S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS

Preliminary
Functional Servicing & Stormwater Managment Report

141-149 MAIN STREET EAST

TOWN OF GRIMSBY

Losani Homes (1998) Ltd.

July 2020

SLA File: 20007

3228 South Service Road, Suite 105, East Wing Burlington, Ontario L7N 3H8
Tel. (905) 631-6978

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

1.0 INTRODUCTION AND BACKGROUND

1.1 Overview

S. Llewellyn & Associates Limited has been retained by Losani Homes (1998) Ltd. to provide Consulting Engineering services for the proposed condominium development at 141-149 Main Street East in the Town of Grimsby (see Figure 1.0 for location plan).

The development is located at the northwest corner of Main Street East (Regional Road 81) and Wentworth Drive. The 0.89 ha site is bound by Main Street East to the south, Wentworth Drive to the east, existing residential lands to the north, and existing/future residential/commercial lands to the west. The proponent proposes to construct a 7-storey condominium building consisting of 217 units with associated surface and underground parking, concrete curbing and landscaped areas.

This Preliminary Functional Servicing and Stormwater Management Report will provide detailed information of the proposed stormwater management and functional servicing scheme for this development. Please refer to the preliminary site engineering plans prepared by S. Llewellyn and Associates Limited and the site plan prepared by Chamberlain Architect Services Limited for additional information.

1.2 Background Information

The following documents were referenced in the preparation of this report:

Ref. 1: MOE Stormwater Management Practices Planning and Design Manual (Ministry of Environment, March 2003)

Ref. 2: Town of Grimsby Engineering Standard Drawings (Town of Grimsby)

Ref. 3: Erosion & Sediment Control Guidelines for Urban Construction (December 2006)

Ref. 4: MOE Design Guidelines for Drinking-Water Systems (Ministry of Environment, 2008)

Ref. 5: MOE Design Guidelines for Sewage Works (Ministry of Environment, 2008)

Ref. 6: Stormwater Management Guidelines (Niagara Peninsula Conservation Authority, March 17th, 2010)

Ref. 7: Geotechnical Investigation, Proposed 6-Storey Condominium Building, 141-149 Main Street East, Grimsby, Ontario (Soil-Mat Engineers & Consultants Ltd., April 27th, 2010)

Ref. 8: Orchardview Phases I and II and Commercial Plaza Stormwater Management and Impact Study (Upper Canada Consultants, January 1990)

Ref. 9: Stormwater Management Report: Nelles Place & Chestnut Grove, Grimsby (Upper Canada Consultants, November 2001)

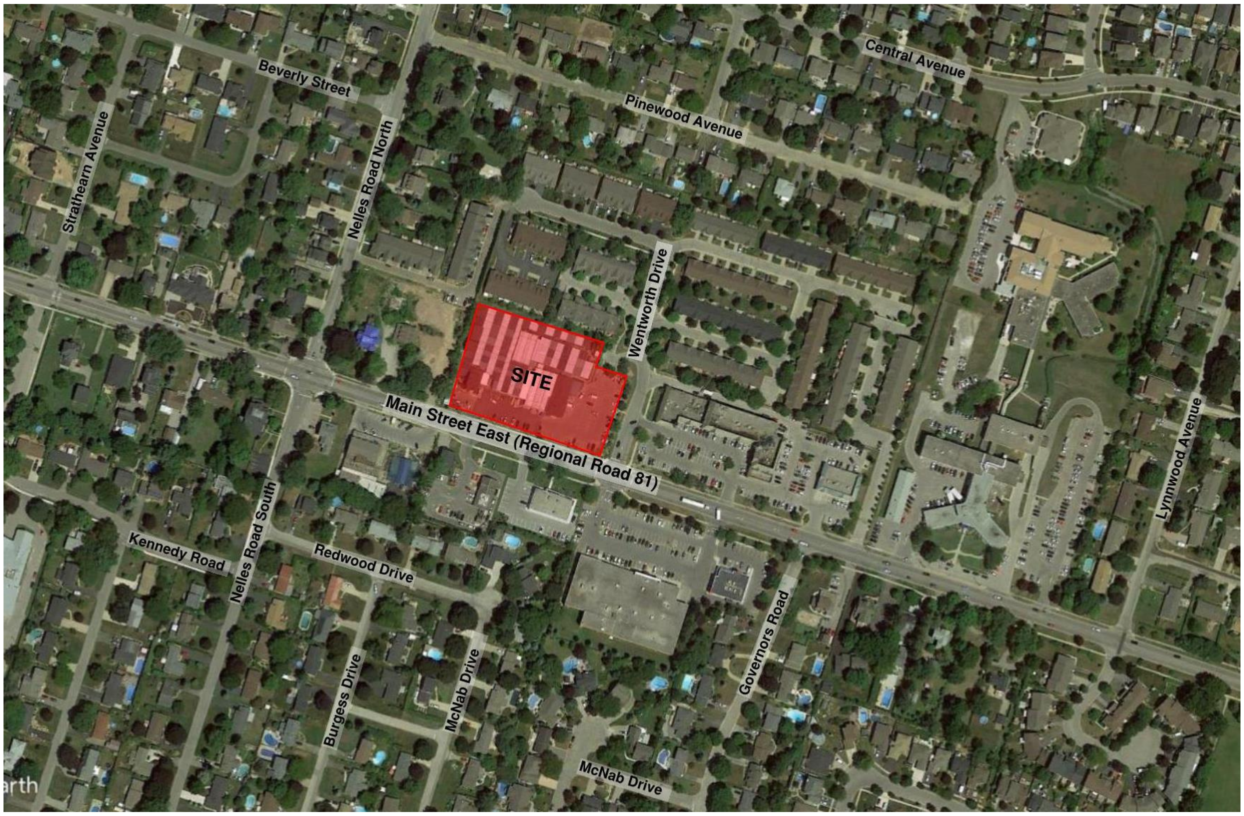


Figure 1.0 – Location Plan

1.2 Geotechnical Investigation

A geotechnical investigation was performed by Soil-Mat Engineers & Consultants Ltd. (Ref. 7) in order to assess subsurface conditions of the proposed site. Based on fourteen (14) boreholes which were drilled on April 1 and 8, 2020 (to a maximum depth of 2.1 to 6.3 m below grade), the site is covered by 50 mm to 125 mm of asphaltic concrete overlying approximately 100mm to 275mm of compact granular base material. The existing pavement structure sits over approximately 1.4m to 1.8m of silty sand/sandy silt or 1.8m and 0.7m of sand and gravel fill. Queenston Shale Bedrock was encountered beneath the silty sand/sandy silt layers at depths of approximately 0.8m and 2.9m below existing grade. Groundwater levels were encountered and range in elevation from 3.0 m to 4.0 m below existing grade.

For the purposes of hydrologic modeling, silty sand/sandy silt soils are characteristic of Hydrologic Soil Group “B” with a Curve Number (CN) of 70.

See Appendix F for a copy of the geotechnical report.

2.0 STORMWATER MANAGEMENT

The following stormwater management (SWM) criteria will be applied to the site, in accordance with the Town of Grimsby requirements:

Quantity Control
As per the Town's Master Drainage Plan, the proposed site lies within subcatchment area 162C within the Outlet 25 watershed with a future land use of 30% total imperviousness. The existing storm sewers were designed to handle flows for the 5-year storm event. Therefore, the stormwater discharge rate from the proposed site shall be controlled to the 5-year storm discharge rate at a maximum of 30% total imperviousness for all storm events up to and including the 100-year storm event.

Quality Control
The stormwater runoff from the proposed site condition must meet Level 1 (Enhanced) stormwater quality control (80% TSS removal, 90% average annual runoff treatment).

Erosion Control
Erosion and sediment control measures will be implemented in accordance with the standards of the Town of Grimsby.

2.1 Pre-Development Conditions

In the pre-development condition, the 0.89 ha subject site is comprised of an existing commercial lot for the Cole's Nursery business. The existing site has several buildings and greenhouses along with asphalt parking. Roughly half of the site is covered with a canopy of mesh shade tarps while the ground is covered with a woven geotextile. There is an existing 600mmø storm sewer on Wentworth Drive draining north to the existing 750mmø storm sewer which crosses the Pinewood Subdivision. There is also an existing 600mmø storm sewer located in an easement along the western side of the site, where it eventually crosses onto the existing property in the northwest corner of the site. From here, the existing 600mmø storm sewer continues north to the existing storm sewers on Wentworth Drive and then to the existing 750mmø storm sewer into the Pinewood subdivision.

Currently, the existing site experiences a split drainage pattern and therefore two catchments have been identified in the pre-development condition. One catchment area, Catchment 101, represents the area of roughly half of the site which drains to the storm sewers on Wentworth Drive via an existing catchbasin in the asphalt parking or by overland sheet flow. Catchment 102 represents the other half of the site which drains to an existing dry stormwater detention facility in the northwest corner of the site. This dry detention facility outlets to the existing 600mmø storm sewer in the 3.0m storm sewer and major overland flow easement to the northwest of the site. See Table 2.1 and the Pre-Development Storm Drainage Area Plan in Appendix A for details.

Table 2.1: Pre-Development Catchment Areas

Catchment ID	Description	Area (ha)
101	Drainage to Wentworth Drive to the East	0.36
102	Drainage to existing detention pond to the northwest and existing storm sewer	0.59

2.2 Post-Development Conditions

The proposed condominium development consists of a 7-storey condominium building comprising of 217 units with associated surface and underground parking, concrete curbing and landscaped areas. It is proposed to service the site with a private storm sewer system, designed and constructed according to the Town of Grimsby standards.

It is proposed to maintain the split drainage of the site and drain roughly one half of the site to the existing storm sewers on Wentworth Drive to the east and the other half of the site to the existing 600mmø storm sewer in the existing storm sewer easement to the northwest. Therefore, two catchment series have been proposed in the post-development condition with the Catchment 200 series draining to the Wentworth Drive storm sewer to the east and the Catchment 300 series draining to the storm sewer to the northwest.

It is worth noting that the existing sidewalk and boulevard along Main Street East to the south of the site sits lower than the top of curb elevations along Main Street East and drains into the subject site. Therefore, this area has also been included in the site's stormwater management design.

Catchment 201 represents drainage from roughly half of the rooftop area, where its runoff will be subject to stormwater management controls before discharging to the existing 600mmø storm sewer on Wentworth Drive to the east. Catchment 202 represents the drainage from the proposed parking lot and landscaped areas on the eastern portion of the site, which will also be subject to stormwater management controls before discharging to the existing 600mmø storm sewer on Wentworth Drive.

Catchment 203 represents the drainage from the peripheral side yards of the site along the east property line of the site. This catchment area will sheet drain uncontrolled to the adjacent Wentworth Drive right-of-way.

Catchment 301 represents the drainage area of approximately half of the rooftop area, where its runoff will be subject to stormwater management controls before discharging to the existing 600mmø storm sewer in the existing storm sewer easement located at the northwest of the site. Catchment 302 represents the drainage from the proposed parking lot and landscaped areas on the western portion of the site which will also be subject to stormwater management controls before discharging to the existing storm sewer in the storm sewer easement.

Catchment 303 represents drainage from the northwest corner of the site. This catchment area will sheet drain uncontrolled towards the northwest corner of the site where it will outlet into the existing dry detention facility and into the existing 600mmø storm sewer in the existing storm sewer easement.

See Table 2.2 and the Post-Development Storm Drainage Area Plan in Appendix A for details.

Table 2.2: Post-Development Catchment Areas

Catchment ID	Description	Area (ha)	Percent Impervious (%)	Runoff Coefficient
201	Controlled Roof discharge to Wentworth Drive	0.17	100	0.95
202	Controlled parking/landscape discharge to Wentworth Drive	0.21	57	0.62
203	Uncontrolled Discharge to Wentworth Drive Right-of Way	0.07	23	0.40
301	Controlled Roof discharge to Northwest Storm Sewer Easement	0.17	100	0.95
302	Controlled parking/landscape to Northwest Storm Sewer Easement	0.26	64	0.67
303	Uncontrolled Discharge to Northwest Storm Sewer Easement	0.06	16	0.35
	Total:	**0.94**	**69**	**0.70**

Two emergency overland flow routes are proposed for the development. The emergency overland flow for the east portion of the site will outlet at the entrance of the development and to the Wentworth Drive right-of-way. The emergency overland flow for the west portion of the site will outlet to the existing dry stormwater detention facility to the northwest, where it will spill north to the existing 3.0m wide storm sewer and major overland flow easement. From here, the major emergency overland flow continues towards the Wentworth Drive extension.

2.2.1 Water Quantity Control

It is required to restrict the post-development discharge rates from the subject site to the 5-year storm discharge rate at a maximum of 30% total imperviousness for all storm events up to and including the 100-year storm event.

East Outlet to Wentworth Drive

As outlined in the Orchardview development stormwater management report (Ref. 8), an area of 0.389ha (Orchardview catchment ID OII2.2) from the subject site was allocated to drain to the existing 600mmø storm sewer on Wentworth Drive to the east. Based on this area and a maximum assigned site development of 30% total imperviousness, an analysis was performed using the SWMHYMO hydrologic modeling program developed by J.F. Sabourin & Associates to determine the maximum allowable 5-year storm event discharge which all storm events will need to be controlled to. The analysis determined the allowable discharge rate from the site to the Wentworth Drive storm sewer to the east will be **0.037m^3/s**. Detailed SWMHYMO input/output information can be found in Appendix A.

It is proposed to apply quantity control measures for Catchment 201 by means of controlled-flow roof drains. At this time, it is proposed to install 4 Zurn Z-105 controlled flow roof drains within the Catchment 201 area in order to provide restriction in flows in the proposed roof area. The number of roof drains will be confirmed in future submissions. The roof area will be designed to allow a maximum depth of ponding of 0.15m with overflow scuppers at an elevation of 0.15m higher than the roof drain inlets to prevent ponding beyond the maximum depth. Providing rooftop controls helps to reduce the size of the stormwater storage tank required, thus leaving more space within the underground parking garage as usable space.

An analysis was performed on Catchment 201 using the SWMHYMO hydrologic modeling program for the 2-year to 100-year Town of Grimsby design storms (see detailed SWMHYMO input/output information in Appendix A). With the installation of the quantity control measures for Catchment 201, it will be required to provide 80m^3 of roof-top storage during the 100-year storm event. The 0.15m of ponding on the roof will provide 153m^3 of storage. See Table 2.3 below for the rooftop stage-storage-discharge characteristics, and refer to the Rooftop Storage Calculations in Appendix A for further information.

Table 2.3: Rooftop Storage Stage-Storage-Discharge (Catchment 201)		
4 - Zurn Z105 Control-Flo Roof Drains		
Head Above Drain	Available Storage	Discharge
0.05m	51 m^3	0.0030 m^3/s
0.10m	102 m^3	0.0061 m^3/s
0.15m	153 m^3	0.0091 m^3/s

It is proposed to apply quantity control measures to the runoff from Catchment 202 and further quantity control measures to Catchment 201 by routing flows from both catchments through a 110mmø orifice at the north invert of MH 3. The orifice acts as the ultimate stormwater quantity control mechanism for the proposed development.

With the installation of the quantity control measures for Catchment 201 and 202, it will be required to provide 29m^3 of stormwater storage during the 100-year storm event. On-site storage will be provided by a stormwater storage vault within the proposed underground parking garage. It was determined that a 0.9m-high tank cast into the foundation wall of the underground parking will provide 32m^3 of storage volume.

Details on the proposed storage vault can be found on the Preliminary Site Servicing Plan. See Table 2.4 for the stage-storage-discharge characteristics of the proposed storage tank in Appendix A for additional information.

Table 2.4: Proposed Storage Tank Storage Stage-Storage-Discharge (East Outlet to Wentworth Drive)

Elevation (m)	Storage (m^3)	Discharge (m^3/s)
91.85 (Orifice Invert)	0	0
91.95 (Bottom of Storage Vault)	0	0.0080
92.18 (1/4 of Storage Vault)	8	0.0144
92.40 (1/2 of Storage Vault)	16	0.0187
92.63 (3/4 of Storage Vault)	24	0.0222
92.85 (Top of Storage Vault)	32	0.0253

An analysis was performed on the Proposed Condition site using the SWMHYMO hydrologic modeling program for the 2-year to 100-year Town of Grimsby design storms. A summary of the results can be found in the Table 2.5 and detailed SWMHYMO input/output information can be found in Appendix A.

Table 2.5: Proposed Condition Controlled Site Discharge (East Outlet to Wentworth Drive)

Storm Event	Total Discharge (Catchments 201-203) (m^3/s) A	Allowable Discharge (m^3/s)	Difference (m^3/s)
2-Year	0.018	0.037	-0.019
5-Year	0.023	0.037	-0.014
10-Year	0.027	0.037	-0.010
25-Year	0.031	0.037	-0.006
50-Year	0.033	0.037	-0.004
100-Year	0.037	0.037	0

A = Total discharge includes the peak flows from Catchments 201, 202 and 203. Refer to SWMHYMO “Add Hyd” Command in the output file in Appendix A for details.

This analysis determined the following:

- The proposed condition discharge rates for Catchments 201-203 will not exceed the allowable 5-year discharge rate (maximum 30% imperviousness) of 0.037m^3/s for all storm events, with the installation of a 110mmø orifice plate and 4 Zurn Z-105 controlled flow roof drains for Catchments 201 and 202 (Catchment 203 uncontrolled);

- The proposed 0.9m-high underground storage vault and Zurn Z-105 controlled flow roof drains (max. 0.15m of ponding on roof) will provide adequate stormwater storage for Catchment 201 and 202 during all storm events.

Northwest Outlet to Existing Storm Sewer Easement

With the east half of the site draining to Wentworth Drive to the east, the remaining west half of the site will drain to the existing 600mmø storm sewer in the existing storm sewer easement to the northwest of the site. As per the Nelles Place and Chestnut Grove Stormwater Management Report (Ref. 9), stormwater management controls are provided to control runoff from surrounding lands to the available 5-year capacity in the existing downstream storm sewers. These controls are provided through means of pipe storage and surface storage in the form of a detention facility at the northwest corner of the proposed site, south of the existing townhouse units. There is also an existing 0.4m long 525mmø PVC pipe in the existing 600mm diameter storm sewer past a downstream maintenance hole acting as the outlet control. The detention facility was designed to provide a stormwater storage of 77 m^3 to limit the runoff to the available 5-year peak flows. The existing detention facility is to remain and continue to provide stormwater controls for the surrounding lands up to the peak flows it was designed to hold. The Chestnut Grove Stormwater Management Report can be found in Appendix E.

The west half of the proposed site is located within the E4a subcatchment area (from Chestnut Grove SWM report) which has a total area of 1.58 ha and an allocated peak flow of 0.140 m^3/s. This peak flow was determined based on a total imperviousness of 30% for this area and the existing detention facility provides quantity control up to the peak flow. Since 0.389 ha of the site was allocated to drain to Wentworth Drive to the east based on the Orchardview SWM report, the remainder of the subject site (0.50 ha) was assigned to the E4a subcatchment of the Chestnut Grove SWM design. Since 0.49ha of the proposed site is draining to the storm sewers analyzed in the Chestnut Grove SWM report, an allowable discharge rate for the west side of the proposed site was determined based on a percentage of the total E4a subcatchment area and its assigned peak flow. The subject area is roughly 31% of the total E4a subcatchment area and therefore 31% of the peak flow of 0.140m^3/s would be 0.043m^3/s. Therefore, the allowable discharge rate for all storm events will be **0.043m^3/s** at the west outlet.

As with the east side of the site, it is also proposed to apply quantity control measures for Catchment 301 by means of controlled-flow roof drains. At this time, it is proposed to install 6 Zurn Z-105 controlled flow roof drains within the Catchment 301 roof area in order to provide a restriction in flows from the proposed roof area. The number of roof drains will be confirmed in future submissions. A maximum depth of ponding of 0.15m will be permitted on the roof with overflow scuppers at the roof drain inlets to prevent ponding beyond the maximum depth. By providing rooftop controls, the required size of the stormwater storage tank will be reduced, leaving more area within the underground parking garage as usable parking space.

An analysis was performed on Catchment 301 using the SWMHYMO hydrologic modeling program for the 2-year to 100-year Town of Grimsby design storms (see detailed SWMHYMO input/output information in Appendix A). With the installation of the quantity control measures for Catchment 301, it will be required to provide 74m^3 of roof-top storage during the 100-year storm event. The 0.15m of ponding on the roof will provide 154m^3 of storage. See Table 2.6 for the rooftop stage-storage-discharge characteristics, and refer to the Rooftop Storage Calculations in Appendix A for further information.

.

Table 2.6: Rooftop Storage Stage-Storage-Discharge (Catchment 301)		
6 - Zurn Z105 Control-Flo Roof Drains		
Head Above Drain	Available Storage	Discharge
0.05m	51 m^3	0.0046 m^3/s
0.10m	103 m^3	0.0091 m^3/s
0.15m	154 m^3	0.0137 m^3/s

It is proposed to apply quantity control measures to the runoff from Catchment 302 and further quantity control measures to Catchment 301 by routing flows from both catchments through a 135mmø orifice at the north invert of MH 4. The orifice acts as the ultimate stormwater quantity control mechanism for the proposed development.

With the installation of the quantity control measures for Catchment 301 and 302, it will be required to provide 34m^3 of stormwater storage during the 100-year storm event. On-site storage will be provided by a stormwater storage vault within the proposed underground parking garage. It was determined that a 1.0m-high tank cast into the foundation wall of the underground parking will provide 36m^3 of storage volume.

Details on the proposed storage vault can be found on the Preliminary Site Servicing Plan. See Table 2.7 for the stage-storage-discharge characteristics of the proposed storage tank in Appendix A for additional information.

Table 2.7: Proposed Storage Tank Storage Stage-Storage-Discharge (West Outlet to Storm Easement)		
Elevation (m)	Storage (m^3)	Discharge (m^3/s)
91.65 (Orifice Invert)	0	0
91.765 (Bottom of Storage Vault)	0	0.0126
91.98 (1/4 of Storage Vault)	9	0.0219
92.21 (1/2 of Storage Vault)	18	0.0283
92.43 (3/4 of Storage Vault)	27	0.0335
92.65 (Top of Storage Vault)	36	0.0380

An analysis was performed on the Post-development Condition of the site using the SWMHYMO hydrologic modeling program for the 2-year to 100-year Town of Grimsby design storms. A summary of the results can be found in the Table 2.8 and detailed SWMHYMO input/output information can be found in Appendix B.

Table 2.8: Proposed Condition Controlled Site Discharge (West Outlet to Storm Easement)

Storm Event	Total Discharge (Catchments 301-303) (m^3/s) [A]	Allowable Discharge (m^3/s)	Difference (m^3/s)
2-Year	0.023	0.043	-0.020
5-Year	0.028	0.043	-0.015
10-Year	0.032	0.043	-0.011
25-Year	0.036	0.043	-0.007
50-Year	0.039	0.043	-0.004
100-Year	0.042	0.043	-0.001

[A] = Total discharge includes the peak flows from Catchments 301, 302 and 303. Refer to SWMHYMO "Add Hyd" Command in the output file in Appendix A for details.

This analysis determined the following:

- The proposed condition discharge rates for Catchments 301-303 will not exceed the allowable 5-year discharge rate of 0.043 m^3/s for all storm events, with the installation of a 135mmø orifice plate and 6 Zurn Z-105 controlled flow roof drains for Catchments 301 and 302 (Catchment 303 uncontrolled);

- The proposed 1.0m-high underground storage vault and Zurn Z-105 controlled flow roof drains (0.15m of ponding on roof) will provide adequate stormwater storage for Catchment 301 and 302 during all storm events.

2.2.2 Water Quality Control

The proposed development has been designed to achieve a Level 1 "Enhanced" (80% TSS removal, 90% average annual runoff treatment) level of water quality protection. To achieve this criteria, discharge from the proposed site at each outlet will be subject to treatment via a Hydrostorm oil/grit separator (or approved equivalent). See Appendix B for details on the Hydrostorm products.

Hydrostorm sizing software was used to determine the appropriate oil-grit separator size for the site. The software yielded that stormwater runoff generated from Catchment 201 and 202 will be conveyed through a Hydrostorm HS6 oil-grit separator. In using the ETV Canada particle size distribution, it is estimated that the HS6 unit will contribute 80% TSS removal to the stormwater that leaves half of the subject site. Further details are provided in Appendix B.

The Hydrostorm sizing software recommended a Hydrostorm HS7 to treat Catchments 301 and 302 however the HS7 oil-grit separator is not available in Ontario. Therefore, a Hydrostorm HS8 oil-grit separator unit will provide an "Enhanced" level of treatment. In using the ETV Canada particle size distribution, it is estimated that the HS8 unit will contribute 85% TSS removal to the stormwater that leaves the other half of the subject site. Further details are provided in Appendix B.

2.2.3 Sediment and Erosion Control

In order to minimize erosion during the grading and site servicing period of construction, the following measures will be implemented:

- Install silt fencing along the outer boundary of the site to ensure that sediment does not migrate to the adjacent properties;
- Install sediment control (silt sacks) in the proposed catchbasins as well as the nearby existing catchbasins to ensure that no untreated runoff enters the existing conveyance system
- Stabilize all disturbed or landscaped areas with hydro seeding/sodding to minimize the opportunity for erosion.

To ensure and document the effectiveness of the erosion and sediment control structures, an appropriate inspection and maintenance program is necessary. The program will include the following activities:

- Inspection of the erosion and sediment controls (e.g. silt fences, sediment traps, outlets, vegetation, etc.) with follow up reports to the governing municipality; and
- The developer and/or his contractor shall be responsible for any costs incurred during the remediation of problem areas.

Details of the proposed erosion & sediment control measures are provided on the Preliminary Grading and Erosion and Sediment Control Plan.

3.0 SANITARY SEWER SERVICING

3.1 Existing Conditions

There is an existing 200mm diameter sanitary sewer on Main Street East which has an approximate grade of 0.36% and flows towards the west and then north down Nelles Road North. The is no sanitary sewer on Wentworth Drive fronting the proposed site.

3.2 Sanitary Demand

Sanitary discharge for the proposed development was estimated in accordance with the Ministry of the Environment Design Guidelines for Sewage Works (Ref. 5). Table 3.1 summarizes the peak sanitary design flow for the proposed development.

Table 3.1- Post-Development Sanitary Peak Design Discharge					
Site Area (ha)	Persons [A]	Avg. Demand [B] (L/s)	Peaking Factor [C]	Infiltration [D] (L/s)	**Peak Flow [E] (L/s)**
0.89	586	2.29	3.94	0.18	**9.19**

[A]: Persons= 2.7 persons per unit x 217 units = 586 persons

[B]: Average demand = 337.5 L/cap/day (As per MOE Design Guidelines for Sewage Works)

[C]: Peaking Factor (M) = $1+(14/(4+P^{0.5}))$ with P expressed in thousands, Minimum=2.0

[D]: Infiltration flow (L) = 0.20 L/ha/sec

[E]: Peak Flow = (Average Demand x Peaking Factor) + Infiltration

3.3 Proposed Sanitary Servicing

The proposed site will be serviced by a private 200mmø sanitary service, which will be connected to the existing 200mmø sanitary sewer on Main Street East. This sanitary service will be designed and constructed in accordance with the Town of Grimsby standards.

The minimum grade of the proposed 200mmø sanitary sewer will be 2.0%. At this minimum grade, the proposed sanitary sewer will have a capacity of 0.046 m^3/s (46 l/s). Therefore, the proposed 200mmø sanitary sewer at a minimum of 2.0% grade is adequately sized to service the proposed site.

An analysis was performed to investigate the capacity in the existing downstream sanitary sewer. The analysis examined the existing 200mmø sanitary sewer from the beginning of the sewer run at Governor’s Road to Nelles Road as the downstream sanitary sewer flowing north on Nelles Road increases in size to 250mmø. A population density of 125 persons per hectare was used to determine the population of the existing commercial properties and a flow per capita of 360 L/day/cap was used. The sanitary drainage area plan and design sheet can be found in Appendix D.

The analysis determined that, with the addition of sanitary flows from the proposed site, the downstream sanitary sewer up to Nelles Road will be at 77.4% capacity. Therefore, it was determined that the existing sanitary sewer on Main Street East to Nelles Road has sufficient capacity to service the proposed residential development at 141-149 Main Street East.

4.0 DOMESTIC AND FIRE WATER SUPPLY SERVICING

4.1 Existing Conditions

The existing municipal water distribution system consists of a 250mmø watermain on Main Street East and a 200mmø watermain on Wentworth Drive.

4.2 Domestic Water Demand

Water demand for the proposed development was estimated in accordance with the Ministry of the Environment Design Guidelines for Drinking-Water Systems (Ref. 4). Table 4.1 summarizes the domestic water demand requirements for the Average Daily, Maximum Daily and Peaking Hourly demand scenarios.

Table 4.1: Post-Development Domestic Water Demand

Population [A]	Average Daily Demand [B] (l/s)	Max. Daily Peaking Factor [C]	Max. Hourly Peaking Factor [D]	**Max. Daily Demand [E] (l/s)**	**Max. Hourly Demand [F] (l/s)**
586 persons	2.44	2.75	4.13	**6.71**	**10.08**

[A] Population (P) = 217 units x 2.7 persons/unit = 586 persons
[B] Average Daily Demand = (270 l/cap/day + 450 l/cap/day)/2 = 360 l/cap/day x population
[C] Max. Daily Peaking Factor = 2.75 (refer to Table 3-1 from MOE Manual)
[D] Max. Hourly Peaking Factor = 4.13 (refer to Table 3-1 from MOE Manual)
[E] Max. Daily Demand = Average Daily Demand x Max. Daily Peaking Factor
[F] Max. Hourly Demand = Average Daily Demand x Max. Hourly Peaking Factor

4.3 Fire Flow Demand

Fire flow demands for the development are governed by a number of guidelines and criteria such as the Water Supply for Public Fire Protection (Fire Underwriters Survey, 1999), Ontario Building Code (OBC), and various codes and standards published by the National Fire Protection Association (NFPA). Since the FUS criteria provides adjustment for sprinklered buildings (OBC does not), the FUS method was used to determine the fire flow demand for the proposed development.

Attached in Appendix C is an estimate of the required fire flow rates for the proposed development. The proposed building will be of non-combustible (C=0.8) construction type, with a limited combustible occupancy (-15% correction). The type of construction for the building will be confirmed upon the detailed design stage. Based on the FUS, the required fire flow demand for the development is **283 L/s**. The gross floor area for the proposed building was taken from the floor plans provided by Chamberlain Architects Services Limited.

There are two fire hydrants fronting the site on Main Street East. There are no hydrants in close proximity to the site on Wentworth Drive. A hydrant has been proposed north of the proposed building to satisfy the FUS maximum recommended spacing requirements.

Two hydrant flow tests were completed to determine the available flows that can be supplied by the existing water distribution system on Main Street East and Wentworth Drive. A summary of the hydrant flow test results can be found in Table 4.2 and in Appendix C. As shown, the minimum available fire flow for firefighting purposes for the development is **360 L/s**.

Table 4.2: Hydrant Flow Test Results		
Location	First hydrant on Main St. west of Wentworth Drive	First hydrant on Wentworth Dr. north of Main Street
Test Date (mm/dd/yyyy)	6/12/2020	6/12/2020
Static Pressure	84 psi	84 psi
Residual Pressure During Test Flow (1 port)	80 psi	80 psi
Test Flow Rate (1 port)	1311 USGPM (83 l/s)	1278 USGPM (81 l/s)
Residual Pressure During Test Flow (2 ports)	75 psi	75 psi
Test Flow Rate (2 ports)	2276 USGPM (144 l/s)	2122 USGPM (134 l/s)
Theoretical Flow @ 20 psi	**5857 USGPM (370 l/s)**	**5711 USGPM (360 l/s)**

Therefore, the existing water distribution system has suitable pressure and capacity to service the development for firefighting purposes. Details of the required fire flow calculations will be confirmed during the detailed design stage and the possibility of fire separation within the proposed building will be investigated if required.

4.4 Proposed Water Servicing and Analysis

Proposed water servicing for the site consists of connecting a 200mmø water service to the existing 250mmø watermain on Main Street East. The 200mmø water service will split at property line to provide a 200mmø fire water service and 150mmø domestic water service for the proposed building. All proposed watermain and water services are to be designed and constructed in accordance with the standards and specifications of the Town of Grimsby.

Based on the hydrant flow test results, it is concluded that the existing water distribution system has adequate pressure and capacity to service the proposed development for firefighting and domestic purposes.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the information provided herein, it is concluded that:

- The development be graded and serviced in accordance with the Preliminary Grading & Erosion Control Plan and Preliminary Site Servicing Plan prepared by S. Llewellyn & Associates Limited;

- A total of ten (10) Zurn Z105 controlled-flow roof drains be installed as per this report to provide supplementary rooftop stormwater control and storage;

- 110mmø and 135mmø orifice plates (ultimate control) be installed at the east and west outlets respectively as per the Site Servicing Plan and this report to achieve effective stormwater quantity control for the subject site;

- Underground storage vaults be incorporated into the underground parking garage of the proposed condominium building at both outlets as per the Site Servicing Plan and this report to provide adequate stormwater storage during storm events;

- A Hydrostorm HS6 and a Hydrostorm HS8 oil/grit separator (or approved equivalent) be installed at the east and west outlets respectively as per the Site Servicing Plan and this report to provide effective stormwater quality control;

- Erosion and sediment controls be installed as described in this report, and as per the standards and specifications of the Town of Grimsby;

- The proposed sanitary and water servicing system be installed as per the Preliminary Site Servicing Plan and this report to adequately service the proposed development;

- This report be used as the basis for the servicing and stormwater management design. All design data, assumptions and calculations will be confirmed and/or updated as part of the future Site Plan Approval submission.

Therefore, it is recommended that this report be used as the basis for the detailed servicing and stormwater management design for the proposed development.

We trust the information enclosed herein is satisfactory. Should you have any questions please do not hesitate to contact our office.

Prepared by:

S. LLEWELLYN & ASSOCIATES LIMITED

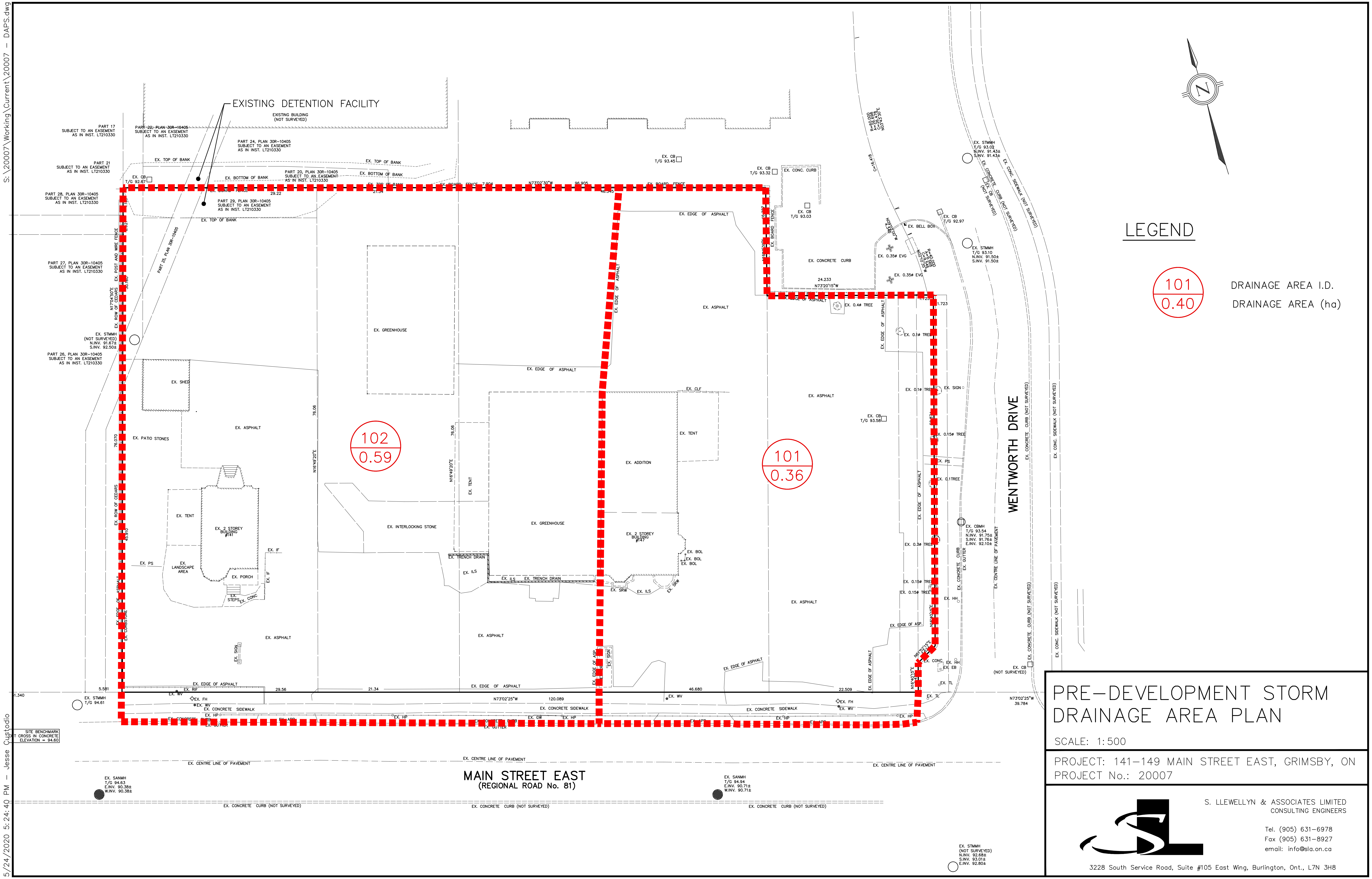
B.S. LLEWELLYN
27[illegible]0300
July 23/2020

Jesse Custodio, EIT

Scott Llewellyn, P. Eng.

APPENDIX A

STORMWATER QUANTITY INFORMATION



PRE-DEVELOPMENT STORM DRAINAGE AREA PLAN

SCALE: 1:500

PROJECT: 141–149 MAIN STREET EAST, GRIMSBY, ON
PROJECT No.: 20007

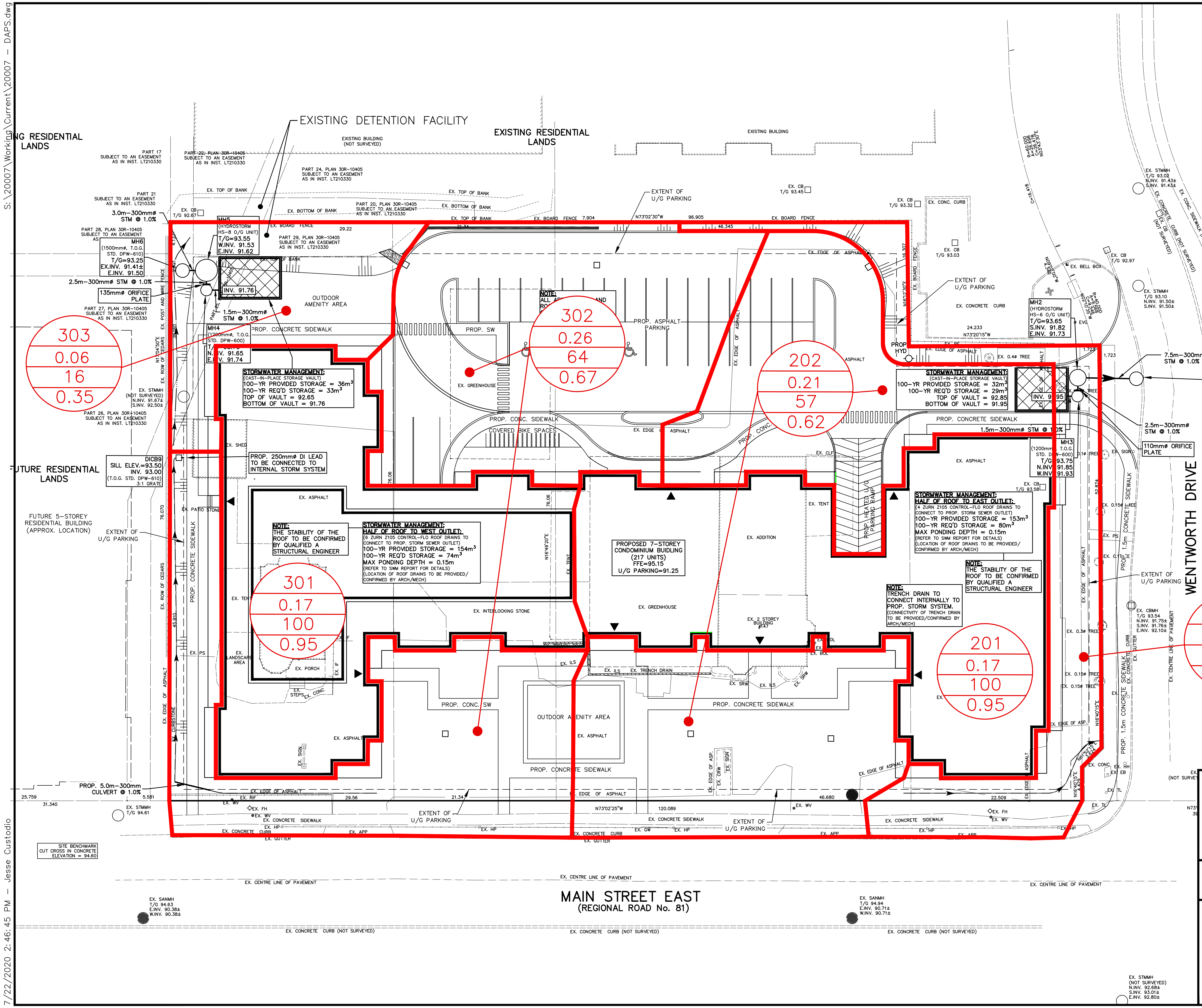
S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS

Tel. (905) 631–6978
Fax (905) 631–8927
email: info@sla.on.ca

3228 South Service Road, Suite #105 East Wing, Burlington, Ont., L7N 3H8

S:\20007\Working\Current\20007 - DAPS.dwg

7/22/2020 2:46:45 PM - Jesse Custodio



STORMWATER MANAGEMENT:
(CAST-IN-PLACE STORAGE VAULT)
100-YR PROVIDED STORAGE = 36m^3
100-YR REQ'D STORAGE = 33m^3
TOP OF VAULT = 92.65
BOTTOM OF VAULT = 91.76

STORMWATER MANAGEMENT:
(CAST-IN-PLACE STORAGE VAULT)
100-YR PROVIDED STORAGE = 32m^3
100-YR REQ'D STORAGE = 29m^3
TOP OF VAULT = 92.85
BOTTOM OF VAULT = 91.95

NOTE:
ALL AREAS ... AND ...

NOTE:
THE STABILITY OF THE ROOF TO BE CONFIRMED BY QUALIFIED A STRUCTURAL ENGINEER

STORMWATER MANAGEMENT:
HALF OF ROOF TO WEST OUTLET:
(6 ZURN Z105 CONTROL-FLO ROOF DRAINS TO CONNECT TO PROP. STORM SEWER OUTLET)
100-YR PROVIDED STORAGE = 154m^3
100-YR REQ'D STORAGE = 74m^3
MAX PONDING DEPTH = 0.15m
(REFER TO SWM REPORT FOR DETAILS)
(LOCATION OF ROOF DRAINS TO BE PROVIDED/CONFIRMED BY ARCH/MECH)

STORMWATER MANAGEMENT:
HALF OF ROOF TO EAST OUTLET:
(4 ZURN Z105 CONTROL-FLO ROOF DRAINS TO CONNECT TO PROP. STORM SEWER OUTLET)
100-YR PROVIDED STORAGE = 153m^3
100-YR REQ'D STORAGE = 80m^3
MAX PONDING DEPTH = 0.15m
(REFER TO SWM REPORT FOR DETAILS)
(LOCATION OF ROOF DRAINS TO BE PROVIDED/CONFIRMED BY ARCH/MECH)

NOTE:
THE STABILITY OF THE ROOF TO BE CONFIRMED BY QUALIFIED A STRUCTURAL ENGINEER

NOTE:
TRENCH DRAIN TO CONNECT INTERNALLY TO PROP. STORM SYSTEM.
(CONNECTIVITY OF TRENCH DRAIN TO BE PROVIDED/CONFIRMED BY ARCH/MECH)

LEGEND

101	DRAINAGE AREA I.D.
1.02	DRAINAGE AREA (ha)
77	PERCENT IMPERVIOUS
0.75	RUNOFF COEFFICENT

POST-DEVELOPMENT STORM DRAINAGE AREA PLAN

SCALE: 1:500

PROJECT: 141-149 MAIN STREET EAST, GRIMSBY, ON
PROJECT No.: 20007

S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS

Tel. (905) 631-6978
Fax (905) 631-8927
email: info@sla.on.ca

3228 South Service Road, Suite #105 East Wing, Burlington, Ont., L7N 3H8

Project: 141-149 Main Street East, Grimsby Project No. 20007

STAGE-STORAGE-DISCHARGE CALCULATIONS – ROOFTOP STORAGE

East Outlet to Wentworth Drive (Catchment 201):

Type of Drain=Zurn105 (Canadian Market) Control-Flo Roof Drain
Discharge per Drain=5 Imperial gpm per 1" head (0.38 l/s per 0.025m head)
Available Storage= (60% x Roof Area) x Depth Above Drain
Roof Area=1698.0 m^2
Of Roof Drains=4

<table>
<tr><th colspan="3">Roof Stage-Storage-Discharge (Catchment 201)</th></tr>
<tr><td colspan="3">4 Zurn Z105 Control-Flo Roof Drains</td></tr>
<tr><td>Head Above Drain</td><td>Available Storage</td><td>Discharge</td></tr>
<tr><td>0.05m</td><td>51 m^3</td><td>0.0030 m^3/s</td></tr>
<tr><td>0.10m</td><td>102 m^3</td><td>0.0061 m^3/s</td></tr>
<tr><td>0.15m</td><td>153 m^3</td><td>0.0091 m^3/s</td></tr>
</table>

West Outlet to Existing Storm Sewer Easement (Catchment 301):

Type of Drain=Zurn105 (Canadian Market) Control-Flo Roof Drain
Discharge per Drain=5 Imperial gpm per 1" head (0.38 l/s per 0.025m head)
Available Storage= (60% x Roof Area) x Depth Above Drain
Roof Area=1713.0 m^2
Of Roof Drains=6

<table>
<tr><th colspan="3">Roof Stage-Storage-Discharge (Catchment 301)</th></tr>
<tr><td colspan="3">6 Zurn Z105 Control-Flo Roof Drains</td></tr>
<tr><td>Head Above Drain</td><td>Available Storage</td><td>Discharge</td></tr>
<tr><td>0.05m</td><td>51 m^3</td><td>0.0046 m^3/s</td></tr>
<tr><td>0.10m</td><td>103 m^3</td><td>0.0091 m^3/s</td></tr>
<tr><td>0.15m</td><td>154 m^3</td><td>0.0137 m^3/s</td></tr>
</table>

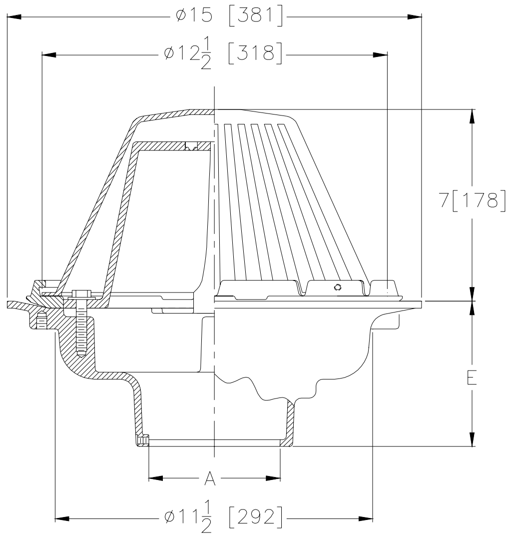
ZURN

Z-105
CONTROL-FLO ROOF DRAIN
w/ Parabolic Weir

SPECIFICATION SHEET

TAG_________________

Dimensional Data (inches and [mm]) are Subject to Manufacturing Tolerances and Change Without Notice



A Pipe Size Inches / [mm]	Approx. Wt. Lbs. / [kg]	Dome Open Area Sq. In. / [sq cm]
2 - 3 - 4 [51 - 76 - 102]	34 [15]	148 [955]

ENGINEERING SPECIFICATION: ZURN Z-105 "Control-Flo" roof drain for dead -level roof construction, Dura-Coated cast iron body. "Control-Flo" weir shall be linear functioning with integral membrane flashing clamp/gravel guard and Poly-Dome. All data shall be verified proportional to flow rates.

