S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS

Preliminary
Functional Servicing and Stormwater Management Report

9 & 11 Kerman Avenue

Town of Grimsby
Niagara Region

Prepared for:
Tarbutt Construction Ltd.
189 South Service Road
Grimsby,ON L3M 4H6

July 2021

SLA File: 21048

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1 Introduction and Background

1.1 Overview

S. Llewellyn & Associates Limited has been retained by Tarbutt Construction Limited to provide consulting engineering services related to a proposed Site Plan development at 9 & 11 Kerman Avenue in the Town of Grimsby. The site has an area of 2.256 ha and is located on the west side of Kerman Avenue, north of Main Street West. The site is bounded by Blessed Trinity Catholic Secondary School to the north and existing residential development to the south, east and west. See Figure 1.0 for location plan and Appendix A for the Site Plan.

The proponent proposed to constructed a 47 unit development consisting primarily of 39 duplex bungaloft condo units, one (1) single family condo unit and seven (7) freehold units with frontage on Kerman Avenue (Lots 1 and 2) and Sumac Court (Lots 16, 17, 18, 46 and 47). A municipal cul-de-sac for Sumac Court will be constructed on the west side of the development. The Site Plan will have one access from Kerman Avenue and two access points from the future Sumac Court cul-de-sac on the west side of the development. The development will also include a stormwater management block and a pedestrian access will be provided to Main Street on the south side.

This report will provide an overview of the proposed stormwater management and functional servicing scheme for the proposed development in support of the re-zoning application. Please refer to the preliminary site engineering plans prepared by S. Llewellyn and Associates Limited and the Draft Plan prepared by IBI Group for additional information.

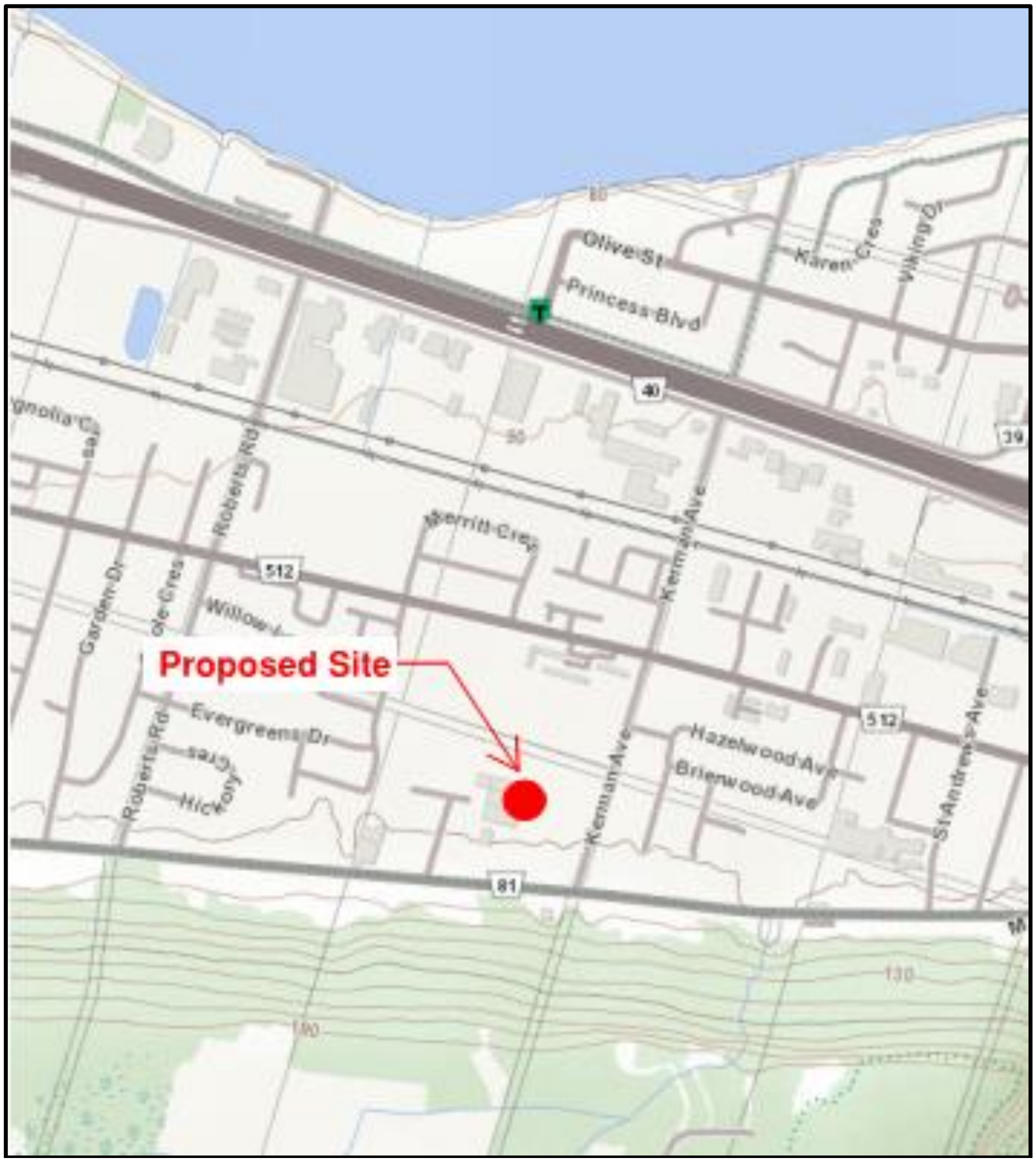


Figure 1.0: Location Plan

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: Geotechnical Investigation – Proposed Residential Development, 9 Kerman Avenue and 250 Main Street, Grimsby, Ontario. Soil-Mat Limited. (May 18, 2021)

Ref. 3: Niagara Region Water & Wastewater Master Servicing Plan, Volume 3 (2016)

Ref. 4: Niagara Region Water & Wastewater Master Servicing Plan, Volume 4 (2016)

Ref. 5: Erosion & Sediment Control Guidelines for Urban Construction (December 2006)

Ref. 6: Silver Maples Subdivision Stormwater Management Report – Town of Grimsby. Philips Engineering (August 12, 1999).

Ref. 7: Stormwater Management Report for Van Geest Greenhouse Expansion, Town of Grimsby. A.M. Candara Associates Inc. (July 2001).

1.3 Geotechnical Information

A geotechnical report (Ref. 2) has been prepared characterizing the existing in-situ soil conditions. See Appendix D for a copy of the full report. The surface soils consist of 75 mm to 750 mm of sand and gravel fill or topsoil. A silty sand stratum is located below the surface layer. Static groundwater levels were recorded 2.0 m to 2.5 m below existing ground.

2 Stormwater Management Criteria

Quantity Control

As part of the Silver Maples Subdivision SWM report (Ref. 6) as well as earlier work for the Blessed Trinity Secondary School, Philips Engineering defined drainage boundaries within the local area. The proposed development straddles Catchment areas 304 and 306. See Figures A-1 and A-2 in Appendix A. The proposed development occupies approximately 60% of the Catchment 306 drainage area. Therefore, the allowable post-development discharge will be proportioned based on the area coverage as indicated in Table 2.1.

Table 2.1: Allowable Flow Rates for Proposed Development

Storm Event	Calculated Flow (l/s) from Catchment 306 (per Philips)	% Allocated to Proposed Development	Target Flow Rate for Proposed Development (l/s)
10-Yr	30	60%	**18 l/s**
100-Yr	90	60%	**54 l/s**

Quality Control

Water quality control will be provided by a centralized stormwater management quality facility that was constructed downstream for the Civic Neighbourhood (Outlets 11 and 13). The facility was constructed per MOE guidelines. The proposed development will be required to cost-share it’s portion of the facilities construction. The proponent will need to consult with the Town on any cash-in-lieu requirements with respect to the off-site quality control facility.

2.1 Pre-Development Conditions

Under existing conditions, the property contains a large greenhouse building along with a single family residence, asphalt driveway/parking area and some small miscellaneous sheds. Based on field reviews and existing drawings/reports, drainage from the greenhouse roof is either directed to the northwest through the school property (Outlet 2) or north through the school property (Outlet 3). See Figures A-1 and A-2 in Appendix A. There are some on-site catchbasins that drain localized areas, but the majority of the property drains via overland flow to the north.

There are no piped outlets and/or drainage easements between the north limits of the property and the ultimate outlet at Livingston Avenue. Referring to Figure A-1 in Appendix A, for the northerly outlet (east of existing greenhouse building) draining to Outlet 3, storm runoff drains across the school property and then along the back property lines of the homes fronting Kerman Avenue. There is a small private storm system (200 mm subdrain) along these backyards to help with conveyance of flows to the private storm sewer system within the townhouse development on Livingston Avenue that conveys flows to the municipal storm sewer.

The northwest outlet (ultimately draining to Outlet 2 in Figure A-1) drains overland through the school property. Although an existing piped outlet adjacent to the greenhouse was observed in the field and a previous SWM report by A.M. for the greenhouse expansion (Candaras Associates - Ref. 7, see Appendix A) indicated a storm sewer connection in the school property, field investigations were undertaken within the school property and no storm sewers were found that extended to the greenhouse buildings. Based on the Candaras report, an area of 0.69 ha at C = 0.68 drained the north west outlet, with controlled post-development flows of 30 l/s, 30 l/s and 70 l/s for the 2, 5 and 100-year storm events respectively.

The other storm sewer infrastructure in the area is an existing storm sewer system that drains in a northerly direction through the property. This system starts as a 200 mm diameter pipe in the front yard of 250 Main Street West that drains north to a circular manhole structure (with open grate) at the back corner of the lot at 250 Main Street. From there, a 525 mm diameter storm sewer continues north to an existing manhole located east of the existing greenhouse building that then outlets into the school lands at the north property line. A condition survey of this system showed that the 200 mm diameter section was in generally good condition. The 525 mm diameter section was predominately reinforced concrete pipe that was shown to be in poor condition, with large joint offsets, longitudinal cracking, root intrusions, debris and one repaired section consisting of a different pipe material.

The existing pond/storage area located within the front yard of the 250 Main Street West accepts drainage from the existing 750 mm culvert crossing under Main Street that collects runoff the area south of Main Street. Although the area south of Main Street is reasonably large as it includes the slope of the escarpment, by accounts of people familiar with the properties in question, significant flow is rarely observed through the storm sewer that cross the subject lands or at the outlet on the school grounds. The existing pond area fills to a depth of 0.60 m or more before it starts to spill through the existing 200 mm storm sewer. Given the sandy soils in the area, the combination of storage volume and infiltration may be effective in controlling the downstream flow through the existing storm sewer system.

2.2 Post-Development Conditions

As indicated previously, the existing drainage regime for the property and neighbouring lands lacks formal storm sewer outlets/easements and relies on overland flow across private properties. The stormwater management scheme is proposed as follows:

- Storm discharge from the proposed development area will outlet to a new storm sewer on Kerman Avenue that will convey flows north to the Livingston Avenue storm sewer. A section of existing 450 mm storm sewer on Livingston Avenue will be upgraded to 525 mm diameter to match the storm sewer at the Outlet 3 location.

  The existing storm sewer on Kerman Avenue is too high adjacent to the site to accommodate the proposed on-site storm sewer and storage tanks. In addition, the existing Kerman Avenue storm sewer drains south along Kerman Avenue, past Livingston Avenue and outlets to Lake Ontario (Outlet 11); whereas the site drainage areas drained to the Livingston Avenue storm sewer which drained west.

- Drainage from the proposed cul-de-sac extension will drain to existing Sumac Court. Additional underground (pipe) storage will be provided to supplement the storage already provided on Sumac Court. This is discussed in more detail later.

- The existing storm drainage system that conveys external flows from Main Street, north through the existing residential areas and through the proposed development with an outlet to the school lands will be maintained. The 525 mm diameter section of storm sewer will be realigned into the backyard area of the proposed development and will drain through the SWM block to a location close to the current outlet location.

Table 2.2 summarizes the post-development catchment areas related to the proposed development area. Catchments 201 will be directed to on-site SWM storage tanks. Catchment 202 represents the proposed driveway that will drain uncontrolled. Runoff from both Catchments 201 and 202 will drain to a new

Table 2.2: Post-Development Catchment Areas

Catchment ID	Description	Area (ha)	Percent Imp (%)
201	Proposed Site Area draining to SWM tanks	1.943	69
202	Proposed Site Area (driveway) draining to SWM tanks	0.076	62
301	Proposed Site Area fronting Kerman	0.069	61
401	Sumac Court Cul-de-sac draining to Sumac Court	0.168	70
	Total Site Area	2.256	

2.2.1 Water Quantity Control

Water quantity control will be provided by and an on-site storage tank with dual orifice controls located at MH 9 at the east side of the site. It is proposed to provide approximately 747 m^3 of storage within StormCon tanks (see Appendix A for product information) with an additional 22 m^3 of storm pipe/structure storage for a total available storage volume of 769 m^3. Due to the proximity of building units and well as potential groundwater concerns, the tank system will be covered with an impermeable liner system.

Table 2.3 summarizes the stage-storage-discharge characteristics for the underground tanks and dual orifice controls. For a detailed stage-storage-discharge listing see Appendix A.

Table 2.3 – SWM Tanks Stage-Storage-Discharge Characteristics

Elev. (m)	Stage	Total Storage (m^3)	Discharge, Q (m^3/s) [A]
93.25	Orifice No. 1 Invert – 93.25 [A]	0	0.0000
93.80	Bottom of Tank	0	0.0026
94.00		75	0.0059
94.20		151	0.0079
94.40		226	0.0095
94.60		302	0.0108
94.80		378	0.0120
95.00		455	0.0131
95.20	Orifice No. 2 Invert 95.20 [B]	531	0.0141
95.40		609	0.0289
95.60		694	0.0361
95.78	Top Tank	769	0.0411

Orifice Controls:
[A] Low Flow Orifice Plate – 75mm diameter at invert elevation 93.25 m at STM MH 9
[B] Higher Stage – Horizontal Orifice Plate – 125mm diameter pipe at invert elevation 95.20 m

A hydrologic analysis was performed using the SWMHYMO Hydrological Modelling Program with the Town Grimsby 12 hour SCS storm distribution, similar to what was used in the Silver Maples Subdivision analysis. A summary of the results can be found in Table 2.4 and the SWMHYMO input and output file can be found in Appendix A along with other supporting information.

Table 2.4: Post-Development Conditions Peak Flow (Catchments 201 + 202)

Storm Event	Peak Flow to New Kerman Ave. Storm sewer (m^3/s) [A]	SWM Tank Storage Volume (m^3) [A]	Flow Target (m^3/s)[B]
10-Yr	0.016	492	0.018
100-Yr	0.041	734	0.054

[A] See SWMHYMO modeling in Appendix A
[B] See Table 2.1

The analysis determined the following:

- The post-development condition discharge to Outlet 3 can be controlled to less than allowable prorate flow rates.
- Sufficient storage can be provided within an underground tank storage system.
- Conveyance of post-development site flows to a new storm sewer on Kerman Avenue will reduce overland flow onto the school property at both the north side of the site (Outlet 3) as well as at the northwest (Outlet 2).

Residential Fronting Kerman Avenue

The proposed Site Plan includes two (2) freehold single family residences with frontage on Kerman Avenue. These new units will replace an existing single family dwelling that currently occupies this location. Runoff from the residential lots will drain to the Kerman Avenue right-of-way and be collected by the existing storm sewer system. The 5-year existing and proposed discharge is summarized below. The more development intensive proposed conditions indicate a negligible increase in flow of 1 l/s. See Appendix A for a drainage area plan for the two conditions.

Existing Conditions
Area = 0.0936 ha
Runoff Coeff. (C) = 0.42
5-yr. Intensity = 87.93 mm/hr (tc=10 min)
$Q_{5\ EXIST} = 2.78CiA = 2.78\ (0.42)\ (87.93)\ (0.0936) =$ **10 l/s**

Proposed Conditions (Catchment 301)
Area = 0.0690 ha
Runoff Coeff. (C) = 0.67
5-yr. Intensity = 87.93 mm/hr (tc=10 min)
$Q_{5\ PROP} = 2.78CiA = 2.78\ (0.67)\ (87.93)\ (0.0690) =$ **11 l/s**

Sumac Court Stormwater Management

The Silver Maples Subdivision (Ref. 6) provided stormwater control via underground superpipe storage and surface storage at catchbasin low points that collected and controlled runoff from the 2.27 ha development. Part of the proposed development will involve the construction of a cul-de-sac extension on the east leg of Sumac Court. The construction of the cul-de-sac will introduce an additional 0.168 ha (Catchment 401) to the existing Sumac Court right-of-way and stormwater management system. The OTTHYMO modeling prepared by Philips Engineering for the Silver Maples Subdivision was re-created using SWMHYMO. An initial analysis was performed by simply adding the additional area to the model, but this resulted in overtopping of the surface storage while some storage capacity was still available in the underground system. The available surface storage relies on providing inlets at specific elevations with specific spill points. Providing additional surface storage is not feasible since the cul-de-sac road grades will be higher. In order to provide additional storage to accommodate runoff from the additional area it is proposed to provide 30 m of 1200 mm storm sewer (CSP, HDPE) within the Sumac Court cul-de-sac connected to the existing system. The use of pipe that is not concrete would be preferred so that the smaller outside diameter would allow connection to the existing 1800 mm manhole. The proposed storm sewer will provide an additional 35 m^3 of underground storage for a total of 292 m^3 (257 m^3 per original design + 35 m^3).

Table 2.5 summarizes the SWM calculations related to the Sumac Court system. Results from the original Silver Maples OTTYHYMO modeling were extracted from the original subdivision report (Ref. 6). The old OTTHYMO model showed limited significant digits, particularly for storage volumes which are only reported the nearest 100 m^3. The original/existing model was re-created using SWMHYMO. The SWMHYMO model generates flows that are higher than the OTTHYMO model. The storage volumes are similar if one accounts for rounding and significant digits reported by OTTHYMO.

The proposed conditions (inclusion of Catchment 401) were modeled assuming that all flows would be directed to the underground system from the cul-de-sac. Total capture CB's – double catchbasins with curb face inlets would be provided on Sumac Court at the property limit to inlet all surface flows into the future 1200 mm storm sewer that is connected to the existing superpipe system previously installed. Under proposed conditions the total discharge shows and increase over the existing conditions. Both SWMHYMO models produce flows the that are greater than the OTTHYMO modeling. The Sumac Court modeling is provided in Appendix A and shows that the additional pipe storage can contain the runoff from the cul-de-sac expansion.

Although the flow rates show an increase, as indicated previously, a large portion of the west side of the proposed development (Catchment 304 in the original drainage boundary shown in Figure A-1) no longer drains into the school property from the northwest corner of the proposed development, but is directed east and controlled by the on-site SWM measures. Therefore, the school will have less external flow draining into the property and into the existing drainage system.

Table 2.5: Sumac Court Stormwater Management Summary						
Scenario →	Original Silver Maples OTTHYMO		Existing (update with SWMHYMO)		Proposed Conditions (added volume)	
Storage Component	10-yr	100-yr	10-yr	100-yr	10-yr	100-yr
Surface Storage (m^3)	0.00	100	15.9	63.8	15.9	63.8
Discharge (m^3/s)	0.01	0.03	0.006	0.044	0.006	0.044
Pipe Storage (m^3)	200	200	153.7	238.5	188.1	290.0
Discharge (m^3/s)	0.02	0.03	0.021	0.032	0.025	0.038
Total Discharge (m^3/s)	0.02	**0.05**	0.023	**0.066**	0.028	**0.074**

2.2.2 Water Quality Control

As indicated previously, water quality control will be provided by the centralized stormwater management quality facility constructed for the Civic Neighbourhood (Outlets 11 and 13). The proposed development will be required to cost-share it's portion of the facilities construction. Further discussions will be required with the Town to determine the contribution for the proposed development.

The proposed development will include an oil/grit unit to provide pre-treatment of storm flows entering the underground storage tank. The oil/grit unit, that will be located at MH 5, has not been sized to meet any specific TSS removal targets, but simply to pre-treat the storm water to make future maintenance of the tanks easier. Since MH 5 will likely be 1500 mm diameter, it is proposed to provide a HydroStorm HS-5 unit. Based on an MOE particle size distribution, an HS-5 unit will provide 69% TSS removal. See Appendix A for Oil/grit unit sizing output.

2.2.3 Storm Sewers

Storm sewers will generally be sized for the 5-year storm event. However, due to the orientation of entrances onto Sumac Court and grading constraints, total capture CB's and inlets will be required to capture runoff from all storm events up to an including the 100-year event. In those situations, storm sewers will be sized to convey the 100-year storm to the underground storage tanks.

2.2.4 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 low end of the site to ensure that sediment does not migrate to the adjacent properties;

- Install sediment control (silt sacks) in the proposed and nearby existing catchbasins to ensure that no untreated runoff enters the existing conveyance system;
- Install a mud mat at the construction entrance of the site to reduce mud tracking and sediment leaving the site via construction traffic; and
- 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 and provisions:

- Inspecting the erosion and sediment controls before documenting and submitting associated 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.

A detailed erosion and sediment control plan will be prepared during the detailed design process.

2.2.5 Alternative Storm Sewer Servicing Option

The storm servicing scheme outlined above proposed the installation of approximately 330 m of new storm sewer on Kerman Avenue that would drain north and then outlet west into the existing Livingston Avenue storm sewer system to maintain the original outlet for the subject lands and provide a legal outlet. The existing storm sewer on Kerman Avenue drains north to Lake Ontario (Outlet 11).

In order to limit disturbance to Kerman Avenue and the Kerman/Livingston intersection, one option for consideration would be the installation of approximately 100 m of 375 mm diameter storm sewer from the proposed development connection point to the upstream end of the existing 900 mm storm sewer at Kerman/Hazelwood intersection. The 10-year controlled flows from the development are only 18 l/s and the proposed site is near the upstream end of the storm sewer drainage system. The impact of these minor flows on the downstream storm sewers that range in size from 900 mm to 1200 mm should not be significant. This would also free-up some capacity within the Livingston Avenue storm system.

