209	ST-2002		0.19				0.392	0.392	15.00	121	47.6	300	2.10%	27.4	140.1 OK	0.34	0.90	1.98	1.78	0.26
	ST-2002	ST-2003							5.597	17.58	109	608.5	525	2.00%	8.7	608.2 OK	1.00	1.14	2.81	3.20	0.05
	ST-2003	CB/MH 210							5.597	17.63	109	607.4	525	2.00%	34.2	608.2 OK	1.00	1.14	2.81	3.20	0.18
210	CB/MH 210	ST-2004		0.34				0.707	6.304	17.80	108	679.4	525	1.60%	35.7	544.0 Surch	1.25	1.14	2.51	2.86	0.21
211	CB 211	CB/MH 212		0.05				0.095	0.095	15.00	121	11.6	300	0.50%	7.8	68.4 OK	0.17	0.74	0.97	0.72	0.18
212	CB/MH 212	ST-2004		0.11				0.240	0.335	15.18	120	40.3	300	0.50%	33.9	68.4 OK	0.59	1.03	0.97	1.00	0.57
	ST-2004	CB/MH 213						0.000	6.639	18.01	107	709.7	525	0.50%	11.6	304.1 Surch	2.33	1.14	1.40	1.60	0.12
213	CB/MH 213	CB/MH 214		0.22				0.467	7.105	18.13	106	756.0	525	0.50%	7.6	304.1 Surch	2.49	1.14	1.40	1.60	0.08
214	CB/MH 214	SQU-200		0.10				0.208	7.313	18.13	106	778.2	750	9.50%	8.6	3431.4 OK	0.23	0.81	7.77	6.29	0.02
	SQU-200	MC-3500							7.313	18.21	106	775.8	750	9.50%	5.4	3431.4 OK	0.23	0.81	7.77	6.29	0.01
	MC-3500	ST-2005							7.313	18.23	106	775.4	750	0.10%	2.6	352.0 Surch	2.20	1.14	0.80	0.91	0.05
SQU-300																					
F-1E		CB F-1E		0.10				0.198	0.198	15.00	121	24.1	300	2.80%	15.3	161.8 OK	0.15	0.72	2.29	1.65	0.15
F-2E	CB F-2E	CB F-4E		0.15				0.310	0.508	15.15	121	61.3	300	0.50%	65.1	68.4 OK	0.90	1.13	0.97	1.09	0.99
F-3E	CB F-3E	CB F-4E		0.05				0.106	0.106	15.00	121	12.8	300	6.50%	15.4	246.5 OK	0.05	0.53	3.49	1.85	0.14
F-4E	CB F-4E	ST-3001		0.23				0.472	1.086	16.15	115	125.3	300	0.50%	31.2	68.4 Surch	1.83	1.14	0.97	1.10	0.47
F-5E	CB F-5E	ST-3001		0.08				0.162	0.162	15.00	121	19.7	300	2.10%	32.9	140.1 OK	0.14	0.72	1.98	1.43	0.38
301		CB 301		0.07				0.147	0.147	15.00	121	17.8	300	0.50%	2.4	68.4 OK	0.26	0.86	0.97	0.83	0.05
BLOCK F (East)	ST-3001	CB/MH 303							1.395	16.62	113	157.8	375	0.50%	15.6	124.0 Surch	1.27	1.14	1.12	1.28	0.20
302		CB 302		0.36				0.749	0.749	15.00	121	91.0	300	0.50%	43.8	68.4 Surch	1.33	1.14	0.97	1.10	0.66
303	CB/MH 303	ST-3002		0.14				0.283	2.427	16.82	112	272.2	375	0.50%	56.4	124.0 Surch	2.20	1.14	1.12	1.28	0.73
	ST-3002	CB/MH 306							2.427	17.56	109	264.2	375	0.50%	10.4	124.0 Surch	2.13	1.14	1.12	1.28	0.14
304	CB 304	CB/MH 306		0.17				0.363	0.363	15.00	121	44.2	300	6.80%	7.8	252.2 OK	0.18	0.76	3.57	2.71	0.05
305		CB 305		0.08				0.170	0.170	15.00	121	20.7	300	7.40%	6.8	263.1 OK	0.08	0.59	3.72	2.20	0.05
306	CB/MH 306	CB/MH 310		0.14				0.291	3.252	17.69	108	352.0	450	0.70%	56.3	238.5 Surch	1.48	1.14	1.50	1.71	0.55
307	CB 307	CB/MH 310		0.09				0.195	0.195	15.00	121	23.7	300	7.30%	6.1	261.3 OK	0.09	0.64	3.70	2.37	0.04
308	CB 308	CB/MH 310		0.06				0.119	0.119	15.00	121	14.4	300	7.80%	7.8	270.1 OK	0.05	0.53	3.82	2.02	0.06
309		CB 309		0.07				0.156	0.156	15.00	121	19.0	300	0.50%	7.0	68.4 OK	0.28	0.86	0.97	0.83	0.14
310	CB/MH 310	CB/MH 312		0.08				0.169	3.891	18.24	106	412.3	450	0.50%	61.5	201.6 Surch	2.05	1.14	1.27	1.45	0.71
311	CB 311	CB/MH 312		0.06				0.131	0.131	15.00	121	15.9	300	0.50%	7.8	68.4 OK	0.23	0.82	0.97	0.79	0.16
312	CB/MH 312	ST-3003		0.11				0.220	4.242	18.95	103	437.6	450	0.50%	9.2	201.6 Surch	2.17	1.14	1.27	1.45	0.11

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STORM SEWER DESIGN SHEET

100 Year Storm Event (Q=2.78 AIR, $I=46.1t^{-0.699}$)

EXTERNAL DRAINAGE AREAS
HAIG ROAD
INTERNAL AREAS

LOCATION			AREAS (ha)					Indiv.	Accum.	Time of	Rainfall	Peak	SEWER DATA									
STREET	FROM	TO	R=0.45	R=0.60	R=0.65	R=0.7	R=0.85	2.78AR	2.78AR	Conc. min.	Intensity I (mm/hr)	Flow Q_p(l/s)	DIA. (mm)	SLOPE (%)	LENGTH (m)	CAPACITY (Q_f) (l/s) n= 0.013		Qp/Qf	Vp/Vf	Vf (m/s)	Vp (m/s)	TIME of FLOW (min)
	ST-3003	CB/MH 314							4.242	19.06	103	435.9	450	0.50%	29.2	201.6	Surch	2.16	1.14	1.27	1.45	0.34
313	CB 313	CB/MH 314		0.09				0.196	0.196	15.00	121	23.8	300	0.50%	7.8	68.4	OK	0.35	0.91	0.97	0.88	0.15
314	CB/MH 314	CB/MH 320		0.07				0.137	4.574	19.39	102	464.4	525	0.50%	38.6	304.1	Surch	1.53	1.14	1.40	1.60	0.40
315	CB 315	DCB/MH 316		0.15				0.321	0.321	15.00	121	39.0	300	1.90%	26.2	133.3	OK	0.29	0.88	1.89	1.65	0.26
316	DCB/MH 316	CB/MH 317		0.20				0.415	0.736	15.26	120	88.4	375	1.70%	34.2	228.6	OK	0.39	0.94	2.07	1.95	0.29
317	CB/MH 317	CB/MH 320		0.24				0.500	1.237	15.56	118	146.5	375	2.00%	35.7	248.0	OK	0.59	1.03	2.25	2.31	0.26
318	CB 318	CB 319		0.06				0.124	0.124	15.00	121	15.0	300	0.50%	13.4	68.4	OK	0.22	0.81	0.97	0.78	0.29
319	CB 319	CB/MH 320		0.07				0.143	0.267	15.29	120	32.0	375	0.50%	7.8	124.0	OK	0.26	0.84	1.12	0.94	0.14
320	CB/MH 320	DCB/MH 321		0.09				0.190	6.268	19.79	100	627.3	525	0.50%	40.0	304.1	Surch	2.06	1.14	1.40	1.60	0.42
321	DCB/MH 321	DCB/MH 322		0.19				0.397	6.665	20.21	99	657.4	525	0.50%	7.8	304.1	Surch	2.16	1.14	1.40	1.60	0.08
322	DCB/MH 322	SQU-300							6.665	20.29	98	655.6	750	9.40%	9.4	3413.2	OK	0.19	0.78	7.73	6.03	0.03
	SQU-300	ST-2005		0.10				0.218	6.883	20.44	98	673.5	750	0.10%	9.4	352.0	Surch	1.91	1.14	0.80	0.91	0.17
	ST-2005	OUTLET							14.196	20.61	97	1381.1	750	0.35%	7.9	658.6	Surch	2.10	1.14	1.49	1.70	0.08

PREPARED BY: SDS

DATE:December 12, 2023
REV: December 13, 2024

van MEER limited

621 DUNDAS STREET EAST
CITY of BELLEVILLE
2255718 Ontario Inc. - OWNER

STORM SEWER DESIGN SHEET

100 Year Storm Event ($Q=2.78\,AIR$, $I=46.1t^{-0.699}$)

EXTERNAL DRAINAGE AREAS
HAIG ROAD
INTERNAL AREAS

LOCATION			AREAS (ha)					Indiv.	Accum.	Time of	Rainfall	Peak	SEWER DATA									
STREET	FROM	TO	R=0.45	R=0.60	R=0.65	R=0.7	R=0.85	2.78AR	2.78AR	Conc. min.	Intensity I (mm/hr)	Flow Q_p(l/s)	DIA. (mm)	SLOPE (%)	LENGTH (m)	CAPACITY (Q_f) (l/s) n= 0.013		Qp/Qf	Vp/Vf	Vf (m/s)	Vp (m/s)	TIME of FLOW (min)
SQU-400																						
401	CB 401	ST-4001		0.18				0.366	0.366	15.00	121	44.5	300	0.50%	67.6	68.4	OK	0.65	1.06	0.97	1.03	1.10
402	CB 402	CB 403		0.11				0.231	0.231	15.00	121	28.0	300	0.50%	31.7	68.4	OK	0.41	0.95	0.97	0.92	0.57
403	CB 403	ST-4001		0.22				0.449	0.679	15.57	118	80.4	300	0.60%	16.1	74.9	Surch	1.07	1.14	1.06	1.21	0.22
	ST-4001	CB/MH 406							1.045	15.80	117	122.5	300	1.10%	23.3	101.4	Surch	1.21	1.14	1.43	1.64	0.24
404	CB 404	CB 405		0.17				0.350	0.350	15.00	121	42.5	300	1.00%	31.3	96.7	OK	0.44	0.97	1.37	1.32	0.40
405	CB 405	CB/MH 406		0.16				0.331	0.681	15.40	119	81.3	300	0.50%	19.4	68.4	Surch	1.19	1.14	0.97	1.10	0.29
406	CB/MH 406	CB/MH 408		0.22				0.469	2.195	16.03	116	254.6	375	0.75%	33.2	151.8	Surch	1.68	1.14	1.37	1.57	0.35
407	CB 407	CB/MH 408		0.10				0.211	0.211	15.00	121	25.7	300	3.70%	47.2	186.0	OK	0.14	0.71	2.63	1.87	0.42
408	CB/MH 408	SQU-400		0.08				0.175	2.581	16.39	114	294.8	450	11.50%	6.0	966.8	OK	0.30	0.88	6.08	5.35	0.02
	SQU-400	MC-3500							2.581	16.41	114	294.6	450	0.50%	13.7	201.6	Surch	1.46	1.14	1.27	1.45	0.16
	MC-3500	ST-4002							2.581	16.56	113	292.6	450	1.00%	5.4	285.1	OK	1.03	1.14	1.79	2.04	0.04
	ST-4002	OUTLET							2.581	16.61	113	292.0	450	3.10%	33.3	502.0	OK	0.58	1.03	3.16	3.25	0.17
SQU-500																						
501	CB 501	SQU-500		0.31				0.655	0.655	15.00	121	79.5	450	1.80%	45.0	382.5	OK	0.21	0.79	2.41	1.90	0.39
502	CB 502	CB 503		0.27				0.565	0.565	15.00	121	68.7	300	0.50%	52.5	68.4	OK	1.00	1.14	0.97	1.10	0.79
503	CB 503	CB/MH 504		0.10				0.209	0.775	15.79	117	90.8	300	0.50%	32.2	68.4	Surch	1.33	1.14	0.97	1.10	0.49
504	CB/MH 504	SQU-500		0.19				0.397	1.827	16.28	115	209.6	450	4.10%	15.6	577.3	OK	0.36	0.92	3.63	3.34	0.08
	SQU-500	MC-3500							1.827	16.36	114	208.9	450	0.45%	4.5	191.3	Surch	1.09	1.14	1.20	1.37	0.05
	MC-3500	ST-5001							1.827	16.41	114	208.4	450	14.40%	2.3	1081.9	OK	0.19	0.78	6.80	5.31	0.01
	ST-5001	OUTLET							1.827	16.42	114	208.3	450	0.35%	9.1	168.7	Surch	1.24	1.14	1.06	1.21	0.13
SQU-600																						
601	CB 601	ST-6001		0.07				0.139	0.139	15.00	121	16.9	300	0.50%	7.6	68.4	OK	0.25	0.83	0.97	0.80	0.16
602	CB 602	ST-6001		0.26				0.543	0.543	15.00	121	66.0	300	0.50%	3.1	68.4	OK	0.97	1.14	0.97	1.10	0.05
	ST-6001	DCB 603							0.682	15.16	121	82.3	300	0.50%	51.6	68.4	Surch	1.20	1.14	0.97	1.10	0.78
603	DCB 603	SQU-600		0.45				0.929	1.612	15.94	116	187.7	450	5.40%	9.6	662.5	OK	0.28	0.87	4.17	3.62	0.04
	SQU-600	MC-3500							1.612	15.98	116	187.3	450	0.50%	4.0	201.6	OK	0.93	1.14	1.27	1.45	0.05
	MC-3500	OUTLET							1.612	16.03	116	186.9	450	4.70%	6.0	618.1	OK	0.30	0.88	3.89	3.42	0.03
	PROPOSED INFORMATION					Shown in VERTICAL TEXT																
	EXISTING INFORMATION					*Shown in ITALISIZED TEXT*																

PREPARED BY: SDS

DATE:December 12, 2023
REV: December 13, 2024

van MEER limited

621 DUNDAS STREET EAST
CITY of BELLEVILLE
2255718 Ontario Inc. - OWNER

VAN MEER LIMITED
LAND DEVELOPMENT • PROJECT MANAGEMENT • ENGINEERING
83 North Park Street, Belleville, Ont. K8P 2Y6 Tel. 613-969-0171

621 DUNDAS STREET EAST
WEST OF HAIG ROAD
CITY OF BELLEVILLE

Date	Description	By	Chk'd By
DEC. 13/24	REVISED SITE LAYOUT FROM ARCHITECT 24-12-05	S.D.S.	
JAN. 18/24	REVISED SITE LAYOUT FROM ARCHITECT 24-01-17	S.D.S.	
JAN. 8/24	REVISED SITE LAYOUT FROM ARCHITECT 24-01-04	S.D.S.	
DEC. 20/23	UNDERLAY 23-12-15 SITE LAYOUT FROM ARCHITECT	S.D.S.	
NOV. 8/23	REVISED SITE LAYOUT FROM ARCHITECT	S.D.S.	

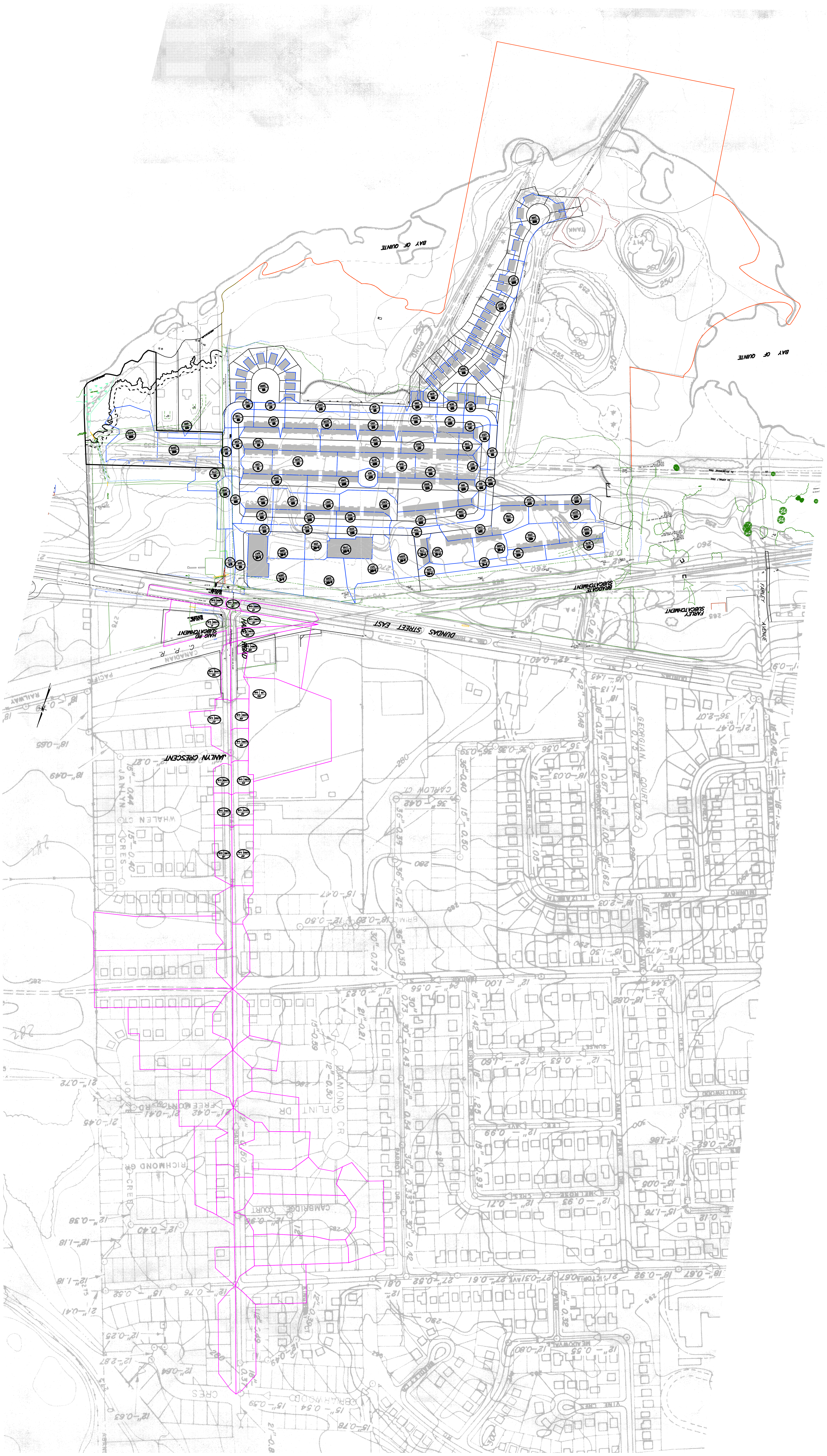
R E V I S I O N S

SCALE: 1:1250
DESIGNED: A.H.V.
DRAWN: S.D.S.
DATE: /07
COMPUTER: \Drawings\BELLEVILLE\ \Dundas St\621 Bakelite Property\

REGISTERED PROFESSIONAL ENGINEER
A. H. VANDERMEER
Dec. 13/24
PROVINCE OF ONTARIO

STORM SEWER DESIGN
DRAINAGE AREA PLAN & PIPE NETWORK
DRAWING Dun/621-St1

DRAWING: 621 Dundas St_24-12-05.dwg



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621 DUNDAS STREET EAST
WEST OF HAIG ROAD
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NOV. 8/23	REVISED SITE LAYOUT FROM ARCHITECT	S.D.S.	

REVISIONS

SCALE: 1:2500
DESIGNED: A.H.V.
DRAWN: S.D.S.
DATE: /07
COMPUTER: \Drawings\BELLEVILLE\ \Dundas St\621 Bakelite Property\

REGISTERED PROFESSIONAL ENGINEER
A. H. VANDERMEER
Dec. 13/24
PROVINCE OF ONTARIO

STORM SEWER DESIGN
HAIG ROAD SUB-CATCHMENT
DRAWING Dun/621-St2

DRAWING: 621 Dundas St._24-12-05.dwg

Ontario IDF CURVE LOOKUP

Active coordinate

44° 9' 45" N, 77° 23' 15" W (44.162500,-77.387500)

Retrieved: Wed, 13 Dec 2023 16:28:41 GMT

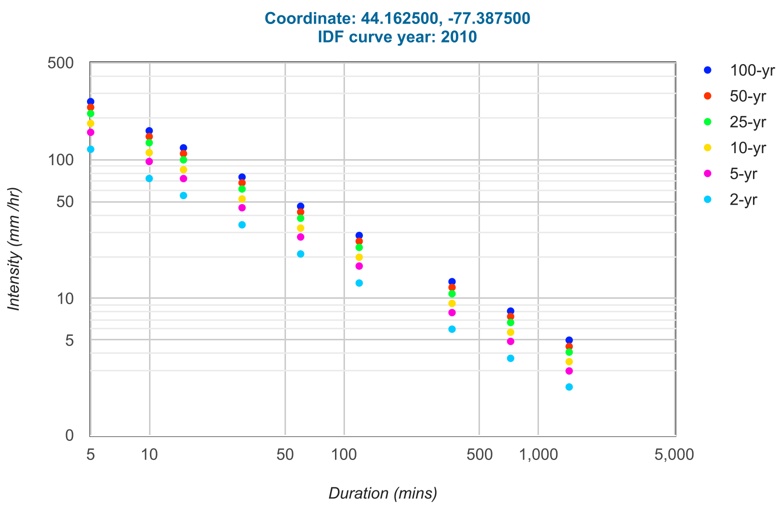
Location summary

These are the locations in the selection.

IDF Curve: 44° 9' 45" N, 77° 23' 15" W (44.162500,-77.387500)

Results

An IDF curve was found.