OPTIONS (Check/specify appropriate options)

PIPE SIZE	(Specify size/type)	OUTLET		E BODY HT. DIM.
2,3,4 [50,75,100]	______	IC	Inside Caulk	5 1/4 [133]
2,3,4 [50,75,100]	______	IP	Threaded	3 3/4 [95]
2,3,4 [50,75,100]	______	NH	No-Hub	5 1/4 [133]
2,3,4 [50,75,100]	______	NL	Neo-Loc	4 5/8 [117]

PREFIXES

____ Z- D.C.C.I. Body with Poly-Dome*

____ ZA- D.C.C.I. Body with Aluminum Dome

SUFFIXES

____ -A Waterproof Flange

____ -AR Acid Resistant Epoxy Coated Finish

____ -C Underdeck Clamp

____ -DP Top Set® Roof Deck Plate (Replaces both the -C and -R)

____ -DR Adjustable Drain Riser Extension Assembly 3-5/8" [92] to 7-1/4" [184]

____ -E Static Extension 1 [25] thru 4 [102] (Specify Ht.)

____ -EA Adjustable Extension Assembly 1 3/4 [44] thru 3 1/2 [89]

____ -EB Elevating Body Plate

____ -G Galvanized Cast Iron

____ -R Roof Sump Receiver

____ -VP Vandal Proof Secured Top

____ -90 90º Threaded Side Outlet Body

*REGULARLY FURNISHED UNLESS OTHERWISE SPECIFIED

REV. A **DATE: 09/14/05** **C.N. NO. 89837**

DWG. NO. 63601 **PRODUCT NO. Z-105**

STAGE-STORAGE-DISCHARGE CALCULATIONS (EAST OUTLET)

Outlet Device No. 1 (Quantity)

Type:	Circular Orifice
Diameter (mm)	**110**
Area (m^2)	0.00950
Invert Elev. (m)	91.85
C/L Elev. (m)	91.91
Disch. Coeff. (C_d)	0.6
Discharge (Q) =	$C_d A (2 g H)^{0.5}$
Number of Orifices:	1

		SWM Tank Volumes				Outlet No. 1	
	Elevation m	Area m^2	Tank Incremental Volume	Cumulative Tank Volume m^3	Active Storage Volume m^3	H m	Discharge m^3/s
Orifice Invert	91.85	0	0	0	0	0.000	0.0000
Bottom of Storage Vault	91.95	36	0	0	0	0.100	0.0080
1/4 of Tank	92.18	36	8	8	8	0.325	0.0144
1/2 of Tank	92.40	36	8	16	16	0.550	0.0187
3/4 of Tank	92.63	36	8	24	24	0.775	0.0222
Top of Tank	92.85	36	8	32	32	1.000	0.0253

```
2     Metric units
*#****************************************************************************|
*#  Project Name: 141-149 MAIN STREET EAST
*#              GRIMSBY, ONTARIO
*#  JOB NUMBER  : 20007
*#       Date   : MAY 2020
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 20007.DAT
*#****************************************************************************|
*
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[002]
                    GRIM3002.stm
*
READ STORM          STORM_FILENAME "STORM.001"
*
*#*****************************************************************************|
*#
*#     ALLOWABLE DISCHARGE RATE HYDROLOGIC MODELING (FOR 5-YEAR EVENT ONLY)
*#     ====================================================================
*#
*#*****************************************************************************|
*# ALLOCATED DISCHARGE TO WENTWORTH DRIVE 600mm STORM SEWER (EAST)
*
CALIB STANDHYD      ID=[1], NHYD=["EAST"], DT=[1](min), AREA=[0.389](ha),
                    XIMP=[0.30], TIMP=[0.30], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[70],
                    Pervious   surfaces: IAper=[4.0](mm), SLPP=[2.5](%),
                                         LGP=[10](m), MNP=[0.250], SCP=[0](min),
                    Impervious surfaces: IAimp=[1.0](mm), SLPI=[2.5](%),
                                         LGI=[15](m), MNI=[0.015], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*#*****************************************************************************|
*#
*#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ===============================================
*#
*#*****************************************************************************|
*# CATCHMENT AREA 201 - CONTROLLED DISCHARGE - ROOF DRAINS
*
CALIB STANDHYD      ID=[2], NHYD=["201"], DT=[1](min), AREA=[0.17](ha),
                    XIMP=[0.99], TIMP=[0.99], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[70],
                    Pervious   surfaces: IAper=[4](mm), SLPP=[2.0](%),
                                         LGP=[1](m), MNP=[0.250], SCP=[0](min),
                    Impervious surfaces: IAimp=[1.0](mm), SLPI=[1.0](%),
                                         LGI=[15](m), MNI=[0.015], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
**#****************************************************************************|
*# ROUTE CATCHMENT 201 THROUGH CONTROLLED-FLOW ROOF DRAINS
*#
ROUTE RESERVOIR     IDout=[3],   NHYD=["SWM201"],  IDin=[2],
                    RDT=[1](min),
                          TABLE of ( OUTFLOW-STORAGE ) values
                                      (cms)  -  (ha-m)
                                       0.0  , 0.0
                                    0.0030  , 0.0051
                                    0.0061  , 0.0102
                                    0.0091  , 0.0153
```

East Outlet to Wentworth Drive

```
                                       -1   ,  -1    (max twenty pts)
                          IDovf=[4], NHYDovf=["OVF"]
**#****************************************************************************|
*# CATCHMENT AREA 202 - CONTROLLED PARKING LOT/LANDSCAPE DISCHARGE
*
CALIB STANDHYD      ID=[5], NHYD=["202"], DT=[1](min), AREA=[0.21](ha),
                    XIMP=[0.57], TIMP=[0.57], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[70],
                    Pervious   surfaces: IAper=[4](mm), SLPP=[2.5](%),
                                         LGP=[10](m), MNP=[0.250], SCP=[0](min),
                    Impervious surfaces: IAimp=[1.0](mm), SLPI=[2.5](%),
                                         LGI=[15](m), MNI=[0.015], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*#****************************************************************************|
ADD HYD             IDsum=[6], NHYD=["201+202"], IDs to add=[3,4,5]
*#****************************************************************************|
*# ROUTE CATCHMENT 201 & 202 THROUGH ORIFICE SYSTEM
*#
ROUTE RESERVOIR     IDout=[7],   NHYD=["SWM200"],  IDin=[6],
                    RDT=[1](min),
                          TABLE of ( OUTFLOW-STORAGE ) values
                                      (cms) -  (ha-m)
                                        0.0 , 0.0
                                     0.0080 , 0.0000
                                     0.0144 , 0.0008
                                     0.0187 , 0.0016
                                     0.0222 , 0.0024
                                     0.0253 , 0.0032
                                       -1   ,  -1    (max twenty pts)
                          IDovf=[8], NHYDovf=["OVF"]
**#****************************************************************************|
*# CATCHMENT AREA 203 - UNCONTROLLED RUNOFF TO WENTWORTH DRIVE RIGHT-OF-WAY
*
CALIB STANDHYD      ID=[9], NHYD=["203"], DT=[1](min), AREA=[0.07](ha),
                    XIMP=[0.23], TIMP=[0.23], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[70],
                    Pervious   surfaces: IAper=[4](mm), SLPP=[20.0](%),
                                         LGP=[5](m), MNP=[0.250], SCP=[0](min),
                    Impervious surfaces: IAimp=[1.0](mm), SLPI=[3.0](%),
                                         LGI=[5](m), MNI=[0.015], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*#****************************************************************************|
ADD HYD             IDsum=[10], NHYD=["200 SERIES"], IDs to add=[7,8,9]
*#****************************************************************************|
*#****************************************************************************|
* RUN REMAINING DESIGN STORMS (GRIMSBY 5 TO 100-YR)
*
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[005]
                    GRIM3005.stm
*
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[010]
                    GRIM3010.stm
*
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[025]
                    GRIM3025.stm
*
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[050]
                    GRIM3050.stm
*
```

East Outlet to Wentworth Drive

```
START                   TZERO=[0.0],   METOUT=[2],   NSTORM=[1],   NRUN=[100]
                        GRIM3100.stm
*
*%-------------------|---------------------------------------------------------|
FINISH
```

East Outlet to Wentworth Drive

```
================================================================================

   SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999    =========
   S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
   SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
       S   W W   M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
   SSSSS   W W   M   M  H   H    Y    M   M   OOO           9      9   =========
                                                        9   9  9   9   # 3902680
        StormWater Management HYdrologic Model           999    999    =========

 ******************************************************************************
 ***************************** SWMHYMO Ver/4.05  *****************************
 *********  A single event and continuous hydrologic simulation model  *********
 *********     based on the principles of HYMO and its successors      *********
 *********                OTTHYMO-83 and OTTHYMO-89.                   *********
 ******************************************************************************
 ********* Distributed by:  J.F. Sabourin and Associates Inc.          *********
 *********                  Ottawa,  Ontario: (613) 836-3884           *********
 *********                  Gatineau, Quebec: (819) 243-6858           *********
 *********                  E-Mail: swmhymo@jfsa.Com                   *********
 ******************************************************************************

 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++++ Licensed user: S. Llewellyn & Associates Ltd               +++++++++
 +++++++++                                       SERIAL#:3902680      +++++++++
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ******************************************************************************
 *********            ++++++ PROGRAM ARRAY DIMENSIONS ++++++           *********
 *********            Maximum value for ID numbers  :     10           *********
 *********            Max. number of rainfall points: 105408           *********
 *********            Max. number of flow points    : 105408           *********
 ******************************************************************************


 *********************   D E T A I L E D   O U T P U T   *********************
 ******************************************************************************
 *         DATE: 2020-05-24     TIME: 15:39:19     RUN COUNTER: 000216         *
 ******************************************************************************
 * Input   filename: T:\projects\20007\SWMHYMO\20007E.dat                      *
 * Output  filename: T:\projects\20007\SWMHYMO\20007E.out                      *
 * Summary filename: T:\projects\20007\SWMHYMO\20007E.sum                      *
 * User comments:                                                              *
 * 1:__________________________________________________________________________*
 * 2:__________________________________________________________________________*
 * 3:__________________________________________________________________________*
 ******************************************************************************

--------------------------------------------------------------------------------
001:0001------------------------------------------------------------------------
*#*****************************************************************************|
*#  Project Name: 141-149 MAIN STREET EAST
*#                GRIMSBY, ONTARIO
*#  JOB NUMBER  : 20007
*#       Date   : MAY 2020
*#     Revised  :
*#     Company  : S. LLEWELLYN AND ASSOCIATES LTD.
*#        File  : 20007.DAT
*#*****************************************************************************|
*
  ** END OF RUN :    1

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




--------------------
| START              |  Project  dir.: T:\projects\20007\SWMHYMO\
--------------------  Rainfall dir.: T:\projects\20007\SWMHYMO\
    TZERO =    .00 hrs on        0
    METOUT=    2 (output = METRIC)
    NRUN  = 002
    NSTORM=    1
           #  1=GRIM3002.stm
--------------------------------------------------------------------------------
002:0002------------------------------------------------------------------------
*#*****************************************************************************|
*#  Project Name: 141-149 MAIN STREET EAST
*#                GRIMSBY, ONTARIO
*#  JOB NUMBER  : 20007
*#       Date   : MAY 2020
*#     Revised  :
*#     Company  : S. LLEWELLYN AND ASSOCIATES LTD.
*#        File  : 20007.DAT
*#*****************************************************************************|
*
--------------------------------------------------------------------------------
002:0002------------------------------------------------------------------------
*
--------------------
| READ STORM         |    Filename: 2YR EVENT A=603.25, B=6, C=0.790
| Ptotal=  29.15 mm|    Comments: 2YR EVENT A=603.25, B=6, C=0.790
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .17   2.617 |   1.00  17.549 |   1.83   5.664 |   2.67   2.733
               .33   3.090 |   1.17  67.490 |   2.00   4.615 |   2.83   2.494
               .50   3.806 |   1.33  21.188 |   2.17   3.914 |   3.00   2.297
               .67   5.031 |   1.50  10.890 |   2.33   3.410 |
               .83   7.646 |   1.67   7.408 |   2.50   3.031 |

--------------------------------------------------------------------------------
002:0003------------------------------------------------------------------------
*
*#*****************************************************************************|
*#
*#     ALLOWABLE DISCHARGE RATE HYDROLOGIC MODELING (FOR 5-YEAR EVENT ONLY)
*#     ====================================================================
*#
*#*****************************************************************************|
*# ALLOCATED DISCHARGE TO WENTWORTH DRIVE 600mm STORM SEWER (EAST)
*
----------------------
| CALIB STANDHYD      |   Area    (ha)=     .39
| 01:EAST   DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
----------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .12          .27
     Dep. Storage     (mm)=      1.00         4.00
     Average Slope     (%)=      2.50         2.50
```

```
     Length            (m)=     15.00        10.00
     Mannings n           =      .015         .250

     Max.eff.Inten.(mm/hr)=     67.49        10.19
               over (min)       1.00         8.00
     Storage Coeff.  (min)=       .79 (ii)    7.95 (ii)
     Unit Hyd. Tpeak (min)=      1.00         8.00
     Unit Hyd. peak  (cms)=      1.22          .14
                                                          *TOTALS*
     PEAK FLOW       (cms)=       .02          .01          .025 (iii)
     TIME TO PEAK    (hrs)=      1.17         1.27         1.167
     RUNOFF VOLUME    (mm)=     28.15         4.72        11.747
     TOTAL RAINFALL   (mm)=     29.15        29.15        29.146
     RUNOFF COEFFICIENT   =       .97          .16          .403

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
002:0004------------------------------------------------------------------------
*#*****************************************************************************|
*#
*#       POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#       ================================================
*#
*#*****************************************************************************|
*# CATCHMENT AREA 201 - CONTROLLED DISCHARGE - ROOF DRAINS
*
----------------------
| CALIB STANDHYD      |   Area    (ha)=     .17
| 02:201    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
----------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .17          .00
     Dep. Storage     (mm)=      1.00         4.00
     Average Slope     (%)=      1.00         2.00
     Length            (m)=     15.00         1.00
     Mannings n           =      .015         .250

     Max.eff.Inten.(mm/hr)=     67.49        12.89
               over (min)       1.00         3.00
     Storage Coeff.  (min)=      1.04 (ii)    2.79 (ii)
     Unit Hyd. Tpeak (min)=      1.00         3.00
     Unit Hyd. peak  (cms)=      1.05          .39
                                                          *TOTALS*
     PEAK FLOW       (cms)=       .03          .00          .032 (iii)
     TIME TO PEAK    (hrs)=      1.17         1.18         1.167
     RUNOFF VOLUME    (mm)=     28.15         4.72        27.912
     TOTAL RAINFALL   (mm)=     29.15        29.15        29.146
     RUNOFF COEFFICIENT   =       .97          .16          .958

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
002:0005------------------------------------------------------------------------
**#****************************************************************************|
*# ROUTE CATCHMENT 201 THROUGH CONTROLLED-FLOW ROOF DRAINS
*#
---------------------
| ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
|  IN>02:(201    )   |
| OUT<03:(SWM201)    |    =========  OUTLFOW STORAGE TABLE  =========
---------------------     OUTFLOW    STORAGE  |  OUTFLOW    STORAGE
                            (cms)    (ha.m.)  |    (cms)    (ha.m.)
                             .000  .0000E+00  |     .006  .1020E-01
                             .003  .5100E-02  |     .009  .1530E-01

     ROUTING RESULTS              AREA     QPEAK     TPEAK        R.V.
     --------------------         (ha)     (cms)     (hrs)        (mm)
     INFLOW >02: (201    )         .17      .032     1.167      27.912
     OUTFLOW<03: (SWM201)          .17      .002     2.000      27.911
    OVERFLOW<04: (OVF    )         .00      .000      .000        .000

                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =          0
                    CUMULATIVE TIME OF OVERFLOWS  (hours)=        .00
                    PERCENTAGE OF TIME OVERFLOWING    (%)=        .00


                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=     6.591
                    TIME SHIFT OF PEAK FLOW          (min)=     50.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=.3541E-02

--------------------------------------------------------------------------------
002:0006------------------------------------------------------------------------
**#****************************************************************************|
*# CATCHMENT AREA 202 - CONTROLLED PARKING LOT/LANDSCAPE DISCHARGE
*
----------------------
| CALIB STANDHYD      |   Area    (ha)=     .21
| 05:202    DT= 1.00 |   Total Imp(%)=   57.00   Dir. Conn.(%)=   57.00
----------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .12          .09
     Dep. Storage     (mm)=      1.00         4.00
     Average Slope     (%)=      2.50         2.50
     Length            (m)=     15.00        10.00
     Mannings n           =      .015         .250

     Max.eff.Inten.(mm/hr)=     67.49        10.19
               over (min)       1.00         8.00
     Storage Coeff.  (min)=       .79 (ii)    7.95 (ii)
     Unit Hyd. Tpeak (min)=      1.00         8.00
     Unit Hyd. peak  (cms)=      1.22          .14
                                                          *TOTALS*
     PEAK FLOW       (cms)=       .02          .00          .023 (iii)
     TIME TO PEAK    (hrs)=      1.17         1.27         1.167
     RUNOFF VOLUME    (mm)=     28.15         4.72        18.072
     TOTAL RAINFALL   (mm)=     29.15        29.15        29.146
     RUNOFF COEFFICIENT   =       .97          .16          .620

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

East Outlet to Wentworth Drive

```
 -------------------------------------------------------------------------------
 002:0007-----------------------------------------------------------------------
 *#*************************************************************************|
 ------------------------
 | ADD HYD (201+202    ) | ID: NHYD         AREA      QPEAK    TPEAK   R.V.     DWF
 ------------------------                    (ha)      (cms)    (hrs)   (mm)    (cms)
                     ID1 03:SWM201          .17       .002     2.00  27.91     .000
                    +ID2 04:OVF             .00       .000      .00    .00     .000
                    +ID3 05:202             .21       .023     1.17  18.07     .000
                     ===========================================================
                     SUM 06:201+202         .38       .025     1.17  22.47     .000

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 -------------------------------------------------------------------------------
 002:0008-----------------------------------------------------------------------
 *#*************************************************************************|
 *# ROUTE CATCHMENT 201 & 202 THROUGH ORIFICE SYSTEM
 *#
 ---------------------
 | ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
 |  IN>06:(201+20)    |
 | OUT<07:(SWM200)    |    =========  OUTLFOW STORAGE TABLE  =========
 ---------------------     OUTFLOW     STORAGE   |   OUTFLOW     STORAGE
                             (cms)     (ha.m.)   |     (cms)     (ha.m.)
                              .000  .0000E+00    |      .019  .1600E-02
                              .008  .0000E+00    |      .022  .2400E-02
                              .014  .8000E-03    |      .025  .3200E-02

     ROUTING RESULTS               AREA      QPEAK      TPEAK         R.V.
     --------------------          (ha)      (cms)      (hrs)         (mm)
     INFLOW >06: (201+20)           .38       .025      1.167       22.474
     OUTFLOW<07: (SWM200)           .38       .014      1.183       22.488
    OVERFLOW<08: (OVF    )          .00       .000       .000         .000

                   TOTAL NUMBER OF SIMULATED OVERFLOWS  =          0
                   CUMULATIVE TIME OF OVERFLOWS  (hours)=        .00
                   PERCENTAGE OF TIME OVERFLOWING     (%)=        .00


                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=    55.624
                   TIME SHIFT OF PEAK FLOW          (min)=      1.00
                   MAXIMUM  STORAGE   USED        (ha.m.)=.7368E-03

 -------------------------------------------------------------------------------
 002:0009-----------------------------------------------------------------------
 **#*************************************************************************|
 *# CATCHMENT AREA 203 - UNCONTROLLED RUNOFF TO WENTWORTH DRIVE RIGHT-OF-WAY
 *
 ----------------------
 | CALIB STANDHYD      |   Area    (ha)=     .07
 | 09:203    DT= 1.00  |   Total Imp(%)=   23.00   Dir. Conn.(%)=   23.00
 ----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .02           .05
     Dep. Storage     (mm)=       1.00          4.00
     Average Slope     (%)=       3.00         20.00
     Length            (m)=       5.00          5.00
     Mannings n          =        .015          .250

     Max.eff.Inten.(mm/hr)=      67.49         12.89
                over (min)        1.00          3.00
     Storage Coeff.  (min)=        .39 (ii)     2.69 (ii)
     Unit Hyd. Tpeak (min)=       1.00          3.00
     Unit Hyd. peak  (cms)=       1.57           .40
                                                            *TOTALS*
     PEAK FLOW       (cms)=        .00           .00           .005 (iii)
     TIME TO PEAK    (hrs)=       1.12          1.18          1.167
     RUNOFF VOLUME    (mm)=      28.15          4.72         10.107
     TOTAL RAINFALL   (mm)=      29.15         29.15         29.146
     RUNOFF COEFFICIENT   =        .97           .16           .347

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 -------------------------------------------------------------------------------
 002:0010-----------------------------------------------------------------------
 *#*************************************************************************|
 ------------------------
 | ADD HYD (200 SERIES) | ID: NHYD         AREA      QPEAK    TPEAK   R.V.     DWF
 ------------------------                    (ha)      (cms)    (hrs)   (mm)    (cms)
                     ID1 07:SWM200          .38       .014     1.18  22.49     .000
                    +ID2 08:OVF             .00       .000      .00    .00     .000
                    +ID3 09:203             .07       .005     1.17  10.11     .000
                     ===========================================================
                     SUM 10:200 SERIES      .45       .018     1.17  20.56     .000

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

 -------------------------------------------------------------------------------
 002:0011-----------------------------------------------------------------------
 *#*************************************************************************|
 *#*************************************************************************|
 * RUN REMAINING DESIGN STORMS (GRIMSBY 5 TO 100-YR)
 *
   ** END OF RUN :    4

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





 --------------------
 | START              |  Project  dir.: T:\projects\20007\SWMHYMO\
 --------------------    Rainfall dir.: T:\projects\20007\SWMHYMO\
     TZERO =   .00 hrs on       0
     METOUT=   2 (output = METRIC)
     NRUN  = 005
     NSTORM=   1
            #  1=GRIM3005.stm
 -------------------------------------------------------------------------------
 005:0002-----------------------------------------------------------------------
 *#*************************************************************************|
 *#  Project Name: 141-149 MAIN STREET EAST
 *#                GRIMSBY, ONTARIO
 *#  JOB NUMBER  : 20007
 *#       Date   : MAY 2020
 *#    Revised   :
 *#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
 *#       File   : 20007.DAT
 *#*************************************************************************|
 *
 -------------------------------------------------------------------------------
 005:0002-----------------------------------------------------------------------
 *
 --------------------
 | READ STORM         |    Filename: 5YR EVENT A=785.59, B=6, C=0.790
 | Ptotal=  37.96 mm|      Comments: 5YR EVENT A=785.59, B=6, C=0.790
 --------------------
               TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
                hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
                .17   3.408 |   1.00  22.854 |   1.83   7.376 |   2.67   3.560
                .33   4.024 |   1.17  87.890 |   2.00   6.010 |   2.83   3.248
                .50   4.957 |   1.33  27.593 |   2.17   5.097 |   3.00   2.991
                .67   6.552 |   1.50  14.182 |   2.33   4.441 |
                .83   9.957 |   1.67   9.647 |   2.50   3.947 |

 -------------------------------------------------------------------------------
 005:0003-----------------------------------------------------------------------
 *
 *#*************************************************************************|
 *#
 *#     ALLOWABLE DISCHARGE RATE HYDROLOGIC MODELING (FOR 5-YEAR EVENT ONLY)
 *#     ===================================================================
 *#
 *#*************************************************************************|
 *# ALLOCATED DISCHARGE TO WENTWORTH DRIVE 600mm STORM SEWER (EAST)
 *
 ----------------------
 | CALIB STANDHYD      |   Area    (ha)=     .39
 | 01:EAST   DT= 1.00  |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
 ----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .12           .27
     Dep. Storage     (mm)=       1.00          4.00
     Average Slope     (%)=       2.50          2.50
     Length            (m)=      15.00         10.00
     Mannings n          =        .015          .250

     Max.eff.Inten.(mm/hr)=      87.89         19.78
                over (min)        1.00          6.00
     Storage Coeff.  (min)=        .71 (ii)     6.21 (ii)
     Unit Hyd. Tpeak (min)=       1.00          6.00
     Unit Hyd. peak  (cms)=       1.28           .18
                                                            *TOTALS*
     PEAK FLOW       (cms)=        .03           .01           .037 (iii)
     TIME TO PEAK    (hrs)=       1.15          1.23          1.167
     RUNOFF VOLUME    (mm)=      36.96          8.07         16.738
     TOTAL RAINFALL   (mm)=      37.96         37.96         37.956
     RUNOFF COEFFICIENT   =        .97           .21           .441

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 -------------------------------------------------------------------------------
 005:0004-----------------------------------------------------------------------
 *#*************************************************************************|
 *#
 *#       POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
 *#       ===============================================
 *#
 *#*************************************************************************|
 *# CATCHMENT AREA 201 - CONTROLLED DISCHARGE - ROOF DRAINS
 *
 ----------------------
 | CALIB STANDHYD      |   Area    (ha)=     .17
 | 02:201    DT= 1.00  |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
 ----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .17           .00
     Dep. Storage     (mm)=       1.00          4.00
     Average Slope     (%)=       1.00          2.00
     Length            (m)=      15.00          1.00
     Mannings n          =        .015          .250

     Max.eff.Inten.(mm/hr)=      87.89         22.97
                over (min)        1.00          2.00
     Storage Coeff.  (min)=        .94 (ii)     2.33 (ii)
     Unit Hyd. Tpeak (min)=       1.00          2.00
     Unit Hyd. peak  (cms)=       1.11           .51
                                                            *TOTALS*
     PEAK FLOW       (cms)=        .04           .00           .041 (iii)
     TIME TO PEAK    (hrs)=       1.17          1.17          1.167
     RUNOFF VOLUME    (mm)=      36.96          8.07         36.667
     TOTAL RAINFALL   (mm)=      37.96         37.96         37.956
     RUNOFF COEFFICIENT   =        .97           .21           .966

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

 -------------------------------------------------------------------------------
 005:0005-----------------------------------------------------------------------
 **#*************************************************************************|
 *# ROUTE CATCHMENT 201 THROUGH CONTROLLED-FLOW ROOF DRAINS
 *#
 ---------------------
 | ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
 |  IN>02:(201   )    |
 | OUT<03:(SWM201)    |    =========  OUTLFOW STORAGE TABLE  =========
 ---------------------     OUTFLOW     STORAGE   |   OUTFLOW     STORAGE
                             (cms)     (ha.m.)   |     (cms)     (ha.m.)
                              .000  .0000E+00    |      .006  .1020E-01
                              .003  .5100E-02    |      .009  .1530E-01

     ROUTING RESULTS               AREA      QPEAK      TPEAK         R.V.
     --------------------          (ha)      (cms)      (hrs)         (mm)
     INFLOW >02: (201    )          .17       .041      1.167       36.667
     OUTFLOW<03: (SWM201)           .17       .003      2.000       36.666
    OVERFLOW<04: (OVF    )          .00       .000       .000         .000

                   TOTAL NUMBER OF SIMULATED OVERFLOWS  =          0
                   CUMULATIVE TIME OF OVERFLOWS  (hours)=        .00
                   PERCENTAGE OF TIME OVERFLOWING     (%)=        .00
```

East Outlet to Wentworth Drive

```
                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=    6.640
                    TIME SHIFT OF PEAK FLOW          (min)=    50.00
                    MAXIMUM  STORAGE   USED        (ha.m.)=.4649E-02

--------------------------------------------------------------------------------
005:0006------------------------------------------------------------------------
**#****************************************************************************|
*# CATCHMENT AREA 202 - CONTROLLED PARKING LOT/LANDSCAPE DISCHARGE
*
----------------------
| CALIB STANDHYD      |    Area     (ha)=      .21
| 05:202     DT= 1.00 |    Total Imp(%)=    57.00   Dir. Conn.(%)=    57.00
----------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area      (ha)=       .12          .09
     Dep. Storage      (mm)=      1.00         4.00
     Average Slope      (%)=      2.50         2.50
     Length             (m)=     15.00        10.00
     Mannings n            =      .015         .250

     Max.eff.Inten.(mm/hr)=      87.89        19.78
               over (min)       1.00         6.00
     Storage Coeff.  (min)=       .71 (ii)     6.21 (ii)
     Unit Hyd. Tpeak (min)=      1.00         6.00
     Unit Hyd. peak  (cms)=      1.28          .18
                                                        *TOTALS*
     PEAK FLOW        (cms)=       .03          .00          .032 (iii)
     TIME TO PEAK     (hrs)=      1.15         1.23         1.167
     RUNOFF VOLUME     (mm)=     36.96         8.07        24.536
     TOTAL RAINFALL    (mm)=     37.96        37.96        37.956
     RUNOFF COEFFICIENT   =       .97          .21          .646

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  70.0     Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
005:0007------------------------------------------------------------------------
*#****************************************************************************|
------------------------
| ADD HYD (201+202    ) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
                    ID1 03:SWM201           .17      .003    2.00  36.67    .000
                   +ID2 04:OVF              .00      .000     .00    .00    .000
                   +ID3 05:202              .21      .032    1.17  24.54    .000
                    ===========================================================
                    SUM 06:201+202          .38      .034    1.17  29.96    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
005:0008------------------------------------------------------------------------
*#****************************************************************************|
*# ROUTE CATCHMENT 201 & 202 THROUGH ORIFICE SYSTEM
*#
---------------------
| ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
|  IN>06:(201+20)    |
| OUT<07:(SWM200)    |    =========  OUTLFOW STORAGE TABLE  =========
---------------------     OUTFLOW    STORAGE   |   OUTFLOW    STORAGE
                            (cms)    (ha.m.)   |    (cms)     (ha.m.)
                             .000  .0000E+00   |     .019  .1600E-02
                             .008  .0000E+00   |     .022  .2400E-02
                             .014  .8000E-03   |     .025  .3200E-02

     ROUTING RESULTS               AREA     QPEAK     TPEAK        R.V.
     --------------------          (ha)     (cms)     (hrs)        (mm)
     INFLOW >06: (201+20)           .38      .034     1.167      29.963
     OUTFLOW<07: (SWM200)           .38      .016     1.200      29.970
   OVERFLOW<08: (OVF   )            .00      .000      .000        .000

                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =          0
                    CUMULATIVE TIME OF OVERFLOWS  (hours)=        .00
                    PERCENTAGE OF TIME OVERFLOWING    (%)=        .00


                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=   47.978
                    TIME SHIFT OF PEAK FLOW          (min)=     2.00
                    MAXIMUM  STORAGE   USED        (ha.m.)=.1147E-02

--------------------------------------------------------------------------------
005:0009------------------------------------------------------------------------
**#****************************************************************************|
*# CATCHMENT AREA 203 - UNCONTROLLED RUNOFF TO WENTWORTH DRIVE RIGHT-OF-WAY
*
----------------------
| CALIB STANDHYD      |    Area     (ha)=      .07
| 09:203     DT= 1.00 |    Total Imp(%)=    23.00   Dir. Conn.(%)=    23.00
----------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area      (ha)=       .02          .05
     Dep. Storage      (mm)=      1.00         4.00
     Average Slope      (%)=      3.00        20.00
     Length             (m)=      5.00         5.00
     Mannings n            =      .015         .250

     Max.eff.Inten.(mm/hr)=      87.89        22.97
               over (min)       1.00         2.00
     Storage Coeff.  (min)=       .35 (ii)     2.18 (ii)
     Unit Hyd. Tpeak (min)=      1.00         2.00
     Unit Hyd. peak  (cms)=      1.60          .53
                                                        *TOTALS*
     PEAK FLOW        (cms)=       .00          .00          .007 (iii)
     TIME TO PEAK     (hrs)=      1.08         1.17         1.167
     RUNOFF VOLUME     (mm)=     36.96         8.07        14.716
     TOTAL RAINFALL    (mm)=     37.96        37.96        37.956
     RUNOFF COEFFICIENT   =       .97          .21          .388

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  70.0     Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
005:0010------------------------------------------------------------------------
*#****************************************************************************|
------------------------
```

```
| ADD HYD (200 SERIES) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
                    ID1 07:SWM200           .38      .016    1.20  29.97    .000
                   +ID2 08:OVF              .00      .000     .00    .00    .000
                   +ID3 09:203              .07      .007    1.17  14.72    .000
                    ===========================================================
                    SUM 10:200 SERIES       .45      .023    1.17  27.60    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
005:0011------------------------------------------------------------------------
*#****************************************************************************|
*#****************************************************************************|
* RUN REMAINING DESIGN STORMS (GRIMSBY 5 TO 100-YR)
*
--------------------------------------------------------------------------------
005:0002------------------------------------------------------------------------
*
  ** END OF RUN :   9

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




--------------------
| START              |  Project  dir.: T:\projects\20007\SWMHYMO\
--------------------   Rainfall dir.: T:\projects\20007\SWMHYMO\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 010
    NSTORM=   1
           #  1=GRIM3010.stm
--------------------------------------------------------------------------------
010:0002------------------------------------------------------------------------
*#****************************************************************************|
*#  Project Name: 141-149 MAIN STREET EAST
*#                  GRIMSBY, ONTARIO
*#  JOB NUMBER  : 20007
*#       Date   : MAY 2020
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 20007.DAT
*#****************************************************************************|
*
--------------------------------------------------------------------------------
010:0002------------------------------------------------------------------------
*
--------------------
| READ STORM         |    Filename: 10YR EVENT A=953.64, B=7, C=0.790
| Ptotal=  45.88 mm|     Comments: 10YR EVENT A=953.64, B=7, C=0.790
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .17   4.198 |   1.00  28.390 |   1.83   9.175 |   2.67   4.387
               .33   4.967 |   1.17 101.702 |   2.00   7.457 |   2.83   3.998
               .50   6.135 |   1.33  34.205 |   2.17   6.310 |   3.00   3.679
               .67   8.139 |   1.50  17.722 |   2.33   5.489 |
               .83  12.422 |   1.67  12.033 |   2.50   4.870 |

--------------------------------------------------------------------------------
010:0003------------------------------------------------------------------------
*
*#****************************************************************************|
*#
*#     ALLOWABLE DISCHARGE RATE HYDROLOGIC MODELING (FOR 5-YEAR EVENT ONLY)
*#     ===================================================================
*#
*#****************************************************************************|
*# ALLOCATED DISCHARGE TO WENTWORTH DRIVE 600mm STORM SEWER (EAST)
*
----------------------
| CALIB STANDHYD      |    Area     (ha)=      .39
| 01:EAST    DT= 1.00 |    Total Imp(%)=    30.00   Dir. Conn.(%)=    30.00
----------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area      (ha)=       .12          .27
     Dep. Storage      (mm)=      1.00         4.00
     Average Slope      (%)=      2.50         2.50
     Length             (m)=     15.00        10.00
     Mannings n            =      .015         .250

     Max.eff.Inten.(mm/hr)=     101.70        28.38
               over (min)       1.00         5.00
     Storage Coeff.  (min)=       .67 (ii)     5.43 (ii)
     Unit Hyd. Tpeak (min)=      1.00         5.00
     Unit Hyd. peak  (cms)=      1.31          .21
                                                        *TOTALS*
     PEAK FLOW        (cms)=       .03          .02          .046 (iii)
     TIME TO PEAK     (hrs)=      1.15         1.22         1.167
     RUNOFF VOLUME     (mm)=     44.88        11.64        21.609
     TOTAL RAINFALL    (mm)=     45.88        45.88        45.880
     RUNOFF COEFFICIENT   =       .98          .25          .471

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  70.0     Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
010:0004------------------------------------------------------------------------
*#****************************************************************************|
*#
*#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ===============================================
*#
*#****************************************************************************|
*# CATCHMENT AREA 201 - CONTROLLED DISCHARGE - ROOF DRAINS
*
----------------------
| CALIB STANDHYD      |    Area     (ha)=      .17
| 02:201     DT= 1.00 |    Total Imp(%)=    99.00   Dir. Conn.(%)=    99.00
----------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area      (ha)=       .17          .00
     Dep. Storage      (mm)=      1.00         4.00
     Average Slope      (%)=      1.00         2.00
     Length             (m)=     15.00         1.00
     Mannings n            =      .015         .250
```

```
     Max.eff.Inten.(mm/hr)=     101.70        31.27
                over (min)        1.00         2.00
     Storage Coeff.  (min)=        .89 (ii)    2.11 (ii)
     Unit Hyd. Tpeak (min)=       1.00         2.00
     Unit Hyd. peak  (cms)=       1.15          .54
                                                             *TOTALS*
     PEAK FLOW       (cms)=        .05          .00            .048 (iii)
     TIME TO PEAK    (hrs)=       1.17         1.17           1.167
     RUNOFF VOLUME    (mm)=      44.88        11.64          44.547
     TOTAL RAINFALL   (mm)=      45.88        45.88          45.880
     RUNOFF COEFFICIENT   =        .98          .25            .971

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
010:0005------------------------------------------------------------------------
**#*************************************************************************|
*# ROUTE CATCHMENT 201 THROUGH CONTROLLED-FLOW ROOF DRAINS
*#
---------------------
| ROUTE RESERVOIR  |      Requested routing time step =  1.0 min.
|  IN>02:(201    ) |
| OUT<03:(SWM201)  |      =========  OUTLFOW STORAGE TABLE  =========
---------------------      OUTFLOW    STORAGE  |  OUTFLOW    STORAGE
                            (cms)     (ha.m.)  |   (cms)     (ha.m.)
                             .000  .0000E+00   |    .006  .1020E-01
                             .003  .5100E-02   |    .009  .1530E-01

     ROUTING RESULTS            AREA     QPEAK     TPEAK        R.V.
     --------------------       (ha)     (cms)     (hrs)        (mm)
     INFLOW >02: (201    )      .17      .048     1.167      44.547
     OUTFLOW<03: (SWM201)       .17      .003     2.000      44.546
    OVERFLOW<04: (OVF    )      .00      .000      .000        .000

                   TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                   CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                   PERCENTAGE OF TIME OVERFLOWING    (%)=      .00


                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=    6.970
                   TIME SHIFT OF PEAK FLOW          (min)=   50.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.5632E-02

--------------------------------------------------------------------------------
010:0006------------------------------------------------------------------------
**#*************************************************************************|
*# CATCHMENT AREA 202 - CONTROLLED PARKING LOT/LANDSCAPE DISCHARGE
*
----------------------
| CALIB STANDHYD     |    Area    (ha)=     .21
| 05:202    DT= 1.00 |    Total Imp(%)=   57.00   Dir. Conn.(%)=   57.00
----------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .12          .09
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       2.50         2.50
     Length            (m)=      15.00        10.00
     Mannings n           =       .015         .250

     Max.eff.Inten.(mm/hr)=     101.70        28.38
                over (min)        1.00         5.00
     Storage Coeff.  (min)=        .67 (ii)    5.43 (ii)
     Unit Hyd. Tpeak (min)=       1.00         5.00
     Unit Hyd. peak  (cms)=       1.31          .21
                                                             *TOTALS*
     PEAK FLOW       (cms)=        .03          .01            .038 (iii)
     TIME TO PEAK    (hrs)=       1.15         1.22           1.167
     RUNOFF VOLUME    (mm)=      44.88        11.64          30.585
     TOTAL RAINFALL   (mm)=      45.88        45.88          45.880
     RUNOFF COEFFICIENT   =        .98          .25            .667

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
010:0007------------------------------------------------------------------------
*#*************************************************************************|
------------------------
| ADD HYD (201+202   ) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.     DWF
------------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
                    ID1 03:SWM201           .17      .003    2.00  44.55    .000
                   +ID2 04:OVF              .00      .000     .00    .00    .000
                   +ID3 05:202              .21      .038    1.17  30.58    .000
                    ============================================================
                    SUM 06:201+202          .38      .041    1.17  36.83    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
010:0008------------------------------------------------------------------------
*#*************************************************************************|
*# ROUTE CATCHMENT 201 & 202 THROUGH ORIFICE SYSTEM
*#
---------------------
| ROUTE RESERVOIR  |      Requested routing time step =  1.0 min.
|  IN>06:(201+20)  |
| OUT<07:(SWM200)  |      =========  OUTLFOW STORAGE TABLE  =========
---------------------      OUTFLOW    STORAGE  |  OUTFLOW    STORAGE
                            (cms)     (ha.m.)  |   (cms)     (ha.m.)
                             .000  .0000E+00   |    .019  .1600E-02
                             .008  .0000E+00   |    .022  .2400E-02
                             .014  .8000E-03   |    .025  .3200E-02

     ROUTING RESULTS            AREA     QPEAK     TPEAK        R.V.
     --------------------       (ha)     (cms)     (hrs)        (mm)
     INFLOW >06: (201+20)       .38      .041     1.167      36.831
     OUTFLOW<07: (SWM200)       .38      .018     1.267      36.848
    OVERFLOW<08: (OVF    )      .00      .000      .000        .000

                   TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                   CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                   PERCENTAGE OF TIME OVERFLOWING    (%)=      .00
```

```
                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   45.313
                   TIME SHIFT OF PEAK FLOW          (min)=    6.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.1546E-02

--------------------------------------------------------------------------------
010:0009------------------------------------------------------------------------
**#*************************************************************************|
*# CATCHMENT AREA 203 - UNCONTROLLED RUNOFF TO WENTWORTH DRIVE RIGHT-OF-WAY
*
----------------------
| CALIB STANDHYD     |    Area    (ha)=     .07
| 09:203    DT= 1.00 |    Total Imp(%)=   23.00   Dir. Conn.(%)=   23.00
----------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .02          .05
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       3.00        20.00
     Length            (m)=       5.00         5.00
     Mannings n           =       .015         .250

     Max.eff.Inten.(mm/hr)=     101.70        31.27
                over (min)        1.00         2.00
     Storage Coeff.  (min)=        .33 (ii)    1.95 (ii)
     Unit Hyd. Tpeak (min)=       1.00         2.00
     Unit Hyd. peak  (cms)=       1.62          .57
                                                             *TOTALS*
     PEAK FLOW       (cms)=        .00          .00            .009 (iii)
     TIME TO PEAK    (hrs)=       1.08         1.17           1.167
     RUNOFF VOLUME    (mm)=      44.88        11.64          19.282
     TOTAL RAINFALL   (mm)=      45.88        45.88          45.880
     RUNOFF COEFFICIENT   =        .98          .25            .420

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
010:0010------------------------------------------------------------------------
*#*************************************************************************|
------------------------
| ADD HYD (200 SERIES) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.     DWF
------------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
                    ID1 07:SWM200           .38      .018    1.27  36.85    .000
                   +ID2 08:OVF              .00      .000     .00    .00    .000
                   +ID3 09:203              .07      .009    1.17  19.28    .000
                    ============================================================
                    SUM 10:200 SERIES       .45      .027    1.17  34.12    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
010:0011------------------------------------------------------------------------
*#*************************************************************************|
*#*************************************************************************|
* RUN REMAINING DESIGN STORMS (GRIMSBY 5 TO 100-YR)
*
--------------------------------------------------------------------------------
010:0002------------------------------------------------------------------------
*
--------------------------------------------------------------------------------
010:0002------------------------------------------------------------------------
*
  ** END OF RUN :  24

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





--------------------
| START            |  Project  dir.: T:\projects\20007\SWMHYMO\
--------------------  Rainfall dir.: T:\projects\20007\SWMHYMO\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 025
    NSTORM=   1
           #  1=GRIM3025.stm
--------------------------------------------------------------------------------
025:0002------------------------------------------------------------------------
*#*************************************************************************|
*#  Project Name: 141-149 MAIN STREET EAST
*#                     GRIMSBY, ONTARIO
*#  JOB NUMBER  : 20007
*#       Date   : MAY 2020
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 20007.DAT
*#*************************************************************************|
*
--------------------------------------------------------------------------------
025:0002------------------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: 25YR EVENT A=1119.2, B=7, C=0.790
| Ptotal=  53.84 mm|    Comments: 25YR EVENT A=1119.2, B=7, C=0.790
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .17   4.926 |   1.00  33.313 |   1.83  10.766 |   2.67   5.148
               .33   5.829 |   1.17 119.339 |   2.00   8.751 |   2.83   4.692
               .50   7.199 |   1.33  40.137 |   2.17   7.405 |   3.00   4.317
               .67   9.550 |   1.50  20.795 |   2.33   6.440 |
               .83  14.577 |   1.67  14.120 |   2.50   5.715 |

--------------------------------------------------------------------------------
025:0003------------------------------------------------------------------------
*
*#*************************************************************************|
*#
*#     ALLOWABLE DISCHARGE RATE HYDROLOGIC MODELING (FOR 5-YEAR EVENT ONLY)
*#     ===================================================================
*#
*#*************************************************************************|
*# ALLOCATED DISCHARGE TO WENTWORTH DRIVE 600mm STORM SEWER (EAST)
*
----------------------
| CALIB STANDHYD     |    Area    (ha)=     .39
| 01:EAST   DT= 1.00 |    Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
----------------------
```

```
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .12          .27
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       2.50         2.50
     Length            (m)=      15.00        10.00
     Mannings n           =       .015         .250

     Max.eff.Inten.(mm/hr)=     119.34        38.48
               over (min)       1.00         5.00
     Storage Coeff.  (min)=        .63 (ii)     4.84 (ii)
     Unit Hyd. Tpeak (min)=       1.00         5.00
     Unit Hyd. peak  (cms)=       1.35          .23
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .04          .02          .058 (iii)
     TIME TO PEAK    (hrs)=       1.15         1.20         1.167
     RUNOFF VOLUME    (mm)=      52.84        15.65        26.806
     TOTAL RAINFALL   (mm)=      53.84        53.84        53.836
     RUNOFF COEFFICIENT   =        .98          .29          .498

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
025:0004------------------------------------------------------------------------
*#*************************************************************************|
*#
*#         POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#         ===============================================
*#
*#*************************************************************************|
*# CATCHMENT AREA 201 - CONTROLLED DISCHARGE - ROOF DRAINS
*
----------------------
| CALIB STANDHYD      |   Area    (ha)=     .17
| 02:201    DT= 1.00  |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .17          .00
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      15.00         1.00
     Mannings n           =       .015         .250

     Max.eff.Inten.(mm/hr)=     119.34        42.10
               over (min)       1.00         2.00
     Storage Coeff.  (min)=        .83 (ii)     1.92 (ii)
     Unit Hyd. Tpeak (min)=       1.00         2.00
     Unit Hyd. peak  (cms)=       1.19          .57
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .06          .00          .056 (iii)
     TIME TO PEAK    (hrs)=       1.17         1.17         1.167
     RUNOFF VOLUME    (mm)=      52.84        15.65        52.464
     TOTAL RAINFALL   (mm)=      53.84        53.84        53.836
     RUNOFF COEFFICIENT   =        .98          .29          .975

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
025:0005------------------------------------------------------------------------
**#************************************************************************|
*# ROUTE CATCHMENT 201 THROUGH CONTROLLED-FLOW ROOF DRAINS
*#
---------------------
| ROUTE RESERVOIR    |     Requested routing time step =  1.0 min.
|  IN>02:(201   )    |
| OUT<03:(SWM201)    |     =========  OUTLFOW STORAGE TABLE  =========
---------------------      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                            (cms)     (ha.m.)   |   (cms)     (ha.m.)
                             .000  .0000E+00    |    .006  .1020E-01
                             .003  .5100E-02    |    .009  .1530E-01

     ROUTING RESULTS              AREA     QPEAK      TPEAK        R.V.
     --------------------         (ha)     (cms)      (hrs)        (mm)
     INFLOW >02: (201   )          .17      .056      1.167      52.464
     OUTFLOW<03: (SWM201)          .17      .004      2.000      52.463
    OVERFLOW<04: (OVF   )          .00      .000       .000        .000

                   TOTAL NUMBER OF SIMULATED OVERFLOWS  =         0
                   CUMULATIVE TIME OF OVERFLOWS  (hours)=       .00
                   PERCENTAGE OF TIME OVERFLOWING    (%)=       .00


                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=     7.018
                   TIME SHIFT OF PEAK FLOW          (min)=    50.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.6627E-02

--------------------------------------------------------------------------------
025:0006------------------------------------------------------------------------
**#************************************************************************|
*# CATCHMENT AREA 202 - CONTROLLED PARKING LOT/LANDSCAPE DISCHARGE
*
----------------------
| CALIB STANDHYD      |   Area    (ha)=     .21
| 05:202    DT= 1.00  |   Total Imp(%)=   57.00   Dir. Conn.(%)=   57.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .12          .09
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       2.50         2.50
     Length            (m)=      15.00        10.00
     Mannings n           =       .015         .250

     Max.eff.Inten.(mm/hr)=     119.34        38.48
               over (min)       1.00         5.00
     Storage Coeff.  (min)=        .63 (ii)     4.84 (ii)
     Unit Hyd. Tpeak (min)=       1.00         5.00
     Unit Hyd. peak  (cms)=       1.35          .23
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .04          .01          .046 (iii)
     TIME TO PEAK    (hrs)=       1.15         1.20         1.167
     RUNOFF VOLUME    (mm)=      52.84        15.65        36.846
     TOTAL RAINFALL   (mm)=      53.84        53.84        53.836
     RUNOFF COEFFICIENT   =        .98          .29          .684

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
```

```
           CN* =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
025:0007------------------------------------------------------------------------
*#*************************************************************************|
------------------------
| ADD HYD (201+202   ) | ID: NHYD          AREA     QPEAK    TPEAK   R.V.    DWF
------------------------                    (ha)     (cms)    (hrs)   (mm)   (cms)
                     ID1 03:SWM201           .17      .004     2.00  52.46    .000
                    +ID2 04:OVF              .00      .000      .00    .00    .000
                    +ID3 05:202              .21      .046     1.17  36.85    .000
                     ===========================================================
                     SUM 06:201+202          .38      .049     1.17  43.83    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
025:0008------------------------------------------------------------------------
*#*************************************************************************|
*# ROUTE CATCHMENT 201 & 202 THROUGH ORIFICE SYSTEM
*#
---------------------
| ROUTE RESERVOIR    |     Requested routing time step =  1.0 min.
|  IN>06:(201+20)    |
| OUT<07:(SWM200)    |     =========  OUTLFOW STORAGE TABLE  =========
---------------------      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                            (cms)     (ha.m.)   |   (cms)     (ha.m.)
                             .000  .0000E+00    |    .019  .1600E-02
                             .008  .0000E+00    |    .022  .2400E-02
                             .014  .8000E-03    |    .025  .3200E-02

     ROUTING RESULTS              AREA     QPEAK      TPEAK        R.V.
     --------------------         (ha)     (cms)      (hrs)        (mm)
     INFLOW >06: (201+20)          .38      .049      1.167      43.833
     OUTFLOW<07: (SWM200)          .38      .021      1.333      43.836
    OVERFLOW<08: (OVF   )          .00      .000       .000        .000

                   TOTAL NUMBER OF SIMULATED OVERFLOWS  =         0
                   CUMULATIVE TIME OF OVERFLOWS  (hours)=       .00
                   PERCENTAGE OF TIME OVERFLOWING    (%)=       .00


                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=    42.574
                   TIME SHIFT OF PEAK FLOW          (min)=    10.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.2090E-02

--------------------------------------------------------------------------------
025:0009------------------------------------------------------------------------
**#************************************************************************|
*# CATCHMENT AREA 203 - UNCONTROLLED RUNOFF TO WENTWORTH DRIVE RIGHT-OF-WAY
*
----------------------
| CALIB STANDHYD      |   Area    (ha)=     .07
| 09:203    DT= 1.00  |   Total Imp(%)=   23.00   Dir. Conn.(%)=   23.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .02          .05
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       3.00        20.00
     Length            (m)=       5.00         5.00
     Mannings n           =       .015         .250

     Max.eff.Inten.(mm/hr)=     119.34        42.10
               over (min)       1.00         2.00
     Storage Coeff.  (min)=        .31 (ii)     1.74 (ii)
     Unit Hyd. Tpeak (min)=       1.00         2.00
     Unit Hyd. peak  (cms)=       1.63          .61
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .01          .01          .011 (iii)
     TIME TO PEAK    (hrs)=       1.07         1.17         1.167
     RUNOFF VOLUME    (mm)=      52.84        15.65        24.203
     TOTAL RAINFALL   (mm)=      53.84        53.84        53.836
     RUNOFF COEFFICIENT   =        .98          .29          .450

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
025:0010------------------------------------------------------------------------
*#*************************************************************************|
------------------------
| ADD HYD (200 SERIES) | ID: NHYD          AREA     QPEAK    TPEAK   R.V.    DWF
------------------------                    (ha)     (cms)    (hrs)   (mm)   (cms)
                     ID1 07:SWM200           .38      .021     1.33  43.84    .000
                    +ID2 08:OVF              .00      .000      .00    .00    .000
                    +ID3 09:203              .07      .011     1.17  24.20    .000
                     ===========================================================
                     SUM 10:200 SERIES       .45      .031     1.17  40.78    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
025:0011------------------------------------------------------------------------
*#*************************************************************************|
*#*************************************************************************|
* RUN REMAINING DESIGN STORMS (GRIMSBY 5 TO 100-YR)
*
--------------------------------------------------------------------------------
025:0002------------------------------------------------------------------------
--------------------------------------------------------------------------------
025:0002------------------------------------------------------------------------
*
--------------------------------------------------------------------------------
025:0002------------------------------------------------------------------------
*
  ** END OF RUN :  49

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





--------------------
| START             |   Project  dir.: T:\projects\20007\SWMHYMO\
```

East Outlet to Wentworth Drive

```
--------------------  Rainfall dir.: T:\projects\20007\SWMHYMO\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 050
    NSTORM=   1
           #  1=GRIM3050.stm
--------------------------------------------------------------------------------
050:0002------------------------------------------------------------------------
*#*************************************************************************|
*#  Project Name: 141-149 MAIN STREET EAST
*#                GRIMSBY, ONTARIO
*#  JOB NUMBER  : 20007
*#       Date   : MAY 2020
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 20007.DAT
*#*************************************************************************|
*
--------------------------------------------------------------------------------
050:0002------------------------------------------------------------------------
*
--------------------
| READ STORM        |     Filename: 50YR EVENT A=1301.80, B=8, C=0.800
| Ptotal=  59.18 mm|     Comments: 50YR EVENT A=1301.80, B=8, C=0.800
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .17   5.313 |   1.00  37.542 |   1.83  11.899 |   2.67   5.558
               .33   6.319 |   1.17 128.922 |   2.00   9.610 |   2.83   5.052
               .50   7.857 |   1.33  45.256 |   2.17   8.088 |   3.00   4.636
               .67  10.517 |   1.50  23.366 |   2.33   7.004 |
               .83  16.251 |   1.67  15.728 |   2.50   6.191 |

--------------------------------------------------------------------------------
050:0003------------------------------------------------------------------------
*
*#*************************************************************************|
*#
*#     ALLOWABLE DISCHARGE RATE HYDROLOGIC MODELING (FOR 5-YEAR EVENT ONLY)
*#     ===================================================================
*#
*#*************************************************************************|
*# ALLOCATED DISCHARGE TO WENTWORTH DRIVE 600mm STORM SEWER (EAST)
*
----------------------
| CALIB STANDHYD      |   Area    (ha)=     .39
| 01:EAST   DT= 1.00  |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .12          .27
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       2.50         2.50
     Length            (m)=      15.00        10.00
     Mannings n          =        .015         .250

     Max.eff.Inten.(mm/hr)=     128.92        44.89
               over (min)       1.00         5.00
     Storage Coeff.  (min)=        .61 (ii)     4.57 (ii)
     Unit Hyd. Tpeak (min)=       1.00         5.00
     Unit Hyd. peak  (cms)=       1.37          .24
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .04          .03          .065 (iii)
     TIME TO PEAK    (hrs)=       1.15         1.20         1.167
     RUNOFF VOLUME    (mm)=      58.18        18.56        30.451
     TOTAL RAINFALL   (mm)=      59.18        59.18        59.185
     RUNOFF COEFFICIENT   =        .98          .31          .515

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
050:0004------------------------------------------------------------------------
*#*************************************************************************|
*#
*#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ===============================================
*#
*#*************************************************************************|
*# CATCHMENT AREA 201 - CONTROLLED DISCHARGE - ROOF DRAINS
*
----------------------
| CALIB STANDHYD      |   Area    (ha)=     .17
| 02:201    DT= 1.00  |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .17          .00
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      15.00         1.00
     Mannings n          =        .015         .250

     Max.eff.Inten.(mm/hr)=     128.92        48.87
               over (min)       1.00         2.00
     Storage Coeff.  (min)=        .81 (ii)     1.83 (ii)
     Unit Hyd. Tpeak (min)=       1.00         2.00
     Unit Hyd. peak  (cms)=       1.21          .59
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .06          .00          .060 (iii)
     TIME TO PEAK    (hrs)=       1.17         1.17         1.167
     RUNOFF VOLUME    (mm)=      58.18        18.56        57.788
     TOTAL RAINFALL   (mm)=      59.18        59.18        59.185
     RUNOFF COEFFICIENT   =        .98          .31          .976

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
050:0005------------------------------------------------------------------------
**#************************************************************************|
*# ROUTE CATCHMENT 201 THROUGH CONTROLLED-FLOW ROOF DRAINS
*#
---------------------
| ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
|  IN>02:(201   )    |
| OUT<03:(SWM201)    |    =========  OUTLFOW STORAGE TABLE  =========
---------------------     OUTFLOW    STORAGE  |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)  |    (cms)    (ha.m.)
                            .000  .0000E+00   |     .006  .1020E-01
                            .003  .5100E-02   |     .009  .1530E-01

     ROUTING RESULTS             AREA      QPEAK      TPEAK         R.V.
     --------------------        (ha)      (cms)      (hrs)         (mm)
     INFLOW >02: (201    )        .17       .060      1.167       57.788
     OUTFLOW<03: (SWM201)         .17       .004      2.000       57.787
    OVERFLOW<04: (OVF    )        .00       .000       .000         .000

                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =          0
                    CUMULATIVE TIME OF OVERFLOWS  (hours)=        .00
                    PERCENTAGE OF TIME OVERFLOWING    (%)=        .00


                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=     7.181
                    TIME SHIFT OF PEAK FLOW         (min)=     50.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=.7310E-02

--------------------------------------------------------------------------------
050:0006------------------------------------------------------------------------
**#************************************************************************|
*# CATCHMENT AREA 202 - CONTROLLED PARKING LOT/LANDSCAPE DISCHARGE
*
----------------------
| CALIB STANDHYD      |   Area    (ha)=     .21
| 05:202    DT= 1.00  |   Total Imp(%)=   57.00   Dir. Conn.(%)=   57.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .12          .09
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       2.50         2.50
     Length            (m)=      15.00        10.00
     Mannings n          =        .015         .250

     Max.eff.Inten.(mm/hr)=     128.92        44.89
               over (min)       1.00         5.00
     Storage Coeff.  (min)=        .61 (ii)     4.57 (ii)
     Unit Hyd. Tpeak (min)=       1.00         5.00
     Unit Hyd. peak  (cms)=       1.37          .24
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .04          .01          .051 (iii)
     TIME TO PEAK    (hrs)=       1.15         1.20         1.167
     RUNOFF VOLUME    (mm)=      58.18        18.56        41.148
     TOTAL RAINFALL   (mm)=      59.18        59.18        59.185
     RUNOFF COEFFICIENT   =        .98          .31          .695

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
050:0007------------------------------------------------------------------------
*#*************************************************************************|
------------------------
| ADD HYD (201+202    ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.     DWF
------------------------                   (ha)     (cms)   (hrs)   (mm)    (cms)
                      ID1 03:SWM201         .17      .004    2.00  57.79    .000
                     +ID2 04:OVF            .00      .000     .00    .00    .000
                     +ID3 05:202            .21      .051    1.17  41.15    .000
                      ==========================================================
                      SUM 06:201+202        .38      .054    1.17  48.59    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
050:0008------------------------------------------------------------------------
*#*************************************************************************|
*# ROUTE CATCHMENT 201 & 202 THROUGH ORIFICE SYSTEM
*#
---------------------
| ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
|  IN>06:(201+20)    |
| OUT<07:(SWM200)    |    =========  OUTLFOW STORAGE TABLE  =========
---------------------     OUTFLOW    STORAGE  |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)  |    (cms)    (ha.m.)
                            .000  .0000E+00   |     .019  .1600E-02
                            .008  .0000E+00   |     .022  .2400E-02
                            .014  .8000E-03   |     .025  .3200E-02

     ROUTING RESULTS             AREA      QPEAK      TPEAK         R.V.
     --------------------        (ha)      (cms)      (hrs)         (mm)
     INFLOW >06: (201+20)         .38       .054      1.167       48.592
     OUTFLOW<07: (SWM200)         .38       .022      1.333       48.599
    OVERFLOW<08: (OVF    )        .00       .000       .000         .000

                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =          0
                    CUMULATIVE TIME OF OVERFLOWS  (hours)=        .00
                    PERCENTAGE OF TIME OVERFLOWING    (%)=        .00


                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=    41.748
                    TIME SHIFT OF PEAK FLOW         (min)=     10.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=.2468E-02

--------------------------------------------------------------------------------
050:0009------------------------------------------------------------------------
**#************************************************************************|
*# CATCHMENT AREA 203 - UNCONTROLLED RUNOFF TO WENTWORTH DRIVE RIGHT-OF-WAY
*
----------------------
| CALIB STANDHYD      |   Area    (ha)=     .07
| 09:203    DT= 1.00  |   Total Imp(%)=   23.00   Dir. Conn.(%)=   23.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .02          .05
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       3.00        20.00
     Length            (m)=       5.00         5.00
     Mannings n          =        .015         .250

     Max.eff.Inten.(mm/hr)=     128.92        48.87
               over (min)       1.00         2.00
     Storage Coeff.  (min)=        .30 (ii)     1.65 (ii)
     Unit Hyd. Tpeak (min)=       1.00         2.00
     Unit Hyd. peak  (cms)=       1.64          .63
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .01          .01          .013 (iii)
     TIME TO PEAK    (hrs)=       1.07         1.17         1.167
     RUNOFF VOLUME    (mm)=      58.18        18.56        27.677
```

East Outlet to Wentworth Drive

```
     TOTAL RAINFALL   (mm)=      59.18        59.18         59.185
     RUNOFF COEFFICIENT   =        .98          .31           .468

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
050:0010------------------------------------------------------------------------
*#*************************************************************************|
------------------------
| ADD HYD (200 SERIES) |  ID: NHYD          AREA      QPEAK    TPEAK   R.V.    DWF
------------------------                    (ha)      (cms)    (hrs)   (mm)   (cms)
                     ID1 07:SWM200          .38       .022     1.33  48.60    .000
                    +ID2 08:OVF             .00       .000      .00    .00    .000
                    +ID3 09:203             .07       .013     1.17  27.68    .000
                     ==========================================================
                     SUM 10:200 SERIES      .45       .033     1.17  45.34    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
050:0011------------------------------------------------------------------------
*#*************************************************************************|
*#*************************************************************************|
* RUN REMAINING DESIGN STORMS (GRIMSBY 5 TO 100-YR)
*
--------------------------------------------------------------------------------
050:0002------------------------------------------------------------------------
*
--------------------------------------------------------------------------------
050:0002------------------------------------------------------------------------
*
--------------------------------------------------------------------------------
050:0002------------------------------------------------------------------------
*
--------------------------------------------------------------------------------
050:0002------------------------------------------------------------------------
*
  ** END OF RUN :  99

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




--------------------
| START            |  Project  dir.: T:\projects\20007\SWMHYMO\
--------------------  Rainfall dir.: T:\projects\20007\SWMHYMO\
   TZERO =   .00 hrs on       0
   METOUT=   2 (output = METRIC)
   NRUN  = 100
   NSTORM=   1
          #  1=GRIM3100.stm
--------------------------------------------------------------------------------
100:0002------------------------------------------------------------------------
*#*************************************************************************|
*#  Project Name: 141-149 MAIN STREET EAST
*#                GRIMSBY, ONTARIO
*#  JOB NUMBER  : 20007
*#       Date   : MAY 2020
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 20007.DAT
*#*************************************************************************|
*
--------------------------------------------------------------------------------
100:0002------------------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: 100YR EVENT A=1426.13, B=8, C=0.800
| Ptotal=  64.84 mm|    Comments: 100YR EVENT A=1426.13, B=8, C=0.800
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .17   5.820 |   1.00  41.127 |   1.83  13.035 |   2.67   6.089
               .33   6.922 |   1.17 141.235 |   2.00  10.527 |   2.83   5.534
               .50   8.608 |   1.33  49.578 |   2.17   8.861 |   3.00   5.079
               .67  11.522 |   1.50  25.597 |   2.33   7.673 |
               .83  17.803 |   1.67  17.230 |   2.50   6.782 |

--------------------------------------------------------------------------------
100:0003------------------------------------------------------------------------
*
*#*************************************************************************|
*#
*#     ALLOWABLE DISCHARGE RATE HYDROLOGIC MODELING (FOR 5-YEAR EVENT ONLY)
*#     ===================================================================
*#
*#*************************************************************************|
*# ALLOCATED DISCHARGE TO WENTWORTH DRIVE 600mm STORM SEWER (EAST)
*
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .39
| 01:EAST   DT= 1.00 |   Total Imp(%)=   30.00   Dir. Conn.(%)=   30.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .12          .27
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       2.50         2.50
     Length            (m)=      15.00        10.00
     Mannings n           =       .015         .250

     Max.eff.Inten.(mm/hr)=     141.23        54.50
               over (min)       1.00         4.00
     Storage Coeff.  (min)=        .59 (ii)     4.25 (ii)
     Unit Hyd. Tpeak (min)=       1.00         4.00
     Unit Hyd. peak  (cms)=       1.39          .27
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .05          .03          .076 (iii)
     TIME TO PEAK    (hrs)=       1.13         1.20         1.167
     RUNOFF VOLUME    (mm)=      63.84        21.81        34.419
     TOTAL RAINFALL   (mm)=      64.84        64.84        64.837
     RUNOFF COEFFICIENT   =        .98          .34          .531