3 Sanitary Sewer Servicing

3.1 Existing Conditions

An existing 200 mm diameter municipal sanitary sewer is located within the Kerman Avenue right-of-way that drains north to Livingston Avenue. An existing 200 mm sanitary sewer at 0.78% slope is located within the cul-de-sac bulb on Sumac Court on the west side of the proposed development. The Sumac Court system drains west and then north through an easement where it connects to an existing 200 mm sanitary sewer draining through the Blessed Trinity Catholic Secondary School property that outlets to Livingston Avenue.

3.2 Proposed Conditions

The two single family lots fronting Kerman Avenue will have sanitary laterals connected to the existing 200 mm sanitary sewer on Kerman Avenue, similar to the existing homes that occupied the property. The remainder of the development will drain west to the 200 mm sanitary sewer system on Sumac Court. Tables 3.1 and 3.2 summarize the anticipated sanitary flows to the two outlets. For the purposes of this analysis, single family units were assumed to have a population of 4 people per unit, while the bungaloft semi-detached units were assumed to have a population of 3.05 people per unit. The total population is estimated to be 147 people. For the sanitary drainage to Sumac Court (Table 3.2) that results in a population density of approximately 66 people/hectare which is greater than the typically used value of 60 pp/ha for single family units and reasonable for a multi-family (semi-detached) consisting of bungaloft type of units that will have fewer bedrooms and gross floor area than a typical 2-storey unit.

A sanitary sewer design sheet was prepared for the existing municipal system that incorporates the larger sewershed analysis prepared by S. Llewellyn and Associates in 2009 for the Main Street sanitary sewer along with the sanitary flows from the existing Silver Maples Subdivision (Sumac Court) and the proposed sanitary flows from the proposed development. It should be noted that the Silver Maples Subdivision design assumed that 1.9 ha of the proposed development at 60 pp/ha (114 people) would drain to the Sumac Court sanitary sewer.as part of the original design of the Sumac Court sewer. The proposed development at 139 people will be higher than the original design by 25 people.

See Appendix B for the existing sanitary drainage area plans and the updated sanitary sewer design sheet. The analysis shows that with the inclusion of the existing sanitary flow from the proposed development (Table 3.2) into the Sumac Court system, sanitary sewer capacity is at or below 33% of full flow capacity. Therefore, the existing system will not be adversely affected by the proposed development even with the slightly higher population count as noted above.

Internally, the proposed development will be serviced with 200 mm diameter private sanitary sewer with a minimum slope of 0.5% with a full flow capacity of 23 l/s which is sufficient to convey the estimated peak sanitary flow of 2.56 l/s.

Table 3.1 – Proposed Development Sanitary Sewer Discharge to Kerman Avenue

Site Area	0.145 ha (Lots 1 + Lot 2)
Population	4 people/unit x 2 units = 8 persons
Average Dry Weather Flow [A]	320 l/person/day x 8 persons = 2560 l/day (0.030 l/s)
Peaking Factor [B]	4.42
Infiltration Allowance [C]	0.20 l/s/ha x 0.145 ha = 0.029 l/s
Peak Sanitary Flow	(0.030 l/s x 4.42) + 0.029 l/s = **0.16 l/s**

[A] Average dry weather flow of 320 l/person/day

[B] Peaking factor = 1+ 14/(4+$P^{0.5}$) with P being population in thousands

[C] Infiltration based on a 0.20 l/s/ha

Table 3.2 – Proposed Development Sanitary Sewer Discharge to Sumac Court

Site Area	2.111 ha (remaining area)
Population	1 single family (Lot 19) - 4 people/unit x 1 units = 4 persons 44 bungaloft semis – 3.05 people/unit x 44 units = 135 persons Total Population = 139 persons
Average Dry Weather Flow [A]	320 l/person/day x 139 persons = 44,480 l/day (0.51 l/s)
Peaking Factor [B]	4.20
Infiltration Allowance [C]	0.20 l/s/ha x 2.111 ha = 0.42 l/s
Peak Sanitary Flow	(0.51 l/s x 4.20) + 0.42 l/s = **2.56 l/s**

[A] Average dry weather flow of 320 l/person/day

[B] Peaking factor = 1+ 14/(4+$P^{0.5}$) with P being population in thousands

[C] Infiltration based on a 0.20 l/s/ha

4 Domestic and Fire Water Supply Servicing

4.1 Existing Conditions

An existing 150 mm diameter municipal watermain is located on the west side of the Kerman Avenue right-of-way. An existing 150 mm watermain stub is located at the dead end of Sumac Court immediately west of the proposed development. sanitary sewer at 0.78% slope is located within the cul-de-sac bulb on Sumac Court on the west side of the proposed development.

4.2 Domestic Water Demand

Domestic water demands for the proposed development were calculated using per capita demand and peaking factor information from the Niagara Region Water & Wastewater Master Servicing Plan (Ref. 3). An average daily water demand of 300 L/capita/day was used with Max. Day and Peak Hour peaking factors of 2.0 and 4.0, respectively. A total population of 147 people (calculated in the pervious section on sanitary sewers) was utilized. Table 4.1 summarizes the domestic water demand requirements for the Average Daily, Maximum Daily and Peaking Hourly demand scenarios.

Table 4.1 - Proposed Domestic Water Demand

Population (Persons)	Average Daily Demand [A] (l/s)	Max. Daily Peaking Factor [B]	Max. Hourly Peaking Factor [B]	**Max. Daily Demand (l/s)**	**Max. Hourly Demand (l/s)**
147	0.51	2.0	4.0	**1.02**	**2.04**

[A] Average Daily Demand = 300 L/cap/day x Population per Niagara Region Water & Wastewater Master Servicing Plan, Volume 3 (2016)

[B] per Niagara Region Water & Wastewater Master Servicing Plan, Volume 3 (2016)

4.3 Fire Flow Demand

Fire flow demands for the development are governed by the Water Supply for Public Fire Protection (Fire Underwriters Survey, 1999). Preliminary calculations were prepared for what appeared to the worst case conditions within the development (see Appendix C for FUS calculations). At this time, architectural drawings for the proposed bungaloft units are not available, so it was assumed that each bungaloft building unit (consisting of two homes) had a gross floor area (including garage) of approximately 483 m^2. It was also noted that the sideyard separation of the units is less than 3 m. Within the FUS methodology, building units that are closer than 3m apart and have a combustible exterior (ie. siding, wood, stucco) are to be treated as a single contiguous building for calculation purposes.

If the three (3) units between Lots 36 to 41 had combustible exteriors (C=1.5), the required fire flow would be 283 l/s. Similarly, if the six (6) lots between Lots 7 to 18 had combustible exteriors, the required fire flow would be 350 l/s. Since the existing watermains in the area are 150 mm diameter, fire flows of this magnitude are likely not achievable. To reduce the fire flow requirements, the units can be constructed with a fully non-combustible exterior (C=1.0 - brick and/or stone), or non-combustible units can be constructed at strategic locations within the development to act as fire separations between those units or groups of units with combustible exteriors.

4.4 Proposed Water Servicing and Analysis

The proposed development will be serviced by a private 150 mm diameter watermain that will be looped through the development with connections to the existing 150 mm diameter municipal watermains on Kerman Avenue and Sumac Court. Private hydrants will be installed within the development to provide the required building coverage per OBC requirements. Hydrant flow testing will be conducted on the existing hydrants on Kerman Avenue and Sumac Court to determine the existing pressure and flow characteristics of the exiting water distribution system. This information will then be used as boundary condition information to model the private water distribution system and determine available fire flows and further requirements related to type of construction, fire separations, etc.

5 Utilities and Other Services

All other utilities (hydro, gas, telecom) are available as underground services within the exiting rights-of-way adjacent to the development. All services are buried and will utilized to service the proposed development.

6 Conclusions and Recommendations

Based on the information provided herein, it is concluded that a servicing, grading and stormwater management plan can be developed for the proposed development that satisfies the requirements of the stakeholders. It is recommended that this preliminary Functional Servicing and Stormwater Management Report as well as the preliminary engineering drawings prepared by S. Llewellyn and Associates Limited be used as the basis for further discussions with stakeholders and detailed design for SPA submission.

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

John Oreskovic, P.Eng.

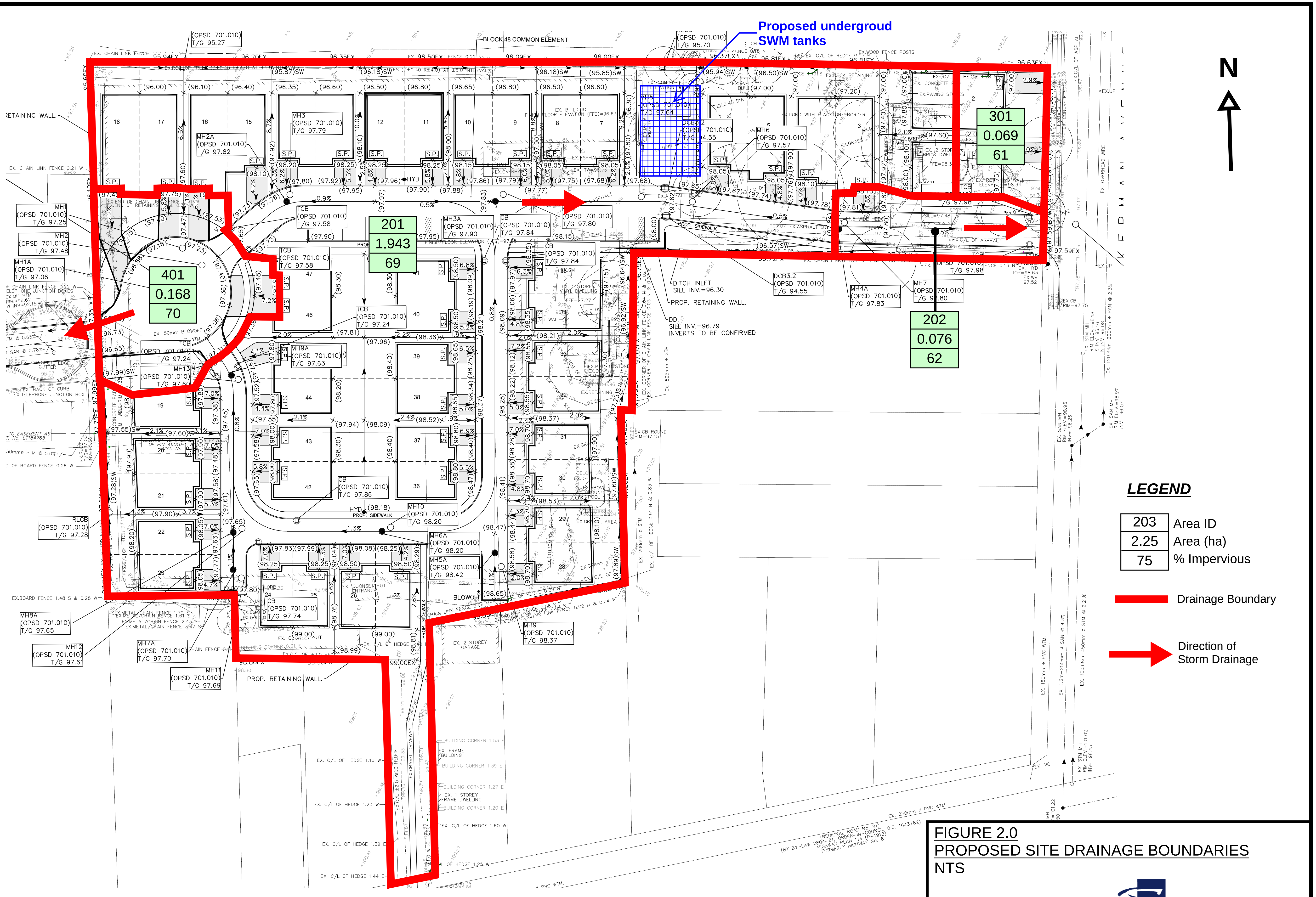
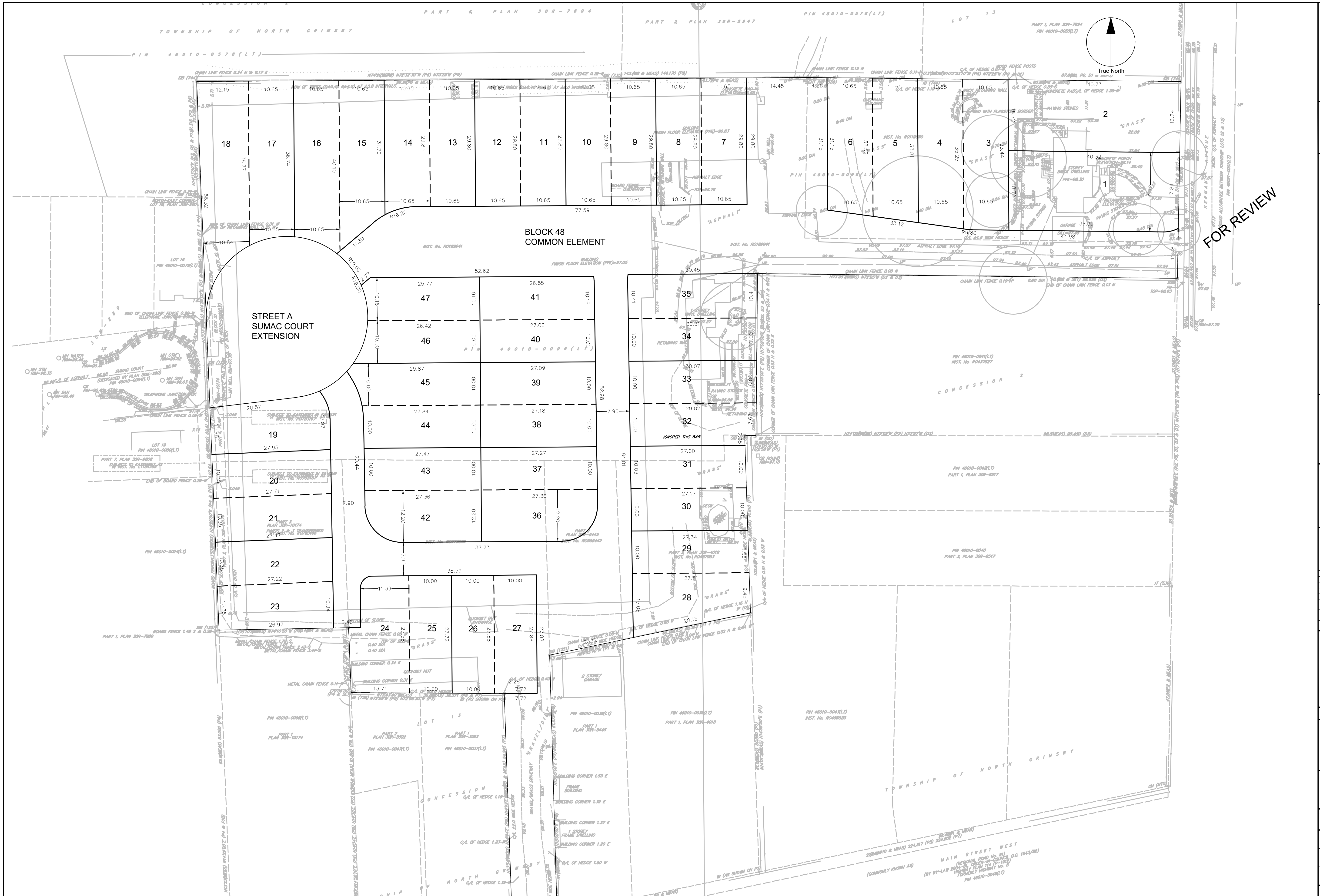


FIGURE 2.0
PROPOSED SITE DRAINAGE BOUNDARIES
NTS

S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS

July 2021

APPENDIX A
STORMWATER MANAGEMENT INFORMATION



LAND USE SCHEDULE			
BLOCKS/LOTS	DESCRIPTION	AREA (ha)	# UNITS
LOTS 1, 2 & 19	SINGLE DETACHED	0.177	3
LOTS 3-18, 20-47	SEMI-DETACHED	1.375	44
BLOCK 48	COMMON ELEMENT	0.581	0
STREET A	ROW EXTENSION	0.123	0
TOTAL		2.256	47

DRAFT PLAN OF SUBDIVISION

PART OF LOT 13, CONCESSION 2
GEOGRAPHIC TOWNSHIP OF NORTH
GRIMSBY, NOW IN THE TOWN OF
GRIMSBY, REGIONAL MUNICIPALITY OF
NIAGARA

COPYRIGHT

KEY MAP - N.T.S.

INFORMATION REQUIRED

UNDER SECTION 51 (17) OF THE PLANNING ACT, R.S.O. 1990. c.P.13 AS AMENDED

(a) - AS SHOWN
(b) - AS SHOWN
(c) - AS SHOWN
(d) - AS LISTED BELOW
(e) - AS SHOWN
(f) - AS SHOWN
(g) - AS SHOWN
(h) - MUNICIPAL WATER
(i) - FINE SANDY LOAM
(j) - AS SHOWN
(k) - MUNICIPAL SANITARY AND STORM SEWERS
(l) - NONE

SURVEYOR'S CERTIFICATE

I HEREBY CERTIFY THAT THE BOUNDARIES OF THE LANDS TO BE SUBDIVIDED ON THIS PLAN AND THEIR RELATIONSHIP TO THE ADJACENT LANDS ARE ACCURATELY AND CORRECTLY SHOWN.

SIGNED ______________________

SURVEYOR NAME, O.L.S.
J.D. BARNES LIMITED

DATE ____________

OWNER'S CERTIFICATE

I HEREBY CONSENT TO THE FILING OF THIS PLAN BY IBI GROUP, IN DRAFT FORM.

SIGNED ______________________

JIM TARBUTT
TARBUTT CONSTRUCTION LTD.

DATE ____________

#	DATE	BY	DESCRIPTION
1	2021-XX-XX	JM	FIRST DRAFT PLAN OF SUBDIVISION SUBMISSION

DRAWING ISSUE RECORD

APPROVALS

IBI GROUP
Suite 200 - 360 James Street North
Hamilton ON L8L 1H5 Canada
tel 905 546 1010 fax 905 546 1011
ibigroup.com

BENCHMARK

BEARINGS ARE UTM GRID, DERIVED FROM GNSS OBSERVATIONS, UTM ZONE 17, NAD83 (CSRS)(2010.0)

SCALE 15 0 10 20 40
1:1000 (m)

PROJECT NO:
123578

DRAWN BY:	CHECKED BY:
J.MARCUS	T.TUCKER
PROJECT MGR:	APPROVED BY:
J.MARCUS	J.ARIENS

SHEET TITLE

DRAFT PLAN OF SUBDIVISION

SHEET NUMBER
DPS1.0

ISSUE
1

SCALE CHECK 1 in 10mm

File Location: S:\21048\DBO\06_Site Plan - July 27, 2021\123578SP-2021-07-07 - Standard\123578SP-2021-07-07.dwg Last Saved: July 27, 2021, by jared.marcus Plotted: Wednesday, August 4, 2021 5:26:02 PM by John Oreskovic