Coefficient summary

IDF Curve: 44° 9' 45" N, 77° 23' 15" W (44.162500,-77.387500)

Retrieved: Wed, 13 Dec 2023 16:28:41 GMT

Data year: 2010
IDF curve year: 2010

Return period	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
A	20.9	27.7	32.1	37.8	41.9	46.1
B	-0.699	-0.699	-0.699	-0.699	-0.699	-0.699

Statistics

Rainfall intensity (mm hr^{-1})

Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
2-yr	118.7	73.1	55.1	33.9	20.9	12.9	6.0	3.7	2.3
5-yr	157.3	96.9	73.0	45.0	27.7	17.1	7.9	4.9	3.0
10-yr	182.3	112.3	84.6	52.1	32.1	19.8	9.2	5.7	3.5
25-yr	214.7	132.3	99.6	61.4	37.8	23.3	10.8	6.7	4.1
50-yr	238.0	146.6	110.4	68.0	41.9	25.8	12.0	7.4	4.5
100-yr	261.8	161.3	121.5	74.8	46.1	28.4	13.2	8.1	5.0

Rainfall depth (mm)

Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
2-yr	9.9	12.2	13.8	17.0	20.9	25.7	35.8	44.2	54.4
5-yr	13.1	16.2	18.2	22.5	27.7	34.1	47.5	58.5	72.1
10-yr	15.2	18.7	21.1	26.1	32.1	39.5	55.0	67.8	83.6
25-yr	17.9	22.0	24.9	30.7	37.8	46.6	64.8	79.9	98.4
50-yr	19.8	24.4	27.6	34.0	41.9	51.6	71.9	88.5	109.1
100-yr	21.8	26.9	30.4	37.4	46.1	56.8	79.1	97.4	120.0

APPENDIX E

Stormwater Management – Design

Storm Sewer Design	Drawing DUN/621-St3
Pre-development Overland Flow Route 100yr Storm Event	
Storm Sewer Design	Drawing DUN/621-St4
Post-development Overland Flow Route 100yr Storm Event	

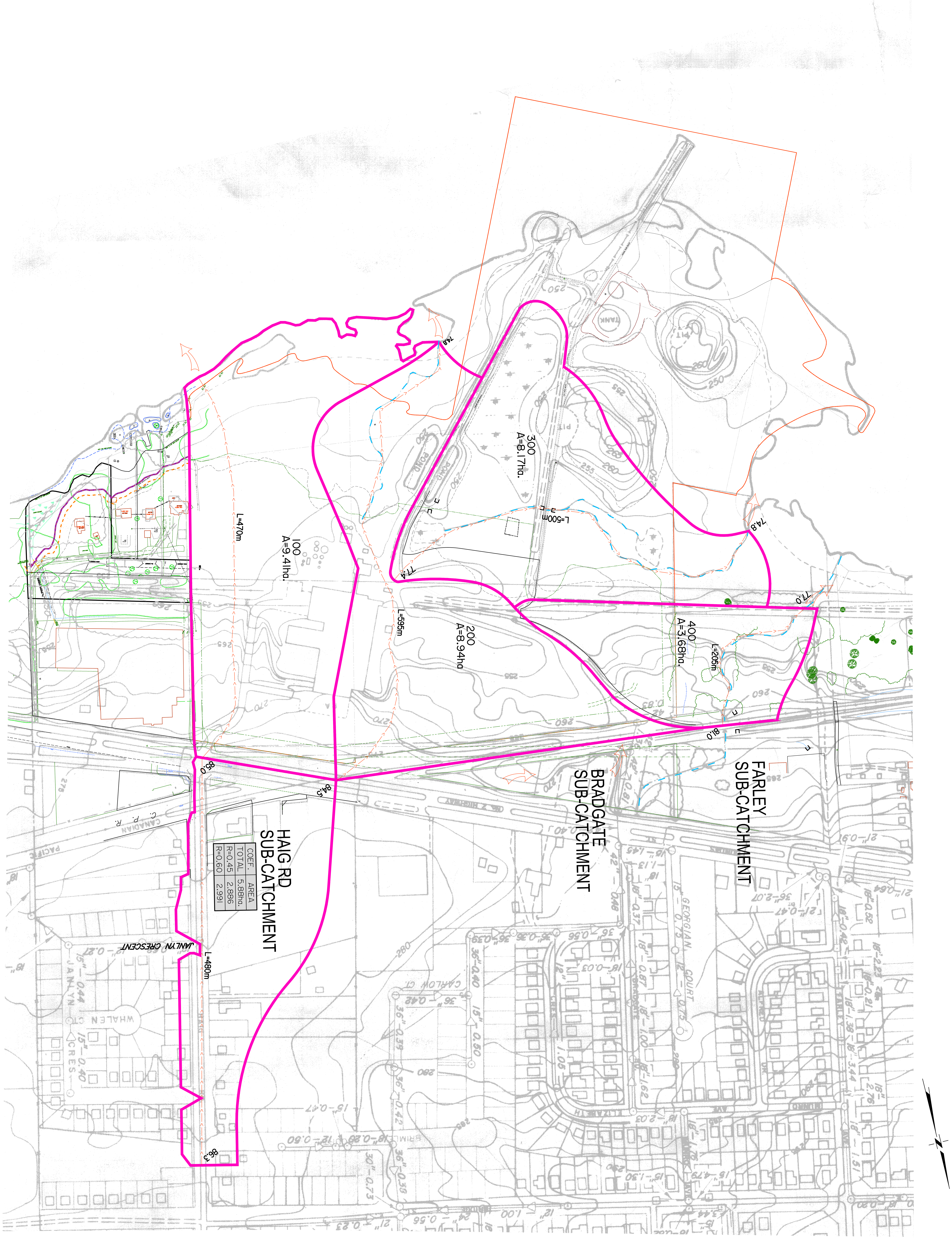
Storm Sewer Design Sheets – Imperviousness and Tc / Flow Calculations

MOE Quality Event Calculations

Summary of TSS Removal of Quality Treatment Units (Downstream Defender)

Hydro International Downstream Defender Sizing

Hydro International Downstream Defender Operation & Maintenance Manual



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621 DUNDAS STREET EAST
WEST OF HAIG ROAD
CITY OF BELLEVILLE

Date	Description	By	Chk'd By
DEC. 13/24	REVISED SITE LAYOUT FROM ARCHITECT 24-12-05	S.D.S.	
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DEC. 20/23	UNDERLAY 23-12-15 SITE LAYOUT FROM ARCHITECT	S.D.S.	
NOV. 8/23	REVISED SITE LAYOUT FROM ARCHITECT	S.D.S.	

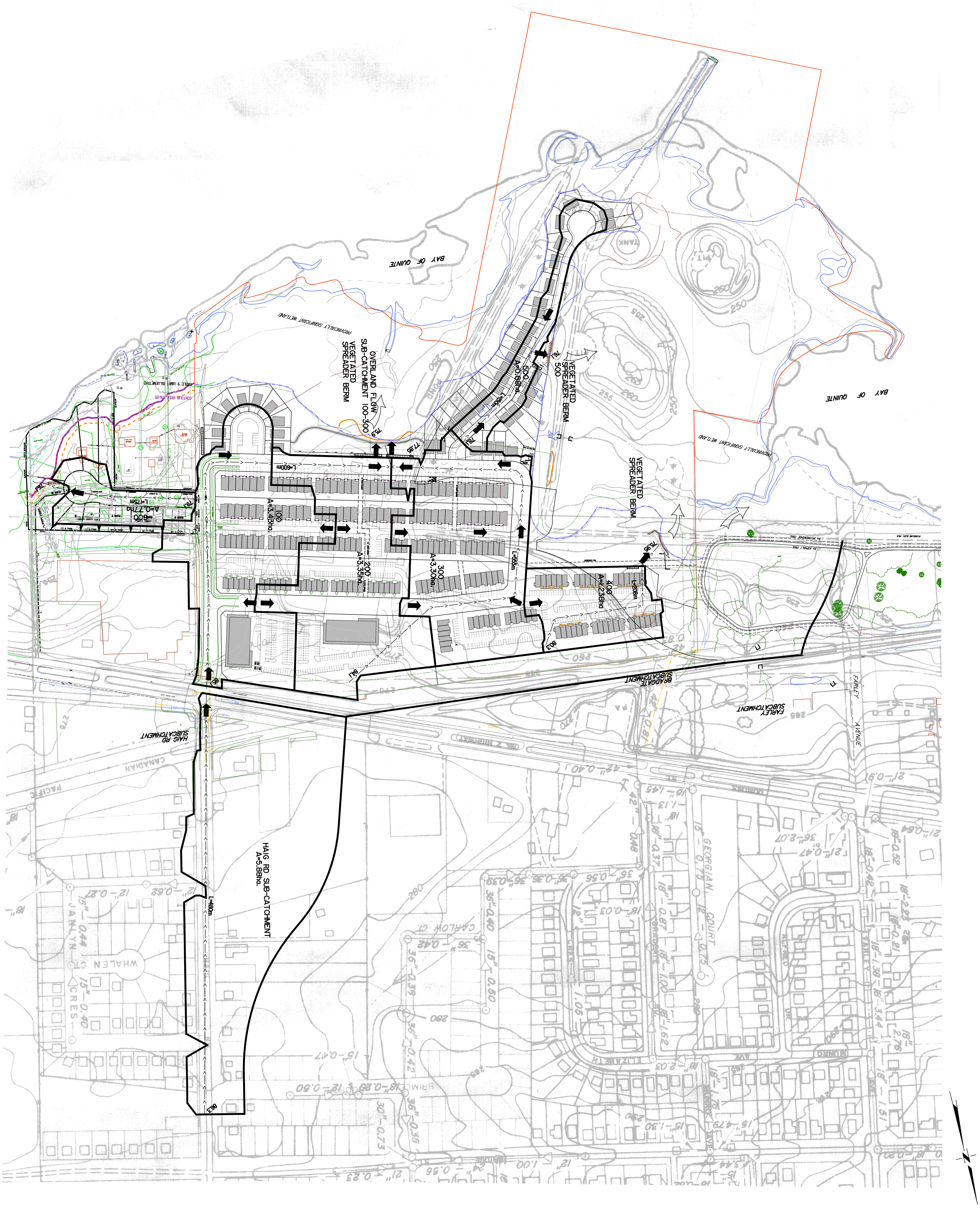
REVISIONS

SCALE: 1:2000
DESIGNED: A.H.V.
DRAWN: S.D.S.
DATE: /07
COMPUTER: \Drawings\BELLEVILLE\ \Dundas St\621 Bakelite Property\

REGISTERED PROFESSIONAL ENGINEER — A. H. VANDERMEER — PROVINCE OF ONTARIO — Dec. 13/24

STORM SEWER DESIGN
PRE-DEVELOPMENT OVERLAND
FLOW ROUTE 100yr STORM EVENT
DRAWING Dun/621-S13

DRAWING: 621 Dundas St._24-12-05.dwg



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NOV. 8/23	REVISED SITE LAYOUT FROM ARCHITECT	S.D.S.	

REVISIONS

SCALE: 1:2000
DESIGNED: A.H.V.
DRAWN: S.D.S.
DATE: /07
COMPUTER \Drawings\BELLEVILLE\ \Dundas St\621 Bakelite Property\

REGISTERED PROFESSIONAL ENGINEER
A. H. VANDERMEER
Dec. 13/24
PROVINCE OF ONTARIO

STORM SEWER DESIGN
POST-DEVELOPMENT OVERLAND FLOW ROUTE 100yr STORM EVENT
DRAWING Dun/621-St4

DRAWING: 621 Dundas St_24-12-05.dwg

STORM SEWER DESIGN SHEET

T_c / FLOW CALCULATIONS

Subcatchment - Haig Rd, Series 100, 200 & 300

5yr Storm Event

Runoff Coefficient (R)	0.606	0.2	0.6	0.9
Area (A)	15.959	4.192	5.880	5.887
RA	9.665	0.838	3.528	5.298

Bransby-Williams Formula

(C values of 0.4 or greater)

$Elev_H$ =	86.30
$Elev_L$ =	75.90
A (ha)=	15.959
C =	0.606
L =	1080
S_w =	0.96%
T_c =	47.02
I =	31
Q_p =	836.60

100yr Storm Event

Runoff Coefficient (R)	0.657	0.2	0.6	0.9
Area (A)	15.959	4.192	5.880	5.887
RA	10.492	1.048	4.410	5.033

Bransby-Williams Formula

(C values of 0.4 or greater)

$Elev_H$ =	86.30
$Elev_L$ =	75.90
A (ha)=	15.959
C =	0.657
L =	1080
S_w =	0.96%
T_c =	47.02
I =	51
Q_p =	1479.57

Subcatchment - 400

5yr Storm Event

Runoff Coefficient (R)	0.601	0.2	0.6	0.9
Area (A)	6.654	2.839		3.814
RA	4.001	0.568	0.000	3.433

Bransby-Williams Formula

(C values of 0.4 or greater)

$Elev_H$ =	84.10
$Elev_L$ =	75.90
A (ha)=	6.654
C =	0.601
L =	555
S_w =	1.48%
T_c =	24.21
I =	49
Q_p =	542.82

100yr Storm Event

Runoff Coefficient (R)	0.597	0.2	0.6	0.9
Area (A)	6.654	2.839	0.000	3.814
RA	3.971	0.710	0.000	3.261

Bransby-Williams Formula

(C values of 0.4 or greater)

$Elev_H$ =	84.10
$Elev_L$ =	75.90
A (ha)=	6.654
C =	0.597
L =	555
S_w =	1.48%
T_c =	24.21
I =	80
Q_p =	878.38

Subcatchment - 500

5yr Storm Event

Runoff Coefficient (R)	0.617	0.2	0.6	0.9
Area (A)	1.238	0.500		0.738
RA	0.764	0.100	0.000	0.664

Bransby-Williams Formula

(C values of 0.4 or greater)

$Elev_H$ =	80.30
$Elev_L$ =	75.95
A (ha)=	1.238
C =	0.617
L =	208
S_w =	2.09%
T_c =	10.01
I =	89
Q_p =	188.45

100yr Storm Event

Runoff Coefficient (R)	0.611	0.2	0.6	0.9
Area (A)	1.238	0.500	0.000	0.738
RA	0.756	0.125	0.000	0.631

Bransby-Williams Formula

(C values of 0.4 or greater)

$Elev_H$ =	80.30
$Elev_L$ =	75.95
A (ha)=	1.238
C =	0.611
L =	208
S_w =	2.09%
T_c =	10.01
I =	145
Q_p =	304.20

Subcatchment - 600

5yr Storm Event

Runoff Coefficient (R)	0.645	0.2	0.6	0.9
Area (A)	0.876	0.319		0.557
RA	0.565	0.064	0.000	0.502

Bransby-Williams Formula

(C values of 0.4 or greater)

$Elev_H$ =	78.10
$Elev_L$ =	76.10
A (ha)=	0.876
C =	0.645
L =	150
S_w =	1.33%
T_c =	8.18
I =	102
Q_p =	159.89

100yr Storm Event

Runoff Coefficient (R)	0.635	0.2	0.6	0.9
Area (A)	0.876	0.319	0.000	0.557
RA	0.556	0.080	0.000	0.476

Bransby-Williams Formula

(C values of 0.4 or greater)

$Elev_H$ =	78.10
$Elev_L$ =	76.10
A (ha)=	0.876
C =	0.635
L =	150
S_w =	1.33%
T_c =	8.18
I =	166
Q_p =	256.73

Subcatchment - 500

5yr Storm Event

Runoff Coefficient (R)	0.666	0.2	0.6	0.9
Area (A)	0.773	0.258		0.515
RA	0.515	0.052	0.000	0.463

Bransby-Williams Formula

(C values of 0.4 or greater)

$Elev_H$ =	79.10
$Elev_L$ =	76.10
A (ha)=	0.773
C =	0.666
L =	175
S_w =	1.71%
T_c =	9.19
I =	94
Q_p =	134.60

100yr Storm Event

Runoff Coefficient (R)	0.653	0.2	0.6	0.9
Area (A)	0.773	0.258	0.000	0.515
RA	0.505	0.065	0.000	0.440

Bransby-Williams Formula

(C values of 0.4 or greater)

$Elev_H$ =	79.10
$Elev_L$ =	76.10
A (ha)=	0.773
C =	0.653
L =	175
S_w =	1.71%
T_c =	9.19
I =	153
Q_p =	215.28

STORM SEWER DESIGN
MOE QUALITY EVENT CALCULATIONS

$$Q = \frac{CiA}{360}$$ Equation 4.8: Rational Method

where
Q = peak flow rate (m^3/s)
C = runoff coefficient
I = rainfall intensity (mm/hr)
A = drainage area (ha)

i = 43C + 5.9 Equation 4.9: 25 mm Storm Intensit

where
I = rainfall intensity mm/hr)
C = runoff coefficient

	AREA	C	i	Q (L/s)
SQU-100	3.58	0.62	32.6	200.5
SQU-200	3.35	0.60	31.7	177.1
SQU-300	3.35	0.62	32.6	188.0
SQU-400	1.24	0.62	32.6	69.4
SQU 500	1.08	0.65	33.9	65.8
SQU-600	0.77	0.67	34.7	49.9

ADS Treatment Train Sizing

Project Name:	Dundas St SQU100
Consulting Engineer:	vanMEER limited
Location:	Belleville, Ontario
Sizing Completed By:	Haider Nasrullah
Email:	haider.nasrullah@ads-pipe.com

Summary of Results	
Isolator Row PLUS TSS Removal:	80.2%
DD10 TSS Removal:	59.0%
Combined TSS Removal:	91.8%
Total Volume Treated:	>90%

Site Details	
Site Area (ha):	3.58
Rational C:	0.62
Particle Size Distribution:	ETV
Rainfall Station:	Belleville, ONT

Note: Isolator Row PLUS removal efficiencies based solely on ETV/NJDEP PSD, above-noted PSD is for OGS sizing only

Individual OGS Results

Model	TSS Removal	Volume Treated
DD4	31.0%	>90%
DD6	46.0%	>90%
DD8	55.0%	>90%
DD10	59.0%	>90%
DD12	62.0%	>90%

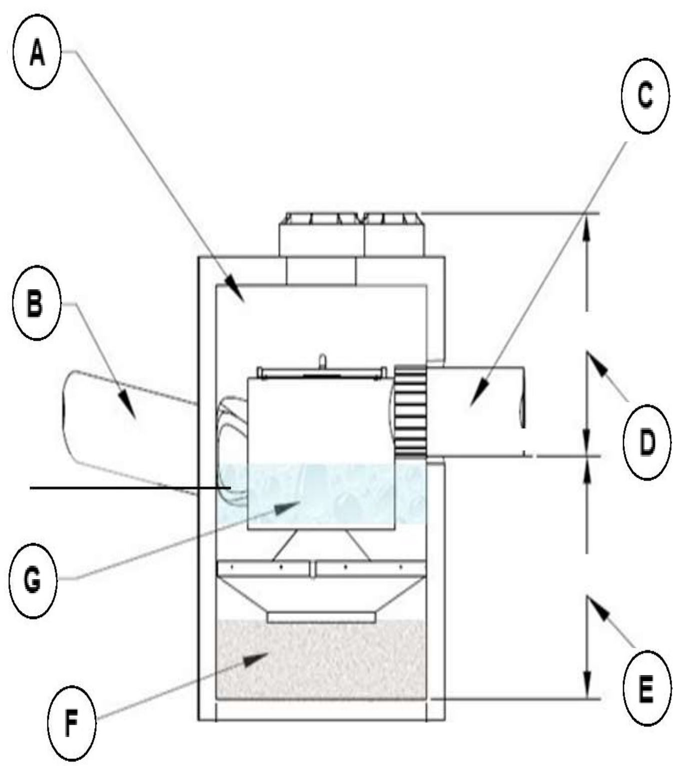
Stormtech Details	
Chamber Model:	MC-3500
No. Chambers in Isolator Row PLUS:	15
Volume Treated by Isolator Row PLUS:	>90%

Notes: Refer to Stormtech drawings for full IR+ configuration.

Isolator Row PLUS must include Flared End Ramp (FLAMP) for proper performance.

Overall System Capacities	
Total Sediment Storage Capacity:	19.45 m³
Oil Storage Capacity:	3,975 L
Max. OGS Pipe Diameter:	750 mm
Peak OGS Flow Capacity:	708 L/s
Peak Isolator Row PLUS Flowrate:	167.9 L/s

OGS Specifications	
Unit Diameter (A):	3,000 mm
Inlet Pipe Diameter (B):	600 mm
Outlet Pipe Diameter (C):	600 mm
Top of Grade Elevation:	0.00 m
Bottom of Sump Elevation:	-2.85 m
Inlet Pipe Elevation:	0.00 m
Outlet Pipe Elevation:	0.00 m



Notes:

Isolator Row PLUS removal efficiency based on verified ETV test report. For dimensions and configuration of Isolator Row PLUS, please see Stormtech drawing package.

Project Name:	Dundas St SQU100
Consulting Engineer:	vanMEER limited
Location:	Belleville, Ontario

Net Annual Removal Efficiency Summary

Rainfall Intensity	Fraction of Rainfall	Removal Efficiency		Combined Removal Efficiency	Combined Weighted Removal Efficiency
		DD10	IR PLUS		
mm/hr	%	%	%	%	%
0.50	0.4%	68.8%	81.2%	94.1%	0.4%
1.00	13.2%	67.6%	81.2%	93.9%	12.4%
1.50	14.0%	66.4%	81.2%	93.7%	13.1%
2.00	14.0%	65.2%	81.2%	93.5%	13.0%
2.50	3.6%	64.1%	81.2%	93.2%	3.3%
3.00	2.5%	63.0%	81.2%	93.0%	2.4%
3.50	8.4%	61.9%	81.2%	92.8%	7.8%
4.00	5.1%	60.8%	81.2%	92.6%	4.7%
4.50	1.6%	59.7%	81.2%	92.4%	1.5%
5.00	5.1%	58.7%	81.2%	92.2%	4.7%
6.00	4.8%	56.7%	81.2%	91.9%	4.4%
7.00	4.5%	54.7%	81.2%	91.5%	4.1%
8.00	3.5%	52.8%	81.2%	91.1%	3.2%
9.00	2.4%	51.0%	81.2%	90.8%	2.2%
10.00	2.5%	49.2%	81.2%	90.5%	2.3%
20.00	9.7%	42.9%	81.2%	89.3%	8.6%
30.00	2.8%	42.9%	73.7%	85.0%	2.4%
40.00	0.9%	42.9%	55.3%	74.5%	0.7%
50.00	0.4%	42.9%	44.2%	68.2%	0.3%
100.00	0.6%	42.9%	22.1%	55.5%	0.3%
150.00	0.1%	42.9%	14.7%	51.3%	0.0%
200.00	0.0%	42.9%	11.1%	49.2%	0.0%
		Total Net Annual Removal Efficiency			**91.8%**
		Total Runoff Volume Treated			**>90%**

Notes:

(1) Rainfall Data: 1960:2007, HLY03, Belleville, ONT, 6150700 & 6150689.

(2) Canada ETV PSD & Test Protocols - ISO14034 Certifed

(3) actored to account for bypass flow.

(4) Combined removal efficiencies calculated based on NCDENR Stormwater BMP Manual, Section 3.9.4, where Total Removal Efficiency = 1st BMP Efficiency + 2nd BMP Efficiency - (1st BMP Efficiency x 2nd BMP Efficiency)

ADS Treatment Train Sizing

Project Name: Dundas St SQU200

Consulting Engineer: vanMEER limited

Location: Belleville, Ontario

Sizing Completed By: Haider Nasrullah **Email:** haider.nasrullah@ads-pipe.com

Summary of Results	
Isolator Row PLUS TSS Removal:	80.5%
DD10 TSS Removal:	60.0%
Combined TSS Removal:	92.1%
Total Volume Treated:	>90%

Site Details	
Site Area (ha):	3.35
Rational C:	0.60
Particle Size Distribution:	ETV
Rainfall Station:	Belleville, ONT

Note: Isolator Row PLUS removal efficiencies based solely on ETV/NJDEP PSD, above-noted PSD is for OGS sizing only

Individual OGS Results

Model	TSS Removal	Volume Treated
DD4	32.0%	>90%
DD6	48.0%	>90%
DD8	55.0%	>90%
DD10	60.0%	>90%
DD12	63.0%	>90%

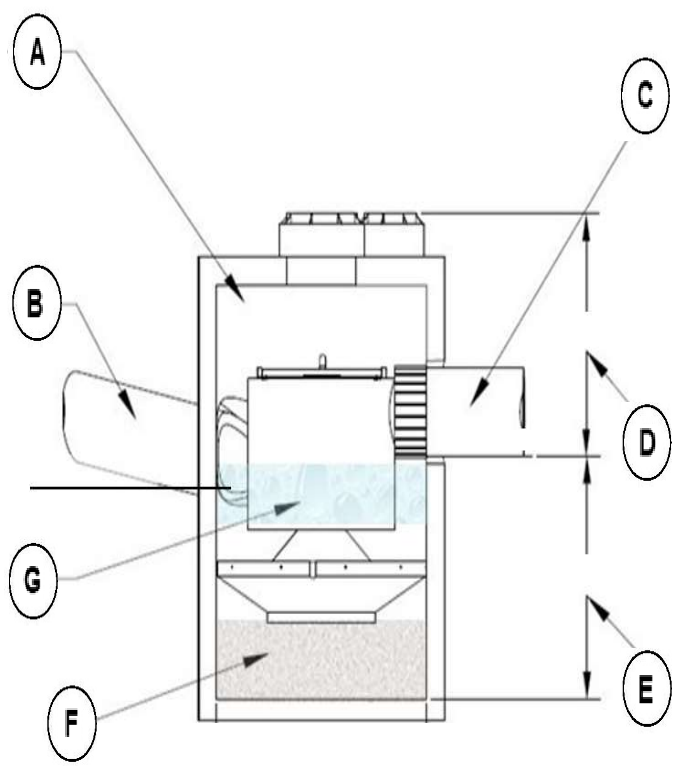
Stormtech Details	
Chamber Model:	MC-3500
No. Chambers in Isolator Row PLUS:	15
Volume Treated by Isolator Row PLUS:	>90%

Notes: Refer to Stormtech drawings for full IR+ configuration.

Isolator Row PLUS must include Flared End Ramp (FLAMP) for proper performance.

Overall System Capacities	
Total Sediment Storage Capacity:	19.45 m³
Oil Storage Capacity:	3,975 L
Max. OGS Pipe Diameter:	750 mm
Peak OGS Flow Capacity:	708 L/s
Peak Isolator Row PLUS Flowrate:	167.9 L/s

OGS Specifications	
Unit Diameter (A):	3,000 mm
Inlet Pipe Diameter (B):	600 mm
Outlet Pipe Diameter (C):	600 mm
Top of Grade Elevation:	0.00 m
Bottom of Sump Elevation:	-2.85 m
Inlet Pipe Elevation:	0.00 m
Outlet Pipe Elevation:	0.00 m



Notes:

Isolator Row PLUS removal efficiency based on verified ETV test report. For dimensions and configuration of Isolator Row PLUS, please see Stormtech drawing package.