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
```

```
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
100:0004------------------------------------------------------------------------
*#*************************************************************************|
*#
*#       POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#       ===============================================
*#
*#*************************************************************************|
*# CATCHMENT AREA 201 - CONTROLLED DISCHARGE - ROOF DRAINS
*
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .17
| 02:201    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .17          .00
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      15.00         1.00
     Mannings n           =       .015         .250

     Max.eff.Inten.(mm/hr)=     141.23        57.44
               over (min)       1.00         2.00
     Storage Coeff.  (min)=        .78 (ii)     1.74 (ii)
     Unit Hyd. Tpeak (min)=       1.00         2.00
     Unit Hyd. peak  (cms)=       1.23          .61
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .07          .00          .066 (iii)
     TIME TO PEAK    (hrs)=       1.17         1.17         1.167
     RUNOFF VOLUME    (mm)=      63.84        21.81        63.417
     TOTAL RAINFALL   (mm)=      64.84        64.84        64.837
     RUNOFF COEFFICIENT   =        .98          .34          .978

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
100:0005------------------------------------------------------------------------
**#************************************************************************|
*# ROUTE CATCHMENT 201 THROUGH CONTROLLED-FLOW ROOF DRAINS
*#
---------------------
| ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
|  IN>02:(201   )    |
| OUT<03:(SWM201)    |    =========  OUTLFOW STORAGE TABLE  =========
---------------------     OUTFLOW    STORAGE  |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)  |   (cms)     (ha.m.)
                            .000  .0000E+00   |    .006  .1020E-01
                            .003  .5100E-02   |    .009  .1530E-01

     ROUTING RESULTS            AREA     QPEAK     TPEAK        R.V.
     --------------------       (ha)     (cms)     (hrs)        (mm)
     INFLOW >02: (201   )        .17      .066     1.167      63.417
     OUTFLOW<03: (SWM201)        .17      .005     2.000      63.416
   OVERFLOW<04: (OVF   )        .00      .000      .000        .000

                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                    CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                    PERCENTAGE OF TIME OVERFLOWING    (%)=      .00


                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=    7.203
                    TIME SHIFT OF PEAK FLOW         (min)=    50.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=.8019E-02

--------------------------------------------------------------------------------
100:0006------------------------------------------------------------------------
**#************************************************************************|
*# CATCHMENT AREA 202 - CONTROLLED PARKING LOT/LANDSCAPE DISCHARGE
*
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .21
| 05:202    DT= 1.00 |   Total Imp(%)=   57.00   Dir. Conn.(%)=   57.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .12          .09
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       2.50         2.50
     Length            (m)=      15.00        10.00
     Mannings n           =       .015         .250

     Max.eff.Inten.(mm/hr)=     141.23        54.50
               over (min)       1.00         4.00
     Storage Coeff.  (min)=        .59 (ii)     4.25 (ii)
     Unit Hyd. Tpeak (min)=       1.00         4.00
     Unit Hyd. peak  (cms)=       1.39          .27
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .05          .01          .057 (iii)
     TIME TO PEAK    (hrs)=       1.13         1.20         1.167
     RUNOFF VOLUME    (mm)=      63.84        21.81        45.766
     TOTAL RAINFALL   (mm)=      64.84        64.84        64.837
     RUNOFF COEFFICIENT   =        .98          .34          .706

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
100:0007------------------------------------------------------------------------
*#*************************************************************************|
------------------------
| ADD HYD (201+202   ) |  ID: NHYD          AREA      QPEAK    TPEAK   R.V.    DWF
------------------------                    (ha)      (cms)    (hrs)   (mm)   (cms)
                     ID1 03:SWM201          .17       .005     2.00  63.42    .000
                    +ID2 04:OVF             .00       .000      .00    .00    .000
                    +ID3 05:202             .21       .057     1.17  45.77    .000
                     ==========================================================
                     SUM 06:201+202         .38       .060     1.17  53.66    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
100:0008------------------------------------------------------------------------
*#*************************************************************************|
*# ROUTE CATCHMENT 201 & 202 THROUGH ORIFICE SYSTEM
```

East Outlet to Wentworth Drive

```
*#
---------------------
| ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
|  IN>06:(201+20)    |
| OUT<07:(SWM200)    |    =========  OUTLFOW STORAGE TABLE  =========
---------------------     OUTFLOW    STORAGE  |  OUTFLOW    STORAGE
                            (cms)     (ha.m.)  |    (cms)     (ha.m.)
                             .000  .0000E+00  |     .019  .1600E-02
                             .008  .0000E+00  |     .022  .2400E-02
                             .014  .8000E-03  |     .025  .3200E-02

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >06: (201+20)        .38      .060     1.167     53.662
     OUTFLOW<07: (SWM200)        .38      .024     1.333     53.666
    OVERFLOW<08: (OVF   )        .00      .000      .000       .000

                   TOTAL NUMBER OF SIMULATED OVERFLOWS  =         0
                   CUMULATIVE TIME OF OVERFLOWS  (hours)=       .00
                   PERCENTAGE OF TIME OVERFLOWING    (%)=       .00


                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=   39.921
                   TIME SHIFT OF PEAK FLOW          (min)=    10.00
                   MAXIMUM  STORAGE   USED        (ha.m.)=.2908E-02

--------------------------------------------------------------------------------
100:0009------------------------------------------------------------------------
**#****************************************************************************|
*# CATCHMENT AREA 203 - UNCONTROLLED RUNOFF TO WENTWORTH DRIVE RIGHT-OF-WAY
*
----------------------
| CALIB STANDHYD      |   Area    (ha)=     .07
| 09:203    DT= 1.00  |   Total Imp(%)=   23.00   Dir. Conn.(%)=   23.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .02          .05
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       3.00        20.00
     Length            (m)=       5.00         5.00
     Mannings n           =       .015         .250

     Max.eff.Inten.(mm/hr)=     141.23        57.44
                over (min)        1.00         2.00
     Storage Coeff.  (min)=        .29 (ii)    1.56 (ii)
     Unit Hyd. Tpeak (min)=       1.00         2.00
     Unit Hyd. peak  (cms)=       1.65          .65
                                                          *TOTALS*
     PEAK FLOW       (cms)=        .01          .01          .014 (iii)
     TIME TO PEAK    (hrs)=       1.07         1.17         1.167
     RUNOFF VOLUME    (mm)=      63.84        21.81        31.477
     TOTAL RAINFALL   (mm)=      64.84        64.84        64.837
     RUNOFF COEFFICIENT   =        .98          .34          .485

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
100:0010------------------------------------------------------------------------
*#*****************************************************************************|
------------------------
| ADD HYD (200 SERIES) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
                     ID1 07:SWM200          .38      .024    1.33  53.67    .000
                    +ID2 08:OVF             .00      .000     .00    .00    .000
                    +ID3 09:203             .07      .014    1.17  31.48    .000
                     ===========================================================
                     SUM 10:200 SERIES      .45      .037    1.17  50.21    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
100:0011------------------------------------------------------------------------
*#*****************************************************************************|
*#*****************************************************************************|
* RUN REMAINING DESIGN STORMS (GRIMSBY 5 TO 100-YR)
*
--------------------------------------------------------------------------------
100:0002------------------------------------------------------------------------
*
--------------------------------------------------------------------------------
100:0002------------------------------------------------------------------------
*
--------------------------------------------------------------------------------
100:0002------------------------------------------------------------------------
*
--------------------------------------------------------------------------------
100:0002------------------------------------------------------------------------
*
--------------------------------------------------------------------------------
100:0002------------------------------------------------------------------------
*
      FINISH
--------------------------------------------------------------------------------
********************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2020-05-24     at 15:39:22
================================================================================
```

STAGE-STORAGE-DISCHARGE CALCULATIONS (WEST OUTLET)

Outlet Device No. 1 (Quantity)

Type:	Circular Orifice
Diameter (mm)	**135**
Area (m^2)	0.01431
Invert Elev. (m)	91.65
C/L Elev. (m)	91.72
Disch. Coeff. (C_d)	0.6
Discharge (Q) =	$C_d A (2 g H)^{0.5}$
Number of Orifices:	1

		SWM Tank Volumes				Outlet No. 1	
	Elevation m	Area m^2	Tank Incremental Volume	Cumulative Tank Volume m^3	Active Storage Volume m^3	H m	Discharge m^3/s
Orifice Invert	91.65	0	0	0	0	0.000	0.0000
Bottom of Storage Vault	91.76	40	0	0	0	0.110	0.0126
1/4 of Tank	91.98	40	9	9	9	0.332	0.0219
1/2 of Tank	92.21	40	9	18	18	0.555	0.0283
3/4 of Tank	92.43	40	9	27	27	0.777	0.0335
Top of Tank	92.65	40	9	36	36	1.000	0.0380

West Outlet to Existing Storm Easement

```
2     Metric units
*#****************************************************************************|
*#  Project Name: 141-149 MAIN STREET EAST
*#              GRIMSBY, ONTARIO
*#  JOB NUMBER  : 20007
*#       Date   : MAY 2020
*#     Revised  :
*#     Company  : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 20007.DAT
*#****************************************************************************|
*
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[002]
                    GRIM3002.stm
*
READ STORM          STORM_FILENAME "STORM.001"
*
*#*****************************************************************************|
*#
*#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ===============================================
*#
*#*****************************************************************************|
*# CATCHMENT AREA 301 - CONTROLLED DISCHARGE - ROOF DRAINS
*
CALIB STANDHYD      ID=[1], NHYD=["301"], DT=[1](min), AREA=[0.17](ha),
                    XIMP=[0.99], TIMP=[0.99], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[70],
                    Pervious   surfaces: IAper=[4](mm), SLPP=[2.0](%),
                                         LGP=[1](m), MNP=[0.250], SCP=[0](min),
                    Impervious surfaces: IAimp=[1.0](mm), SLPI=[1.0](%),
                                         LGI=[15](m), MNI=[0.015], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
**#****************************************************************************|
*# ROUTE CATCHMENT 301 THROUGH CONTROLLED-FLOW ROOF DRAINS
*#
ROUTE RESERVOIR     IDout=[2],   NHYD=["SWM301"],  IDin=[1],
                    RDT=[1](min),
                          TABLE of ( OUTFLOW-STORAGE ) values
                                      (cms)  -  (ha-m)
                                       0.0  ,  0.0
                                    0.0046  ,  0.0051
                                    0.0091  ,  0.0103
                                    0.0137  ,  0.0154
                                       -1   ,   -1    (max twenty pts)
                          IDovf=[3], NHYDovf=["OVF"]
**#****************************************************************************|
*# CATCHMENT AREA 302 - CONTROLLED PARKING LOT/LANDSCAPE DISCHARGE
*
CALIB STANDHYD      ID=[4], NHYD=["302"], DT=[1](min), AREA=[0.26](ha),
                    XIMP=[0.64], TIMP=[0.64], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[70],
                    Pervious   surfaces: IAper=[4](mm), SLPP=[2.5](%),
                                         LGP=[10](m), MNP=[0.250], SCP=[0](min),
                    Impervious surfaces: IAimp=[1.0](mm), SLPI=[2.5](%),
                                         LGI=[15](m), MNI=[0.015], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*#****************************************************************************|
ADD HYD             IDsum=[5], NHYD=["301+302"], IDs to add=[2,3,4]
*#****************************************************************************|
```

West Outlet to Existing Storm Easement

```
*# ROUTE CATCHMENT 301 & 302 THROUGH ORIFICE SYSTEM
*#
ROUTE RESERVOIR     IDout=[6],   NHYD=["SWM301"],  IDin=[5],
                    RDT=[1](min),
                          TABLE of ( OUTFLOW-STORAGE ) values
                                      (cms)  -  (ha-m)
                                        0.0 , 0.0
                                     0.0126 , 0.0000
                                     0.0219 , 0.0009
                                     0.0283 , 0.0018
                                     0.0335 , 0.0027
                                     0.0380 , 0.0036
                                       -1   ,  -1    (max twenty pts)
                          IDovf=[7], NHYDovf=["OVF"]
**#*****************************************************************************|
*# CATCHMENT AREA 303 - UNCONTROLLED RUNOFF TO STORM SEWER EASEMENT
*
CALIB NASHYD        ID=[8], NHYD=["303"], DT=[1]min, AREA=[0.06](ha),
                    DWF=[0](cms),  CN/C=[70], IA=[4.0](mm),
                    N=[3], TP=[0.10]hrs,
                    RAINFALL=[ ,  ,  ,  , ](mm/hr),  END=-1
*#****************************************************************************|
ADD HYD             IDsum=[9], NHYD=["300 SERIES"], IDs to add=[6,7,8]
*#****************************************************************************|
*#****************************************************************************|
* RUN REMAINING DESIGN STORMS (GRIMSBY 5 TO 100-YR)
*
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[005]
                    GRIM3005.stm
*
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[010]
                    GRIM3010.stm
*
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[025]
                    GRIM3025.stm
*
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[050]
                    GRIM3050.stm
*
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[100]
                    GRIM3100.stm
*
*%-----------------|-----------------------------------------------------------|
FINISH
```

West Outlet to Existing Storm Easement

```
================================================================================

   SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999     =========
   S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
   SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9    Ver  4.05
       S   W W   M   M  H   H    Y    M   M  O   O       9999   9999    Sept 2011
   SSSSS   W W   M   M  H   H    Y    M   M   OOO           9      9    =========
                                                        9   9  9   9    # 3902680
        StormWater Management HYdrologic Model           999    999     =========

 ******************************************************************************
 ***************************** SWMHYMO Ver/4.05  *****************************
 *********  A single event and continuous hydrologic simulation model  *********
 *********     based on the principles of HYMO and its successors      *********
 *********                 OTTHYMO-83 and OTTHYMO-89.                  *********
 ******************************************************************************
 ********* Distributed by:  J.F. Sabourin and Associates Inc.          *********
 *********                  Ottawa,  Ontario: (613) 836-3884           *********
 *********                  Gatineau, Quebec: (819) 243-6858           *********
 *********                  E-Mail: swmhymo@jfsa.Com                   *********
 ******************************************************************************

 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++++ Licensed user: S. Llewellyn & Associates Ltd               +++++++++
 +++++++++                                      SERIAL#:3902680        +++++++++
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ******************************************************************************
 *********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++           *********
 *********           Maximum value for ID numbers  :     10           *********
 *********           Max. number of rainfall points: 105408           *********
 *********           Max. number of flow points    : 105408           *********
 ******************************************************************************


 *********************   D E T A I L E D   O U T P U T   *********************
 ******************************************************************************
 *         DATE: 2020-05-24     TIME: 15:48:57     RUN COUNTER: 000217          *
 ******************************************************************************
 * Input   filename: T:\projects\20007\SWMHYMO\20007W.dat                      *
 * Output  filename: T:\projects\20007\SWMHYMO\20007W.out                      *
 * Summary filename: T:\projects\20007\SWMHYMO\20007W.sum                      *
 * User comments:                                                              *
 * 1:__________________________________________________________________________*
 * 2:__________________________________________________________________________*
 * 3:__________________________________________________________________________*
 ******************************************************************************

--------------------------------------------------------------------------------
001:0001------------------------------------------------------------------------
*#****************************************************************************|
*#  Project Name: 141-149 MAIN STREET EAST
*#                GRIMSBY, ONTARIO
*#  JOB NUMBER  : 20007
*#       Date   : MAY 2020
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 20007.DAT
*#****************************************************************************|
*
  ** END OF RUN :   1

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




--------------------
| START              |  Project  dir.: T:\projects\20007\SWMHYMO\
--------------------  Rainfall dir.: T:\projects\20007\SWMHYMO\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 002
    NSTORM=   1
           #  1=GRIM3002.stm
--------------------------------------------------------------------------------
002:0002------------------------------------------------------------------------
*#****************************************************************************|
*#  Project Name: 141-149 MAIN STREET EAST
*#                GRIMSBY, ONTARIO
*#  JOB NUMBER  : 20007
*#       Date   : MAY 2020
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 20007.DAT
*#****************************************************************************|
*
--------------------------------------------------------------------------------
002:0002------------------------------------------------------------------------
*
--------------------
| READ STORM         |    Filename: 2YR EVENT A=603.25, B=6, C=0.790
| Ptotal=  29.15 mm|    Comments: 2YR EVENT A=603.25, B=6, C=0.790
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .17   2.617 |   1.00  17.549 |   1.83   5.664 |   2.67   2.733
               .33   3.090 |   1.17  67.490 |   2.00   4.615 |   2.83   2.494
               .50   3.806 |   1.33  21.188 |   2.17   3.914 |   3.00   2.297
               .67   5.031 |   1.50  10.890 |   2.33   3.410 |
               .83   7.646 |   1.67   7.408 |   2.50   3.031 |

--------------------------------------------------------------------------------
002:0003------------------------------------------------------------------------
*
*#****************************************************************************|
*#
*#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ===============================================
*#
*#****************************************************************************|
*# CATCHMENT AREA 301 - CONTROLLED DISCHARGE - ROOF DRAINS
*
----------------------
| CALIB STANDHYD      |   Area    (ha)=     .17
| 01:301    DT= 1.00  |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .17          .00
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       1.00         2.00
```

```
     Length            (m)=      15.00         1.00
     Mannings n           =       .015         .250

     Max.eff.Inten.(mm/hr)=      67.49        12.89
               over (min)         1.00         3.00
     Storage Coeff.  (min)=       1.04 (ii)    2.79 (ii)
     Unit Hyd. Tpeak (min)=       1.00         3.00
     Unit Hyd. peak  (cms)=       1.05          .39
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .03          .00           .032 (iii)
     TIME TO PEAK    (hrs)=       1.17         1.18          1.167
     RUNOFF VOLUME    (mm)=      28.15         4.72         27.912
     TOTAL RAINFALL   (mm)=      29.15        29.15         29.146
     RUNOFF COEFFICIENT   =        .97          .16           .958

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
002:0004------------------------------------------------------------------------
**#***************************************************************************|
*# ROUTE CATCHMENT 301 THROUGH CONTROLLED-FLOW ROOF DRAINS
*#
---------------------
| ROUTE RESERVOIR     |    Requested routing time step =  1.0 min.
|  IN>01:(301    )    |
| OUT<02:(SWM301)     |    =========  OUTLFOW STORAGE TABLE  =========
---------------------      OUTFLOW    STORAGE  |  OUTFLOW    STORAGE
                            (cms)     (ha.m.)  |   (cms)     (ha.m.)
                             .000  .0000E+00   |    .009  .1030E-01
                             .005  .5100E-02   |    .014  .1540E-01

     ROUTING RESULTS             AREA      QPEAK      TPEAK        R.V.
     --------------------        (ha)      (cms)      (hrs)        (mm)
     INFLOW >01: (301    )        .17       .032      1.167      27.912
     OUTFLOW<02: (SWM301)         .17       .003      1.683      27.911
    OVERFLOW<03: (OVF    )        .00       .000       .000        .000

                   TOTAL NUMBER OF SIMULATED OVERFLOWS  =         0
                   CUMULATIVE TIME OF OVERFLOWS  (hours)=       .00
                   PERCENTAGE OF TIME OVERFLOWING    (%)=       .00


                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=     9.371
                   TIME SHIFT OF PEAK FLOW          (min)=    31.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.3283E-02

--------------------------------------------------------------------------------
002:0005------------------------------------------------------------------------
**#***************************************************************************|
*# CATCHMENT AREA 302 - CONTROLLED PARKING LOT/LANDSCAPE DISCHARGE
*
----------------------
| CALIB STANDHYD      |   Area    (ha)=     .26
| 04:302    DT= 1.00  |   Total Imp(%)=   64.00   Dir. Conn.(%)=   64.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .17          .09
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       2.50         2.50
     Length            (m)=      15.00        10.00
     Mannings n           =       .015         .250

     Max.eff.Inten.(mm/hr)=      67.49        10.19
               over (min)         1.00         8.00
     Storage Coeff.  (min)=        .79 (ii)    7.95 (ii)
     Unit Hyd. Tpeak (min)=       1.00         8.00
     Unit Hyd. peak  (cms)=       1.22          .14
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .03          .00           .032 (iii)
     TIME TO PEAK    (hrs)=       1.17         1.27          1.167
     RUNOFF VOLUME    (mm)=      28.15         4.72         19.712
     TOTAL RAINFALL   (mm)=      29.15        29.15         29.146
     RUNOFF COEFFICIENT   =        .97          .16           .676

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
002:0006------------------------------------------------------------------------
*#***************************************************************************|
------------------------
| ADD HYD (301+302    ) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.     DWF
------------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
                    ID1 02:SWM301           .17      .003    1.68  27.91    .000
                   +ID2 03:OVF              .00      .000     .00    .00    .000
                   +ID3 04:302              .26      .032    1.17  19.71    .000
                    ==========================================================
                    SUM 05:301+302          .43      .035    1.17  22.95    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
002:0007------------------------------------------------------------------------
*#***************************************************************************|
*# ROUTE CATCHMENT 301 & 302 THROUGH ORIFICE SYSTEM
*#
---------------------
| ROUTE RESERVOIR     |    Requested routing time step =  1.0 min.
|  IN>05:(301+30)     |
| OUT<06:(SWM301)     |    =========  OUTLFOW STORAGE TABLE  =========
---------------------      OUTFLOW    STORAGE  |  OUTFLOW    STORAGE
                            (cms)     (ha.m.)  |   (cms)     (ha.m.)
                             .000  .0000E+00   |    .028  .1800E-02
                             .013  .0000E+00   |    .034  .2700E-02
                             .022  .9000E-03   |    .038  .3600E-02

     ROUTING RESULTS             AREA      QPEAK      TPEAK        R.V.
     --------------------        (ha)      (cms)      (hrs)        (mm)
     INFLOW >05: (301+30)         .43       .035      1.167      22.953
     OUTFLOW<06: (SWM301)         .43       .022      1.183      22.984
    OVERFLOW<07: (OVF    )        .00       .000       .000        .000

                   TOTAL NUMBER OF SIMULATED OVERFLOWS  =         0
                   CUMULATIVE TIME OF OVERFLOWS  (hours)=       .00
                   PERCENTAGE OF TIME OVERFLOWING    (%)=       .00
```

West Outlet to Existing Storm Easement

```
                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=   63.081
                    TIME SHIFT OF PEAK FLOW         (min)=     1.00
                    MAXIMUM  STORAGE   USED        (ha.m.)=.8942E-03

--------------------------------------------------------------------------------
002:0008------------------------------------------------------------------------
**#****************************************************************************|
*# CATCHMENT AREA 303 - UNCONTROLLED RUNOFF TO STORM SEWER EASEMENT
*
----------------------
| CALIB NASHYD       |   Area     (ha)=     .06   Curve Number    (CN)=70.00
| 08:303    DT= 1.00 |   Ia       (mm)=   4.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=     .100

     Unit Hyd Qpeak  (cms)=     .023

     PEAK FLOW       (cms)=     .001 (i)
     TIME TO PEAK    (hrs)=    1.233
     RUNOFF VOLUME    (mm)=    4.715
     TOTAL RAINFALL   (mm)=   29.146
     RUNOFF COEFFICIENT   =     .162

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
002:0009------------------------------------------------------------------------
*#*****************************************************************************|
------------------------
| ADD HYD (300 SERIES) | ID: NHYD           AREA      QPEAK   TPEAK   R.V.    DWF
------------------------                    (ha)      (cms)   (hrs)   (mm)   (cms)
                     ID1 06:SWM301          .43      .022    1.18  22.98    .000
                    +ID2 07:OVF             .00      .000     .00    .00    .000
                    +ID3 08:303             .06      .001    1.23   4.71    .000
                     ===========================================================
                     SUM 09:300 SERIES      .49      .023    1.18  20.75    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
002:0010------------------------------------------------------------------------
*#*****************************************************************************|
*#*****************************************************************************|
* RUN REMAINING DESIGN STORMS (GRIMSBY 5 TO 100-YR)
*
  ** END OF RUN :    4

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



--------------------
| START            |   Project  dir.: T:\projects\20007\SWMHYMO\
--------------------   Rainfall dir.: T:\projects\20007\SWMHYMO\
   TZERO =    .00 hrs on        0
   METOUT=    2 (output = METRIC)
   NRUN  = 005
   NSTORM=    1
          #  1=GRIM3005.stm
--------------------------------------------------------------------------------
005:0002------------------------------------------------------------------------
*#*****************************************************************************|
*#  Project Name: 141-149 MAIN STREET EAST
*#                GRIMSBY, ONTARIO
*#  JOB NUMBER  : 20007
*#       Date   : MAY 2020
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 20007.DAT
*#*****************************************************************************|
*
--------------------------------------------------------------------------------
005:0002------------------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: 5YR EVENT A=785.59, B=6, C=0.790
| Ptotal=  37.96 mm|    Comments: 5YR EVENT A=785.59, B=6, C=0.790
--------------------
               TIME   RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
                hrs  mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
                .17  3.408 |   1.00  22.854 |   1.83   7.376 |   2.67   3.560
                .33  4.024 |   1.17  87.890 |   2.00   6.010 |   2.83   3.248
                .50  4.957 |   1.33  27.593 |   2.17   5.097 |   3.00   2.991
                .67  6.552 |   1.50  14.182 |   2.33   4.441 |
                .83  9.957 |   1.67   9.647 |   2.50   3.947 |

--------------------------------------------------------------------------------
005:0003------------------------------------------------------------------------
*
*#*****************************************************************************|
*#
*#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ================================================
*#
*#*****************************************************************************|
*# CATCHMENT AREA 301 - CONTROLLED DISCHARGE - ROOF DRAINS
*
----------------------
| CALIB STANDHYD     |   Area     (ha)=     .17
| 01:301    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .17          .00
     Dep. Storage     (mm)=      1.00         4.00
     Average Slope     (%)=      1.00         2.00
     Length            (m)=     15.00         1.00
     Mannings n           =      .015         .250

     Max.eff.Inten.(mm/hr)=     87.89        22.97
                over (min)      1.00         2.00
     Storage Coeff.  (min)=       .94 (ii)     2.33 (ii)
     Unit Hyd. Tpeak (min)=      1.00         2.00
     Unit Hyd. peak  (cms)=      1.11          .51
                                                          *TOTALS*
     PEAK FLOW       (cms)=       .04          .00          .041 (iii)
     TIME TO PEAK    (hrs)=      1.17         1.17         1.167
     RUNOFF VOLUME    (mm)=     36.96         8.07        36.667
     TOTAL RAINFALL   (mm)=     37.96        37.96        37.956
     RUNOFF COEFFICIENT   =       .97          .21          .966
```

```
       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
005:0004------------------------------------------------------------------------
**#****************************************************************************|
*# ROUTE CATCHMENT 301 THROUGH CONTROLLED-FLOW ROOF DRAINS
*#
---------------------
| ROUTE RESERVOIR   |     Requested routing time step =  1.0 min.
|  IN>01:(301   )   |
| OUT<02:(SWM301)   |     =========  OUTLFOW STORAGE TABLE  =========
---------------------     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                            (cms)    (ha.m.)   |    (cms)    (ha.m.)
                             .000  .0000E+00   |     .009  .1030E-01
                             .005  .5100E-02   |     .014  .1540E-01

     ROUTING RESULTS             AREA      QPEAK      TPEAK        R.V.
     --------------------        (ha)      (cms)      (hrs)        (mm)
     INFLOW >01: (301   )         .17       .041      1.167      36.667
     OUTFLOW<02: (SWM301)         .17       .004      1.683      36.666
    OVERFLOW<03: (OVF   )         .00       .000       .000        .000

                    TOTAL NUMBER OF SIMULATED OVERFLOWS   =        0
                    CUMULATIVE TIME OF OVERFLOWS  (hours)=       .00
                    PERCENTAGE OF TIME OVERFLOWING     (%)=       .00


                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=    9.441
                    TIME SHIFT OF PEAK FLOW         (min)=    31.00
                    MAXIMUM  STORAGE   USED        (ha.m.)=.4311E-02

--------------------------------------------------------------------------------
005:0005------------------------------------------------------------------------
**#****************************************************************************|
*# CATCHMENT AREA 302 - CONTROLLED PARKING LOT/LANDSCAPE DISCHARGE
*
----------------------
| CALIB STANDHYD     |   Area     (ha)=     .26
| 04:302    DT= 1.00 |   Total Imp(%)=   64.00   Dir. Conn.(%)=   64.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .17          .09
     Dep. Storage     (mm)=      1.00         4.00
     Average Slope     (%)=      2.50         2.50
     Length            (m)=     15.00        10.00
     Mannings n           =      .015         .250

     Max.eff.Inten.(mm/hr)=     87.89        19.78
                over (min)      1.00         6.00
     Storage Coeff.  (min)=       .71 (ii)     6.21 (ii)
     Unit Hyd. Tpeak (min)=      1.00         6.00
     Unit Hyd. peak  (cms)=      1.28          .18
                                                          *TOTALS*
     PEAK FLOW       (cms)=       .04          .00          .043 (iii)
     TIME TO PEAK    (hrs)=      1.17         1.23         1.167
     RUNOFF VOLUME    (mm)=     36.96         8.07        26.558
     TOTAL RAINFALL   (mm)=     37.96        37.96        37.956
     RUNOFF COEFFICIENT   =       .97          .21          .700

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
005:0006------------------------------------------------------------------------
*#*****************************************************************************|
------------------------
| ADD HYD (301+302   ) | ID: NHYD           AREA      QPEAK   TPEAK   R.V.    DWF
------------------------                    (ha)      (cms)   (hrs)   (mm)   (cms)
                     ID1 02:SWM301          .17      .004    1.68  36.67    .000
                    +ID2 03:OVF             .00      .000     .00    .00    .000
                    +ID3 04:302             .26      .043    1.17  26.56    .000
                     ===========================================================
                     SUM 05:301+302         .43      .046    1.17  30.55    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
005:0007------------------------------------------------------------------------
*#*****************************************************************************|
*# ROUTE CATCHMENT 301 & 302 THROUGH ORIFICE SYSTEM
*#
---------------------
| ROUTE RESERVOIR   |     Requested routing time step =  1.0 min.
|  IN>05:(301+30)   |
| OUT<06:(SWM301)   |     =========  OUTLFOW STORAGE TABLE  =========
---------------------     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                            (cms)    (ha.m.)   |    (cms)    (ha.m.)
                             .000  .0000E+00   |     .028  .1800E-02
                             .013  .0000E+00   |     .034  .2700E-02
                             .022  .9000E-03   |     .038  .3600E-02

     ROUTING RESULTS             AREA      QPEAK      TPEAK        R.V.
     --------------------        (ha)      (cms)      (hrs)        (mm)
     INFLOW >05: (301+30)         .43       .046      1.167      30.554
     OUTFLOW<06: (SWM301)         .43       .025      1.183      30.575
    OVERFLOW<07: (OVF   )         .00       .000       .000        .000

                    TOTAL NUMBER OF SIMULATED OVERFLOWS   =        0
                    CUMULATIVE TIME OF OVERFLOWS  (hours)=       .00
                    PERCENTAGE OF TIME OVERFLOWING     (%)=       .00


                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=   54.854
                    TIME SHIFT OF PEAK FLOW         (min)=     1.00
                    MAXIMUM  STORAGE   USED        (ha.m.)=.1399E-02

--------------------------------------------------------------------------------
005:0008------------------------------------------------------------------------
**#****************************************************************************|
*# CATCHMENT AREA 303 - UNCONTROLLED RUNOFF TO STORM SEWER EASEMENT
*
----------------------
| CALIB NASHYD       |   Area     (ha)=     .06   Curve Number    (CN)=70.00
| 08:303    DT= 1.00 |   Ia       (mm)=   4.000   # of Linear Res.(N)= 3.00
```

```
----------------------   U.H. Tp(hrs)=    .100

     Unit Hyd Qpeak  (cms)=     .023

     PEAK FLOW       (cms)=     .002 (i)
     TIME TO PEAK    (hrs)=    1.233
     RUNOFF VOLUME    (mm)=    8.070
     TOTAL RAINFALL   (mm)=   37.956
     RUNOFF COEFFICIENT   =     .213

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
005:0009------------------------------------------------------------------------
*#*****************************************************************************|
------------------------
| ADD HYD (300 SERIES) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
                     ID1 06:SWM301          .43      .025    1.18  30.58    .000
                    +ID2 07:OVF             .00      .000     .00    .00    .000
                    +ID3 08:303             .06      .002    1.23   8.07    .000
                     ===========================================================
                     SUM 09:300 SERIES      .49      .028    1.20  27.82    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
005:0010------------------------------------------------------------------------
*#*****************************************************************************|
*#*****************************************************************************|
* RUN REMAINING DESIGN STORMS (GRIMSBY 5 TO 100-YR)
*
--------------------------------------------------------------------------------
005:0002------------------------------------------------------------------------
*
  ** END OF RUN :    9

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




--------------------
| START            |  Project  dir.: T:\projects\20007\SWMHYMO\
--------------------  Rainfall dir.: T:\projects\20007\SWMHYMO\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 010
    NSTORM=   1
           #  1=GRIM3010.stm
--------------------------------------------------------------------------------
010:0002------------------------------------------------------------------------
*#*****************************************************************************|
*#  Project Name: 141-149 MAIN STREET EAST
*#                GRIMSBY, ONTARIO
*#  JOB NUMBER  : 20007
*#       Date   : MAY 2020
*#     Revised  :
*#     Company  : S. LLEWELLYN AND ASSOCIATES LTD.
*#        File  : 20007.DAT
*#*****************************************************************************|
*
--------------------------------------------------------------------------------
010:0002------------------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: 10YR EVENT A=953.64, B=7, C=0.790
| Ptotal=  45.88 mm|    Comments: 10YR EVENT A=953.64, B=7, C=0.790
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .17   4.198 |   1.00  28.390 |   1.83   9.175 |   2.67   4.387
               .33   4.967 |   1.17 101.702 |   2.00   7.457 |   2.83   3.998
               .50   6.135 |   1.33  34.205 |   2.17   6.310 |   3.00   3.679
               .67   8.139 |   1.50  17.722 |   2.33   5.489 |
               .83  12.422 |   1.67  12.033 |   2.50   4.870 |

--------------------------------------------------------------------------------
010:0003------------------------------------------------------------------------
*
*#*****************************************************************************|
*#
*#        POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#        ==============================================
*#
*#*****************************************************************************|
*# CATCHMENT AREA 301 - CONTROLLED DISCHARGE - ROOF DRAINS
*
----------------------
| CALIB STANDHYD     |   Area    (ha)=    .17
| 01:301    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
----------------------
                              IMPERVIOUS   PERVIOUS (i)
     Surface Area     (ha)=        .17          .00
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      15.00         1.00
     Mannings n           =       .015         .250

     Max.eff.Inten.(mm/hr)=     101.70        31.27
                over (min)       1.00         2.00
     Storage Coeff.  (min)=        .89 (ii)    2.11 (ii)
     Unit Hyd. Tpeak (min)=       1.00         2.00
     Unit Hyd. peak  (cms)=       1.15          .54
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .05          .00            .048 (iii)
     TIME TO PEAK    (hrs)=       1.17         1.17           1.167
     RUNOFF VOLUME    (mm)=      44.88        11.64          44.547
     TOTAL RAINFALL   (mm)=      45.88        45.88          45.880
     RUNOFF COEFFICIENT   =        .98          .25            .971

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
010:0004------------------------------------------------------------------------
**#****************************************************************************|
*# ROUTE CATCHMENT 301 THROUGH CONTROLLED-FLOW ROOF DRAINS
```

```
*#
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>01:(301   )   |
| OUT<02:(SWM301)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)  |    (cms)     (ha.m.)
                            .000  .0000E+00   |     .009  .1030E-01
                            .005  .5100E-02   |     .014  .1540E-01

     ROUTING RESULTS            AREA     QPEAK     TPEAK        R.V.
     --------------------       (ha)     (cms)     (hrs)        (mm)
     INFLOW >01: (301   )        .17      .048     1.167      44.547
     OUTFLOW<02: (SWM301)        .17      .005     1.683      44.547
    OVERFLOW<03: (OVF   )        .00      .000      .000        .000

                   TOTAL NUMBER OF SIMULATED OVERFLOWS   =        0
                   CUMULATIVE TIME OF OVERFLOWS  (hours)=       .00
                   PERCENTAGE OF TIME OVERFLOWING    (%)=       .00


                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=     9.849
                   TIME SHIFT OF PEAK FLOW         (min)=     31.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.5211E-02

--------------------------------------------------------------------------------
010:0005------------------------------------------------------------------------
**#****************************************************************************|
*# CATCHMENT AREA 302 - CONTROLLED PARKING LOT/LANDSCAPE DISCHARGE
*
----------------------
| CALIB STANDHYD     |   Area    (ha)=    .26
| 04:302    DT= 1.00 |   Total Imp(%)=   64.00   Dir. Conn.(%)=   64.00
----------------------
                              IMPERVIOUS   PERVIOUS (i)
     Surface Area     (ha)=        .17          .09
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       2.50         2.50
     Length            (m)=      15.00        10.00
     Mannings n           =       .015         .250

     Max.eff.Inten.(mm/hr)=     101.70        28.38
                over (min)       1.00         5.00
     Storage Coeff.  (min)=        .67 (ii)    5.43 (ii)
     Unit Hyd. Tpeak (min)=       1.00         5.00
     Unit Hyd. peak  (cms)=       1.31          .21
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .05          .01            .052 (iii)
     TIME TO PEAK    (hrs)=       1.15         1.22           1.167
     RUNOFF VOLUME    (mm)=      44.88        11.64          32.912
     TOTAL RAINFALL   (mm)=      45.88        45.88          45.880
     RUNOFF COEFFICIENT   =        .98          .25            .717

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
010:0006------------------------------------------------------------------------
*#*****************************************************************************|
------------------------
| ADD HYD (301+302   ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
                     ID1 02:SWM301          .17      .005    1.68  44.55    .000
                    +ID2 03:OVF             .00      .000     .00    .00    .000
                    +ID3 04:302             .26      .052    1.17  32.91    .000
                     ===========================================================
                     SUM 05:301+302         .43      .055    1.17  37.51    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
010:0007------------------------------------------------------------------------
*#*****************************************************************************|
*# ROUTE CATCHMENT 301 & 302 THROUGH ORIFICE SYSTEM
*#
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>05:(301+30)   |
| OUT<06:(SWM301)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)  |    (cms)     (ha.m.)
                            .000  .0000E+00   |     .028  .1800E-02
                            .013  .0000E+00   |     .034  .2700E-02
                            .022  .9000E-03   |     .038  .3600E-02

     ROUTING RESULTS            AREA     QPEAK     TPEAK        R.V.
     --------------------       (ha)     (cms)     (hrs)        (mm)
     INFLOW >05: (301+30)        .43      .055     1.167      37.512
     OUTFLOW<06: (SWM301)        .43      .028     1.200      37.535
    OVERFLOW<07: (OVF   )        .00      .000      .000        .000

                   TOTAL NUMBER OF SIMULATED OVERFLOWS   =        0
                   CUMULATIVE TIME OF OVERFLOWS  (hours)=       .00
                   PERCENTAGE OF TIME OVERFLOWING    (%)=       .00


                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=    51.635
                   TIME SHIFT OF PEAK FLOW         (min)=      2.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.1839E-02

--------------------------------------------------------------------------------
010:0008------------------------------------------------------------------------
**#****************************************************************************|
*# CATCHMENT AREA 303 - UNCONTROLLED RUNOFF TO STORM SEWER EASEMENT
*
----------------------
| CALIB NASHYD       |   Area    (ha)=     .06   Curve Number   (CN)=70.00
| 08:303    DT= 1.00 |   Ia      (mm)=   4.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .100

     Unit Hyd Qpeak  (cms)=     .023

     PEAK FLOW       (cms)=     .003 (i)
     TIME TO PEAK    (hrs)=    1.233
     RUNOFF VOLUME    (mm)=   11.632
     TOTAL RAINFALL   (mm)=   45.880
     RUNOFF COEFFICIENT   =     .254

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

West Outlet to Existing Storm Easement

```
--------------------------------------------------------------------------------
010:0009------------------------------------------------------------------------
*#***************************************************************************|
------------------------
| ADD HYD (300 SERIES) | ID: NHYD          AREA      QPEAK    TPEAK   R.V.    DWF
------------------------                   (ha)      (cms)    (hrs)   (mm)   (cms)
                        ID1 06:SWM301       .43       .028     1.20  37.54    .000
                       +ID2 07:OVF          .00       .000      .00    .00    .000
                       +ID3 08:303          .06       .003     1.23  11.63    .000
                        ===========================================================
                        SUM 09:300 SERIES   .49       .032     1.22  34.36    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
010:0010------------------------------------------------------------------------
*#***************************************************************************|
*#***************************************************************************|
* RUN REMAINING DESIGN STORMS (GRIMSBY 5 TO 100-YR)
*
--------------------------------------------------------------------------------
010:0002------------------------------------------------------------------------
*
--------------------------------------------------------------------------------
010:0002------------------------------------------------------------------------
*
  ** END OF RUN :   24

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




--------------------
| START              |  Project  dir.: T:\projects\20007\SWMHYMO\
--------------------   Rainfall dir.: T:\projects\20007\SWMHYMO\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 025
    NSTORM=   1
           #  1=GRIM3025.stm
--------------------------------------------------------------------------------
025:0002------------------------------------------------------------------------
*#***************************************************************************|
*#  Project Name: 141-149 MAIN STREET EAST
*#                GRIMSBY, ONTARIO
*#  JOB NUMBER  : 20007
*#       Date   : MAY 2020
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 20007.DAT
*#***************************************************************************|
*
--------------------------------------------------------------------------------
025:0002------------------------------------------------------------------------
*
--------------------
| READ STORM         |    Filename: 25YR EVENT A=1119.2, B=7, C=0.790
| Ptotal=  53.84 mm|    Comments: 25YR EVENT A=1119.2, B=7, C=0.790
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .17   4.926 |   1.00  33.313 |   1.83  10.766 |   2.67   5.148
               .33   5.829 |   1.17 119.339 |   2.00   8.751 |   2.83   4.692
               .50   7.199 |   1.33  40.137 |   2.17   7.405 |   3.00   4.317
               .67   9.550 |   1.50  20.795 |   2.33   6.440 |
               .83  14.577 |   1.67  14.120 |   2.50   5.715 |

--------------------------------------------------------------------------------
025:0003------------------------------------------------------------------------
*
*#****************************************************************************|
*#
*#       POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#       ===============================================
*#
*#****************************************************************************|
*# CATCHMENT AREA 301 - CONTROLLED DISCHARGE - ROOF DRAINS
*
----------------------
| CALIB STANDHYD      |   Area    (ha)=     .17
| 01:301    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .17           .00
     Dep. Storage     (mm)=       1.00          4.00
     Average Slope     (%)=       1.00          2.00
     Length            (m)=      15.00          1.00
     Mannings n          =        .015          .250

     Max.eff.Inten.(mm/hr)=     119.34         42.10
               over (min)        1.00          2.00
     Storage Coeff.  (min)=        .83 (ii)     1.92 (ii)
     Unit Hyd. Tpeak (min)=       1.00          2.00
     Unit Hyd. peak  (cms)=       1.19           .57
                                                         *TOTALS*
     PEAK FLOW       (cms)=        .06           .00         .056 (iii)
     TIME TO PEAK    (hrs)=       1.17          1.17        1.167
     RUNOFF VOLUME    (mm)=      52.84         15.65       52.464
     TOTAL RAINFALL   (mm)=      53.84         53.84       53.836
     RUNOFF COEFFICIENT   =        .98           .29         .975

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
025:0004------------------------------------------------------------------------
**#***************************************************************************|
*# ROUTE CATCHMENT 301 THROUGH CONTROLLED-FLOW ROOF DRAINS
*#
--------------------
| ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
|  IN>01:(301   )    |
| OUT<02:(SWM301)    |    =========  OUTLFOW STORAGE TABLE  =========
--------------------      OUTFLOW    STORAGE   |   OUTFLOW    STORAGE
                            (cms)    (ha.m.)   |     (cms)    (ha.m.)
                             .000  .0000E+00   |      .009  .1030E-01
                             .005  .5100E-02   |      .014  .1540E-01

     ROUTING RESULTS             AREA      QPEAK      TPEAK        R.V.
     --------------------        (ha)      (cms)      (hrs)        (mm)
     INFLOW >01: (301   )         .17       .056      1.167      52.464
     OUTFLOW<02: (SWM301)         .17       .005      1.683      52.464
    OVERFLOW<03: (OVF   )         .00       .000       .000        .000

                   TOTAL NUMBER OF SIMULATED OVERFLOWS  =         0
                   CUMULATIVE TIME OF OVERFLOWS  (hours)=       .00
                   PERCENTAGE OF TIME OVERFLOWING    (%)=       .00


                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=     9.825
                   TIME SHIFT OF PEAK FLOW         (min)=     31.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.6139E-02

--------------------------------------------------------------------------------
025:0005------------------------------------------------------------------------
**#***************************************************************************|
*# CATCHMENT AREA 302 - CONTROLLED PARKING LOT/LANDSCAPE DISCHARGE
*
----------------------
| CALIB STANDHYD      |   Area    (ha)=     .26
| 04:302    DT= 1.00 |   Total Imp(%)=   64.00   Dir. Conn.(%)=   64.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .17           .09
     Dep. Storage     (mm)=       1.00          4.00
     Average Slope     (%)=       2.50          2.50
     Length            (m)=      15.00         10.00
     Mannings n          =        .015          .250

     Max.eff.Inten.(mm/hr)=     119.34         38.48
               over (min)        1.00          5.00
     Storage Coeff.  (min)=        .63 (ii)     4.84 (ii)
     Unit Hyd. Tpeak (min)=       1.00          5.00
     Unit Hyd. peak  (cms)=       1.35           .23
                                                         *TOTALS*
     PEAK FLOW       (cms)=        .06           .01         .062 (iii)
     TIME TO PEAK    (hrs)=       1.15          1.20        1.167
     RUNOFF VOLUME    (mm)=      52.84         15.65       39.449
     TOTAL RAINFALL   (mm)=      53.84         53.84       53.836
     RUNOFF COEFFICIENT   =        .98           .29         .733

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
025:0006------------------------------------------------------------------------
*#***************************************************************************|
------------------------
| ADD HYD (301+302   ) | ID: NHYD          AREA      QPEAK    TPEAK   R.V.    DWF
------------------------                   (ha)      (cms)    (hrs)   (mm)   (cms)
                        ID1 02:SWM301       .17       .005     1.68  52.46    .000
                       +ID2 03:OVF          .00       .000      .00    .00    .000
                       +ID3 04:302          .26       .062     1.17  39.45    .000
                        ===========================================================
                        SUM 05:301+302      .43       .066     1.17  44.59    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
025:0007------------------------------------------------------------------------
*#***************************************************************************|
*# ROUTE CATCHMENT 301 & 302 THROUGH ORIFICE SYSTEM
*#
--------------------
| ROUTE RESERVOIR    |    Requested routing time step =  1.0 min.
|  IN>05:(301+30)    |
| OUT<06:(SWM301)    |    =========  OUTLFOW STORAGE TABLE  =========
--------------------      OUTFLOW    STORAGE   |   OUTFLOW    STORAGE
                            (cms)    (ha.m.)   |     (cms)    (ha.m.)
                             .000  .0000E+00   |      .028  .1800E-02
                             .013  .0000E+00   |      .034  .2700E-02
                             .022  .9000E-03   |      .038  .3600E-02

     ROUTING RESULTS             AREA      QPEAK      TPEAK        R.V.
     --------------------        (ha)      (cms)      (hrs)        (mm)
     INFLOW >05: (301+30)         .43       .066      1.167      44.595
     OUTFLOW<06: (SWM301)         .43       .032      1.200      44.609
    OVERFLOW<07: (OVF   )         .00       .000       .000        .000

                   TOTAL NUMBER OF SIMULATED OVERFLOWS  =         0
                   CUMULATIVE TIME OF OVERFLOWS  (hours)=       .00
                   PERCENTAGE OF TIME OVERFLOWING    (%)=       .00


                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=    48.163
                   TIME SHIFT OF PEAK FLOW         (min)=      2.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.2409E-02

--------------------------------------------------------------------------------
025:0008------------------------------------------------------------------------
**#***************************************************************************|
*# CATCHMENT AREA 303 - UNCONTROLLED RUNOFF TO STORM SEWER EASEMENT
*
----------------------
| CALIB NASHYD        |   Area    (ha)=     .06   Curve Number   (CN)=70.00
| 08:303    DT= 1.00 |   Ia      (mm)=   4.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .100

     Unit Hyd Qpeak  (cms)=     .023

     PEAK FLOW       (cms)=     .004 (i)
     TIME TO PEAK    (hrs)=    1.233
     RUNOFF VOLUME    (mm)=   15.647
     TOTAL RAINFALL   (mm)=   53.836
     RUNOFF COEFFICIENT   =     .291

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
025:0009------------------------------------------------------------------------
*#***************************************************************************|
------------------------
| ADD HYD (300 SERIES) | ID: NHYD          AREA      QPEAK    TPEAK   R.V.    DWF
------------------------                   (ha)      (cms)    (hrs)   (mm)   (cms)
                        ID1 06:SWM301       .43       .032     1.20  44.61    .000
```

```
                  +ID2 07:OVF            .00      .000     .00    .00     .000
                  +ID3 08:303            .06      .004    1.23  15.65     .000
                   ==========================================================
                   SUM 09:300 SERIES     .49      .036    1.22  41.06     .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
025:0010------------------------------------------------------------------------
*#****************************************************************************|
*#****************************************************************************|
* RUN REMAINING DESIGN STORMS (GRIMSBY 5 TO 100-YR)
*
--------------------------------------------------------------------------------
025:0002------------------------------------------------------------------------
*
--------------------------------------------------------------------------------
025:0002------------------------------------------------------------------------
*
--------------------------------------------------------------------------------
025:0002------------------------------------------------------------------------
*
  ** END OF RUN :  49

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




--------------------
| START              |  Project  dir.: T:\projects\20007\SWMHYMO\
--------------------  Rainfall dir.: T:\projects\20007\SWMHYMO\
    TZERO =   .00 hrs on       0
    METOUT=   2 (output = METRIC)
    NRUN  = 050
    NSTORM=   1
           #  1=GRIM3050.stm
--------------------------------------------------------------------------------
050:0002------------------------------------------------------------------------
*#****************************************************************************|
*#  Project Name: 141-149 MAIN STREET EAST
*#                GRIMSBY, ONTARIO
*#  JOB NUMBER  : 20007
*#       Date   : MAY 2020
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 20007.DAT
*#****************************************************************************|
*
--------------------------------------------------------------------------------
050:0002------------------------------------------------------------------------
*
--------------------
| READ STORM         |    Filename: 50YR EVENT A=1301.80, B=8, C=0.800
| Ptotal=  59.18 mm|    Comments: 50YR EVENT A=1301.80, B=8, C=0.800
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .17   5.313 |   1.00  37.542 |   1.83  11.899 |   2.67   5.558
               .33   6.319 |   1.17 128.922 |   2.00   9.610 |   2.83   5.052
               .50   7.857 |   1.33  45.256 |   2.17   8.088 |   3.00   4.636
               .67  10.517 |   1.50  23.366 |   2.33   7.004 |
               .83  16.251 |   1.67  15.728 |   2.50   6.191 |

--------------------------------------------------------------------------------
050:0003------------------------------------------------------------------------
*
*#*****************************************************************************|
*#
*#       POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#       ===============================================
*#
*#*****************************************************************************|
*# CATCHMENT AREA 301 - CONTROLLED DISCHARGE - ROOF DRAINS
*
----------------------
| CALIB STANDHYD       |   Area    (ha)=     .17
| 01:301    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
----------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .17          .00
     Dep. Storage     (mm)=      1.00         4.00
     Average Slope     (%)=      1.00         2.00
     Length            (m)=     15.00         1.00
     Mannings n           =      .015         .250

     Max.eff.Inten.(mm/hr)=    128.92        48.87
               over (min)      1.00         2.00
     Storage Coeff.  (min)=       .81 (ii)     1.83 (ii)
     Unit Hyd. Tpeak (min)=      1.00         2.00
     Unit Hyd. peak  (cms)=      1.21          .59
                                                          *TOTALS*
     PEAK FLOW       (cms)=       .06          .00          .060 (iii)
     TIME TO PEAK    (hrs)=      1.17         1.17         1.167
     RUNOFF VOLUME    (mm)=     58.18        18.56        57.788
     TOTAL RAINFALL   (mm)=     59.18        59.18        59.185
     RUNOFF COEFFICIENT   =       .98          .31          .976

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
050:0004------------------------------------------------------------------------
**#***************************************************************************|
*# ROUTE CATCHMENT 301 THROUGH CONTROLLED-FLOW ROOF DRAINS
*#
---------------------
| ROUTE RESERVOIR     |    Requested routing time step =  1.0 min.
|  IN>01:(301    )    |
| OUT<02:(SWM301)     |    =========  OUTLFOW STORAGE TABLE  =========
---------------------     OUTFLOW    STORAGE  |  OUTFLOW    STORAGE
                            (cms)     (ha.m.)  |    (cms)     (ha.m.)
                             .000  .0000E+00  |     .009  .1030E-01
                             .005  .5100E-02  |     .014  .1540E-01

     ROUTING RESULTS             AREA     QPEAK     TPEAK        R.V.
     --------------------        (ha)     (cms)     (hrs)        (mm)
     INFLOW >01: (301   )         .17      .060     1.167      57.788
```

```
     OUTFLOW<02: (SWM301)         .17      .006     1.683      57.788
    OVERFLOW<03: (OVF   )         .00      .000      .000        .000

                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                    CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                    PERCENTAGE OF TIME OVERFLOWING    (%)=      .00


                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=   10.007
                    TIME SHIFT OF PEAK FLOW         (min)=    31.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=.6779E-02

--------------------------------------------------------------------------------
050:0005------------------------------------------------------------------------
**#***************************************************************************|
*# CATCHMENT AREA 302 - CONTROLLED PARKING LOT/LANDSCAPE DISCHARGE
*
----------------------
| CALIB STANDHYD       |   Area    (ha)=     .26
| 04:302    DT= 1.00 |   Total Imp(%)=   64.00   Dir. Conn.(%)=   64.00
----------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       .17          .09
     Dep. Storage     (mm)=      1.00         4.00
     Average Slope     (%)=      2.50         2.50
     Length            (m)=     15.00        10.00
     Mannings n           =      .015         .250

     Max.eff.Inten.(mm/hr)=    128.92        44.89
               over (min)      1.00         5.00
     Storage Coeff.  (min)=       .61 (ii)     4.57 (ii)
     Unit Hyd. Tpeak (min)=      1.00         5.00
     Unit Hyd. peak  (cms)=      1.37          .24
                                                          *TOTALS*
     PEAK FLOW       (cms)=       .06          .01          .068 (iii)
     TIME TO PEAK    (hrs)=      1.15         1.20         1.167
     RUNOFF VOLUME    (mm)=     58.18        18.56        43.921
     TOTAL RAINFALL   (mm)=     59.18        59.18        59.185
     RUNOFF COEFFICIENT   =       .98          .31          .742

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
050:0006------------------------------------------------------------------------
*#****************************************************************************|
------------------------
| ADD HYD (301+302   ) | ID: NHYD          AREA      QPEAK   TPEAK   R.V.     DWF
------------------------                   (ha)      (cms)   (hrs)   (mm)   (cms)
                    ID1 02:SWM301           .17       .006    1.68  57.79    .000
                   +ID2 03:OVF              .00       .000     .00    .00    .000
                   +ID3 04:302              .26       .068    1.17  43.92    .000
                    ==========================================================
                    SUM 05:301+302          .43       .072    1.17  49.40    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
050:0007------------------------------------------------------------------------
*#****************************************************************************|
*# ROUTE CATCHMENT 301 & 302 THROUGH ORIFICE SYSTEM
*#
---------------------
| ROUTE RESERVOIR     |    Requested routing time step =  1.0 min.
|  IN>05:(301+30)     |
| OUT<06:(SWM301)     |    =========  OUTLFOW STORAGE TABLE  =========
---------------------     OUTFLOW    STORAGE  |  OUTFLOW    STORAGE
                            (cms)     (ha.m.)  |    (cms)     (ha.m.)
                             .000  .0000E+00  |     .028  .1800E-02
                             .013  .0000E+00  |     .034  .2700E-02
                             .022  .9000E-03  |     .038  .3600E-02

     ROUTING RESULTS             AREA     QPEAK     TPEAK        R.V.
     --------------------        (ha)     (cms)     (hrs)        (mm)
     INFLOW >05: (301+30)         .43      .072     1.167      49.403
     OUTFLOW<06: (SWM301)         .43      .034     1.250      49.416
    OVERFLOW<07: (OVF   )         .00      .000      .000        .000

                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                    CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                    PERCENTAGE OF TIME OVERFLOWING    (%)=      .00


                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=   46.952
                    TIME SHIFT OF PEAK FLOW         (min)=     5.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=.2788E-02

--------------------------------------------------------------------------------
050:0008------------------------------------------------------------------------
**#***************************************************************************|
*# CATCHMENT AREA 303 - UNCONTROLLED RUNOFF TO STORM SEWER EASEMENT
*
----------------------
| CALIB NASHYD         |   Area    (ha)=     .06   Curve Number   (CN)=70.00
| 08:303    DT= 1.00 |   Ia      (mm)=   4.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .100

     Unit Hyd Qpeak  (cms)=     .023

     PEAK FLOW       (cms)=     .005 (i)
     TIME TO PEAK    (hrs)=    1.233
     RUNOFF VOLUME    (mm)=   18.561
     TOTAL RAINFALL   (mm)=   59.185
     RUNOFF COEFFICIENT   =     .314

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
050:0009------------------------------------------------------------------------
*#****************************************************************************|
------------------------
| ADD HYD (300 SERIES) | ID: NHYD          AREA      QPEAK   TPEAK   R.V.     DWF
------------------------                   (ha)      (cms)   (hrs)   (mm)   (cms)
                    ID1 06:SWM301           .43       .034    1.25  49.42    .000
                   +ID2 07:OVF              .00       .000     .00    .00    .000
                   +ID3 08:303              .06       .005    1.23  18.56    .000
                    ==========================================================
                    SUM 09:300 SERIES       .49       .039    1.23  45.64    .000
```