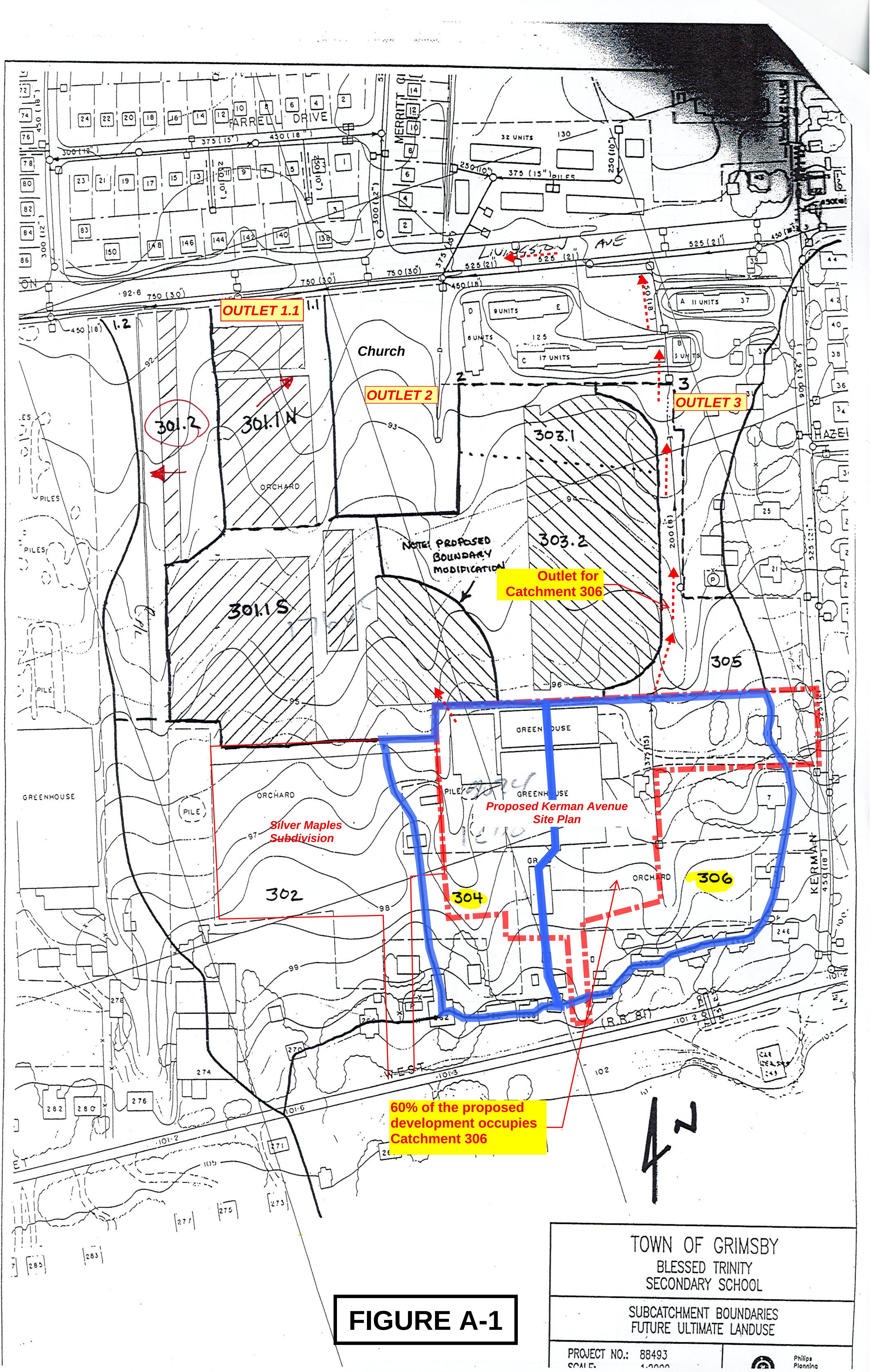


FIGURE A-1

TOWN OF GRIMSBY
BLESSED TRINITY
SECONDARY SCHOOL

SUBCATCHMENT BOUNDARIES
FUTURE ULTIMATE LANDUSE

PROJECT NO.: 88493
SCALE: 1:2000

Philips Planning

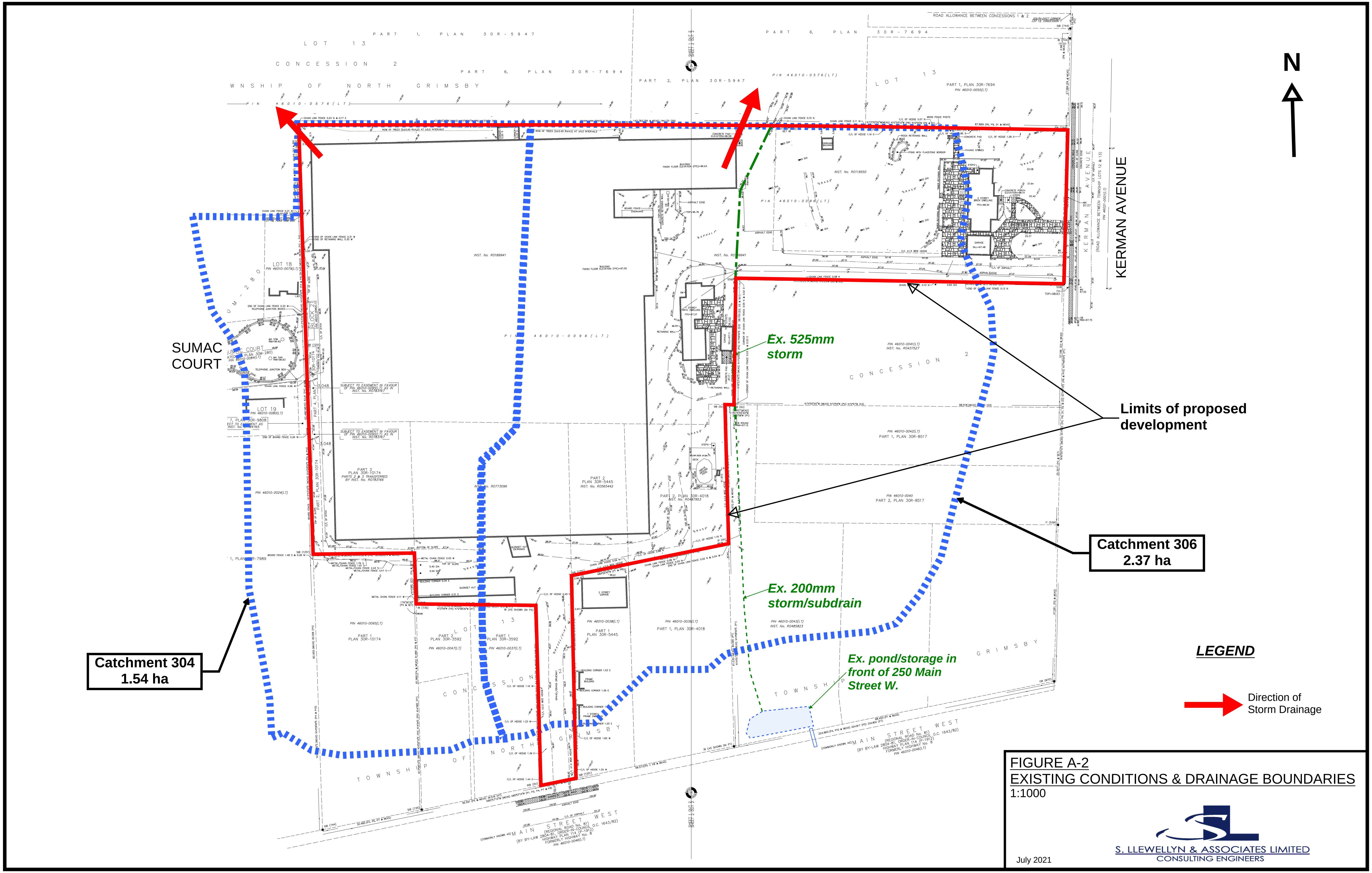


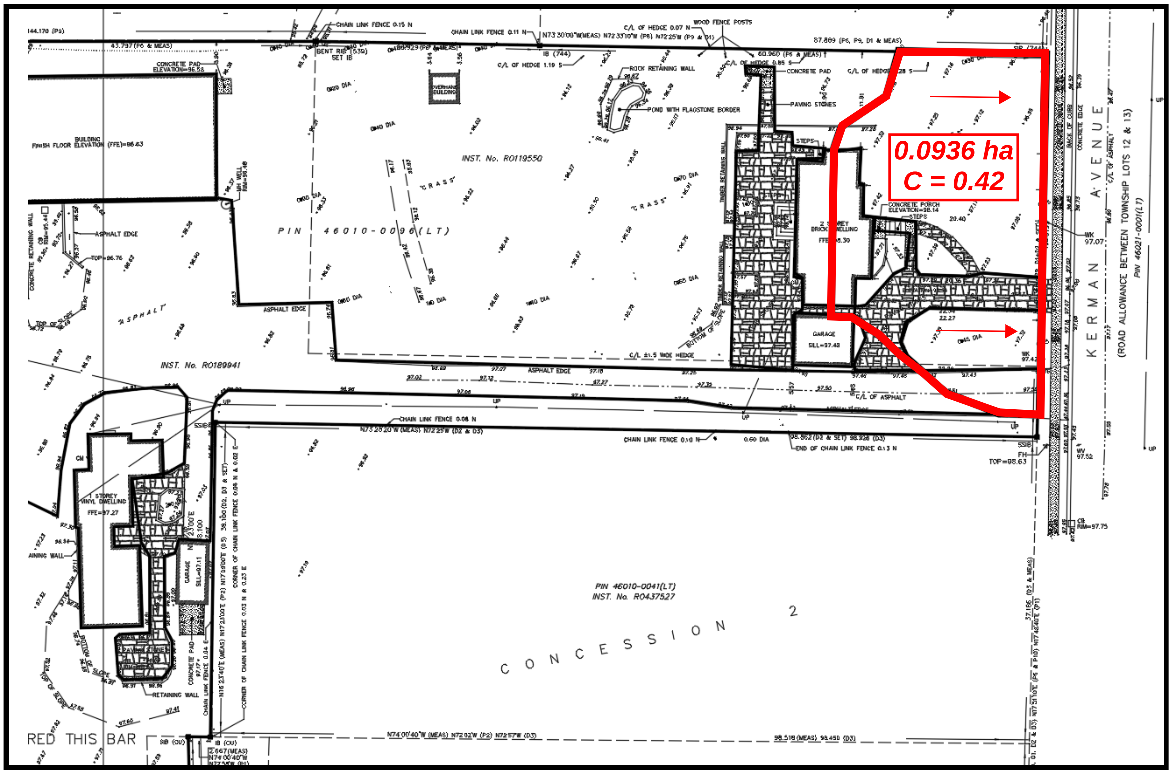
FIGURE A-2
EXISTING CONDITIONS & DRAINAGE BOUNDARIES
1:1000

July 2021

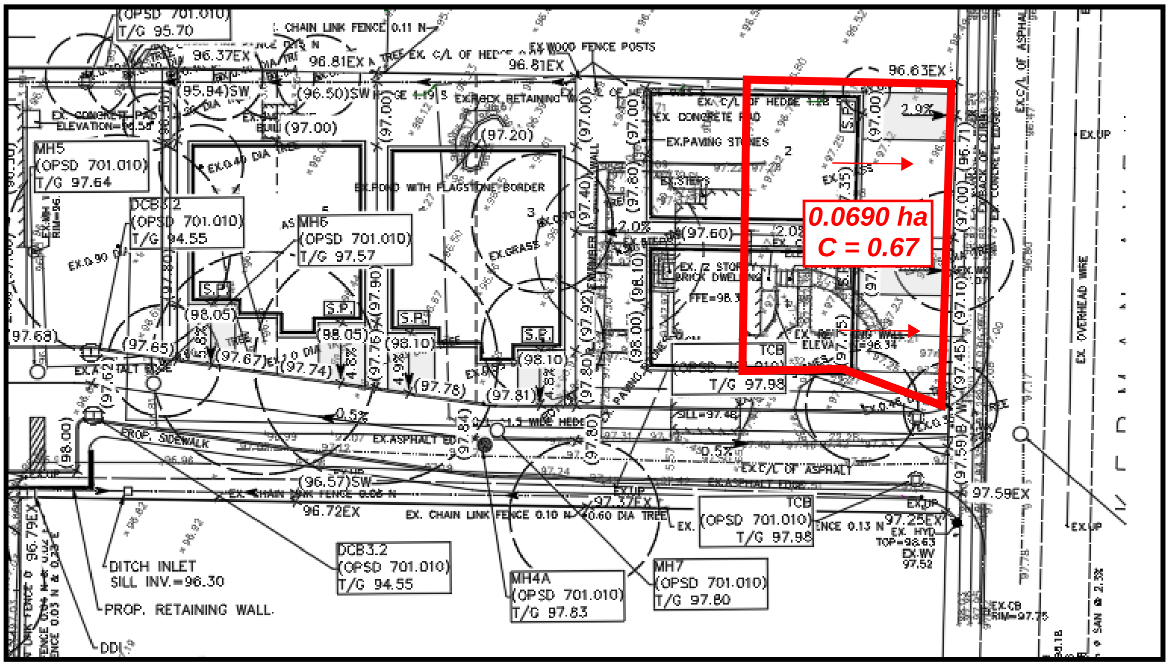
S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS

Single Family Residential Drainage to Kerman Avenue Right-of-Way

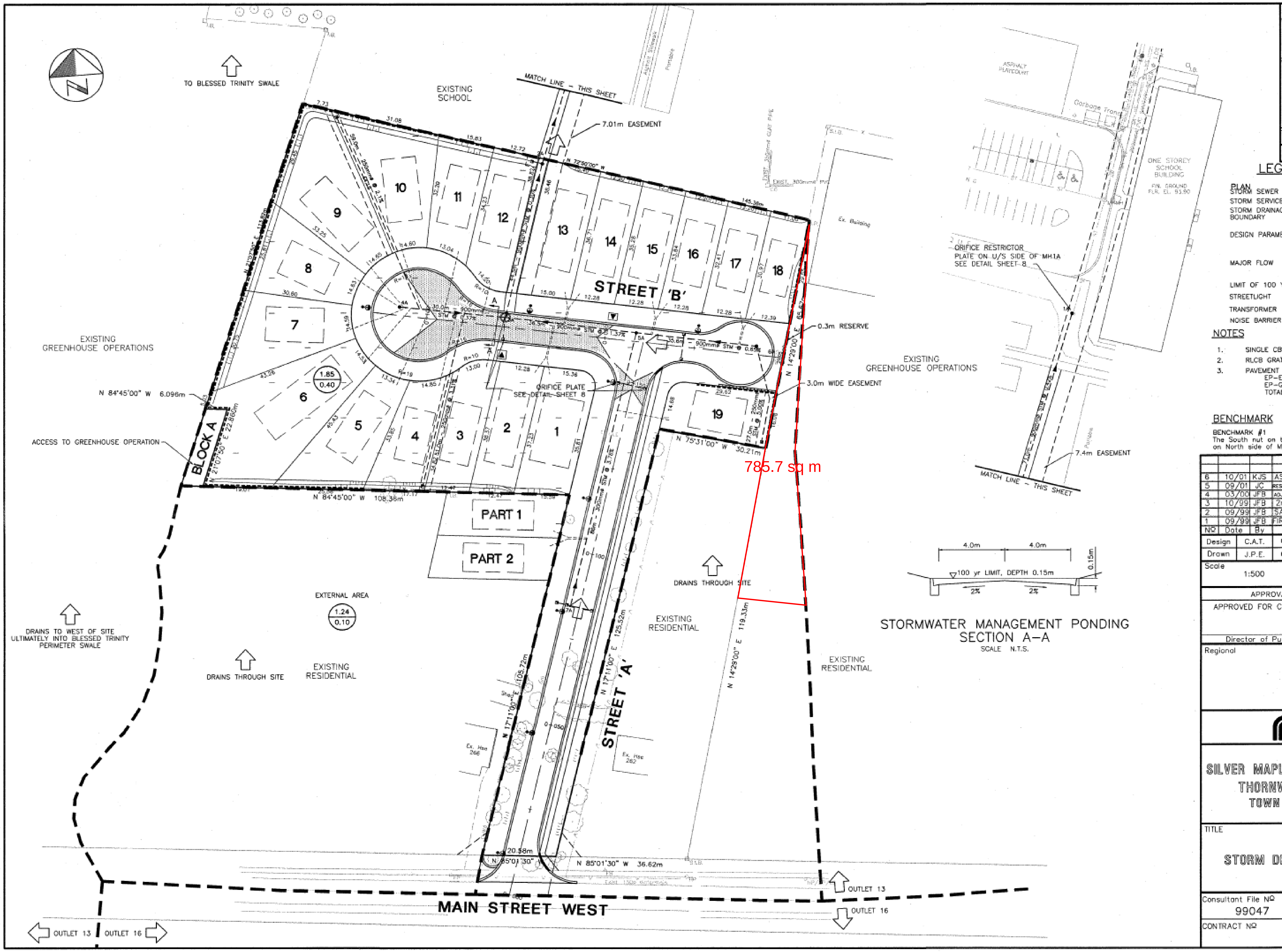
Existing Conditions



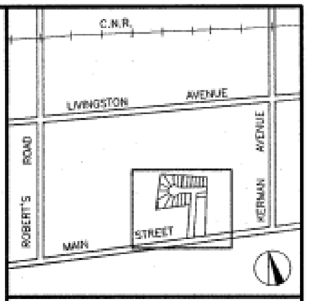
Proposed Conditions (Catchment 301)



SD-YOI-56B



STORMWATER MANAGEMENT PONDING
SECTION A–A
SCALE N.T.S.



KEY PLAN

LEGEND

PLAN
STORM SEWER - - - - - - - -
STORM SERVICE -----------
STORM DRAINAGE BOUNDARY ▬ ▬ ▬ ▬
DESIGN PARAMETERS (A/C) A—AREA IN ha. C—RUNOFF COEFFICIENT
MAJOR FLOW ⇦
LIMIT OF 100 YEAR PONDING ▨
STREETLIGHT •◐
TRANSFORMER ▲
NOISE BARRIER FENCE - - - - - - - -

NOTES

1. SINGLE CB LEAD 250ø PVC.
2. RLCB GRATE TO BE PYRAMID TYPE (DPW 627)
3. PAVEMENT DIMENSIONS:
   EP–EP: 8.0m
   EP–GUTTER: 0.25m
   TOTAL ROAD WIDTH: 8.5m

BENCHMARK

BENCHMARK #1 Elev.101.299
The South nut on top flange of fire hydrant
on North side of Main Street.

NΩ	Date	By	REVISIONS	MANU	CAD
6	10/01	KJS	AS CONSTRUCTED		X
5	09/01	JC	RESOLUTION: PW01-69 SIDEWALK REMOVED		X
4	03/00	JFB	ADJUST NOISE WALL LOCATIONS & HEIGHTS		X
3	10/99	JFB	2nd SUBMISSION COMMENTS		X
2	09/99	JFB	SAN SEW.&MAIN ST. ACCESS		X
1	09/99	JFB	FIRST SUBMISSION COMMENTS		X

Design	C.A.T.	Ch'kd	J.F.B.	Date AUGUST 1999
Drawn	J.P.E.	Ch'kd	C.A.T.	

Scale 1:500

References

APPROVALS
APPROVED FOR CONSTRUCTION

Director of Public Works

Field Notes

Stamp

Regional

Philips Planning + Engineering Limited

SILVER MAPLES SUBDIVISION
THORNWOOD HOMES
TOWN OF GRIMSBY

TITLE

STORM DRAINAGE PLAN

Consultant File NΩ 99047

Regional Drawing NΩ

CONTRACT NΩ

Drawing NΩ SHEET 2 OF 11

JAN 8/02 – B.O.N

G:\WORK\99047\HWY\DWG\AS_CONSTRUCTED\99047-02.DWG

S. LLEWELLYN & ASSOCIATES LIMITED
CONSULTING ENGINEERS

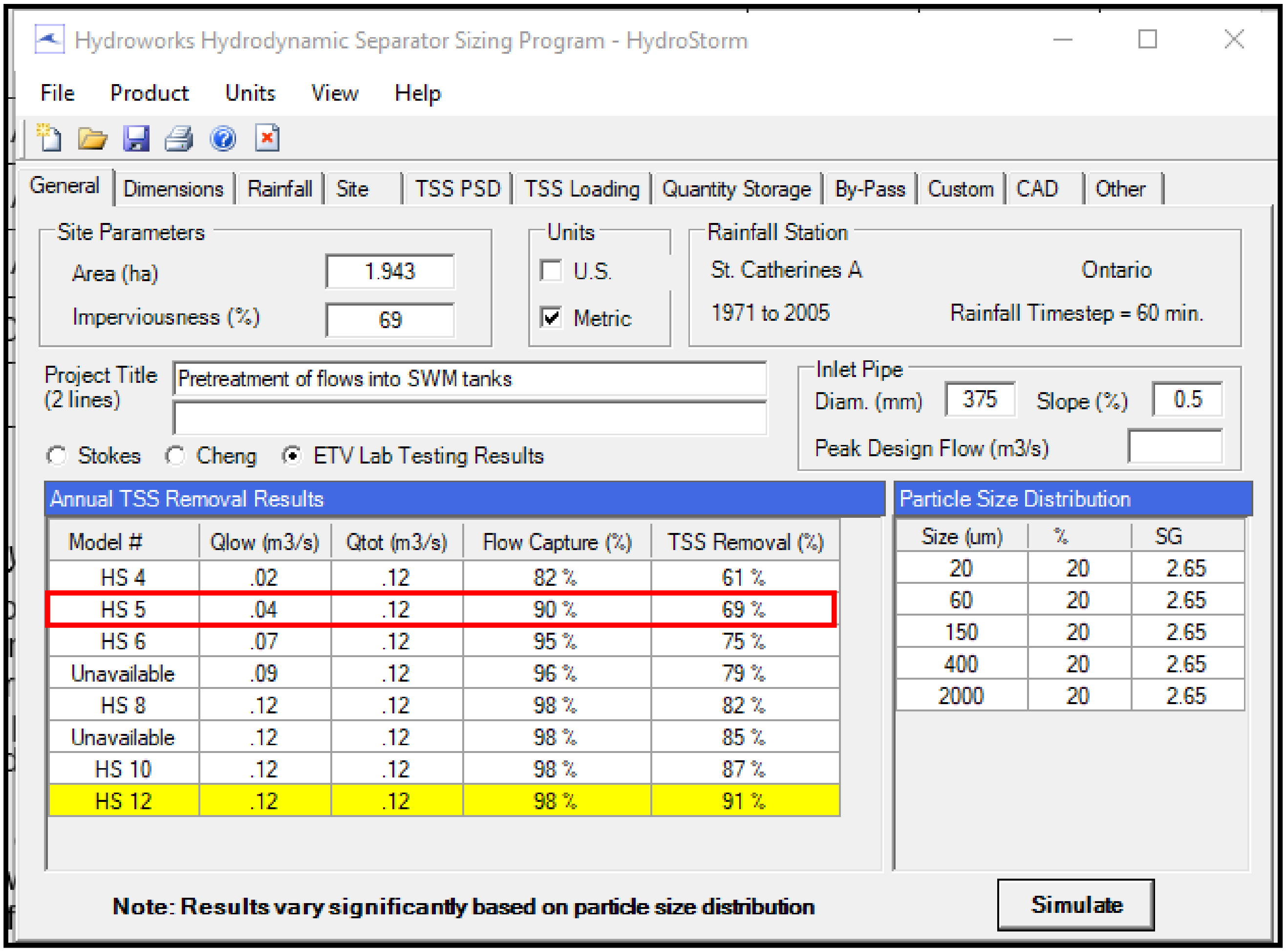
Stormwater Management Underground Storage Tank
STAGE-STORAGE-DISCHARGE CALCULATIONS

Outlet Device No. 1 (Quantity)		Outlet Device No. 2 (Quantity)	
Type:	Orifice Plate (Vertical)	Type:	Orifice Plate (Horizontal)
Diameter (mm)	75	Diameter (mm)	125
Area (m^2)	0.00442	Area (m^2)	0.01227
Invert Elev. (m)	93.25	Invert Elev. (m)	95.20
C/L Elev. (m)	93.30	C/L Elev. (m)	95.20
Disch. Coeff. (C_d)	0.6	Disch. Coeff. (C_d)	0.6

		Underground Tank, Ponding and Pipe Storage					Outlet No. 1		Outlet No. 2		
	Elevation m	Tank Footprint Area m^2	Ponding Increm. Volume m^2		Pipe/ Structure Storage m^3	**Total Active Storage Volume m^3**	H m	Discharge m^3/s	H m	Discharge m^3/s	**Total Discharge m^3/s**
Orifice No. 1 Invert	93.25	389.1	0	0		**0**	0.000	0.0000		0.0000	**0.0000**
Bottom of Tank	93.80	389.1	0	0		**0**	0.500	0.0083		0.0000	**0.0083**
	94.00	389.1	75	75		**75**	0.700	0.0098		0.0000	**0.0098**
	94.20	389.1	75	151		**151**	0.900	0.0111		0.0000	**0.0111**
	94.40	389.1	75	226		**226**	1.100	0.0123		0.0000	**0.0123**
	94.60	389.1	75	302		**302**	1.300	0.0134		0.0000	**0.0134**
	94.80	389.1	75	377	1	**378**	1.500	0.0144		0.0000	**0.0144**
	95.00	389.1	75	453	2	**455**	1.700	0.0153	0.000	0.0000	**0.0153**
Orfice No. 2 Invert 95.22	95.20	389.1	75	528	3	**531**	1.900	0.0162	0.000	0.0000	**0.0162**
	95.40	389.1	75	604	5	**609**	2.100	0.0170	0.200	0.0146	**0.0316**
	95.60	389.1	75	679	15	**694**	2.300	0.0178	0.400	0.0206	**0.0384**
Top Tank	95.78	389.1	68	747	22	**769**	2.480	0.0185	0.580	0.0248	**0.0433**

Water Quality - Pretreatment of flows entering stormwater tanks.