Project Name:	Dundas St SQU200
Consulting Engineer:	vanMEER limited
Location:	Belleville, Ontario

Net Annual Removal Efficiency Summary

Rainfall Intensity	Fraction of Rainfall	Removal Efficiency		Combined Removal Efficiency	Combined Weighted Removal Efficiency
		DD10	IR PLUS		
mm/hr	%	%	%	%	%
0.50	0.4%	68.9%	81.2%	94.1%	0.4%
1.00	13.2%	67.8%	81.2%	93.9%	12.4%
1.50	14.0%	66.7%	81.2%	93.7%	13.1%
2.00	14.0%	65.7%	81.2%	93.5%	13.1%
2.50	3.6%	64.6%	81.2%	93.3%	3.3%
3.00	2.5%	63.6%	81.2%	93.2%	2.4%
3.50	8.4%	62.6%	81.2%	93.0%	7.8%
4.00	5.1%	61.6%	81.2%	92.8%	4.7%
4.50	1.6%	60.6%	81.2%	92.6%	1.5%
5.00	5.1%	59.7%	81.2%	92.4%	4.7%
6.00	4.8%	57.8%	81.2%	92.1%	4.4%
7.00	4.5%	56.0%	81.2%	91.7%	4.1%
8.00	3.5%	54.2%	81.2%	91.4%	3.2%
9.00	2.4%	52.5%	81.2%	91.1%	2.2%
10.00	2.5%	50.9%	81.2%	90.8%	2.3%
20.00	9.7%	42.9%	81.2%	89.3%	8.6%
30.00	2.8%	42.9%	81.2%	89.3%	2.5%
40.00	0.9%	42.9%	61.0%	77.8%	0.7%
50.00	0.4%	42.9%	48.8%	70.8%	0.3%
100.00	0.6%	42.9%	24.4%	56.8%	0.3%
150.00	0.1%	42.9%	16.3%	52.2%	0.0%
200.00	0.0%	42.9%	12.2%	49.9%	0.0%
		Total Net Annual Removal Efficiency			**92.1%**
		Total Runoff Volume Treated			**>90%**

Notes:

(1) Rainfall Data: 1960:2007, HLY03, Belleville, ONT, 6150700 & 6150689.

(2) Canada ETV PSD & Test Protocols - ISO14034 Certifed

(3) actored to account for bypass flow.

(4) Combined removal efficiencies calculated based on NCDENR Stormwater BMP Manual, Section 3.9.4, where Total Removal Efficiency = 1st BMP Efficiency + 2nd BMP Efficiency - (1st BMP Efficiency x 2nd BMP Efficiency)

ADS Treatment Train Sizing

Project Name:	Dundas St SQU300
Consulting Engineer:	vanMEER limited
Location:	Belleville, Ontario
Sizing Completed By:	Haider Nasrullah
Email:	haider.nasrullah@ads-pipe.com

Summary of Results	
Isolator Row PLUS TSS Removal:	80.4%
DD10 TSS Removal:	60.0%
Combined TSS Removal:	92.0%
Total Volume Treated:	>90%

Site Details	
Site Area (ha):	3.35
Rational C:	0.61
Particle Size Distribution:	ETV
Rainfall Station:	Belleville, ONT

Note: Isolator Row PLUS removal efficiencies based solely on ETV/NJDEP PSD, above-noted PSD is for OGS sizing only

Individual OGS Results

Model	TSS Removal	Volume Treated
DD4	32.0%	>90%
DD6	47.0%	>90%
DD8	55.0%	>90%
DD10	60.0%	>90%
DD12	63.0%	>90%

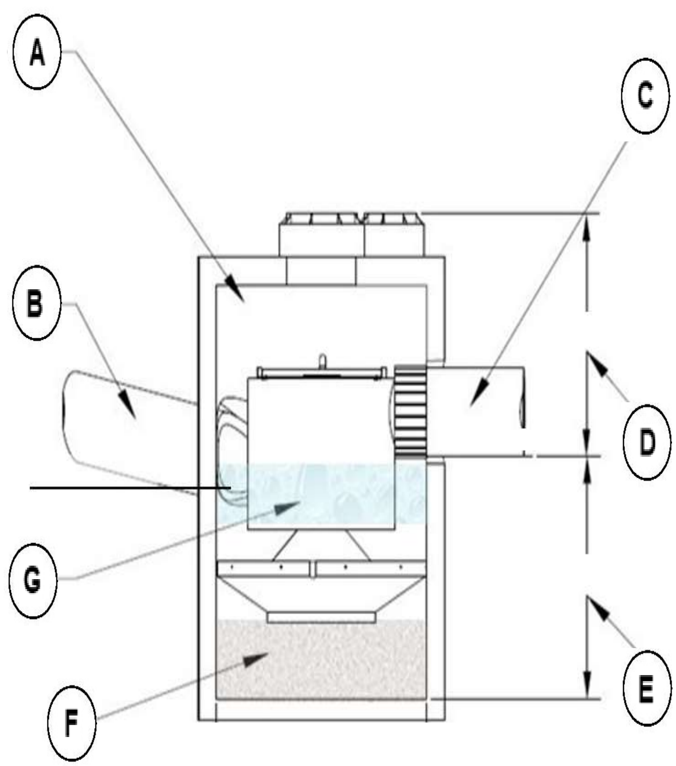
Stormtech Details	
Chamber Model:	MC-3500
No. Chambers in Isolator Row PLUS:	15
Volume Treated by Isolator Row PLUS:	>90%

Notes: Refer to Stormtech drawings for full IR+ configuration.

Isolator Row PLUS must include Flared End Ramp (FLAMP) for proper performance.

Overall System Capacities	
Total Sediment Storage Capacity:	19.45 m³
Oil Storage Capacity:	3,975 L
Max. OGS Pipe Diameter:	750 mm
Peak OGS Flow Capacity:	708 L/s
Peak Isolator Row PLUS Flowrate:	167.9 L/s

OGS Specifications	
Unit Diameter (A):	3,000 mm
Inlet Pipe Diameter (B):	600 mm
Outlet Pipe Diameter (C):	600 mm
Top of Grade Elevation:	0.00 m
Bottom of Sump Elevation:	-2.85 m
Inlet Pipe Elevation:	0.00 m
Outlet Pipe Elevation:	0.00 m



Notes:

Isolator Row PLUS removal efficiency based on verified ETV test report. For dimensions and configuration of Isolator Row PLUS, please see Stormtech drawing package.

Project Name:	Dundas St SQU300
Consulting Engineer:	vanMEER limited
Location:	Belleville, Ontario

Net Annual Removal Efficiency Summary

Rainfall Intensity	Fraction of Rainfall	Removal Efficiency		Combined Removal Efficiency	Combined Weighted Removal Efficiency
		DD10	IR PLUS		
mm/hr	%	%	%	%	%
0.50	0.4%	68.9%	81.2%	94.1%	0.4%
1.00	13.2%	67.7%	81.2%	93.9%	12.4%
1.50	14.0%	66.7%	81.2%	93.7%	13.1%
2.00	14.0%	65.6%	81.2%	93.5%	13.1%
2.50	3.6%	64.5%	81.2%	93.3%	3.3%
3.00	2.5%	63.5%	81.2%	93.1%	2.4%
3.50	8.4%	62.5%	81.2%	92.9%	7.8%
4.00	5.1%	61.5%	81.2%	92.8%	4.7%
4.50	1.6%	60.5%	81.2%	92.6%	1.5%
5.00	5.1%	59.5%	81.2%	92.4%	4.7%
6.00	4.8%	57.6%	81.2%	92.0%	4.4%
7.00	4.5%	55.8%	81.2%	91.7%	4.1%
8.00	3.5%	54.0%	81.2%	91.4%	3.2%
9.00	2.4%	52.3%	81.2%	91.0%	2.2%
10.00	2.5%	50.6%	81.2%	90.7%	2.3%
20.00	9.7%	42.9%	81.2%	89.3%	8.6%
30.00	2.8%	42.9%	80.0%	88.6%	2.5%
40.00	0.9%	42.9%	60.0%	77.2%	0.7%
50.00	0.4%	42.9%	48.0%	70.3%	0.3%
100.00	0.6%	42.9%	24.0%	56.6%	0.3%
150.00	0.1%	42.9%	16.0%	52.1%	0.0%
200.00	0.0%	42.9%	12.0%	49.8%	0.0%
		Total Net Annual Removal Efficiency			**92.0%**
		Total Runoff Volume Treated			**>90%**

Notes:

(1) Rainfall Data: 1960:2007, HLY03, Belleville, ONT, 6150700 & 6150689.

(2) Canada ETV PSD & Test Protocols - ISO14034 Certifed

(3) actored to account for bypass flow.

(4) Combined removal efficiencies calculated based on NCDENR Stormwater BMP Manual, Section 3.9.4, where Total Removal Efficiency = 1st BMP Efficiency + 2nd BMP Efficiency - (1st BMP Efficiency x 2nd BMP Efficiency)

ADS Treatment Train Sizing

Project Name:	Dundas St SQU400
Consulting Engineer:	vanMEER limited
Location:	Belleville, Ontario
Sizing Completed By:	Haider Nasrullah
Email:	haider.nasrullah@ads-pipe.com

Summary of Results	
Isolator Row PLUS TSS Removal:	80.5%
DD6 TSS Removal:	58.0%
Combined TSS Removal:	91.5%
Total Volume Treated:	>90%

Site Details	
Site Area (ha):	1.24
Rational C:	0.62
Particle Size Distribution:	ETV
Rainfall Station:	Belleville, ONT

Note: Isolator Row PLUS removal efficiencies based solely on ETV/NJDEP PSD, above-noted PSD is for OGS sizing only

Individual OGS Results

Model	TSS Removal	Volume Treated
DD4	47.0%	>90%
DD6	58.0%	>90%
DD8	62.0%	>90%
DD10	65.0%	>90%
DD12	66.0%	>90%

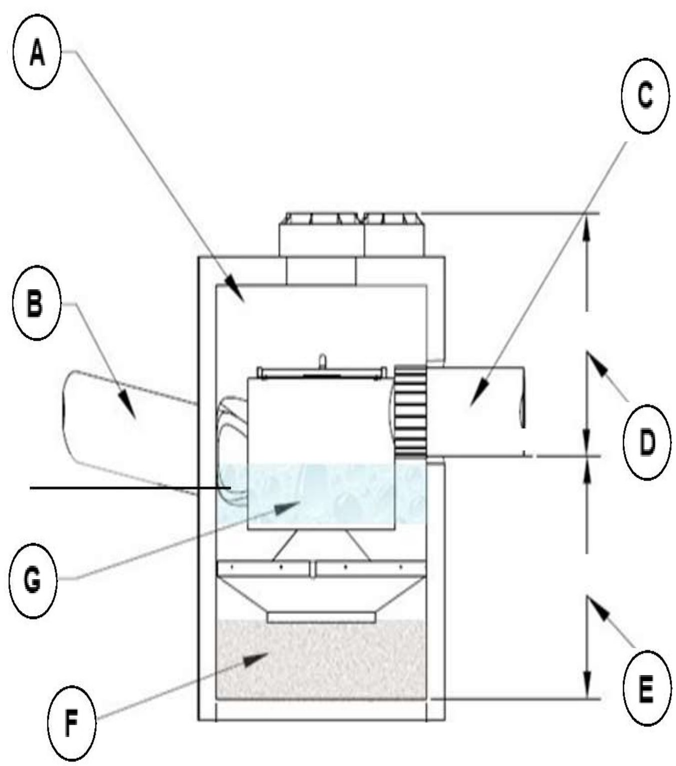
Stormtech Details	
Chamber Model:	MC-3500
No. Chambers in Isolator Row PLUS:	6
Volume Treated by Isolator Row PLUS:	>90%

Notes: Refer to Stormtech drawings for full IR+ configuration.

Isolator Row PLUS must include Flared End Ramp (FLAMP) for proper performance.

Overall System Capacities	
Total Sediment Storage Capacity:	6.71 m³
Oil Storage Capacity:	818 L
Max. OGS Pipe Diameter:	450 mm
Peak OGS Flow Capacity:	227 L/s
Peak Isolator Row PLUS Flowrate:	67.1 L/s

OGS Specifications	
Unit Diameter (A):	1,800 mm
Inlet Pipe Diameter (B):	600 mm
Outlet Pipe Diameter (C):	600 mm
Top of Grade Elevation:	0.00 m
Bottom of Sump Elevation:	-1.80 m
Inlet Pipe Elevation:	0.00 m
Outlet Pipe Elevation:	0.00 m



Notes:

Isolator Row PLUS removal efficiency based on verified ETV test report. For dimensions and configuration of Isolator Row PLUS, please see Stormtech drawing package.

Project Name:	Dundas St SQU400
Consulting Engineer:	vanMEER limited
Location:	Belleville, Ontario

Net Annual Removal Efficiency Summary

Rainfall Intensity	Fraction of Rainfall	Removal Efficiency		Combined Removal Efficiency	Combined Weighted Removal Efficiency
		DD6	IR PLUS		
mm/hr	%	%	%	%	%
0.50	0.4%	68.8%	81.2%	94.1%	0.4%
1.00	13.2%	67.6%	81.2%	93.9%	12.4%
1.50	14.0%	66.5%	81.2%	93.7%	13.1%
2.00	14.0%	65.4%	81.2%	93.5%	13.0%
2.50	3.6%	64.3%	81.2%	93.3%	3.3%
3.00	2.5%	63.2%	81.2%	93.1%	2.4%
3.50	8.4%	62.1%	81.2%	92.9%	7.8%
4.00	5.1%	61.1%	81.2%	92.7%	4.7%
4.50	1.6%	60.1%	81.2%	92.5%	1.5%
5.00	5.1%	59.1%	81.2%	92.3%	4.7%
6.00	4.8%	57.1%	81.2%	91.9%	4.4%
7.00	4.5%	55.2%	81.2%	91.6%	4.1%
8.00	3.5%	53.3%	81.2%	91.2%	3.2%
9.00	2.4%	51.6%	81.2%	90.9%	2.2%
10.00	2.5%	49.8%	81.2%	90.6%	2.3%
20.00	9.7%	35.5%	81.2%	87.9%	8.5%
30.00	2.8%	25.3%	81.2%	86.0%	2.4%
40.00	0.9%	18.0%	63.8%	70.3%	0.7%
50.00	0.4%	17.9%	51.1%	59.8%	0.3%
100.00	0.6%	17.9%	25.5%	38.9%	0.2%
150.00	0.1%	17.9%	17.0%	31.9%	0.0%
200.00	0.0%	17.9%	12.8%	28.4%	0.0%
		Total Net Annual Removal Efficiency			**91.5%**
		Total Runoff Volume Treated			**>90%**

Notes:

(1) Rainfall Data: 1960:2007, HLY03, Belleville, ONT, 6150700 & 6150689.

(2) Canada ETV PSD & Test Protocols - ISO14034 Certifed

(3) actored to account for bypass flow.

(4) Combined removal efficiencies calculated based on NCDENR Stormwater BMP Manual, Section 3.9.4, where Total Removal Efficiency = 1st BMP Efficiency + 2nd BMP Efficiency - (1st BMP Efficiency x 2nd BMP Efficiency)

ADS Treatment Train Sizing

Project Name: Dundas St SQU500

Consulting Engineer: vanMEER limited

Location: Belleville, Ontario

Sizing Completed By: Haider Nasrullah **Email:** haider.nasrullah@ads-pipe.com

Summary of Results	
Isolator Row PLUS TSS Removal:	80.1%
DD6 TSS Removal:	58.0%
Combined TSS Removal:	91.2%
Total Volume Treated:	>90%

Site Details	
Site Area (ha):	1.24
Rational C:	0.62
Particle Size Distribution:	ETV
Rainfall Station:	Belleville, ONT

Note: Isolator Row PLUS removal efficiencies based solely on ETV/NJDEP PSD, above-noted PSD is for OGS sizing only

Individual OGS Results		
Model	TSS Removal	Volume Treated
DD4	47.0%	>90%
DD6	58.0%	>90%
DD8	62.0%	>90%
DD10	65.0%	>90%
DD12	66.0%	>90%

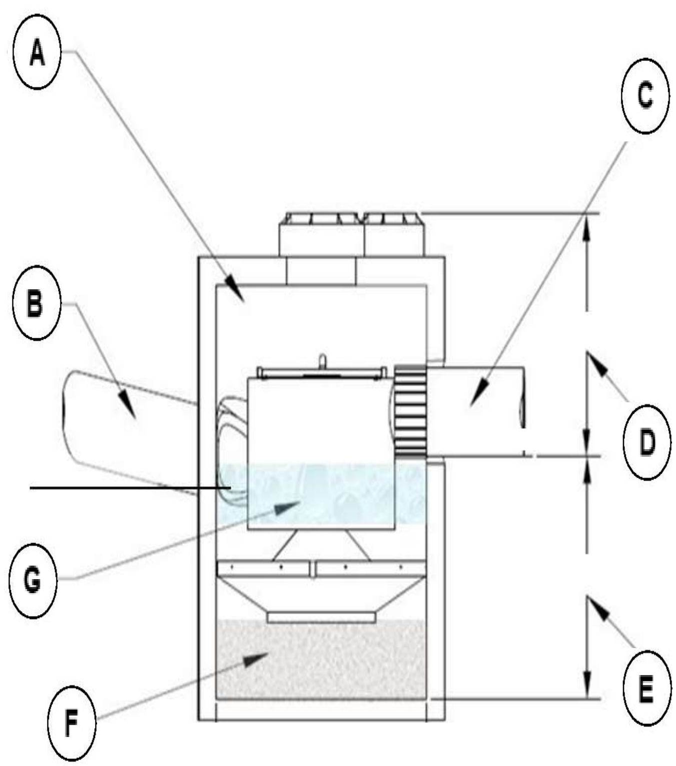
Stormtech Details	
Chamber Model:	MC-3500
No. Chambers in Isolator Row PLUS:	5
Volume Treated by Isolator Row PLUS:	>90%

Notes: Refer to Stormtech drawings for full IR+ configuration.

Isolator Row PLUS must include Flared End Ramp (FLAMP) for proper performance.

Overall System Capacities	
Total Sediment Storage Capacity:	5.91 m³
Oil Storage Capacity:	818 L
Max. OGS Pipe Diameter:	450 mm
Peak OGS Flow Capacity:	227 L/s
Peak Isolator Row PLUS Flowrate:	56 L/s

OGS Specifications	
Unit Diameter (A):	1,800 mm
Inlet Pipe Diameter (B):	600 mm
Outlet Pipe Diameter (C):	600 mm
Top of Grade Elevation:	0.00 m
Bottom of Sump Elevation:	-1.80 m
Inlet Pipe Elevation:	0.00 m
Outlet Pipe Elevation:	0.00 m



Notes:

Isolator Row PLUS removal efficiency based on verified ETV test report. For dimensions and configuration of Isolator Row PLUS, please see Stormtech drawing package.

Project Name:	Dundas St SQU500
Consulting Engineer:	vanMEER limited
Location:	Belleville, Ontario

Net Annual Removal Efficiency Summary

Rainfall Intensity	Fraction of Rainfall	Removal Efficiency		Combined Removal Efficiency	Combined Weighted Removal Efficiency
		DD6	IR PLUS		
mm/hr	%	%	%	%	%
0.50	0.4%	68.8%	81.2%	94.1%	0.4%
1.00	13.2%	67.6%	81.2%	93.9%	12.4%
1.50	14.0%	66.5%	81.2%	93.7%	13.1%
2.00	14.0%	65.4%	81.2%	93.5%	13.0%
2.50	3.6%	64.3%	81.2%	93.3%	3.3%
3.00	2.5%	63.2%	81.2%	93.1%	2.4%
3.50	8.4%	62.1%	81.2%	92.9%	7.8%
4.00	5.1%	61.1%	81.2%	92.7%	4.7%
4.50	1.6%	60.1%	81.2%	92.5%	1.5%
5.00	5.1%	59.1%	81.2%	92.3%	4.7%
6.00	4.8%	57.1%	81.2%	91.9%	4.4%
7.00	4.5%	55.2%	81.2%	91.6%	4.1%
8.00	3.5%	53.3%	81.2%	91.2%	3.2%
9.00	2.4%	51.6%	81.2%	90.9%	2.2%
10.00	2.5%	49.8%	81.2%	90.6%	2.3%
20.00	9.7%	35.5%	81.2%	87.9%	8.5%
30.00	2.8%	25.3%	70.9%	78.3%	2.2%
40.00	0.9%	18.0%	53.2%	61.6%	0.6%
50.00	0.4%	17.9%	42.5%	52.8%	0.2%
100.00	0.6%	17.9%	21.3%	35.4%	0.2%
150.00	0.1%	17.9%	14.2%	29.6%	0.0%
200.00	0.0%	17.9%	10.6%	26.7%	0.0%
		Total Net Annual Removal Efficiency			**91.2%**
		Total Runoff Volume Treated			**>90%**

Notes:

(1) Rainfall Data: 1960:2007, HLY03, Belleville, ONT, 6150700 & 6150689.

(2) Canada ETV PSD & Test Protocols - ISO14034 Certifed

(3) actored to account for bypass flow.

(4) Combined removal efficiencies calculated based on NCDENR Stormwater BMP Manual, Section 3.9.4, where Total Removal Efficiency = 1st BMP Efficiency + 2nd BMP Efficiency - (1st BMP Efficiency x 2nd BMP Efficiency)

ADS Treatment Train Sizing

Project Name:	Dundas St SQU600
Consulting Engineer:	vanMEER limited
Location:	Belleville, Ontario
Sizing Completed By:	Haider Nasrullah
Email:	haider.nasrullah@ads-pipe.com

Summary of Results	
Isolator Row PLUS TSS Removal:	80.8%
DD6 TSS Removal:	61.0%
Combined TSS Removal:	92.3%
Total Volume Treated:	>90%

Site Details	
Site Area (ha):	0.77
Rational C:	0.67
Particle Size Distribution:	ETV
Rainfall Station:	Belleville, ONT

Note: Isolator Row PLUS removal efficiencies based solely on ETV/NJDEP PSD, above-noted PSD is for OGS sizing only

Individual OGS Results

Model	TSS Removal	Volume Treated
DD4	53.0%	>90%
DD6	61.0%	>90%
DD8	65.0%	>90%
DD10	66.0%	>90%
DD12	67.0%	>90%

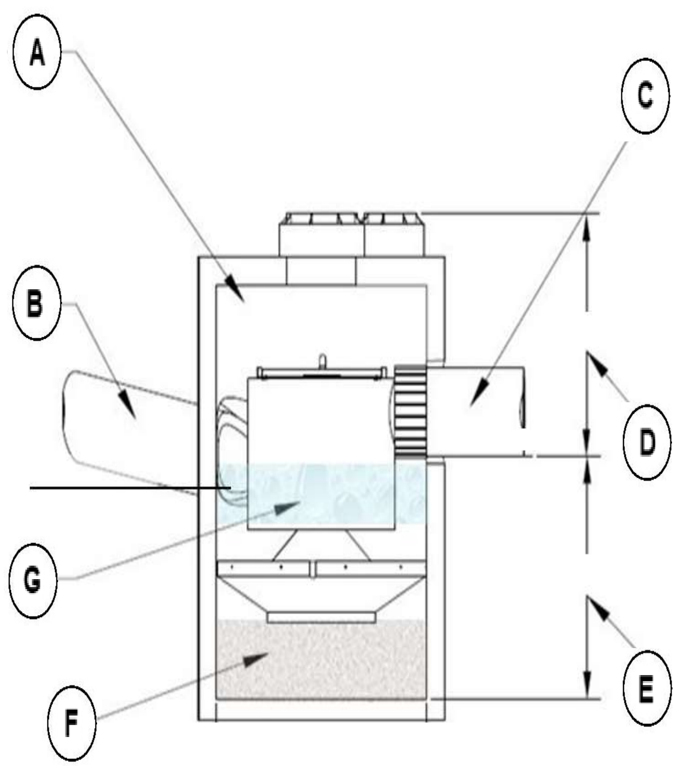
Stormtech Details	
Chamber Model:	MC-3500
No. Chambers in Isolator Row PLUS:	5
Volume Treated by Isolator Row PLUS:	>90%

Notes: Refer to Stormtech drawings for full IR+ configuration.

Isolator Row PLUS must include Flared End Ramp (FLAMP) for proper performance.

Overall System Capacities	
Total Sediment Storage Capacity:	5.91 m³
Oil Storage Capacity:	818 L
Max. OGS Pipe Diameter:	450 mm
Peak OGS Flow Capacity:	227 L/s
Peak Isolator Row PLUS Flowrate:	56 L/s

OGS Specifications	
Unit Diameter (A):	1,800 mm
Inlet Pipe Diameter (B):	600 mm
Outlet Pipe Diameter (C):	600 mm
Top of Grade Elevation:	0.00 m
Bottom of Sump Elevation:	-1.80 m
Inlet Pipe Elevation:	0.00 m
Outlet Pipe Elevation:	0.00 m



Notes:

Isolator Row PLUS removal efficiency based on verified ETV test report. For dimensions and configuration of Isolator Row PLUS, please see Stormtech drawing package.