West Outlet to Existing Storm Easement

```
   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
050:0010------------------------------------------------------------------------
*#*****************************************************************************|
*#*****************************************************************************|
* RUN REMAINING DESIGN STORMS (GRIMSBY 5 TO 100-YR)
*
--------------------------------------------------------------------------------
050:0002------------------------------------------------------------------------
*
--------------------------------------------------------------------------------
050:0002------------------------------------------------------------------------
*
--------------------------------------------------------------------------------
050:0002------------------------------------------------------------------------
*
--------------------------------------------------------------------------------
050:0002------------------------------------------------------------------------
*
  ** END OF RUN :  99

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




--------------------
| START            |  Project  dir.: T:\projects\20007\SWMHYMO\
--------------------  Rainfall dir.: T:\projects\20007\SWMHYMO\
    TZERO =   .00 hrs on       0
    METOUT=   2 (output = METRIC)
    NRUN  = 100
    NSTORM=   1
           #  1=GRIM3100.stm
--------------------------------------------------------------------------------
100:0002------------------------------------------------------------------------
*#*****************************************************************************|
*#  Project Name: 141-149 MAIN STREET EAST
*#                GRIMSBY, ONTARIO
*#  JOB NUMBER  : 20007
*#       Date   : MAY 2020
*#    Revised   :
*#    Company   : S. LLEWELLYN AND ASSOCIATES LTD.
*#       File   : 20007.DAT
*#*****************************************************************************|
*
--------------------------------------------------------------------------------
100:0002------------------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: 100YR EVENT A=1426.13, B=8, C=0.800
| Ptotal=  64.84 mm|    Comments: 100YR EVENT A=1426.13, B=8, C=0.800
--------------------
              TIME    RAIN |    TIME    RAIN |    TIME    RAIN |    TIME    RAIN
               hrs   mm/hr |     hrs   mm/hr |     hrs   mm/hr |     hrs   mm/hr
               .17   5.820 |    1.00  41.127 |    1.83  13.035 |    2.67   6.089
               .33   6.922 |    1.17 141.235 |    2.00  10.527 |    2.83   5.534
               .50   8.608 |    1.33  49.578 |    2.17   8.861 |    3.00   5.079
               .67  11.522 |    1.50  25.597 |    2.33   7.673 |
               .83  17.803 |    1.67  17.230 |    2.50   6.782 |

--------------------------------------------------------------------------------
100:0003------------------------------------------------------------------------
*
*#*****************************************************************************|
*#
*#       POST-DEVELOPMENT CONDITIONS HYDROLOGIC MODELING
*#       ===============================================
*#
*#*****************************************************************************|
*# CATCHMENT AREA 301 - CONTROLLED DISCHARGE - ROOF DRAINS
*
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .17
| 01:301    DT= 1.00 |   Total Imp(%)=   99.00   Dir. Conn.(%)=   99.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .17          .00
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      15.00         1.00
     Mannings n           =       .015         .250

     Max.eff.Inten.(mm/hr)=     141.23        57.44
                over (min)        1.00         2.00
     Storage Coeff.  (min)=        .78 (ii)     1.74 (ii)
     Unit Hyd. Tpeak (min)=       1.00         2.00
     Unit Hyd. peak  (cms)=       1.23          .61
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .07          .00          .066 (iii)
     TIME TO PEAK    (hrs)=       1.17         1.17         1.167
     RUNOFF VOLUME    (mm)=      63.84        21.81        63.417
     TOTAL RAINFALL   (mm)=      64.84        64.84        64.837
     RUNOFF COEFFICIENT   =        .98          .34          .978

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
100:0004------------------------------------------------------------------------
**#****************************************************************************|
*# ROUTE CATCHMENT 301 THROUGH CONTROLLED-FLOW ROOF DRAINS
*#
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>01:(301    )  |
| OUT<02:(SWM301)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |   OUTFLOW    STORAGE
                          (cms)    (ha.m.)    |    (cms)    (ha.m.)
                           .000  .0000E+00    |     .009  .1030E-01
                           .005  .5100E-02    |     .014  .1540E-01

     ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
     --------------------        (ha)     (cms)     (hrs)       (mm)
     INFLOW >01: (301    )        .17      .066     1.167     63.417
     OUTFLOW<02: (SWM301)         .17      .007     1.683     63.416
    OVERFLOW<03: (OVF    )        .00      .000      .000       .000

                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                    CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                    PERCENTAGE OF TIME OVERFLOWING    (%)=      .00


                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=    9.997
                    TIME SHIFT OF PEAK FLOW         (min)=    31.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=.7441E-02

--------------------------------------------------------------------------------
100:0005------------------------------------------------------------------------
**#****************************************************************************|
*# CATCHMENT AREA 302 - CONTROLLED PARKING LOT/LANDSCAPE DISCHARGE
*
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .26
| 04:302    DT= 1.00 |   Total Imp(%)=   64.00   Dir. Conn.(%)=   64.00
----------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .17          .09
     Dep. Storage     (mm)=       1.00         4.00
     Average Slope     (%)=       2.50         2.50
     Length            (m)=      15.00        10.00
     Mannings n           =       .015         .250

     Max.eff.Inten.(mm/hr)=     141.23        54.50
                over (min)        1.00         4.00
     Storage Coeff.  (min)=        .59 (ii)     4.25 (ii)
     Unit Hyd. Tpeak (min)=       1.00         4.00
     Unit Hyd. peak  (cms)=       1.39          .27
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .07          .01          .076 (iii)
     TIME TO PEAK    (hrs)=       1.15         1.20         1.167
     RUNOFF VOLUME    (mm)=      63.84        21.81        48.708
     TOTAL RAINFALL   (mm)=      64.84        64.84        64.837
     RUNOFF COEFFICIENT   =        .98          .34          .751

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  70.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
100:0006------------------------------------------------------------------------
*#*****************************************************************************|
------------------------
| ADD HYD (301+302   ) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                    (ha)     (cms)   (hrs)   (mm)  (cms)
                     ID1 02:SWM301          .17      .007    1.68  63.42   .000
                    +ID2 03:OVF             .00      .000     .00    .00   .000
                    +ID3 04:302             .26      .076    1.17  48.71   .000
                     ==========================================================
                     SUM 05:301+302         .43      .081    1.17  54.52   .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
100:0007------------------------------------------------------------------------
*#*****************************************************************************|
*# ROUTE CATCHMENT 301 & 302 THROUGH ORIFICE SYSTEM
*#
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>05:(301+30)   |
| OUT<06:(SWM301)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |   OUTFLOW    STORAGE
                          (cms)    (ha.m.)    |    (cms)    (ha.m.)
                           .000  .0000E+00    |     .028  .1800E-02
                           .013  .0000E+00    |     .034  .2700E-02
                           .022  .9000E-03    |     .038  .3600E-02

     ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
     --------------------        (ha)     (cms)     (hrs)       (mm)
     INFLOW >05: (301+30)         .43      .081     1.167     54.523
     OUTFLOW<06: (SWM301)         .43      .036     1.283     54.534
    OVERFLOW<07: (OVF    )        .00      .000      .000       .000

                    TOTAL NUMBER OF SIMULATED OVERFLOWS  =        0
                    CUMULATIVE TIME OF OVERFLOWS  (hours)=      .00
                    PERCENTAGE OF TIME OVERFLOWING    (%)=      .00


                    PEAK   FLOW   REDUCTION [Qout/Qin](%)=   45.086
                    TIME SHIFT OF PEAK FLOW         (min)=     7.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=.3285E-02

--------------------------------------------------------------------------------
100:0008------------------------------------------------------------------------
**#****************************************************************************|
*# CATCHMENT AREA 303 - UNCONTROLLED RUNOFF TO STORM SEWER EASEMENT
*
----------------------
| CALIB NASHYD       |   Area    (ha)=     .06   Curve Number   (CN)=70.00
| 08:303    DT= 1.00 |   Ia      (mm)=   4.000   # of Linear Res.(N)= 3.00
----------------------   U.H. Tp(hrs)=    .100

     Unit Hyd Qpeak  (cms)=     .023

     PEAK FLOW       (cms)=     .006 (i)
     TIME TO PEAK    (hrs)=    1.217
     RUNOFF VOLUME    (mm)=   21.807
     TOTAL RAINFALL   (mm)=   64.837
     RUNOFF COEFFICIENT   =     .336

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
100:0009------------------------------------------------------------------------
*#*****************************************************************************|
------------------------
| ADD HYD (300 SERIES) | ID: NHYD          AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                    (ha)     (cms)   (hrs)   (mm)  (cms)
                     ID1 06:SWM301          .43      .036    1.28  54.53   .000
                    +ID2 07:OVF             .00      .000     .00    .00   .000
                    +ID3 08:303             .06      .006    1.22  21.81   .000
                     ==========================================================
                     SUM 09:300 SERIES      .49      .042    1.23  50.53   .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
```

```
--------------------------------------------------------------------------------
100:0010------------------------------------------------------------------------
*#****************************************************************************
*#****************************************************************************
* RUN REMAINING DESIGN STORMS (GRIMSBY 5 TO 100-YR)
*
--------------------------------------------------------------------------------
100:0002------------------------------------------------------------------------
*
--------------------------------------------------------------------------------
100:0002------------------------------------------------------------------------
*
--------------------------------------------------------------------------------
100:0002------------------------------------------------------------------------
*
--------------------------------------------------------------------------------
100:0002------------------------------------------------------------------------
*
--------------------------------------------------------------------------------
100:0002------------------------------------------------------------------------
*
      FINISH
--------------------------------------------------------------------------------
********************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2020-05-24     at 15:49:00
================================================================================
```

APPENDIX B

STORMWATER QUALITY INFORMATION

Hydroworks Sizing Summary

20007 - 141-149 Main Street East, Grimsby
East Outlet

05-25-2020

Recommended Size: HS 6

A HydroStorm HS 6 is recommended to provide 80 % annual TSS removal based on a drainage area of 0.38 (ha) with an imperviousness of 76 % and Hamilton Airport, Ontario rainfall for the ETV Canada particle size distribution.

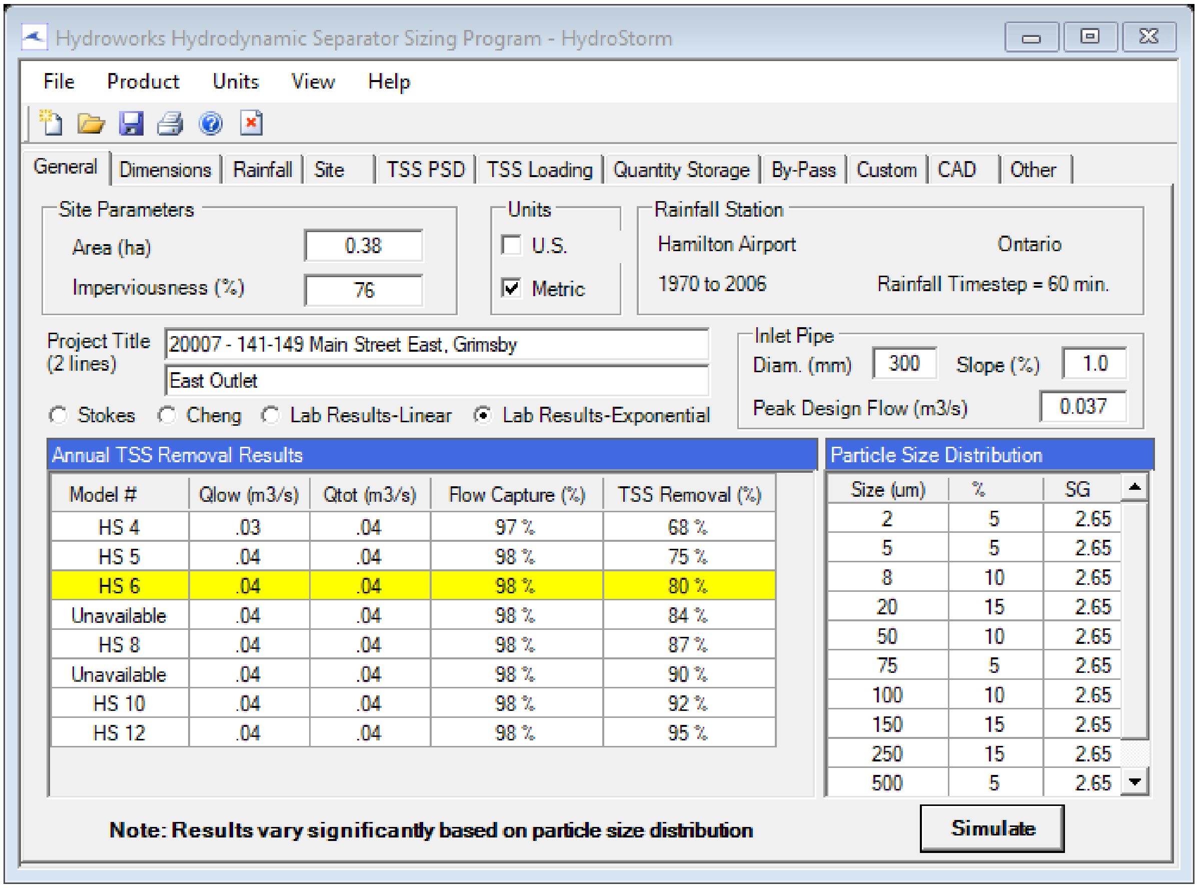
The recommended HydroStorm HS 6 treats 98 % of the annual runoff and provides 80 % annual TSS removal for the Hamilton Airport rainfall records and ETV Canada particle size distribution.

The HydroStorm has a headloss coefficient (K) of 1.04. The given peak flow Of .037 (m3/s) Is less than the full pipe flow Of .1 (m3/s) indicating free flow In the pipe during the peak flow assuming no tailwater condition. Partial pipe flow was assumed For the headloss calculations. The critical depth Is greater than the normal depth For the peak flow And 300 (mm) pipe diameter And 1 % slope given. Critical depth was assumed For the headloss calculations. The headloss was calculated To be 61 (mm) based On a flow depth Of 147 (mm) .

This summary report provides the main parameters that were used for sizing. These parameters are shown on the summary tables and graphs provided in this report.

If you have any questions regarding this sizing summary please do not hesitate to contact Hydroworks at 888-290-7900 or email us at support@hydroworks.com.

TSS Removal Sizing Summary



Site Parameters

Area (ha) 0.38

Imperviousness (%) 76

Units

☐ U.S.

☑ Metric

Rainfall Station

Hamilton Airport Ontario

1970 to 2006 Rainfall Timestep = 60 min.

Project Title (2 lines) 20007 - 141-149 Main Street East, Grimsby

East Outlet

○ Stokes ○ Cheng ○ Lab Results-Linear ● Lab Results-Exponential

Inlet Pipe

Diam. (mm) 300 Slope (%) 1.0

Peak Design Flow (m3/s) 0.037

Annual TSS Removal Results

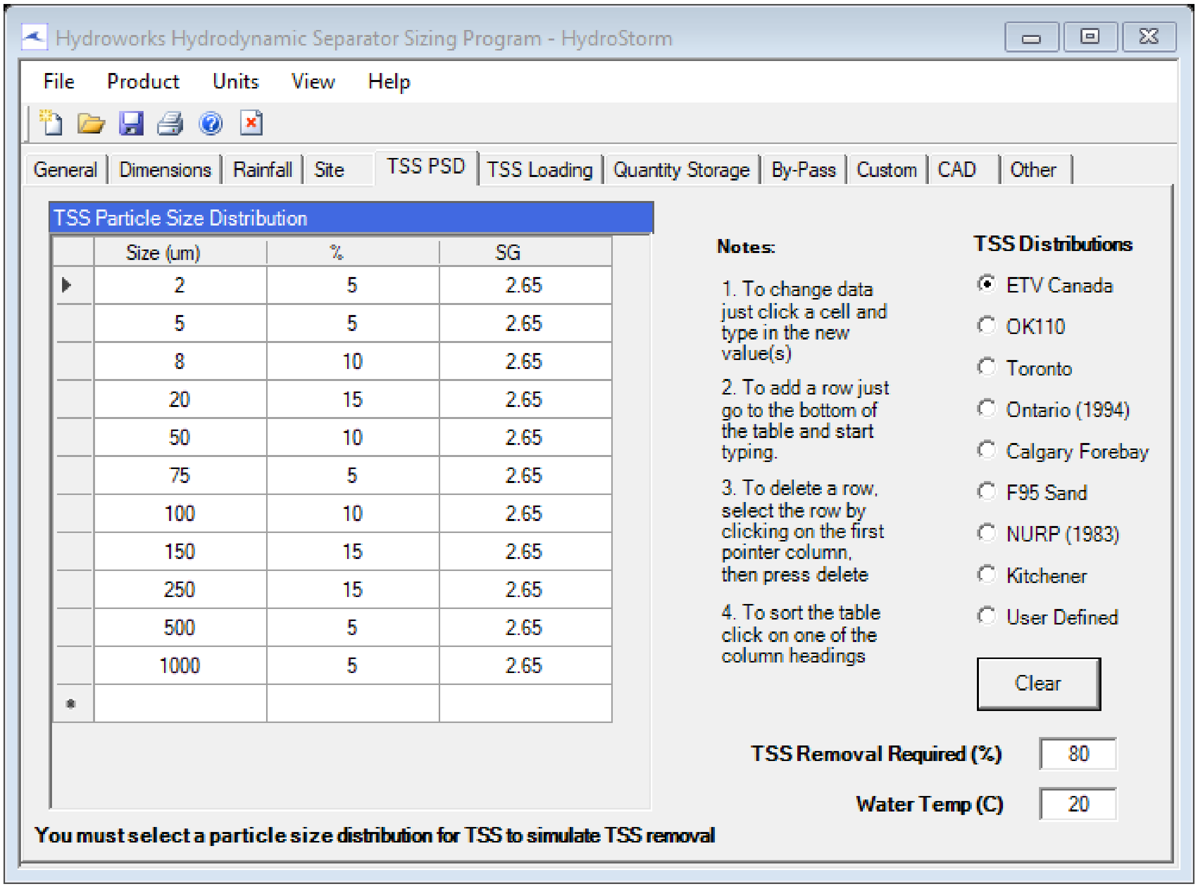
Model #	Qlow (m3/s)	Qtot (m3/s)	Flow Capture (%)	TSS Removal (%)
HS 4	.03	.04	97 %	68 %
HS 5	.04	.04	98 %	75 %
HS 6	.04	.04	98 %	80 %
Unavailable	.04	.04	98 %	84 %
HS 8	.04	.04	98 %	87 %
Unavailable	.04	.04	98 %	90 %
HS 10	.04	.04	98 %	92 %
HS 12	.04	.04	98 %	95 %

Particle Size Distribution

Size (um)	%	SG
2	5	2.65
5	5	2.65
8	10	2.65
20	15	2.65
50	10	2.65
75	5	2.65
100	10	2.65
150	15	2.65
250	15	2.65
500	5	2.65

Note: Results vary significantly based on particle size distribution

TSS Particle Size Distribution



TSS Particle Size Distribution

Size (um)	%	SG
2	5	2.65
5	5	2.65
8	10	2.65
20	15	2.65
50	10	2.65
75	5	2.65
100	10	2.65
150	15	2.65
250	15	2.65
500	5	2.65
1000	5	2.65

Notes:

1. To change data just click a cell and type in the new value(s)
2. To add a row just go to the bottom of the table and start typing.
3. To delete a row, select the row by clicking on the first pointer column, then press delete
4. To sort the table click on one of the column headings

TSS Distributions

● ETV Canada

○ OK110

○ Toronto

○ Ontario (1994)

○ Calgary Forebay

○ F95 Sand

○ NURP (1983)

○ Kitchener

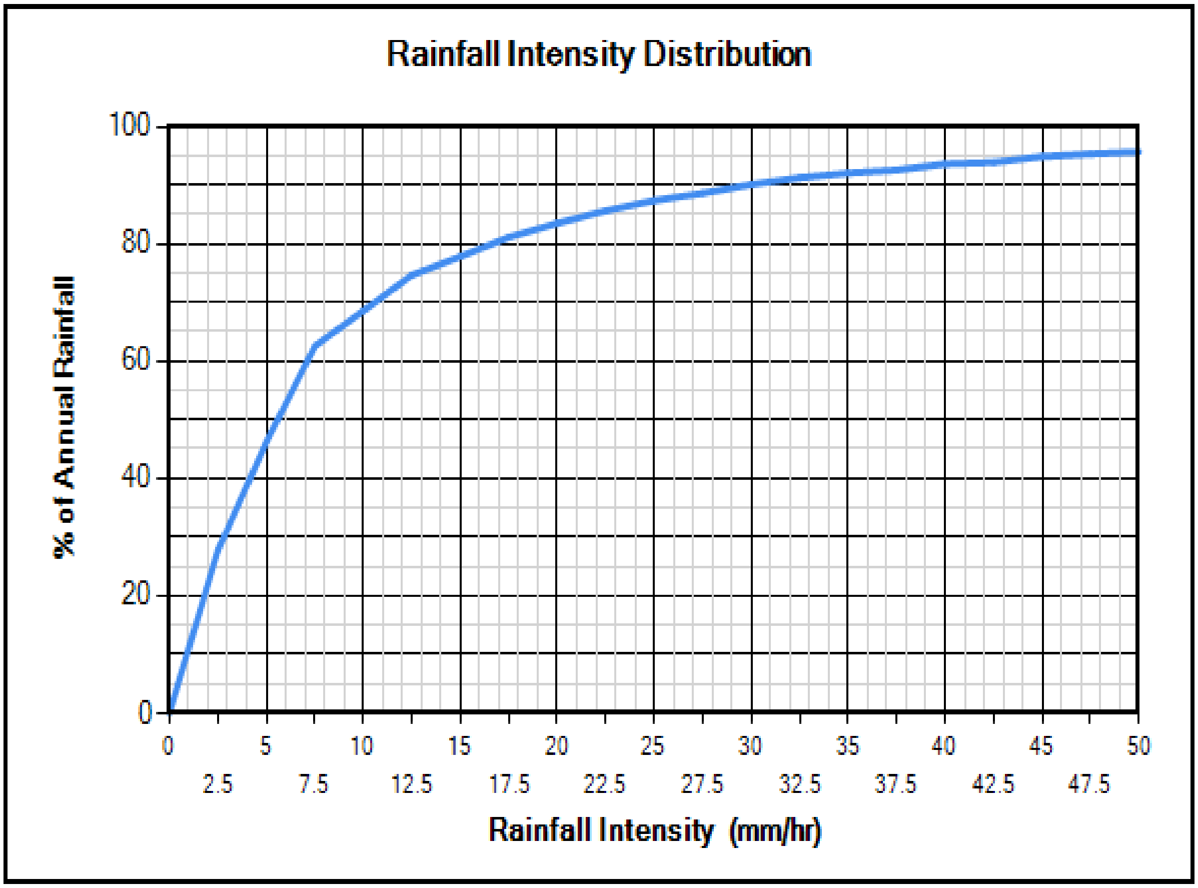
○ User Defined

TSS Removal Required (%) 80

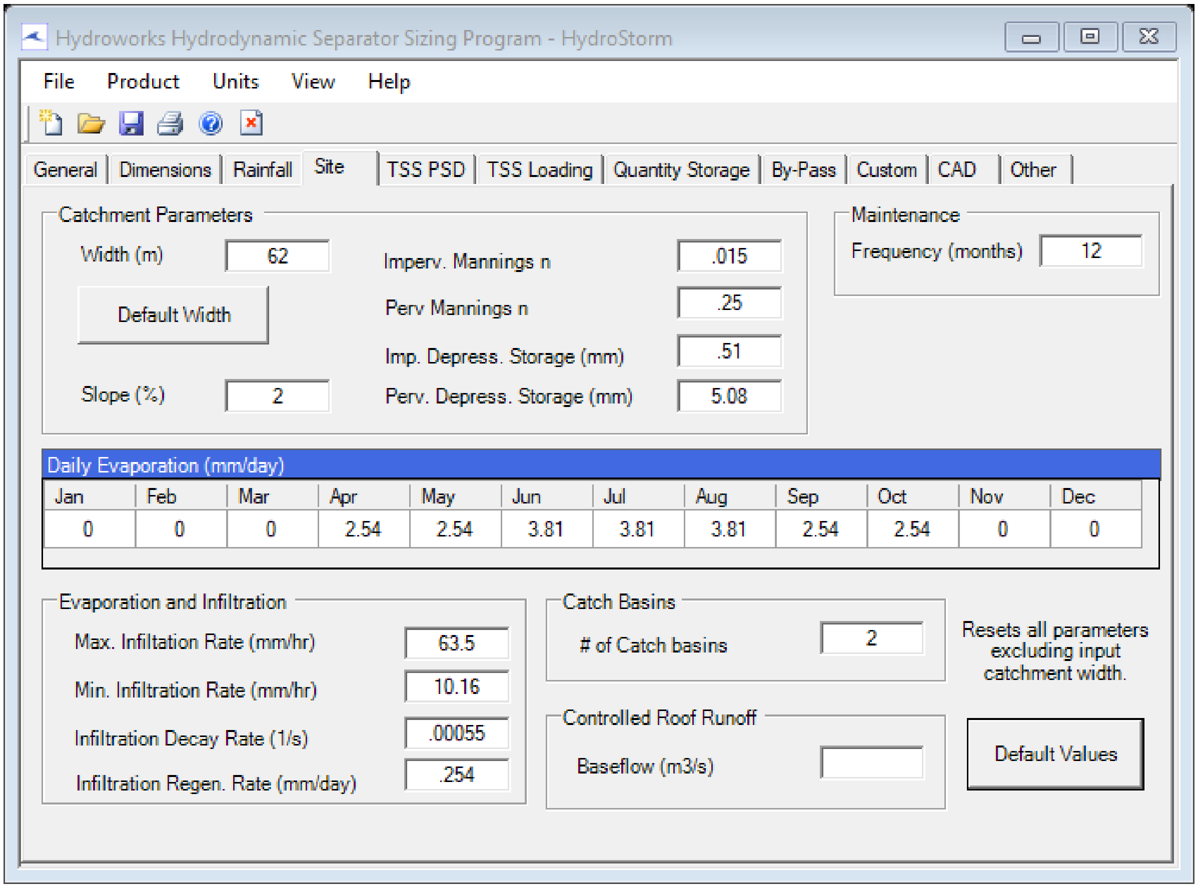
Water Temp (C) 20

You must select a particle size distribution for TSS to simulate TSS removal

Rainfall Station - Hamilton Airport, Ontario(1970 to 2006)



Site Physical Characteristics



Catchment Parameters

Width (m) 62

Slope (%) 2

Imperv. Mannings n .015

Perv Mannings n .25

Imp. Depress. Storage (mm) .51

Perv. Depress. Storage (mm) 5.08

Maintenance

Frequency (months) 12

Daily Evaporation (mm/day)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	2.54	2.54	3.81	3.81	3.81	2.54	2.54	0	0

Evaporation and Infiltration

Max. Infiltation Rate (mm/hr) 63.5

Min. Infiltration Rate (mm/hr) 10.16

Infiltration Decay Rate (1/s) .00055

Infiltration Regen. Rate (mm/day) .254

Catch Basins

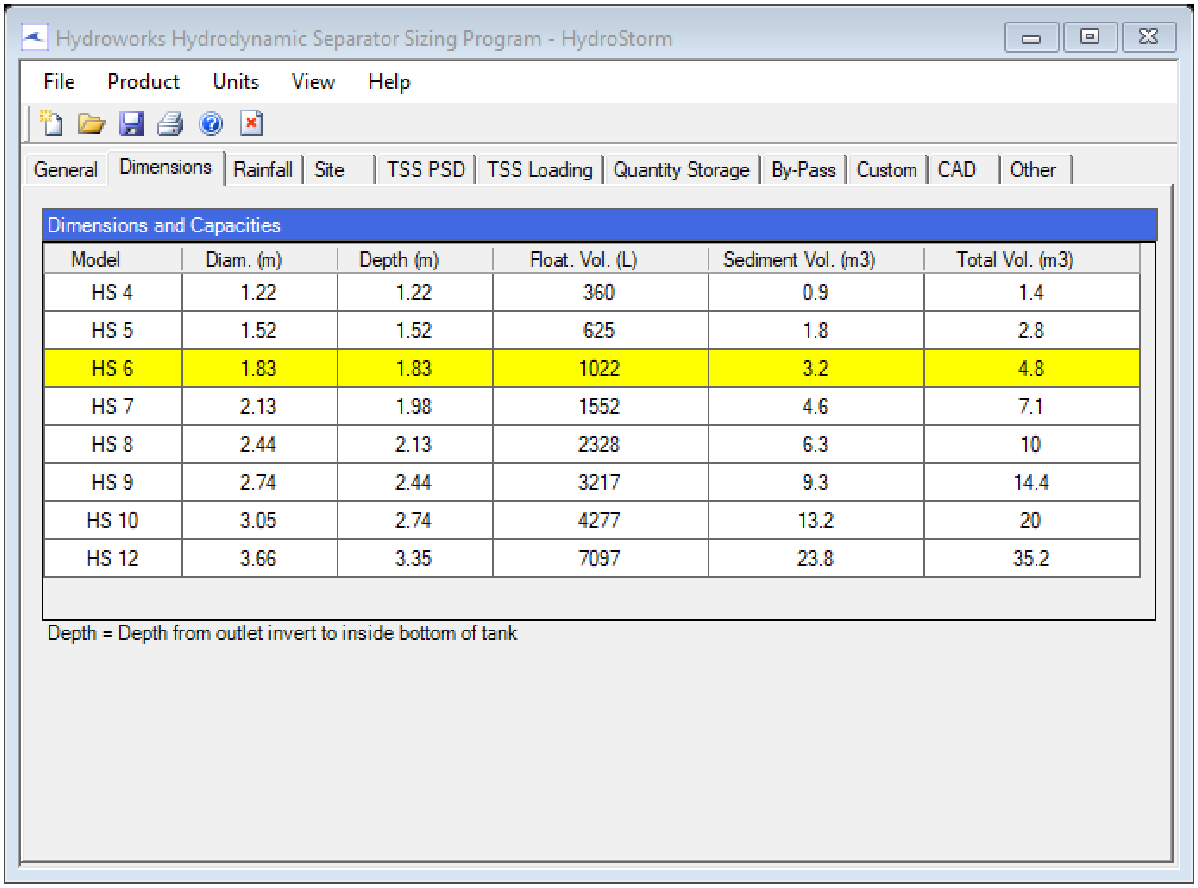
# of Catch basins 2

Controlled Roof Runoff

Baseflow (m3/s)

Resets all parameters excluding input catchment width.

Dimensions And Capacities

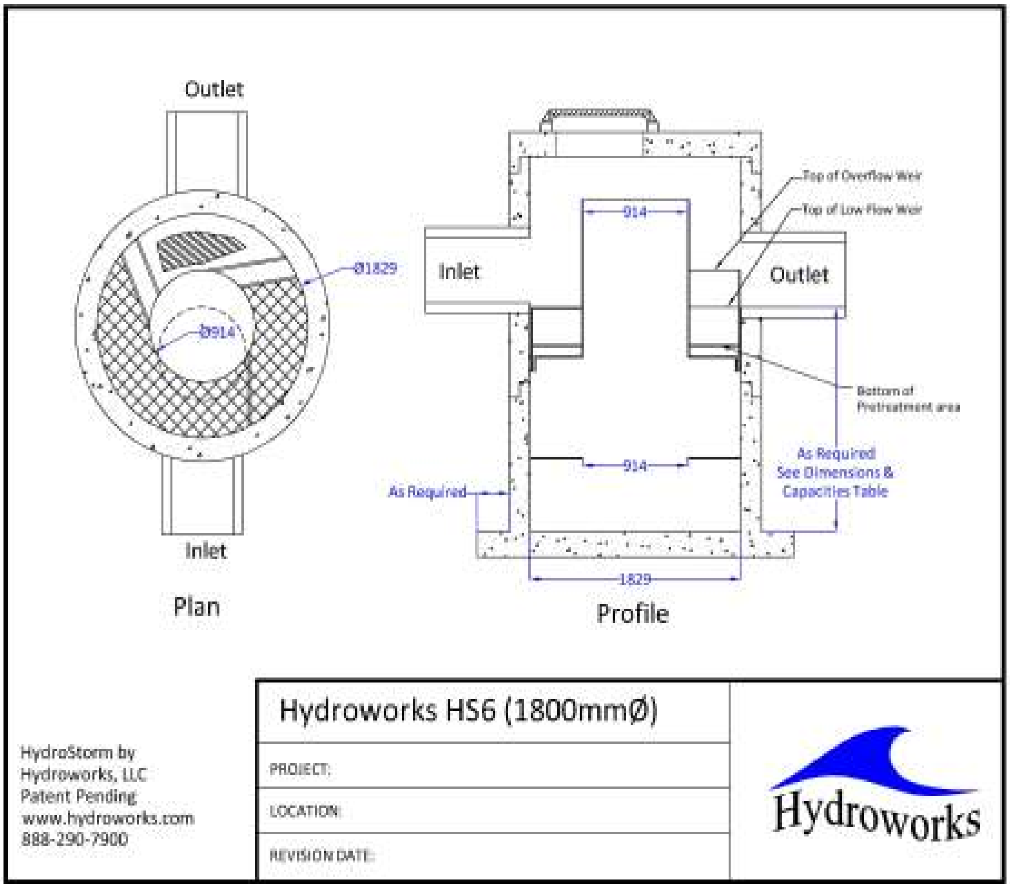


Dimensions and Capacities

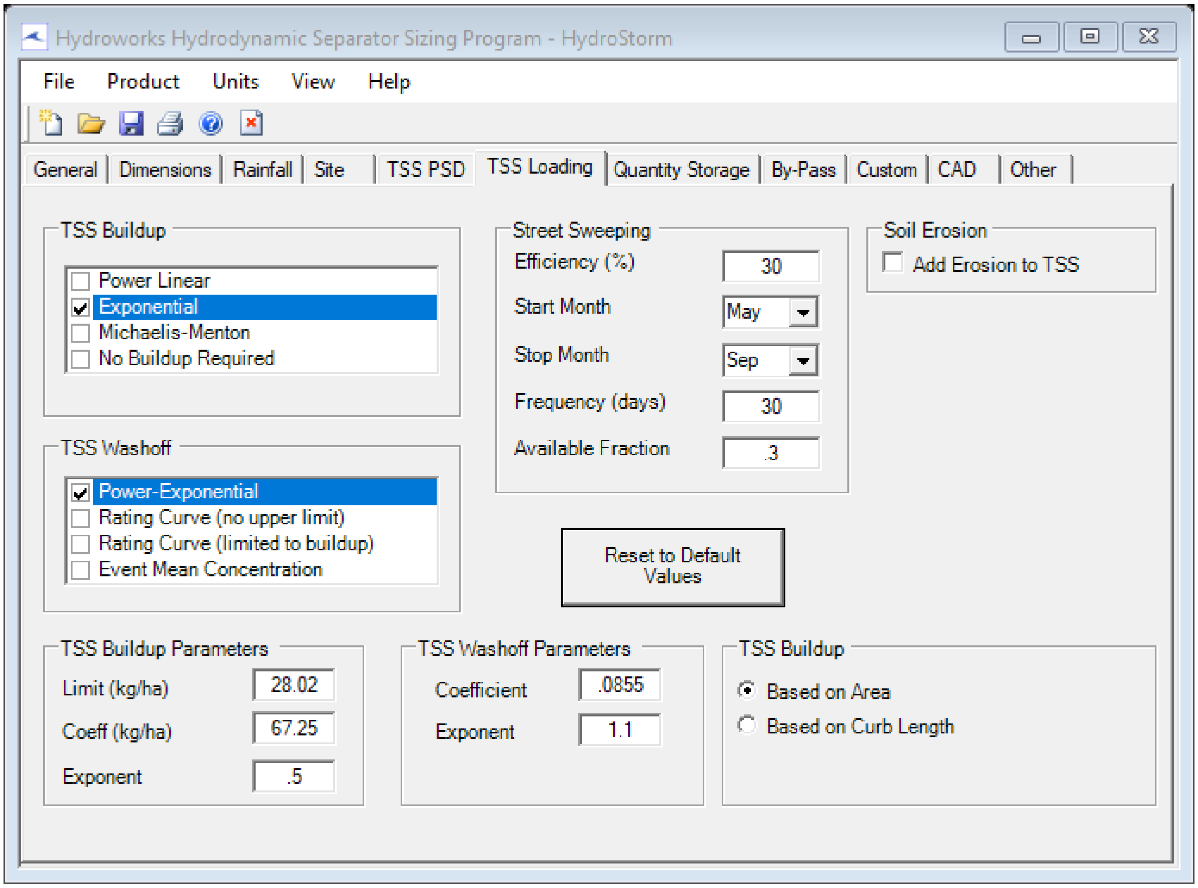
Model	Diam. (m)	Depth (m)	Float. Vol. (L)	Sediment Vol. (m3)	Total Vol. (m3)
HS 4	1.22	1.22	360	0.9	1.4
HS 5	1.52	1.52	625	1.8	2.8
HS 6	1.83	1.83	1022	3.2	4.8
HS 7	2.13	1.98	1552	4.6	7.1
HS 8	2.44	2.13	2328	6.3	10
HS 9	2.74	2.44	3217	9.3	14.4
HS 10	3.05	2.74	4277	13.2	20
HS 12	3.66	3.35	7097	23.8	35.2

Depth = Depth from outlet invert to inside bottom of tank

Generic HS 6 CAD Drawing



TSS Buildup And Washoff



TSS Buildup

- ☐ Power Linear
- ☑ Exponential
- ☐ Michaelis-Menton
- ☐ No Buildup Required

TSS Washoff

- ☑ Power-Exponential
- ☐ Rating Curve (no upper limit)
- ☐ Rating Curve (limited to buildup)
- ☐ Event Mean Concentration

Street Sweeping

Efficiency (%)	30
Start Month	May
Stop Month	Sep
Frequency (days)	30
Available Fraction	.3

Soil Erosion

- ☐ Add Erosion to TSS

TSS Buildup Parameters

Limit (kg/ha)	28.02
Coeff (kg/ha)	67.25
Exponent	.5

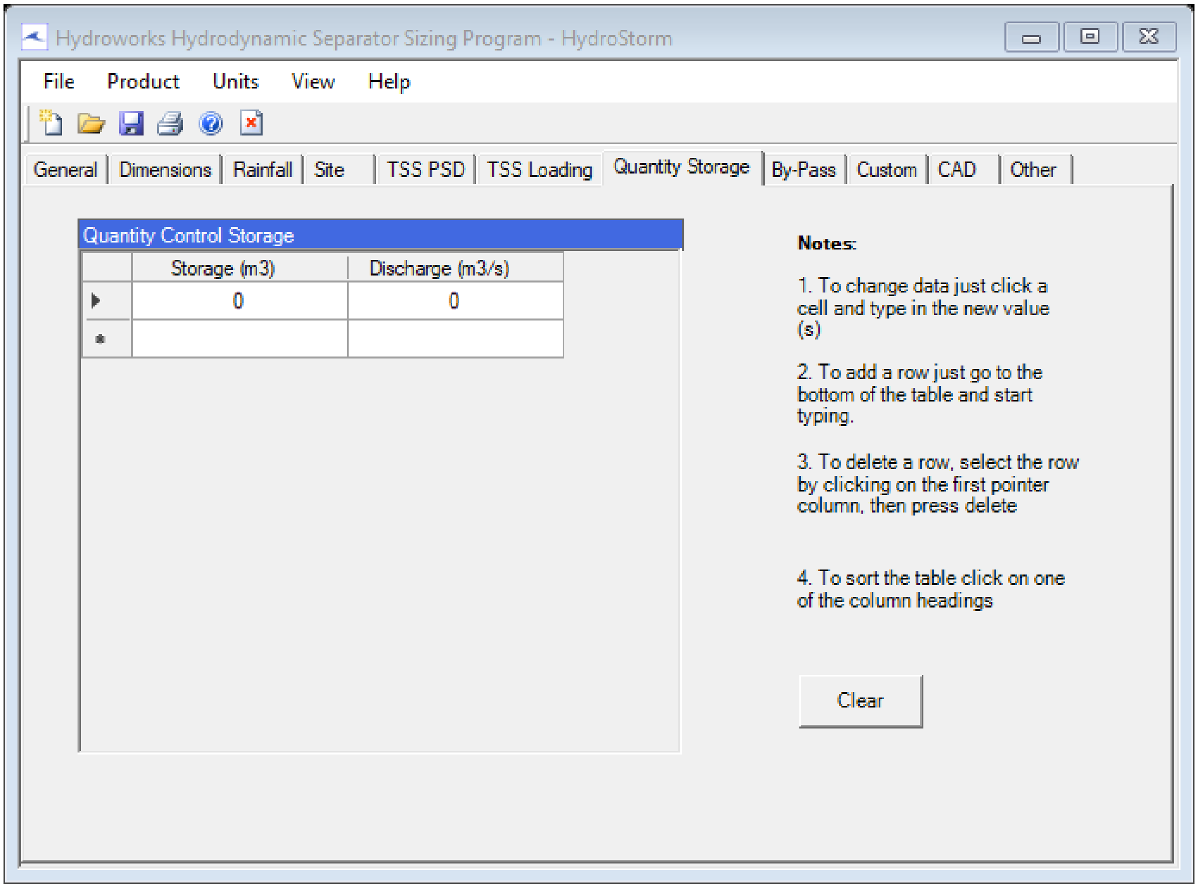
TSS Washoff Parameters

Coefficient	.0855
Exponent	1.1

TSS Buildup

- ● Based on Area
- ○ Based on Curb Length

Upstream Quantity Storage



Quantity Control Storage

Storage (m3)	Discharge (m3/s)
0	0

Notes:

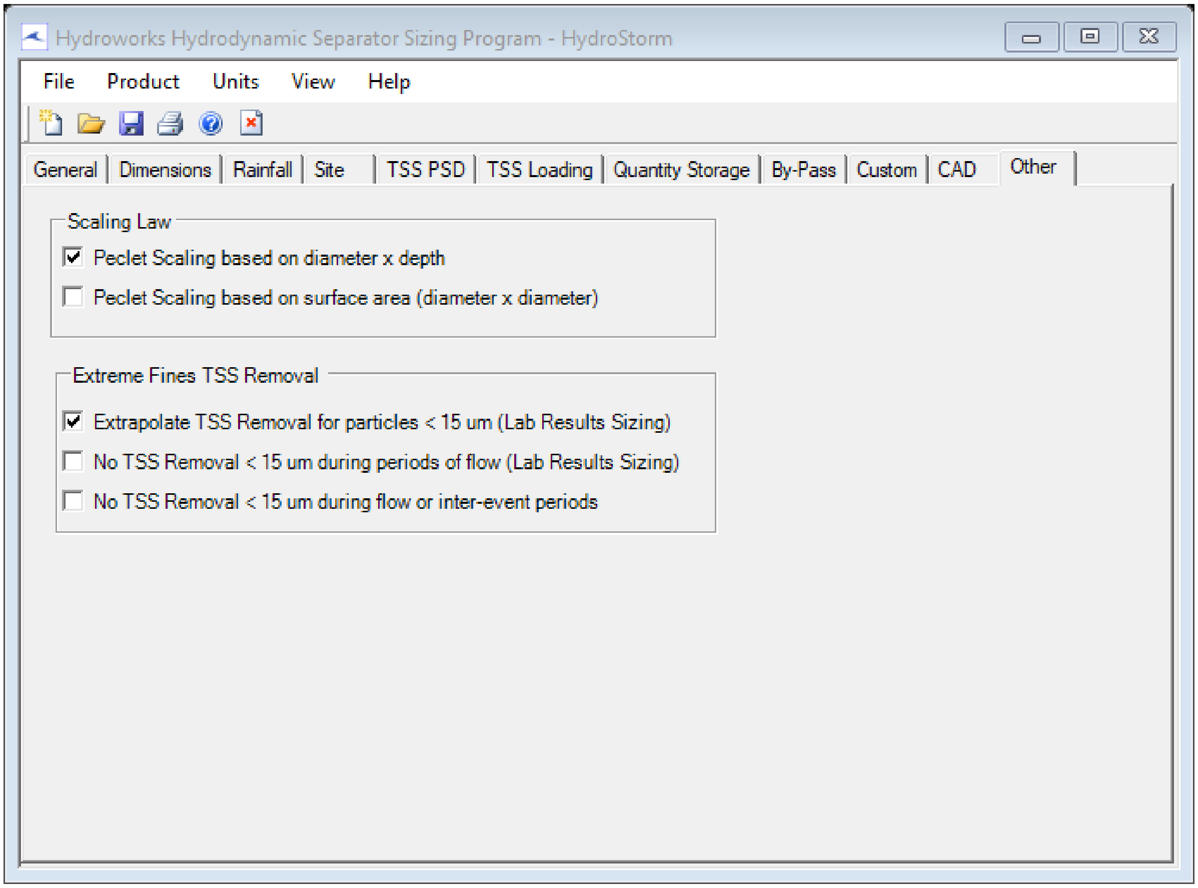
1. To change data just click a cell and type in the new value (s)

2. To add a row just go to the bottom of the table and start typing.

3. To delete a row, select the row by clicking on the first pointer column, then press delete

4. To sort the table click on one of the column headings

Other Parameters



Scaling Law

☑ Peclet Scaling based on diameter x depth

☐ Peclet Scaling based on surface area (diameter x diameter)

Extreme Fines TSS Removal

☑ Extrapolate TSS Removal for particles < 15 um (Lab Results Sizing)

☐ No TSS Removal < 15 um during periods of flow (Lab Results Sizing)

☐ No TSS Removal < 15 um during flow or inter-event periods

Hydroworks Sizing Program - Version 4.9

Hydroworks

Hydroworks Sizing Summary

20007 - 141-149 Main Street East, Grimsby
West Outlet

05-25-2020

Recommended Size: Unavailable

HS 7 not available in Ontario,
therefore HS 8 is recommended

A HydroStorm ~~Unavailable~~ HS 8 is recommended to provide ~~80~~ 85% % annual TSS removal based on a drainage area of 0.43 (ha) with an imperviousness of 78 % and Hamilton Airport, Ontario rainfall for the ETV Canada particle size distribution.

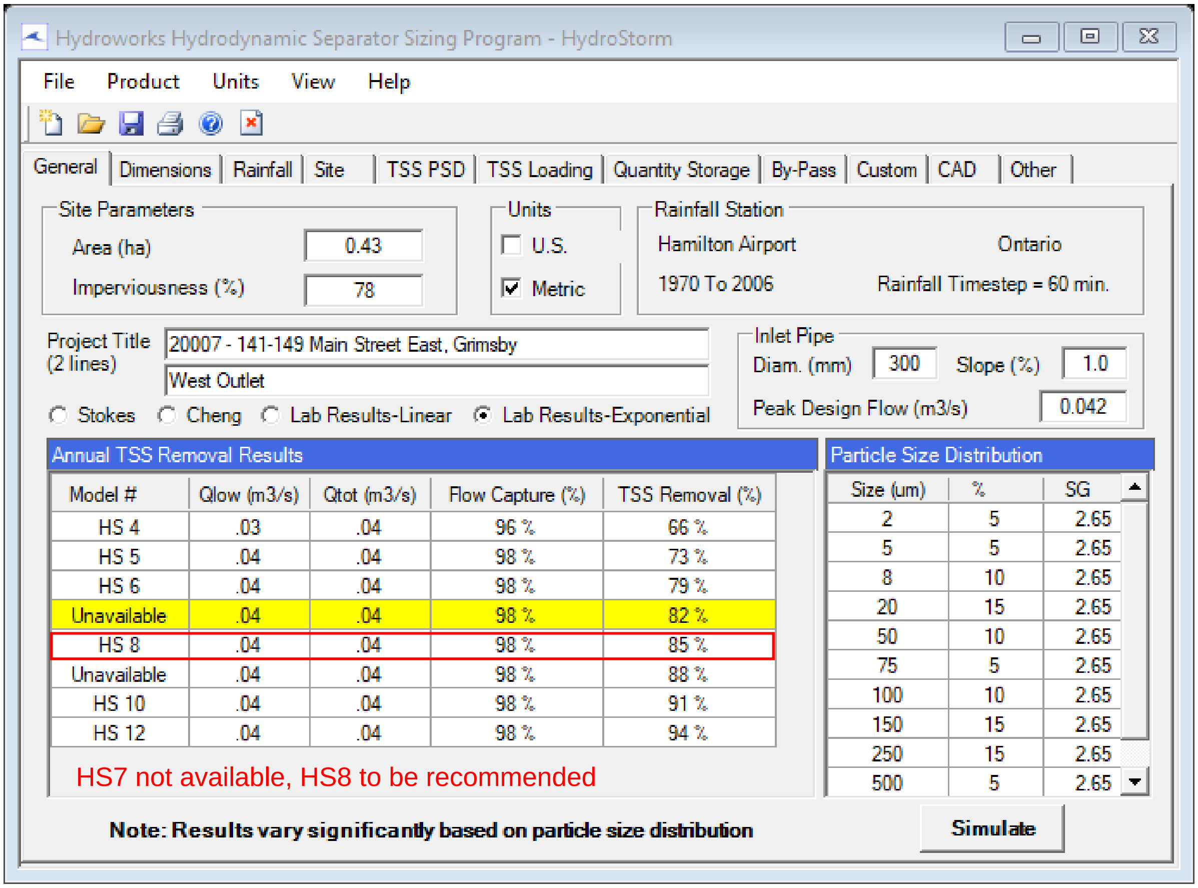
The recommended HydroStorm ~~Unavailable~~ HS 8 treats ~~98~~ 98% % of the annual runoff and provides ~~82~~ 85% % annual TSS removal for the Hamilton Airport rainfall records and ETV Canada particle size distribution.

The HydroStorm has a headloss coefficient (K) of 1.04. The given peak flow Of .042 (m3/s) Is less than the full pipe flow Of .1 (m3/s) indicating free flow In the pipe during the peak flow assuming no tailwater condition. Partial pipe flow was assumed For the headloss calculations. The critical depth Is greater than the normal depth For the peak flow And 300 (mm) pipe diameter And 1 % slope given. Critical depth was assumed For the headloss calculations. The headloss was calculated To be 67 (mm) based On a flow depth Of 157 (mm) .

This summary report provides the main parameters that were used for sizing. These parameters are shown on the summary tables and graphs provided in this report.

If you have any questions regarding this sizing summary please do not hesitate to contact Hydroworks at 888-290-7900 or email us at support@hydroworks.com.

TSS Removal Sizing Summary



Site Parameters

Area (ha): 0.43

Imperviousness (%): 78

Units

☐ U.S.