MOE particle size distribution
Unit sized based on manhole requirements - No target TSS



Site Parameters
Area (ha) 1.943
Imperviousness (%) 69

Units
☐ U.S.
☑ Metric

Rainfall Station
St. Catherines A Ontario
1971 to 2005 Rainfall Timestep = 60 min.

Project Title (2 lines): Pretreatment of flows into SWM tanks

○ Stokes ○ Cheng ● ETV Lab Testing Results

Inlet Pipe
Diam. (mm) 375 Slope (%) 0.5
Peak Design Flow (m3/s)

Annual TSS Removal Results

Model #	Qlow (m3/s)	Qtot (m3/s)	Flow Capture (%)	TSS Removal (%)
HS 4	.02	.12	82 %	61 %
HS 5	.04	.12	90 %	69 %
HS 6	.07	.12	95 %	75 %
Unavailable	.09	.12	96 %	79 %
HS 8	.12	.12	98 %	82 %
Unavailable	.12	.12	98 %	85 %
HS 10	.12	.12	98 %	87 %
HS 12	.12	.12	98 %	91 %

Particle Size Distribution

Size (um)	%	SG
20	20	2.65
60	20	2.65
150	20	2.65
400	20	2.65
2000	20	2.65

Note: Results vary significantly based on particle size distribution

```
2     Metric units
*#****************************************************************************|
*#  Project Name: TARBUTT CONSTRUCTION
*#            GRIMBSBY, ONTARIO
*#  JOB NUMBER  : 21048
*#       Date   : UPDATED JULY 2021
*#    Company   : S. LLEWELLYN & ASSOICATES LIMITED
*#       File   : 21048-2.DAT
TEST
*#****************************************************************************|
*#
*#****************************************************************************|
*
*
START               TZERO=0.0 hrs  METRIC=2  NSTORM=1  NRUN=010
                    GSCS_010.stm
*
READ STORM          STORM_FILENAME "STORM.001"
*
*
*%-----------------|-----------------------------------------------------------|
*# FUTURE SITE PLAN AREA CONTROLLED BY ON-SITE SWM
CALIB STANDHYD      ID= 1 NHYD=["201"], DT=[5], AREA=[1.943],
                    XIMP=[0.55], TIMP=[0.69], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[50],
                    Pervious   surfaces: IAper=[4.0](mm), SLPP=[2.0](%),
                                         LGP=[10](m), MNP=[0.025], SCP=[0](min),
                    Impervious surfaces: IAimp=[0.5](mm), SLPI=[2.0](%),
                                         LGI=[30](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|
*# FUTURE DRIVEWAY AREA DRAINING UNCONTROLLED TO NEW KERMAN STORM SEWER
CALIB STANDHYD      ID= 2 NHYD=["202"], DT=[5], AREA=[0.076],
                    XIMP=[0.62], TIMP=[0.62], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[50],
                    Pervious   surfaces: IAper=[4.0](mm), SLPP=[2.0](%),
                                         LGP=[10](m), MNP=[0.025], SCP=[0](min),
                    Impervious surfaces: IAimp=[0.5](mm), SLPI=[2.0](%),
                                         LGI=[30](m), MNI=[0.013], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|
ADD HYD             IDsum=[5], NHYD=["TOTAL"], IDs to add=[1 2]
*%-----------------|-----------------------------------------------------------|
* ROUTE FLOWS THROUGH ON-SITE TANK
ROUTE RESERVOIR     IDout=[3],   NHYD=["TANK"],  IDin=[5],
                    RDT=[1](min),
                          TABLE of ( OUTFLOW-STORAGE ) values
                                      (cms) - (ha-m)
  0.0000    0.0000
  0.0083    0.0000
  0.0098    0.0075
  0.0111    0.0151
  0.0123    0.0226
  0.0134    0.0302
  0.0144    0.0378
  0.0153    0.0455
  0.0162    0.0531
  0.0316    0.0609
  0.0384    0.0694
```

```
  0.0433    0.0769
                                       -1       -1   (max twenty pts)
                          IDovf=[4], NHYDovf=["OFLTANK"]
*%------------------|-------------------------------------------------------------|
*%------------------|-------------------------------------------------------------|
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[100]
                    GSCS_100.stm

FINISH
```

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

   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               +++++++++
  +++++++++                in any City          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: 2021-08-04     TIME: 00:47:29     RUN COUNTER: 000210        *
  ******************************************************************************
  * Input   filename: C:\Users\JORESK~1\Desktop\SLAMIC~1\21048\21048-2.dat      *
  * Output  filename: C:\Users\JORESK~1\Desktop\SLAMIC~1\21048\21048-2.out      *
  * Summary filename: C:\Users\JORESK~1\Desktop\SLAMIC~1\21048\21048-2.sum      *
  * User comments:                                                             *
  * 1:__________________________________________________________________________*
  * 2:__________________________________________________________________________*
  * 3:__________________________________________________________________________*
  ******************************************************************************

--------------------------------------------------------------------------------
001:0001------------------------------------------------------------------------
*#*************************************************************************|
*#  Project Name: TARBUTT CONSTRUCTION
*#            GRIMBSBY, ONTARIO
*#  JOB NUMBER  : 21048
*#       Date   : UPDATED JULY
2021
*#    Company   : S. LLEWELLYN & ASSOICATES LIMITED
*#       File   : 21048-2.DAT
TEST
```

```
*#*****************************************************************************|
*#
*#*****************************************************************************|
*
*
  ** END OF RUN :   9

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





--------------------
| START            |  Project  dir.:
C:\Users\JORESK~1\Desktop\SLAMIC~1\21048\
--------------------  Rainfall dir.:
C:\Users\JORESK~1\Desktop\SLAMIC~1\21048\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 010
    NSTORM=   1
           #  1=GSCS_010.stm
--------------------------------------------------------------------------------
010:0002------------------------------------------------------------------------
*#*****************************************************************************|
*#  Project Name: TARBUTT CONSTRUCTION
*#            GRIMBSBY, ONTARIO
*#  JOB NUMBER  : 21048
*#       Date   : UPDATED JULY
2021
*#    Company   : S. LLEWELLYN & ASSOICATES LIMITED
*#       File   : 21048-2.DAT
TEST
*#*****************************************************************************|
*#
*#*****************************************************************************|
*
*
--------------------------------------------------------------------------------
010:0002------------------------------------------------------------------------
*
--------------------
| READ STORM       |    Filename: 10 YEAR SCS 12 HOUR - TOWN OF GRIMSBY
| Ptotal=  65.35 mm|    Comments: 10 YEAR SCS 12 HOUR - TOWN OF GRIMSBY
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .20   1.290 |   3.20   2.580 |   6.20  15.800 |   9.20   2.580
               .40   1.290 |   3.40   2.580 |   6.40   9.370 |   9.40   2.580
               .60   1.290 |   3.60   2.580 |   6.60   6.780 |   9.60   2.580
               .80   1.290 |   3.80   2.580 |   6.80   6.460 |   9.80   2.580
              1.00   1.290 |   4.00   2.580 |   7.00   4.520 |  10.00   2.580
              1.20   1.290 |   4.20   4.520 |   7.20   3.880 |  10.20   1.290
              1.40   1.290 |   4.40   4.520 |   7.40   3.880 |  10.40   1.290
              1.60   1.290 |   4.60   4.520 |   7.60   3.880 |  10.60   1.290
              1.80   1.290 |   4.80   4.520 |   7.80   3.880 |  10.80   1.290
              2.00   1.290 |   5.00   4.520 |   8.00   3.880 |  11.00   1.290
              2.20   2.580 |   5.20   5.810 |   8.20   2.580 |  11.20   1.290
```

```
              2.40   2.580 |   5.40   8.400 |   8.40   2.580 |  11.40   1.290
              2.60   2.580 |   5.60  19.400 |   8.60   2.580 |  11.60   1.290
              2.80   2.580 |   5.80  42.300 |   8.80   2.580 |  11.80   1.290
              3.00   2.580 |   6.00  88.500 |   9.00   2.580 |  12.00   1.290

------------------------------------------------------------------------------------
010:0003----------------------------------------------------------------------------
*
*
*# FUTURE SITE PLAN AREA CONTROLLED BY ON-SITE SWM
---------------------
| CALIB STANDHYD     |   Area    (ha)=    1.94
| 01:201    DT= 5.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   55.00
---------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       1.34          .60
     Dep. Storage     (mm)=        .50         4.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      30.00        10.00
     Mannings n          =        .013         .025

     Max.eff.Inten.(mm/hr)=      88.50        41.68
                over (min)        6.00         6.00
     Storage Coeff.  (min)=       1.06 (ii)    2.15 (ii)
     Unit Hyd. Tpeak (min)=       6.00         6.00
     Unit Hyd. peak  (cms)=        .28          .27
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .26          .07           .332 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.00          6.000
     RUNOFF VOLUME    (mm)=      64.85        16.49         43.087
     TOTAL RAINFALL   (mm)=      65.35        65.35         65.348
     RUNOFF COEFFICIENT  =         .99          .25           .659
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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----------------------------------------------------------------------------
*# FUTURE DRIVEWAY AREA DRAINING UNCONTROLLED TO NEW KERMAN STORM SEWER
---------------------
| CALIB STANDHYD     |   Area    (ha)=     .08
| 02:202    DT= 5.00 |   Total Imp(%)=   62.00   Dir. Conn.(%)=   62.00
---------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .05          .03
     Dep. Storage     (mm)=        .50         4.00
     Average Slope     (%)=       2.00         2.00
     Length            (m)=      30.00        10.00
     Mannings n          =        .013         .025

     Max.eff.Inten.(mm/hr)=      88.50        20.93
                over (min)        6.00         6.00
     Storage Coeff.  (min)=       1.06 (ii)    2.50 (ii)
     Unit Hyd. Tpeak (min)=       6.00         6.00
```

```
     Unit Hyd. peak  (cms)=        .28          .26
                                                            *TOTALS*
     PEAK FLOW       (cms)=        .01          .00            .013 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.00           6.000
     RUNOFF VOLUME    (mm)=      64.85        11.93          44.741
     TOTAL RAINFALL   (mm)=      65.35        65.35          65.348
     RUNOFF COEFFICIENT   =        .99          .18            .685
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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----------------------------------------------------------------------------
----------------------
| ADD HYD (TOTAL     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
----------------------                   (ha)     (cms)   (hrs)   (mm)   (cms)
                     ID1 01:201           1.94      .332    6.00  43.09
                     .000
                    +ID2 02:202            .08      .013    6.00  44.74
                    .000
                     ==========================================================
                     SUM 05:TOTAL         2.02      .345    6.00  43.15
                     .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------------
010:0006----------------------------------------------------------------------------
* ROUTE FLOWS THROUGH ON-SITE TANK
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>05:(TOTAL )   |
| OUT<03:(TANK  )   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |   (cms)     (ha.m.)
                            .000  .0000E+00   |     .014  .3780E-01
                            .008  .0000E+00   |     .015  .4550E-01
                            .010  .7500E-02   |     .016  .5310E-01
                            .011  .1510E-01   |     .032  .6090E-01
                            .012  .2260E-01   |     .038  .6940E-01
                            .013  .3020E-01   |     .043  .7690E-01

     ROUTING RESULTS            AREA     QPEAK     TPEAK        R.V.
     --------------------       (ha)     (cms)     (hrs)        (mm)
     INFLOW >05: (TOTAL )       2.02      .345     6.000      43.150
     OUTFLOW<03: (TANK  )       2.02      .016     8.000      43.160
    OVERFLOW<04: (OFLTAN)        .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](%)=     4.565
```

```
                   TIME SHIFT OF PEAK FLOW         (min)=   120.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.4919E-01

-------------------------------------------------------------------------------------
010:0007-----------------------------------------------------------------------------
  ** END OF RUN :  99

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




--------------------
| START              |  Project  dir.:
C:\Users\JORESK~1\Desktop\SLAMIC~1\21048\
--------------------  Rainfall dir.:
C:\Users\JORESK~1\Desktop\SLAMIC~1\21048\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 100
    NSTORM=   1
           #  1=GSCS_100.stm
-------------------------------------------------------------------------------------
100:0002-----------------------------------------------------------------------------
*#*************************************************************************|
*#  Project Name: TARBUTT CONSTRUCTION
*#            GRIMBSBY, ONTARIO
*#  JOB NUMBER  : 21048
*#       Date   : UPDATED JULY
2021
*#    Company   : S. LLEWELLYN & ASSOICATES LIMITED
*#       File   : 21048-2.DAT
TEST
*#*************************************************************************|
*#
*#*************************************************************************|
*
*
-------------------------------------------------------------------------------------
100:0002-----------------------------------------------------------------------------
*
--------------------
| READ STORM        |    Filename: 100 YEAR SCS 12 HOUR - TOWN OF GRIMSBY
| Ptotal=  93.20 mm|    Comments: 100 YEAR SCS 12 HOUR - TOWN OF GRIMSBY
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .20   1.840 |   3.20   3.680 |   6.20  22.600 |   9.20   3.680
               .40   1.840 |   3.40   3.680 |   6.40  13.400 |   9.40   3.680
               .60   1.840 |   3.60   3.680 |   6.60   9.670 |   9.60   3.680
               .80   1.840 |   3.80   3.680 |   6.80   9.210 |   9.80   3.680
              1.00   1.840 |   4.00   3.680 |   7.00   6.450 |  10.00   3.680
              1.20   1.840 |   4.20   6.450 |   7.20   5.530 |  10.20   1.840
              1.40   1.840 |   4.40   6.450 |   7.40   5.530 |  10.40   1.840
              1.60   1.840 |   4.60   6.450 |   7.60   5.530 |  10.60   1.840
              1.80   1.840 |   4.80   6.450 |   7.80   5.530 |  10.80   1.840
              2.00   1.840 |   5.00   6.450 |   8.00   5.530 |  11.00   1.840
              2.20   3.680 |   5.20   8.290 |   8.20   3.680 |  11.20   1.840
```

```
              2.40    3.680 |    5.40  12.000 |    8.40    3.680 |   11.40    1.840
              2.60    3.680 |    5.60  27.600 |    8.60    3.680 |   11.60    1.840
              2.80    3.680 |    5.80  60.300 |    8.80    3.680 |   11.80    1.840
              3.00    3.680 |    6.00 126.200 |    9.00    3.680 |   12.00    1.840

-----------------------------------------------------------------------------------
100:0003---------------------------------------------------------------------------
*
*
*# FUTURE SITE PLAN AREA CONTROLLED BY ON-SITE SWM
----------------------
| CALIB STANDHYD     |   Area    (ha)=    1.94
| 01:201    DT= 5.00 |   Total Imp(%)=   69.00   Dir. Conn.(%)=   55.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        1.34          .60
     Dep. Storage     (mm)=         .50         4.00
     Average Slope     (%)=        2.00         2.00
     Length            (m)=       30.00        10.00
     Mannings n          =         .013         .025

     Max.eff.Inten.(mm/hr)=      126.20        77.34
                over (min)         6.00         6.00
     Storage Coeff.  (min)=         .92 (ii)    1.77 (ii)
     Unit Hyd. Tpeak (min)=        6.00         6.00
     Unit Hyd. peak  (cms)=         .28          .27
                                                            *TOTALS*
     PEAK FLOW       (cms)=         .37          .13           .503 (iii)
     TIME TO PEAK    (hrs)=        6.00         6.00          6.000
     RUNOFF VOLUME    (mm)=       92.70        30.82         64.857
     TOTAL RAINFALL   (mm)=       93.20        93.20         93.204
     RUNOFF COEFFICIENT  =          .99          .33           .696
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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---------------------------------------------------------------------------
*# FUTURE DRIVEWAY AREA DRAINING UNCONTROLLED TO NEW KERMAN STORM SEWER
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .08
| 02:202    DT= 5.00 |   Total Imp(%)=   62.00   Dir. Conn.(%)=   62.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=         .05          .03
     Dep. Storage     (mm)=         .50         4.00
     Average Slope     (%)=        2.00         2.00
     Length            (m)=       30.00        10.00
     Mannings n          =         .013         .025

     Max.eff.Inten.(mm/hr)=      126.20        40.37
                over (min)         6.00         6.00
     Storage Coeff.  (min)=         .92 (ii)    2.03 (ii)
     Unit Hyd. Tpeak (min)=        6.00         6.00
```

```
     Unit Hyd. peak  (cms)=        .28          .27
                                                       *TOTALS*
     PEAK FLOW       (cms)=        .02          .00          .020 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.00         6.000
     RUNOFF VOLUME    (mm)=      92.70        23.19        66.287
     TOTAL RAINFALL   (mm)=      93.20        93.20        93.204
     RUNOFF COEFFICIENT   =        .99          .25          .711
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  50.0    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----------------------------------------------------------------------------
------------------------
| ADD HYD (TOTAL     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
                    ID1 01:201            1.94      .503    6.00  64.86
                    .000
                   +ID2 02:202             .08      .020    6.00  66.29
                   .000
                    ==========================================================
                    SUM 05:TOTAL          2.02      .523    6.00  64.91
                    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------------
100:0006----------------------------------------------------------------------------
* ROUTE FLOWS THROUGH ON-SITE TANK
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  1.0 min.
|  IN>05:(TOTAL )   |
| OUT<03:(TANK  )   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   | OUTFLOW    STORAGE
                           (cms)     (ha.m.)  |   (cms)     (ha.m.)
                            .000  .0000E+00   |     .014  .3780E-01
                            .008  .0000E+00   |     .015  .4550E-01
                            .010  .7500E-02   |     .016  .5310E-01
                            .011  .1510E-01   |     .032  .6090E-01
                            .012  .2260E-01   |     .038  .6940E-01
                            .013  .3020E-01   |     .043  .7690E-01

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >05: (TOTAL )       2.02      .523     6.000     64.911
     OUTFLOW<03: (TANK  )       2.02      .041     6.650     64.921
    OVERFLOW<04: (OFLTAN)        .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](%)=    7.839
```

```
                    TIME SHIFT OF PEAK FLOW          (min)=    39.00
                    MAXIMUM  STORAGE   USED        (ha.m.)=.7337E-01

-------------------------------------------------------------------------------------
100:0007----------------------------------------------------------------------------
-------------------------------------------------------------------------------------
100:0002----------------------------------------------------------------------------
      FINISH
-------------------------------------------------------------------------------------
*************************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
 010:0003 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 010:0004 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 100:0003 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 100:0004 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
   Simulation ended on 2021-08-04     at 00:47:30
=====================================================================================
```

SILVER MAPLES SUBDIVISION
PHILIPS ENGINEERING (AUGUST 1999)

SILVER MAPLES SUBDIVISION - CATCHMENT 306

EXISTING
CONDITIONS
100-YEAR

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

   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       cF-102841600000

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  LICENSED TO: Philips Planning & Eng, Burlington

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


  Input   filename: EXIST.OTT
  Output  filename: EXIST.OUT
  Summary filename: EXIST.SUM


DATE: 06-24-1960                      TIME: 11:57:00

USER: ____________________________________________


COMMENTS: ____________________________________________________________


  ****************************
  ** 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
     ------------------
     READ STORM                     12.0
     [ Ptot= 93.19 mm ]
     fname :GRIM_SCS.100
     remark:100 Year SCS 12 hour  Town of Grimsby
     ------------------
  *  CALIB STANDHYD        1302  3   5.0     5.36      .56   6.00   41.51  .45     .000
     [I%=13.2:S%= 1.30]
     ------------------
     PRINT HYD             1302  3   5.0     5.36      .56   6.00   41.51  n/a     .000
     ------------------
  *  CALIB STANDHYD        1311  8   5.0    58.85     1.91   7.08   35.17  .38     .000
     [I%=  .1:S%= 5.00]
     ------------------
  *  CALIB STANDHYD        1303  2   5.0    25.99     1.77   6.00   46.42  .50     .000
     [I%=17.5:S%= 1.90]
     ------------------
     ADD [1311 + 1303]     0101  9   5.0    84.84     2.78   7.00   38.62  n/a     .000
     ------------------
     PRINT HYD             0101  9   5.0    84.84     2.78   7.00   38.62  n/a     .000
     ------------------
     ADD [0101 + 1302]     0102  1   5.0    90.20     2.87   7.00   38.79  n/a     .000
     ------------------
  *  CALIB STANDHYD        1375  3   5.0      .29      .10   6.00   89.32  .96     .000
     [I%=95.0:S%=  .40]
     ------------------
     PRINT HYD             1375  3   5.0      .29      .10   6.00   89.32  n/a     .000
     ------------------
  *  CALIB STANDHYD        0305  5   5.0      .52      .02   6.25   16.80  .18     .000
     [I%=  .1:S%= 1.45]
     ------------------
  *  CALIB STANDHYD        0306  6   5.0     2.37      .09   6.33   20.45  .22     .000
     [I%=  .1:S%= 1.45]
     ------------------
     ADD [0305 + 0306]     0903  7   5.0     2.89      .10   6.25   19.80  n/a     .000
```