Project Name:	Dundas St SQU600
Consulting Engineer:	vanMEER limited
Location:	Belleville, Ontario

Net Annual Removal Efficiency Summary

Rainfall Intensity	Fraction of Rainfall	Removal Efficiency		Combined Removal Efficiency	Combined Weighted Removal Efficiency
		DD6	IR PLUS		
mm/hr	%	%	%	%	%
0.50	0.4%	69.2%	81.2%	94.2%	0.4%
1.00	13.2%	68.4%	81.2%	94.1%	12.4%
1.50	14.0%	67.6%	81.2%	93.9%	13.1%
2.00	14.0%	66.9%	81.2%	93.8%	13.1%
2.50	3.6%	66.1%	81.2%	93.6%	3.3%
3.00	2.5%	65.4%	81.2%	93.5%	2.4%
3.50	8.4%	64.6%	81.2%	93.3%	7.9%
4.00	5.1%	63.9%	81.2%	93.2%	4.7%
4.50	1.6%	63.2%	81.2%	93.1%	1.5%
5.00	5.1%	62.4%	81.2%	92.9%	4.7%
6.00	4.8%	61.0%	81.2%	92.7%	4.4%
7.00	4.5%	59.7%	81.2%	92.4%	4.2%
8.00	3.5%	58.3%	81.2%	92.2%	3.2%
9.00	2.4%	57.0%	81.2%	91.9%	2.3%
10.00	2.5%	55.7%	81.2%	91.7%	2.3%
20.00	9.7%	44.4%	81.2%	89.5%	8.7%
30.00	2.8%	35.3%	81.2%	87.8%	2.4%
40.00	0.9%	28.1%	79.3%	85.1%	0.8%
50.00	0.4%	22.4%	63.4%	71.6%	0.3%
100.00	0.6%	17.9%	31.7%	43.9%	0.3%
150.00	0.1%	17.9%	21.1%	35.3%	0.0%
200.00	0.0%	17.9%	15.9%	30.9%	0.0%
		Total Net Annual Removal Efficiency			**92.3%**
		Total Runoff Volume Treated			**>90%**

Notes:

(1) Rainfall Data: 1960:2007, HLY03, Belleville, ONT, 6150700 & 6150689.

(2) Canada ETV PSD & Test Protocols - ISO14034 Certifed

(3) actored to account for bypass flow.

(4) Combined removal efficiencies calculated based on NCDENR Stormwater BMP Manual, Section 3.9.4, where Total Removal Efficiency = 1st BMP Efficiency + 2nd BMP Efficiency - (1st BMP Efficiency x 2nd BMP Efficiency)

StormTech® Isolator® Row Plus

The StormTech Isolator Row Plus is an enhancement to our proven water quality treatment system. This updated system is both a NJCAT and ETV verified water quality treatment device that can be incorporated into any system layout.

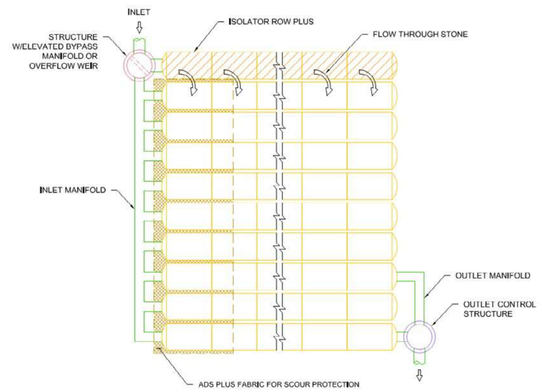
Features

- Isolator Row Plus is now ETV verified. As a Manufactured Treatment Device it achieves over 81% TSS removal per the ISO 14034:2016 ETV standard and the Canadian Environmental Technology Verification Process.
- A patented Flamp™ (Flared End Ramp) provides a smooth transition from pipe invert to fabric bottom. The FLAMP is attached to the inlet pipe inside the chamber end cap and improves chamber function over time by distributing sediment and debris that would otherwise collect at the inlet. It also serves to improve the fluid and solid flow back into the inlet pipe during maintenance and cleaning.
- Proprietary ADS Plus fabric maintains durability and sediment removal while allowing for higher water quality flow rates. A single layer of ADS Plus fabric is placed between the angular base stone and the Isolator Row Plus chambers.

Technology Descriptions

The Isolator Row Plus is designed to capture the "first flush" runoff and offers the versatility to be sized on a volume or a flow basis. Considered an LID (low impact development) technology, the Isolator Row Plus can be part of the treatment train design for water quality. An upstream manhole not only provides access to the Isolator Row Plus but includes a high/low concept such that stormwater flow rates or volumes that exceed the capacity of the Isolator Row Plus bypass through a manifold to the other chambers. This creates a differential between the Isolator Row Plus row of chambers and the manifold to the rest of the system, thus allowing for settlement time in the Isolator Row Plus. Stormwater is then either infiltrated into the soils below or passed at a controlled rate through an outlet manifold and outlet control structure.

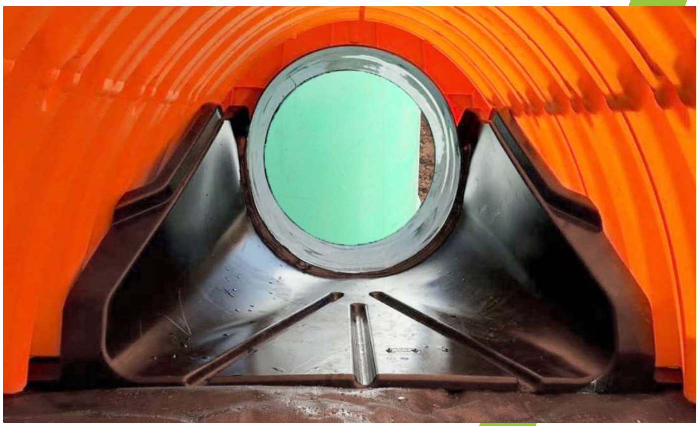
Schematic of the StormTech Isolator Row PLUS System



Summary of Verified Claims[1]

Maximum Treatment Flow Rate (MTFR) (L/s/m²)	2.8
Effective Filtration Treatment Area (m²)	5.06
Test Sediment Size (microns)	1-1000
Mean Particle Concentration (mg/L)	200
TSS Removal Efficiency	81%

[1] Verification of StormTech SC-740 Isolator Row PLUS test results in accordance with the ISO 14034:2016 ETV standard. The full Verification Statement for the StormTech SC-740 Isolator Row PLUS can be downloaded from the VerifiGlobal website



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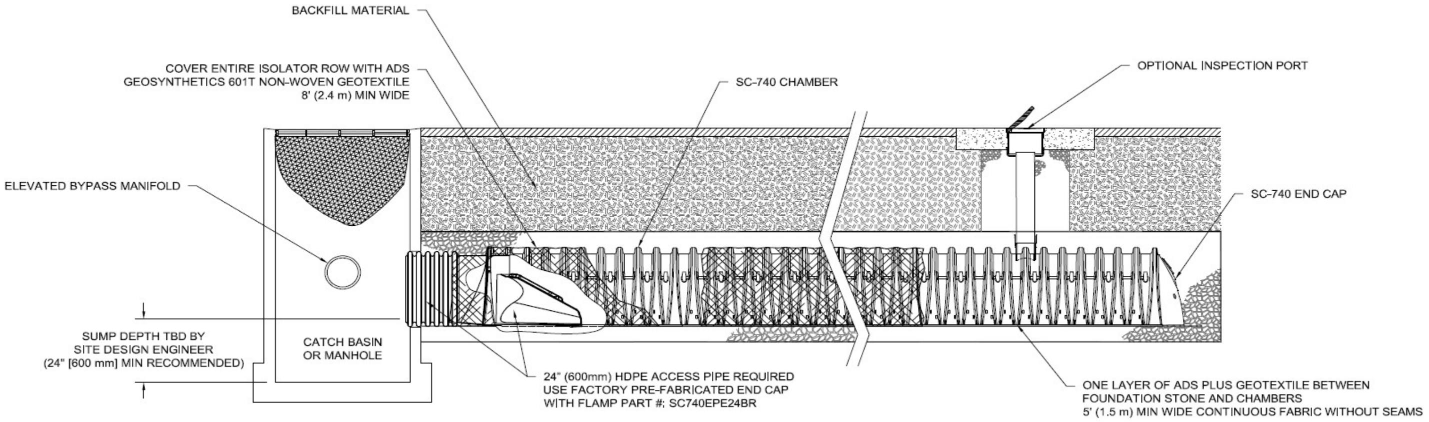
VerifiGlobal

ads-pipecanada.ca
519-699-0222

StormTech Isolator Row Plus (not to scale)

Note: Non-woven fabric is only required over the chambers for the SC-310 and SC-740 chamber models.



Maintenance

The Isolator Row Plus was designed to reduce the cost of periodic maintenance. By "isolating" sediment to just one row of the StormTech system, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. Maintenance is accomplished with the JetVac process. The JetVac® process utilizes a high-pressure water nozzle to propel itself down the Isolator Row Plus while scouring and suspending sediment. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency.

	Chamber Storage	Chamber Footprint	Treatment Rate
SC-160LP	0.42 m³ (15.0 cf)	1.06 m² (11.45 sf)	3.11 L/s (0.11 cfs)
SC-310	0.88 m³ (31.0 cf)	1.64 m² (17.7 sf)	4.53 L/s (0.16 cfs)
SC-740	2.12 m³ (74.9 cf)	2.58 m² (27.8 sf)	7.36 L/s (0.26 cfs)
DC-780	2.22 m³ (78.4 cf)	2.58 m² (27.8 sf)	7.36 L/s (0.26 cfs)
MC-3500	4.96 m³ (175.0 cf)	3.99 m² (42.9 sf)	11.32 L/s (0.40 cfs)
MC-4500	4.60 m³ (162.6 cf)	2.80 m² (30.1 sf)	7.93 L/s (0.28 cfs)

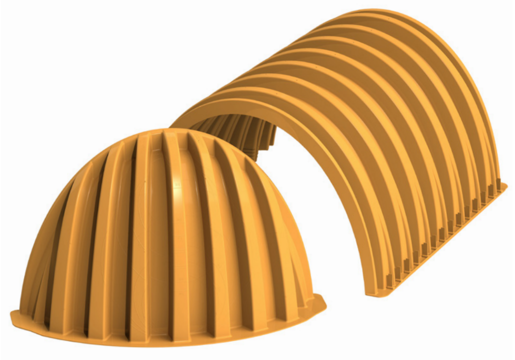
Installation

Installation of the stormwater treatment unit(s) shall be preformed per manufacture's installation instructions. Such instructions can be obtained by calling Advanced Drainage systems at 888-367-7473 or by logging on to www.ads-pipe.com or www.stormtech.com.

ads-pipecanada.ca
519-699-0222

StormTech® MC-3500 Chamber

Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech system is designed primarily to be used under parking lots, thus maximizing land usage for private (commercial) and public applications. StormTech chambers can also be used in conjunction with Green Infrastructure, thus enhancing the performance and extending the service life of these practices.



Nominal Chamber Specifications
(not to scale)

Size (L x W x H)
90" x 77" x 45"
2286 mm x 1956 mm x 1143 mm

Chamber Storage
109.9 ft^3 (3.11 m^3)

Min. Installed Storage*
175.0 ft^3 (4.96 m^3)

Weight
134 lbs (60.8 kg)

Shipping
15 chambers/pallet
7 end caps/pallet
7 pallets/truck

*Assumes a minimum of 12" (300 mm) of stone above, 9" (230 mm) of stone below chambers, 6" (150 mm) of stone between chambers/ end caps and 40% stone porosity.

Nominal End Cap Specifications
(not to scale)

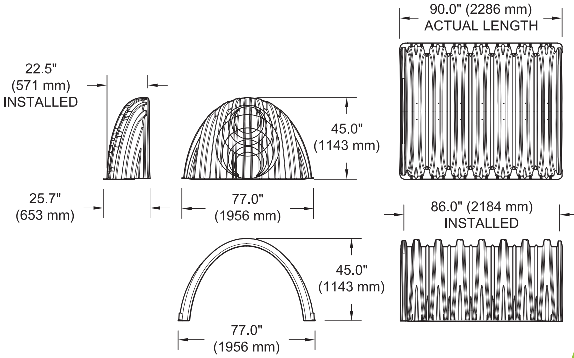
Size (L x W x H)
26.5" x 71" x 45.1"
673 mm x 1803 mm x 1145 mm

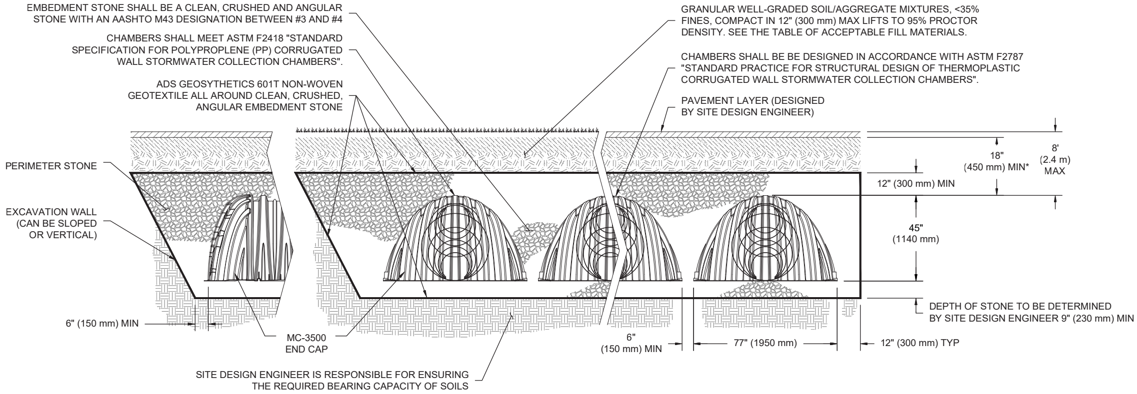
End Cap Storage
14.9 ft^3 (0.42 m^3)

Min. Installed Storage*
45.1 ft^3 (1.28 m^3)

Weight
49 lbs (22.2 kg)

*Assumes a minimum of 12" (300 mm) of stone above, 9" (230 mm) of stone below, 6" (150 mm) of stone perimeter, 6" (150 mm) of stone between chambers/ end caps and 40% stone porosity.





*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 24" (600 mm).

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StormTech MC-3500 Specifications

Storage Volume Per Chamber

	Bare Chamber Storage ft³ (m³)	Chamber and Stone Foundation Depth in. (mm)			
		9 in (230 mm)	12 in (300 mm)	15 in (375 mm)	18 in (450 mm)
Chamber	109.9 (3.11)	175.0 (4.96)	179.9 (5.09)	184.9 (5.24)	189.9 (5.38)
End Cap	14.9 (0.42)	45.1 (1.28)	46.6 (1.32)	48.3 (1.37)	49.9 (1.41)

Note: Assumes 6" (150 mm) row spacing, 40% stone porosity, 12" (300 mm) stone above and includes the bare chamber/end cap volume.

Amount of Stone Per Chamber

English Tons (yds³)	Stone Foundation Depth			
	9 in	12 in	15 in	18 in
Chamber	8.5 (6.0)	9.1 (6.5)	9.7 (6.9)	10.4 (7.4)
End Cap	3.9 (2.8)	4.1 (2.9)	4.3 (3.1)	4.5 (3.2)
Metric Kilograms (m³)	**230 mm**	**300 mm**	**375 mm**	**450 mm**
Chamber	7711 (4.6)	8255 (5.0)	8800 (5.3)	9435 (5.7)
End Cap	3538 (2.1)	3719 (2.2)	3901 (2.4)	4082 (2.5)

Note: Assumes 12" (300 mm) of stone above and 6" (150 mm) row spacing and 6" (150 mm) of perimeter stone in front of end caps.

Volume Excavation Per Chamber yd³ (m³)

	Stone Foundation Depth			
	9 in (230 mm)	12 in (300 mm)	15 in (375mm)	18 in (450 mm)
Chamber	11.9 (9.1)	12.4 (9.5)	12.8 (9.8)	13.3 (10.2)
End Cap	4.0 (3.1)	4.1 (3.3)	4.3 (3.3)	4.4 (3.4)

Note: Assumes 6" (150 mm) of separation between chamber rows and 24" (600 mm) of cover. The volume of excavation will vary as depth of cover increases.

ADS StormTech products, manufactured in accordance with ASTM F2418 or ASTMF2922, comply with all requirements in the Build America, Buy America (BABA) Act.

Working on a project?
Visit us at adspipe.com/stormtech and utilize the Design Tool

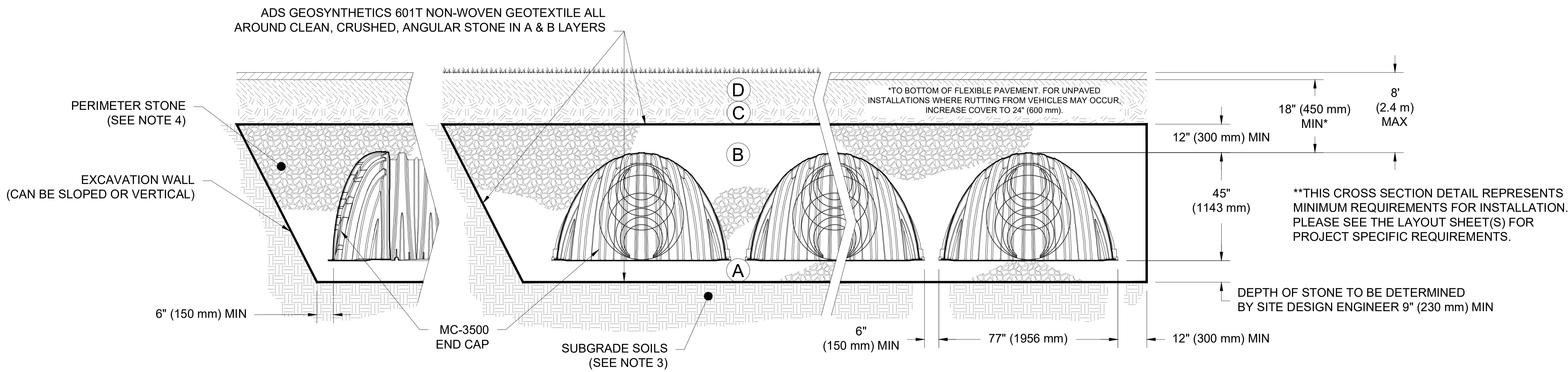
ADS StormTech™

adspipe.com
800-821-6710

ACCEPTABLE FILL MATERIALS: STORMTECH MC-3500 CHAMBER SYSTEMS

MATERIAL LOCATION		DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 24" (600 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 24" (600 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 12" (300 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS.
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 9" (230 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.



*FOR COVER DEPTHS GREATER THAN 8.0' (2.4 m) PLEASE CONTACT ADS

NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 45x76 DESIGNATION SS.
2. MC-3500 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 500 LBS/FT/%. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

MC-3500
STANDARD CROSS SECTION

DATE:	8/03/22	DRAWN:	KLJ
PROJECT #:		CHECKED:	KLJ

DATE	DRWN	CHKD	DESCRIPTION

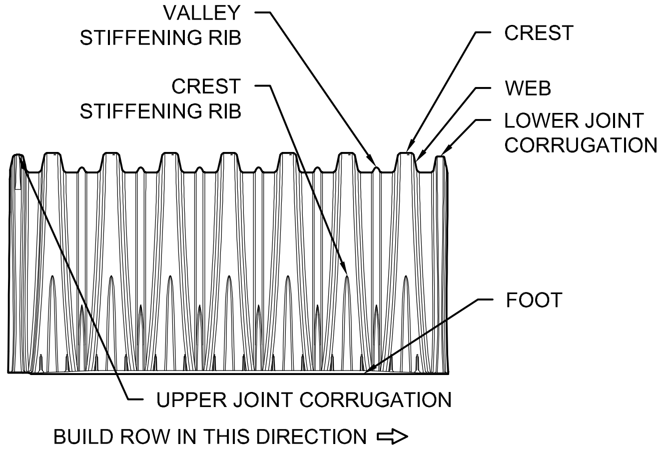
StormTech® Chamber System
888-892-2694 | WWW.STORMTECH.COM

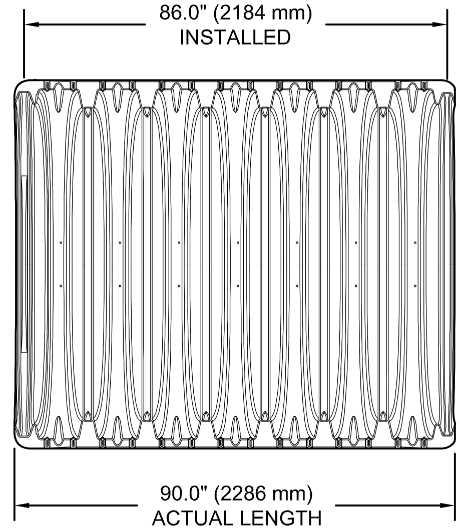
ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026

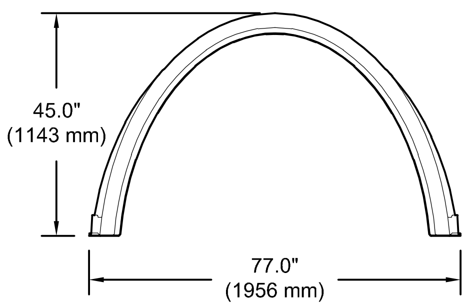
SHEET 1 OF 1

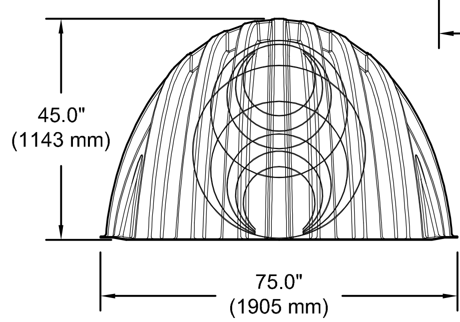
MC-3500 TECHNICAL SPECIFICATION

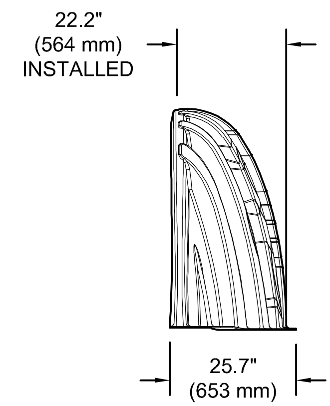
NTS











NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	77.0" X 45.0" X 86.0"	(1956 mm X 1143 mm X 2184 mm)
CHAMBER STORAGE	109.9 CUBIC FEET	(3.11 m³)
MINIMUM INSTALLED STORAGE*	175.0 CUBIC FEET	(4.96 m³)
WEIGHT	134 lbs.	(60.8 kg)

NOMINAL END CAP SPECIFICATIONS

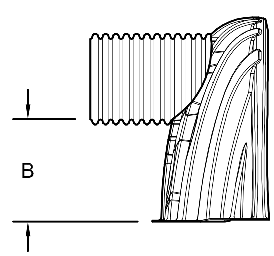
SIZE (W X H X INSTALLED LENGTH)	75.0" X 45.0" X 22.2"	(1905 mm X 1143 mm X 564 mm)
END CAP STORAGE	14.9 CUBIC FEET	(0.42 m³)
MINIMUM INSTALLED STORAGE*	45.1 CUBIC FEET	(1.28 m³)
WEIGHT	49 lbs.	(22.2 kg)

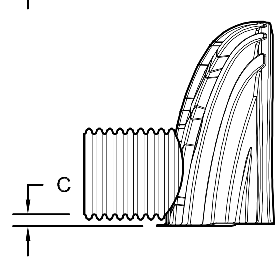
*ASSUMES 12" (305 mm) STONE ABOVE, 9" (229 mm) STONE FOUNDATION, 6" (152 mm) STONE BETWEEN CHAMBERS, 6" (152 mm) STONE PERIMETER IN FRONT OF END CAPS AND 40% STONE POROSITY.