☑ Metric

Rainfall Station

Hamilton Airport Ontario

1970 To 2006 Rainfall Timestep = 60 min.

Project Title (2 lines): 20007 - 141-149 Main Street East, Grimsby

West Outlet

Inlet Pipe

Diam. (mm): 300 Slope (%): 1.0

Peak Design Flow (m3/s): 0.042

○ Stokes ○ Cheng ○ Lab Results-Linear ● Lab Results-Exponential

Annual TSS Removal Results

Model #	Qlow (m3/s)	Qtot (m3/s)	Flow Capture (%)	TSS Removal (%)
HS 4	.03	.04	96 %	66 %
HS 5	.04	.04	98 %	73 %
HS 6	.04	.04	98 %	79 %
Unavailable	.04	.04	98 %	82 %
HS 8	.04	.04	98 %	85 %
Unavailable	.04	.04	98 %	88 %
HS 10	.04	.04	98 %	91 %
HS 12	.04	.04	98 %	94 %

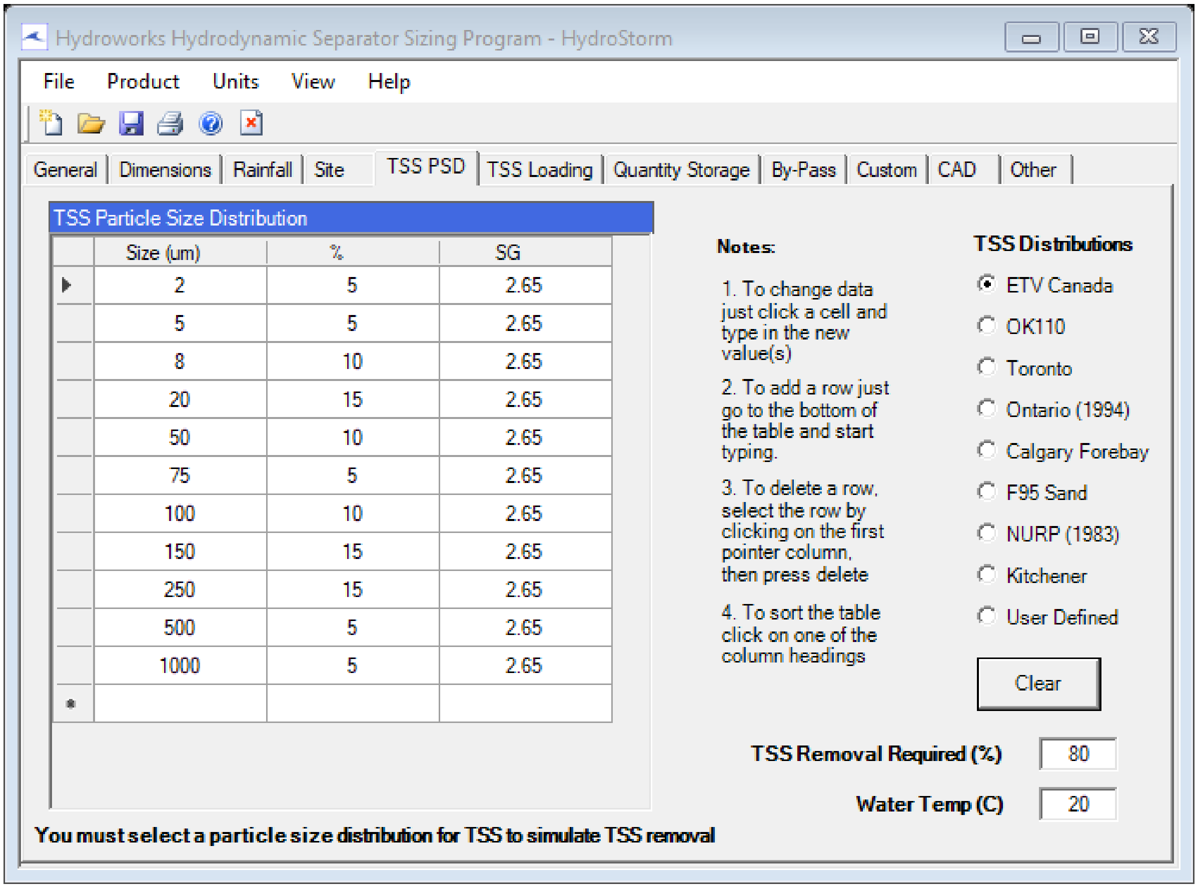
HS7 not available, HS8 to be recommended

Particle Size Distribution

Size (um)	%	SG
2	5	2.65
5	5	2.65
8	10	2.65
20	15	2.65
50	10	2.65
75	5	2.65
100	10	2.65
150	15	2.65
250	15	2.65
500	5	2.65

Note: Results vary significantly based on particle size distribution

TSS Particle Size Distribution



TSS Particle Size Distribution

Size (um)	%	SG
2	5	2.65
5	5	2.65
8	10	2.65
20	15	2.65
50	10	2.65
75	5	2.65
100	10	2.65
150	15	2.65
250	15	2.65
500	5	2.65
1000	5	2.65

Notes:

1. To change data just click a cell and type in the new value(s)
2. To add a row just go to the bottom of the table and start typing.
3. To delete a row, select the row by clicking on the first pointer column, then press delete
4. To sort the table click on one of the column headings

TSS Distributions

● ETV Canada

○ OK110

○ Toronto

○ Ontario (1994)

○ Calgary Forebay

○ F95 Sand

○ NURP (1983)

○ Kitchener

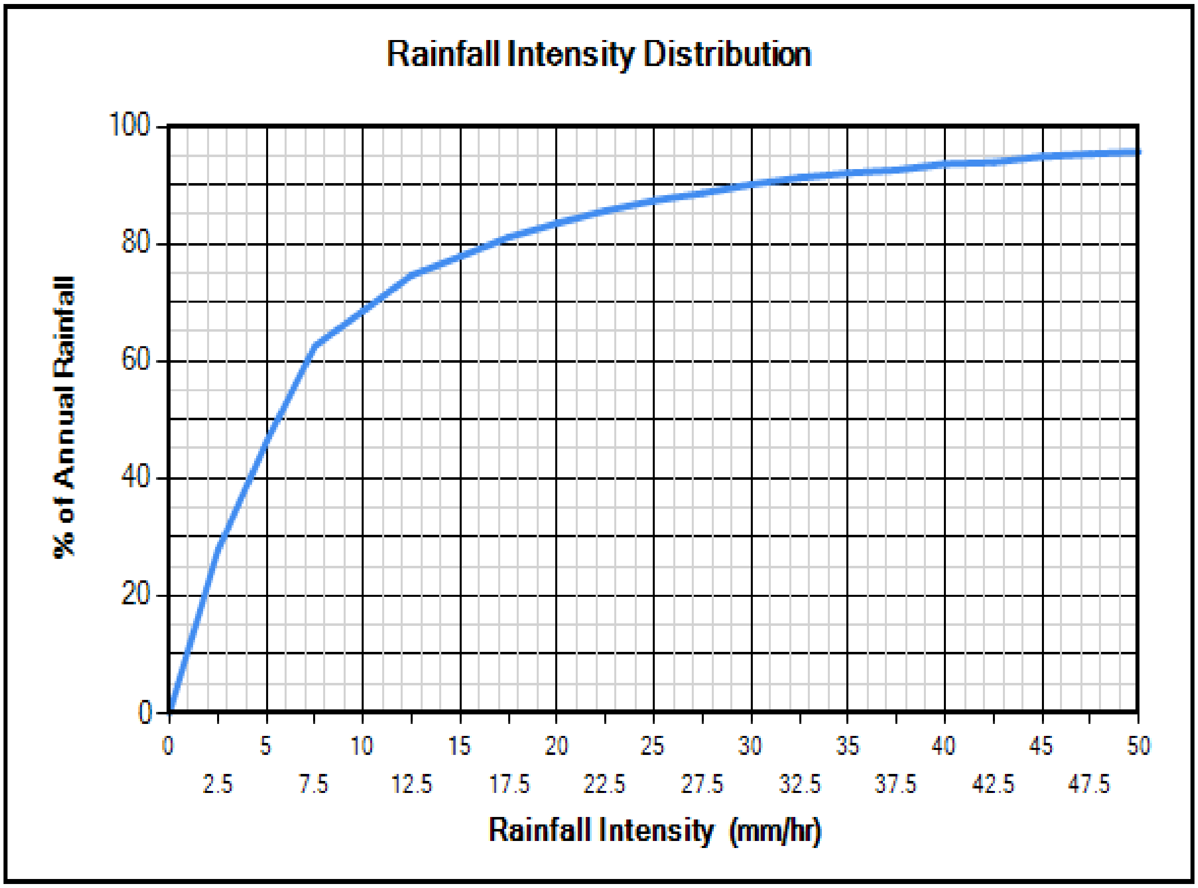
○ User Defined

TSS Removal Required (%): 80

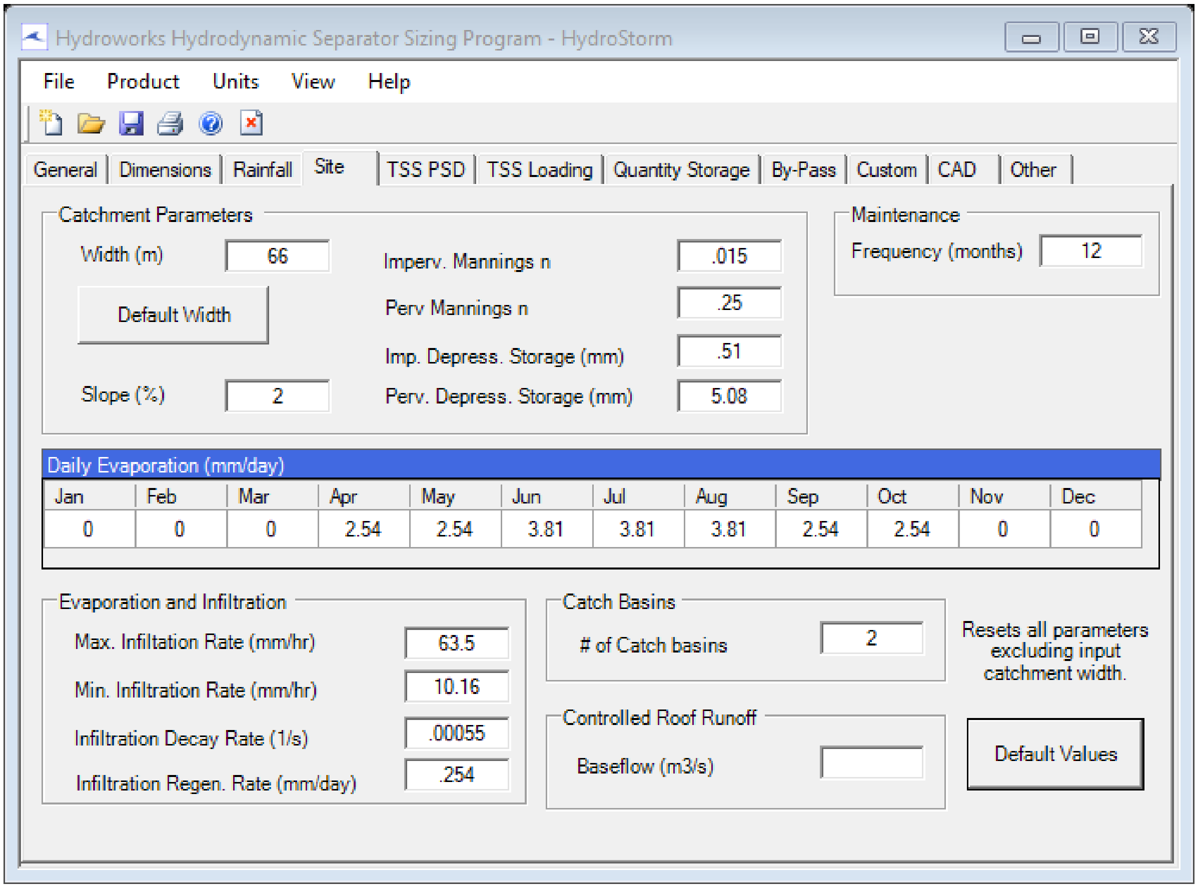
Water Temp (C): 20

You must select a particle size distribution for TSS to simulate TSS removal

Rainfall Station - Hamilton Airport, Ontario(1970 To 2006)



Site Physical Characteristics



Catchment Parameters

Width (m) 66

Slope (%) 2

Imperv. Mannings n .015

Perv Mannings n .25

Imp. Depress. Storage (mm) .51

Perv. Depress. Storage (mm) 5.08

Maintenance

Frequency (months) 12

Daily Evaporation (mm/day)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	2.54	2.54	3.81	3.81	3.81	2.54	2.54	0	0

Evaporation and Infiltration

Max. Infiltation Rate (mm/hr) 63.5

Min. Infiltration Rate (mm/hr) 10.16

Infiltration Decay Rate (1/s) .00055

Infiltration Regen. Rate (mm/day) .254

Catch Basins

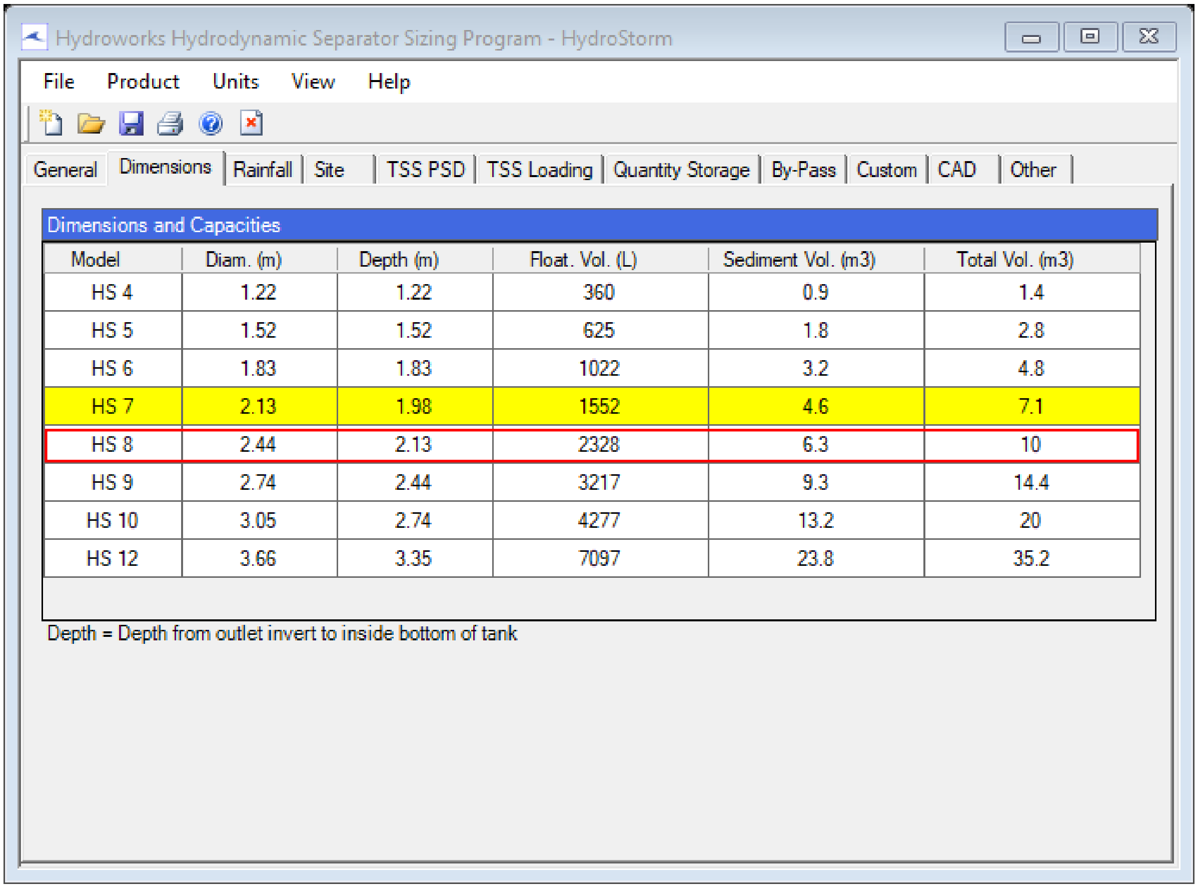
# of Catch basins 2

Controlled Roof Runoff

Baseflow (m3/s)

Resets all parameters excluding input catchment width.

Dimensions And Capacities

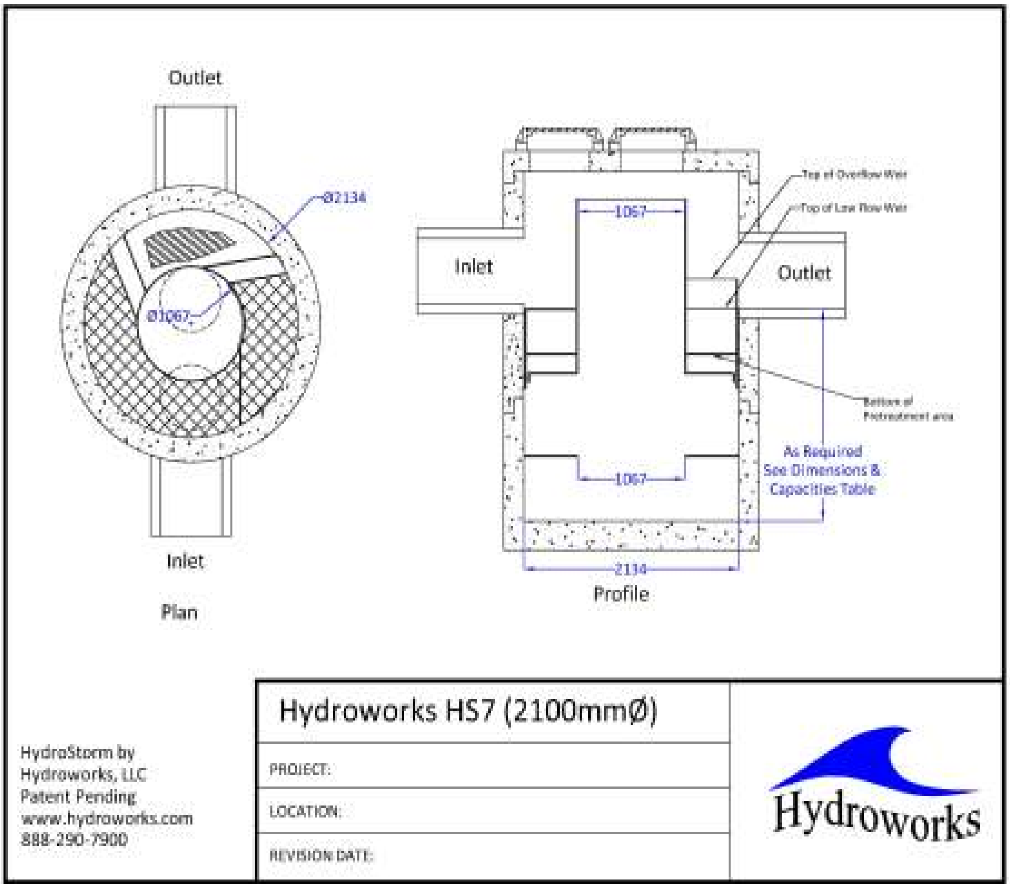


Dimensions and Capacities

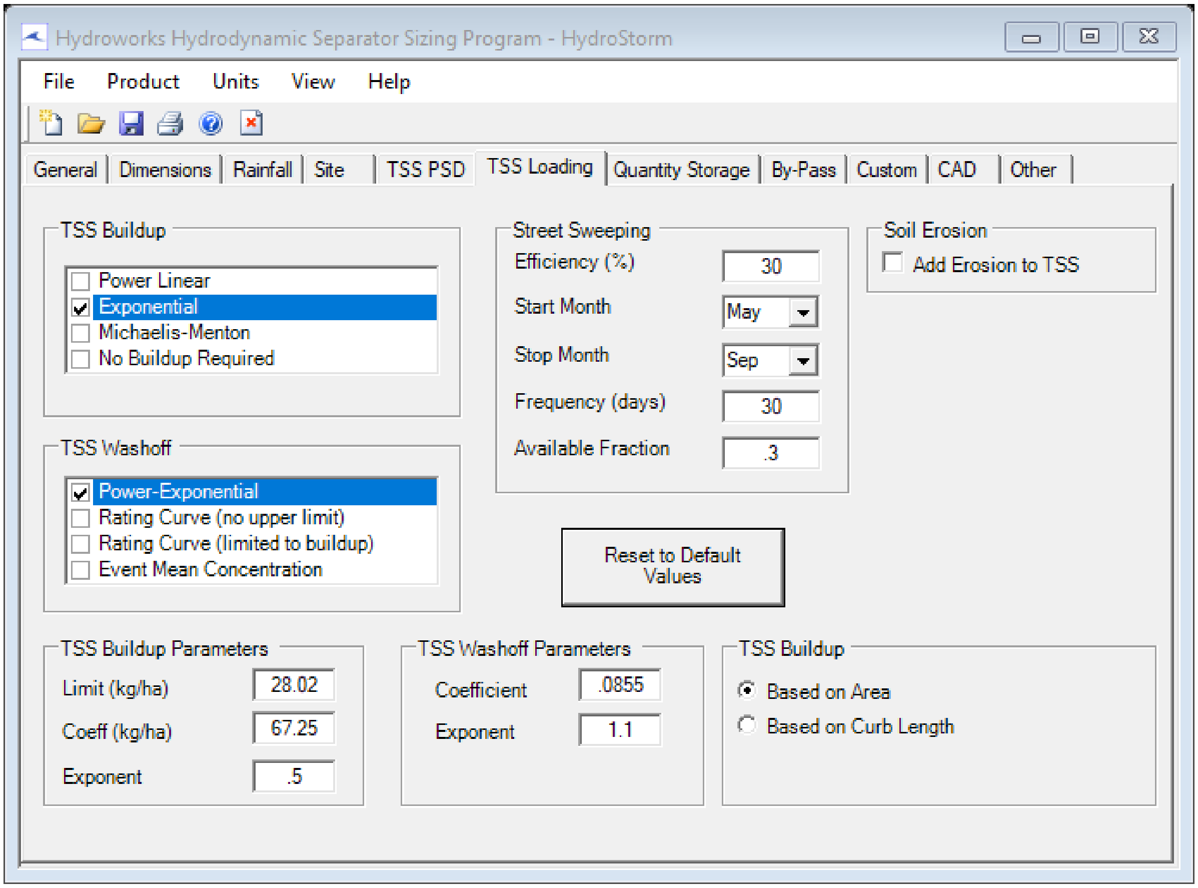
Model	Diam. (m)	Depth (m)	Float. Vol. (L)	Sediment Vol. (m3)	Total Vol. (m3)
HS 4	1.22	1.22	360	0.9	1.4
HS 5	1.52	1.52	625	1.8	2.8
HS 6	1.83	1.83	1022	3.2	4.8
HS 7	2.13	1.98	1552	4.6	7.1
HS 8	2.44	2.13	2328	6.3	10
HS 9	2.74	2.44	3217	9.3	14.4
HS 10	3.05	2.74	4277	13.2	20
HS 12	3.66	3.35	7097	23.8	35.2

Depth = Depth from outlet invert to inside bottom of tank

Generic Unavailable CAD Drawing



TSS Buildup And Washoff



TSS Buildup
- ☐ Power Linear
- ☑ Exponential
- ☐ Michaelis-Menton
- ☐ No Buildup Required

TSS Washoff
- ☑ Power-Exponential
- ☐ Rating Curve (no upper limit)
- ☐ Rating Curve (limited to buildup)
- ☐ Event Mean Concentration

Street Sweeping
Efficiency (%) 30
Start Month May
Stop Month Sep
Frequency (days) 30
Available Fraction .3

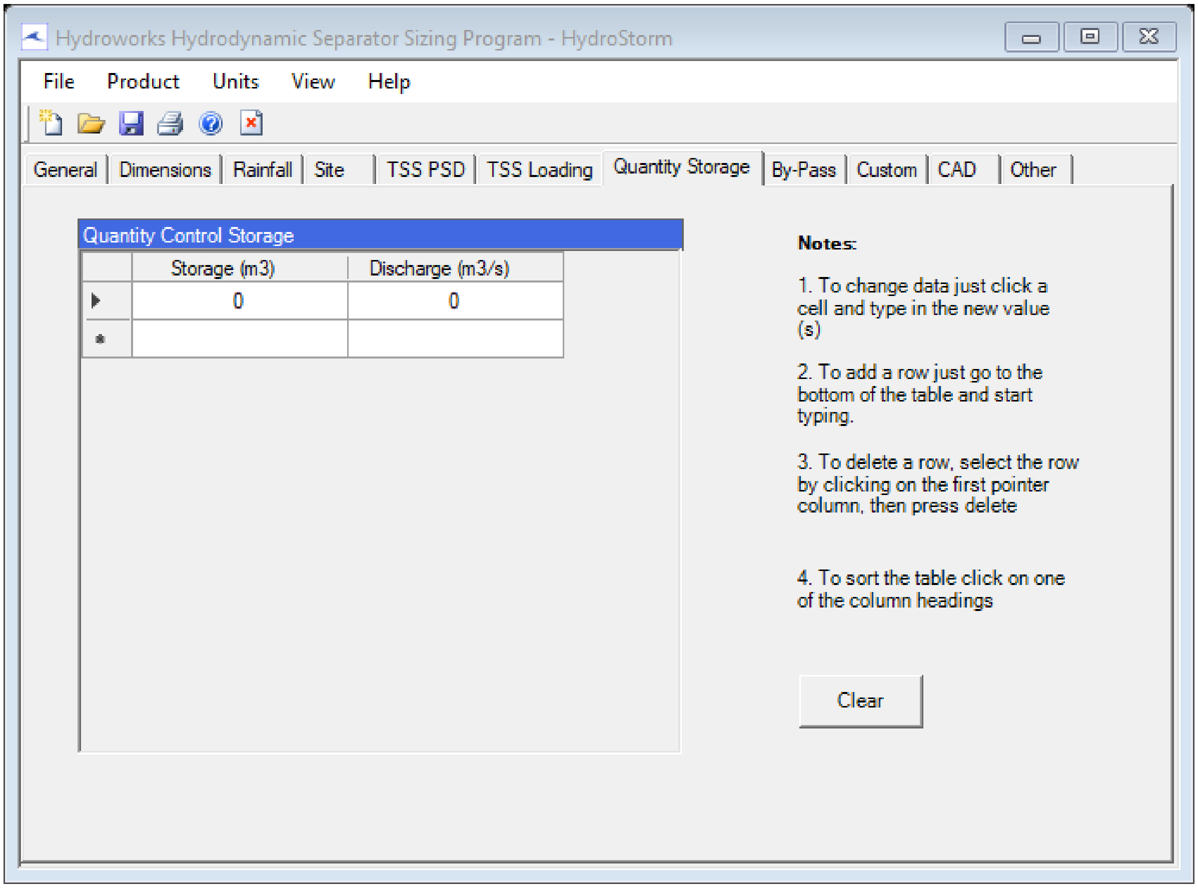
Soil Erosion
☐ Add Erosion to TSS

TSS Buildup Parameters
Limit (kg/ha) 28.02
Coeff (kg/ha) 67.25
Exponent .5

TSS Washoff Parameters
Coefficient .0855
Exponent 1.1

TSS Buildup
● Based on Area
○ Based on Curb Length

Upstream Quantity Storage



Quantity Control Storage

	Storage (m3)	Discharge (m3/s)
▶	0	0
*		

Notes:

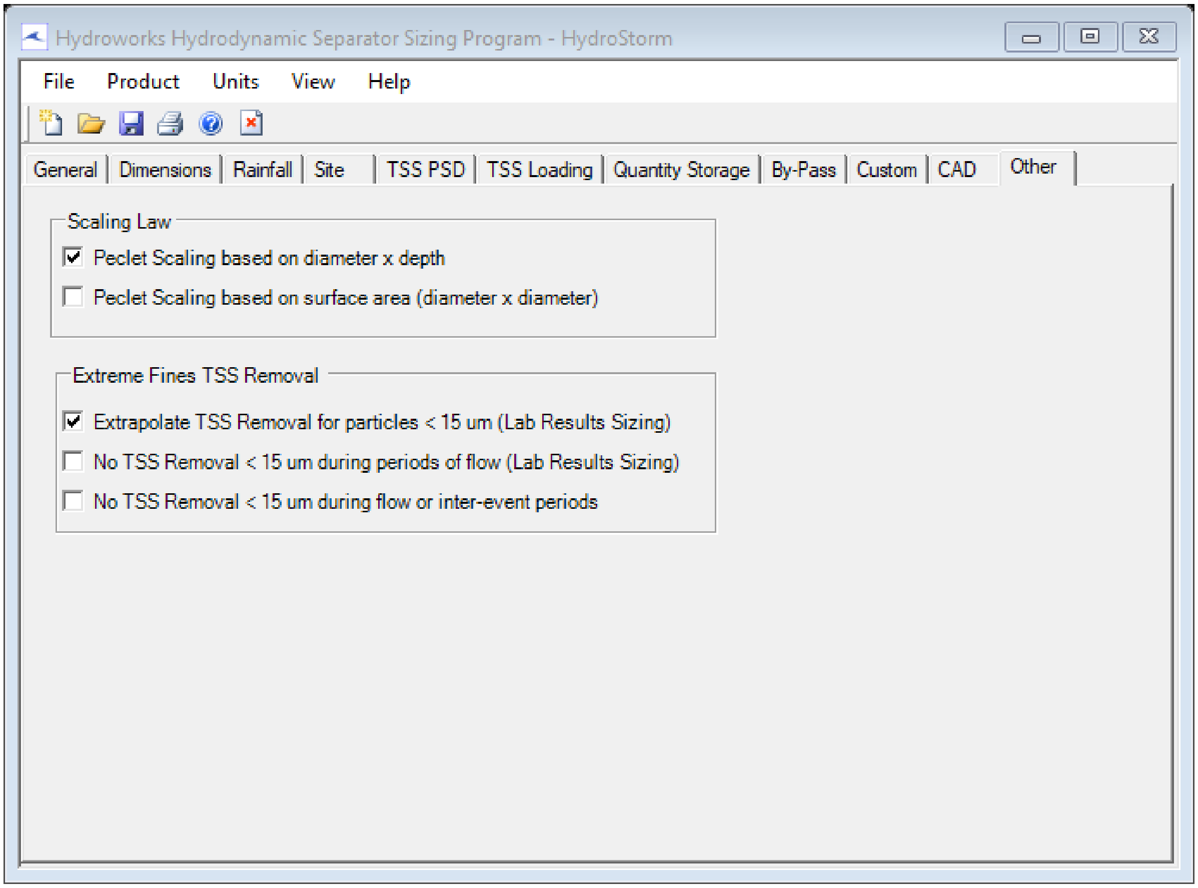
1. To change data just click a cell and type in the new value (s)

2. To add a row just go to the bottom of the table and start typing.

3. To delete a row, select the row by clicking on the first pointer column, then press delete

4. To sort the table click on one of the column headings

Other Parameters



Scaling Law

☑ Peclet Scaling based on diameter x depth

☐ Peclet Scaling based on surface area (diameter x diameter)

Extreme Fines TSS Removal

☑ Extrapolate TSS Removal for particles < 15 um (Lab Results Sizing)

☐ No TSS Removal < 15 um during periods of flow (Lab Results Sizing)

☐ No TSS Removal < 15 um during flow or inter-event periods

Hydroworks Sizing Program - Version 4.9

Hydroworks® HydroStorm

Operations & Maintenance Manual

Version 1.0

Please call Hydroworks at 888-290-7900 or email us at support@hydroworks.com if you have any questions regarding the Inspection Checklist. Please fax a copy of the completed checklist to Hydroworks at 888-783-7271 for our records.

Introduction

The HydroStorm is a state of the art hydrodynamic separator. Hydrodynamic separators remove solids, debris and lighter than water (oil, trash, floating debris) pollutants from stormwater. Hydrodynamic separators and other water quality measures are mandated by regulatory agencies (Town/City, State, Federal Government) to protect storm water quality from pollution generated by urban development (traffic, people) as part of new development permitting requirements.

As storm water treatment structures fill up with pollutants they become less and less effective in removing new pollution. Therefore, it is important that storm water treatment structures be maintained on a regular basis to ensure that they are operating at optimum performance. The HydroStorm is no different in this regard and this manual has been assembled to provide the owner/operator with the necessary information to inspect and coordinate maintenance of their HydroStorm.

Hydroworks® HydroStorm Operation

The Hydroworks HydroStorm (HS) separator is a unique hydrodynamic by-pass separator. It incorporates a protected submerged pretreatment zone to collect larger solids, a treatment tank to remove finer solids, and a dual set of weirs to create a high flow bypass. High flows are conveyed directly to the outlet and do not enter the treatment area, however, the submerged pretreatment area still allows removal of coarse solids during high flows.

Under normal or low flows, water enters an inlet area with a horizontal grate. The area underneath the grate is submerged with openings to the main treatment area of the separator. Coarse solids fall through the grate and are either trapped in the pretreatment area or conveyed into the main treatment area depending on the flow rate. Fines are transported into the main treatment area. Openings and weirs in the pretreatment area allow entry of water and solids into the main treatment area and cause water to rotate in the main treatment area creating a vortex motion. Water in the main treatment area is forced to rise along the walls of the separator to discharge from the treatment area to the downstream pipe.

The vortex motion forces solids and floatables to the middle of the inner chamber. Floatables are trapped since the inlet to the treatment area is submerged. The design maximizes the retention of settled solids since solids are forced to the center of the inner chamber by the vortex motion of water while water must flow up the walls of the separator to discharge into the downstream pipe.

A set of high flow weirs near the outlet pipe create a high flow bypass over both the pretreatment area and main treatment chamber. The rate of flow into the treatment area is regulated by the number and size of openings into the treatment chamber and the height of by-pass weirs. High flows flow over the weirs directly to the outlet pipe preventing the scour and resuspension of any fines collected in the treatment chamber.

A central access tube is located in the structure to provide access for cleaning. The arrangement of the inlet area and bypass weirs near the outlet pipe facilitate the use of multiple inlet pipes.

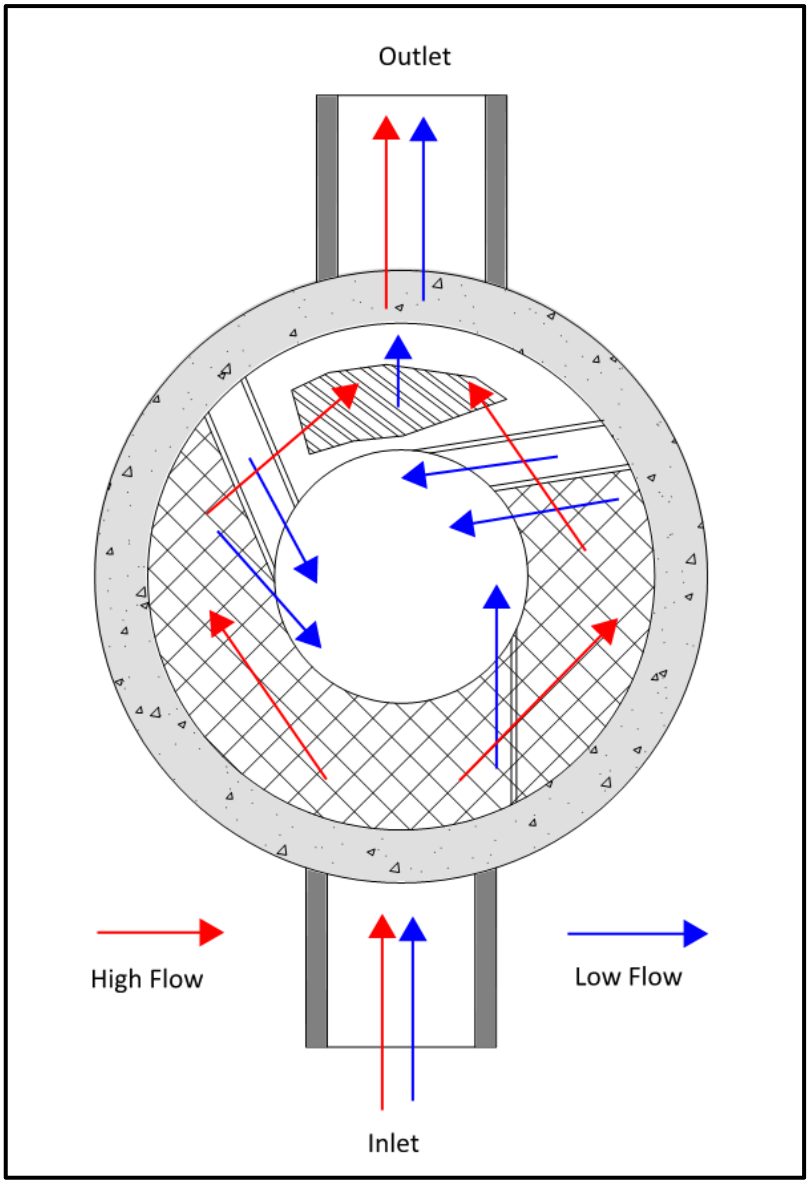


Figure 1. Hydroworks HydroStorm Operation – Plan View

Figure 2 is a profile view of the HydroStorm separator showing the flow patterns for low and high flows.

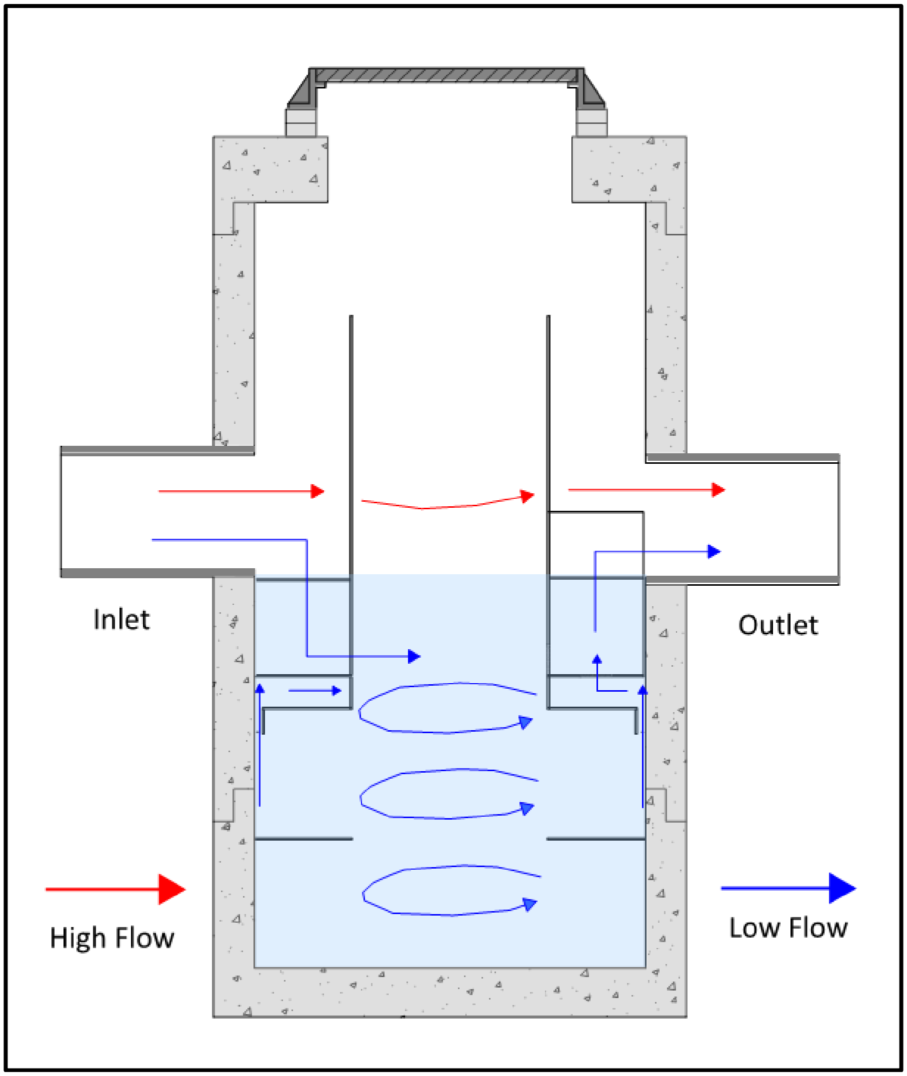


Figure 2. Hydroworks HydroStorm Operation – Profile View

The HS 4i is an inlet version of the HS 4 separator. There is a catch-basin grate on top of the HS 4i. A funnel sits sits underneath the grate on the frame and directs the water to the inlet side of the separator to ensure all lows flows are properly treated. The whole funnel is removed for inspection and cleaning.

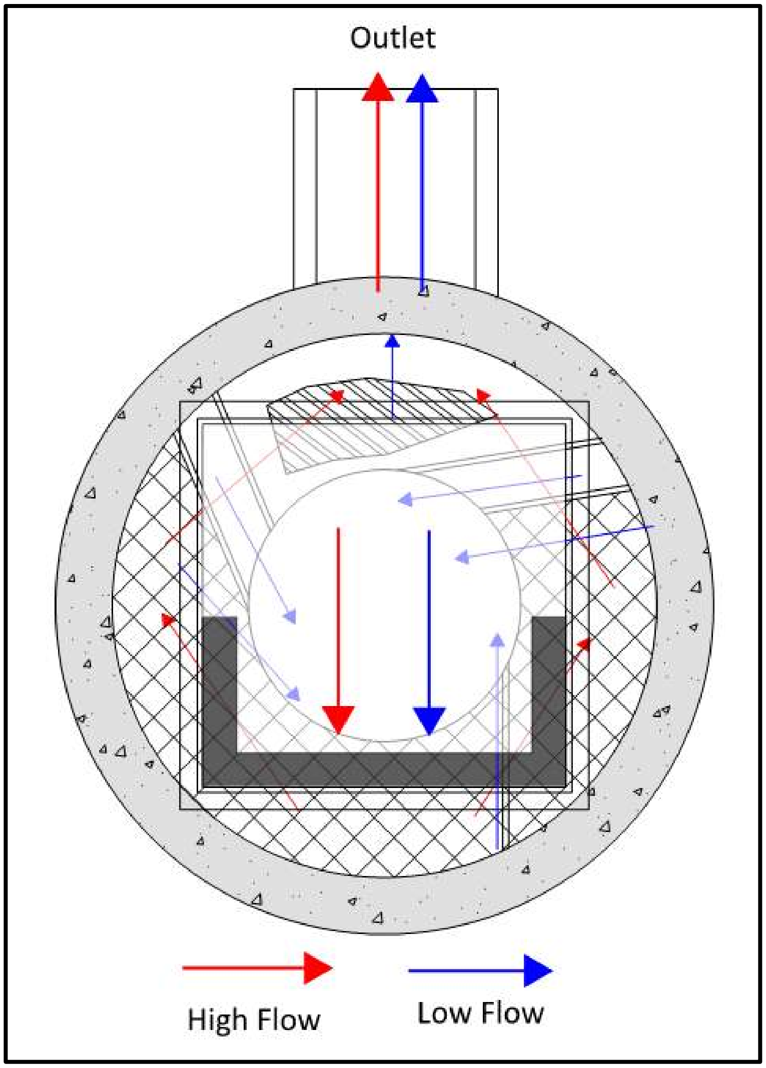


Figure 3. Hydroworks HS 4i Funnel

Inspection

Procedure

Floatables

A visual inspection can be conducted for floatables by removing the covers and looking down into the center access tube of the separator. Separators with an inlet grate (HS 4i or custom separator) will have a plastic funnel located under the grate that must be removed from the frame prior to inspection or maintenance. If you are missing a funnel please contact Hydroworks at the numbers provided at the end of this document.

TSS/Sediment

Inspection for TSS build-up can be conducted using a Sludge Judge®, Core Pro®, AccuSludge® or equivalent sampling device that allows the measurement of the depth of TSS/sediment in the unit. These devices typically have a ball valve at the bottom of the tube that allows water and TSS to flow into the tube when lowering the tube into the unit. Once the unit touches the bottom of the device, it is quickly pulled upward such that the water and TSS in the tube forces the ball valve closed allowing the user to see a full core of water/TSS in the unit. The unit should be inspected for TSS through each of the access covers. Several readings (2 or 3) should be made at each access cover to ensure that an accurate TSS depth measurement is recorded.

Frequency

Construction Period

The HydroStorm separator should be inspected every four weeks and after every large storm (over 0.5” (12.5 mm) of rain) during the construction period.

Post-Construction Period

The Hydroworks HydroStorm separator should be inspected during the first year of operation for normal stabilized sites (grassed or paved areas). If the unit is subject to oil spills or runoff from unstabilized (storage piles, exposed soils) areas the HydroStorm separator should be inspected more frequently (4 times per year). The initial annual inspection will indicate the required future frequency of inspection and maintenance if the unit was maintained after the construction period.

Reporting

Reports should be prepared as part of each inspection and include the following information:

1. Date of inspection
2. GPS coordinates of Hydroworks unit
3. Time since last rainfall
4. Date of last inspection
5. Installation deficiencies (missing parts, incorrect installation of parts)
6. Structural deficiencies (concrete cracks, broken parts)
7. Operational deficiencies (leaks, blockages)
8. Presence of oil sheen or depth of oil layer
9. Estimate of depth/volume of floatables (trash, leaves) captured
10. Sediment depth measured
11. Recommendations for any repairs and/or maintenance for the unit
12. Estimation of time before maintenance is required if not required at time of inspection

A sample inspection checklist is provided at the end of this manual.

Maintenance

Procedure

The Hydroworks HydroStorm unit is typically maintained using a vacuum truck. There are numerous companies that can maintain the HydroStorm separator. Maintenance with a vacuum truck involves removing all of the water and sediment together. The water is then separated from the sediment on the truck or at the disposal facility.

A central access opening (24” or greater) is provided to the gain access to the lower treatment tank of the unit. This is the primary location to maintain by vacuum truck. The pretreatment area can also be vacuumed and/or flushed into the lower treatment tank of the separator for cleaning via the central access once the water level is lowered below the pretreatment floor.

In instances where a vacuum truck is not available other maintenance methods (i.e. clamshell bucket) can be used, but they will be less effective. If a clamshell bucket is used the water must be decanted prior to cleaning since the sediment is under water and typically fine in nature. Disposal of the water will depend on local requirements. Disposal options for the decanted water may include:

1. Discharge into a nearby sanitary sewer manhole
2. Discharge into a nearby LID practice (grassed swale, bioretention)
3. Discharge through a filter bag into a downstream storm drain connection

The local municipality should be consulted for the allowable disposal options for both water and sediments prior to any maintenance operation. Once the water is decanted the sediment can be removed with the clamshell bucket.

Disposal of the contents of the separator depend on local requirements. Maintenance of a Hydroworks HydroStorm unit will typically take 1 to 2 hours based on a vacuum truck and longer for other cleaning methods (i.e. clamshell bucket).

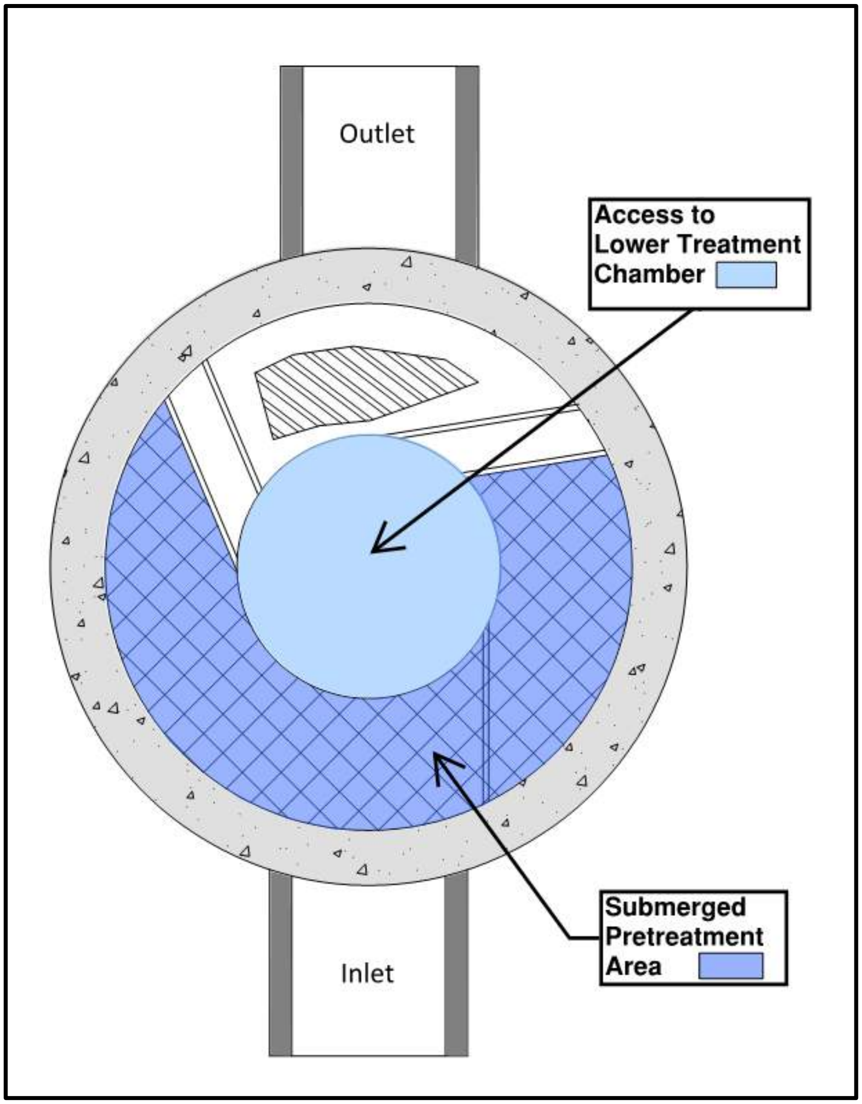


Figure 3. Maintenance Access

Frequency

<u>Construction Period</u>

A HydroStorm separator can fill with construction sediment quickly during the construction period. The HydroStorm must be maintained during the construction period when the depth of TSS/sediment reaches 24” (600 mm). It must also be maintained during the construction period if there is an appreciable depth of oil in the unit (more than a sheen) or if floatables other than oil cover over 50% of the area of the separator

The HydroStorm separator should be maintained at the end of the construction period, prior to operation for the post-construction period.

Post-Construction Period

The HydroStorm was independently tested by Alden Research Laboratory in 2017. A HydroStorm HS 4 was tested for scour with a 50% sediment depth of 0.5 ft. Therefore, maintenance for sediment accumulation is required if the depth of sediment is 1 ft or greater in separators with standard water (sump) depths (Table 1).

There will be designs with increased sediment storage based on specifications or site-specific criteria. A measurement of the total water depth in the separator through the central access tube should be taken and compared to water depth given in Table 1. The standard water depth from Table 1 should be subtracted from the measured water depth and the resulting extra depth should be added to the 1 ft to determine the site-specific sediment maintenance depth for that separator.

For example, if the measured water depth in the HS-7 is 7 feet, then the sediment maintenance depth for that HS-7 is 2 ft (= 1 + 7 – 6) and the separator does not need to be cleaned for sediment accumulation until the measure sediment depth is 2 ft.

The HydroStorm separator must also be maintained if there is an appreciable depth of oil in the unit (more than a sheen) or if floatables other than oil cover over 50% of the water surface of the separator.

Table 1 Standard Dimensions for Hydroworks HydroStorm Models

Model	Diameter (ft)	Total Water Depth (ft)	Sediment Maintenance Depth for Table 1 Total Water Depth(ft)
HS-3	3	3	1
HS-4	4	4	1
HS-5	5	4	1
HS-6	6	4	1
HS-7	7	6	1
HS-8	8	7	1
HS-9	9	7.5	1
HS-10	10	8	1
HS-11	11	9	1
HS-12	12	9.5	1

HYDROSTORM INSPECTION SHEET

Date ______________________________
Date of Last Inspection ______________________________

Site ______________________________
City ______________________________
State ______________________________
Owner ______________________________

GPS Coordinates ______________________________

Date of last rainfall ______________________________

Site Characteristics	**Yes**	**No**
Soil erosion evident	☐	☐
Exposed material storage on site	☐	☐
Large exposure to leaf litter (lots of trees)	☐	☐
High traffic (vehicle) area	☐	☐

HydroStorm	**Yes**	**No**
Obstructions in the inlet or outlet	☐ *	☐
Missing internal components	☐ **	☐
Improperly installed inlet or outlet pipes	☐ ***	☐
Internal component damage (cracked, broken, loose pieces)	☐ **	☐
Floating debris in the separator (oil, leaves, trash)	☐	☐
Large debris visible in the separator	☐ *	☐
Concrete cracks/deficiencies	☐ ***	☐
Exposed rebar	☐ **	☐
Water seepage (water level not at outlet pipe invert)	☐ ***	☐

Water level depth below outlet pipe invert _______“

Routine Measurements

Floating debris depth	**< 0.5” (13mm)**	☐	**>0.5” 13mm)**	☐ *
Floating debris coverage	**< 50% of surface area**	☐	**> 50% surface area**	☐ *
Sludge depth	**< 12” (300mm)**	☐	**> 12” (300mm)**	☐ *****

* Maintenance required
** Repairs required
*** Further investigation is required

Hydroworks

Other Comments:

Hydroworks

Hydroworks® HydroStorm

One Year Limited Warranty

Hydroworks, LLC warrants, to the purchaser and subsequent owner(s) during the warranty period subject to the terms and conditions hereof, the Hydroworks HydroStorm to be free from defects in material and workmanship under normal use and service, when properly installed, used, inspected and maintained in accordance with Hydroworks written instructions, for the period of the warranty. The standard warranty period is 1 year.

The warranty period begins once the separator has been manufactured and is available for delivery. Any components determined to be defective, either by failure or by inspection, in material and workmanship will be repaired, replaced or remanufactured at Hydroworks' option provided, however, that by doing so Hydroworks, LLC will not be obligated to replace an entire insert or concrete section, or the complete unit. This warranty does not cover shipping charges, damages, labor, any costs incurred to obtain access to the unit, any costs to repair/replace any surface treatment/cover after repair/replacement, or other charges that may occur due to product failure, repair or replacement.

This warranty does not apply to any material that has been disassembled or modified without prior approval of Hydroworks, LLC, that has been subjected to misuse, misapplication, neglect, alteration, accident or act of God, or that has not been installed, inspected, operated or maintained in accordance with Hydroworks, LLC instructions and is in lieu of all other warranties expressed or implied. Hydroworks, LLC does not authorize any representative or other person to expand or otherwise modify this limited warranty.

The owner shall provide Hydroworks, LLC with written notice of any alleged defect in material or workmanship including a detailed description of the alleged defect upon discovery of the defect. Hydroworks, LLC should be contacted at 136 Central Ave., Clark, NJ 07066 or any other address as supplied by Hydroworks, LLC. (888-290-7900).

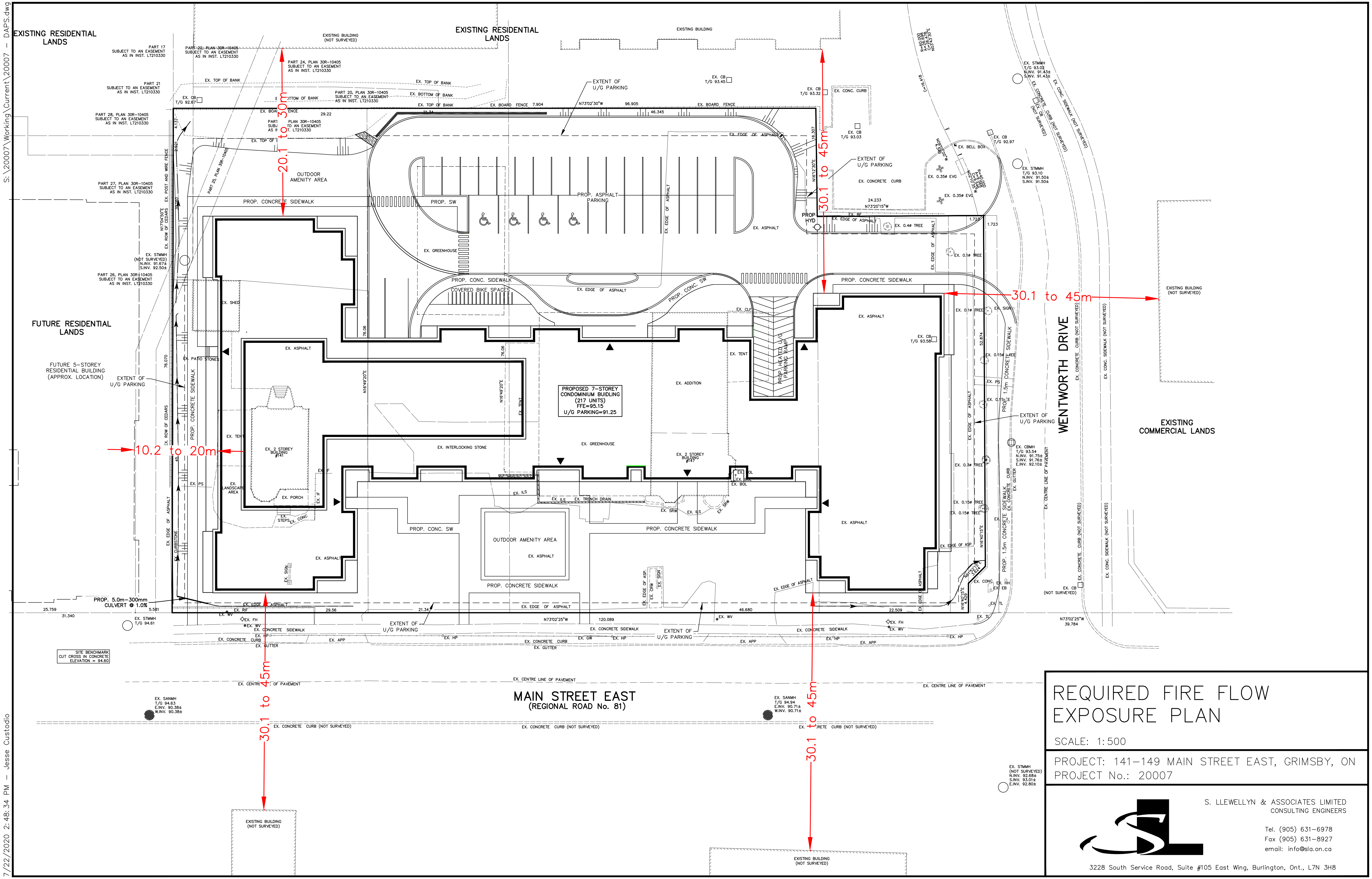
This limited warranty is exclusive. There are no other warranties, express or implied, or merchantability or fitness for a particular purpose and none shall be created whether under the uniform commercial code, custom or usage in the industry or the course of dealings between the parties. Hydroworks, LLC will replace any goods that are defective under this warranty as the sole and exclusive remedy for breach of this warranty.

Subject to the foregoing, all conditions, warranties, terms, undertakings or liabilities (including liability as to negligence), expressed or implied, and howsoever arising, as to the condition, suitability, fitness, safety, or title to the Hydroworks HydroStorm are hereby negated and excluded and Hydroworks, LLC gives and makes no such representation, warranty or undertaking except as expressly set forth herein. Under no circumstances shall Hydroworks, LLC be liable to the Purchaser or to any third party for product liability claims; claims arising from the design, shipment, or installation of the HydroStorm, or the cost of other goods or services related to the purchase and installation of the HydroStorm. For this Limited Warranty to apply, the HydroStorm must be installed in accordance with all site conditions required by state and local codes; all other applicable laws; and Hydroworks' written installation instructions.

Hydroworks, LLC expressly disclaims liability for special, consequential or incidental damages (even if it has been advised of the possibility of the same) or breach of expressed or implied warranty. Hydroworks, LLC 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 damages to the HydroStorm arising from ordinary wear and tear; alteration, accident, misuse, abuse or neglect; improper maintenance, failure of the product due to improper installation of the concrete sections or improper sizing; or any other event not caused by Hydroworks, LLC. This limited warranty represents Hydroworks' sole liability to the purchaser for claims related to the HydroStorm, whether the claim is based upon contract, tort, or other legal basis.

APPENDIX C

FIRE FLOW CALCULATIONS



REQUIRED FIRE FLOW EXPOSURE PLAN

SCALE: 1:500

PROJECT: 141–149 MAIN STREET EAST, GRIMSBY, ON
PROJECT No.: 20007

S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS

Tel. (905) 631–6978
Fax (905) 631–8927
email: info@sla.on.ca

3228 South Service Road, Suite #105 East Wing, Burlington, Ont., L7N 3H8

S:\20007\Working\Current\20007 – DAPS.dwg

7/22/2020 2:48:34 PM – Jesse Custodio

FIRE FLOW DEMAND REQUIREMENTS - FIRE UNDERWRITERS SURVEY (FUS GUIDELINES)

Project Number: **20007**
Project Name: **141-149 Main Street East, Grimsby**
Date: **Jun-20**

Fire flow demands for the FUS method is based on information and guidance provided in "Water Supply for Public Protection" (Fire Underwriters Survey, 1999).

An estimate of the fire flow required is given by the following formula:

$$F = 220C\sqrt{A} \qquad \textbf{(1)}$$

where:

F = the required fire flow in litres per minute
C = coefficient related to the type of construction
= 1.5 for wood frame construction (structure essentially all combustible).
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior)
= 0.8 for non-combustible construction (unprotected metal structural components, masonry or metal walls)
= 0.6 for fire-resistive construction (fully protected frame, floors, roof)
A = Total floor area in square metres

	Building Area			(1)		(2)			(3)		(4)		**Final Adjusted Fire Flow**	
Building / Location	# of Storeys	**Total GFA (m^2)**	Type of Construction	***Fire Flow "F"***		***Occupancy***			***Sprinkler***		***Exposure***			
				(l/min)	(l/s)	%	Adjustment (l/min)	**Adjusted Fire Flow (l/min)**	%	Adjustment (l/min)	%	Adjustment (l/min)	**(l/min)**	**(l/s)**
Proposed Condominium	**6**	**19003.0**	**0.8**	24000	400.0	**-15**	-3600.0	**20400.0**	**-50**	-10200.0	35	7140.0	**17000**	**283**

(2) Occupancy

Non-Combustible	-25%
Limited Combustible	-15%
Combustible	No charge
Free Burning	15%
Rapid Burning	25%

(3) Sprinkler

Minimum credit for systems designed to NFPA 13 is 30%.

If the domestic and fire services are supplied by the same municipal water system, then take an additional 10%.

If the sprinkler system is fully supervised (ie. annunciator panel that alerts the Fire Dept., such as a school), then an additional 10% can be taken. Maximum credit = 50%.