Existing conditions
100-yr flow from
Catchment 306 = 90 l/s

SILVER MAPLES SUBDIVISION - CATCHMENT 306

EXISTING CONDITIONS 10-YEAR

```
  ------------------
* CALIB STANDHYD      1302  3  5.0    5.36    .28  6.00  24.20  .37    .000
  [I%=13.2:S%= 1.30]
  ------------------
  PRINT HYD           1302  3  5.0    5.36    .28  6.00  24.20  n/a    .000
  ------------------
* CALIB STANDHYD      1311  8  5.0   58.85    .84  7.33  18.87  .29    .000
  [I%=  .1:S%= 5.00]
  ------------------
* CALIB STANDHYD      1303  2  5.0   25.99   1.13  6.00  27.73  .42    .000
  [I%=17.5:S%= 1.90]
  ------------------
  ADD [1311 + 1303]   0101  9  5.0   84.84   1.28  6.00  21.58  n/a    .000
  ------------------
  PRINT HYD           0101  9  5.0   84.84   1.28  6.00  21.58  n/a    .000
  ------------------
  ADD [0101 + 1302]   0102  1  5.0   90.20   1.56  6.00  21.74  n/a    .000
  ------------------
* CALIB STANDHYD      1375  3  5.0     .29    .07  6.00  62.14  .95    .000
  [I%=95.0:S%=  .40]
  ------------------
  PRINT HYD           1375  3  5.0     .29    .07  6.00  62.14  n/a    .000
  ------------------
* CALIB STANDHYD      0305  5  5.0     .52    .01  6.42   7.16  .11    .000
  [I%=  .1:S%= 1.45]
  ------------------
* CALIB STANDHYD      0306  6  5.0    2.37    .03  6.58   9.25  .14    .000
  [I%=  .1:S%= 1.45]
  ------------------
  ADD [0305 + 0306]   0903  7  5.0    2.89    .03  6.58   8.87  n/a    .000
  ------------------
* CALIB STANDHYD      1374  4  5.0    1.32    .19  6.00  43.62  .67    .000
  [I%=55.0:S%= 2.00]
  ------------------
  ADD [0903 + 1374]   0103  5  5.0    4.21    .20  6.00  19.77  n/a    .000
  ------------------
  PRINT HYD           0103  5  5.0    4.21    .20  6.00  19.77  n/a    .000
  ------------------
  ADD [1375 + 0103]   0104  2  5.0    4.50    .27  6.00  22.50  n/a    .000
  ------------------
* CALIB STANDHYD      3031  5  5.0     .54    .02  6.00  12.92  .20    .000
  [I%=11.0:S%= 1.45]
  ------------------
* CALIB STANDHYD      3032  6  5.0    2.12    .05  6.00  11.49  .18    .000
  [I%= 8.5:S%= 1.45]
  ------------------
  ADD [3031 + 3032]   0902  7  5.0    2.66    .06  6.00  11.78  n/a    .000
  ------------------
* CALIB STANDHYD      1373  3  5.0    3.07    .36  6.00  39.00  .60    .000
  [I%=47.0:S%= 2.00]
  ------------------
  ADD [0902 + 1373]   0105  4  5.0    5.73    .43  6.00  26.36  n/a    .000
  ------------------
  PRINT HYD           0105  4  5.0    5.73    .43  6.00  26.36  n/a    .000
  ------------------
  ADD [0104 + 0105]   0106  3  5.0   10.23    .69  6.00  24.66  n/a    .000
  ------------------
* CALIB STANDHYD      3012  5  5.0     .86    .02  6.25  12.60  .19    .000
  [I%=  .1:S%= 1.45]
  ------------------
* CALIB STANDHYD      3021  7  5.0    1.52    .01  6.58   7.67  .12    .000
  [I%=  .1:S%= 1.45]
  ------------------
* CALIB STANDHYD      3022  8  5.0    2.27    .02  6.58   7.67  .12    .000
  [I%=  .1:S%= 2.10]
  ------------------
  ADD [3021 + 3022]   0302  6  5.0    3.79    .03  6.58   7.67  n/a    .000
  ------------------
* CALIB STANDHYD      0304  7  5.0    1.54    .03  6.42  10.44  .16    .000
  [I%=  .1:S%= 1.45]
  ------------------
```

Existing conditions
10-yr flow from
Catchment 306 = 30 l/s

SILVER MAPLES SUBDIVISION - SUMAC COURT
PHILIPS ENGINEERING (AUGUST 1999)

SILVER MAPLES SUBDIVISION - SUMAC SWM CONTROL INPUT MODEL (OTTHYMO)

```
    flow from Blessed Trinity subareas to subcatchment 1373
   HYD                         ID= 4  NHYD= 105  IDI= 7  IDII= 3

* flow from subcatchment 1373 (into Manhole 108)
PRINT HYD                      ID= 4

* total flow at Manhole 108
ADD HYD                        ID= 3  NHYD= 106  IDI= 2   IDII= 4

*    * Subcatchment 301.2 - west portion, drains to Outlet 1.2
*                         - FUTURE DEVELOPMENT AREA
*                         - ACCESS ROAD, VISITOR PARKING, DELIVERY

CALIB STANDHYD          ID= 5 NHYD= 3012 DT=5 min AREA= 0.86 ha
                        XIMP =.001 TIMP= .370 DWF= 0.0 LOSS= 2
                        CN=48.74
                        DPSP=20.04 SLPP=1.45  LGP= 60.10  MNP=.20  SCP=0.0
                        DPSI= 0.8  SLPI=1.00  LGI= 46.06  MNI=.035 SCI=0.0
                        END= -1

*
* SUBCATCHMENT 302 - south of site, take through swale to west limit
*                  - drains to Outlet 1.2
*
* External Drainage Area West of Development--To be routed
CALIB STANDHYD          ID= 7 NHYD= 3021 DT=5 min AREA= 1.520 ha
                        XIMP =.001 TIMP= .089 DWF= 0.0 LOSS= 2
                        CN=48.74
                        DPSP=20.04 SLPP=1.45  LGP= 96.08  MNP=.20  SCP=0.0
                        DPSI= 0.8  SLPI=1.00  LGI= 30.03  MNI=.035 SCI=0.0
                        END= -1

* Drainage From Site
CALIB STANDHYD          ID= 8 NHYD= 3022 DT=5 min AREA=  2.27 ha
                        XIMP =.172 TIMP= .341 DWF= 0.0 LOSS= 2
                        CN=48.74
                        DPSP=20.04 SLPP=2.10  LGP= 99.86  MNP=.20  SCP=0.0
                        DPSI= 0.8  SLPI=1.00  LGI= 71.84  MNI=.035 SCI=0.0
                        END= -1
*
* Divide hydrograph for major and minor flows
COMPUTE DUHYD           ID=8  NHYD= 3023  CINLET=0.07  NINLET=1
                        MAJID=4  MINID=2
*
* Route major flows through street "reservoir"
ROUTE RESERVOIR         ID= 9 NHYD= 3024 IDIN= 4  DT=5
                           Q(cms)     STORAGE(ha m)
                           0.000         0.0000
                           0.010         0.0023
                           0.030         0.0047
                           0.050         0.0070
                           -1
*
* Route minor id through sewer storage
ROUTE RESERVOIR         ID= 8 NHYD= 3025 IDIN= 2  DT=5
                           Q(cms)     STORAGE(ha m)
                           0.000         0.0000
                           0.032         0.0238
                           0.038         0.0257
                           -1
*
* Total flows from site
ADD HYD                 ID= 2  NHYD= 3026  IDI= 8   IDII= 9
*
* Total Flows from 302
ADD HYD                 ID= 6  NHYD= 302   IDI= 7   IDII= 2
*
* SUBCATCHMENT 304 - take to west now
*
CALIB STANDHYD          ID= 7 NHYD= 304 DT=5 min AREA=  1.54 ha
```

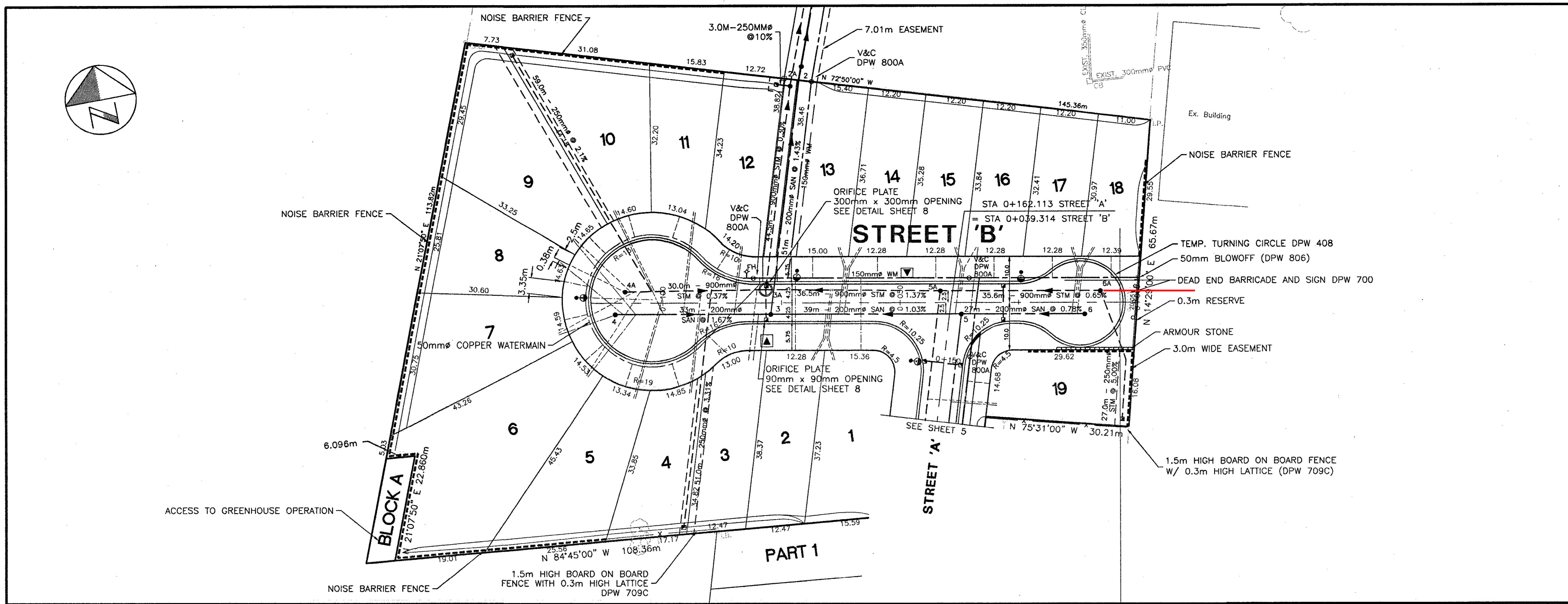
swale

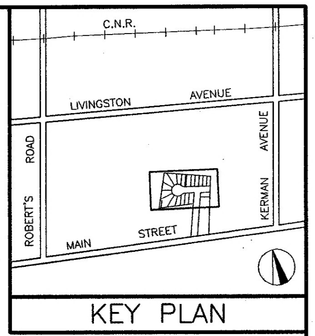
1.95 + 0.42 ha

storage for silver maples

Original Sumac Court SWM modeling of surface and underground storage

SD-YOI-56 F





KEY PLAN

LEGEND

PLAN

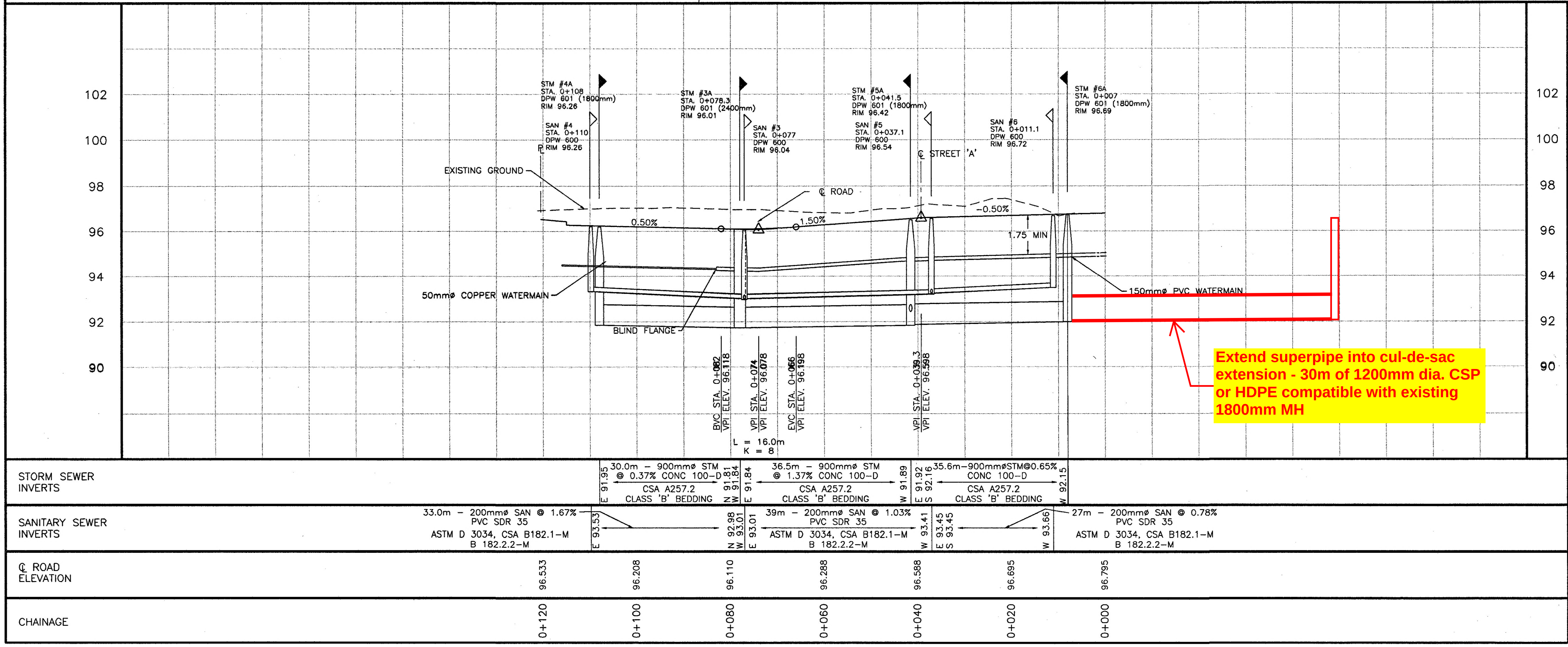
STORM SEWER	– – – – – – – – – –
SANITARY SEWER	——— – – ———
WATERMAIN	——— - ——— - ———
STORM SERVICE	- - - - - - - - - - - -
SANITARY SERVICE	————————
WATER SERVICE	—·—·—·—·—
STREETLIGHT	•◐
TRANSFORMER	▲
NOISE BARRIER FENCE	▪▪▪▪▪▪▪▪▪▪

NOTES

1. SINGLE CB LEAD 250ø PVC.
2. RLCB GRATE TO BE PYRAMID TYPE (DPW 627)
3. PAVEMENT DIMENSIONS:
   EP–EP: 8.0m
   EP–GUTTER: 0.25m
   TOTAL ROAD WIDTH: 8.5m

BENCHMARK

BENCHMARK #1 Elev.101.299
The South nut on top flange of fire hydrant
on North side of Main Street.



Extend superpipe into cul-de-sac extension - 30m of 1200mm dia. CSP or HDPE compatible with existing 1800mm MH

6	10/01	KJS	AS CONSTRUCTED		X
5	09/01	JC	RESOLUTION: PW01–69 SIDEWALK REMOVED		X
4	03/00	JFB	ADJUST NOISE WALL LOCATIONS & HEIGHTS		X
3	10/99	JFB	2nd SUBMISSION COMMENTS		X
2	09/99	JFB	SAN SEW.&MAIN ST. ACCESS		X
1	09/99	JFB	FIRST SUBMISSION COMMENTS		X
Nº	Date	By	REVISIONS	MANU	CAD

Design	C.A.T.	Ch'kd	J.F.B.
Drawn	J.P.E.	Ch'kd	C.A.T.

Date
AUGUST 1999

Scale
Horiz. 1:500 (0 5 10 20)
Vert. 1:100 (0 1 2 4)

References

APPROVALS
APPROVED FOR CONSTRUCTION

Director of Public Works

Field Notes

Regional

Stamp

Philips Planning + Engineering Limited

SILVER MAPLES SUBDIVISION
THORNWOOD HOMES
TOWN OF GRIMSBY

TITLE

PLAN & PROFILE
STREET 'B'
STA 0+000–STA 0+116

Consultant File Nº 99047

Regional Drawing Nº

CONTRACT Nº

Drawing Nº SHEET 6 OF 11

G:\WORK\99047\HWY\DWG\AS_CONSTRUCTED\99047-06.DWG

JAN 8/02 – B.G.N

```
2     Metric units
*#****************************************************************************|
*#  Project Name: TARBUTT CONSTRUCTION
*#            GRIMBSBY, ONTARIO
*#  JOB NUMBER  : 21048
*#       Date   : UPDATED JULY 2021
*#    Company   : S. LLEWELLYN & ASSOCIATES LIMITED
*#       File   :
SUMAC.DAT
*#****************************************************************************|
*#
*#****************************************************************************|
*
*
START               TZERO=0.0 hrs  METRIC=2  NSTORM=1  NRUN=010
                    GSCS_010.stm
*
READ STORM          STORM_FILENAME "STORM.001"
*
*# 5 Year 12 hour SCS
*MASS STORM            PTOTAL=[56.502](mm), CSDT=[ 10 ](min),
*                      CURVE_FILENAME=["5.mst "]
*
*# 100 Year 12 hour SCS
*#MASS STORM            PTOTAL=[ 93.19 ](mm), CSDT=[ 10 ](min),
*#                   CURVE_FILENAME=["100.mst "]

*
*##############################################################
*###                 SUMAC COURT                            ##
*###  ORIGINAL MODEL PER PHIIPS - SILVER MAPLES SUBDIVISION  ##
*###                                                        ##
*##############################################################
*
*%-----------------|-----------------------------------------------------------|
*# SILVER MAPLES - FUTURE SITE PLAN AREA CONTROLLED BY ON-SITE SWM
CALIB STANDHYD      ID= 8 NHYD=["3022"], DT=[5], AREA=[2.27],
                    XIMP=[0.172], TIMP=[0.341], DWF=[0](cms), LOSS=[2],
                    SCS curve number CN=[48.75],
                    Pervious   surfaces: IAper=[20.04](mm), SLPP=[2.10](%),
                                         LGP=[99.86](m), MNP=[0.20], SCP=[0](min),
                    Impervious surfaces: IAimp=[0.8](mm), SLPI=[1.0](%),
                                         LGI=[71.84](m), MNI=[0.035], SCI=[0](min),
                    RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|
*# DIVIDE HYDROGRPAH FOR MAJOR AND MINOR FLOWS
COMPUTE DUALHYD     IDin=[8], CINLET=[0.07](cms), NINLET=[1],
                    MAJID=[4], MajNHYD=["MAJ"],
                    MINID=[2], MinNHYD=["MIN"],
                    TMJSTO=[0](cu-m)
*%-----------------|-----------------------------------------------------------|
*# ROUTE MAJOR FLOWS THROUGH STREET RESERVOIR
ROUTE RESERVOIR     IDout=[9],   NHYD=["STREET"],  IDin=[4],
                    RDT=[5](min),
                          TABLE of ( OUTFLOW-STORAGE ) values
                                      (cms) - (ha-m)
  0.0000    0.0000
  0.010 0.0023
  0.030 0.0047
```

```
  0.050 0.0070
                                  -1      -1   (max twenty pts)
                         IDovf=[1], NHYDovf=["OFLSTR"]
*%-----------------|-----------------------------------------------------------|
*# ROUTE MINOR FLOWS THROUGH SEWER STORAGE
ROUTE RESERVOIR      IDout=[8],   NHYD=["PIPES"],  IDin=[2],
                     RDT=[5](min),
                           TABLE of ( OUTFLOW-STORAGE ) values
                                     (cms) - (ha-m)
  0.0000    0.0000
  0.032 0.0238
  0.038 0.0257
                                  -1      -1   (max twenty pts)
                         IDovf=[3], NHYDovf=["OFLPIP"]
*%-----------------|-----------------------------------------------------------|
*# TOTAL FLOW FROM SITE
ADD HYD              IDsum=[2], NHYD=["TOTAL"], IDs to add=[8 9]
*%-----------------|-----------------------------------------------------------|
*
*
*
*###############################################################
*###                    SUMAC COURT                          ##
*###  MODEL REVISED TO INCLUDE PROPOSED CUL-DE-SAC EXTENSION ##
*###                                                         ##
*###############################################################
*
*%-----------------|-----------------------------------------------------------|
*# SILVER MAPLES - FUTURE SITE PLAN AREA CONTROLLED BY ON-SITE SWM
CALIB STANDHYD       ID= 8 NHYD=["3022"], DT=[5], AREA=[2.27],
                     XIMP=[0.172], TIMP=[0.341], DWF=[0](cms), LOSS=[2],
                     SCS curve number CN=[48.75],
                     Pervious   surfaces: IAper=[20.04](mm), SLPP=[2.10](%),
                                          LGP=[99.86](m), MNP=[0.20], SCP=[0](min),
                     Impervious surfaces: IAimp=[0.8](mm), SLPI=[1.0](%),
                                          LGI=[71.84](m), MNI=[0.035], SCI=[0](min),
                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|
*# DIVIDE HYDROGRPAH FOR MAJOR AND MINOR FLOWS
COMPUTE DUALHYD      IDin=[8], CINLET=[0.07](cms), NINLET=[1],
                     MAJID=[4], MajNHYD=["MAJ"],
                     MINID=[2], MinNHYD=["MIN"],
                     TMJSTO=[0](cu-m)
*%-----------------|-----------------------------------------------------------|
*# FUTURE CUL-DE-SAC EXPANSION ON PROPOSED LANDS
CALIB STANDHYD       ID= 9 NHYD=["401"], DT=[5], AREA=[0.168],
                     XIMP=[0.70], TIMP=[0.70], DWF=[0](cms), LOSS=[2],
                     SCS curve number CN=[48.75],
                     Pervious   surfaces: IAper=[20.04](mm), SLPP=[2.0](%),
                                          LGP=[5](m), MNP=[0.20], SCP=[0](min),
                     Impervious surfaces: IAimp=[0.8](mm), SLPI=[1.0](%),
                                          LGI=[40](m), MNI=[0.035], SCI=[0](min),
                     RAINFALL=[ ,  ,  ,  , ](mm/hr) ,  END=-1
*%-----------------|-----------------------------------------------------------|
*# TOTAL FLOW DIRECTED TO UNDERGROUND SYSTEM
*# = MINOR FLOW FROM SILVER MAPLE + ALL FLOWS FROM CUL-DE-SAC (TOTAL CAPTURE)
ADD HYD              IDsum=[10], NHYD=["TOTAL"], IDs to add=[2 9]
*%-----------------|-----------------------------------------------------------|
*# ROUTE MAJOR FLOWS THROUGH STREET RESERVOIR
```

```
ROUTE RESERVOIR     IDout=[9],   NHYD=["STREET"],  IDin=[4],
                    RDT=[5](min),
                          TABLE of ( OUTFLOW-STORAGE ) values
                                      (cms) - (ha-m)
  0.0000    0.0000
  0.010 0.0023
  0.030 0.0047
  0.050 0.0070
                                        -1      -1   (max twenty pts)
                          IDovf=[1], NHYDovf=["OFLSTR"]
*%-----------------|-----------------------------------------------------------|
*# ROUTE MINOR FLOWS THROUGH SEWER STORAGE
*# ADDITIONAL 35M3 OF PIPE STORAGE PROVIDED
ROUTE RESERVOIR     IDout=[8],   NHYD=["PIPES"],  IDin=[10],
                    RDT=[5](min),
                          TABLE of ( OUTFLOW-STORAGE ) values
                                      (cms) - (ha-m)
  0.0000    0.0000
  0.032 0.0238
  0.038 0.0292
                                        -1      -1   (max twenty pts)
                          IDovf=[3], NHYDovf=["OFLPIP"]
*%-----------------|-----------------------------------------------------------|
*# TOTAL FLOW FROM SITE
ADD HYD             IDsum=[2], NHYD=["TOTAL"], IDs to add=[8 9]
*%-----------------|-----------------------------------------------------------|
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[100]
                    GSCS_100.stm

FINISH
```