PARTIAL CUT HOLES AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
PARTIAL CUT HOLES AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"
END CAPS WITH A PREFABRICATED WELDED STUB END WITH "W"
END CAPS WITH A WELDED CROWN PLATE END WITH "C"

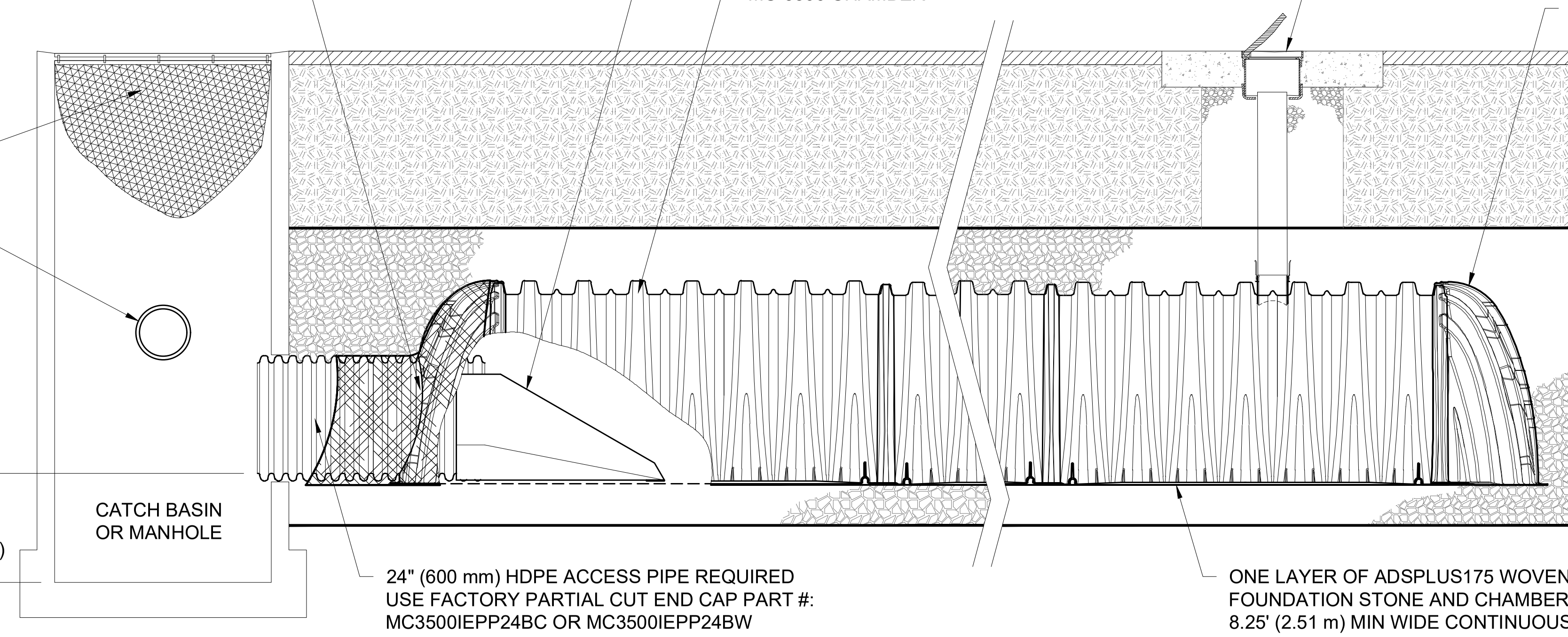
PART #	STUB	B	C
MC3500IEPP06T	6" (150 mm)	33.21" (844 mm)	---
MC3500IEPP06B		---	0.66" (17 mm)
MC3500IEPP08T	8" (200 mm)	31.16" (791 mm)	---
MC3500IEPP08B		---	0.81" (21 mm)
MC3500IEPP10T	10" (250 mm)	29.04" (738 mm)	---
MC3500IEPP10B		---	0.93" (24 mm)
MC3500IEPP12T	12" (300 mm)	26.36" (670 mm)	---
MC3500IEPP12B		---	1.35" (34 mm)
MC3500IEPP15T	15" (375 mm)	23.39" (594 mm)	---
MC3500IEPP15B		---	1.50" (38 mm)
MC3500IEPP18TC	18" (450 mm)	20.03" (509 mm)	---
MC3500IEPP18TW			
MC3500IEPP18BC		---	1.77" (45 mm)
MC3500IEPP18BW			
MC3500IEPP24TC	24" (600 mm)	14.48" (368 mm)	---
MC3500IEPP24TW			
MC3500IEPP24BC		---	2.06" (52 mm)
MC3500IEPP24BW			
MC3500IEPP30BC	30" (750 mm)	---	2.75" (70 mm)

NOTE: ALL DIMENSIONS ARE NOMINAL





CUSTOM PARTIAL CUT INVERTS ARE AVAILABLE UPON REQUEST. INVENTORIED MANIFOLDS INCLUDE 12-24" (300-600 mm) SIZE ON SIZE AND 15-48" (375-1200 mm) ECCENTRIC MANIFOLDS. CUSTOM INVERT LOCATIONS ON THE MC-3500 END CAP CUT IN THE FIELD ARE NOT RECOMMENDED FOR PIPE SIZES GREATER THAN 10" (250 mm). THE INVERT LOCATION IN COLUMN 'B' ARE THE HIGHEST POSSIBLE FOR THE PIPE SIZE.



MC-3500 ISOLATOR ROW PLUS DETAIL

NTS

INSPECTION & MAINTENANCE

STEP 1) INSPECT ISOLATOR ROW PLUS FOR SEDIMENT
- A. INSPECTION PORTS (IF PRESENT)
  - A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN
  - A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED
  - A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
  - A.4. LOWER A CAMERA INTO ISOLATOR ROW PLUS FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
  - A.5. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
- B. ALL ISOLATOR PLUS ROWS
  - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW PLUS
  - B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW PLUS THROUGH OUTLET PIPE
    - i) MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY
    - ii) FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE
  - B.3. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.

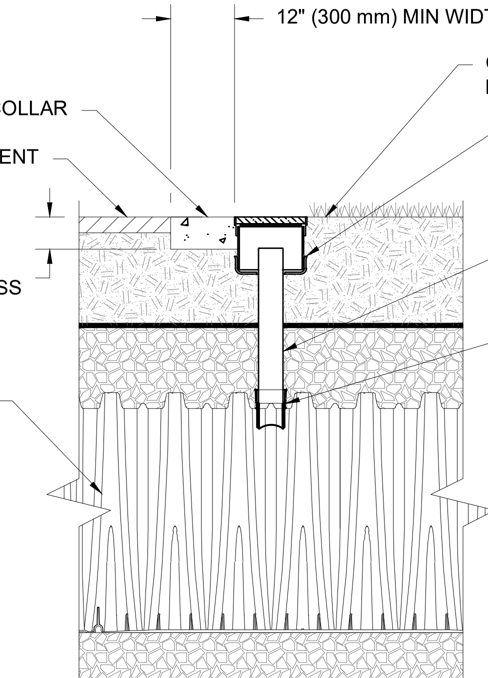
STEP 2) CLEAN OUT ISOLATOR ROW PLUS USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45" (1.1 m) OR MORE IS PREFERRED
- B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
- C. VACUUM STRUCTURE SUMP AS REQUIRED

STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.

STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

NOTES

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.
2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.



NOTE:
INSPECTION PORTS MAY BE CONNECTED THROUGH ANY CHAMBER CORRUGATION VALLEY.

4" PVC INSPECTION PORT DETAIL (MC SERIES CHAMBER)

NTS

MC-3500	
ISOLATOR ROW PLUS DETAILS	
DATE: 8/03/22	DRAWN: KLJ
PROJECT #:	CHECKED: KLJ

DATE	DRWN	CHKD	DESCRIPTION

StormTech®
Chamber System
888-892-2694 | WWW.STORMTECH.COM

4640 TRUEMAN BLVD
HILLIARD, OH 43026

SHEET 1 OF 1

Isolator® Row Plus

O&M Manual

The Isolator® Row Plus

Introduction

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row Plus is a technique to inexpensively enhance Total Suspended Solids (TSS) and Total Phosphorus (TP) removal with easy access for inspection and maintenance.

The Isolator Row Plus

The Isolator Row Plus is a row of StormTech chambers, either SC-160, SC-310, SC-310-3, SC-740, DC-780, MC-3500 or MC-7200 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for sediment settling and filtration as stormwater rises in the Isolator Row Plus and passes through the filter fabric. The open bottom chambers and perforated sidewalls (SC-310, SC- 310-3 and SC-740 models) allow stormwater to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row Plus protecting the adjacent stone and chambers storage areas from sediment accumulation.

ADS geotextile fabric is placed between the stone and the Isolator Row Plus chambers. The woven geotextile provides a media for stormwater filtration, a durable surface for maintenance, prevents scour of the underlying stone and remains intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the chamber's sidewall. The non-woven fabric is not required over the SC-160, DC-780, MC-3500 or MC-7200 models as these chambers do not have perforated side walls.

The Isolator Row Plus is designed to capture the "first flush" runoff and offers the versatility to be sized on a volume basis or a flow-rate basis. An upstream manhole provides access to the Isolator Row Plus and includes a high/low concept such that stormwater flow rates or volumes that exceed the capacity of the Isolator Row Plus bypass through a manifold to the other chambers. This is achieved with an elevated bypass manifold or a high-flow weir. This creates a differential between the Isolator Row Plus row of chambers and the manifold to the rest of the system, thus allowing for settlement time in the Isolator Row Plus. After Stormwater flows through the Isolator Row Plus and into the rest of the chamber system it is either exfiltrated into the soils below or passed at a controlled rate through an outlet manifold and outlet control structure.

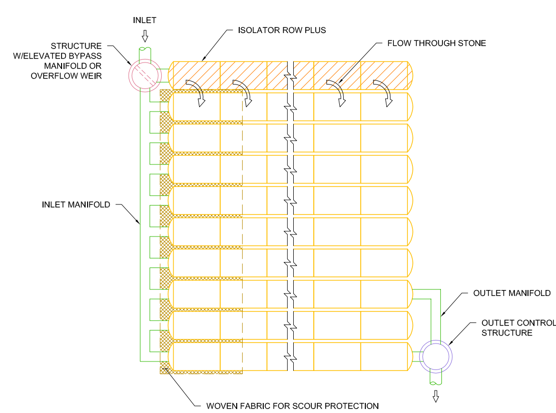
The Isolator Row FLAMP™ (patent pending) is a flared end ramp apparatus attached to the inlet pipe on the inside of the chamber end cap. The FLAMP provides a smooth transition from pipe invert to fabric bottom. It is configured to improve chamber function performance by enhancing outflow of solid debris that would otherwise collect at the chamber's end. It also serves to improve the fluid and solid flow into the access pipe during maintenance and cleaning and to guide cleaning and inspection equipment back into the inlet pipe when complete.

The Isolator Row Plus may be part of a treatment train system. The treatment train design and pretreatment device selection by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, StormTech recommend using the Isolator Row Plus to minimize maintenance requirements and maintenance costs.

Note: *See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row Plus.*

Looking down the Isolator Row PLUS from the manhole opening, ADS PLUS Fabric is shown between the chamber and stone base.

StormTech Isolator Row PLUS with Overflow Spillway (not to scale)



Isolator Row Plus Inspection/Maintenance

Inspection

The frequency of inspection and maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial, residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row Plus should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

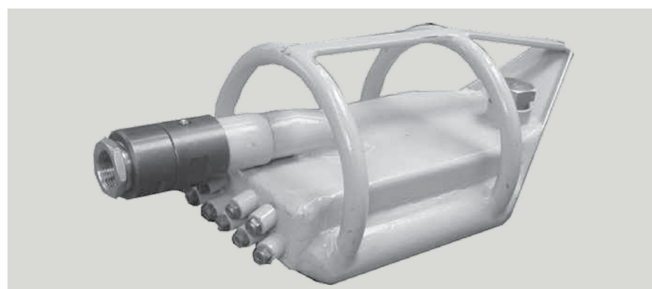
The Isolator Row Plus incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the Isolator Row Plus, clean-out should be performed.

Maintenance

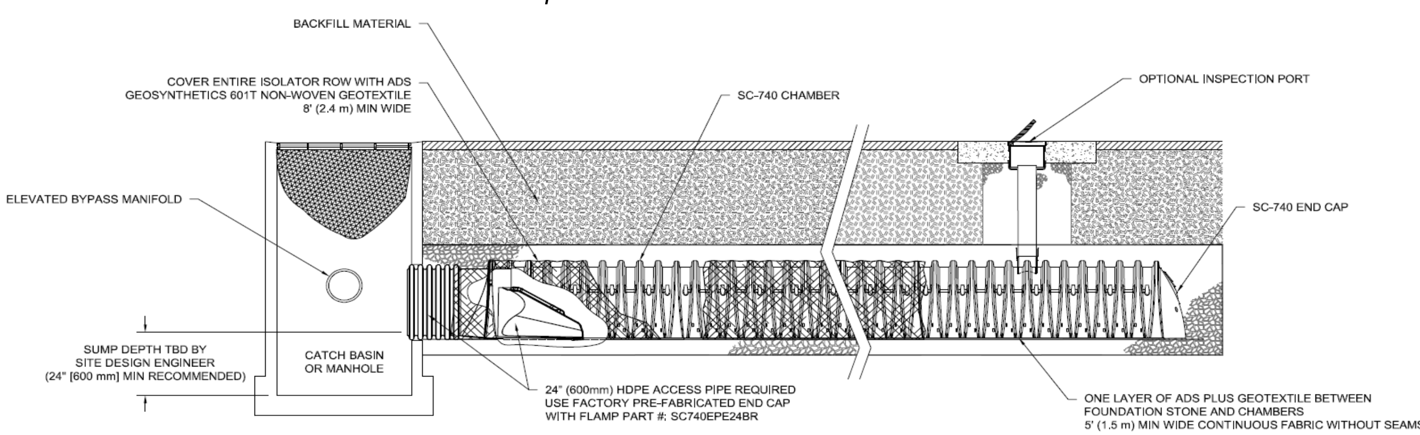
The Isolator Row Plus was designed to reduce the cost of periodic maintenance. By “isolating” sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entries.

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row Plus while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45” are best. StormTech recommends a maximum nozzle pressure of 2000 psi be utilized during cleaning. JetVac reels can vary in length. For ease of maintenance, ADS recommends Isolator Row Plus lengths up to 200' (61 m). **The JetVac process shall only be performed on StormTech Isolator Row Plus that have ADS Plus Fabric (as specified by StormTech) over their angular base stone.**



StormTech Isolator Row PLUS (*not to scale*)

Note: *Non-woven fabric is only required over the inlet pipe connection into the end cap for SC-160LP, DC-780, MC-3500 and MC-7200 chamber models and is not required over the entire Isolator Row PLUS.*



Isolator Row Plus Step By Step Maintenance Procedures

Step 1

Inspect Isolator Row Plus for sediment.

A) Inspection ports (if present)
  i. Remove lid from floor box frame
  ii. Remove cap from inspection riser
  iii. Using a flashlight and stadia rod,measure depth of sediment and record results on maintenance log.
  iv. If sediment is at or above 3 inch depth, proceed to Step 2. If not, proceed to Step 3.

B) All Isolator Row Plus
  i. Remove cover from manhole at upstream end of Isolator Row Plus
  ii. Using a flashlight, inspect down Isolator Row Plus through outlet pipe
    1. Mirrors on poles or cameras may be used to avoid a confined space entry
    2. Follow OSHA regulations for confined space entry if entering manhole
  iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches), proceed to Step 2.
  If not, proceed to Step 3.

Step 2

Clean out Isolator Row Plus using the JetVac process.

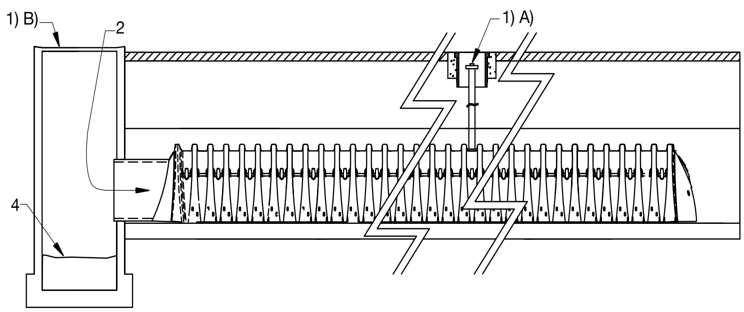
A) A fixed floor cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
B) Apply multiple passes of JetVac until backflush water is clean
C) Vacuum manhole sump as required

Step 3

Replace all caps, lids and covers, record observations and actions.

Step 4

Inspect & clean catch basins and manholes upstream of the StormTech system.



Sample Maintenance Log

Date	Stadia Rod Readings		Sediment Depth (1)–(2)	Observations/Actions	Inspector
	Fixed point to chamber bottom (1)	Fixed point to top of sediment (2)			
3/15/11	6.3 ft	none		New installation. Fixed point is CI frame at grade	DJM
9/24/11		6.2	0.1 ft	Some grit felt	SM
6/20/13		5.8	0.5 ft	Mucky feel, debris visible in manhole and in Isolator Row PLUS, maintenance due	NV
7/7/13	6.3 ft		0	System jetted and vacuumed	DJM

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StormTech® Installation Guide
MC-3500 & MC-4500 Chamber

StormTech
Installation Video

Required Materials and Equipment List

- Acceptable fill materials per Table 1
- ADS Plus and non-woven geotextile fabrics
- StormTech solid end caps, pre-cored and pre-fabricated end caps
- StormTech chambers, manifolds and fittings

Note: MC-3500 chamber pallets are 77" x 90" (2.0 m x 2.3 m) and weigh about 2010 lbs. (912 kg) and MC-4500 pallets are 100" x 52" (2.5 m x 1.3 m) and weigh about 840 lbs. (381 kg). Unloading chambers requires 72" (1.8 m) (min.) forks and/or tie downs (straps, chains, etc).

Important Notes:

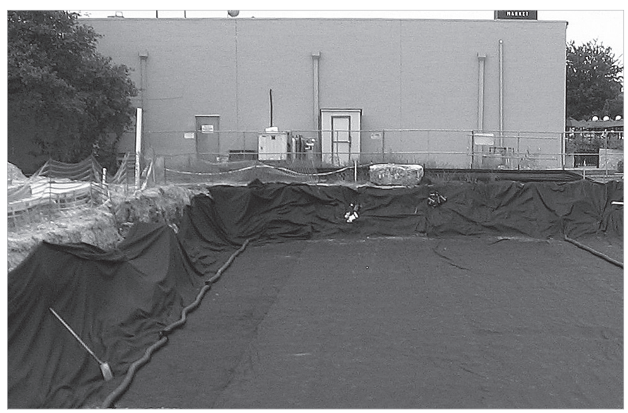
A. This installation guide provides the minimum requirements for proper installation of chambers. Nonadherence to this guide may result in damage to chambers during installation. Replacement of damaged chambers during or after backfilling is costly and very time consuming. It is recommended that all installers are familiar with this guide, and that the contractor inspects the chambers for distortion, damage and joint integrity as work progresses.

B. Use of a dozer to push embedment stone between the rows of chambers may cause damage to chambers and is not an acceptable backfill method. Any chambers damaged by using the "dump and push" method are not covered under the StormTech standard warranty.

C. Care should be taken in the handling of chambers and end caps. End caps must be stored standing upright. Avoid dropping, prying or excessive force on chambers during removal from pallet and initial placement.

Requirements for System Installation

Excavate bed and prepare subgrade per engineer's plans. Plans and specifications should include Best Management Practices (BMPs) to deter contamination of open pits during construction.



Place non-woven geotextile over prepared soils and up excavation walls.

Place clean, crushed, angular stone foundation 9" (230 mm) min. Install underdrains if required. Compact to achieve a flat surface.

Manifold, Scour Fabric and Chamber Assembly

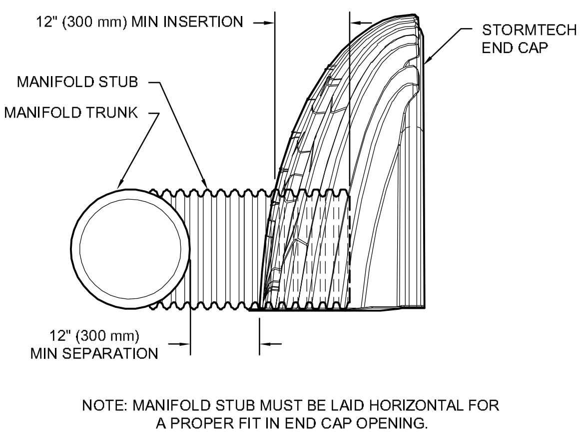
Install manifolds and lay out ADS PLUS fabric at inlet rows [min. 17.5 ft (5.33 m)] at each inlet end cap. Place a continuous piece (no seams) along entire length of Isolator® PLUS Row(s).

Align the first chamber and end cap of each row with inlet pipes. Contractor may choose to postpone stone placement around end chambers and leave ends of rows open for easy inspection of chambers during the backfill process.

Continue installing chambers by overlapping chamber end corrugations. Chamber joints are labeled "Lower Joint – Overlap Here" and "Build this direction – Upper Joint" Be sure that the chamber placement does not exceed the reach of the construction equipment used to place the stone. Maintain minimum 6" (150 mm) spacing between MC-3500 rows and 9" (230 mm) spacing between MC-4500 rows.

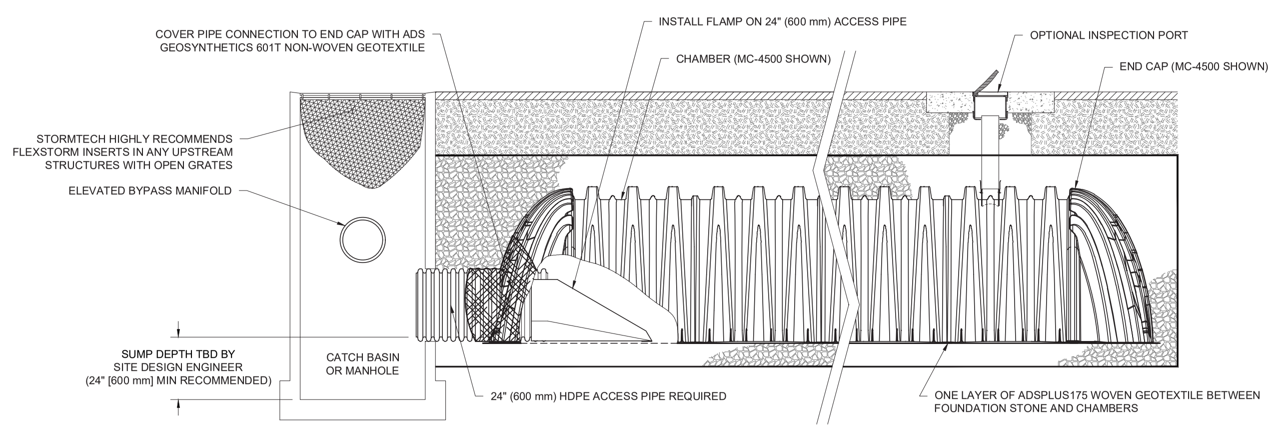
Place a continuous layer of ADS PLUS fabric between the foundation stone and the Isolator Row PLUS chambers, making sure the fabric lays flat and extends the entire width of the chamber feet. When used on an Isolator Row PLUS, a 24" FLAMP (flared end ramp) is attached to the inside of the inlet pipe with a provided threaded rod and bolt. The FLAMP then lays on top of the ADS PLUS fabric.

Manifold Insertion



Insert inlet and outlet manifolds a minimum 12" (300 mm) into chamber end caps. Manifold header should be a minimum 12" (300 mm) from base of end cap.

StormTech Isolator Row Plus Detail

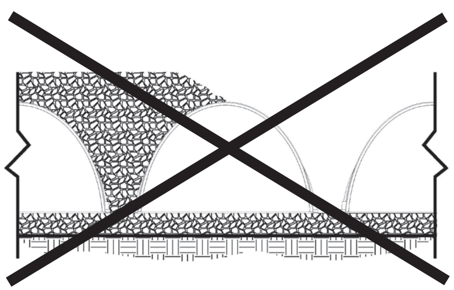


Initial Anchoring of Chambers – Embedment Stone

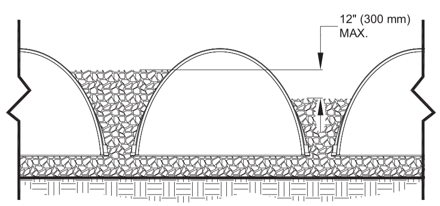
Initial embedment shall be spotted along the centerline of the chamber evenly anchoring the lower portion of the chamber. This is best accomplished with a stone conveyor or excavator reaching along the row.

No equipment shall be operated on the bed at this stage of the installation. Excavators must be located off the bed. Dump trucks shall not dump stone directly on to the bed. Dozers or loaders are not allowed on the bed at this time.

Backfill of Chambers – Embedment Stone

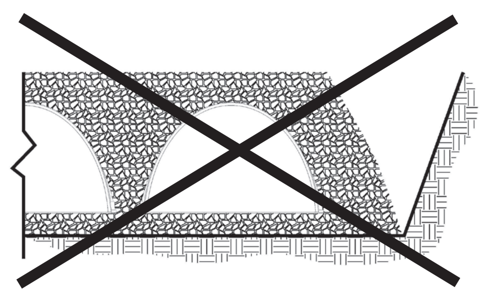


Uneven Backfill

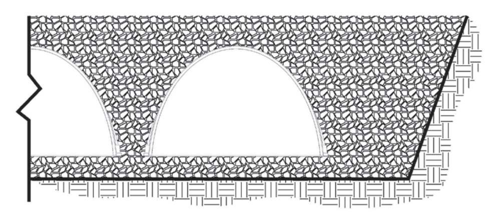


Even Backfill

Backfill chambers evenly. Stone column height should never differ by more than 12” (300 mm) between adjacent chamber rows or between chamber rows and perimeter.