(4) Exposure

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

Calculate for all sides. Maximum charge shall not exceed 75%

JACKSON WATERWORKS

JW

Telephone: **905.229.3176**
Toll Free: **800.734.5732**
email: **jww@bellnet.ca**
Website: **www.jacksonwaterworks.ca**

Mr. Jesse Custodio
S. Llewellyn & Associates Limited
3228 South Service Road, East Wing, Suite 105
Burlington Ontario **L7N 3H8**

16 June 2020

Jackson Waterworks has recently completed fire hydrant flow testing at 141-149 Main Street East in Grimsby.

We define the Test Hydrants as the ones being flowed, and the Base Hydrant as the one where static and residual pressures are recorded. Wherever possible, we inspect the secondary valve for the Test Hydrants to make sure it is in the fully open position. Likewise, we count the number of turns needed to open the Test Hydrants (to make sure it is opening completely).

We do not use pitot conversion factors for different nozzle profiles. The Engineer may use these factors if desired and warranted.

The secondary valve for the Test Hydrant on Main Street East was found to be fully open at the time of the test.

The secondary valve for the Test Hydrant on Wentworth Drive could not be located for inspection at the time of the test.

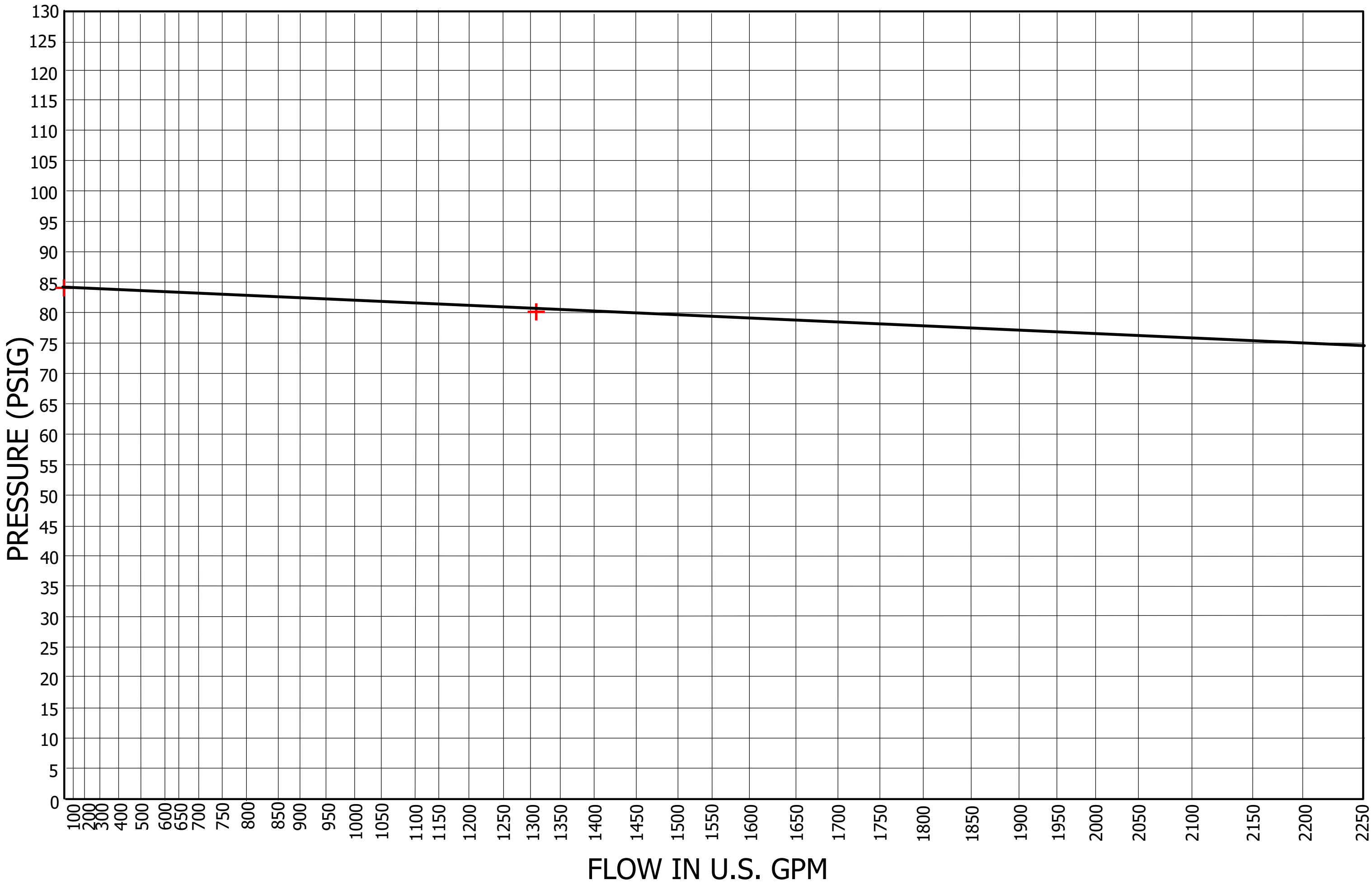
Testing was completed in accordance with NFPA 291 guidelines.

There were no irregularities to report.

Trusting this meets with your approval, we are...

Yours truly,

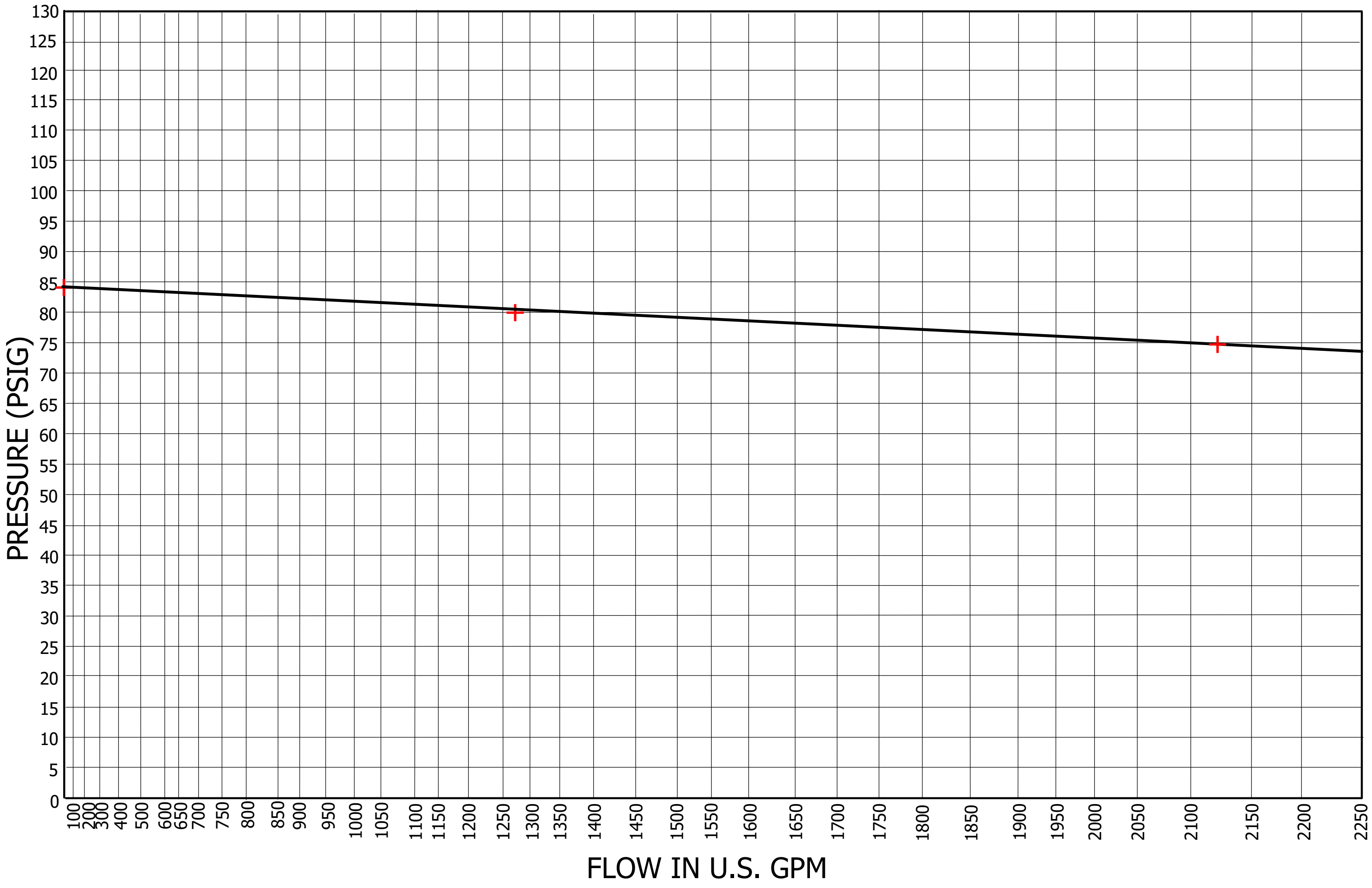
Mark Schmidt
Jackson Waterworks



# of Ports	PORT DIA. (in/mm)	PITOT (psig)	FLOW (usgpm)	RESIDUAL (psig)
1	2.50/63	61	1311	80
2	2.50/63	46/46	2276	75
THEORETICAL FLOW @ 20psi			5857	

General Data	
Test Date	12 June 2020
Test Time	11:00am
Pipe Dia.	10"
Static	84

Site Information	
Site or Developer Name	Losani Homes
Site Address/Municipality	141-149 Main Street East, Grimsby
Location of Test Hydrant	Main Street East, 1st West of Wentworth Drive
Location of Base Hydrant	Main Street East, 2nd West of Wentworth Drive
Technician's Comments	No conversion factor used for flow calculation based on round and flush internal nozzle
	configuration. Flow testing has been conducted in accrodance with NFPA 291 guidelines
	wherever possible. Refer to attached report for further information.
	Verified By: Mark Schmidt



# of Ports	PORT DIA. (in/mm)	PITOT (psig)	FLOW (usgpm)	RESIDUAL (psig)
1	2.50/63	58	1278	80
2	2.50/63	40/40	2122	75
THEORETICAL FLOW @ 20psi			5711	

General Data	
Test Date	12 June 2020
Test Time	11:30am
Pipe Dia.	10"
Static	84

Site Information	
Site or Developer Name	Losani Homes
Site Address/Municipality	141-149 Main Street East, Grimsby
Location of Test Hydrant	Wentworth Drive, 1st North of Main Street East
Location of Base Hydrant	Main Street East, 1st West of Wentworth Drive
Technician's Comments	No conversion factor used for flow calculation based on round and flush internal nozzle
	configuration. Flow testing has been conducted in accrodance with NFPA 291 guidelines
	wherever possible. Refer to attached report for further information.
	Verified By: Mark Schmidt

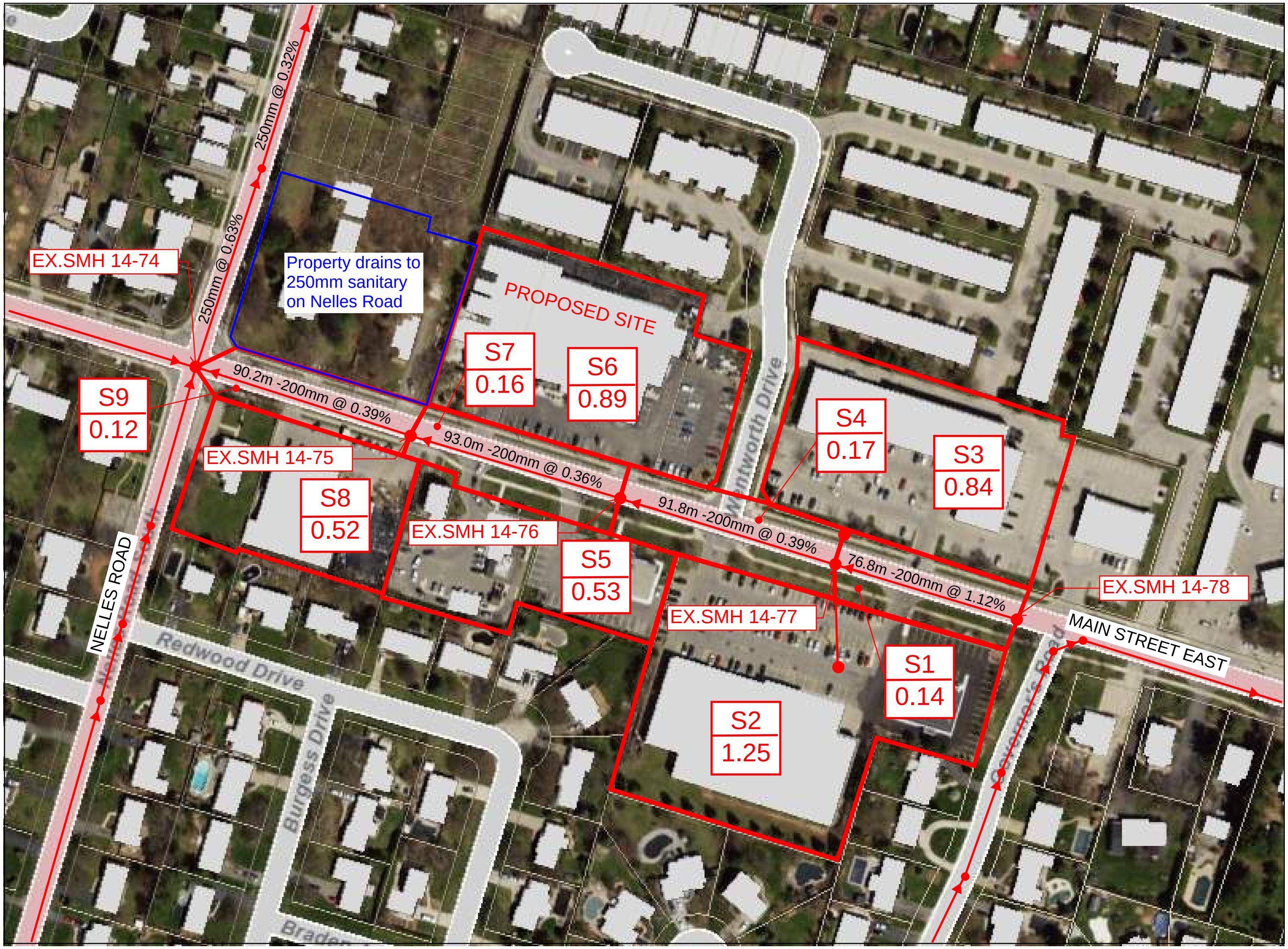
APPENDIX D

EXISTING SANITARY SEWER ANALYSIS

Niagara Region

Niagara Navigator

SANITARY DRAINAGE AREA PLAN



Legend

S1 — AREA NUMBER
0.50 — AREA (ha)

0.1 0 0.06 0.1 Kilometers

N

Notes

S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS

Town of Grimsby
141-149 Main Street East
Project Number: 20007
Sanitary Sewer Design Calculations

Computed by: J. Custodio
Revised by:
Checked by: S. Llewellyn
Version:
Date: May 25, 2020

Design Characteristics			
Infiltration Rate (i)		0.20	L/sec
Flow per Capita		360	L/day/cap
Velocities	V_{min} =	0.60	m/s
	V_{max} =	3.00	m/s
Manning's n Factors		=	0.013

Peak Factor = $M = 1 + 14/(4 + P^{0.5)}$, P is in thousands
2.00 ≤ M ≤ 4.00

Street Name	From MH	To MH	Population Density [per/ha]	Area			Population		Peaking	Flow				Proposed Sewer Design							Remarks
				Number	Incremental [ha]	Cumulative [ha]	Increment [per]	Cumulative [per]	Factor M	Average l/s	Peak l/s	Infiltration l/s	**Total l/s**	Length [m]	Diameter [mm]	Material	Grade %	**Capacity l/s**	Capacity %	Velocity m/s	
MAIN STREET EAST TO NELLES ROAD																					
Main Street East	14-78	14-77	-	S1	0.14	0.14	0	0	4.00	0.00	0.00	0.03	**0.03**	76.8	200	A.C.	1.12	**34.71**	0.1%	1.10	
Existing Commercial	EX	14-77	125	S2	1.25	1.25	156	156	4.00	0.65	2.60	0.25	**2.85**								
Existing Commercial	EX	14-77	125	S3	0.84	0.84	105	105	4.00	0.44	1.75	0.17	**1.92**								
Main Street East	14-77	14-76	-	S4	0.17	2.40	0	261	4.00	1.09	4.35	0.48	**4.83**	91.8	200	A.C.	0.39	**20.48**	23.6%	0.65	
Existing Commercial	EX	14-75	125	S5	0.53	0.53	66	66	4.00	0.28	1.10	0.11	**1.21**								
Proposed Site	MH1A	14-75	-	S6	0.89	0.89	586	586	3.94	2.29	9.01	0.18	**9.19**	16.0	200	PVC	2.00	**46.38**	19.8%	1.48	Flow per Capita = 337.5 L/day/cap
Main Street East	14-76	14-75	-	S7	0.16	3.98	0	914	3.82	3.65	13.98	0.80	**14.77**	93.0	200	A.C.	0.36	**19.68**	75.1%	0.63	
Existing Commercial	EX	14-74	125	S8	0.52	0.52	65	65	4.00	0.27	1.08	0.10	**1.19**								
Main Street East	14-75	14-74	-	S9	0.12	4.62	0	979	3.81	3.92	14.94	0.92	**15.86**	90.2	200	A.C.	0.39	**20.48**	77.4%	0.65	

APPENDIX E

CHESTNUT GROVE STORMWATER MANAGEMENT REPORT

2ND SUBMISSION

UPPER CANADA
CONSULTANTS
ENGINEERS/PLANNERS

**Upper Canada
Planning &
Engineering Ltd.**

215 Ontario Street
St. Catharines, ON
L2R 5L2

Phone 905-688-9400
Fax 905-688-5274

November 1, 2001
File: 0129

Director of Public Works
Grimsby, Town of
160 Livingston Avenue
P.O. Box 159
Grimsby, Ontario
L3M 4G3

Attn: Mr. Robert LeRoux, P. Eng. - Director of Public Works

**Re: Stormwater Management Plan Addendum
Nelles Place & Chesnut Grove, Grimsby**

We are pleased to provide a stormwater management plan for the above noted projects. These projects are located west of Wentworth Drive and Orchardview developments.

The purpose of this analysis is to evaluate the capacity of the existing storm sewer through the easement between Wentworth Drive and Pinewood Avenue under the 5 year design Grimsby IDF storm event.

The analysis revisited a previous study, as prepared by Upper Canada Consultants for the Orchardview development, dated February 22, 1990. This previous study delineated the headwater catchment areas, hydrologic and rainfall parameters, to the existing storm sewer conveying stormwater to Pinewood Avenue. As shown on the attached plan, the drainage boundary is divided into four subcatchment areas. The characteristics of these subcatchments are listed in Table 1.

The method in determining the peak flows uses the hydrologic and hydraulic model OTTHYMO89, which was used in the previously approved study. The characteristics of these subcatchments for the hydrologic model are listed in Table 1. The input, summary and output model files are enclosed in Appendix A for reference purposes.

The design rainfall event used in this modelling is a Chicago distribution for a 2 hour event. This distribution was used in this modelling, as it was the distribution from the previously Town approved report, relates to existing storm sewer capacities, and suits this watershed characteristics, which was all discussed with the Town's stormwater review consultant.

The existing storm sewer between Wentworth Drive and Pinewood Avenue (CBMH 14-18 to CBMH 14-17) is a 750mm diameter concrete pipe at a slope of 0.69%. The full flow capacity of this storm sewer is 965 litres/second or 0.965 m^3/s. As seen in Table 2, the existing 5 year peak flow being conveyed to this storm sewer is 0.830m^3/s, which is less than the available capacity.

Table 1. Subcatchment Parameters

Subcatchment No.	Area (hectares)	Direct Impervious (%)	Total Impervious (%)	Slope (%)	Pervious Length (m)	Impervious Length (m)
Existing Conditions						
E1	2.80	25	35	5	30	120
E2	4.70	30	40	3	50	155
E3	1.50	50	50	3	30	100
E4	3.00	CN = 75		TP = 0.167 hours		
Total Area =	12.00	hectares				
Proposed Conditions						
E4a	1.58	25	30	1.5	30	100
E4b	1.42	25	30	1.5	30	140
E5	0.35	25	30	1.5	30	140
E6	2.02	25	30	1.5	30	140

Table 2. 5 Year Peak Flows and Volumes at Wentworth Drive

	Peak Flows (m^3/s)			
Design Storm	**Existing**	**Proposed (without SWM)**	**Proposed (with SWM)**	**Existing Storm Sewer Capacity**
Peak Flows (m^3/s)	0.830	1.060	0.960	0.965
Volume (m^3)	1,757	1,890	1,890	-

As shown in Table 2, the 5 year peak flow of 1.070m^3/s for the proposed developments is greater than the peak flow over the available capacity of the existing storm sewer between Wentworth Drive and Pinewood Avenue. To limit the amount of flow from the proposed development, various stormwater quantity control alternatives were assessed. The following alternatives were assessed with economic, practicality, feasibility and acceptable methods.

1. Super Pipes - This type of stormwater quantity practice utilizes the storage capacity of underground conduits. Generally, this practice requires oversized conduits which surcharge with a control device in a downstream structure to control peak flows. The economics of this practice are generally unappreciated. Due to the surcharged conditions in the storm sewer, gravity foundation drains are not permitted, which the Town prefers to have gravity connections.

2. Inlet Control Devices - This type of stormwater management practice utilizes the restricted inflow of stormwater at catch basins. The Town does not prefer this practice on public roads, or in the rear yards of residential lands, therefore, this type of facility is not acceptable.

3. Surface Storage - This type of stormwater management practice utilizes the detention of stormwater in a detention facility. The Town prefers this practice and generally it provides adequate storage volumes with minimal land requirements.

In the selection of a suitable stormwater management practice to limit 5 year flows at Wentworth Drive, it was determined that a combination of surface storage and pipe storage would provide the required flow control. The stormwater control shall be provided upstream of the developments. The surface storage shall be provided along the southerly limit of Chesnut Grove and the northerly limit of the existing commercial lands. The owner of the Chesnut Grove development owns both the proposed condominium development.

The proposed stormwater management practices utilizes surface storage and pipe storage. The surface storage is provided by a shallow (0.45m) detention area south of the condominium units. The pipe storage provided in the 600mm diameter storm sewer from MH '3' to MH '2', which is 59m long. The storage calculations for both the surface and pipe detention are provided for reference purposes. If the existing commercial property is developed, the proposed surface storage area shall reconfigured to provide the storage on the future parking area at the northerly limit of the commercial property. The total storage volume to be provided for the proposed configuration is approximately 79.2m^3. The future storage volume over the parking area was calculated to show the extent of ponding, which is approximately 77.2m^3. At the time of development of the commercial property, the storage volume should be verified and closely match the proposed volume of 79.2m^3.

The outlet control for this stormwater management facility is located in MH'2', which consists of a 0.4m long - 525mm diameter PVC(DR35) in the proposed 600mm diameter storm sewer. On the enclosed, the outlet control configuration is shown for reference purposes. The downstream storm sewer, 675mm diameter was sized to convey the maximum outflow from this control structure under normal flow conditions.

The proposed stormwater management quantity controls provide peak flow control for both the Nelles Place and Chesnut Grove developments. The controlled peak flows limit the 5 year flows entering the existing storm sewer between Wentworth Drive and Pinewood Avenue to $0.940m^3/s$, which is less than the sewer full flow capacity of $0.965m^3/s$.

A review of the existing stormwater system between the site and Lake Ontario shows that on the north side of the QEW, an existing stormwater quality facility was constructed for stormwater quality control on other developments in this watershed. We recommend the developer of Nelles Place and Chesnut Grove provide a cash-in-lieu contribution toward the existing stormwater quality management facility. The method of calculating the cash-in-lieu contribution should be calculated by Town, based on the watershed area, development area, future development areas, and the cost of constructing the facility.

The major flows passing through and from these developments shall be conveyed overland in the proposed roadways from Chesnut Grove to Wentworth Drive Extension and then continuing northerly through the Town overland flow route between Wentworth Drive and Pinewood Avenue. The maximum depth flooding on Wentworth Drive Extension shall be 0.20m in the sag of the proposed road approximately 45m west of the existing Wentworth Drive.

An analysis of the downstream system, Belmont Avenue from Pinewood Drive to Central Avenue, was undertaken to verify this system is not impacted. The analysis has shown that the existing storm sewer has more than adequate capacity to convey the 5 year design storm flows. This analysis is shown in the hydrologic modelling for reference purposes.

The storm sewer design sheets, for MOE approval have utilized the hydrologic model peak flows from the outlet control structure and the rational method for the downstream areas. Therefore, the differences in peak flows between the modelling and design sheet are negligible. The method in sizing the proposed storm sewers is considered to be a conservative approach.

Therefore, based on the above comments and the hydrologic modelling, the proposed developments shall not impact the capacity of the existing storm sewer system downstream of Wentworth Drive and stormwater quality shall be provided in the existing facility downstream.

It is recommended that a surface and pipe storage be constructed as shown and described on the enclosed figures to control the 5 year peak flows before discharging to the existing storm sewer at Wentworth Drive.

Should you have any questions or concerns regarding the information provided, please do not hesitate to contact our office.

Yours very truly,

Jason Schooley

Jason Schooley, P. Eng.

cc: Paul Phelps, Peter Phelps & Associates Ltd.
Scott Llewllyn, S. Llewllyn & Associates Ltd.

Encl.

APPENDIX A

OTTHYMO-89 Modelling Files

A-1. Existing Conditions - Input File

```
2
*#**********************************
*# NELLES PLACE AND CNESNUT GROVE
*# TOWN OF GRIMSBY
*# STORMWATER MANAGEMENT REVIEW
*#
*# 5 YEAR DESIGN STORM EVENT
*# CHICAGO 2 HOUR DISTRIBUTION
*#
*# MINOR DRAINAGE SYSTEM DESIGN ANALYSIS
*# DRAINAGE AREA SOUTH OF PINEWOOD AVENUE
*#
*# MODELLING DATA REFERENCED FROM SWM REPORT
*# FOR ORCHARDVIEW PHASES I AND II, AND
*# COMMERCIAL PLAZA, FEBRUARY 22, 1990
*#
*#******************************************
*# EXISTING CONDITIONS
*#******************************************
*
START                SIMULATION STARTS AT 0.0 HRS  METOUT= 2
*
CHICAGO STORM        IUNITS= 2  TD= 2.0 HRS  R= 0.46  SDT= 5.0 MIN  ICASE= 1
                     A= 785.59 MM/HR  B= 6.00 MIN  C= 0.790
*
*#***************************
*#UCC URBAN SUB-BASIN NO. E1*
*#***************************
*
CALIB STANDHYD       ID= 1  NNYD= 3000  DT= 1.0 MIN  AREA= 2.80 HA
                     XIMP= 0.25  TIMP= 0.35  DWF= 0.0  LOSS= 1
                     FO= 50.0 MM/HR  FC= 3.0 MM/HR  K= 2.00 I/HR  F= 0.0 MM
                     DPSP= 5.0 MM  SLPP= 5.00%  LGP= 30.0 M  MNP= 0.250  SCP= 0.0
                     DPSI= 1.0 MM  SLPI= 5.00%  LGI= 120.0 M  MNI= 0.013  SCI= 0.0
                     END= -1
*
ROUTE PIPE           ITYPE= 1  ID= 2  NHYD= 3001  PIPE= 3.1
                     DIAM= 600 MM  LENGTN= 150 M  ROUGH= 0.0I3  SLOPE= 0.01 M/M
                     IDIN= 1  DT= 1.0 MIN
*
ROUTE CHANNEL        ID= 3   NHYD= 3002  IDIN= 2  DT= 1.0 MIN  LENGTH= 190 M
                     SLOPE= I.0%   FPSLOPE= 1.0%  VSN= 3.2  NSEG= 3
                        N       DIST (m)
                      0.035      1.00
                     -0.25       I.30
                      0.035      2.30
                     DIST (m)      ELEV(m)
                      0.0           99.0
                      I.0           98.5
                      1.3           98.5
                      2.3           99.0
*
*#***************************
*#UCC URBAN SUB-BASIN NO. E2*
*#***************************
*
CALIB STANDHYD       ID= 4  NHYD= 3003  DT= 1.0 MIN  AREA= 4.70 HA
                     XIMP= 0.30  TIMP= 0.40  DWF= 0.0 CMS  LOSS= 1
                     FO= 50.0 MM/HR  FC= 3.0 MM/NR  K= 2.00 I/HR   F= 0.0 MM
                     DPSP= 4.0 MM  SLPP= 3.00%  LGP= 50.0 M   MNP= 0.250  SCP= 0.0
                     DPSI= 1.0 MM  SLPI= 3.00%  LGI= 155.0 M  MNI= 0.013  SCI= 0.0
                     END= -1
*
ADD HYD              ID= 5  NHYD= 3004  IDI= 3  IDII= 4
*
ROUTE PIPE           ITYPE= 1  ID= 6  NHYD= 3005  PIPE= 3.3
                     DIAM= 600 MM  LENGHT=118 M  ROUGH= D.013  SLOPE= 0.01 M/M
                     IDIN= 5  DT= 1.0 MIN
*
*#***************************
*#UCC URBAN SUB-BASIN NO. E3*
*#***************************
*
CALIB STANDHYD       ID= 7  NNYD= 3007  DT= 1.0 MIN  AREA= 1.50 HA
                     XIMP= 0.50  TIMP= 0.50  DWF= 0.0 CMS  LOSS= 1
                     FO= 50.0 MM/HR  FC= 3.0 MM/HR  K= 2.00 I/NR  F= 0.0 MM
                     DPSP= 4.0 MM  SLPP= 3.00%  LGP= 30.0 M  MNP= 0.250  SCP= 0.0
                     DPSI= 1.0 MM  SLPI= 3.00%  LGI= 100.0 M  MNI= 0.013  SCI= 0.0
                     END= -1
*
ADD NYD              ID= 8  NHYD=3008  IDI= 6  IDII= 7
*
ROUTE PIPE           ITYPE= 1  ID= 9  NHYD= 3D09  PIPE= 3.4
                     DIAM= 600 MM  LENGTH= 92.0 M  ROUGH= 0.013  SLOPE= 0.01 M/M
                     IDIN= 8  DT= 1.0 MIN
*
ROUTE CHANNEL        ID= 10  NHYD= 3010  IDIN= 9  DT= 1.0 MIN  LENGTH= 155.0 M
                     CNSLOPE= 0.75%  FPSLOPE= 0.75%   VSN= 3.5   NSEG= 3.0
                        N       DIST (m)
                      0.050      17.0
                     -0.25       17.3
                      0.050      41.0
                     DIST (m)      ELEV(m)
                      0.0           93.5
                      7.0           93.0
                     17.0           92.75
                     17.3           92.75
                     28.0           93.0
                     41.0           93.5
*
*#***************************
*#UCC URBAN SUB-BASIN NO. E4*
*#***************************
*
CALIB NASHYD         ID= 1  NHYD= 3011  DT= 1.0 MIN  AREA= 3.00 HA
                     DWF= 0.0  CN= 75   IA= 1.0 MM  N= 3.0  TP= 0.167
                     END=-1
*
ADD HYD              ID= 2  NNYD= 3012  IDI= 1  IDII= 10
*
*#*****************************************
*#EXISTING 750MM STORM SEWER
*#FROM WENTWORTH DRIVE TO PINEWOOD DRIVE
*#*****************************************
*
ROUTE PIPE           1TYPE= 1  ID= 1  NHYD= 3011  PIPE= 3.6
                     DIAM= 750 MM  LENGTH= 57.3 M  ROUGH= 0.013  SLOPE= 0.008 M/M
                     IDIN= 2  DT= 1.0 MIN
*
ROUTE PIPE           ITYPE= 1  ID= 2  NHYD= 3012  PIPE= 3.7
                     DIAM= 750 MM  LENGTN= 47.4 M  ROUGH= 0.013  SLOPE= 0.0069 M/M
                     IDIN= 1  DT= 1.0 MIN
*
FINISN
```

A-2. Existing Conditions - Summary File

```
===========================================================================

      OOO    TTTTT   TTTTT  H   H  Y   Y  M   M   OOO    I N T E R H Y M O
     O   O     T       T    H   H   Y Y   MM MM  O   O   * * * 1989b * * *
     O   O     T       T    HHHHH    Y    M M M  O   O
     O   O     T       T    H   H    Y    M   M  O   O
      OOO      T       T    H   H    Y    M   M   OOO    cD-417441600036

Distributed by the INTERHYMO Centre. Copyright (c), 1989.  Paul Wisner & Assoc.
  EXCLUSIVE USE TO : Uppear Canada Consultants

                    *****  S U M M A R Y   O U T P U T  *****

  Input   filename: F:EX.IN
  Output  filename: F:EX.OUT
  Summary filename: F:EX.SUM

DATE: 09-11-2001                     TIME: 11:05:57

USER: ______________________________________________

COMMENTS: __________________________________________________________

      # ***********************************
      #  NELLES PLACE AND CHESNUT GROVE
      #  TOWN OF GRIMSBY
      #  STORMWATER MANAGEMENT REVIEW
      #
      #  5 YEAR DESIGN STORM EVENT
      #  CNICAGO 2 HOUR DISTRIBUTION
      #
      #  MINOR DRAINAGE SYSTEM DESIGN ANALYSIS
      #  DRAINAGE AREA SOUTN OF PINEWOOD AVENUE
      #
      #  MODELLING DATA REFERENCED FROM SWM REPORT
      #  FOR ORCHARDVIEW PHASES I AND II, AND
      #  COMMERICAL PLAZA, FEBRUARY 22, 1990
      #
      # *****************************************
      #  EXISTING CONDITIONS
      # *****************************************
  ****************************
  ** SIMULATION NUMBER:   1 **
  ****************************

  W/E COMMAND              HYD ID   DT    AREA  Qpeak Tpeak   R.V. R.C.   Qbase
                                   min     ha    cms   hrs     mm           cms

      START @   .00 hrs
      ------------------
      CHIC STORM                   5.0
      [ Ptot= 34.42 mm ]
      ------------------
      # **************************
      # UCC URBAN SUB-BASIN NO. E1*
      # **************************
      CALIB STANDHYD      3000  1  1.0    2.80    .29   .98  14.45  .42    .000
      [I%=25.0:S%= 5.00]
      ------------------
      PIPE    [ 1 : 3000] 3001  2  1.0    2.80    .29  1.00  14.44  n/a    .000
      {DiamUsed= 600.mm}
      ------------------
      CHANNEL[ 2 : 3001]  3002  3  1.0    2.80    .25  1.05  I4.32  n/a    .000
      ------------------
      # **************************
      # UCC URBAN SUB-BASIN NO. E2*
      # **************************
      CALIB STANDNYD      3003  4  1.0    4.70    .46   .97  16.44  .48    .000
      [I%=30.0:S%= 3.00]
      ------------------
      ADD [3002 + 3003]   3004  5  1.0    7.50    .65  1.05  15.65  n/a    .000
      ------------------
  *   PIPE    [ 5 : 3004] 3005  6  1.D    7.50    .65  1.05  15.65  n/a    .000
      {DiamUsed= 613.mm}
      ------------------
      # **************************
      # UCC URBAN SUB-BASIN NO. E3*
      # **************************
      CALIB STANDHYD      3007  7  1.0    1.50    .24   .95  20.05  .58    .000
      [I%=50.0:S%= 3.00]
      ------------------
      ADD [3005 + 3007]   3008  8  1.0    9.00    .86   .98  16.38  n/a    .000
      ------------------
  *   PIPE    [ 8 : 3008] 3009  9  1.0    9.00    .86   .98  16.38  n/a    .000
      {DiamUsed= 682.mm}
      ------------------
      CHANNEL[ 9 : 3009]  3010 10  1.0    9.00    .70  1.10  16.36  n/a    .000
      ------------------
      # **************************
      # UCC URBAN SUB-BASIN NO. E4*
      # **************************
      CALIB NASHYD        30II  I  1.0    3.00    .13  1.10   9.46  .27    .000
      [CN=75.0          ]
      [ N= 3.0:Tp=  .17]
      ------------------
      ADD [3011 + 3010]   3012  2  1.0   12.00    .83  1.10  14.64  n/a    .000
      ------------------
      # **********************************
      # EXISTING 750MM STORM SEWER
      # FROM WENTWORTH DRIVE TO PINEWOOD DRIVE
      # **********************************
      PIPE    [ 2 : 3012] 3011  1  1.0   12.00    .83  1.10  14.64  n/a    .000
      {DiamUsed= 750.mm}
      ------------------
      PIPE    [ 1 : 3011] 3012  2  1.0   12.00    .83  1.12  14.64  n/a    .000
      {DiamUsed= 750.mm}
      ------------------
FINISH

===========================================================================
```

A-3. Proposed Conditions - Input File

```
2
*#**********************************
*# NELLES PLACE AND CHESNUT GROVE
*# TOWN OF GRIMSBY
*# STORMWATER MANAGEMEHT REVIEW
*#
*# 5 YEAR DESIGN STORM EVEHT
*# CHICAGO 2 HOUR DISTRIBUTIOH
*#
*# MIHOR DRAIHAGE SYSTEM DESIGN ANALYSIS
*# DRAIHAGE AREA SOUTH OF PINEWOOD AVENUE
*#
*# MODELLIHG DATA REFEREHCED FROM SWM REPORT
*# FOR ORCHARDVIEW PHASES I AND II, AND
*# COMMERICAL PLAZA, FEBRUARY 22, 1990
*#
*#*****************************************
*# PROPOSED CONDITIOHS
*#*****************************************
*
START                 SIMULATION STARTS AT 0.0 HRS  METOUT= 2
*
CHICAGO STORM         IUHITS= 2  TD= 2.0 HRS  R= 0.46  SDT= 5.0 MIH  ICASE= 1
                      A= 785.59 MM/NR  B= 6.00 MIN  C= 0.790
*
*#***************************
*#UCC URBAN SUB-BASIH NO. E1*
*#***************************
*
CALIB STANDHYD        ID= I  HNYD= 3000  DT= 1.0 MIH  AREA= 2.80 HA
                      XIMP= 0.25  TIMP= 0.35  DWF= 0.0  LOSS= I
                      FO= 50.0 MM/NR  FC= 3.0 MM/NR  K= 2.00 I/NR  F= 0.0 MM
                      DPSP= 5.0 MM  SLPP= 5.00%  LGP= 30.0 M  MNP= 0.250  SCP= 0.0
                      DPSI= 1.0 MM  SLPI= 5.00%  LGI= 120.0 M  MMI= 0.013  SCI= 0.0
                      EHD= -1
*
ROUTE PIPE            ITYPE= 1  ID= 2  NHYD= 3001  P1PE= 3.1
                      DIAM= 600 MM  LENGTH= 150 M  ROUGN= 0.0I3  SLOPE= 0.01 M/M
                      IDIN= 1  DT= 1.0 MIH
*
ROUTE CHANHEL         ID= 3   HNYD= 3002  IDIH= 2  DT= I.0 MIN  LENGTH= 190 M
                      SLOPE= I.0%   FPSLOPE= 1.0%  VSH= 3.2  HSEG= 3
                          N       DIST (m)
                        0.035     1.00
                       -0.25      I.30
                        0.035     2.30
                       DIST (m)      ELEV(m)
                        0.0           99.0
                        1.0           98.5
                        1.3           98.5
                        2.3           99.0
*
*#***************************
*#UCC URBAN SUB-BASIN NO. E2*
*#***************************
*
CALIB STANDNYD        ID= 4  HHYD= 3003  DT= 1.0 MIN  AREA= 4.70 HA
                      XIMP= 0.30  TIMP= 0.40  DWF= 0.0 CMS  LOSS= 1
                      FO= 50.0 MM/HR  FC= 3.0 MM/NR  K= 2.00 I/NR   F= 0.0 MM
                      DPSP= 4.0 MM  SLPP= 3.00%  LGP= 50.0 M   MMP= D.250  SCP= 0.0
                      DPSI= I.0 MM  SLPI= 3.00%  LGI= 155.0 M  MNI= 0.013  SCI= 0.0
                      END= -1
*
ADD HYD               ID= 5  HHYD= 3004  IDI= 3  IDII= 4
*
ROUTE PIPE            ITYPE= 1  ID= 6  NHYD= 3005  PIPE= 3.3
                      DIAM= 600 MM  LENGHT=118 M  ROUGH= 0.013  SLOPE= 0.01 M/M
                      IDIN= 5  DT= 1.0 MIH
*
*#***************************
*#UCC URBAN SUB-BASIN NO. E3*
*#***************************
*
CALIB STANDHYD        ID= 7  HHYD= 3007  DT= 1.0 MIN  AREA= 1.50 HA
                      XIMP= 0.50  TIMP= 0.50  DWF= 0.0 CMS  LOSS= I
                      FO= 50.0 MM/NR  FC= 3.0 MM/HR  K= 2.00 I/HR  F= 0.0 MM
                      DPSP= 4.0 MM  SLPP= 1.50%  LGP= 30.0 M  MMP= 0.250  SCP= 0.0
                      DPSI= 1.0 MM  SLPI= 1.50%  LGI= 100.0 M  MNI= 0.0I3  SCI= 0.0
                      EHD= -1
*
ADD HYD               ID= 8  NNYD=3008  IDI= 6  IDII= 7
*
*
*#***************************
*#UCC URBAN SUB-BASIN NO. E4a
*#***************************
*
CALIB STANDNYD        ID= 7  NHYD= 3007  DT= I.0 MIN  AREA= 1.58 HA
                      X1MP= 0.25  TIMP= 0.30  DWF= 0.0 CMS  LOSS= 1
                      FO= 50.0 MM/HR  FC= 3.0 MM/HR  K= 2.00 I/HR  F= 0.0 MM
                      DPSP= 4.0 MM  SLPP= 1.50%  LGP= 30.0 M  MNP= 0.250  SCP= 0.0
                      DPSI= 1.0 MM  SLPI= 1.50%  LGI= 100.0 M  MMI= 0.013  SCI= 0.0
                      END= -1
*
ADD HYD               ID= 6  NNYD=3008  IDI= 7  IDII= 8
*
*#***************************
*# PROPOSED DETENTION POND
*# UPSTREAM OF CNESNUT GROVE
*# 525mm ORIFICE AND STORAGE
*#***************************
*
ROUTE RESERVOIR       ID= 1  NHYD= 3011  IDIN= 6  DT= 1.0MIN
                      DISCHARGE(CMS)  STORAGE (HAM)
                        0.00              0.00000
                        0.76              0.00051
                        0.86              0.00795
                        -1
*
ROUTE PIPE            ITYPE= I  ID= 9  HHYD= 3009  PIPE= 3.4
                      DIAM= 686 MM  LENGTH= 43.5 M  ROUGH= 0.013  SLOPE= 0.0105M/M
                      IDIN= 1  DT= 1.0 MIH
```

```
*
*#***************************
*#UCC URBAN SUB-BASIN NO. E4b
*#***************************
*
CALIB STANDHYD        ID= 1  HHYD= 3010  DT= 1.0 MIN  AREA= I.42 HA
                      XIMP= 0.25  TIMP= 0.30  DWF= 0.0 CMS  LOSS= 1
                      FO= 50.0 MM/NR  FC= 3.0 MM/HR  K= 2.00 I/HR  F= 0.0 MM
                      DPSP= 5.0 MM  SLPP= 1.50%  LGP= 30.0 M  MNP= 0.250  SCP= 0.0
                      DPS1= 1.0 MM  SLPI= 1.50%  LGI= I40.0 M  MMI= D.013  SCI= 0.0
                      END= -1
*
*#*************************************
*# APPROX. FLOWS WITNOUT UPSTREAM POND
*#*************************************
*
ADD HYD               ID= 10  NHYD= 3011  IDI= 1  IDII= 6
*
*#***************************
*# PROPOSED FLOWS WITN SWM
*#***************************
*
ADD HYD               ID= 10  NHYD= 3011  IDI= 1  IDII= 9
*
*
*#**************************************
*#EXISTIHG 750MM STORM SEWER
*#FROM WEHTWORTH DRIVE TO PINEWOOD DRIVE
*#**************************************
*
ROUTE PIPE            ITYPE= 1  ID= 2  NHYD= 3013  PIPE= 3.6
                      DIAM= 750 MM  LENGTH= 58.4 M  ROUGH= 0.013  SLOPE= 0.008 M/M
                      IDIN= 10  DT= 1.0 MIN
*
*#***************************
*#UCC URBAN SUB-BASIN NO. E5
*#***************************
*
CALIB STANDNYD        ID= I  HHYD= 3010  DT= 1.0 MIN  AREA= 0.35 HA
                      XIMP= 0.25  TIMP= 0.30  DWF= 0.0 CMS  LOSS= 1
                      FO= 50.0 MM/HR  FC= 3.0 MM/HR  K= 2.00 I/NR  F= 0.0 MM
                      DPSP= 5.0 MM  SLPP= 1.50%  LGP= 30.0 M  MNP= 0.250  SCP= 0.0
                      DPSI= 1.0 MM  SLPI= 1.50%  LGI= 140.0 M  MNI= 0.0I3  SCI= 0.0
                      EHD= -1
*
ADD HYD               ID= 3  NNYD= 3011  IDI= 1  IDII= 2
*
ROUTE PIPE            ITYPE= 1  ID= 2  NHYD= 3013  PIPE= 3.6
                      DIAN= 750 MM  LENGTH= 47.4 M  ROUGN= 0.013  SLOPE= 0.0069 M/M
                      1DIN= 3  DT= 1.0 MIH
*
CALIB STANDHYD        ID= 1  HNYD= 30I0  DT= 1.0 MIH  AREA= 2.02 HA
                      XIMP= 0.25  TIMP= 0.30  DWF= 0.0 CMS  LOSS= 1
                      FO= 50.0 MM/HR  FC= 3.0 MM/HR  K= 2.0D I/NR  F= 0.0 MM
                      DPSP= 5.0 MM  SLPP= I.50%  LGP= 30.0 M  MNP= 0.250  SCP= 0.0
                      DPSI= 1.0 MM  SLPI= 1.50%  LGI= I40.0 M  MNI= 0.013  SCI= 0.0
                      END= -I
*
ADD HYD               ID= 3  NHYD= 3011  IDI= 2  IDII= 1
*
ROUTE PIPE            ITYPE= 1  ID= 4  NNYD= 3D13  PIPE= 3.6
                      DIAN= 750 MM  LENGTH= 95.4 M  ROUGN= 0.013  SLOPE= 0.0119 M/M
                      IDIN= 3  DT= 1.0 MIH
*
*
FIHISH
```

A-4. Proposed Conditions - Summary File

```
===============================================================================

      OOO    TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    I N T E R H Y M O
     O   O     T      T    H   H   Y Y   MM MM  O   O   * * * 1989b * * *
     O   O     T      T    HHHHH    Y    M M M  O   O
     O   O     T      T    H   H    Y    M   M  O   O
      OOO      T      T    H   H    Y    M   M   OOO    cD-417441600102

Distributed by the INTERHYMO Centre. Copyright (c), 1989.  Paul Wisner & Assoc.
  EXCLUSIVE USE TO : Uppear Canada Consultants

                    *****  S U M M A R Y   O U T P U T  *****


  Input   filename: F:SWMP.IN
  Output  filename: F:SWMP.OUT
  Summary filename: F:SWMP.SUM


DATE: 10-31-2001                        TIME: 16:21:53

USER: ________________________________________

COMMENTS: __________________________________________________________

      # ********************************
      #  NELLES PLACE AND CHESNUT GROVE
      #  TOWN OF GRIMSBY
      #  STORMWATER MANAGEMENT REVIEW
      #
      #  5 YEAR DESIGN STORM EVENT
      #  CHICAGO 2 HOUR DISTRIBUTION
      #
      #  MINOR DRAINAGE SYSTEM DESIGN ANALYSIS
      #  DRAINAGE AREA SOUTH OF PINEWOOD AVENUE
      #
      #  MODELLING DATA REFERENCED FROM SWM REPORT
      #  FOR ORCHARDVIEW PHASES I AND II, AND
      #  COMMERICAL PLAZA, FEBRUARY 22, 1990
      #
      # ****************************************
      #  PROPOSED CONDITIONS
      # ****************************************
 **************************
 ** SIMULATION NUMBER:   1 **
 **************************

 W/E COMMAND              HYD ID   DT     AREA   Qpeak Tpeak   R.V. R.C.    Qbase
                                   min     ha     cms   hrs     mm           cms

     START @   .00 hrs
     ------------------
     CHIC STORM                    5.0
     [ Ptot= 34.42 mm ]
     ------------------
     # **************************
     # UCC URBAN SUB-BASIN NO. E1*
     # **************************
     CALIB STANDHYD      3000  1  1.0     2.80    .29   .98  14.45  .42    .000
     [I%=25.0:S%= 5.00]
     ------------------
     PIPE   [ 1 : 3000] 3001  2  1.0     2.80    .29  1.00  14.44  n/a    .000
     {DiamUsed= 600.mm}
     ------------------
     CHANNEL[ 2 : 3001] 3002  3  1.0     2.80    .25  1.05  14.32  n/a    .000
     ------------------
     # **************************
     # UCC URBAN SUB-BASIN NO. E2*
     # **************************
     CALIB STANDHYD      3003  4  1.0     4.70    .46   .97  16.44  .48    .000
     [I%=30.0:S%= 3.00]
     ------------------
     ADD [3002 + 3003]   3004  5  1.0     7.50    .65  1.05  15.65  n/a    .000
     ------------------
 *   PIPE   [ 5 : 3004] 3005  6  1.0     7.50    .65  1.05  15.65  n/a    .000
     {DiamUsed= 613.mm}
     ------------------
     # **************************
     # UCC URBAN SUB-BASIN NO. E3*
     # **************************
     CALIB STANDHYD      3007  7  1.0     1.50    .23   .95  20.05  .58    .000
     [I%=50.0:S%= 1.50]
     ------------------
     ADD [3005 + 3007]   3008  8  1.0     9.00    .84   .98  16.38  n/a    .000
     ------------------
     # **************************
     # UCC URBAN SUB-BASIN NO. E4a
     # **************************
     CALIB STANDHYD      3007  7  1.0     1.58    .14   .97  14.18  .41    .000
     [I%=25.0:S%= 1.50]
     ------------------
     ADD [3007 + 3008]   3008  6  1.0    10.58    .98   .98  16.05  n/a    .000
     ------------------
     # **************************
     #  PROPOSED DETENTION POND
     #  UPSTREAM OF CHESNUT GROVE
     #  525mm ORIFICE AND STORAGE
     # **************************
     RESRVR [ 6 : 3008] 3011  1  1.0    10.58    .85  1.10  16.05  n/a    .000
     {ST=   .01 ha.m }
     ------------------
     PIPE   [ 1 : 3011] 3009  9  1.0    10.58    .85  1.10  16.05  n/a    .000
     {DiamUsed= 686.mm}
     ------------------
     # **************************
     # UCC URBAN SUB-BASIN NO. E4b
     # **************************
     CALIB STANDHYD      3010  1  1.0     1.42    .11   .97  13.48  .39    .000
     [I%=25.0:S%= 1.50]
     ------------------
     # ************************************
     #  APPROX. FLOWS WITHOUT UPSTREAM POND
     # ************************************
     ADD [3010 + 3008]   3011 10  1.0    12.00   1.08   .98  15.75  n/a    .000
     ------------------
     # **************************
     #  PROPOSED FLOWS WITH SWM
     # **************************
     ADD [3010 + 3009]   3011 10  1.0    12.00    .94  1.08  15.75  n/a    .000
     ------------------
     # ************************************
     # EXISTING 750MM STORM SEWER
     # FROM WENTWORTH DRIVE TO PINEWOOD DRIVE
     # ************************************
     PIPE   [10 : 3011] 3013  2  1.0    12.00    .94  1.08  15.75  n/a    .000
     {DiamUsed= 750.mm}
     ------------------
     # **************************
     # UCC URBAN SUB-BASIN NO. E5
     # **************************
     CALIB STANDHYD      3010  1  1.0      .35    .03   .97  13.47  .39    .000
     [I%=25.0:S%= 1.50]
     ------------------
     ADD [3010 + 3013]   3011  3  1.0    12.35    .97  1.08  15.68  n/a    .000
     ------------------
 *   PIPE   [ 3 : 3011] 3013  2  1.0    12.35    .97  1.08  15.68  n/a    .000
     {DiamUsed= 762.mm}
     ------------------
     CALIB STANDHYD      3010  1  1.0     2.02    .16   .97  13.48  .39    .000
     [I%=25.0:S%= 1.50]
     ------------------
     ADD [3013 + 3010]   3011  3  1.0    14.37   1.10  1.08  15.37  n/a    .000
     ------------------
     PIPE   [ 3 : 3011] 3013  4  1.0    14.37   1.10  1.08  15.37  n/a    .000
     {DiamUsed= 750.mm}
     ------------------
 FINISH

===============================================================================
```