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

   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                +++++++++
 +++++++++               in any City          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: 2021-08-04     TIME: 18:29:57     RUN COUNTER: 000211         *
 *******************************************************************************
 * Input   filename: C:\Users\JORESK~1\Desktop\SLAMIC~1\21048\Sumac.dat        *
 * Output  filename: C:\Users\JORESK~1\Desktop\SLAMIC~1\21048\Sumac.out        *
 * Summary filename: C:\Users\JORESK~1\Desktop\SLAMIC~1\21048\Sumac.sum        *
 * User comments:                                                              *
 * 1:__________________________________________________________________________*
 * 2:__________________________________________________________________________*
 * 3:__________________________________________________________________________*
 *******************************************************************************

-------------------------------------------------------------------------------------
001:0001-----------------------------------------------------------------------------
*#*************************************************************************|
*#  Project Name: TARBUTT CONSTRUCTION
*#            GRIMBSBY, ONTARIO
*#  JOB NUMBER  : 21048
*#       Date   : UPDATED JULY
2021
*#    Company   : S. LLEWELLYN & ASSOCIATES LIMITED
*#       File   :
SUMAC.DAT
```

```
*#*****************************************************************************|
*#
*#*****************************************************************************|
*
*
  ** END OF RUN :   9

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





--------------------
| START             |  Project  dir.:
C:\Users\JORESK~1\Desktop\SLAMIC~1\21048\
--------------------  Rainfall dir.:
C:\Users\JORESK~1\Desktop\SLAMIC~1\21048\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 010
    NSTORM=   1
           #  1=GSCS_010.stm
--------------------------------------------------------------------------------------
010:0002------------------------------------------------------------------------------
*#*****************************************************************************|
*#  Project Name: TARBUTT CONSTRUCTION
*#            GRIMBSBY, ONTARIO
*#  JOB NUMBER  : 21048
*#       Date   : UPDATED JULY
2021
*#    Company   : S. LLEWELLYN & ASSOCIATES LIMITED
*#       File   :
SUMAC.DAT
*#*****************************************************************************|
*#
*#*****************************************************************************|
*
*
--------------------------------------------------------------------------------------
010:0002------------------------------------------------------------------------------
*
--------------------
| READ STORM        |    Filename: 10 YEAR SCS 12 HOUR - TOWN OF GRIMSBY
| Ptotal=  65.35 mm|    Comments: 10 YEAR SCS 12 HOUR - TOWN OF GRIMSBY
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .20   1.290 |   3.20   2.580 |   6.20  15.800 |   9.20   2.580
               .40   1.290 |   3.40   2.580 |   6.40   9.370 |   9.40   2.580
               .60   1.290 |   3.60   2.580 |   6.60   6.780 |   9.60   2.580
               .80   1.290 |   3.80   2.580 |   6.80   6.460 |   9.80   2.580
              1.00   1.290 |   4.00   2.580 |   7.00   4.520 |  10.00   2.580
              1.20   1.290 |   4.20   4.520 |   7.20   3.880 |  10.20   1.290
              1.40   1.290 |   4.40   4.520 |   7.40   3.880 |  10.40   1.290
              1.60   1.290 |   4.60   4.520 |   7.60   3.880 |  10.60   1.290
              1.80   1.290 |   4.80   4.520 |   7.80   3.880 |  10.80   1.290
              2.00   1.290 |   5.00   4.520 |   8.00   3.880 |  11.00   1.290
              2.20   2.580 |   5.20   5.810 |   8.20   2.580 |  11.20   1.290
```

```
              2.40   2.580 |   5.40   8.400 |   8.40   2.580 |  11.40   1.290
              2.60   2.580 |   5.60  19.400 |   8.60   2.580 |  11.60   1.290
              2.80   2.580 |   5.80  42.300 |   8.80   2.580 |  11.80   1.290
              3.00   2.580 |   6.00  88.500 |   9.00   2.580 |  12.00   1.290

--------------------------------------------------------------------------------
010:0003------------------------------------------------------------------------
*
*# 5 Year 12 hour SCS
*MASS STORM            PTOTAL=[56.502](mm), CSDT=[ 10 ](min),
*                      CURVE_FILENAME=["5.mst "]
*
*# 100 Year 12 hour SCS
*#MASS STORM            PTOTAL=[ 93.19 ](mm), CSDT=[ 10 ](min),
*#                    CURVE_FILENAME=["100.mst "]
*
*###########################################################
*###                 SUMAC COURT                        ##
*###  ORIGINAL MODEL PER PHIIPS - SILVER MAPLES SUBDIVISION  ##
*###                                                    ##
*###########################################################
*
*# SILVER MAPLES - FUTURE SITE PLAN AREA CONTROLLED BY ON-SITE SWM
----------------------
| CALIB STANDHYD     |   Area    (ha)=    2.27
| 08:3022   DT= 5.00 |   Total Imp(%)=   34.10   Dir. Conn.(%)=   17.20
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=         .77         1.50
     Dep. Storage     (mm)=         .80        20.04
     Average Slope     (%)=        1.00         2.10
     Length            (m)=       71.84        99.86
     Mannings n          =        .035         .200

     Max.eff.Inten.(mm/hr)=       88.50        10.14
               over (min)         6.00        30.00
     Storage Coeff.  (min)=        3.99 (ii)    30.30 (ii)
     Unit Hyd. Tpeak (min)=        6.00        30.00
     Unit Hyd. peak  (cms)=         .22          .04
                                                            *TOTALS*
     PEAK FLOW       (cms)=         .09          .03           .102 (iii)
     TIME TO PEAK    (hrs)=        6.00         6.40          6.000
     RUNOFF VOLUME    (mm)=       64.55         9.32         18.816
     TOTAL RAINFALL   (mm)=       65.35        65.35         65.348
     RUNOFF COEFFICIENT   =         .99          .14           .288
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  48.8    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------------------------------------------------------------------------
*# DIVIDE HYDROGRPAH FOR MAJOR AND MINOR FLOWS
----------------------
| COMPUTE DUALHYD    |   Average inlet capacities   [CINLET] =    .070  (cms)
```

```
| TotalHyd 08:3022   |   Number of inlets in system [NINLET] =       1
----------------------   Total minor system capacity         =    .070  (cms)
                         Total major system storage [TMJSTO] =      0.(cu.m.)

             ID: NHYD        AREA     QPEAK     TPEAK     R.V.      DWF
                             (ha)     (cms)     (hrs)     (mm)    (cms)
    TOTAL HYD.   08:3022     2.27      .102     6.000   18.816     .000
    ====================================================================
    MAJOR SYST   04:MAJ       .10      .032     6.000   18.816     .000
    MINOR SYST   02:MIN      2.17      .070     5.900   18.816     .000

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------
010:0005-----------------------------------------------------------------
*# ROUTE MAJOR FLOWS THROUGH STREET RESERVOIR
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  5.0 min.
|  IN>04:(MAJ   )   |
| OUT<09:(STREET)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE  | OUTFLOW    STORAGE
                           (cms)    (ha.m.)  |   (cms)    (ha.m.)
                            .000  .0000E+00  |     .030  .4700E-02
                            .010  .2300E-02  |     .050  .7000E-02

    ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
    --------------------       (ha)     (cms)     (hrs)       (mm)
    INFLOW >04: (MAJ   )        .10      .032     6.000     18.816
    OUTFLOW<09: (STREET)        .10      .006     6.100     18.816
   OVERFLOW<01: (OFLSTR)        .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](%)=   20.033
                  TIME SHIFT OF PEAK FLOW         (min)=     6.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.1588E-02

-------------------------------------------------------------------------
010:0006-----------------------------------------------------------------
*# ROUTE MINOR FLOWS THROUGH SEWER STORAGE
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  5.0 min.
|  IN>02:(MIN   )   |
| OUT<08:(PIPES )   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE  | OUTFLOW    STORAGE
                           (cms)    (ha.m.)  |   (cms)    (ha.m.)
                            .000  .0000E+00  |     .038  .2570E-01
                            .032  .2380E-01  |     .000  .0000E+00

    ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
    --------------------       (ha)     (cms)     (hrs)       (mm)
    INFLOW >02: (MIN   )       2.17      .070     5.900     18.816
    OUTFLOW<08: (PIPES )       2.17      .021     7.000     18.816
   OVERFLOW<03: (OFLPIP)        .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](%)=   29.501
                    TIME SHIFT OF PEAK FLOW         (min)=    66.00
                    MAXIMUM  STORAGE   USED       (ha.m.)=.1537E-01

--------------------------------------------------------------------------------
010:0007------------------------------------------------------------------------
*# TOTAL FLOW FROM SITE
------------------------
| ADD HYD (TOTAL     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
                      ID1 08:PIPES         2.17     .021    7.00  18.82
                      .000
                     +ID2 09:STREET         .10     .006    6.10  18.82
                     .000
                      ==========================================================
                      SUM 02:TOTAL         2.27     .023    6.60  18.82
                      .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
010:0008------------------------------------------------------------------------
*
*
*
*###############################################################
*###                    SUMAC COURT                          ##
*###  MODEL REVISED TO INCLUDE PROPOSED CUL-DE-SAC EXTENSION ##
*###                                                         ##
*###############################################################
*
*# SILVER MAPLES - FUTURE SITE PLAN AREA CONTROLLED BY ON-SITE SWM
----------------------
| CALIB STANDHYD     |   Area    (ha)=    2.27
| 08:3022   DT= 5.00 |   Total Imp(%)=   34.10   Dir. Conn.(%)=   17.20
----------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .77         1.50
     Dep. Storage     (mm)=        .80        20.04
     Average Slope     (%)=       1.00         2.10
     Length            (m)=      71.84        99.86
     Mannings n           =       .035         .200

     Max.eff.Inten.(mm/hr)=      88.50        10.14
                over (min)        6.00        30.00
     Storage Coeff.  (min)=       3.99 (ii)   30.30 (ii)
     Unit Hyd. Tpeak (min)=       6.00        30.00
     Unit Hyd. peak  (cms)=        .22          .04
                                                             *TOTALS*
     PEAK FLOW       (cms)=        .09          .03            .102 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.40           6.000
     RUNOFF VOLUME    (mm)=      64.55         9.32          18.816
     TOTAL RAINFALL   (mm)=      65.35        65.35          65.348
     RUNOFF COEFFICIENT   =        .99          .14            .288
      *** WARNING: Storage Coefficient is smaller than DT!
```

```
                  Use a smaller DT or a larger area.

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  48.8    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.

-------------------------------------------------------------------------
010:0009-----------------------------------------------------------------
*# DIVIDE HYDROGRPAH FOR MAJOR AND MINOR FLOWS
----------------------
| COMPUTE DUALHYD    |   Average inlet capacities   [CINLET] =    .070  (cms)
| TotalHyd 08:3022   |   Number of inlets in system [NINLET] =      1
----------------------   Total minor system capacity         =    .070  (cms)
                         Total major system storage [TMJSTO] =      0.(cu.m.)

               ID: NHYD        AREA     QPEAK     TPEAK     R.V.      DWF
                               (ha)     (cms)     (hrs)     (mm)     (cms)
     TOTAL HYD.   08:3022      2.27      .102     6.000   18.816     .000
     ====================================================================
     MAJOR SYST   04:MAJ        .10      .032     6.000   18.816     .000
     MINOR SYST   02:MIN       2.17      .070     5.900   18.816     .000

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------
010:0010-----------------------------------------------------------------
*# FUTURE CUL-DE-SAC EXPANSION ON PROPOSED LANDS
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .17
| 09:401    DT= 5.00 |   Total Imp(%)=   70.00   Dir. Conn.(%)=   70.00
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        .12          .05
     Dep. Storage     (mm)=        .80        20.04
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      40.00         5.00
     Mannings n           =       .035         .200

     Max.eff.Inten.(mm/hr)=      88.50        12.25
               over (min)         6.00         6.00
     Storage Coeff.  (min)=       2.80 (ii)    6.91 (ii)
     Unit Hyd. Tpeak (min)=       6.00         6.00
     Unit Hyd. peak  (cms)=        .25          .16
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .03          .00           .030 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.00          6.000
     RUNOFF VOLUME    (mm)=      64.55         6.57         47.155
     TOTAL RAINFALL   (mm)=      65.35        65.35         65.348
     RUNOFF COEFFICIENT   =        .99          .10           .722
      *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.

        (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  48.8    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.
```

```
---------------------------------------------------------------------------------
010:0011-------------------------------------------------------------------------
*# TOTAL FLOW DIRECTED TO UNDERGROUND SYSTEM
*# = MINOR FLOW FROM SILVER MAPLE + ALL FLOWS FROM CUL-DE-SAC (TOTAL CAPTURE)
------------------------
| ADD HYD (TOTAL     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
                    ID1 02:MIN            2.17      .070    5.90  18.82
                    .000
                   +ID2 09:401             .17      .030    6.00  47.16
                   .000
                    ======================================================
                    SUM 10:TOTAL          2.34      .100    6.00  20.85
                    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

---------------------------------------------------------------------------------
010:0012-------------------------------------------------------------------------
*# ROUTE MAJOR FLOWS THROUGH STREET RESERVOIR
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  5.0 min.
|  IN>04:(MAJ   )   |
| OUT<09:(STREET)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |     .030  .4700E-02
                            .010  .2300E-02   |     .050  .7000E-02

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >04: (MAJ   )        .10      .032     6.000     18.816
     OUTFLOW<09: (STREET)        .10      .006     6.100     18.816
    OVERFLOW<01: (OFLSTR)        .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](%)=   20.033
                   TIME SHIFT OF PEAK FLOW         (min)=     6.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.1588E-02

---------------------------------------------------------------------------------
010:0013-------------------------------------------------------------------------
*# ROUTE MINOR FLOWS THROUGH SEWER STORAGE
*# ADDITIONAL 35M3 OF PIPE STORAGE PROVIDED
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  5.0 min.
|  IN>10:(TOTAL )   |
| OUT<08:(PIPES )   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |     .038  .2920E-01
                            .032  .2380E-01   |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
```

```
     --------------------        (ha)      (cms)      (hrs)        (mm)
     INFLOW >10: (TOTAL )        2.34       .100      6.000      20.849
     OUTFLOW<08: (PIPES )        2.34       .025      6.900      20.849
    OVERFLOW<03: (OFLPIP)         .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](%)=   25.253
                   TIME SHIFT OF PEAK FLOW         (min)=    54.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.1881E-01

--------------------------------------------------------------------------------
010:0014------------------------------------------------------------------------
*# TOTAL FLOW FROM SITE
------------------------
| ADD HYD (TOTAL     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
                     ID1 08:PIPES          2.34     .025    6.90  20.85
                     .000
                    +ID2 09:STREET          .10     .006    6.10  18.82
                    .000
                     ===========================================================
                     SUM 02:TOTAL          2.44     .028    6.50  20.77
                     .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
010:0015------------------------------------------------------------------------
  ** END OF RUN :  99

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




--------------------
| START            |  Project  dir.:
C:\Users\JORESK~1\Desktop\SLAMIC~1\21048\
--------------------  Rainfall dir.:
C:\Users\JORESK~1\Desktop\SLAMIC~1\21048\
    TZERO =   .00 hrs on        0
    METOUT=   2 (output = METRIC)
    NRUN  = 100
    NSTORM=   1
           #  1=GSCS_100.stm
--------------------------------------------------------------------------------
100:0002------------------------------------------------------------------------
*#*************************************************************************|
*#  Project Name: TARBUTT CONSTRUCTION
*#            GRIMBSBY, ONTARIO
*#  JOB NUMBER  : 21048
*#       Date   : UPDATED JULY
2021
*#    Company   : S. LLEWELLYN & ASSOCIATES LIMITED
```

```
*#       File   :
SUMAC.DAT
*#***********************************************************************|
*#
*#***********************************************************************|
*
*
-------------------------------------------------------------------------------
100:0002-----------------------------------------------------------------------
*
--------------------
| READ STORM        |    Filename: 100 YEAR SCS 12 HOUR - TOWN OF GRIMSBY
| Ptotal=  93.20 mm|    Comments: 100 YEAR SCS 12 HOUR - TOWN OF GRIMSBY
--------------------
              TIME    RAIN |   TIME    RAIN |   TIME    RAIN |   TIME    RAIN
               hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr |    hrs   mm/hr
               .20   1.840 |   3.20   3.680 |   6.20  22.600 |   9.20   3.680
               .40   1.840 |   3.40   3.680 |   6.40  13.400 |   9.40   3.680
               .60   1.840 |   3.60   3.680 |   6.60   9.670 |   9.60   3.680
               .80   1.840 |   3.80   3.680 |   6.80   9.210 |   9.80   3.680
              1.00   1.840 |   4.00   3.680 |   7.00   6.450 |  10.00   3.680
              1.20   1.840 |   4.20   6.450 |   7.20   5.530 |  10.20   1.840
              1.40   1.840 |   4.40   6.450 |   7.40   5.530 |  10.40   1.840
              1.60   1.840 |   4.60   6.450 |   7.60   5.530 |  10.60   1.840
              1.80   1.840 |   4.80   6.450 |   7.80   5.530 |  10.80   1.840
              2.00   1.840 |   5.00   6.450 |   8.00   5.530 |  11.00   1.840
              2.20   3.680 |   5.20   8.290 |   8.20   3.680 |  11.20   1.840
              2.40   3.680 |   5.40  12.000 |   8.40   3.680 |  11.40   1.840
              2.60   3.680 |   5.60  27.600 |   8.60   3.680 |  11.60   1.840
              2.80   3.680 |   5.80  60.300 |   8.80   3.680 |  11.80   1.840
              3.00   3.680 |   6.00 126.200 |   9.00   3.680 |  12.00   1.840

-------------------------------------------------------------------------------
100:0003-----------------------------------------------------------------------
*
*# 5 Year 12 hour SCS
*MASS STORM            PTOTAL=[56.502](mm), CSDT=[ 10 ](min),
*                      CURVE_FILENAME=["5.mst "]
*
*# 100 Year 12 hour SCS
*#MASS STORM            PTOTAL=[ 93.19 ](mm), CSDT=[ 10 ](min),
*#                    CURVE_FILENAME=["100.mst "]
*
*##########################################################
*###                 SUMAC COURT                        ##
*###  ORIGINAL MODEL PER PHIIPS - SILVER MAPLES SUBDIVISION  ##
*###                                                    ##
*##########################################################
*
*# SILVER MAPLES - FUTURE SITE PLAN AREA CONTROLLED BY ON-SITE SWM
----------------------
| CALIB STANDHYD     |   Area    (ha)=    2.27
| 08:3022   DT= 5.00 |   Total Imp(%)=   34.10   Dir. Conn.(%)=   17.20
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area      (ha)=        .77        1.50
     Dep. Storage      (mm)=        .80       20.04
     Average Slope      (%)=       1.00        2.10
     Length             (m)=      71.84       99.86
```

```
     Mannings n           =       .035         .200

     Max.eff.Inten.(mm/hr)=     126.20        32.26
                over (min)        6.00        18.00
     Storage Coeff.  (min)=       3.46 (ii)   20.02 (ii)
     Unit Hyd. Tpeak (min)=       6.00        18.00
     Unit Hyd. peak  (cms)=        .23          .06
                                                           *TOTALS*
     PEAK FLOW       (cms)=        .13          .08           .188 (iii)
     TIME TO PEAK    (hrs)=       6.00         6.20          6.000
     RUNOFF VOLUME    (mm)=      92.40        20.60         32.947
     TOTAL RAINFALL   (mm)=      93.20        93.20         93.204
     RUNOFF COEFFICIENT   =        .99          .22           .353
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  48.8    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-----------------------------------------------------------------------------
*# DIVIDE HYDROGRPAH FOR MAJOR AND MINOR FLOWS
----------------------
| COMPUTE DUALHYD    |   Average inlet capacities   [CINLET] =    .070  (cms)
| TotalHyd 08:3022   |   Number of inlets in system [NINLET] =       1
----------------------   Total minor system capacity         =    .070  (cms)
                         Total major system storage [TMJSTO] =       0.(cu.m.)