Perimeter Not Backfilled



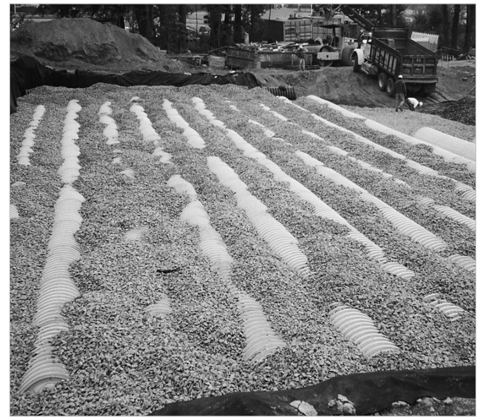
Perimeter Fully Backfilled

Perimeter stone must be brought up evenly with chamber rows. Perimeter must be fully backfilled, with stone extended horizontally to the excavation wall.

ADS StormTech™

Backfill of Chambers – Embedment Stone and Cover Stone

Continue evenly backfilling between rows and around perimeter until embedment stone reaches tops of chambers and a minimum 12" (300 mm) of cover stone is in place. Perimeter stone must extend horizontally to the excavation wall for both straight or sloped sidewalls. The recommended backfill methods are with a stone conveyor outside of the bed or build as you go with an excavator inside the bed reaching along the rows. Backfilling while assembling chambers rows as shown in the picture will help to ensure that equipment reach is not exceeded.

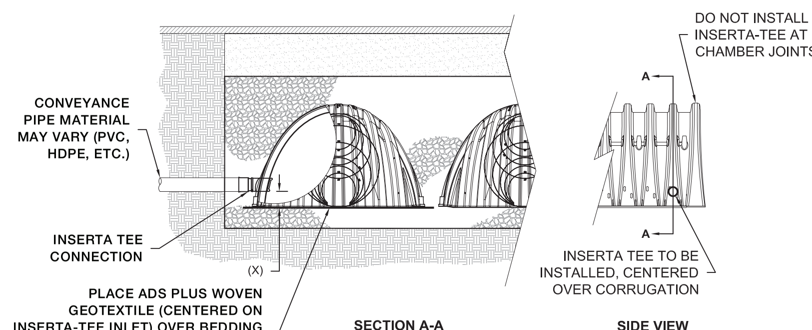


Only after chambers have been backfilled to top of chamber and with a minimum 12" (300 mm) of cover stone on top of chambers can skid loaders and small LGP dozers be used to final grade cover stone and backfill material in accordance with ground pressure limits in Table 2. Equipment must push material parallel to rows only. Never push perpendicular to rows. StormTech recommends the contractor inspect chamber rows before placing final backfill. Any chambers damaged by construction equipment shall be removed and replaced.

Final Backfill of Chambers – Fill Material

Install non-woven geotextile over stone. Geotextile must overlap 24" (600 mm) where edges meet. Compact at 24" (600 mm) of fill. Roller travel parallel with rows.

Inserta Tee Detail



CHAMBER	MAX DIAMETER OF INSERTA TEE	HEIGHT FROM BASE OF CHAMBER (X)
MC-3500	12" (250 mm)	6" (150 mm)
MC-4500	12" (250 mm)	8" (200 mm)
INSERTA TEE FITTINGS AVAILABLE FOR SDR 26, SDR 35, SCH 40 IPS GASKETED & SOLVENT WELD, N-12, HP STORM, C-900 OR DUCTILE IRON		

NOTE:
PART NUMBERS WILL VARY BASED ON INLET PIPE MATERIALS. CONTACT STORMTECH FOR MORE INFORMATION.

Table 1- Acceptable Fill Materials

Material Location	Description	AASHTO M43 Designation[1]	Compaction/Density Requirement
(D) **Final Fill:** Fill Material for layer 'D' starts from the top of the 'C' layer to the bottom of flexible pavement or unpaved finished grade above. Note that the pavement subbase may be part of the 'D' layer.	Any soil/rock materials, native soils or per engineer's plans. Check plans for pavement subgrade requirements.	N/A	Prepare per site design engineer's plans. Paved installations may have stringent material and preparation requirements.
(C) **Initial Fill:** Fill Material for layer 'C' starts from the top of the embedment stone ('B' layer) to 24" (600 mm) above the top of the chamber. Note that pavement subbase may be part of the 'C' layer.	Granular well-graded soil/aggregate mixtures, <35% fines or processed aggregate. Most pavement subbase materials can be used in lieu of this layer.	AASHTO M145[1] A-1, A-2-4, A-3 or AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	Begin compaction after min. 24" (600 mm) of material over the chambers is reached. Compact additional layers in 12" (300 mm) max. lifts to a min. 95% Proctor density for well-graded material and 95% relative density for processed aggregate materials.
(B) **Embedment Stone:** Fill the surrounding chambers from the foundation stone ('A' layer) to the 'C' layer above.	Clean, crushed, angular stone	AASHTO M43[1] 3, 4	No compaction required.
(A) **Foundation Stone:** Fill below chambers from the subgrade up to the foot (bottom) of the chamber.	Clean, crushed, angular stone,	AASHTO M43[1] 3, 4	Place and compact in 9" (230 mm) max lifts using two full coverages with a vibratory compactor.[2, 3]

Please Note:

1. The listed AASHTO designations are for gradations only. The stone must also be clean, crushed, angular. For example, a specification for #4 stone would state: "clean, crushed, angular no. 4 (AASHTO M43) stone".
2. StormTech compaction requirements are met for 'A' location materials when placed and compacted in 9" (230 mm) (max) lifts using two full coverages with a vibratory compactor.
3. Where infiltration surfaces may be comprised by compaction, for standard installations and standard design load conditions, a flat surface may be achieved by raking or dragging without compaction equipment. For special load designs, contact StormTech for compaction requirements.

Figure 1- Inspection Port Detail

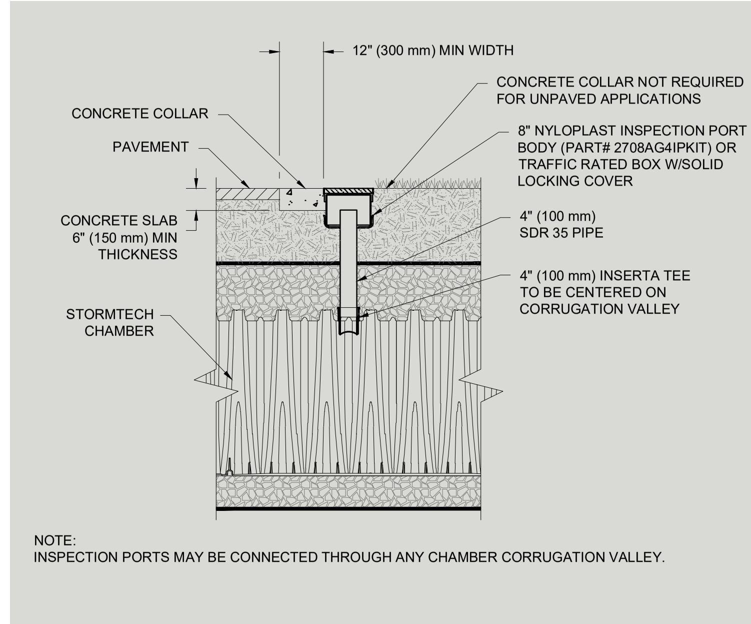
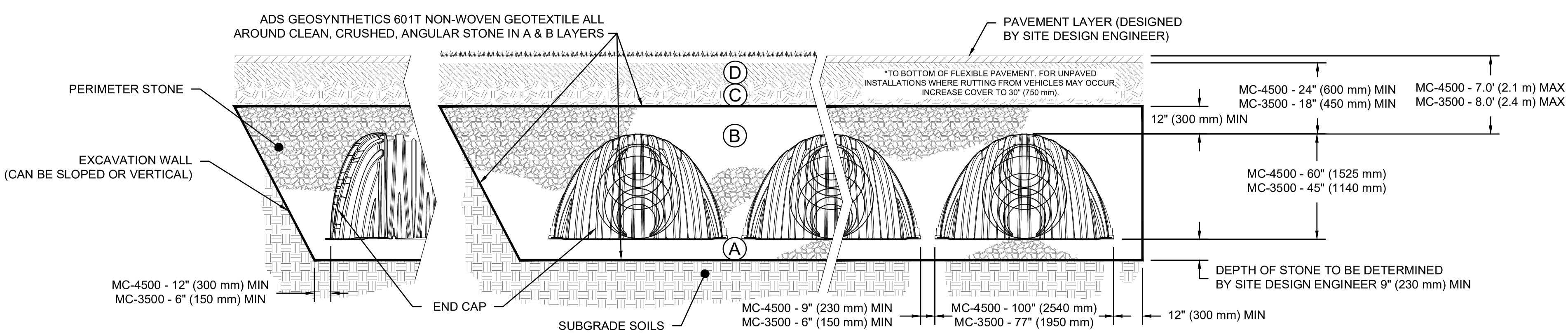


Figure 2 - Fill Material Locations



Notes:

1. 36" (900 mm) of stabilized cover materials over the chambers is recommended during the construction phase if general construction activities, such as full dump truck travel and dumping, are to occur over the bed.
2. During paving operations, dump truck axle loads on 18" (450mm) of cover for MC-3500s may be necessary. Precautions should be taken to avoid rutting of the road base layer, to ensure that compaction requirements have been met, and that a minimum of 18" (450mm) of cover for MC-3500s exists over the chambers. Contact StormTech for additional guidance on allowable axle loads during paving.
3. Ground pressure for track dozers is the vehicle operating weight divided by total ground contact area for both tracks. Excavators will exert higher ground pressures based on loaded bucket weight and boom extension.
4. Mini-excavators (<8,000lbs/3,628 kg) can be used with at least 12" (300 mm) of stone over the chambers and are limited by the maximum ground pressures in Table 2 based on a full bucket at maximum boom extension.
5. StormTech does not require compaction of initial fill at 18" (450 mm) of cover. However, requirements by others for 6" (150 mm) lifts may necessitate the use of small compactors at 18" (450 mm) of cover.
6. Storage of materials such as construction materials, equipment, spoils, etc. should not be located over the StormTech system. The use of equipment over the StormTech system not covered in Table 2 (ex. soil mixing equipment, cranes, etc) is limited. Please contact StormTech for more information.
7. Allowable track loads based on vehicle travel only. Excavators shall not operate on chamber beds until the total backfill reaches 3 feet (900 mm) over the entire bed.

Call StormTech at **888.892.2694** for technical and product information or visit www.stormtech.com

Table 2 - Maximum Allowable Construction Vehicle Loads[6]

Material Location	Fill Depth over Chambers in. (mm)	Maximum Allowable Wheel Loads		Maximum Allowable Track Loads[6]		Maximum Allowable Roller Loads
		Max Axle Load for Trucks lbs (kN)	Max Wheel Load for Loaders lbs (kN)	Track Width in. (mm)	Max Ground Pressure psf (kPa)	Max Drum Weight or Dynamic Force lbs (kN)
Ⓓ Final Fill Material	36" (900) Compacted	32,000 (142)	16,000 (71)	12" (305) 18" (457) 24" (610) 30" (762) 36" (914)	4050 (194) 2760 (132) 2130 (102) 1770 (84) 1530 (73)	38,000 (169)
Ⓒ Initial Fill Material	24" (600) Compacted	32,000 (142)	16,000 (71)	12" (305) 18" (457) 24" (610) 30" (762) 36" (914)	2750 (131) 1920 (92) 1520 (73) 1310 (63) 1180 (56)	20,000 (89)
	24" (600) Loose/Dumped	MC-3500: 32,000 (142) MC-4500: 24,000 (107)	MC-3500: 16,000 (71) MC-4500: 12,000 (53)	12" (305) 18" (457) 24" (610) 30" (762) 36" (914)	2430 (116) 1730 (82) 1390 (66) 1210 (58) 1100 (52)	16,000 (71)
	18" (450)	MC-3500: 32,000 (142) MC-4500: 24,000 (107)	MC-3500: 16,000 (71) MC-4500: 12,000 (53)	12" (305) 18" (457) 24" (610) 30" (762) 36" (914)	2140 (102) 1530 (73) 1260 (60) 1120 (53) 1030 (49)	5,000 (22) (static loads only)[5]
Ⓑ Embedment Stone	12" (300)	Not Allowed	Not Allowed	12" (305) 18" (457) 24" (610) 30" (762)	1100 (53) 710 (34) 660 (32) 580 (28)	Not Allowed
	6" (150)	Not Allowed	Not Allowed	Not Allowed	Not Allowed	Not Allowed

Table 3 - Placement Methods and Descriptions

Material Location	Placement Methods/ Restrictions	Wheel Load Restrictions	Track Load Restrictions	Roller Load Restrictions
		See Table 2 for Maximum Construction Loads		
Ⓓ Final Fill Material	A variety of placement methods may be used. All construction loads must not exceed the maximum limits in Table 2.	36" (900 mm) minimum cover required for dump trucks to dump over chambers.	Dozers to push parallel to rows.[4]	Roller travel parallel to rows only until 36" (900 mm) compacted cover is reached.
Ⓒ Initial Fill Material	Excavator positioned off bed recommended. Small excavator allowed over chambers. Small dozer allowed.	Asphalt can be dumped into paver when compacted pavement subbase reaches 24" (600 mm) above top of chambers.	Small LGP track dozers & skid loaders allowed to grade cover stone with at least 12" (300 mm) stone under tracks at all times. Equipment must push parallel to rows at all times.	Use dynamic force of roller only after compacted fill depth reaches 24" (600 mm) over chambers. Roller travel parallel to chamber rows only.
Ⓑ Embedment Stone	No equipment allowed on bare chambers. Use excavator or stone conveyor positioned off bed or on foundation stone to evenly fill around all chambers to at least the top of chambers.	No wheel loads allowed. Material must be placed outside the limits of the chamber bed.	No tracked equipment is allowed on chambers until a min. 12" (300 mm) cover stone is in place.	No rollers allowed.
Ⓐ Foundation Stone	No StormTech restrictions. Contractor responsible for any conditions or requirements by others relative to subgrade bearing capacity, dewatering or protection of subgrade.			

StormTech® Standard Limited Warranty

STANDARD LIMITED WARRANTY OF STORMTECH LLC ("STORMTECH"): PRODUCTS

(A) This Limited Warranty applies solely to the StormTech chambers and end plates manufactured by StormTech and sold to the original purchaser (the "Purchaser"). The chambers and end plates are collectively referred to as the "Products."

(B) The structural integrity of the Products, when installed strictly in accordance with StormTech's written installation instructions at the time of installation, are warranted to the Purchaser against defective materials and workmanship for one (1) year from the date of purchase. Should a defect appear in the Limited Warranty period, the Purchaser shall provide StormTech with written notice of the alleged defect at StormTech's corporate headquarters within ten (10) days of the discovery of the defect. The notice shall describe the alleged defect in reasonable detail. StormTech agrees to supply replacements for those Products determined by StormTech to be defective and covered by this Limited Warranty. The supply of replacement products is the sole remedy of the Purchaser for breaches of this Limited Warranty. StormTech's liability specifically excludes the cost of removal and/or installation of the Products.

(C) THIS LIMITED WARRANTY IS EXCLUSIVE. THERE ARE NO OTHER WARRANTIES WITH RESPECT TO THE PRODUCTS, INCLUDING NO IMPLIED WARRANTIES OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE.

(D) This Limited Warranty only applies to the Products when the Products are installed in a single layer. UNDER NO CIRCUMSTANCES, SHALL THE PRODUCTS BE INSTALLED IN A MULTI-LAYER CONFIGURATION.

(E) No representative of StormTech has the authority to change this Limited Warranty in any manner or to extend this Limited Warranty. This Limited Warranty does not apply to any person other than to the Purchaser.

(F) Under no circumstances shall StormTech be liable to the Purchaser or to any third party for product liability claims; claims arising from the design, shipment, or installation of the Products, or the cost of other goods or services related to the purchase and installation of the Products. For this Limited Warranty to apply, the Products must be installed in accordance with all site conditions required by state and local codes; all other applicable laws; and StormTech's written installation instructions.

(G) THE LIMITED WARRANTY DOES NOT EXTEND TO INCIDENTAL, CONSEQUENTIAL, SPECIAL OR INDIRECT DAMAGES. STORMTECH SHALL NOT BE LIABLE FOR PENALTIES OR LIQUIDATED DAMAGES, INCLUDING LOSS OF PRODUCTION AND PROFITS; LABOR AND MATERIALS; OVERHEAD COSTS; OR OTHER LOSS OR EXPENSE INCURRED BY THE PURCHASER OR ANY THIRD PARTY. SPECIFICALLY EXCLUDED FROM LIMITED WARRANTY COVERAGE ARE DAMAGE TO THE PRODUCTS ARISING FROM ORDINARY WEAR AND TEAR; ALTERATION, ACCIDENT, MISUSE, ABUSE OR NEGLECT; THE PRODUCTS BEING SUBJECTED TO VEHICLE TRAFFIC OR OTHER CONDITIONS WHICH ARE NOT PERMITTED BY STORMTECH'S WRITTEN SPECIFICATIONS OR INSTALLATION INSTRUCTIONS; FAILURE TO MAINTAIN THE MINIMUM GROUND COVERS SET FORTH IN THE INSTALLATION INSTRUCTIONS; THE PLACEMENT OF IMPROPER MATERIALS INTO THE PRODUCTS; FAILURE OF THE PRODUCTS DUE TO IMPROPER SITING OR IMPROPER SIZING; OR ANY OTHER EVENT NOT CAUSED BY STORMTECH. A PRODUCT ALSO IS EXCLUDED FROM LIMITED WARRANTY COVERAGE IF SUCH PRODUCT IS USED IN A PROJECT OR SYSTEM IN WHICH ANY GEOTEXTILE PRODUCTS OTHER THAN THOSE PROVIDED BY ADVANCED DRAINAGE SYSTEMS ARE USED. THIS LIMITED WARRANTY REPRESENTS STORMTECH'S SOLE LIABILITY TO THE PURCHASER FOR CLAIMS RELATED TO THE PRODUCTS, WHETHER THE CLAIM IS BASED UPON CONTRACT, TORT, OR OTHER LEGAL THEORY.

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800-821-6710

ADS 0601T/O NONWOVEN GEOTEXTILE SPECIFICATION

Scope

This specification describes ADS 0601T/O nonwoven geotextile.

Filter Fabric Requirements

ADS 0601T/O is an orange nonwoven geotextile composed of polypropylene fibers, which are formed into a stable network such that the fibers retain their relative position. ADS 0601T/O is inert to biological degradation and resists naturally encountered chemicals, alkali and acids. ADS 0601T/O conforms to the physical property values listed below:

Filter Fabric Properties

Property	Test Method	Unit	Typical Value[1] MD	Typical Value[1] CD
Grab Tensile Strength	ASTM D4632	lbs (N)	175 (779)	175 (779)
Grab Tensile Elongation	ASTM D4632	%	75	75
Trapezoid Tear Strength	ASTM D4533	lbs (N)	85 (378)	85 (378)
CBR Puncture Strength	ASTM D6241	lbs (N)	480 (2136)	480 (2136)
Permittivity	ASTM D4491	sec^{-1}	1.5	1.5
Flow Rate	ASTM D4491	$gal/min/ft^2$ ($l/min/m^2$)	105 (4278)	105 (4278)
UV Resistance (at 500 hours)[1]	ASTM D4355	% strength retained	80	80

Physical Properties

Property	Test Method	Unit	Typical Value[2]
Weight	ASTM D5161	oz/yd^2 (g/m^2)	6.5 (220)
Thickness	ASTM D5199	mils (mm)	65 (1.7)
Roll Dimensions (W x L)	-	ft (m)	15 x 300 (4.5 x 91)
Roll Area	-	yd^2 (m^2)	500 (418)
Estimated Roll Weight	-	lb (kg)	220 (100)

1 Modified, Minimum Test Value
2 ASTM D4439 Standard Terminology for Geosynthetics: typical value, n-*for geosynthetics*, the mean value calculated from documented manufacturing quality control test results for a defined population obtained from one test method associated with on specific property.

Separation

ADS 315W WOVEN GEOTEXTILE SPECIFICATION

Scope

This specification describes ADS 315W woven geotextile.

Filter Fabric Requirements

ADS 315W is manufactured using high-tenacity polypropylene yarns that are woven to form a dimensionally stable network, which allows the yarns to maintain their relative position. ADS 315W resists ultraviolet deterioration, rotting and biological degradation and is inert to commonly encountered soil chemicals. ADS 315W conforms to the physical property values listed below:

Filter Fabric Properties

Property	Test Method	Unit	M.A.R.V. (Minimum Average Roll Value)[2]
Tensile Strength (Grab)	ASTM D4632	lbs (N)	315 (1400)
Elongation	ASTM D4632	%	15
CBR Puncture	ASTM D6241	lbs (N)	900 (4005)
Puncture	ASTM D4833	lbs (N)	150 (667)
Mullen Burst	ASTM D3786	psi (kPa)	600 (4134)
Trapezoidal Tear	ASTM D4533	lbs (N)	120 (533)
UV Resistance (at 500 hours)	ASTM D4355	%	70
Apparent Opening Size (AOS)*	ASTM D4751	U.S. Sieve (mm)	40 (.425)
Permittivity	ASTM D4491	sec^{-1}	.05
Water Flow Rate	ASTM D4491	gpm/ft^2 ($l/min/m^2$)	4 (163)

* Maximum average roll value.

Packaging

Roll Dimensions (W x L) - ft. (m)	12.5 x 360/ 15 x 300 / 17.5 x 258 (3.81 x 109.8/ 4.57 x 91.5 / 5.33 x 78.6)

StormTech®
Detention • Retention • Water Quality
An ADS company

Isolator® Row PLUS O&M Manual

*THE MOST **ADVANCED** NAME IN WATER MANAGEMENT SOLUTIONS®*

THE ISOLATOR® ROW PLUS

INTRODUCTION

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row PLUS is a technique to inexpensively enhance Total Suspended Solids (TSS) and Total Phosphorus (TP) removal with easy access for inspection and maintenance.

THE ISOLATOR ROW PLUS

The Isolator Row PLUS is a row of StormTech chambers, either SC-160, SC-310, SC-310-3, SC-740, DC-780, MC-3500 or MC-4500 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for settling and filtration of sediment as storm water rises in the Isolator Row PLUS and ultimately passes through the filter fabric. The open bottom chambers and perforated sidewalls (SC-310, SC- 310-3 and SC-740 models) allow storm water to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row PLUS protecting the storage areas of the adjacent stone and chambers from sediment accumulation.

ADS geotextile fabric is placed between the stone and the Isolator Row PLUS chambers. The woven geotextile provides a media for stormwater filtration, a durable surface for maintenance, prevents scour of the underlying stone and remains intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the perforations in the sidewall of the chamber. The non-woven fabric is not required over the SC-160, DC-780, MC-3500 or MC-4500 models as these chambers do not have perforated side walls.

The Isolator Row PLUS is designed to capture the “first flush” runoff and offers the versatility to be sized on a volume basis or a flow-rate basis. An upstream manhole not only provides access to the Isolator Row PLUS but includes a high/low concept such that stormwater flow rates or volumes that exceed the capacity of the Isolator Row PLUS bypass through a manifold to the other chambers. This is achieved with either an elevated bypass manifold or a high-flow weir. This creates a differential between the Isolator Row PLUS row of chambers and the manifold to the rest of the system, thus allowing for settlement time in the Isolator Row PLUS. After Stormwater flows through the Isolator Row PLUS and into the rest of the StormTech chamber system it is either exfiltrated into the soils below or passed at a controlled rate through an outlet manifold and outlet control structure.

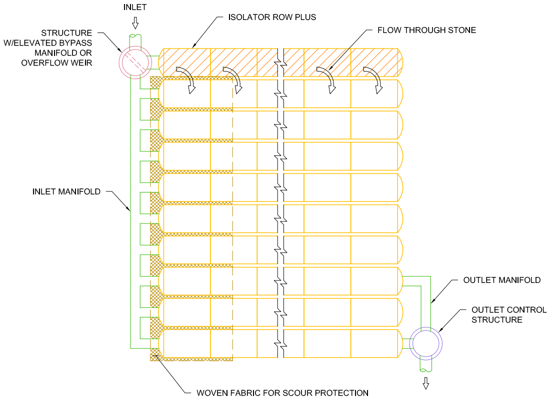
The Isolator Row FLAMP™ (patent pending) is a flared end ramp apparatus that is attached to the inlet pipe on the inside of the chamber end cap. The FLAMP provides a smooth transition from pipe invert to fabric bottom. It is configured to improve chamber function performance over time by enhancing outflow of solid debris that would otherwise collect at an end of the chamber. It also serves to improve the fluid and solid flow into the access pipe during maintenance and cleaning and to guide cleaning and inspection equipment back into the inlet pipe when complete.

The Isolator Row PLUS may be part of a treatment train system. The design of the treatment train and selection of pretreatment devices by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, the Isolator Row PLUS is recommended by StormTech as an effective means to minimize maintenance requirements and maintenance costs.