A-5. Proposed Conditions - Input File (Future Parking Storage)

```
2
*#*********************************
*# NELLES PLACE AND CHESNUT GROVE
*# TOWN OF GRIMSBY
*# STORMWATER MANAGEMENT REVIEW
*#
*# 5 YEAR DESIGN STORM EVENT
*# CHICAGO 2 HOUR DISTRIBUTION
*#
*# MIHOR DRAINAGE SYSTEM DESIGH ANALYSIS
*# DRAINAGE AREA SOUTH OF PINEWOOD AVEHUE
*#
*# MODELLING DATA REFERENCED FROM SWM REPORT
*# FOR ORCHARDVIEW PHASES I AND I1, AND
*# COMMERICAL PLAZA, FEBRUARY 22, 1990
*#
*#**************************************************
*# PROPOSED CONDITIONS WITH FUTURE POND COHFIGURATIOH
*#**************************************************
*
START              SIMULATION STARTS AT 0.0 HRS  METOUT= 2
*
CHICAGO STORM      IUNITS= 2  TD= 2.0 HRS  R= 0.46  SDT= 5.0 MIH  ICASE= 1
                   A= 785.59 MM/HR  B= 6.00 MIH  C= 0.790
*
*#***************************
*#UCC URBAN SUB-BASIH HO. E1*
*#***************************
*
CALIB STANDHYD     ID= 1  NHYD= 3000  DT= 1.0 MIN  AREA= 2.80 HA
                   XIMP= 0.25  TIMP= 0.35  DWF= 0.0  LOSS= 1
                   FO= 50.0 MM/HR  FC= 3.0 MM/HR  K= 2.00 I/HR  F= 0.0 MM
                   DPSP= 5.0 MM  SLPP= 5.00%  LGP= 30.0 M  MNP= 0.250  SCP= 0.0
                   DPSI= 1.0 MM  SLPI= 5.00%  LGI= 120.0 M  MNI= 0.013  SCI= 0.0
                   END= -1
*
ROUTE PIPE         ITYPE= 1  ID= 2  HHYD= 3001  PIPE= 3.1
                   DIAM= 600 MM  LENGTH= 150 M  ROUGH= 0.013  SLOPE= 0.01 M/M
                   IDIN= 1  DT= 1.0 MIH
*
ROUTE CHANNEL      ID= 3  NHYD= 3002  IDIH= 2  DT= 1.0 MIN  LENGTH= 190 M
                   SLOPE= 1.0%   FPSLOPE= 1.0%  VSN= 3.2  NSEG= 3
                       N      DIST (m)
                     0.035     1.00
                    -0.25      1.30
                     0.035     2.30
                    DIST (m)     ELEV(m)
                     0.0          99.0
                     1.0          98.5
                     1.3          98.5
                     2.3          99.0
*
*#***************************
*#UCC URBAN SUB-BASIH NO. E2*
*#***************************
*
CALIB STANDHYD     ID= 4  HHYD= 3003  DT= 1.0 MIN  AREA= 4.70 HA
                   XIMP= 0.30  TIMP= 0.40  DWF= 0.0 CMS  LOSS= 1
                   FO= 50.0 MM/HR  FC= 3.0 MM/HR  K= 2.00 I/HR   F= 0.0 MM
                   DPSP= 4.0 MM  SLPP= 3.00%  LGP= 50.0 M   MNP= 0.250  SCP= 0.0
                   DPSI= 1.0 MM  SLPI= 3.00%  LGI= 155.0 M  MNI= 0.013  SCI= 0.0
                   END= -1
*
ADD HYD            ID= 5  NHYD= 3004  IDI= 3  IDII= 4
*
ROUTE PIPE         ITYPE= 1  ID= 6  NHYD= 3005  PIPE= 3.3
                   DIAM= 600 MM  LENGHT=118 M  ROUGH= 0.013  SLOPE= 0.01 M/M
                   IDIH= 5  DT= 1.0 MIN
*
*#***************************
*#UCC URBAN SUB-BASIN HO. E3*
*#***************************
*
CALIB STANDHYD     ID= 7  HHYD= 3007  DT= 1.0 MIN  AREA= 1.50 HA
                   XIMP= 0.50  TIMP= 0.50  DWF= 0.0 CMS  LOSS= 1
                   FO= 50.0 MM/HR  FC= 3.0 MM/HR  K= 2.00 I/HR  F= 0.0 MM
                   DPSP= 4.0 MM  SLPP= 1.50%  LGP= 30.0 M  MNP= 0.250  SCP= 0.0
                   DPSI= 1.0 MM  SLPI= 1.50%  LGI= 100.0 M  MNI= 0.013  SCI= 0.0
                   END= -1
*
ADD HYD            ID= 8  HHYD=3008  IDI= 6  IDII= 7
*
*
*#***************************
*#UCC URBAN SUB-BASIH NO. E4a
*#***************************
*
CALIB STANDHYD     ID= 7  NHYD= 3007  DT= 1.0 MIH  AREA= 1.58 HA
                   XIMP= 0.25  TIMP= 0.30  DWF= 0.0 CMS  LOSS= 1
                   FO= 50.0 MM/HR  FC= 3.0 MM/HR  K= 2.00 I/HR  F= 0.0 MM
                   DPSP= 4.0 MM  SLPP= 1.50%  LGP= 30.0 M  MNP= 0.250  SCP= 0.0
                   DPSI= 1.0 MM  SLPI= 1.50%  LGI= 100.0 M  MNI= 0.013  SCI= 0.0
                   END= -1
*
ADD HYD            ID= 6  NHYD=3008  IDI= 7  IDII= 8
*
*#***************************
*# PROPOSED DETENTIOH POHD
*# UPSTREAM OF CHESNUT GROVE
*# 528mm ORIFICE AND PARKING LOT STORAGE
*#***************************
*
ROUTE RESERVOIR    ID= 1  HHYD= 3011  IDIH= 6  DT= 1.0MIN
                   DISCHARGE(CMS)  STORAGE (HAM)
                     0.00              0.00000
                     0.76              0.00051
                     0.86              0.00772
                     -1
*
ROUTE PIPE         ITYPE= 1  ID= 9  NHYD= 3009  PIPE= 3.4
                   DIAM= 686 MM  LENGTH= 43.5 M  ROUGH= 0.013  SLOPE= 0.0105M/M
                   IDIN= 1  DT= 1.0 MIH
*
*#***************************
*#UCC URBAN SUB-BASIN NO. E4b
*#***************************
*
CALIB STANDHYD     ID= 1  NHYD= 3010  DT= 1.0 MIN  AREA= 1.42 HA
                   XIMP= 0.25  TIMP= 0.30  DWF= 0.0 CMS  LOSS= 1
                   FO= 50.0 MM/HR  FC= 3.0 MM/HR  K= 2.00 I/HR  F= 0.0 MM
                   DPSP= 5.0 MM  SLPP= 1.50%  LGP= 30.0 M  MNP= 0.250  SCP= 0.0
                   DPSI= 1.0 MM  SLPI= 1.50%  LGI= 140.0 M  MNI= 0.013  SCI= 0.0
                   END= -1
*
*#**************************************
*# APPROX. FLOWS WITHOUT UPSTREAM POHD
*#**************************************
*
ADD HYD            ID= 10  NHYD= 3011  IDI= 1  IDII= 6
*
*#***************************
*# PROPOSED FLOWS WITH SWM
*#***************************
*
ADD HYD            ID= 10  NHYD= 3011  IDI= 1  IDII= 9
*
*
*#***************************************
*#EXISTIHG 750MM STORM SEWER
*#FROM WENTWORTH DRIVE TO PINEWOOD DRIVE
*#***************************************
*
ROUTE PIPE         ITYPE= 1  ID= 2  NHYD= 3013  PIPE= 3.6
                   DIAM= 750 MM  LENGTH= 58.4 M  ROUGH= 0.013  SLOPE= 0.008 M/M
                   IDIN= 10  DT= 1.0 MIN
*
*#***************************
*#UCC URBAN SUB-BASIN NO. E5
*#***************************
*
CALIB STANDHYD     ID= 1  HHYD= 3010  DT= 1.0 MIH  AREA= 0.35 HA
                   XIMP= 0.25  TIMP= 0.30  DWF= 0.0 CMS  LOSS= 1
                   FO= 50.0 MM/HR  FC= 3.0 MM/HR  K= 2.00 I/HR  F= 0.0 MM
                   DPSP= 5.0 MM  SLPP= 1.50%  LGP= 30.0 M  MNP= 0.250  SCP= 0.0
                   DPSI= 1.0 MM  SLPI= 1.50%  LGI= 140.0 M  MNI= 0.013  SCI= 0.0
                   END= -1
*
ADD HYD            ID= 3  NHYD= 3011  IDI= 1  IDII= 2
*
ROUTE PIPE         ITYPE= 1  ID= 2  NHYD= 3013  PIPE= 3.6
                   DIAM= 750 MM  LENGTH= 47.4 M  ROUGH= 0.013  SLOPE= 0.0069 M/M
                   IDIH= 3  DT= 1.0 MIH
*
CALIB STANDHYD     ID= 1  HHYD= 3010  DT= 1.0 MIH  AREA= 2.02 HA
                   XIMP= 0.25  TIMP= 0.30  DWF= 0.0 CMS  LOSS= 1
                   FO= 50.0 MM/HR  FC= 3.0 MM/HR  K= 2.00 I/HR  F= 0.0 MM
                   DPSP= 5.0 MM  SLPP= 1.50%  LGP= 30.0 M  MNP= 0.250  SCP= 0.0
                   DPSI= 1.0 MM  SLPI= 1.50%  LGI= 140.0 M  MNI= 0.013  SCI= 0.0
                   END= -1
*
ADD HYD            ID= 3  NHYD= 3011  IDI= 2  IDII= 1
*
ROUTE PIPE         ITYPE= 1  ID= 4  HHYD= 3013  PIPE= 3.6
                   DIAM= 750 MM  LENGTH= 95.4 M  ROUGH= 0.013  SLOPE= 0.0119 M/M
                   IDIN= 3  DT= 1.0 MIH
*
*
FIHISH
```

A-6. Proposed Conditions - Summary File (Future Parking Storage)

```
==============================================================================

       OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    I N T E R H Y M O
      O   O    T      T    N   H   Y Y   MM MM  O   O   * * * 1989b * * *
      O   O    T      T    HHHHH    Y    M M M  O   O
      O   O    T      T    H   H    Y    M   M  O   O
       OOO     T      T    H   H    Y    M   M   OOO    cD-417441600102

Distributed by the INTERHYMO Centre. Copyright (c), 1989.  Paul Wisner & Assoc.
  EXCLUSIVE USE TO : Uppear Canada Consultants

                  *****  S U M M A R Y   O U T P U T  *****


  Input   filename: F:SWMF.IN
  Output  filename: F:SWMF.OUT
  Summary filename: F:SWMF.SUM


DATE: 10-31-2001                    TIME: 16:21:53

USER: ____________________________________________

COMMENTS: ____________________________________________________________


      # **********************************
      #  NELLES PLACE AND CHESNUT GROVE
      #  TOWN OF GRIMSBY
      #  STORMWATER MANAGEMENT REVIEW
      #
      #  5 YEAR DESIGN STORM EVENT
      #  CHICAGO 2 NOUR DISTRIBUTION
      #
      #  MINOR DRAINAGE SYSTEM DESIGN ANALYSIS
      #  DRAINAGE AREA SOUTH OF PINEWOOD AVENUE
      #
      #  MODELLING DATA REFERENCED FROM SWM REPORT
      #  FOR ORCHARDVIEW PHASES I AND II, AND
      #  COMMERICAL PLAZA, FEBRUARY 22, 1990
      #
      # ****************************************************
      #  PROPOSED CONOITIONS WITH FUTURE POND CONFIGURATION
      # ****************************************************
 ****************************
 ** SIMULATION NUMBER:   1 **
 ****************************

 W/E COMMAND              HYO ID   DT     AREA   Qpeak Tpeak   R.V. R.C.    Qbase
                                   min     ha     cms   hrs     mm           cms

      START @   .00 hrs
      ------------------
      CHIC STORM                   5.0
      [ Ptot= 34.42 mm ]
      ------------------
      # ***************************
      # UCC URBAN SUB-BASIN NO. E1*
      # ***************************
      CALIB STANOHYO      3000  1  1.0     2.80    .29   .98  14.45  .42     .000
      [I%=25.0:S%= 5.00]
      ------------------
      PIPE   [ 1 : 3000] 3001  2  I.0     2.80    .29  1.00  14.44  n/a     .000
      [DiamUsed= 600.mm]
      ------------------
      CHANNEL[ 2 : 3001] 3002  3  1.0     2.80    .25  1.05  14.32  n/a     .000
      ------------------
      # ***************************
      # UCC URBAN SUB-BASIN NO. E2*
      # ***************************
      CALIB STANDHYD      3003  4  1.0     4.70    .46   .97  16.44  .48     .000
      [I%=30.0:S%= 3.00]
      ------------------
      ADD [3002 + 3003]   3004  5  1.0     7.50    .65  1.05  15.65  n/a     .000
      ------------------
   *  PIPE   [ 5 : 3004] 3005  6  1.0     7.50    .65  1.05  15.65  n/a     .000
      [DiamUsed= 613.mm]
      ------------------
      # ***************************
      # UCC URBAN SUB-BASIN NO. E3*
      # ***************************
      CALIB STANDHYO      3007  7  1.0     1.50    .23   .95  20.05  .58     .000
      [I%=50.0:S%= 1.50]
      ------------------
      ADD [3005 + 3007]   3008  8  1.0     9.00    .84   .98  16.38  n/a     .000
      ------------------
      # ***************************
      # UCC URBAN SUB-BASIN NO. E4a
      # ***************************
      CALIB STANDNYD      3007  7  1.0     1.58    .14   .97  14.18  .41     .000
      [I%=25.0:S%= 1.50]
      ------------------
      ADD [3007 + 3008]   3008  6  1.0    10.58    .98   .98  16.D5  n/a     .000
      ------------------
      # ***************************
      #  PROPOSED DETENTION POND
      #  UPSTREAM OF CNESNUT GROVE
      #  528mm ORIFICE AND PARKING LOT STORAGE
      # ***************************
      RESRVR [ 6 : 3008] 3011  1  1.0    10.58    .85  1.10  16.05  n/a     .000
      [ST=   .01 ha.m ]
      ------------------
      PIPE   [ 1 : 3011] 3009  9  I.0    10.58    .85  1.10  16.05  n/a     .000
      [DiamUsed= 686.mm]
      ------------------
      # ***************************
      # UCC URBAN SUB-BASIN NO. E4b
      # ***************************
      CALIB STANDHYD      3010  1  1.0     1.42    .11   .97  13.48  .39     .000
      [I%=25.D:S%= 1.50]
      ------------------
      # *************************************
      #  APPROX. FLOWS WITNOUT UPSTREAM POND
      # *************************************
      ADD [3010 + 3008]   3011 10  1.0    12.00   1.08   .98  15.75  n/a     .000
      ------------------
      # ***************************
      #  PROPOSEO FLOWS WITH SWM
      # ***************************
      ADD [3010 + 3009]   3OI1 1D  1.0    12.00    .94  1.08  15.75  n/a     .000
      ------------------
      # ************************************
      # EXISTING 750MM STORM SEWER
      # FROM WENTWORTH DRIVE TO PINEWOOD DRIVE
      # ************************************
      PIPE   [10 : 3011] 3013  2  1.0    12.00    .94  1.08  15.75  n/a     .000
      [DiamUsed= 750.mm]
      ------------------
      # ***************************
      # UCC URBAN SUB-BASIN NO. E5
      # ***************************
      CALIB STANDNYD      3010  1  1.0      .35    .D3   .97  13.47  .39     .000
      [I%=25.0:S%= 1.50]
      ------------------
      ADD [3010 + 3013]   3011  3  1.0    12.35    .97  1.08  15.68  n/a     .000
      ------------------
   *  PIPE   [ 3 : 3011] 3013  2  1.0    12.35    .97  1.08  15.68  n/a     .000
      [DiamUsed= 763.mm]
      ------------------
      CALIB STANDHYD      3010  1  1.0     2.02    .16   .97  13.48  .39     .000
      [I%=25.0:S%= 1.50]
      ------------------
      ADD [3013 + 3010]   3011  3  1.0    14.37   1.10  1.08  15.37  n/a     .000
      ------------------
      PIPE   [ 3 : 3011] 3013  4  1.0    14.37   1.10  1.08  15.37  n/a     .000
      [OiamUsed= 750.mm]
      ------------------
 FINISN

==============================================================================
```

UPPER CANADA CONSULTANTS
ENGINEERS/PLANNERS

215 Ontario Street
St. Catharines Ontario
L2R 5L2

Phone:(905)688-9400
Fax: (905)688-5274

Project NELLES PLACE SWM
Sheet
Job Number 0129
Date Oct 31, 2001
Calculated By JS
Checked By

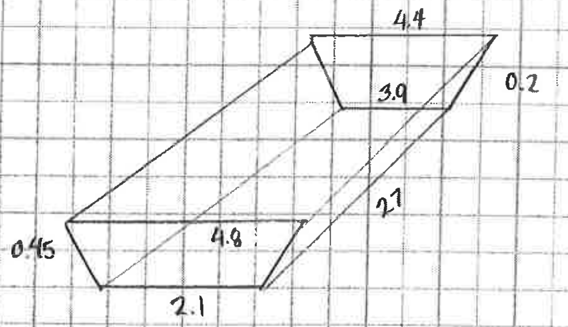
VOLUME CALCULATIONS

FUTURE

REARYARD CHANNEL

Behind Units 9+10 Chesnut Grove $V = 3 m^3$ for previous calcus

Behind Units 6-10 Chesnut Grove

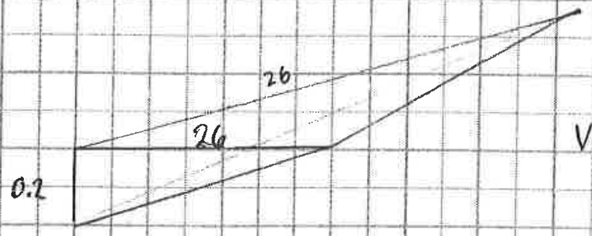


$V = 33 m^3$

$V_{600\phi} = 59m \times 0.29^2$
$= 17.2 m^3$

PARKING LOT

$V = 1.0 m^3$



$V = 23 m^3$

∴ TOTAL REARYARD CHANNEL + PARKING LOT VOLUME = 3+33+1+23+17.2 = 77.2
+ 600ϕ SEW

Project NELLES PLACE SWM
Sheet
Job Number 0129
Date OCT 31, 2001
Calculated By JS
Checked By

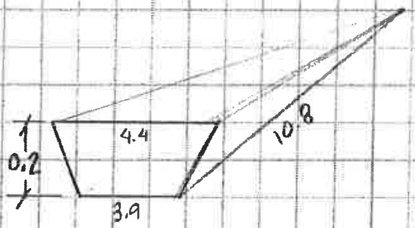
VOLUME CALCULATIONS

PROPOSED

REARYARD CHANNEL

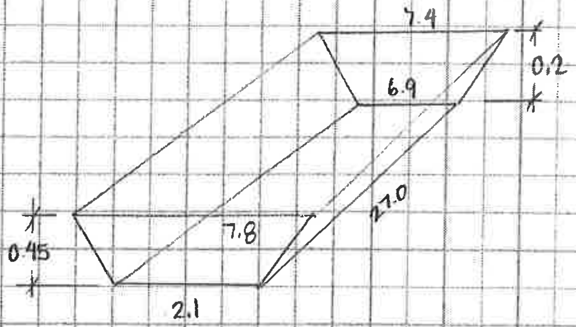
Behind Units 9+10 Chesnut Grove

$V_{600\phi} = 59 \times 0.29 m^2$
$= 17.2 m^3$



$V = 3 m^3$

Behind Units 6-8 and part of existing commerical (#141 Main Street)



$V = 59.3 m^3$

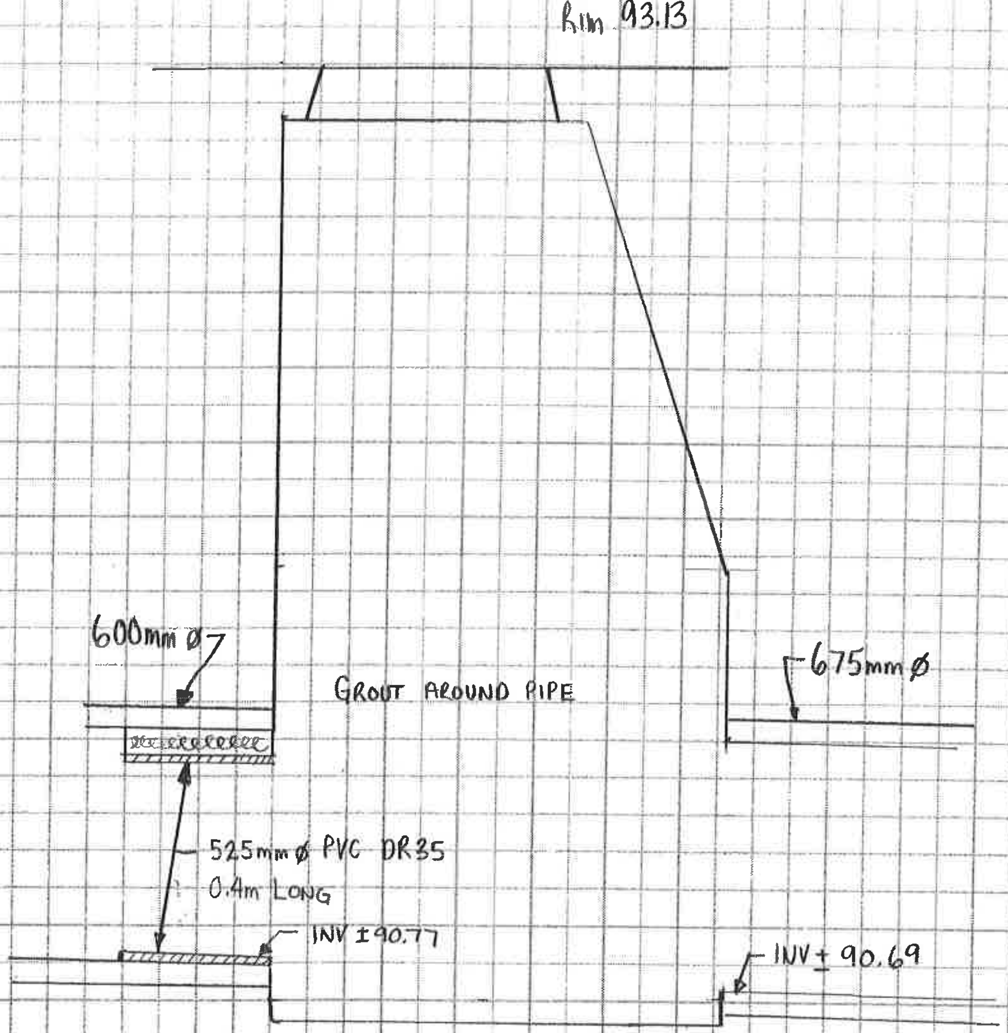
∴ REARYARD CHANNEL VOLUME = $59.3 + 3 + 17.2 m^3 = 79.5 m^3$

UPPER CANADA CONSULTANTS
ENGINEERS/PLANNERS

215 Ontaria Street
St. Catharines Ontario
L2R 5L2

Phone:(905)688-9400
Fax: (905)688-5274

Project NELLES PLACE SWM
Sheet
Job Number 0129
Date OCTOBER 31, 2001
Calculated By JS
Checked By

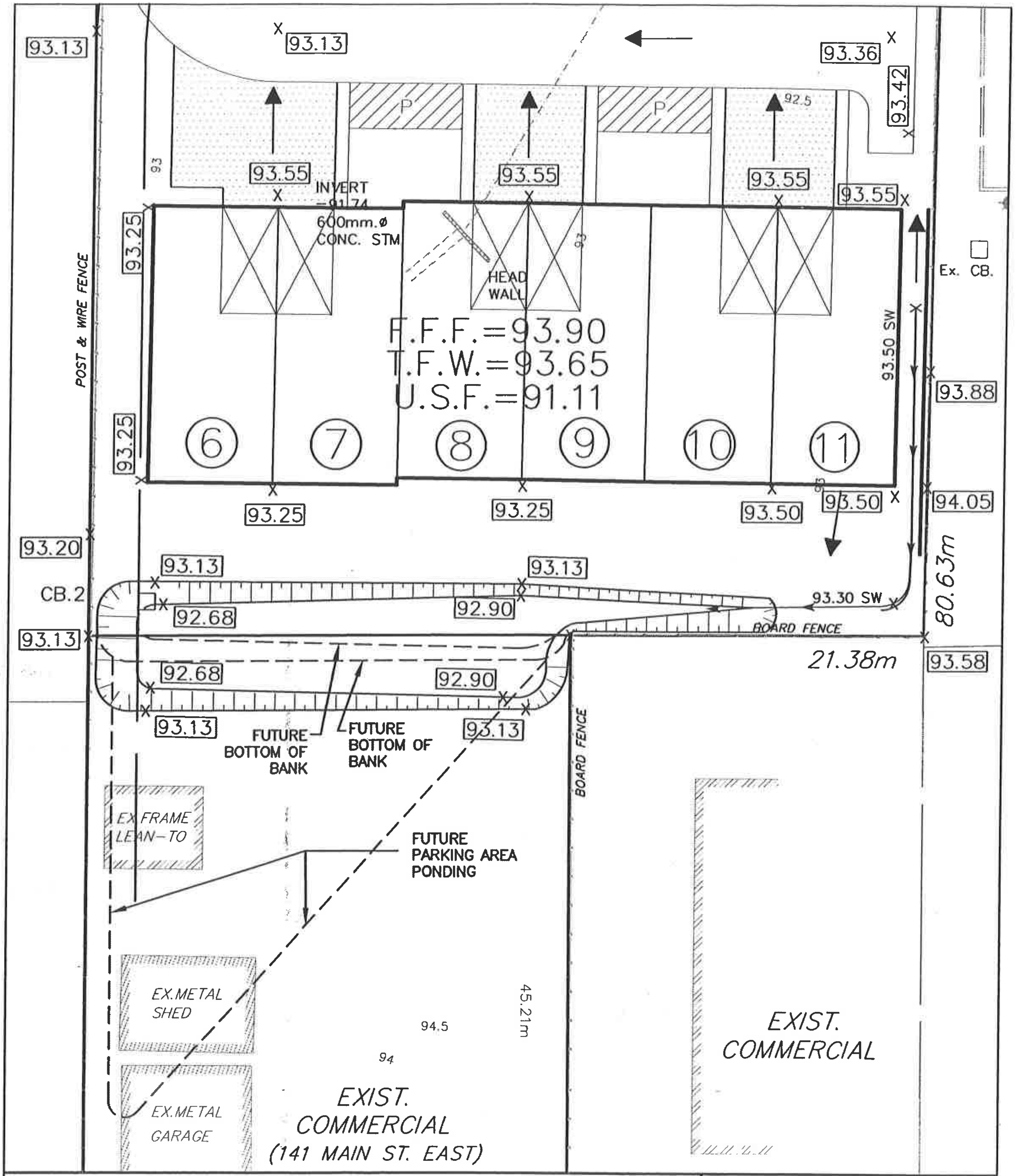


OUTLET CONTROL STRUCTURE
MH'2' CHESNUT GROVE

FACILITY CONTROL OUTFLOWS CALCULATIONS

525 mm ø PVC DR35
AVE INSIDE DIA = 528mm
DISCHARGE COEFFIEINT = 0.63

ELEVATION (m)	DEPTH (m)	DISCHARGE (cms)
0	0	0
92.68	1.91	0.76
93.13	2.36	0.86



NELLES PLACE & CHESNUT GROVE

PROPOSED DETENTION FACILITY

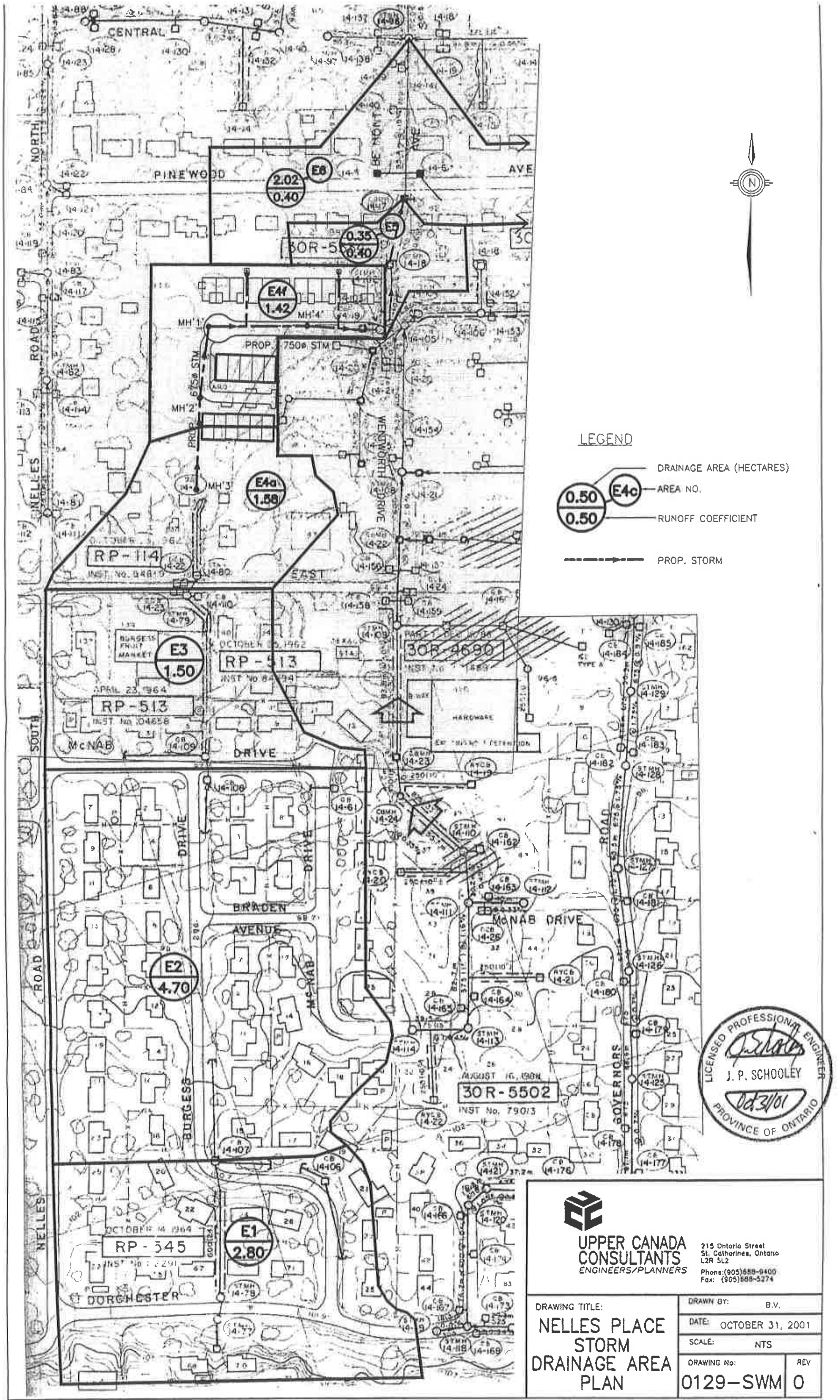
SCALE ±1:300

UPPER CANADA CONSULTANTS
ENGINEERS/PLANNERS

215 Ontario Street
St. Catharines
Ontario L2R 5L2

Phone:(905)688-9400
Fax: (905)688-5274

DWG. No: **FIGURE**

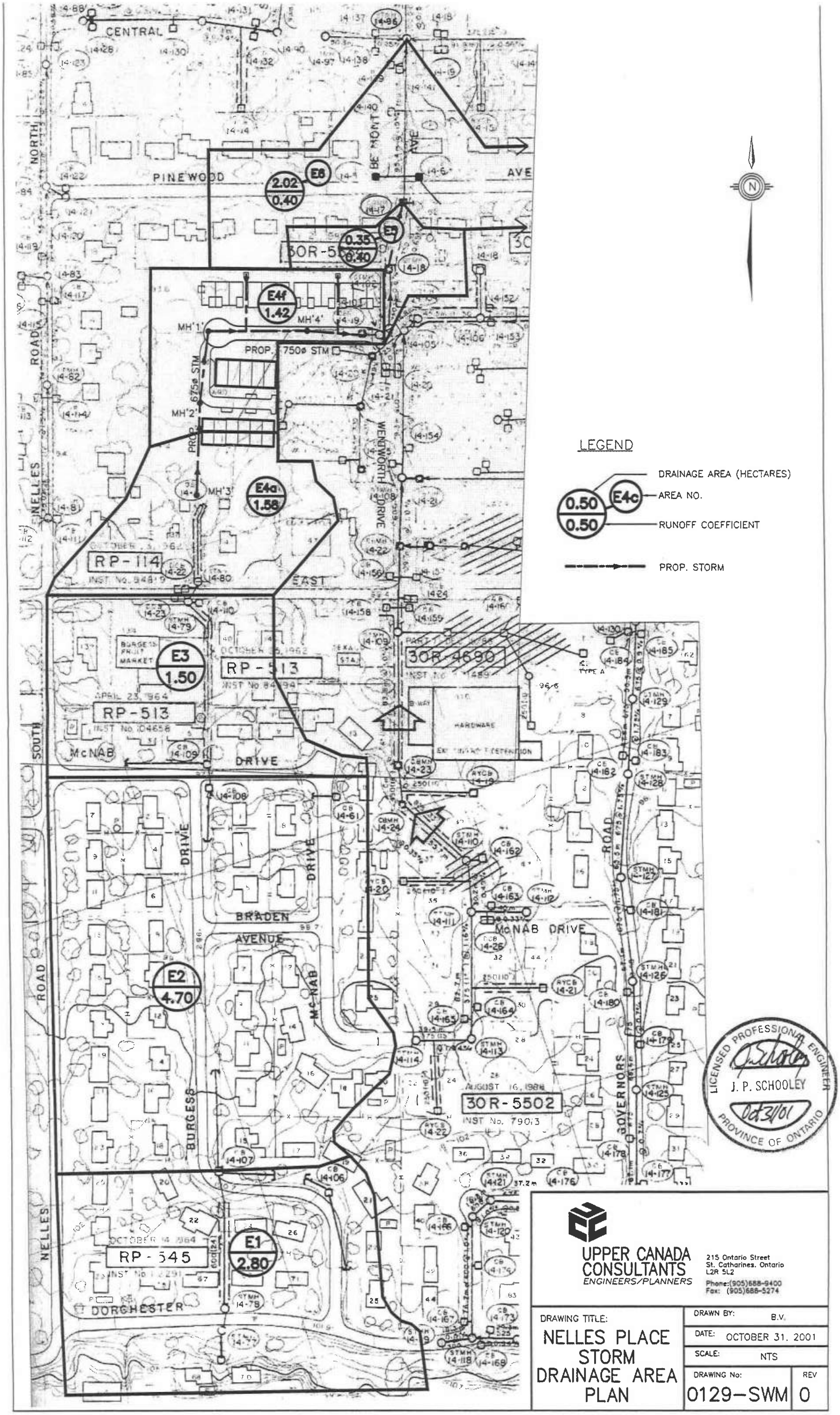


LICENSED PROFESSIONAL ENGINEER
J. P. SCHOOLEY
Oct 31/01
PROVINCE OF ONTARIO

UPPER CANADA CONSULTANTS
ENGINEERS/PLANNERS

215 Ontario Street
St. Catharines, Ontario
L2R 5L2
Phone:(905)688-9400
Fax: (905)688-5274

DRAWING TITLE: NELLES PLACE STORM DRAINAGE AREA PLAN	DRAWN BY: B.V.
	DATE: OCTOBER 31, 2001
	SCALE: NTS
	DRAWING No: 0129-SWM
	REV 0



J. P. SCHOOLEY
Oct 31/01

UPPER CANADA CONSULTANTS
ENGINEERS/PLANNERS

215 Ontario Street
St. Catharines, Ontario
L2R 5L2
Phone:(905)688-9400
Fax: (905)688-5274

DRAWING TITLE: NELLES PLACE STORM DRAINAGE AREA PLAN	DRAWN BY: B.V.
	DATE: OCTOBER 31, 2001
	SCALE: NTS
	DRAWING No: 0129–SWM
	REV 0

2nd Sub Comments

Faxed (905) 945-5010 and Mailed

November 7, 2001
Our File: 88030 - 10 Nelles Place/Outlet 25

Town of Grimsby
160 Livingston Avenue
P.O. Box 159
Grimsby, ON L3M 4G3

ATTENTION: Mr. R. LeRoux, P. Eng.
Director of Public Works

Dear Sir:

RE: Stormwater Review of (Preliminary) Stormwater Management Plan Addendum
Nelles Place and Chestnut Grove
Town of Grimsby
Prepared by Upper Canada Consultants, November 1, 2001

Further to receipt (November 2, 2001) of the Stormwater Management Plan Addendum, (dated November 1, 2001), for Nelles Place and Chestnut Grove, prepared by Upper Canada Consultants (UCC), and further to our conversations with Mel Amio on November 2 and 6, 2001, we have reviewed the submission in conjunction with our earlier comments, and offer the following:

A. Design Criteria and Hydrology

i) The Town's current Master Drainage Plan (MDP) and associated models should be cross-referenced in order to demonstrate hydrologic compatibility. The Town's design storms should be used and findings documented in addition to the 2 hour Chicago design storm. This is particularly important from a volumetric perspective since storage has been proposed.

B. Hydraulics & Stormwater Quantity Management

i) Given the current proposal to implement in-pipe storage with surcharge to a surface storage area, the consultant must document any hydraulic impacts on the upstream drainage system, including any gravity connections.

ii) Further to point A.i), the appended OTTHYMO89 files demonstrate the effectiveness of the proposed storage volume, however rationalization of the difference between the current proposal and the 1990 proposal storage volumes (79 versus 330 m^3) is still required, given the significant (i.e. four-fold) difference.

iii) The proposed development would increase post-development discharge rates above existing levels. As well, the proposed runoff rate will consume essentially 100% of the available downstream sewer capacity. This assumes that there will be no further intensification of land use; as noted before, this perspective should be verified and the implications clearly understood prior to acceptance, particularly as it appears that additional commercial development is envisaged.

iv) The proposed configuration of the flow restrictor in Manhole 2 would likely lead to maintenance concerns; we suggest the restrictor be placed in the downstream pipe.

C. Stormwater Quality Management

v) Under separate cover we have prepared the financial rationalization for the cash-in-lieu contribution by this development. The proposed amount is $ 14,535.86.

If you have any questions, please contact either of the undersigned.

Yours very truly,

PHILIPS ENGINEERING LTD.

Per: Brian E. Bishop, M. Eng., P. Eng.

Per: Ronald B. Scheckenberger, M. Eng., P. Eng.

BEB/RBS/mp
\\PHILIPS\DATA\work\88030\CORRESP\LETTER\outlet25nelles2.doc

c.c. Mel Amio, Town of Grimsby (905) 945-5010

3RD Submission
Additional Info.

UPPER CANADA
CONSULTANTS
ENGINEERS/PLANNERS

**Upper Canada
Planning &
Engineering Ltd.**

215 Ontario Street
St. Catharines, ON
L2R 5L2

Phone 905-688-9400
Fax 905-688-5274

December 4, 2001
File: 0129

Philips Engineering
3215 North Service Road
P.O. Box 220
Burlington, Ontario
L7R 3Y2

RECEIVED
PHILIPS ENGINEERING LTD.
[illegible] 2001
File No.

Attn: Mr. Brian Bishop, P.Eng.

**Re: Additional Information for Stormwater Management Plan
Nelles Place & Chestnut Grove, Grimsby**

Further to your letter dated November 7, 2001 and our telephone discussions we are pleased to offer the following additional information for the stormwater management plan on the above noted project.

A. Design Criteria and Hydrology

i) In our discussions prior to our November 1, 2001 submission, it was agreed that the 2 hour Chicago design storm was suitable for this stormwater management plan, as this design storm criterion was previously approved by the Town in the 1990 report for the study area.

Further to your comments we are providing a summary of peak flows and volumes using the Chicago 2 hour, SCS 6 hour and SCS 12 hour rainfall distributions under both existing and proposed conditions. As seen in the following table, the peak flows with the proposed SWM controls using the SCS and Chicago rainfall distributions are equal to existing levels in the various rainfall distributions.

Peak Flows and Volumes at Wentworth Drive			
	Chicago 2 Hour	**SCS 6 Hour**	**SCS 12 Hour**
Existing Conditions			
Peak Flow (m^3/s)	0.83	0.36	1.11
Volume (m^2)	1,757	2,426	2,852
Proposed Conditions (with SWM)			
Peak Flow (m^3/s)	0.94	0.36	1.12
Volume (m^2)	1,890	2,476	3,017

B. Hydraulics & Stormwater Quantity Management

i) A review of the hydraulics in the proposed stormwater management facility has shown the maximum water level elevation in facility shall be approximately 93.13. The existing upstream 600mm storm sewer has an approximate invert and obvert of 92.50 and 93.11. Since the maximum facility water level and sewer obvert are relatively equal and the outlet control is a 525mm diameter orifice, the anticipated backwater effects in the 600mm storm sewer shall be negligible. The nearest gravity connections to the existing upstream storm sewer system is on McNab Drive with an approximate basement elevation at 95.20, which is 0.60m above Main Street East. Therefore, the proposed facility shall not impact any existing gravity connections and the hydraulic capacity of the existing system.

ii) The difference in the storage volume between the proposed and 1990 report is attributed to the 1990 method and basis in determining the required storage. The method applied to determine a storage requirement was an approximating function that extrapolates the required storage based on a determined peak flow. Typically, this modelled required storage volume is overestimated. In addition, the storage volume calculated in the 1990 report was determined at Wentworth Drive and the proposed facility is upstream of the proposed developments.

iii) The Town is aware and accept the proposed developments will consume 100% of the downstream sewer capacity. The existing commercial lands south of Chestnut Grove have been modelled as commercial lands as it exists. Future development of this parcel of land shall not increase stormwater flows.

iv) The proposed flow restrictor is a 525mm diameter and it is anticipated that a restrictor of this size shall not cause future maintenance concerns. However, if the Town wishes to locate the restrictor in the downstream pipe, we have no objection to this change and this could be performed during construction and change on the as-built drawings.

C. Stormwater Quality Management

v) We request detailed calculations of the financial rationalization for the cash-in-lieu contribution for the stormwater quality aspect of this development.

Based on the above comments, we feel your concerns have been addressed and request your office to provide the Town with the appropriate clearances. Should you have any questions or concerns regarding the information provided, please do not hesitate to contact our office.

Yours very truly,

Jason Schooley

Jason Schooley, P. Eng.

cc: Mel Amio, C.E.T. - Town of Grimsby
Paul Phelps - Peter Phelps & Associates Ltd.
Scott Llewllyn, P.Eng. - Scott Llewllyn & Associates Ltd.

APPENDIX F

GEOTECHNICAL REPORT

SOIL-MAT ENGINEERS & CONSULTANTS LTD.

www.soil-mat.ca info@soil-mat.ca TF: 800.243.1922

Hamilton: 130 Lancing Drive L8W 3A1 T: 905.318.7440 F: 905.318.7455
Milton: PO Box 40012 Derry Heights PO L9T 7W4 T: 800.243.1922

PROJECT NO.: SM 200096-G April 27, 2020

LOSANI HOMES
430 McNeilly Road – Suite 203
Stoney Creek, Ontario
L8E 5E3

Attention: Brandon Almeida
Land Development Coordinator

GEOTECHNICAL INVESTIGATION
PROPOSED 6-STOREY CONDOMINIUM BUILDING
141-149 MAIN STREET EAST
GRIMSBY, ONTARIO

Dear Mr. Almeida,

Further to your authorisation, SOIL-MAT ENGINEERS & CONSULTANTS LTD. has completed the fieldwork, laboratory testing, and report preparation in connection with the above noted project. The fieldwork was completed in general accordance with our proposal, P8367, dated October 9, 2019. Our comments and recommendations, based on our findings at the fourteen [14] borehole locations are presented herein.

1. INTRODUCTION

We understand that the project will involve the construction of a six-storey condominium building with one underground parking level and asphalt paved above grade parking areas at the existing Coles Florist and Garden Centre located at 141 to 149 Main Street East in Grimsby, Ontario. The purpose of this geotechnical investigation work was to assess the subsurface soil and groundwater conditions and to provide comments and recommendations with respect to the design and construction of the proposed development, from a geotechnical point of view.

This report is based on the above summarised project, and on the assumption that the design and construction will be performed in accordance with applicable codes and standards. Any significant deviations from the proposed project design may void the recommendations given in this report. If significant changes are made to the proposed design, this office must be consulted to review the new design with respect to the results of this investigation. It is noted that this report is not intended to address the environmental aspects of the site, which will be reported under separate covers.

2. PROCEDURE

A total of fourteen [14] sampled boreholes were advanced at the locations illustrated in the attached Drawing No. 1, Borehole Location Plan. The borings were advanced using continuous flight power auger equipment on April 1 and 8, 2019 under the direction and supervision of a staff member of SOIL-MAT ENGINEERS & CONSULTANTS LTD. The boreholes were advanced to termination and/or practical auger refusal at depths of between approximately 2.1 and 6.3 metres below the existing ground surface. Upon completion of drilling, monitoring wells were installed at four [4] borehole locations, noted as Borehole Nos. 1, 2, 3, and 4. The monitoring wells consist of 50-millimetre PVC pipe, screened in the lower 3 metres. The monitoring wells were encased in well filter sand up to approximately 0.3 metres above the screened portion, then with bentonite ‘hole plug’ to the surface and fitted with a protective steel ‘flush mount’ casing. The remaining boreholes were backfilled in general accordance with Ontario Regulation 903, and the ground surface was reinstated even with the existing pavement structure using a pre-mixed asphalt ‘cold patch’ product.

Representative samples of the subsoils were recovered from the borings at selected depth intervals using split barrel sampling equipment driven in accordance with the requirements of the ASTM test specification D1586, Standard Penetration Resistance Testing. After undergoing a general field examination, the soil samples were preserved and transported to the SOIL-MAT laboratory for visual, tactile, and olfactory classifications. Routine moisture content tests were performed on all soil samples recovered from the borings.

The boreholes were located on site by a representative of SOIL-MAT ENGINEERS & CONSULTANTS LTD., based on accessibility across the site and clearance of underground services. The ground surface elevation at the borehole locations were referenced to a site specific geodetic benchmark, described as the catchbasin cover on the adjacent Wentworth Drive, as illustrated in the Borehole Location Plan. This benchmark was noted to have an elevation of 93.52 metres, as indicated in the Grading and Servicing Plan prepared by S. Llewellyn & Associates Ltd., provided to our office.

Details of the conditions encountered in the boreholes, together with the results of the field and laboratory tests, are presented in the Log of Borehole Nos. 1 to 14, following the text of this report. It is noted that the boundaries of soil types indicated on the borehole logs are inferred from non-continuous soil sampling and observations made during drilling. These boundaries are intended to reflect transition zones for the purpose of geotechnical design and therefore should not be construed as the exact depths of geological change.

3. SITE DESCRIPTION AND SUBSURFACE CONDITIONS

The subject site is currently occupied by at the existing Coles Florist and Garden Centre and surrounding parking areas located at 141 to 149 Main Street East in Grimsby, Ontario. The garden centre consists of a two storey building with steel frame greenhouse and shade structures over the majority of the property, and the asphalt paved parking areas. The site is bound to the north and west by residential properties, to the east by Wentworth Drive, and to the south by Main Street east. The site is relatively flat and even, approximately level with the adjacent roadways.

The subsurface conditions encountered at the borehole locations are summarised as follows:

Pavement Structure

All of the boreholes were advanced through the pavement structure of the existing parking lot. The pavement structure was noted to consist of approximately 50 to 125 millimetres of asphaltic concrete overlying approximately 100 to 275 millimetres of compact granular base material.

Silty Sand/Sandy Silt

Silty sand/sandy silt was encountered beneath the pavement structure at all boreholes with the exception of Borehole No. 7 and 8. The silty sand/sandy silt was brown in colour with trace to some clay, trace gravel, and occasional organic inclusions, and was generally in a loose condition. The upper levels of the fine grained soils generally had a ‘reworked’ appearance, and may be fill materials associated with former structures on the site, construction of the existing facility, parking lot, etc. Silt sand/sandy silt was proven to depths of approximately 1.4 to 1.8 metres below the existing pavement surface.

Sand and Gravel Fill

Sand and gravel fill was encountered beneath the pavement structure in Borehole Nos. 7 and 8. The granular fill material was brown in colour with contained trace silt, occasional cobbles and organic inclusions, and was generally in a compact to dense condition. Sand and gravel fill was proven to depths of approximately 1.8 and 0.7 metres below the existing pavement surface in Borehole Nos. 7 and 8, respectively.

Queenston Shale Bedrock

Queenston shale bedrock was encountered beneath the silty sand/sandy silt and sand and gravel fill layers at Borehole Nos. 1 to 8, at depths of between approximately 0.8 and 2.9 metres below the existing grade, however may be present at greater depths across the site. The Queenston shale was severely weathered in the upper levels, becoming more sound with depth, and was hard in terms of soil. It is noted that the upper levels of the Queenston shale are severely weathered, exhibiting characteristics of a very stiff to hard cohesive soil. As such, the transition from overburden soils to weathered Queenston shale is somewhat indistinct. The bedrock was not cored as part of this investigation.

A review of available published information [Quaternary Geology of Ontario] indicates the subsurface soils to consist of coarse-textured glaciolacustrine deposits of sand and gravel, with minor silt and clay, with Queenston shale bedrock at relatively shallow depths, consistent with our experience in the area and observations during drilling.

Groundwater Observations

All of the boreholes were recorded as being ‘dry’ upon completion of drilling. It is noted that insufficient time would have passed for the static groundwater level to stabilise in the open boreholes. As noted above, monitoring wells were installed at three [3] borehole locations (Borehole Nos. 1, 2, and 3), to allow for future measurements of the static groundwater level. Readings from these monitoring wells have been summarised as follows:

TABLE A – SUMMARY OF GROUNDWATER READINGS

Date	Groundwater Depth (m)	Groundwater Elevation (m)
Borehole No. 1 – Surface Elevation 94.74 m		
April 9, 2020	Dry (>6.1)	<88.6
April 23, 2020	5.2	89.6
Borehole No. 2 – Surface Elevation 94.94 m		
April 9, 2020	Dry (>6.1)	<88.8
April 23, 2020	5.2	89.74
Borehole No. 3 – Surface Elevation 94.40 m		
April 9, 2020	Dry (>6.1)	<88.3
April 23, 2020	4.9	89.5
Borehole No. 4 – Surface Elevation 94.56 m		
April 9, 2020	Dry (>6.1)	<88.5
April 23, 2020	3.4	91.1

Based on our observations to date, the static groundwater level is conservatively estimated at a depth of approximately 3 to 4 metres below the existing ground surface, at an elevation of approximately 89.5 to 91 metres, and would be expected to fluctuate seasonally. Based on observed water level is possible that the groundwater level has not yet stabilized in the monitoring wells since installation, and as such continuing monitoring of the groundwater level be conducted to more accurately assess the groundwater level would be prudent.

4. FOUNDATION CONSIDERATIONS

With the provision of one underground parking level, it is anticipated that the proposed structure will have a founding depth of approximately 3 to 4 metres below the existing ground surface, into the Queenston shale bedrock. The Queenston shale bedrock is considered capable of supporting the proposed structure on conventional spread footings. Spread footings founded on the upper levels of the weathered Queenston shale bedrock may be designed considering an SLS bearing capacity of 500 kPa [~10,000 psf] SLS and 750 kPa [~15,000 psf] ULS. Where footings extend approximately 1 metre through the weathered levels and into the competent Queenston shale bedrock, a bearing capacity of 1,000 kPa [~20,000 psf] for both SLS and ULS may be considered. It is noted that higher bearing capacities are likely available within the bedrock, however would need to be confirmed via additional investigation work, including coring of the bedrock.

It is noted that the SLS value represents the Serviceability Limit State, which is governed by the tolerable deflection [settlement] based on the proposed building type, using unfactored load combinations. The ULS value represents the Ultimate Limit State and is intended to reflect an upper limit of the available bearing capacity of the founding soils in terms of geotechnical design, using factored load combinations. There is no direct relationship between ULS and SLS; rather they are a function of the soil type and the tolerable deflections for serviceability, respectively. Evidently, the bearing capacity values would be lower for very settlement sensitive structure and larger for more flexible buildings. It is also noted that the SLS and ULS bearing capacities are equivalent for the competent Queenston shale bedrock, as in order for serviceability limits to be realised, ultimate failure of the bedrock would have to occur.

The support conditions afforded by the founding soils are usually not uniform across the site, neither are the loads on the various foundation elements. It is therefore recommended that the footings and foundation walls be structurally reinforced to account for potential variable support and loading conditions.

In areas where it will be necessary to provide adjacent footings at different founding elevations, the lower footing should be constructed before the higher footing is constructed, if possible, and the higher footing should be set below an imaginary line drawn up from the edge of the lower footing at 10 horizontal to 7 vertical. This practice will limit stress transfer from the higher footings to lower footings.

All footings exposed to the environment must be provided with a minimum of 1.2 metres of earth cover or equivalent insulation to protect against frost damage. This frost protection would also be required if construction were undertaken during the winter months. All footings and foundations should be designed and constructed in accordance with the current Ontario Building Code.

With foundations designed as outlined above and as required by the Building Code, and with careful attention paid to construction detail, total and differential settlements should be well within normally tolerated limits of 25 and 20 millimetres, respectively, for the type of building and occupancy expected.

It is imperative that a soils engineer be retained from this office to provide geotechnical engineering services during the excavation and foundation construction phases of the project. This is to observe compliance with the design concepts and recommendations of this report and to allow changes to be made in the event that subsurface conditions differ from the conditions identified at the borehole locations.

5. SEISMIC DESIGN CONSIDERATIONS

The structures shall be designed according to Section 4.1.8 of the Ontario Building Code, Ontario Regulation 332/12. Based on the subsurface soil conditions encountered in this investigation the applicable Site Classification for the seismic design is Site Class B, Rock, based on the average soil characteristics for the site.

The seismic data from Supplementary Standard SB-1 of the Ontario Building Code for Grimsby, Ontario are as follows:

$S_a(0.2)$	**$S_a(0.5)$**	**$S_a(1.0)$**	**$S_a(2.0)$**	**$S_a(5.0)$**	**$S_a(10.0)$**	**PGA**	**PGV**
0.301	0.146	0.068	0.030	0.0073	0.0028	0.195	0.113

6. FLOOR SLAB AND PERMANENT DRAINAGE

The building floor slabs may be constructed using conventional slab-on-grade techniques on a prepared subgrade. The exposed subgrade surface should be well compacted in the presence of a representative of SOIL-MAT ENGINEERS. Any soft 'spots' delineated during this work must be sub-excavated and replaced with quality backfill material compacted to 100 per cent of its standard Proctor maximum dry density. The subgrade level can then be raised to the design level with granular soils compacted to 100 per cent of its standard Proctor maximum dry density. Granular fill, such as an imported Ontario Provincial Standard Specification [OPSS] Granular 'B', Type II (crushed limestone bedrock) product, is preferred within the building footprint due to its relative insensitivity to weather conditions, ease in achieving the required degree of compaction, and its quick response to applied stresses.

As with all concrete floor slabs, there is a tendency for the floor slabs to crack. The slab thickness, concrete mix design, the amount of steel and/or fibre reinforcement and/or wire mesh placed into the concrete slab, if any, will therefore be a function of the owner's tolerance for cracks in, and movements of, the slabs-on-grade, etc. The 'saw-cuts' in the concrete floors, for crack control, should extend to a minimum depth of 1/3 of the thickness of the slab.

A moisture barrier will be required under the floor slabs such as the placement of at least 200 millimetres of compacted 20-millimetre clear crushed stone. At a minimum the moisture barrier material should contain no more than 10 per cent passing the No. 4 sieve. Where 'non-damp' floor slabs are required, as for instance under sheet vinyl floor coverings, etc., extra efforts will be required to damp proof the floor slab, as with the additional provisions of a heavy 'poly' sheet, damp proofing sprays/membranes, drainage board products, etc. Where 'poly' sheets are used care should be taken to prevent puncturing and tearing and a sufficiently heavy gauge material be provided.

Curing of the slab-on-grade must be carefully specified to ensure that slab curl is minimised. This is especially critical during the hot summer months of the year when the surface of the slab tends to dry out quickly while high moisture conditions in the moisture barrier or water trapped on top of any 'poly' sheet at the saw cut joints and cracks, and at the edges of the slabs, maintains the underside of the slab in a moist condition.

It is important that the concrete mix design provide a limiting water/cement ratio and total cement content, which will mitigate moisture related problems with low permeance floor coverings, such as debonding of vinyl and ceramic tile. It is equally important that excess free water not be added to the concrete during its placement as this could increase the potential for shrinkage cracking and curling of the slab.

All basement foundation walls should be suitably water proofed, including the provision of a 'dimple type' drainage board to promote rapid drainage to a perimeter drainage system. The perimeter drainage system should consist of 100-millimetre diameter perforated pipe, encased in a geofabric sock and covered with a minimum of 200 millimetres of a 20-millimetre clear crushed stone product, and the clear crushed stone in turn encased by a heavy filter geotextile product. The suppliers of the filter geotextile should be consulted as to the type best suited for this project. This office should examine the installation of the drains. Even a small break in the filtering materials could result in loss of fines into the drains with attendant performance difficulties, including settlements of the ground surface. The perimeter drains should outlet to a gravity sewer connection, a nearby catch basin, or a sump pit a minimum of 150 millimetres below the underside of finished floor. The exterior grade around the structure should be sloped away from the structure to prevent the ponding of water against the foundation walls. The enclosed Drawing No. 2 shows schematics of the typical requirements for foundation construction with a basement level. Depending on observations made during longer term groundwater monitoring, a more robust perimeter drainage system including underfloor drains may be warranted, or the need for constructing the foundations as watertight, in the event of an elevated groundwater condition.

7. EXCAVATIONS

Excavations for the installation of foundations and underground service connections are expected to extend to depths of up to perhaps 3 to 4 metres below the existing grade. Excavations through the surficial fine grained soils would be expected to remain stable at inclinations of up 45 degrees to the horizontal. Where wet seams are encountered or during periods of extended precipitation, the excavations though the silty sand/sandy silt soils may have a tendency to slough in to as flat as 3 horizontal to 1 vertical, or flatter. Excavations into the weathered Queenston shale bedrock should be anticipated to remain stable at inclinations of up to 60 degrees to the horizontal to near vertical inclinations. The upper levels of the Queenston shale are highly weathered and should yield to heavy excavators equipped with 'rock teeth', however excavation works should be anticipated to slow where excavations are required to extended deeper into the less weathered Queenston shale bedrock, and the use of mechanical rock splitting equipment should be anticipated. Notwithstanding the foregoing, all excavations must comply with the requirements of the current Occupational Health and Safety Act and Regulations for Construction Projects.

Based on the depth of the weathered Queenston shale bedrock relatively to the anticipated construction limits, it may be feasible to conduct the excavations as open cuts. In the event that there is insufficient space for open cut excavations, excavation shoring of the overburden soils and weathered Queenston shale bedrock may be required. A specialty contractor or shoring consultant should be consulted with respect to the design of such a shoring system, where required. For preliminary design purposes the shoring system should be designed on the basis of a retained soil unit weight of γ_{wet} = 20 kN/m^3 [~127 pcf], and a lateral earth pressure coefficient of k_o = 0.5 (at rest case) or k_A = 0.3 (active case). Caissons may be designed for end bearing values within the Queenston shale bedrock as noted above.

The excavation faces and/or shoring system should be monitored during construction, and the contractor should have a contingency plan in place to be implemented should deflections of the shoring system exceed the tolerable limits. In addition, it is imperative that a pre-construction condition survey be conducted of the adjacent structures, roadways, etc. in order to document the existing conditions prior to the commencement of construction. This will allow for comparison and assessment in the event that disturbance due to construction activities is claimed.

Any utility poles, light poles, sidewalks, etc. located within 3 metres of the top of an excavation slope should be braced to ensure their stability. Likewise, temporary support might be required for other existing above and below ground structures, including existing underground services, depending on their proximity to the trench excavations.

As noted above, the static groundwater level is conservatively estimated at depths of approximately 3 to 4 metres. Some infiltration of groundwater through more permeable seams, as well as from surface runoff into open excavations, should be anticipated. However, the rate of groundwater infiltration is expected to be relatively slow, such that it should be possible to adequately control any experienced groundwater infiltration through conventional construction dewatering methods, including pumping from sumps in the base of excavations. Where deeper excavations are required, below about 3 metres, the use of additional pumps may become necessary. More groundwater control should be anticipated when connections are made to existing services. Surface water should be directed away from the excavations.

The base of excavations in the weathered Queenston Shale should remain firm and stable. As such, standard pipe bedding as typically specified by the Town of Grimsby should suffice. The bedding material should be uniformly compacted to a minimum of 95 percent of the materials standard Proctor maximum dry density [SPMDD]. Special attention should be paid to compaction under the pipe haunches.