                  ID: NHYD        AREA    QPEAK     TPEAK     R.V.      DWF
                                  (ha)    (cms)     (hrs)     (mm)    (cms)
     TOTAL HYD.   08:3022         2.27     .188     6.000   32.947     .000
     =======================================================================
     MAJOR SYST   04:MAJ           .35     .118     6.000   32.947     .000
     MINOR SYST   02:MIN          1.92     .070     5.800   32.947     .000

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------------
100:0005-----------------------------------------------------------------------------
*# ROUTE MAJOR FLOWS THROUGH STREET RESERVOIR
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  5.0 min.
|  IN>04:(MAJ   )   |
| OUT<09:(STREET)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |     .030  .4700E-02
                            .010  .2300E-02   |     .050  .7000E-02

     ROUTING RESULTS            AREA     QPEAK     TPEAK       R.V.
     --------------------       (ha)     (cms)     (hrs)       (mm)
     INFLOW >04: (MAJ   )        .35      .118     6.000     32.947
     OUTFLOW<09: (STREET)        .35      .044     6.200     32.947
    OVERFLOW<01: (OFLSTR)        .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](%)=    37.349
                   TIME SHIFT OF PEAK FLOW         (min)=     12.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.6375E-02

--------------------------------------------------------------------------------------
100:0006------------------------------------------------------------------------------
*# ROUTE MINOR FLOWS THROUGH SEWER STORAGE
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  5.0 min.
|  IN>02:(MIN   )   |
| OUT<08:(PIPES )   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)     (ha.m.)   |   (cms)     (ha.m.)
                            .000  .0000E+00    |     .038  .2570E-01
                            .032  .2380E-01    |     .000  .0000E+00

     ROUTING RESULTS            AREA     QPEAK     TPEAK        R.V.
     ---------------------      (ha)     (cms)     (hrs)        (mm)
     INFLOW >02: (MIN   )       1.92      .070     5.800      32.947
     OUTFLOW<08: (PIPES )       1.92      .032     7.000      32.947
    OVERFLOW<03: (OFLPIP)        .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](%)=    45.944
                   TIME SHIFT OF PEAK FLOW         (min)=     72.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=.2385E-01

--------------------------------------------------------------------------------------
100:0007------------------------------------------------------------------------------
*# TOTAL FLOW FROM SITE
------------------------
| ADD HYD (TOTAL     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
                     ID1 08:PIPES          1.92     .032    7.00  32.95
                     .000
                    +ID2 09:STREET          .35     .044    6.20  32.95
                    .000
                     =============================================================
                     SUM 02:TOTAL          2.27     .066    6.20  32.95
                     .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------------
100:0008------------------------------------------------------------------------------
*
*
*
*##############################################################
*###                    SUMAC COURT                          ##
*###  MODEL REVISED TO INCLUDE PROPOSED CUL-DE-SAC EXTENSION ##
```

```
*###                                                          ##
*##############################################################
*
*# SILVER MAPLES - FUTURE SITE PLAN AREA CONTROLLED BY ON-SITE SWM
----------------------
| CALIB STANDHYD     |   Area    (ha)=    2.27
| 08:3022   DT= 5.00 |   Total Imp(%)=   34.10   Dir. Conn.(%)=   17.20
----------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=         .77        1.50
     Dep. Storage     (mm)=         .80       20.04
     Average Slope     (%)=        1.00        2.10
     Length            (m)=       71.84       99.86
     Mannings n          =         .035        .200

     Max.eff.Inten.(mm/hr)=      126.20       32.26
                over (min)         6.00       18.00
     Storage Coeff.  (min)=        3.46 (ii)   20.02 (ii)
     Unit Hyd. Tpeak (min)=        6.00       18.00
     Unit Hyd. peak  (cms)=         .23         .06
                                                              *TOTALS*
     PEAK FLOW       (cms)=         .13         .08             .188 (iii)
     TIME TO PEAK    (hrs)=        6.00        6.20            6.000
     RUNOFF VOLUME    (mm)=       92.40       20.60           32.947
     TOTAL RAINFALL   (mm)=       93.20       93.20           93.204
     RUNOFF COEFFICIENT   =         .99         .22             .353
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  48.8    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.

--------------------------------------------------------------------------------
100:0009------------------------------------------------------------------------
*# DIVIDE HYDROGRPAH FOR MAJOR AND MINOR FLOWS
----------------------
| COMPUTE DUALHYD    |   Average inlet capacities   [CINLET] =    .070  (cms)
| TotalHyd 08:3022   |   Number of inlets in system [NINLET] =       1
----------------------   Total minor system capacity         =    .070  (cms)
                         Total major system storage [TMJSTO] =      0.(cu.m.)

                ID: NHYD        AREA     QPEAK     TPEAK     R.V.      DWF
                                (ha)     (cms)     (hrs)     (mm)    (cms)
     TOTAL HYD.   08:3022         2.27      .188     6.000   32.947     .000
     =========================================================================
     MAJOR SYST   04:MAJ           .35      .118     6.000   32.947     .000
     MINOR SYST   02:MIN          1.92      .070     5.800   32.947     .000

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

--------------------------------------------------------------------------------
100:0010------------------------------------------------------------------------
*# FUTURE CUL-DE-SAC EXPANSION ON PROPOSED LANDS
----------------------
| CALIB STANDHYD     |   Area    (ha)=     .17
| 09:401    DT= 5.00 |   Total Imp(%)=   70.00   Dir. Conn.(%)=   70.00
```

```
----------------------
                         IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      .12          .05
     Dep. Storage     (mm)=      .80        20.04
     Average Slope     (%)=     1.00         2.00
     Length            (m)=    40.00         5.00
     Mannings n          =      .035         .200

     Max.eff.Inten.(mm/hr)=   126.20        29.46
                over (min)      6.00         6.00
     Storage Coeff.  (min)=     2.43 (ii)    5.32 (ii)
     Unit Hyd. Tpeak (min)=     6.00         6.00
     Unit Hyd. peak  (cms)=      .26          .19
                                                        *TOTALS*
     PEAK FLOW       (cms)=      .04          .00          .045 (iii)
     TIME TO PEAK    (hrs)=     6.00         6.00         6.000
     RUNOFF VOLUME    (mm)=    92.40        15.74        69.403
     TOTAL RAINFALL   (mm)=    93.20        93.20        93.204
     RUNOFF COEFFICIENT   =      .99          .17          .745
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN* =  48.8    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.

------------------------------------------------------------------------------------------
100:0011----------------------------------------------------------------------------------
*# TOTAL FLOW DIRECTED TO UNDERGROUND SYSTEM
*# = MINOR FLOW FROM SILVER MAPLE + ALL FLOWS FROM CUL-DE-SAC (TOTAL CAPTURE)
-------------------------
| ADD HYD (TOTAL     ) | ID: NHYD        AREA     QPEAK   TPEAK   R.V.    DWF
-------------------------                 (ha)     (cms)   (hrs)   (mm)   (cms)
                        ID1 02:MIN         1.92     .070    5.80  32.95
                        .000
                       +ID2 09:401          .17     .045    6.00  69.40
                       .000
                        ===========================================================
                        SUM 10:TOTAL       2.09     .115    6.00  35.88
                        .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

------------------------------------------------------------------------------------------
100:0012----------------------------------------------------------------------------------
*# ROUTE MAJOR FLOWS THROUGH STREET RESERVOIR
---------------------
| ROUTE RESERVOIR   |    Requested routing time step =  5.0 min.
|  IN>04:(MAJ   )   |
| OUT<09:(STREET)   |    =========  OUTLFOW STORAGE TABLE  =========
---------------------    OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
                           (cms)    (ha.m.)   |    (cms)    (ha.m.)
                            .000  .0000E+00   |     .030  .4700E-02
                            .010  .2300E-02   |     .050  .7000E-02

     ROUTING RESULTS             AREA     QPEAK     TPEAK       R.V.
     --------------------        (ha)     (cms)     (hrs)       (mm)
```

```
     INFLOW >04: (MAJ   )         .35      .118     6.000     32.947
     OUTFLOW<09: (STREET)         .35      .044     6.200     32.947
    OVERFLOW<01: (OFLSTR)         .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](%)=   37.349
                  TIME SHIFT OF PEAK FLOW          (min)=    12.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.6375E-02

-------------------------------------------------------------------------------
100:0013-----------------------------------------------------------------------
*# ROUTE MINOR FLOWS THROUGH SEWER STORAGE
*# ADDITIONAL 35M3 OF PIPE STORAGE PROVIDED
---------------------
| ROUTE RESERVOIR   |     Requested routing time step =  5.0 min.
|  IN>10:(TOTAL )   |
| OUT<08:(PIPES )   |     =========  OUTLFOW STORAGE TABLE  =========
---------------------     OUTFLOW    STORAGE  | OUTFLOW    STORAGE
                            (cms)    (ha.m.)  |   (cms)    (ha.m.)
                             .000  .0000E+00  |     .038  .2920E-01
                             .032  .2380E-01  |     .000  .0000E+00

     ROUTING RESULTS              AREA     QPEAK     TPEAK       R.V.
     --------------------         (ha)     (cms)     (hrs)       (mm)
     INFLOW >10: (TOTAL )         2.09      .115     6.000     35.882
     OUTFLOW<08: (PIPES )         2.09      .038     6.900     35.882
    OVERFLOW<03: (OFLPIP)          .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](%)=   32.947
                  TIME SHIFT OF PEAK FLOW          (min)=    54.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=.2899E-01

-------------------------------------------------------------------------------
100:0014-----------------------------------------------------------------------
*# TOTAL FLOW FROM SITE
------------------------
| ADD HYD (TOTAL     ) | ID: NHYD         AREA     QPEAK   TPEAK   R.V.    DWF
------------------------                  (ha)     (cms)   (hrs)   (mm)   (cms)
                    ID1 08:PIPES          2.09      .038    6.90  35.88
                    .000
                   +ID2 09:STREET          .35      .044    6.20  32.95
                   .000
                    ===================================================
                    SUM 02:TOTAL          2.44      .074    6.20  35.46
                    .000

   NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.

-------------------------------------------------------------------------------
100:0015-----------------------------------------------------------------------
```

```
-------------------------------------------------------------------------------
100:0002-----------------------------------------------------------------------
      FINISH
-------------------------------------------------------------------------------
*******************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
 010:0003 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 010:0008 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 010:0010 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 100:0003 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 100:0008 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 100:0010 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
   Simulation ended on 2021-08-04     at 18:29:59
===============================================================================
```

A.M. CANDARAS SWM REPORT FOR GREENHOUSE EXPANSION (FEB. 2001)

a.m. candaras associates inc.

consulting engineers

5007-493

RECEIVED
FEB 08 2001
Town of Grimsby

STORMWATER MANAGEMENT REPORT
FOR
VAN GEEST GREENHOUSE EXPANSION
TOWN OF GRIMSBY

1.0 DEVELOPMENT DESCRIPTION

The site presently contains a 7,550m^2 greenhouse which is connected to the adjacent storm sewer system via a 200mm diameter storm connection. The remainder of the site is landscaped area which drains via overland swales to the north. This proposal considers an additional greenhouse area of 4,953m^2. Stormwater management controls will be provided by means of a detention swale on the west side of the property.

2.0 DESIGN CRITERIA

(a) Maximum allowable stormwater discharge to be limited to the existing rates.

(b) On site detention must be provided for the 100 year storm.

3.0 EXISTING SITE CONDITIONS

The existing site consists of three distinct drainage areas. The first of these areas is the existing greenhouse which is connected to the existing storm sewer system by a 200mm diameter storm connection. The remaining areas are both grassed areas , one area drains to the west to and then follows an overland flow swale north, the second area flows to the east and enters an existing catch basin.

The existing runoff rates for the 2 year, 5 year an 100 year storms is provided below in table 1

TABLE 1

Area Description	Tributary Area		Peak Flows (1) (l/s)		
	C=0.25	C=0.90	2 year	5 Year	100 Year
Existing Greenhouse		7,550m^2	154.4	213.5	383.6
Landscaped (West)	5,982m^2		34.0	47.0	84.4
Landscaped (East)	1,952m^2		11.1	15.3	27.5

1. Peak flows based on Rational Formulae

$$Q = C \times A \times I \times N$$

$$Q = C \times A \times I \times 2.778 \times \frac{1ha}{1000m^2}$$

$$I_{2yr} = 81.8mm/hr$$

$$I_{5yr} = 113.1mm/hr$$

$$I_{100yr} = 203.2mm/hr$$

$$Tc = 10\min$$

...2

4.0 POST DEVELOPMENT FLOWS

From the 4,593 m^2 greenhouse addition the runoff will be directed in a westerly direction to follow the drainage swale flowing north. The flows from the west drainage area will increase due to increased area and an increase in the imperviousness. All the runoff from the proposed greenhouse addition will be directed in a westerly direction by roof drains and the pitch and direction of the roof. Flows from the easterly drainage area decreased due to a decrease in the tributary area to the east catch basin. The flows from the existing greenhouse, into the existing storm sewer system will remain the same as no additional area will be directed in to the existing storm sewer system.

The post development flows after this addition are provided in table 2 .

TABLE 2

Area Description	**Tributary Area**		**Peak Flows (1) (l/s)**		
	C=0.25	**C=0.90**	**2 year**	**5 Year**	**100 Year**
Existing Greenhouse		7,550m^2	154.4	213.5	383.6
West Drainage	2,289m^2	4,593m^2	106.9	147.9	256.6
Landscaped (East)	1,052m^2		6.0	8.3	14.8

1. Peak flows based on Rational Formulae

$$Q = C \times A \times I \times N$$

$$Q = C \times A \times I \times 2.778 \times \frac{1ha}{1000m^2}$$

$$I_{2yr} = 81.8mm/hr$$

$$I_{5yr} = 113.1mm/hr$$

$$I_{100yr} = 203.2mm/hr$$

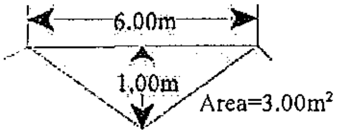
5.0 DETENTION VOLUME CALCULATIONS

To attenuate the flows from the site after building the addition, on-site storage will be required. The runoff rate will be controlled to the existing flows within the detention swale with an outlet orifice of 200mm in diameter.

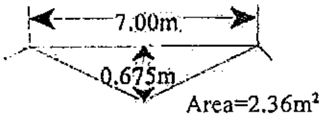
6.0 DETENTION SWALE VOLUME

To achieve the required volume of 168.62m^3 a detention swale will be constructed along the west side of the property. This detention swale will be 65m long at a slope of 0.5%. This will provide a detention volume of 174.2m^3 which is more than required for the 100 year storage as derived in the Otthymo simulation. The detention swale cross sections and volume calculations are provided below:

Bottom of Swale at Orifice end



Top of swale.



$$Volume = \frac{1}{2}\left(3.00m^2 + 2.36m\right)^2 \times 65m$$
$$Volume = 174.20m^2$$

7.0 OUTLET CONTROLS

Outlet control will be provided by using a 200mm diameter orifice sized. The release rates for the orifice are calculated using the following equation.

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

$$\textit{where}$$

$$C = 0.6, g = 9.81, h = Depth(m) - diameter(d)$$

$$A = \frac{\pi \times d^2}{4}$$

The 200mm diameter outlet pipe from the detention facility will attenuate the post addition runoff rates to the existing runoff rates. Flows will follow the existing overland drainage route after the detention swale and orifice.

Prepared by,
a.m. candaras associates inc.

A.M. Candaras, P. Eng.
Consulting Engineer

February 7, 2001
0049

LICENSED PROFESSIONAL ENGINEER
A. M. CANDARAS
PROVINCE OF ONTARIO

Table 3: 100 YR Storm Runoff Computations for Westerly Drainage Area

	2 Year		5 Year		100 Year	
Time Period (min)	**Intensity (mm/hr.)**	**Runoff (l/s)**	**Intensity (mm/hr.)**	**Runoff (l/s)**	**Intensity (mm/hr.)**	**Runoff (l/s)**
35-40	6	2.16	7	2.52	11	14.38
40-45	7	2.52	9	3.24	14	18.30
45-50	9	3.24	12	4.32	19	24.84
50-55	14	5.04	18	6.48	30	39.22
55-60	33	11.88	44	15.84	76	99.36
60-65	116	41.76	161	57.96	292	381.74
65-70	43	15.48	58	20.88	101	132.04
70-75	23	8.28	31	11.16	52	67.98
75-80	16	5.76	21	7.56	35	45.76
80-85	12	4.32	16	5.76	26	33.99
85-90	10	3.60	13	4.68	21	27.45
90-95	8	2.88	11	3.96	18	23.53
95-100	7	2.52	9	3.24	14	18.30
100-105	6	2.16	8	2.88	11	14.38

Addition = 4,593 m^2 @ C =0.90

Landscaped = 2,289 m^2 @ C = 0.25

CAN $= \frac{[(4{,}593\ m^2 \times 0.90) + (2{,}289\ m^2 \times 0.25)] \times 2.778}{10{,}000}$

Runoff = CAIN

= 0.36

Table 4: Storage Discharge Relationship

Depth	Length of Swale	Area at Top	Area at Outlet	Volume	Discharge
1.00m	65m	2.36m^2	3.00m^2	174.20m^3	74.7 l/s
0.90m	65m	1.71m^2	2.43m^2	134.69m^3	69.9 l/s
0.80m	65m	1.17m^2	1.92m^2	100.42m^3	64.7 l/s
0.70m	65m	0.73m^2	1.47m^2	71.47m^3	59.0 l/s
0.60m	65m	0.39m^2	1.08m^2	47.84m^3	52.8 l/s
0.50m	65m	0.16m^2	0.75m^2	29.54m^3	45.7 l/s
0.40m	65m	0.03m^2	0.48m^2	16.55m^3	37.3 l/s
0.30m	60m	0.00m^2	0.27m^2	8.10m^3	26.4 l/s
0.20m	40m	0.00m^2	0.12m^2	2.40m^3	8.35 l/s
0.00m	0m	0.00m^2	0.00m^2	0.00m^3	0

Table 5: Detention Swale Performance

Storm	Existing	Post-addition	Ponding Volume
2 year	34.0 l/s	30 l/s	10m^3
5 year	47.0 l/s	30 l/s	10m^3
100 year	84.4 l/s	70 l/s	140m^3

F:\Secretary\2001\0103\0103swm1.wpd

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

      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    E-9516061300506

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  EXCLUSIVE USE TO : A.M.CANDARAS ASSOC.

  Input   filename: a:0103.swm
  Output  filename: a:0103.out
  Summary filename: a:0103.sum


DATE: 01-27-2001                    TIME: 15:42:55


COMMENTS: ____________________________________________________________


------------------------------------------------------------------------------
***********************************************************
* SIMULATION OF HYDROGRAPH THROUGH STORAGE FACILITY FOR
* Van Geest Greenhouse
***********************************************************
  ****************************
  ** SIMULATION NUMBER:   1 **
  ****************************

--------------------
| READ HYD  (0001) |   AREA      (ha)=     .69
| ID= 1    PCYC=  1 |  QPEAK    (cms)=     .04
| DT= 5.0 min      |   TPEAK    (hrs)=     .50
--------------------   VOLUME    (mm)=    4.85
  Filename: A:01032YR.HYD
  Comments: 2 YR HYDROGRAPH FOR Van Geest Greenhouse

  TIME    FLOW |  TIME    FLOW |  TIME    FLOW |  TIME    FLOW |  TIME    FLOW
   hrs     cms |   hrs     cms |   hrs     cms |   hrs     cms |   hrs     cms
   .00     .00 |   .33     .01 |   .67     .01 |  1.00     .00 |
   .08     .00 |   .42     .01 |   .75     .01 |  1.08     .00 |
   .17     .00 |   .50     .04 |   .83     .00 |  1.17     .00 |
   .25     .00 |   .58     .02 |   .92     .00 |
------------------------------------------------------------------------------
--------------------
| RESERVOIR (0001) |
| IN= 1---> OUT= 3 |
| DT=  5.0 min     |      OUTFLOW    STORAGE  |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)  |   (cms)     (ha.m.)
                            .000       .000   |    .059       .007
                            .026       .001   |    .065       .010
                            .037       .002   |    .070       .013
                            .046       .003   |    .075       .017
                            .053       .005   |    .000       .000

                                AREA     QPEAK     TPEAK        R.V.
                                (ha)     (cms)     (hrs)        (mm)
```

```
     INFLOW : ID= 1 (0001)        .69       .04       .50        4.85
     OUTFLOW: ID= 3 (0001)        .69       .03       .58        4.84

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 61.401
                   TIME SHIFT OF PEAK FLOW        (min)=  5.000
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .001

------------------------------------------------------------------------------
***********************************************************
  ****************************
  ** SIMULATION NUMBER:   1 **
  ****************************

--------------------
| READ HYD  (0001) |   AREA      (ha)=     .69
| ID= 1    PCYC=  1 |  QPEAK    (cms)=     .06
| DT= 5.0 min      |   TPEAK    (hrs)=     .50
--------------------   VOLUME    (mm)=    6.54
  Filename: A:01035YR.HYD
  Comments: 5 YR HYDROGRAPH FOR Van Geest Greenhouse

  TIME    FLOW |  TIME    FLOW |  TIME    FLOW |  TIME    FLOW |  TIME    FLOW
   hrs     cms |   hrs     cms |   hrs     cms |   hrs     cms |   hrs     cms
   .00     .00 |   .33     .01 |   .67     .01 |  1.00     .00 |
   .08     .00 |   .42     .02 |   .75     .01 |  1.08     .00 |
   .17     .00 |   .50     .06 |   .83     .01 |  1.17     .00 |
   .25     .00 |   .58     .02 |   .92     .00 |
------------------------------------------------------------------------------
--------------------
| RESERVOIR (0001) |
| IN= 1---> OUT= 3 |
| DT=  5.0 min     |      OUTFLOW    STORAGE  |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)  |   (cms)     (ha.m.)
                            .000       .000   |    .059       .007
                            .026       .001   |    .065       .010
                            .037       .002   |    .070       .013
                            .046       .003   |    .075       .017
                            .053       .005   |    .000       .000

                                AREA     QPEAK     TPEAK        R.V.
                                (ha)     (cms)     (hrs)        (mm)
     INFLOW : ID= 1 (0001)        .69       .06       .50        6.54
     OUTFLOW: ID= 3 (0001)        .69       .03       .58        6.53

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)= 53.323
                   TIME SHIFT OF PEAK FLOW        (min)=  5.000
                   MAXIMUM  STORAGE   USED       (ha.m.)=   .001

------------------------------------------------------------------------------
***********************************************************
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| ID= 1    PCYC=  1 |  QPEAK    (cms)=     .38
| DT= 5.0 min      |   TPEAK    (hrs)=     .50
--------------------   VOLUME    (mm)=   40.89
  Filename: A:0103100.HYD
  Comments: 100 YR HYDROGRAPH FOR Van Geest Greenhouse

  TIME    FLOW |  TIME    FLOW |  TIME    FLOW |  TIME    FLOW |  TIME    FLOW
   hrs     cms |   hrs     cms |   hrs     cms |   hrs     cms |   hrs     cms
   .00     .00 |   .33     .04 |   .67     .07 |  1.00     .02 |
```
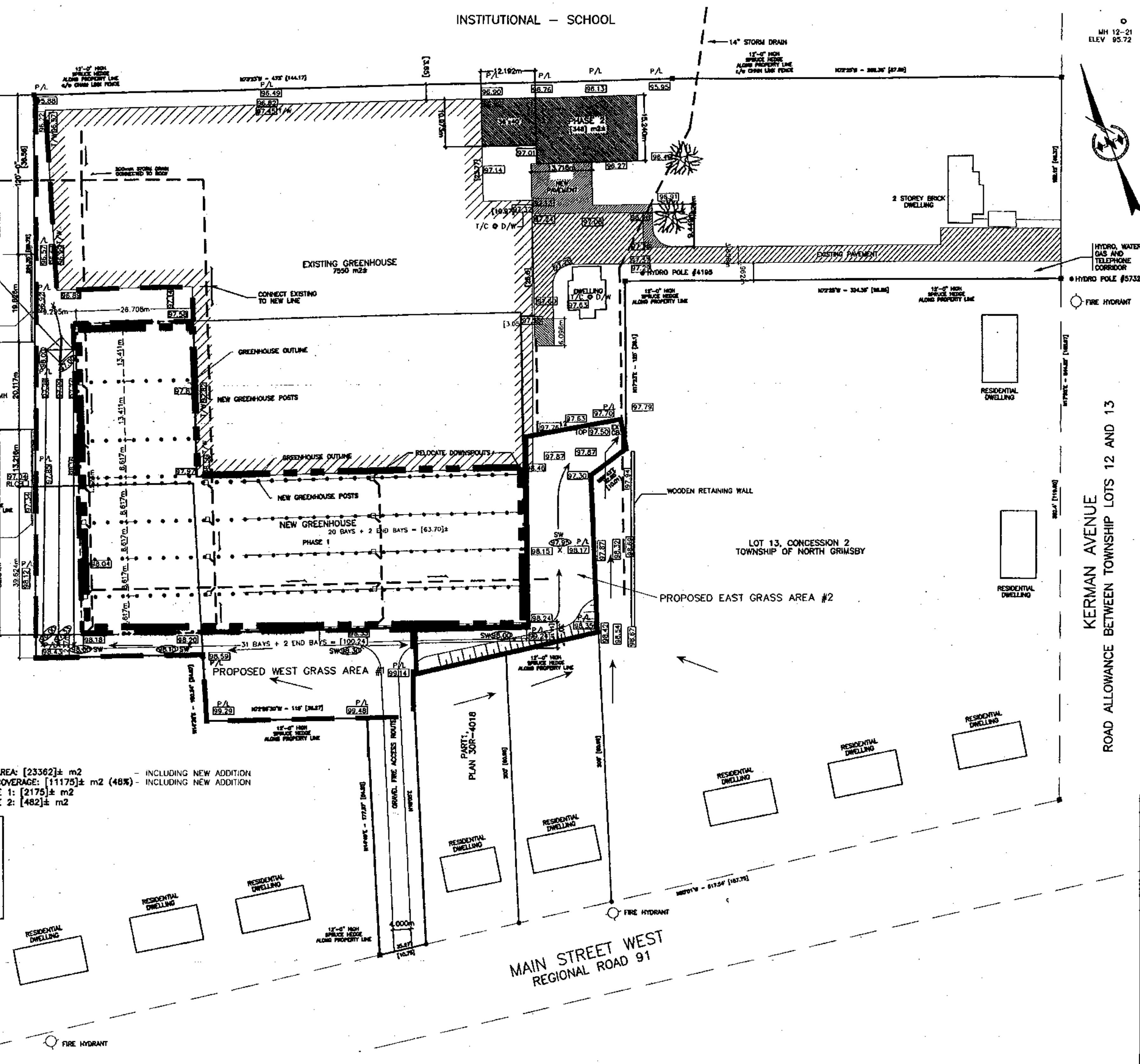
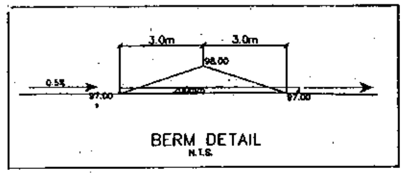

```
   .08       .01 |   .42      .10 |   .75      .05 |  1.08      .02 |
   .17       .02 |   .50      .38 |   .83      .03 |  1.17      .01 |
   .25       .02 |   .58      .13 |   .92      .03 |
-------------------------------------------------------------------------------

-------------------
| RESERVOIR (0001) |
| IN= 1---> OUT= 3 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
-------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           .000       .000    |    .059       .007
                           .026       .001    |    .065       .010
                           .037       .002    |    .070       .013
                           .046       .003    |    .075       .017
                           .053       .005    |    .000       .000

                               AREA      QPEAK      TPEAK        R.V.
                               (ha)      (cms)      (hrs)        (mm)
    INFLOW : ID= 1 (0001)       .69        .38        .50       40.89
    OUTFLOW: ID= 3 (0001)       .69        .07        .67       40.89

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)= 18.589
                  TIME SHIFT OF PEAK FLOW         (min)= 10.000
                  MAXIMUM  STORAGE   USED       (ha.m.)=   .014

-------------------------------------------------------------------------------

 FINISH
===============================================================================
```