Note: See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row PLUS.

Looking down the Isolator Row PLUS from the manhole opening, ADS PLUS Fabric is shown between the chamber and stone base.

StormTech Isolator Row PLUS with Overflow Spillway (not to scale)



ISOLATOR ROW PLUS INSPECTION/MAINTENANCE

INSPECTION

The frequency of inspection and maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial, residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row PLUS should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

The Isolator Row PLUS incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the Isolator Row PLUS, clean-out should be performed.

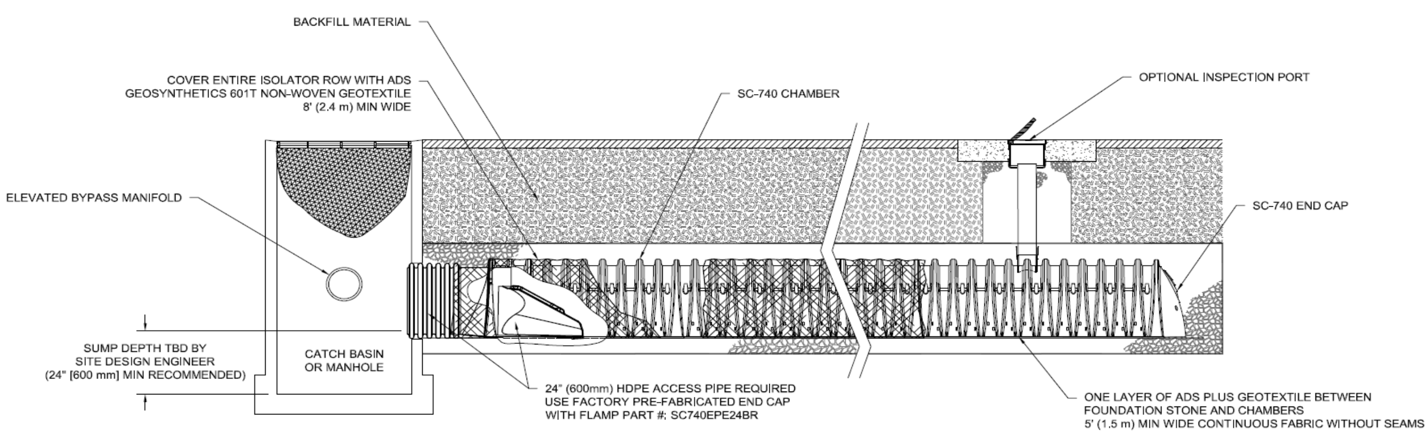
MAINTENANCE

The Isolator Row PLUS was designed to reduce the cost of periodic maintenance. By "isolating" sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entries.

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row PLUS while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45" are best. StormTech recommends a maximum nozzle pressure of 2000 psi be utilized during cleaning. Most JetVac reels have 400 feet of hose allowing maintenance of an Isolator Row PLUS up to 50 chambers long. **The JetVac process shall only be performed on StormTech Isolator Row PLUS that have ADS PLUS Fabric (as specified by StormTech) over their angular base stone.**

StormTech Isolator Row PLUS (not to scale)

Note: Non-woven fabric is only required over the inlet pipe connection into the end cap for SC-160LP, DC-780, MC-3500 and MC-4500 chamber models and is not required over the entire Isolator Row PLUS.



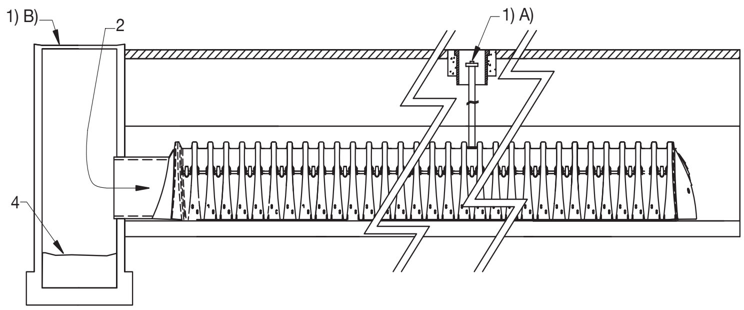
ISOLATOR ROW PLUS STEP BY STEP MAINTENANCE PROCEDURES

STEP 1
Inspect Isolator Row PLUS for sediment.
A) Inspection ports (if present)
  i. Remove lid from floor box frame
  ii. Remove cap from inspection riser
  iii. Using a flashlight and stadia rod,measure depth of sediment and record results on maintenance log.
  iv. If sediment is at or above 3 inch depth, proceed to Step 2. If not, proceed to Step 3.
B) All Isolator Row PLUS
  i. Remove cover from manhole at upstream end of Isolator Row PLUS
  ii. Using a flashlight, inspect down Isolator Row PLUS through outlet pipe
    1. Mirrors on poles or cameras may be used to avoid a confined space entry
    2. Follow OSHA regulations for confined space entry if entering manhole
  iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches), proceed to Step 2. If not, proceed to Step 3.

STEP 2
Clean out Isolator Row PLUS using the JetVac process.
A) A fixed floor cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
B) Apply multiple passes of JetVac until backflush water is clean
C) Vacuum manhole sump as required

STEP 3
Replace all caps, lids and covers, record observations and actions.

STEP 4
Inspect & clean catch basins and manholes upstream of the StormTech system.



SAMPLE MAINTENANCE LOG

Date	Stadia Rod Readings		Sediment Depth (1)–(2)	Observations/Actions	Inspector
	Fixed point to chamber bottom (1)	Fixed point to top of sediment (2)			
3/15/11	6.3 ft	none		New installation. Fixed point is CI frame at grade	DJM
9/24/11		6.2	0.1 ft	Some grit felt	SM
6/20/13		5.8	0.5 ft	Mucky feel, debris visible in manhole and in Isolator Row PLUS, maintenance due	NV
7/7/13	6.3 ft		0	System jetted and vacuumed	DJM

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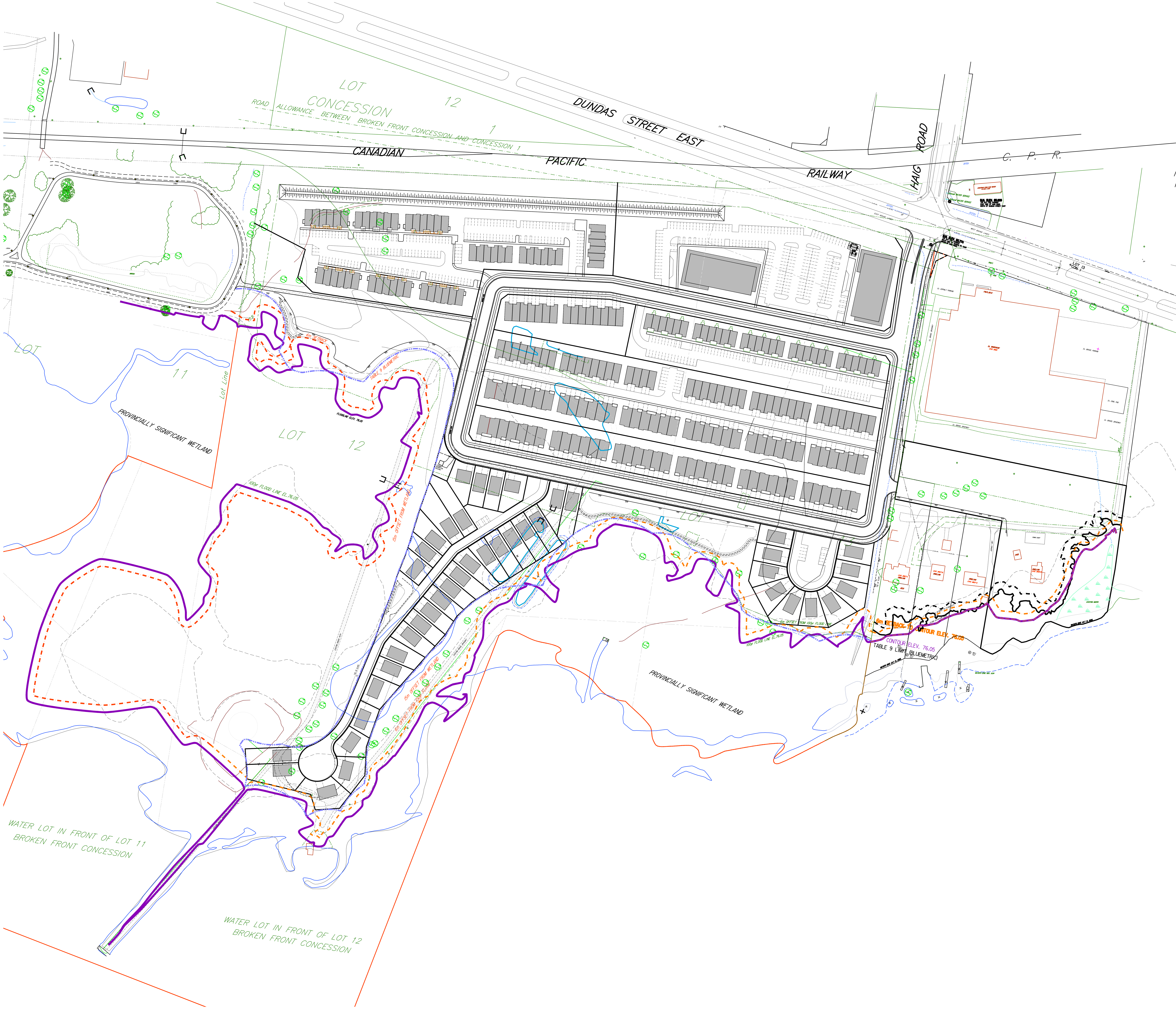
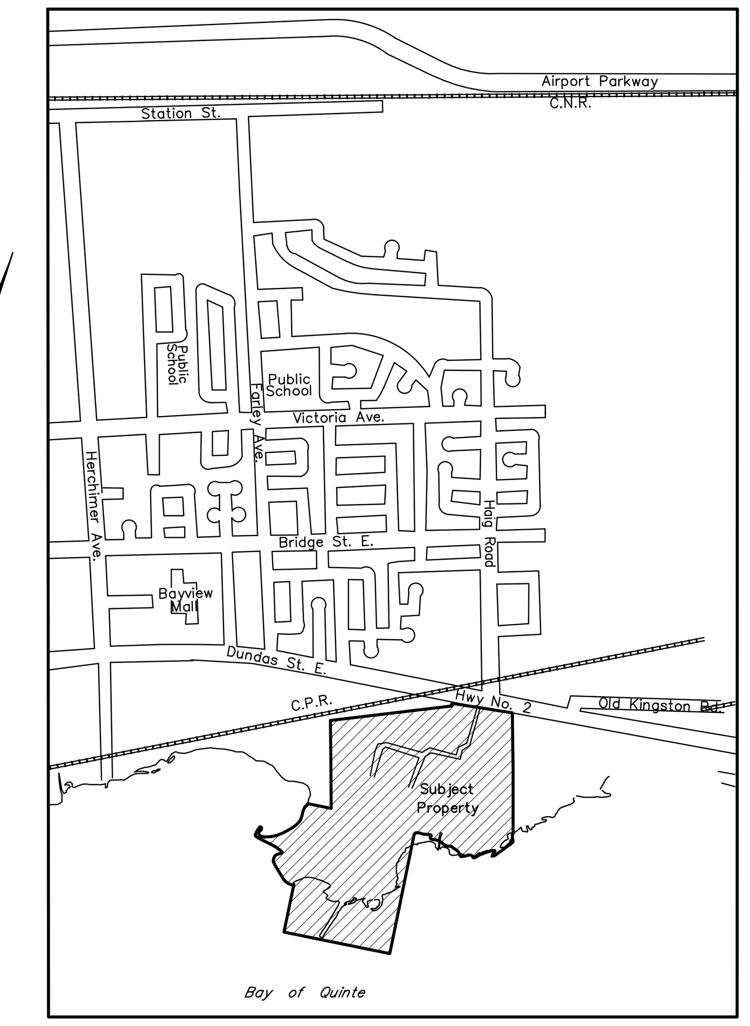
1-800-821-6710 www.ads-pipe.com

APPENDIX F

Engineering Drawings

Drawing Name		Drawing Number
Cover Page	Land Use	DUN/621-00
General Servicing Plan	Overall Development	DUN/621-01
General Servicing Plan	West Portion of Site	DUN/621-01A
General Servicing Plan	Middle Portion of Site	DUN/621-01B
General Servicing Plan	South Portion of Site	DUN/621-01C
General Servicing Plan	East Portion of Site	DUN/621-01D1





KEY PLAN

NOT TO SCALE

LEGAL DESCRIPTION

PART of LOTS 12 and 13, CONCESSION 1
PART of LOTS 11, 12 and 13,
BROKEN FRONT CONCESSION
WATER LOTS lying in front of LOTS 11 and 12,
BROKEN FRONT CONCESSION
AND PART of the ROAD ALLOWANCE BETWEEN
BROKEN FRONT CONCESSION and CONCESSION 1
CITY OF BELLEVILLE, THURLOW WARD
COUNTY OF HASTINGS

OWNER

2255718 ONTARIO INC.

DRAWING LIST

DRAWING	DRAWING NUMBER
COVER PAGE	Dun/621-00
LAND USE	
GENERAL SERVICING PLAN OVERALL DEVELOPMENT	Dun/621-01
GENERAL SERVICING PLAN WEST PORTION OF SITE	Dun/621-01A
GENERAL SERVICING PLAN MIDDLE PORTION OF SITE	Dun/621-01B
GENERAL SERVICING PLAN SOUTH PORTION OF SITE	Dun/621-01C
GENERAL SERVICING PLAN EAST PORTION OF SITE	Dun/621-01D
SANITARY SEWER DESIGN DRAINAGE AREA PLAN & PIPE NETWORK	Dun/621-Sa1
SANITARY SEWER DESIGN GRAVITY vs PIPED SYSTEMS	Dun/621-Sa2
STORM SEWER DESIGN DRAINAGE AREA PLAN & PIPE NETWORK	Dun/621-St1
STORM SEWER DESIGN HAIG ROAD SUB-CATCHMENT	Dun/621-St2
STORM SEWER DESIGN PRE-DEVELOPMENT OVERLAND FLOW ROUTE 100yr STORM EVENT	Dun/621-St3
STORM SEWER DESIGN POST-DEVELOPMENT OVERLAND FLOW ROUTE 100yr STORM EVENT	Dun/621-St4
STORM SEWER DESIGN STORMWATER MANAGEMENT AREAS	Dun/621-SWM1
WATERMAIN DESIGN PIPE NETWORK	Dun/621-W1

REVISIONS

Date	Description	By	Chk'd By
DEC. 13/24	REVISED SITE LAYOUT FROM ARCHITECT 24-12-05	S.D.S.	
JAN. 18/24	REVISED SITE LAYOUT FROM ARCHITECT 24-01-17	S.D.S.	
JAN. 8/24	REVISED SITE LAYOUT FROM ARCHITECT 24-01-04	S.D.S.	
DEC. 20/23	UNDERLAY 23-12-15 SITE LAYOUT FROM ARCHITECT	S.D.S.	
NOV. 8/23	REVISED SITE LAYOUT FROM ARCHITECT	S.D.S.	

SCALE: 1:1500
DESIGNED: A.H.V.
DRAWN: S.D.S.
DATE: /07
COMPUTER \Drawings\BELLEVILLE\ \Dundas St\621 Bakelite Property\

REGISTERED PROFESSIONAL ENGINEER A. H. VANDERMEER Dec. 13/24 PROVINCE OF ONTARIO

COVER PAGE

DRAWING Dun/621-00

DRAWING: 621 Dundas St_24-12-05.dwg

621 DUNDAS STREET EAST
WEST OF HAIG ROAD
CITY OF BELLEVILLE

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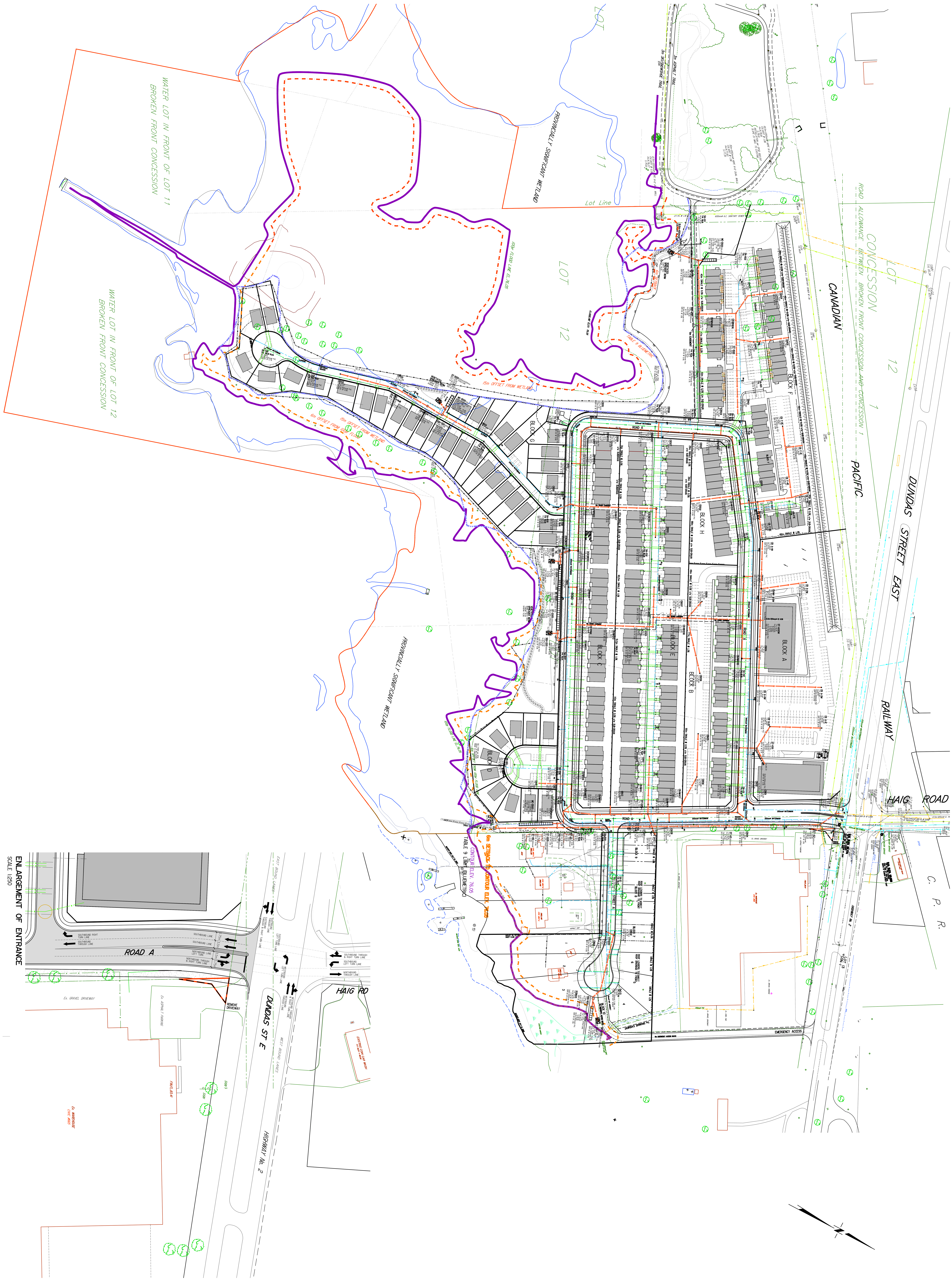

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621 DUNDAS STREET EAST
WEST OF HAIG ROAD
CITY OF BELLEVILLE

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NOV. 8/23	REVISED SITE LAYOUT FROM ARCHITECT	S.D.S.	

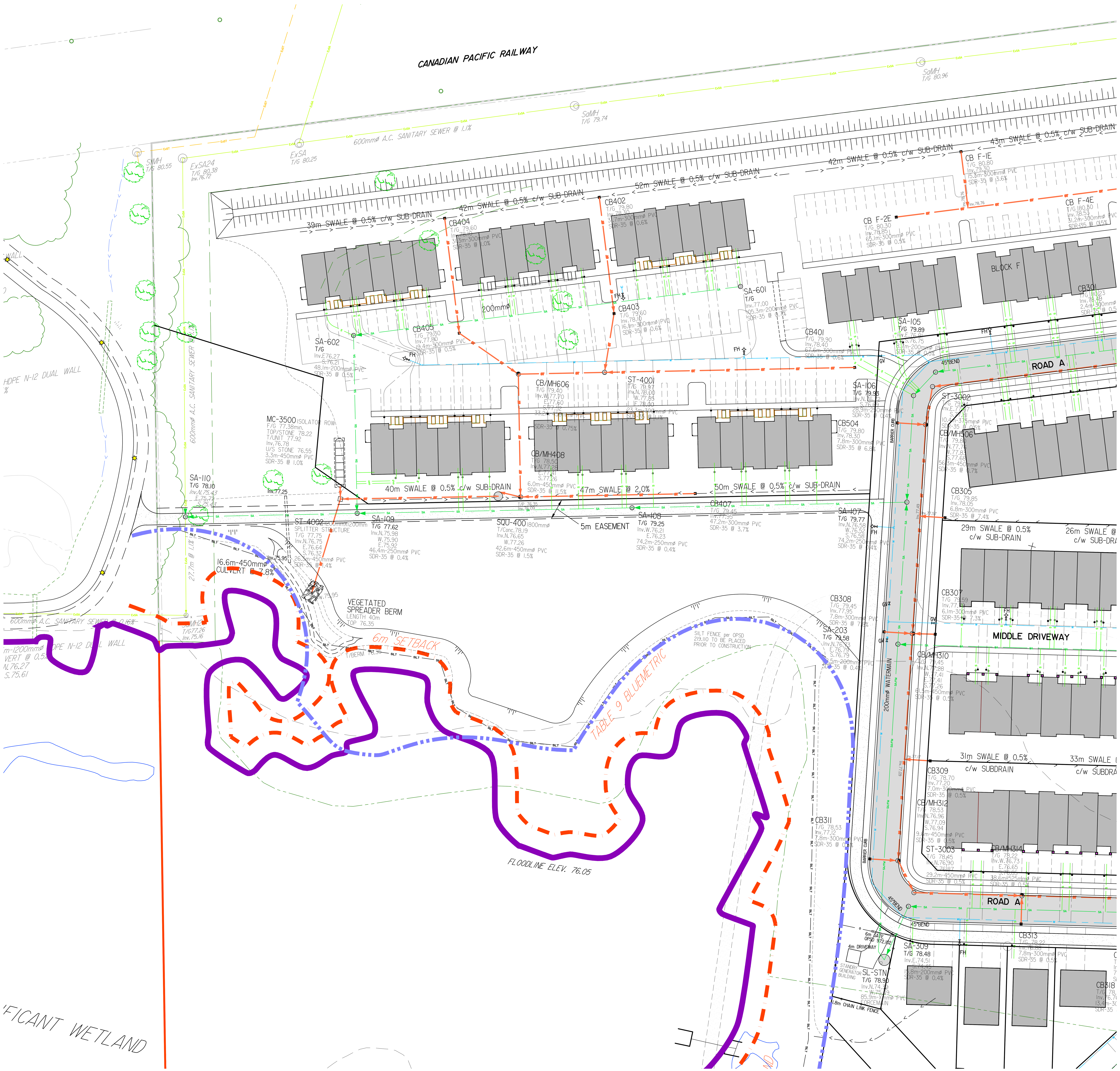
R E V I S I O N S

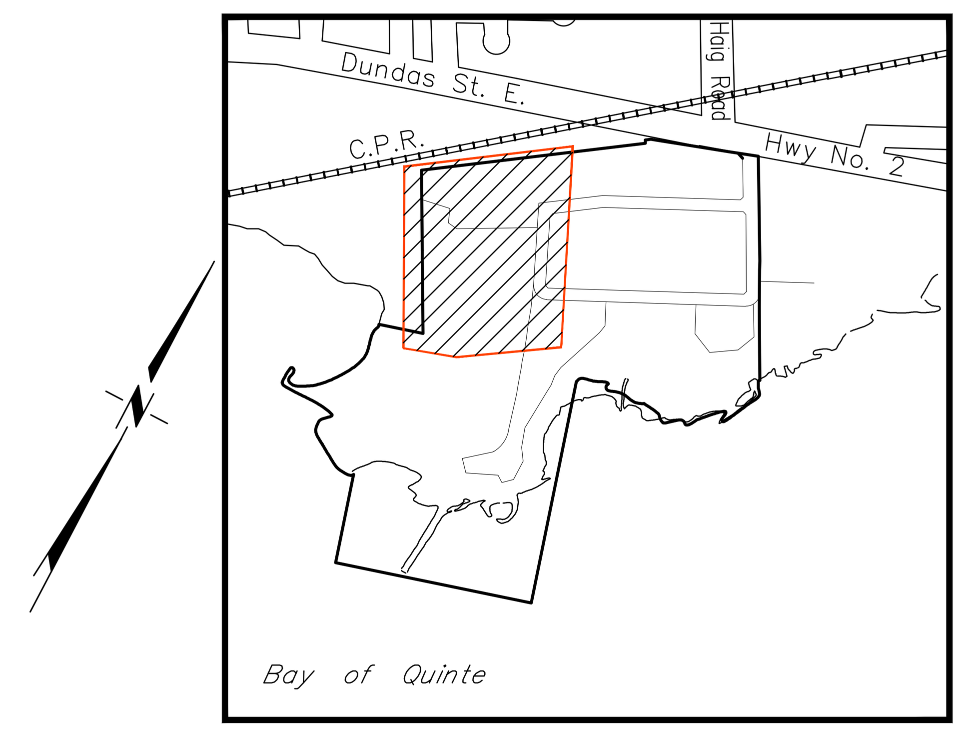
SCALE: 1:500
DESIGNED: A.H.V.
DRAWN: S.D.S.
DATE: 22/02/22
COMPUTER: \Drawings\BELLEVILLE\ \Dundas St\621 Bakelite Property\