8. BACKFILL CONSIDERATIONS

The excavated material will consist primarily of the sandy silt/silty sand and weathered Queenston shale bedrock, encountered in the boreholes, as described above. Given the provision of one underground parking level over the majority of the site, it is expected that the majority of excavated soil will be transported off site. The sandy silt/silty sand soils are generally considered suitable for use as engineered fill, trench backfill, etc., provided that they are free of organics, debris, or other deleterious materials, and can be controlled to within 3 per cent of their optimum moisture content. Some selective sorting the sandy silt/silt sand materials should be anticipated. The use of excavated Queenston Shale material is cautioned and not recommended for trench backfill or engineered fill, as shale fills are difficult to effectively compact in restricted areas such as service trench excavations, and can have significant long-term settlement potential if not sufficiently broken down. The excavated shale material will require significant moisture conditioning and effort to break down into a well graded soil product with particles of less than about 25 millimetres in major dimension in order to achieve effective compaction and avoid ongoing long-term settlements. The more severely weathered upper levels, exhibiting the characteristics of a hard cohesive soil, may be more readily utilised, however significant moisture conditioning and working of the fill would still be expected to be required.

It is noted that the overburden soils and weathered Queenston shale bedrock is not considered to be free draining and should not be used where this characteristic is necessary. It is also noted that these soils will present difficulties in achieving effective compaction where access with compaction equipment is restricted, such as within the building footprint or against foundations. The on-site soils encountered are generally considered to be well ‘dry’ of their standard Proctor optimum moisture content, and some moisture conditioning will be required depending upon the weather conditions at the time of construction. These soils are also noted to be sensitive to high moisture conditions and will become almost impossible to effectively compact when they become well ‘wet’ of optimum. After a period of heavy precipitation, any near-surface wet, saturated or softened material should be allowed to air dry or be removed and discarded.

We note that where backfill material is placed near or slightly above its optimum moisture content, the potential for long term settlements due to the ingress of groundwater and collapse of the fill structure is reduced. Correspondingly, the shear strength of the ‘wet’ backfill material is also lowered, thereby reducing its ability to support construction traffic and therefore impacting roadway construction. If the soil is well dry of its optimum value, it will appear to be very strong when compacted, but will tend to settle with time as the moisture content in the fill increases to equilibrium condition. The sandy silt/silty sand soils will require high compaction energy to achieve acceptable densities if the moisture content is not close to its standard Proctor optimum value. It is therefore very important that the placement moisture content of the backfill soils be within 3 per cent of its standard Proctor optimum moisture content during placement and compaction to minimise long term subsidence [settlement] of the fill mass. Any imported fill required should have its moisture content within 3 per cent of its optimum moisture content and meet the necessary environmental guidelines.

A representative of SOIL-MAT should be present on-site during the backfilling and compaction operations to confirm the uniform compaction of the backfill material to project specification requirements. Close supervision is prudent in areas that are not readily accessible to compaction equipment, for instance near the end of compaction 'runs'. All structural fill should be compacted to 100 per cent of its standard Proctor maximum dry density [SPMDD]. Backfill within service trenches, areas to be paved, etc., should be compacted to a minimum of 95 per cent of its SPMDD, and to 100 per cent of its SPMDD in the upper 1 metre below the design subgrade level. The appropriate compaction equipment should be employed based on soil type, i.e. pad-toe for cohesive soils and smooth drum/vibratory plate for granular soils. A method should be developed to assess compaction efficiency employing the on-site compaction equipment and backfill materials during construction.

9. PAVEMENT CONSIDERATIONS

All areas to be paved should be cleared and stripped of any topsoil, together with any other organic or otherwise unsuitable materials. The exposed subgrade should then be proofrolled with 3 to 4 passes of a loaded tandem truck in the presence of a representative of SOIL-MAT ENGINEERS & CONSULTANTS LTD., immediately prior to the placement of the sub-base material. Any areas of distress revealed by this or other means must be sub-excavated and replaced with suitable backfill material. Alternatively, the soft areas may be stabilised by placing coarse crushed stone and ‘punching’ it into the soft areas. The need for the treatment of softened subgrade will be reduced if construction is undertaken during the dry summer months and careful attention is paid to the compaction operations. The fill over shallow utilities cut into or across the subdivision streets, such as telephone, hydro, gas, etc. must also be compacted to 100 percent of its standard Proctor maximum dry density.

Good drainage provisions will optimise the long-term performance of the pavement structure. The subgrade must be properly crowned and shaped to promote drainage to the subdrain system. Subdrains should be installed to intercept excess subsurface water and mitigate softening of the subgrade material. Surface water should not be allowed to pond adjacent to the outer limits of the paved areas.

The most severe loading conditions on the subgrade typically occur during the course of construction. Therefore, precautionary measures may have to be taken to ensure that the subgrade is not unduly disturbed by construction traffic. These measures would include minimizing the amount of heavy traffic travelling over the subgrade, such as during the placement of granular base layers.

If construction is conducted under adverse weather conditions, additional subgrade preparation may be required. During wet weather conditions, such as during the Fall and Spring months, it should be anticipated that additional subgrade preparation will be required, such as additional depth of Ontario Provincial Standard Specification [OPSS] Granular ‘B’, Type II sub-base material. It is also important that the sub-base and base granular layers of the pavement structure be placed as soon as possible after exposure, preparation and approval of the subgrade level.

The suggested pavement structures outlined in Table A below are based on subgrade parameters estimated on the basis of visual and tactile examinations of the on-site soils and past experience. The outlined pavement structure may be expected to have an approximate ten-year life, assuming that regular maintenance is performed. Should a more detailed pavement structure design be required, site specific traffic information would be needed, together with detailed laboratory testing of the subgrade soils.

TABLE B – SUGGESTED PAVEMENT STRUCTURE

LAYER DESCRIPTION	COMPACTION REQUIREMENTS	LIGHT DUTY SECTIONS	HEAVY DUTY [TRUCK ROUTE]
Asphaltic Concrete Wearing course OPSS HL 3 or HL 3A	Min. 92 % Marshall MRD	65 millimetres	40 millimetres
Binder Course OPSS HL 8	Min. 92 % Marshall		80 millimetres
Base Course OPSS Granular A	100% SPMDD	150 millimetres	150 millimetres
Sub-base Course OPSS Granular B Type II	100% SPMDD	300 millimetres	450 millimetres

* Marshall MRD denotes Maximum Relative Density.
* SPMDD denotes Standard Proctor Maximum Dry Density, ASTM-D698.

Depending on the arrangement of light duty and heavy duty pavement sections, the transition between sections may present some difficulty for contractors. In this regard, consideration might be given to a slightly increased light duty pavement structure consisting of 50 millimetres of HL8 binder course and 40 millimetres of HL3 surface course asphaltic concrete. This structure will provide for a continuous depth of surface course asphalt allowing for ease of construction. As well such a pavement structure would have an improved performance over an increased design life. Such an arrangement of asphalt layers would also allow for future rehabilitation with a ‘mill and pave’ type operation.

Where asphalt pavement is to be constructed above the roof deck of a below grade parking level, the granular base layers recommended for the light duty pavement structure recommended above may be considered for both light duty and heavy duty areas. It is noted that in such cases the roof deck slab should be sufficiently sloped and/or provided with suitable subdrains, in order to promote rapid drainage of water from beneath the pavement. As well the roof slab should be provided with a suitable water proofing system.

To minimise segregation of the finished asphalt mat, the asphalt temperature must be maintained uniform throughout the mat during placement and compaction. All too often, significant temperature gradients exist in the delivered and placed asphalt with the cooler portions of the mat resisting compaction and presenting a honeycomb surface. As the spreader moves forward, a responsible member of the paving crew should monitor the pavement surface, to ensure a smooth uniform surface. The contractor can mitigate the surface segregation by ‘back-casting’ or scattering shovels of the full mix material over the segregated areas and raking out the coarse particles during compaction operations. Of course, the above assumes that the asphalt mix is sufficiently hot to allow the ‘back-casting’ to be performed.

10. GENERAL COMMENTS

The comments provided in this document are intended only for the guidance of the design team. The subsoil descriptions and borehole information are only intended to describe conditions at the borehole locations. Contractors placing bids or undertaking this project should carry out due diligence in order to verify the results of this investigation and to determine how the subsurface conditions will affect their operations.

We trust that this geotechnical report is sufficient for your present requirements. Should you require any additional information or clarification as to the contents of this document, please do not hesitate to contact the undersigned.

Yours very truly,
SOIL-MAT ENGINEERS & CONSULTANTS LTD.

Zachary van Galen, B. Eng. Mgmt., EIT
Junior Engineer

LICENSED PROFESSIONAL ENGINEER
Apr 21/20
S. K. RICHARDSON
100179716
PROVINCE OF ONTARIO

Kyle Richardson, P. Eng.
Project Engineer

Enclosures: Drawing No. 1, Borehole Location Plan
Log of Borehole Nos. 1 to 14, inclusive
Drawing No. 2, Typical Design Requirements for Basement Construction

Distribution: Losani Homes [1, plus pdf]

LEGEND

BH#	Borehole Location
TBM	Temporary Benchmark Top of catchbasin cover. Geodetic Elevation of 93.52 m.

NOTES

1. This drawing should be read in conjunction with Soil-Mat Engineers & Consultants Ltd. Report No. SM 200096-G.

2. Borehole locations are approximate.

SOIL-MAT

ENGINEERS & CONSULTANTS LTD.

Proposed Six Storey Building
141-149 Main St. East
Grimsby, Ontario

Borehole Location Plan

Project No. SM 200096-G

Date: April 2020

Drawn: ZRV | Checked: KR

SM 200096-G Borehole Location Plan

Drawing No. 1

Log of Borehole No. 1

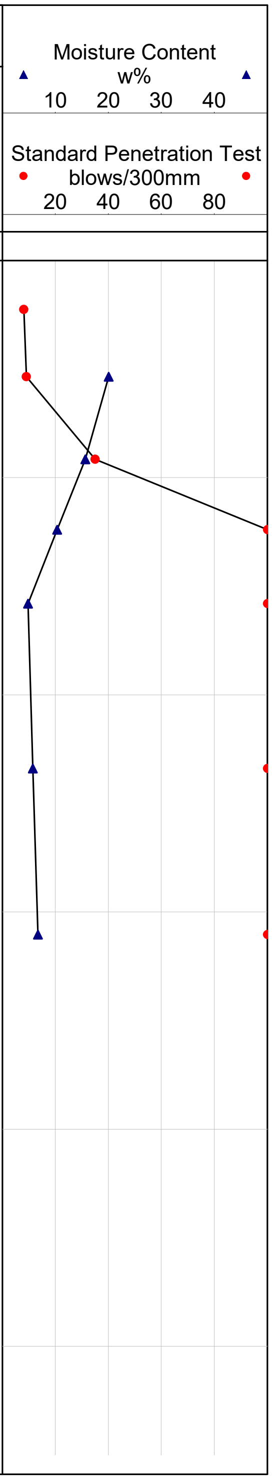
Project No: SM 200096-G
Project: Proposed Six-Storey Condo Building
Location: 141 Main Street East, Grimsby
Client: Losani Homes

Project Manager: Kyle Richardson, P. Eng.
Borehole Location: See Drawing No. 1
UTM Coordinates - N: 4782780
E: 618186

Elevation (m)	Description
94.74	Ground Surface
94.36	**Pavement Structure** Approximately 100 millimetres of asphaltic concrete over 275 millimetres of compact granular base.
93.30	**Sandy Silt/Silty Sand** Brown, trace to some clay, trace gravel, occasional organics, reworked appearance with possible fill, loose.
	Queenston Shale Red with occasional harder grey layers, highly weathered in upper levels, becoming more sound with depth, hard.
88.50	End of Borehole

SAMPLE

Type	Number	Blow Counts	Blows/300mm
SS	1	8,5,3,4	8
SS	2	3,4,5,12	9
SS	3	7,15,20,22	35
SS	4	17,17,50/3"	100
SS	5	50/2"	100
SS	6	50/4"	100
SS	7	50/4"	100



NOTES:

1. Borehole was advanced using solid stem auger equipment on April 3, 2020 to termination at a depth of 6.2 metres.

2. Borehole was recorded as caved to 5.9 metres depth and 'dry' upon completion and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

4. A monitoring well was installed. The following free groundwater level readings have been measured:
April 9, 2020: dry
April 23, 2020: 5.16 metres depth

Drill Method: Solid Stem Augers
Drill Date: April 1, 2020
Hole Size: 150 millimetres
Drilling Contractor: Davis Drilling

Soil-Mat Engineers & Consultants Ltd.
130 Lancing Drive, Hamilton, ON L8W 3A1
T: 905.318.7440 F: 905.318.7455
E: info@soil-mat.ca

Datum: Geodetic
Field Logged by: ZRV
Checked by: KR
Sheet: 1 of 1

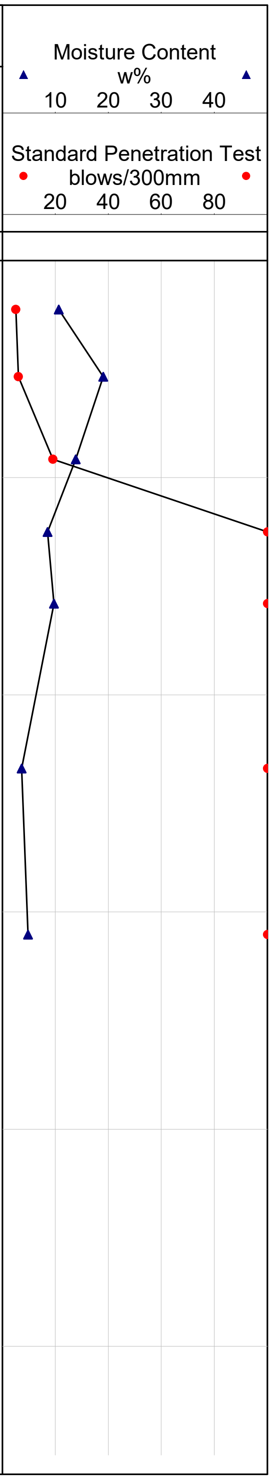
Log of Borehole No. 2

Project No: SM 200096-G
Project: Proposed Six-Storey Condo Building
Location: 141 Main Street East, Grimsby
Client: Losani Homes

Project Manager: Kyle Richardson, P. Eng.
Borehole Location: See Drawing No. 1
UTM Coordinates - N: 4782790
E: 618157

Depth (m)	Elevation (m)	Description
0	94.94	Ground Surface
	94.66	**Pavement Structure** Approximately 75 millimetres of asphaltic concrete over 200 millimetres of compact granular base.
		Sandy Silt/Silty Sand Brown, trace to some clay, trace gravel, occasional organics, reworked appearance with possible fill, loose.
	93.10	**Queenston Shale** Red with occasional harder grey layers, highly weathered in upper levels, becoming more sound with depth, hard.
6	88.80	End of Borehole

Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
SS	1	6,3,2,2	5	▨		
SS	2	3,3,3,4	6	▨		
SS	3	3,5,14,40	19	▨		
SS	4	45,42,50/5"	100	▨		
SS	5	50/3"	100	▨		
SS	6	50/2"	100	▨		
SS	7	50/2"	100	▨		



NOTES:

1. Borehole was advanced using solid stem auger equipment on April 3, 2020 to termination at a depth of 6.2 metres.

2. Borehole was recorded as caved to 5.6 metres depth and 'dry' upon completion and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

4. A monitoring well was installed. The following free groundwater level readings have been measured:
April 9, 2020: dry
April 23, 2020: 5.19 metres depth

Drill Method: Solid Stem Augers
Drill Date: April 1, 2020
Hole Size: 150 millimetres
Drilling Contractor: Davis Drilling

Soil-Mat Engineers & Consultants Ltd.
130 Lancing Drive, Hamilton, ON L8W 3A1
T: 905.318.7440 F: 905.318.7455
E: info@soil-mat.ca

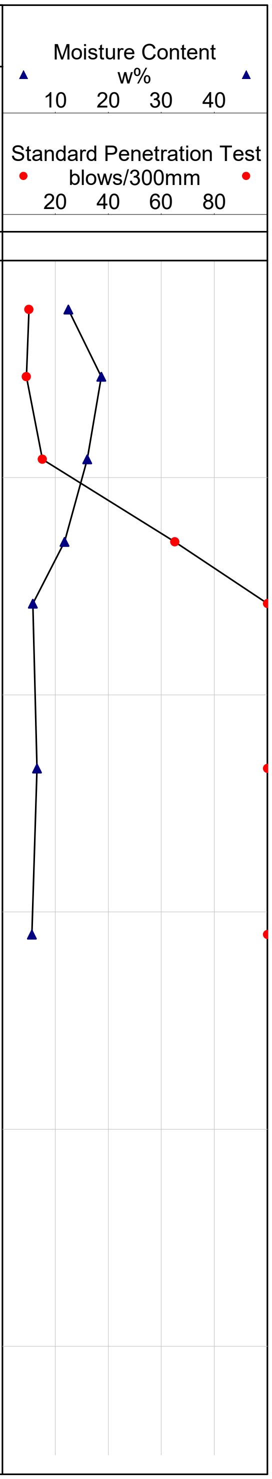
Datum: Geodetic
Field Logged by: ZRV
Checked by: KR
Sheet: 1 of 1

Log of Borehole No. 3

Project No: SM 200096-G
Project: Proposed Six-Storey Condo Building
Location: 141 Main Street East, Grimsby
Client: Losani Homes

Project Manager: Kyle Richardson, P. Eng.
Borehole Location: See Drawing No. 1
UTM Coordinates - N: 4782810
E: 618098

Depth (ft / m)	Elevation (m)	Description	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0 / 0	94.40	Ground Surface							
	94.10	**Pavement Structure** Approximately 75 millimetres of asphaltic concrete over 225 millimetres of compact granular base.							
		Sandy Silt/Silty Sand Brown, trace to some clay, trace gravel, occasional organics, reworked appearance with possible fill, loose.	SS	1	10,5,5,6	10			
			SS	2	4,4,5,8	9			
	92.60	**Queenston Shale** Red with occasional harder grey layers, highly weathered in upper levels, becoming more sound with depth, hard.	SS	3	4,6,9,11	15			
			SS	4	15,25, 40,50/2"	65			
			SS	5	50/2"	100			
			SS	6	35,50/4"	100			
	88.20	End of Borehole	SS	7	50/3"	100			



NOTES:

1. Borehole was advanced using solid stem auger equipment on April 3, 2020 to termination at a depth of 6.2 metres.

2. Borehole was recorded as caved to 5.8 metres depth and 'dry' upon completion and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

4. A monitoring well was installed. The following free groundwater level readings have been measured:
April 9, 2020: dry
April 23, 2020: 4.90 metres depth

Drill Method: Solid Stem Augers
Drill Date: April 1, 2020
Hole Size: 150 millimetres
Drilling Contractor: Davis Drilling

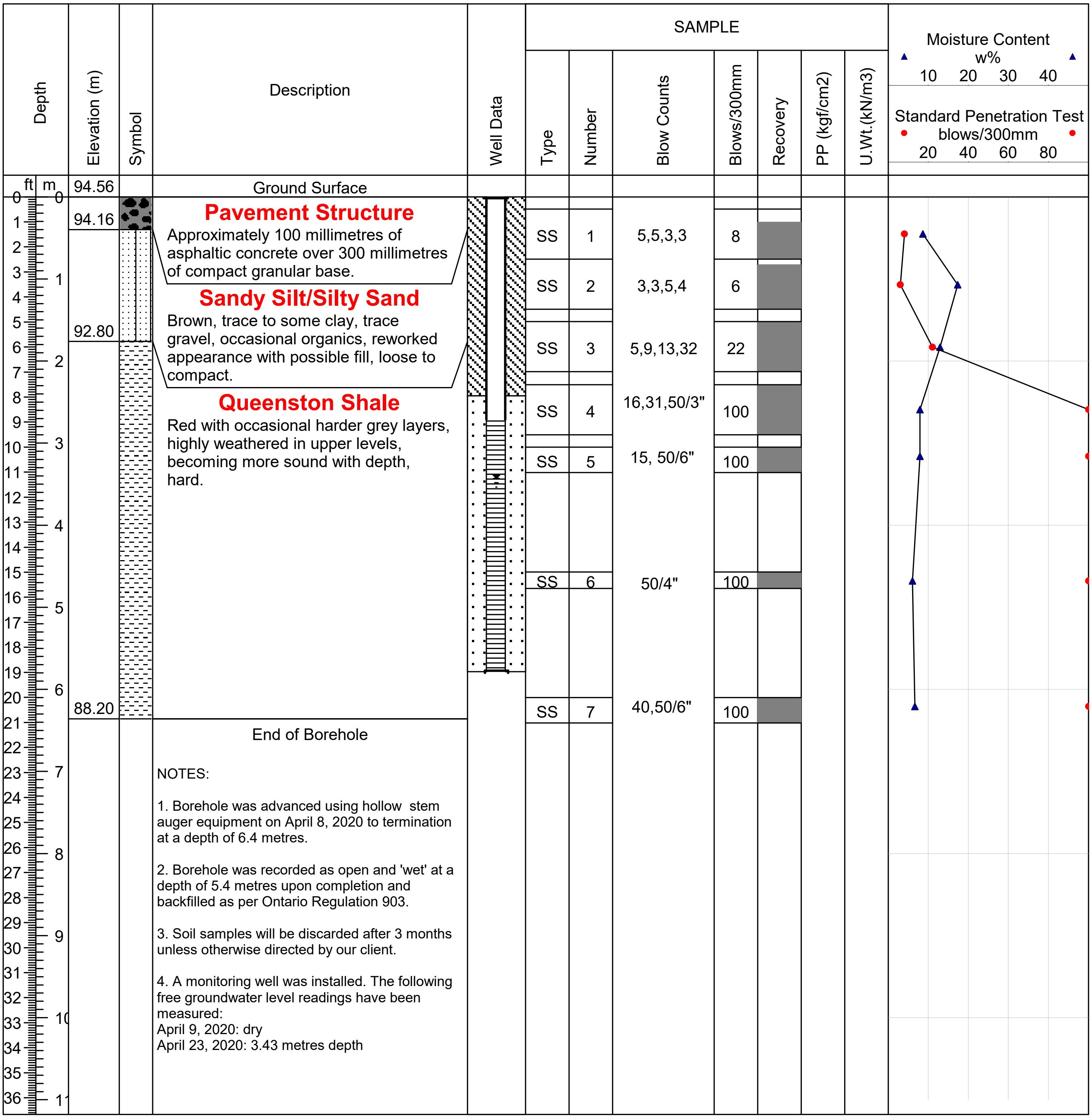
Soil-Mat Engineers & Consultants Ltd.
130 Lancing Drive, Hamilton, ON L8W 3A1
T: 905.318.7440 F: 905.318.7455
E: info@soil-mat.ca

Datum: Geodetic
Field Logged by: ZRV
Checked by: KR
Sheet: 1 of 1

Log of Borehole No. 4

Project No: SM 200096-G
Project: Proposed Six-Storey Condo Building
Location: 141 Main Street East, Grimsby
Client: Losani Homes

Project Manager: Kyle Richardson, P. Eng.
Borehole Location: See Drawing No. 1
UTM Coordinates - N: 4782832
E: 618110



Elevation (m)	Description
94.56	Ground Surface
94.16	**Pavement Structure** Approximately 100 millimetres of asphaltic concrete over 300 millimetres of compact granular base.
92.80	**Sandy Silt/Silty Sand** Brown, trace to some clay, trace gravel, occasional organics, reworked appearance with possible fill, loose to compact.
88.20	**Queenston Shale** Red with occasional harder grey layers, highly weathered in upper levels, becoming more sound with depth, hard.

Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
SS	1	5,5,3,3	8			
SS	2	3,3,5,4	6			
SS	3	5,9,13,32	22			
SS	4	16,31,50/3"	100			
SS	5	15, 50/6"	100			
SS	6	50/4"	100			
SS	7	40,50/6"	100			

End of Borehole

NOTES:

1. Borehole was advanced using hollow stem auger equipment on April 8, 2020 to termination at a depth of 6.4 metres.

2. Borehole was recorded as open and 'wet' at a depth of 5.4 metres upon completion and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

4. A monitoring well was installed. The following free groundwater level readings have been measured:
April 9, 2020: dry
April 23, 2020: 3.43 metres depth

Drill Method: Hollow Stem Augers
Drill Date: April 8, 2020
Hole Size: 200 millimetres
Drilling Contractor: Ponthil Drilling

Soil-Mat Engineers & Consultants Ltd.
130 Lancing Drive, Hamilton, ON L8W 3A1
T: 905.318.7440 F: 905.318.7455
E: info@soil-mat.ca

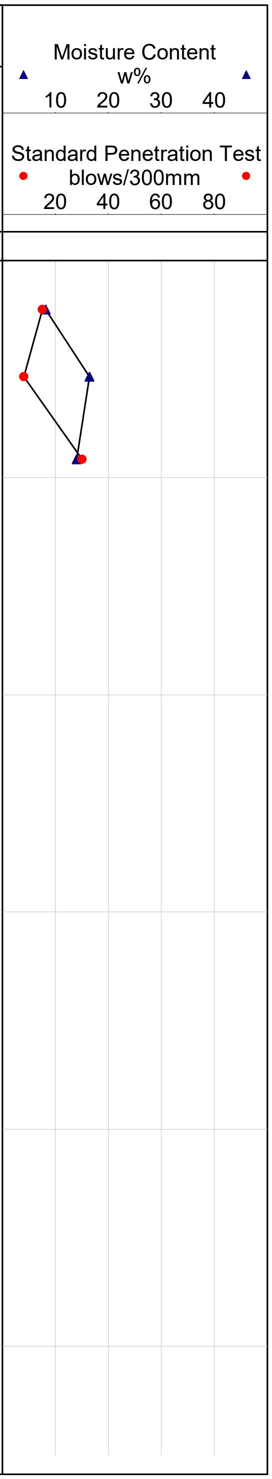
Datum: Geodetic
Field Logged by: BO
Checked by: KR
Sheet: 1 of 1

Log of Borehole No. 5

Project No: SM 200096-G
Project: Proposed Six-Storey Condo Building
Location: 141 Main Street East, Grimsby
Client: Losani Homes

Project Manager: Kyle Richardson, P. Eng.
Borehole Location: See Drawing No. 1
UTM Coordinates - N: 4782797
E: 618185

Depth	Elevation (m)	Symbol	Description	Well Data	SAMPLE Type	SAMPLE Number	SAMPLE Blow Counts	SAMPLE Blows/300mm	SAMPLE Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
ft 0 / m 0	94.75		Ground Surface								
	94.40		**Pavement Structure** Approximately 100 millimetres of asphaltic concrete over 250 millimetres of compact granular base.		SS	1	12,10,5,3	15			
	92.90		**Sandy Silt/Silty Sand** Brown, trace to some clay, trace gravel, occasional organics, reworked appearance with possible fill, loose.		SS	2	4,4,4,4	8			
	92.60		**Queenston Shale** Red with occasional harder grey layers, highly weathered in upper levels, becoming more sound with depth, hard.		SS	3	2,10,20,25	30			
			End of Borehole								



NOTES:

1. Borehole was advanced using solid stem auger equipment on April 3, 2020 to termination at a depth of 2.1 metres.

2. Borehole was recorded as open and 'dry' upon completion and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Augers
Drill Date: April 1, 2020
Hole Size: 150 millimetres
Drilling Contractor: Davis Drilling

Soil-Mat Engineers & Consultants Ltd.
130 Lancing Drive, Hamilton, ON L8W 3A1
T: 905.318.7440 F: 905.318.7455
E: info@soil-mat.ca

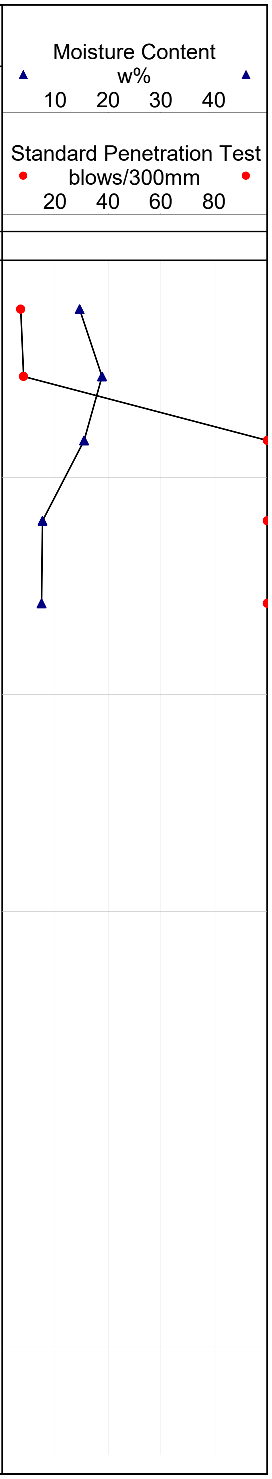
Datum: Geodetic
Field Logged by: ZRV
Checked by: KR
Sheet: 1 of 1

Log of Borehole No. 6

Project No: SM 200096-G
Project: Proposed Six-Storey Condo Building
Location: 141 Main Street East, Grimsby
Client: Losani Homes

Project Manager: Kyle Richardson, P. Eng.
Borehole Location: See Drawing No. 1
UTM Coordinates - N: 4782802
E: 618145

Depth	Elevation (m)	Symbol	Description	Well Data	SAMPLE Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0 ft / 0 m	94.61		Ground Surface								
	94.41		**Pavement Structure** Approximately 50 millimetres of asphaltic concrete over 150 millimetres of compact granular base.								
			Sandy Silt/Silty Sand Brown, trace to some clay, trace gravel, occasional organics, reworked appearance with possible fill, loose.		SS	1	3,3,4,6	7	▨		
					SS	2	3,4,4,5	8	▨		
	92.80				SS	3	7,50/5"	100	▨		
			Queenston Shale Red with occasional harder grey layers, highly weathered in upper levels, becoming more sound with depth, hard.		SS	4	50/5"	100	▨		
	91.50				SS	5	50/2"	100	▨		
			End of Borehole								



NOTES:

1. Borehole was advanced using solid stem auger equipment on April 3, 2020 to termination at a depth of 3.1 metres.

2. Borehole was recorded open and 'dry' upon completion and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Augers
Drill Date: April 1, 2020
Hole Size: 150 millimetres
Drilling Contractor: Davis Drilling

Soil-Mat Engineers & Consultants Ltd.
130 Lancing Drive, Hamilton, ON L8W 3A1
T: 905.318.7440 F: 905.318.7455
E: info@soil-mat.ca

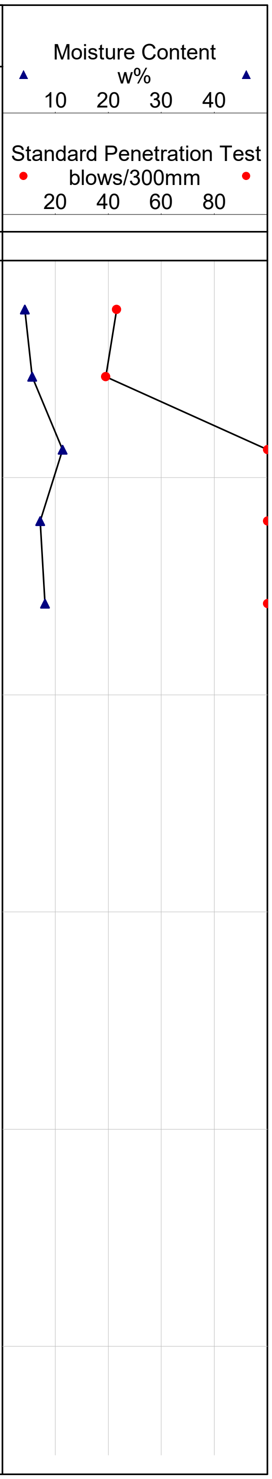
Datum: Geodetic
Field Logged by: ZRV
Checked by: KR
Sheet: 1 of 1

Log of Borehole No. 7

Project No: SM 200096-G
Project: Proposed Six-Storey Condo Building
Location: 141 Main Street East, Grimsby
Client: Losani Homes

Project Manager: Kyle Richardson, P. Eng.
Borehole Location: See Drawing No. 1
UTM Coordinates - N: 4782788
E: 618202

Elevation (m)	Description	Well Data	SAMPLE Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
94.43	Ground Surface								
94.20	**Pavement Structure** Approximately 125 millimetres of asphaltic concrete over 100 millimetres of compact granular base.		SS	1	14,18,25,30	43	▇		
	Sand and Gravel Fill Brown, trace silt, occasional organics and debris, dense.		SS	2	8,20,19,35	39	▇		
92.60			SS	3	12,23,50/5"	100	▇		
	Queenston Shale Red with occasional harder grey layers, highly weathered in upper levels, becoming more sound with depth, hard.		SS	4	30,50/3"	100	▇		
91.10			SS	5	40,50/5"	100	▇		
	End of Borehole								



NOTES:

1. Borehole was advanced using solid stem auger equipment on April 3, 2020 to termination at a depth of 3.3 metres.

2. Borehole was recorded as open and 'dry' upon completion and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Augers
Drill Date: April 1, 2020
Hole Size: 150 millimetres
Drilling Contractor: Davis Drilling

Soil-Mat Engineers & Consultants Ltd.
130 Lancing Drive, Hamilton, ON L8W 3A1
T: 905.318.7440 F: 905.318.7455
E: info@soil-mat.ca

Datum: Geodetic
Field Logged by: ZRV
Checked by: KR
Sheet: 1 of 1

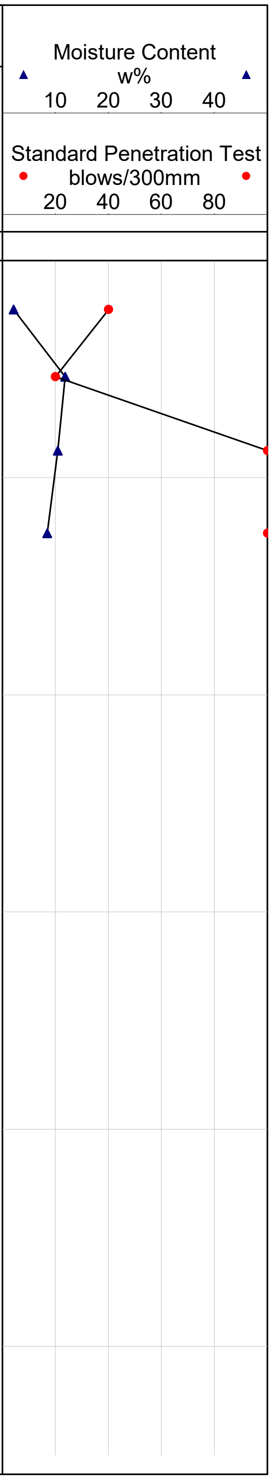
Log of Borehole No. 8

Project No: SM 200096-G
Project: Proposed Six-Storey Condo Building
Location: 141 Main Street East, Grimsby
Client: Losani Homes

Project Manager: Kyle Richardson, P. Eng.
Borehole Location: See Drawing No. 1
UTM Coordinates - N: 4782814
E: 618206

Depth (m)	Elevation (m)	Description
0	94.05	Ground Surface
0 – 0.28	93.77	**Pavement Structure** Approximately 100 millimetres of asphaltic concrete over 175 millimetres of compact granular base.
0.28 – 0.75	93.30	**Sand and Gravel Fill** Brown, trace silt, occasional organics and debris, compact to dense.
0.75 – 2.75	91.30	**Queenston Shale** Red with occasional harder grey layers, highly weathered in upper levels, becoming more sound with depth, hard.
		End of Borehole

Type	Number	Blow Counts	Blows/300mm
SS	1	11,25,15,5	40
SS	2	7,7,13,24	20
SS	3	35,35,50/5"	100
SS	4	10,11,50/5"	100



NOTES:

1. Borehole was advanced using solid stem auger equipment on April 3, 2020 to termination at a depth of 2.7 metres.

2. Borehole was recorded as open and 'dry' upon completion and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Augers
Drill Date: April 1, 2020
Hole Size: 150 millimetres
Drilling Contractor: Davis Drilling

Soil-Mat Engineers & Consultants Ltd.
130 Lancing Drive, Hamilton, ON L8W 3A1
T: 905.318.7440 F: 905.318.7455
E: info@soil-mat.ca

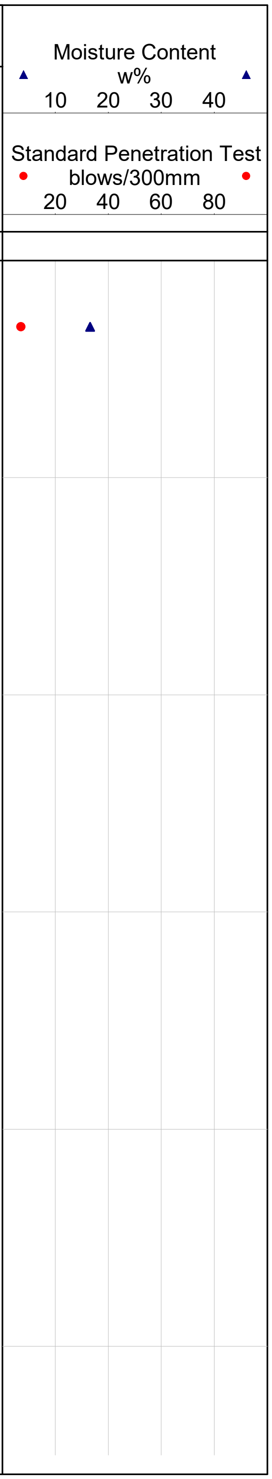
Datum: Geodetic
Field Logged by: ZRV
Checked by: KR
Sheet: 1 of 1

Log of Borehole No. 9

Project No: SM 200096-G
Project: Proposed Six-Storey Condo Building
Location: 141 Main Street East, Grimsby
Client: Losani Homes

Project Manager: Kyle Richardson, P. Eng.
Borehole Location: See Drawing No. 1
UTM Coordinates - N: 4782814
E: 618206

Depth	Elevation (m)	Symbol	Description	Well Data	SAMPLE Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
ft 0 / m 0	94.02		Ground Surface								
	93.74		**Pavement Structure** Approximately 100 millimetres of asphaltic concrete over 175 millimetres of compact granular base.								
	93.10		**Sandy Silt/Silty Sand** Brown, trace to some clay, trace gravel, occasional organics, reworked appearance with possible fill, loose.		SS	1	3,3,4,3	7	▨		
			End of Borehole								



NOTES:

1. Borehole was advanced using solid stem auger equipment on April 3, 2020 to termination at a depth of 0.9 metres.

2. Borehole was recorded open and 'dry' upon completion and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Augers
Drill Date: April 1, 2020
Hole Size: 150 millimetres
Drilling Contractor: Davis Drilling

Soil-Mat Engineers & Consultants Ltd.
130 Lancing Drive, Hamilton, ON L8W 3A1
T: 905.318.7440 F: 905.318.7455
E: info@soil-mat.ca

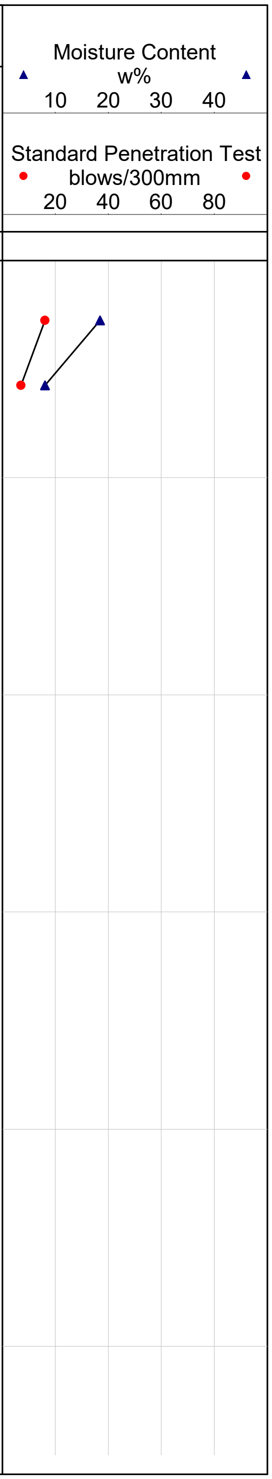
Datum: Geodetic
Field Logged by: ZRV
Checked by: KR
Sheet: 1 of 1

Log of Borehole No. 10

Project No: SM 200096-G
Project: Proposed Six-Storey Condo Building
Location: 141 Main Street East, Grimsby
Client: Losani Homes

Project Manager: Kyle Richardson, P. Eng.
Borehole Location: See Drawing No. 1
UTM Coordinates - N: 4782840
E: 618198

Depth (ft / m)	Elevation (m)	Symbol	Description	Well Data	SAMPLE Type	SAMPLE Number	SAMPLE Blow Counts	SAMPLE Blows/300mm	SAMPLE Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0 / 0	94.93		Ground Surface								
	94.68		**Pavement Structure** Approximately 50 millimetres of asphaltic concrete over 200 millimetres of compact granular base.		SS	1	10,7,9,5	16	▇		
	93.40		**Sandy Silt/Silty Sand** Brown, trace to some clay, trace gravel, occasional organics, reworked appearance with possible fill, loose to compact.		SS	2	3,4,3,4	7	▇		
			End of Borehole								



NOTES:

1. Borehole was advanced using solid stem auger equipment on April 8, 2020 to termination at a depth of 1.4 metres.

2. Borehole was recorded open and 'dry' upon completion and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Augers
Drill Date: April 8, 2020
Hole Size: 150 millimetres
Drilling Contractor: Ponthil Drilling

Soil-Mat Engineers & Consultants Ltd.
130 Lancing Drive, Hamilton, ON L8W 3A1
T: 905.318.7440 F: 905.318.7455
E: info@soil-mat.ca

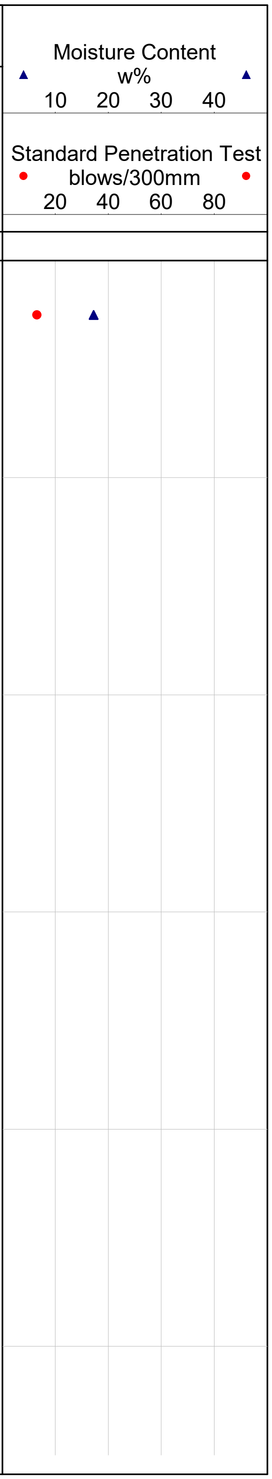
Datum: Geodetic
Field Logged by: BO
Checked by: KR
Sheet: 1 of 1

Log of Borehole No. 11

Project No: SM 200096-G
Project: Proposed Six-Storey Condo Building
Location: 141 Main Street East, Grimsby
Client: Losani Homes

Project Manager: Kyle Richardson, P. Eng.
Borehole Location: See Drawing No. 1
UTM Coordinates - N: 4782853
E: 618165

Depth (ft / m)	Elevation (m)	Symbol	Description	Well Data	SAMPLE Type	SAMPLE Number	SAMPLE Blow Counts	SAMPLE Blows/300mm	SAMPLE Recovery	SAMPLE PP (kgf/cm2)	SAMPLE U.Wt.(kN/m3)
0 / 0	94.75		Ground Surface								
	94.55		**Pavement Structure** Approximately 200 millimetres of compact gravel base.								
	94.00		**Sandy Silt/Silty Sand** Brown, trace to some clay, trace gravel, occasional organics, reworked appearance with possible fill, compact.		SS	1	4,7,6,4	13	▨		
			End of Borehole								



NOTES:

1. Borehole was advanced using solid stem auger equipment on April 8, 2020 to termination at a depth of 0.8 metres.

2. Borehole was recorded open and 'dry' upon completion and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Augers
Drill Date: April 8, 2020
Hole Size: 150 millimetres
Drilling Contractor: Ponthil Drilling

Soil-Mat Engineers & Consultants Ltd.
130 Lancing Drive, Hamilton, ON L8W 3A1
T: 905.318.7440 F: 905.318.7455
E: info@soil-mat.ca

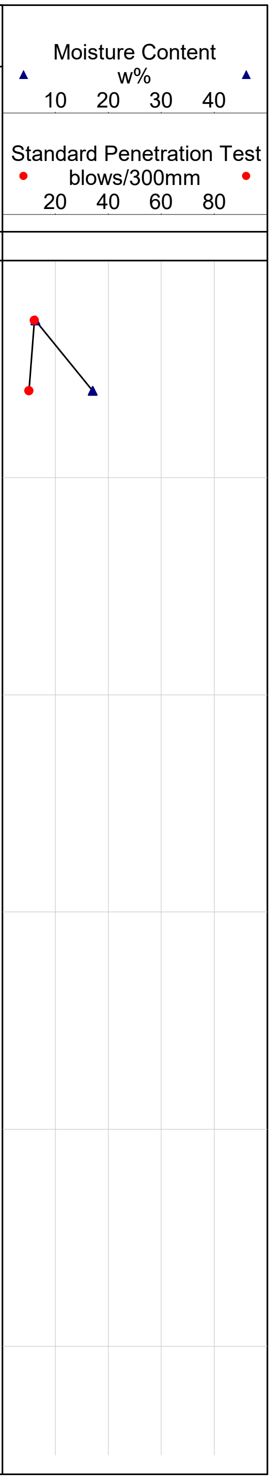
Datum: Geodetic
Field Logged by: BO
Checked by: KR
Sheet: 1 of 1

Log of Borehole No. 12

Project No: SM 200096-G
Project: Proposed Six-Storey Condo Building
Location: 141 Main Street East, Grimsby
Client: Losani Homes

Project Manager: Kyle Richardson, P. Eng.
Borehole Location: See Drawing No. 1
UTM Coordinates - N: 4782864
E: 618122

Elevation (m)	Description	Well Data	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
94.33	Ground Surface								
94.08	**Pavement Structure** Approximately 250 millimetres of compact gravel base.		SS	1	5,6,6,7	12	▇		
92.80	**Sandy Silt/Silty Sand** Brown, trace to some clay, trace gravel, occasional organics, reworked appearance with possible fill, compact.		SS	2	3,5,5,8	10	▇		
	End of Borehole								



NOTES:

1. Borehole was advanced using solid stem auger equipment on April 8, 2020 to termination at a depth of 1.5 metres.

2. Borehole was recorded open and 'dry' upon completion and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Augers
Drill Date: April 8, 2020
Hole Size: 150 millimetres
Drilling Contractor: Ponthil Drilling

Soil-Mat Engineers & Consultants Ltd.
130 Lancing Drive, Hamilton, ON L8W 3A1
T: 905.318.7440 F: 905.318.7455
E: info@soil-mat.ca

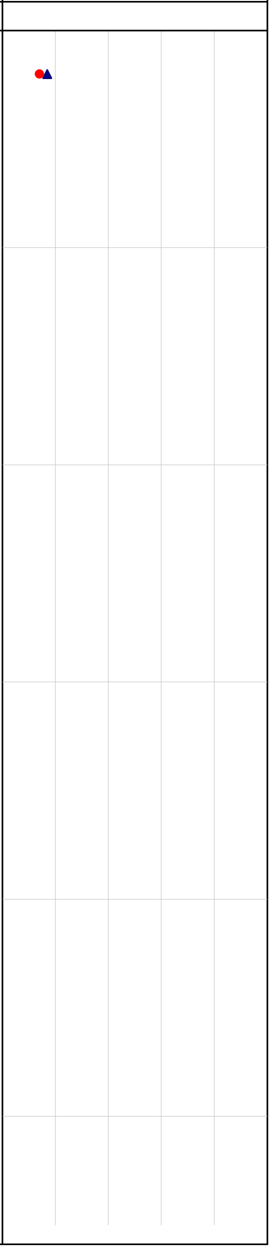
Datum: Geodetic
Field Logged by: BO
Checked by: KR
Sheet: 1 of 1

Log of Borehole No. 13

Project No: SM 200096-G
Project: Proposed Six-Storey Condo Building
Location: 141 Main Street East, Grimsby
Client: Losani Homes

Project Manager: Kyle Richardson, P. Eng.
Borehole Location: See Drawing No. 1
UTM Coordinates - N: 4782842
E: 618128

Depth (ft / m)	Elevation (m)	Symbol	Description	Well Data	SAMPLE Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)	Moisture Content w% ▲ 10 20 30 40 Standard Penetration Test blows/300mm ● 20 40 60 80
0 / 0	94.74		Ground Surface									
	94.00		**Pavement Structure** Approximately 100 millimetres of compact gravel base.		SS	1	4,8,6,5	14	▇			
			Sandy Silt/Silty Sand Brown, trace to some clay, trace gravel, occasional organics, reworked appearance with possible fill, compact.									
			End of Borehole									



NOTES:

1. Borehole was advanced using solid stem auger equipment on April 8, 2020 to termination at a depth of 0.7 metres.

2. Borehole was recorded open and 'dry' upon completion and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Augers
Drill Date: April 8, 2020
Hole Size: 150 millimetres
Drilling Contractor: Ponthil Drilling

Soil-Mat Engineers & Consultants Ltd.
130 Lancing Drive, Hamilton, ON L8W 3A1
T: 905.318.7440 F: 905.318.7455
E: info@soil-mat.ca

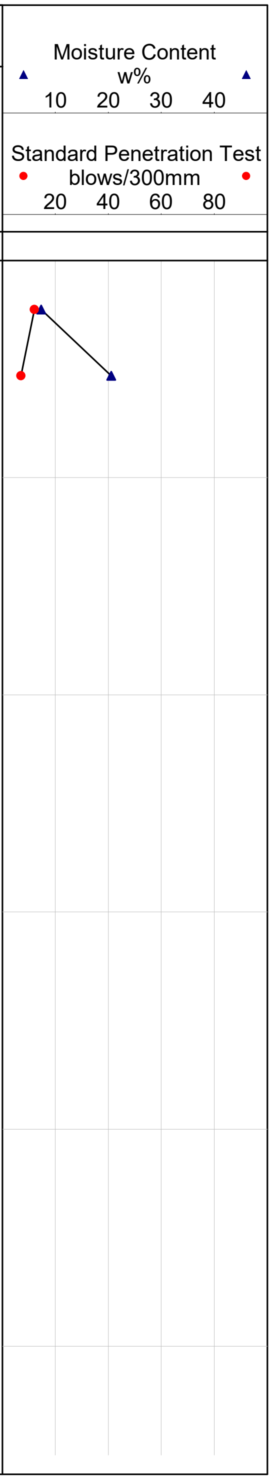
Datum: Geodetic
Field Logged by: BO
Checked by: KR
Sheet: 1 of 1

Log of Borehole No. 14

Project No: SM 200096-G
Project: Proposed Six-Storey Condo Building
Location: 141 Main Street East, Grimsby
Client: Losani Homes

Project Manager: Kyle Richardson, P. Eng.
Borehole Location: See Drawing No. 1
UTM Coordinates - N: 4782824
E: 618138

Depth ft m	Elevation (m)	Symbol	Description	Well Data	SAMPLE Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0 0	95.47		Ground Surface								
			Pavement Structure Approximately 150 millimetres of compact gravel base.		SS	1	4,7,5,5	12	▨		
1	94.00		**Sandy Silt/Silty Sand** Brown, trace to some clay, trace gravel, occasional organics, reworked appearance with possible fill, loose to compact.		SS	2	3,3,4,5	7	▨		
			End of Borehole								



NOTES:

1. Borehole was advanced using solid stem auger equipment on April 8, 2020 to termination at a depth of 1.4 metres.

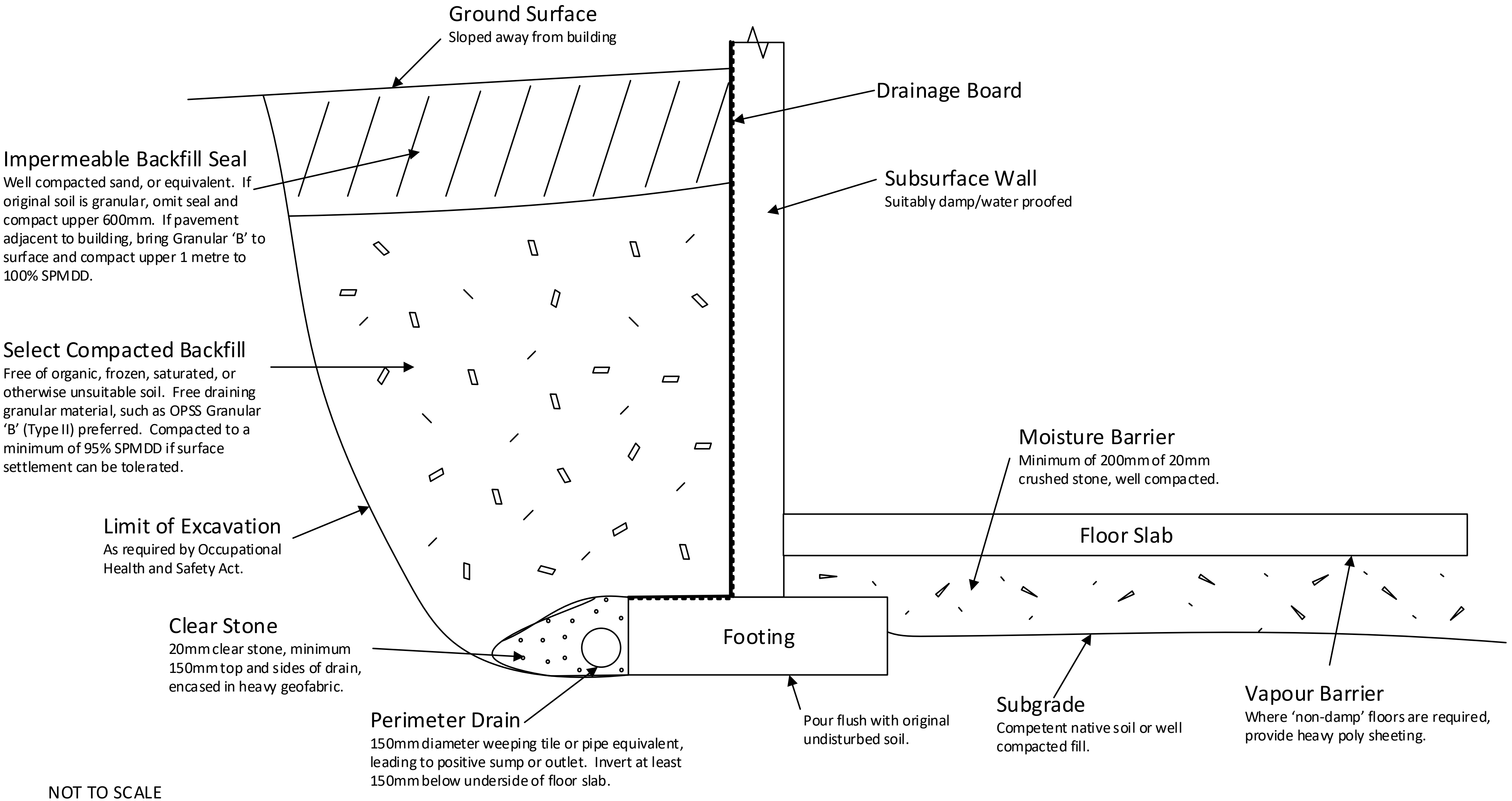
2. Borehole was recorded open and 'dry' upon completion and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Augers
Drill Date: April 8, 2020
Hole Size: 150 millimetres
Drilling Contractor: Ponthil Drilling

Soil-Mat Engineers & Consultants Ltd.
130 Lancing Drive, Hamilton, ON L8W 3A1
T: 905.318.7440 F: 905.318.7455
E: info@soil-mat.ca

Datum: Geodetic
Field Logged by: BO
Checked by: KR
Sheet: 1 of 1



Ground Surface
Sloped away from building

Drainage Board

Subsurface Wall
Suitably damp/water proofed

Impermeable Backfill Seal
Well compacted sand, or equivalent. If original soil is granular, omit seal and compact upper 600mm. If pavement adjacent to building, bring Granular 'B' to surface and compact upper 1 metre to 100% SPMDD.

Select Compacted Backfill
Free of organic, frozen, saturated, or otherwise unsuitable soil. Free draining granular material, such as OPSS Granular 'B' (Type II) preferred. Compacted to a minimum of 95% SPMDD if surface settlement can be tolerated.

Moisture Barrier
Minimum of 200mm of 20mm crushed stone, well compacted.

Limit of Excavation
As required by Occupational Health and Safety Act.

Clear Stone
20mm clear stone, minimum 150mm top and sides of drain, encased in heavy geofabric.

Perimeter Drain
150mm diameter weeping tile or pipe equivalent, leading to positive sump or outlet. Invert at least 150mm below underside of floor slab.

Pour flush with original undisturbed soil.

Subgrade
Competent native soil or well compacted fill.

Vapour Barrier
Where 'non-damp' floors are required, provide heavy poly sheeting.

NOT TO SCALE

Soil-Mat

Soil-Mat Engineers & Consultants Ltd.

Project No.: SM 200096-G

Date: April 2019

Typical Design Requirements
Drainage and Backfill for Basement Walls

Drawing No. 2