REGISTERED PROFESSIONAL ENGINEER
A. H. VANDERMEER
Dec. 13/24
PROVINCE OF ONTARIO

GENERAL SERVICING PLAN
OVERALL DEVELOPMENT
DRAWING Dun/621-01

DRAWING: 621 Dundas St_24-12-05.dwg





DRAWING KEY PLAN

BENCH MARK

BM ELEV. 85.926
TOP NUT OF FIRE HYDRANT
EAST SIDE HAIG RD NORTH OF DUNDAS ST EAST

BM ELEV. 85.774
TOP NUT OF FIRE HYDRANT
SOUTH SIDE OF DUNDAS ST EAST SOUTH OF HAIG RD

NOTES

SEE DRAWING CME/E-D1 FOR CONSTRUCTION NOTES AND DETAILS

LEGEND

DESCRIPTION	EXISTING	PROPOSED	AS-BUILT
EXISTING GROUND ELEVATION	ELEV		
FINISHED GROUND ELEVATION		ELEV OR	ELEV
SWALE ELEVATION	(ELEV)	(ELEV)	(ELEV)
SWALE			
MAINTENANCE HOLE	SA/ST	SA/ST	SA/ST
CATCH BASIN	CB	CB	CB
DITCH INLET	DI	DI	DI
SANITARY SEWER	ExSA	SA	SA
SAN. LATERAL c/w CLEAN-OUT	S	S	S
STORM SEWER	ExST		ST
STORM RESIDENTIAL LATERAL	ExST		S
WATERMAIN			
WATERMAIN VERTICAL DEFLECTION			
WATER LATERAL c/w CURB STOP			
GATE VALVE	GV	GV	GV
BLOW OFF	B/O	B/O ASSEMBLY c/w 50mmø PIPING	B/O
FIRE HYDRANT	FH	FH	FH
UTILITY POLE			
UTILITY POLE/LIGHT STANDARD			
POLE MOUNT TRANSFORMER			
PAD MOUNT TRANSFORMER			
STREETLIGHT PEDESTAL	SP	SP	SP
SWITCHING KIOSK	SK	SK	SK
BELL PEDESTAL	B	B	B
BELL GRADE LEVEL BOX	B/GB	B/GB	B/GB
CABLE PEDESTAL	C	C	C
ELECTRICAL SERVICE			
COMMUNITY MAIL BOX	CMB	CMB	CMB

ONLY WHEN NOT INSTALLED AS PROPOSED

ALL ITALICIZED TEXT INDICATES EXISTING INFORMATION
ALL VERTICAL TEXT INDICATES PROPOSED INFORMATION
ALL UNDERSCORE TEXT INDICATES AS-CONSTRUCTED INFORMATION

SEDIMENTATION & EROSION CONTROL MEASURES

PRIOR TO REMOVAL OF TOPSOIL OR EARTH, SEDIMENT CONTROL FENCE SHALL BE INSTALLED per OPSD. 219.110. THIS INCLUDES ALL DOWNSTREAM SLOPES ADJACENT TO ANY WORK AREAS AND STRAW BALE CHECK DAMS ALONG ANY DRAINAGE PATH.

STRAWBALE FILTER TO BE CONSTRUCTED AS PER S.C.S.2 OF ONTARIO GUIDELINES ON EROSION & SEDIMENT CONTROL FOR URBAN CONSTRUCTION SITES MAY 1987.

STRAWBALE SILT FENCE SHALL BE CHECKED REGULARILY AND MAINTAINED ACCORDINGLY.

TOPSOIL TO BE STRIPPED AND STOCK PILED PRIOR TO EXCAVATION.

TOPSOIL STOCK PILE TO BE ENCLOSED IN STRAWBALE SILTATION FENCE.

ALL DISTURBED AREAS TO BE TOPSOILED AND SEEDED WITH NATIVE GRASS SPECIES AS SOON AS POSSIBLE.

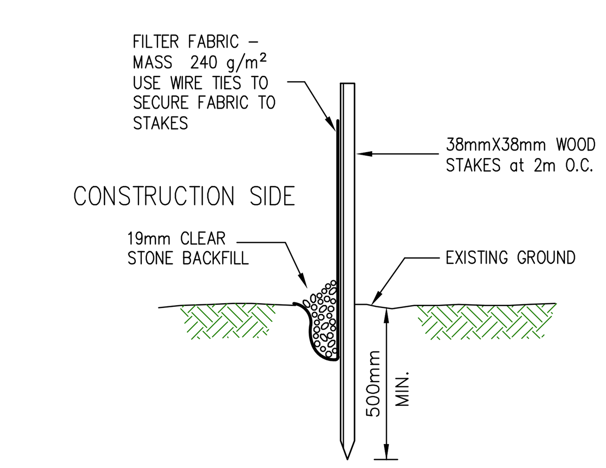
ALL CATCHBASINS TO HAVE FILTER CLOTH PLACED BELOW THE GRATES AS THEY ARE INSTALLED INCLUDING EXISTING CB's. CONTRACTOR TO MAINTAIN AND CLEAN AS NECESSARY UNTIL CONSTRUCTION HAS BEEN COMPLETED.

STORM POND SHALL BE CONSTRUCTED WITH NATIVE MATERIAL.

BOTTOM OF POND TO BE TOPSOILED TO A DEPTH OF 100mm THROUGH OUT.

POND BERM TO BE HYDRO SEEDED IMMEDIATELY AFTER CONSTRUCTION IS COMPLETED.

PRIOR TO DECOMMISSIONING THE SILTATION FENCE AND SILT DAMS, ALL SILT SHALL BE COLLECTED AND REMOVED FROM THE SITE.



SILTATION FENCE
N.T.S.

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621 DUNDAS STREET EAST
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JAN. 8/24	REVISED SITE LAYOUT FROM ARCHITECT 24-01-04	S.D.S.	
DEC. 20/23	UNDERLAY 23-12-15 SITE LAYOUT FROM ARCHITECT	S.D.S.	
NOV. 8/23	REVISED SITE LAYOUT FROM ARCHITECT	S.D.S.	

REVISIONS

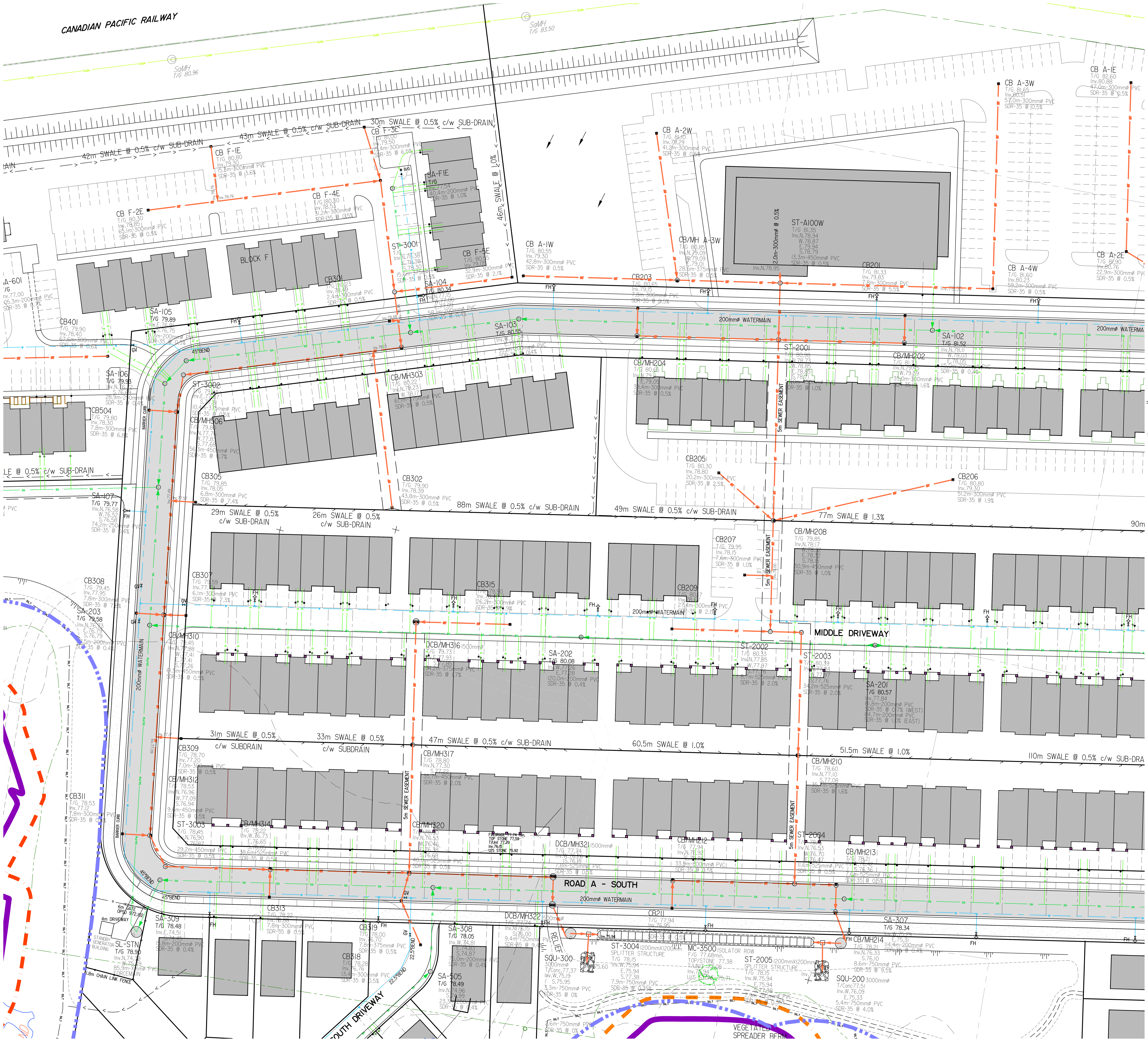
SCALE: 1:500
DESIGNED: A.H.V.
DRAWN: S.D.S.
DATE: /07
COMPUTER \Drawings\BELLEVILLE\ \Dundas St\621 Bakelite Property\

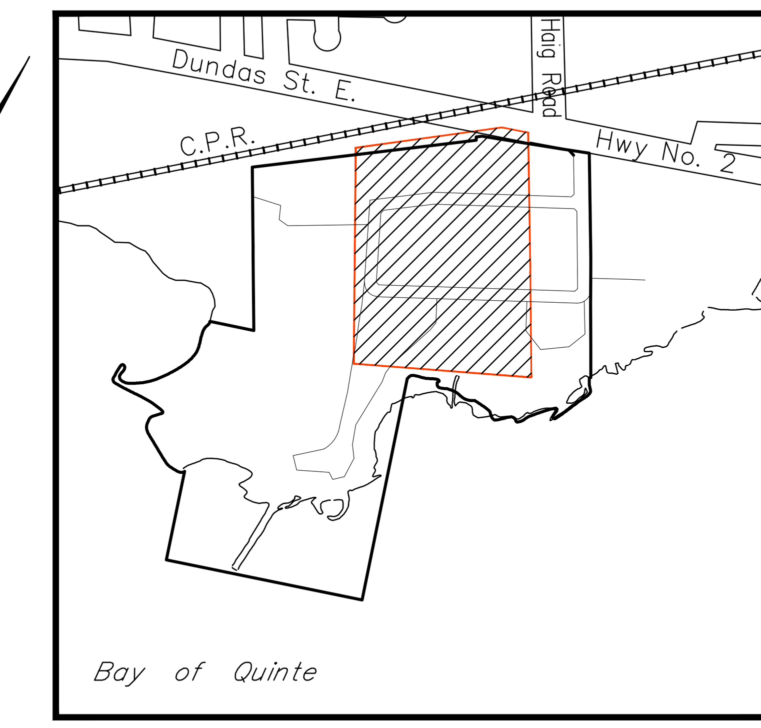
REGISTERED PROFESSIONAL ENGINEER A. H. VANDERMEER Dec. 13/24 PROVINCE OF ONTARIO

GENERAL SERVICING PLAN

DRAWING Dun/621-01A

DRAWING: 621 Dundas St_24-12-05.dwg





DRAWING KEY PLAN

BENCH MARK

BM ELEV. 85.926
TOP NUT OF FIRE HYDRANT
EAST SIDE HAIG RD NORTH OF DUNDAS ST EAST

BM ELEV. 85.774
TOP NUT OF FIRE HYDRANT
SOUTH SIDE OF DUNDAS ST EAST SOUTH OF HAIG RD

NOTES

SEE DRAWING CME/E-D1 FOR CONSTRUCTION NOTES AND DETAILS

LEGEND

DESCRIPTION	EXISTING	PROPOSED	AS-BUILT
EXISTING GROUND ELEVATION	ELEV		
FINISHED GROUND ELEVATION		ELEV OR	ELEV
SWALE ELEVATION	(ELEV)	(ELEV)	(ELEV)
SWALE			
MAINTENANCE HOLE	SA/ST	SA/ST	SA/ST
CATCH BASIN	CB	CB	CB
DITCH INLET	DI	DI	DI
SANITARY SEWER	ExSA	SA	SA
SAN. LATERAL c/w CLEAN-OUT	S	S	S
STORM SEWER	ExST	ST	ST
STORM RESIDENTIAL LATERAL	ExST	S	S
WATERMAIN			
WATERMAIN VERTICAL DEFLECTION			
WATER LATERAL c/w CURB STOP			
GATE VALVE	GV	GV	GV
BLOW OFF	B/O	B/O ASSEMBLY c/w 50mmø PIPING	B/O
FIRE HYDRANT	FH	FH	FH
UTILITY POLE			
UTILITY POLE/LIGHT STANDARD			
POLE MOUNT TRANSFORMER			
PAD MOUNT TRANSFORMER			
STREETLIGHT PEDESTAL	SP	SP	SP
SWITCHING KIOSK	SK	SK	SK
BELL PEDESTAL	B	B	B
BELL GRADE LEVEL BOX	B/GB	B/GB	B/GB
CABLE PEDESTAL	C	C	C
ELECTRICAL SERVICE			
COMMUNITY MAIL BOX	CMB	CMB	CMB

ONLY WHEN NOT INSTALLED AS PROPOSED

ALL ITALICIZED TEXT INDICATES EXISTING INFORMATION
ALL VERTICAL TEXT INDICATES PROPOSED INFORMATION
ALL UNDERSCORE TEXT INDICATES AS-CONSTRUCTED INFORMATION

SEDIMENTATION & EROSION CONTROL MEASURES

PRIOR TO REMOVAL OF TOPSOIL OR EARTH, SEDIMENT CONTROL FENCE SHALL BE INSTALLED per OPSD. 219.110. THIS INCLUDES ALL DOWNSTREAM SLOPES ADJACENT TO ANY WORK AREAS AND STRAW BALE CHECK DAMS ALONG ANY DRAINAGE PATH.

STRAWBALE FILTER TO BE CONSTRUCTED AS PER S.C.S.2 OF ONTARIO GUIDELINES ON EROSION & SEDIMENT CONTROL FOR URBAN CONSTRUCTION SITES MAY 1987.

STRAWBALE SILT FENCE SHALL BE CHECKED REGULARILY AND MAINTAINED ACCORDINGLY.

TOPSOIL TO BE STRIPPED AND STOCK PILED PRIOR TO EXCAVATION.

TOPSOIL STOCK PILE TO BE ENCLOSED IN STRAWBALE SILTATION FENCE.

ALL DISTURBED AREAS TO BE TOPSOILED AND SEEDED WITH NATIVE GRASS SPECIES AS SOON AS POSSIBLE.

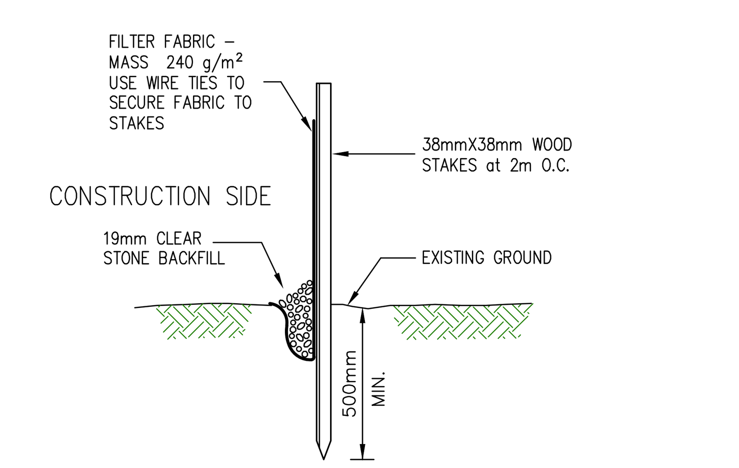
ALL CATCHBASINS TO HAVE FILTER CLOTH PLACED BELOW THE GRATES AS THEY ARE INSTALLED INCLUDING EXISTING CB's. CONTRACTOR TO MAINTAIN AND CLEAN AS NECESSARY UNTIL CONSTRUCTION HAS BEEN COMPLETED.

STORM POND SHALL BE CONSTRUCTED WITH NATIVE MATERIAL.

BOTTOM OF POND TO BE TOPSOILED TO A DEPTH OF 100mm THROUGH OUT.

POND BERM TO BE HYDRO SEEDED IMMEDIATELY AFTER CONSTRUCTION IS COMPLETED.

PRIOR TO DECOMMISSIONING THE SILTATION FENCE AND SILT DAMS, ALL SILT SHALL BE COLLECTED AND REMOVED FROM THE SITE.



SILTATION FENCE
N.T.S.

VAN MEER LIMITED
LAND DEVELOPMENT · PROJECT MANAGEMENT · ENGINEERING
83 North Park Street, Belleville, Ont. K8P 2Y6 Tel. 613-969-0171

621 DUNDAS STREET EAST
WEST OF HAIG ROAD
CITY OF BELLEVILLE

Date	Description	By	Chk'd By
DEC. 13/24	REVISED SITE LAYOUT FROM ARCHITECT 24-12-05	S.D.S.	
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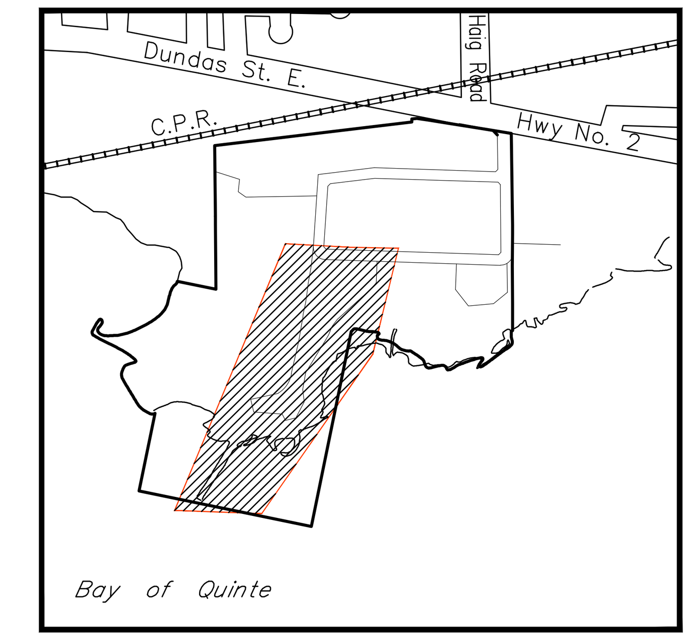
R E V I S I O N S

SCALE: 1:500
DESIGNED: A.H.V.
DRAWN: S.D.S.
DATE: /07
COMPUTER: \Drawings\BELLEVILLE\ \Dundas St\621 Bakelite Property\

REGISTERED PROFESSIONAL ENGINEER A. H. VANDERMEER Dec. 13/24 PROVINCE OF ONTARIO

GENERAL SERVICING PLAN
DRAWING Dun/621-01B

DRAWING: 621 Dundas St_24-12-05.dwg



DRAWING KEY PLAN

BENCH MARK

BM ELEV. 85.926
TOP NUT OF FIRE HYDRANT
EAST SIDE HAIG RD NORTH OF DUNDAS ST EAST

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TOP NUT OF FIRE HYDRANT
SOUTH SIDE OF DUNDAS ST EAST SOUTH OF HAIG RD

NOTES

SEE DRAWING CME/E-D1 FOR CONSTRUCTION NOTES AND DETAILS

LEGEND

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CATCH BASIN	CB	CB	CB
DITCH INLET	DI	DI	DI
SANITARY SEWER	ExSA	SA	SA
SAN. LATERAL c/w CLEAN-OUT	S	S	S
STORM SEWER	ExST		ST
STORM RESIDENTIAL LATERAL	ExST		S
WATERMAIN			
WATERMAIN VERTICAL DEFLECTION			
WATER LATERAL c/w CURB STOP			
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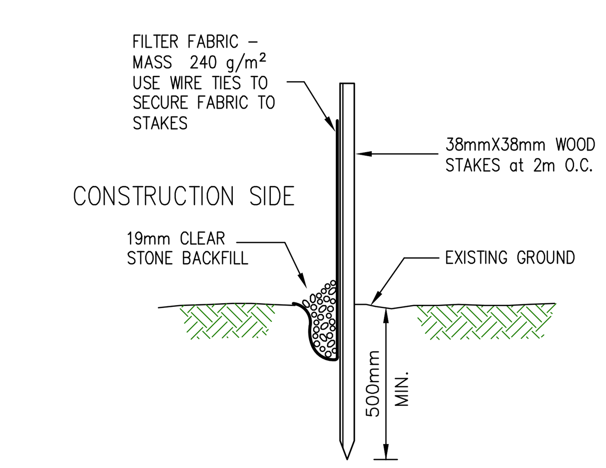

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R E V I S I O N S

SCALE: 1:750
DESIGNED: A.H.V.
DRAWN: S.D.S.
DATE: /07
COMPUTER \Drawings\BELLEVILLE\ \Dundas St\621 Bakelite Property\

REGISTERED PROFESSIONAL ENGINEER A. H. VANDERMEER PROVINCE OF ONTARIO Dec. 13/24

GENERAL SERVICING PLAN
DRAWING Dun/621-01C

DRAWING: 621 Dundas St_24-12-05.dwg

VAN MEER LIMITED
LAND DEVELOPMENT • PROJECT MANAGEMENT • ENGINEERING
83 North Park Street, Belleville, Ont. K8P 2V6 Tel. 613-969-0171
621 DUNDAS STREET EAST
WEST OF HAIG ROAD
CITY OF BELLEVILLE
GENERAL SERVICING PLAN
DRAWING Dun/621-01D1
REVISIONS
DRAWING KEY PLAN
Bay of Quinte
BENCH MARK
BM ELEV. 85.926 TOP NUT OF FIRE HYDRANT EAST SIDE HAIG RD NORTH OF DUNDAS ST EAST
BM ELEV. 85.774 TOP NUT OF FIRE HYDRANT SOUTH SIDE OF DUNDAS ST EAST SOUTH OF HAIG RD
SILTATION FENCE
N.T.S.
SEDIMENTATION & EROSION CONTROL MEASURES
NOTES
SEE DETAIL DRAWING FOR CONSTRUCTION NOTES AND DETAILS
LEGEND
HIGHWAY No. 2
150mm⌀ WATERMAIN
300mm⌀ WATERMAIN
EMERGENCY ACCESS
ROAD A
STREET A
BLOCK 7
BLOCK 8
BLOCK 9
BLOCK 10
ROOF LEADERS TO DIRECT ROOF DRAINAGE TO FRONT
PROVIDE 1.8m COVER OVER WATERMAIN
90m SWALE @ 0.5% c/w SUB-DRAIN
7m DRAINAGE EASEMENT
6m SETBACK TO CONTOUR ELEV. 76.05
CONTOUR ELEV. 76.05
TABLE 9 LIMIT (BLUEMETRIC)
100yr FLOOD LINE EL.76.05