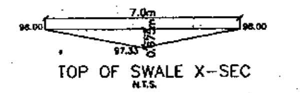
NEW RESIDENTIAL LANDS HAVE ALL STORMWATER DRAINAGE CONTAINED WITHIN THEIR OWN PROPERTY AND NO LONGER DRAIN ONTO VAN GEEST PROPERTY

ALL OF THE NEW GREENHOUSE ROOF LEADS ARE TO DISCHARGE ONTO THE GRASS AND OVERLAND FLOW TO THE DETENTION FACILITY

LOT AREA: [23362]± m2 – INCLUDING NEW ADDITION
LOT COVERAGE: [11175]± m2 (48%) – INCLUDING NEW ADDITION
PHASE 1: [2175]± m2
PHASE 2: [482]± m2



BERM DETAIL
N.T.S.



TOP OF SWALE X-SEC
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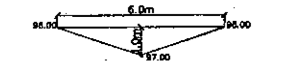
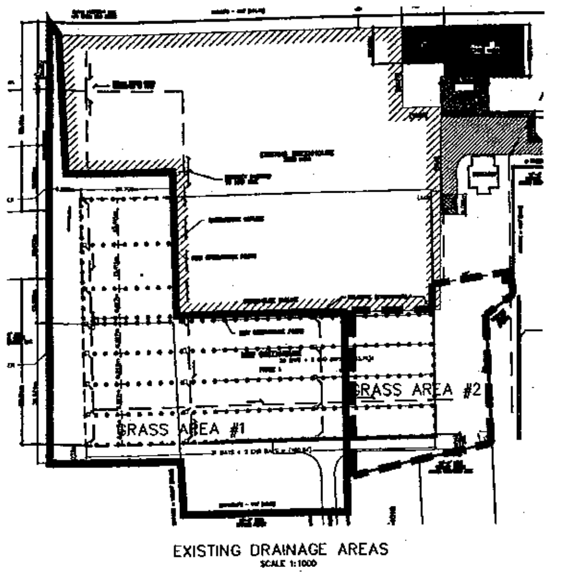


BOTTOM OF SLOPE X-SEC
N.T.S.

PROPOSED DRAINAGE AREAS

▬ ▪ ▪ ▬	PROPOSED GREENHOUSE AREA	4593 m^2
▬ ▬	PROPOSED WEST GRASS AREA 1	2289 m^2
▬	PROPOSED EAST GRASS AREA 2	1052 m^2
	TOTAL	7934 m^2



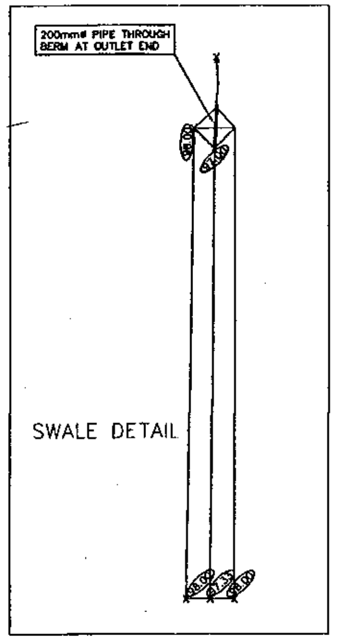
EXISTING DRAINAGE AREAS
SCALE 1:1000

EXISTING DRAINAGE AREAS

▬	EXISTING GRASS AREA 1	5982 m^2
▬ ▬ ▬	EXISTING GRASS AREA 2	1952 m^2
	TOTAL	7934 m^2

LEGEND

98.15	EXISTING ELEVATION
(98.15)	PROPOSED ELEVATION



SWALE DETAIL

LICENSED PROFESSIONAL ENGINEER
A. M. CANDARAS
PROVINCE OF ONTARIO

No.	Date	By	REVISIONS

a.m.candaros associates inc.
consulting engineers
8400 Jane st., suite 203, concord ont. L4K 4L8
(905)738-0043 Fax (905)738-9461
Email: amcai@idirect.com

VAN GEEST EXPANSION

NORTH GRIMSBY

STORMWATER MANAGEMENT PLAN

SCALE: 1:500	DATE: FEB 2/01	PROJ No. 0103
DRAWN: FP	CHK'D: A.M.C.	PLAN No. STM-1
DESIGNED: A.M.C.	SHEET 1 OF 1	

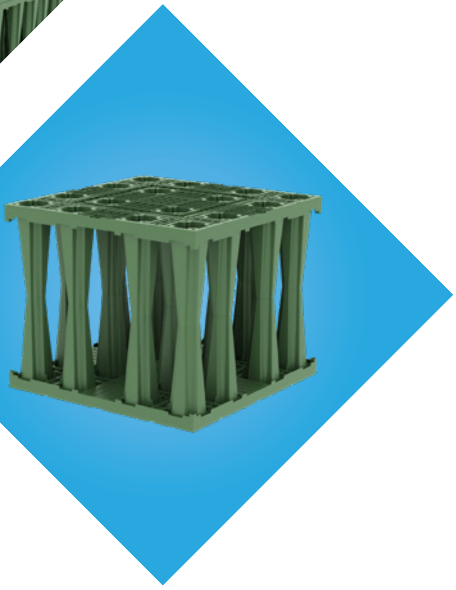
UNDERGROUND STORAGE TANKS

STORMCON
STORMWATER MANAGEMENT SOLUTIONS.

GreenStorm ST

Rigofill ST product by FRÄNKISCHE

Underground storage infiltration modules

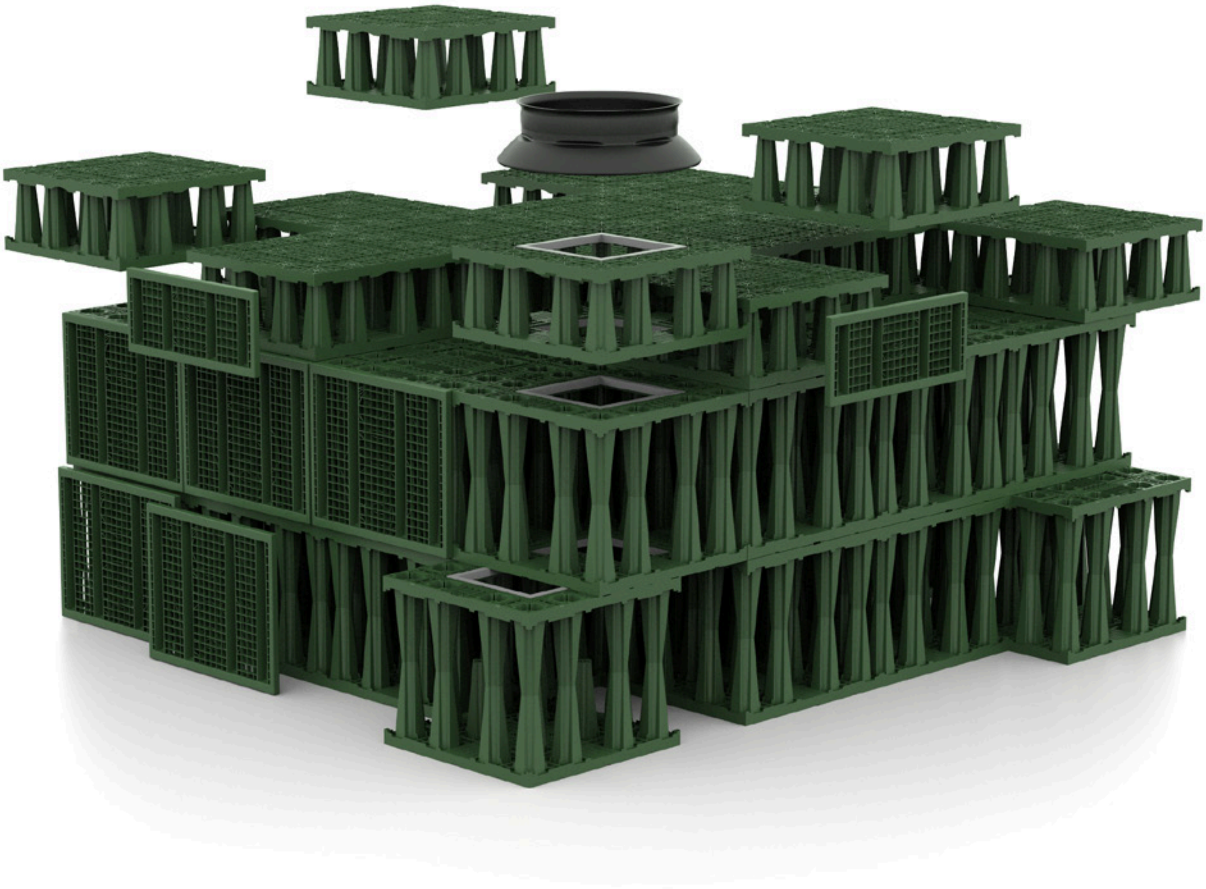


www.stormcon.ca

Individual system geometries due to modular design

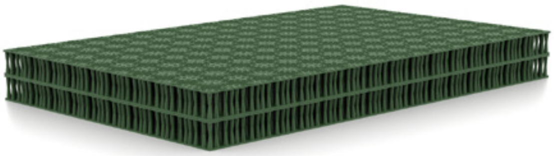
Sizes (length and width) of GreenStorm ST*orage/infiltration systems can be freely designed with hardly any limitations. The 800 mm cellular block type structure can easily be adapted to fit nearly any layout.

With heights of 660 mm (full block) and 350 mm (half block), systems can be built in various sizes to accommodate any single- or multi-layer combination. Therefore, the system can very easily be adapted to on-site requirements. Under high groundwater conditions or low permeability of backfill soil, for example, rather shallow depth systems are to be preferred. For soils with good permeability, however, high and compact systems are favourable and may be built accordingly. The maximum space available is used.

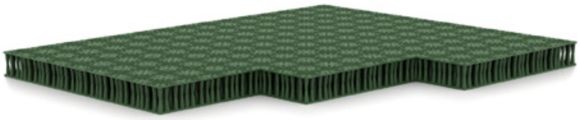


*Rigofill ST product by FRÄNKISCHE

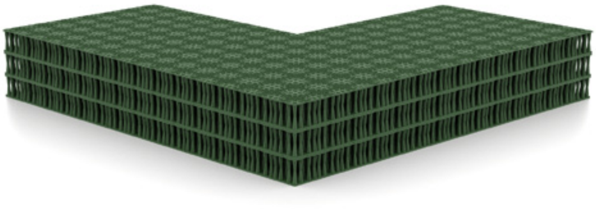
Possible system geometries



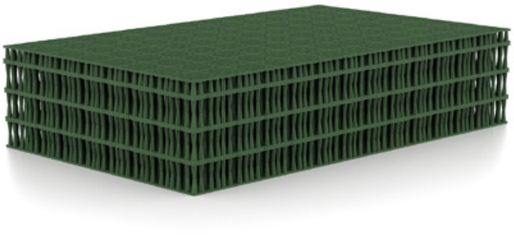
GreenStorm ST*
2-layer



GreenStorm ST*
1-layer



GreenStorm ST*
3-layer



GreenStorm ST*
3 1/2-layer

*Rigofill ST product by FRÄNKISCHE

Loading

GreenStorm ST* Heavy traffic

Storage/infiltration systems are subsoil structures and must have sufficient load-carrying capacity against impacting soil and traffic loads.

GreenStorm ST* storage/ infiltration systems are extremely strong and have been designed with various applications in mind:
While GreenStorm ST* has been designed in
particular for traffic loads of up to 13 tons axle load.

Certification CSTB

Avis Technique 17.2/14-285_V2

Rigofill inspect
Rigofill ST

High resistance

When installed under traffic areas, relevant national guidelines must be observed.

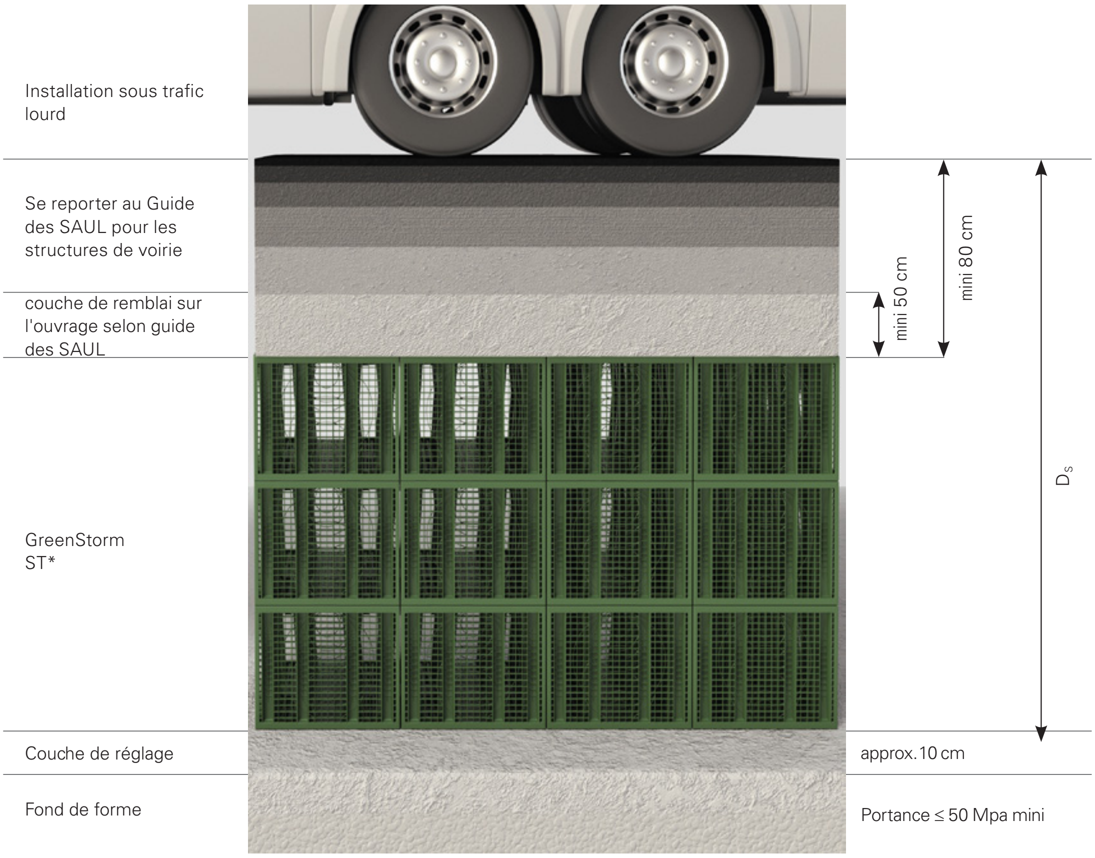
To build the planum for the road construction, an upper levelling layer must be provided. It should preferably be built as a gravel sub-base with a thickness of at least 350 mm, other materials usually result in larger covers.

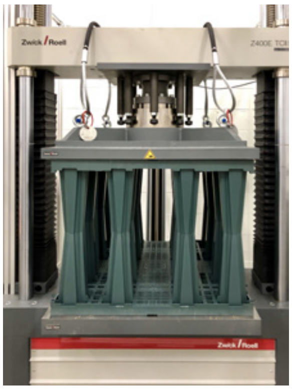
Generally, a uniform modulus of deformation EV2 ≥ 45 MN/m^2 must be proven on the planum.

Installation under traffic area

The subsoil structures must have sufficient load-carrying capacity against impacting soil and traffic loads to ensure reliable stability.

This is why GreenStorm ST* is suitable for traffic loads of up to 15 tons axle load (20 tons possible, please refer to our technical department).



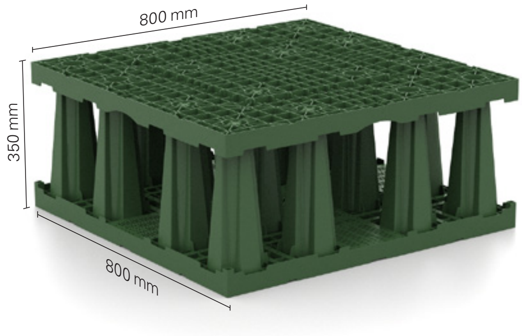


With conventional installation parameters*, depths of cover of DC 4 m and soil depths DSof 6 m are possible for infiltration systems. A project-specific stability analysis can be prepared by STORMCON.

*specific weight of soil 18 kN/m^3
Mean soil temperature max. 23 °C,
6 m soil depth, = 0.3, 4-laye

GreenStorm ST* – Design-relevant dimensions

Dimensions



Sidewall grid connection options

Full block connection options
Dia 100 mm, 135 mm, 150 mm, 200 mm,
250 mm, 300 mm, 375 mm et 450 mm

This allows all available nominal diameters to be realised both at the top and the bottom of the module.

*Rigofill ST product by FRÄNKISCHE

APPENDIX B
SANITARY SEWER INFORMATION

Project No. 09032 ***(Updated for Project 21048)***
Sheet No. 1
Checked by: JGO
Computed by: JGO
Date: July 16, 2010

TOWN OF GRIMSBY

SANITARY SEWER DESIGN

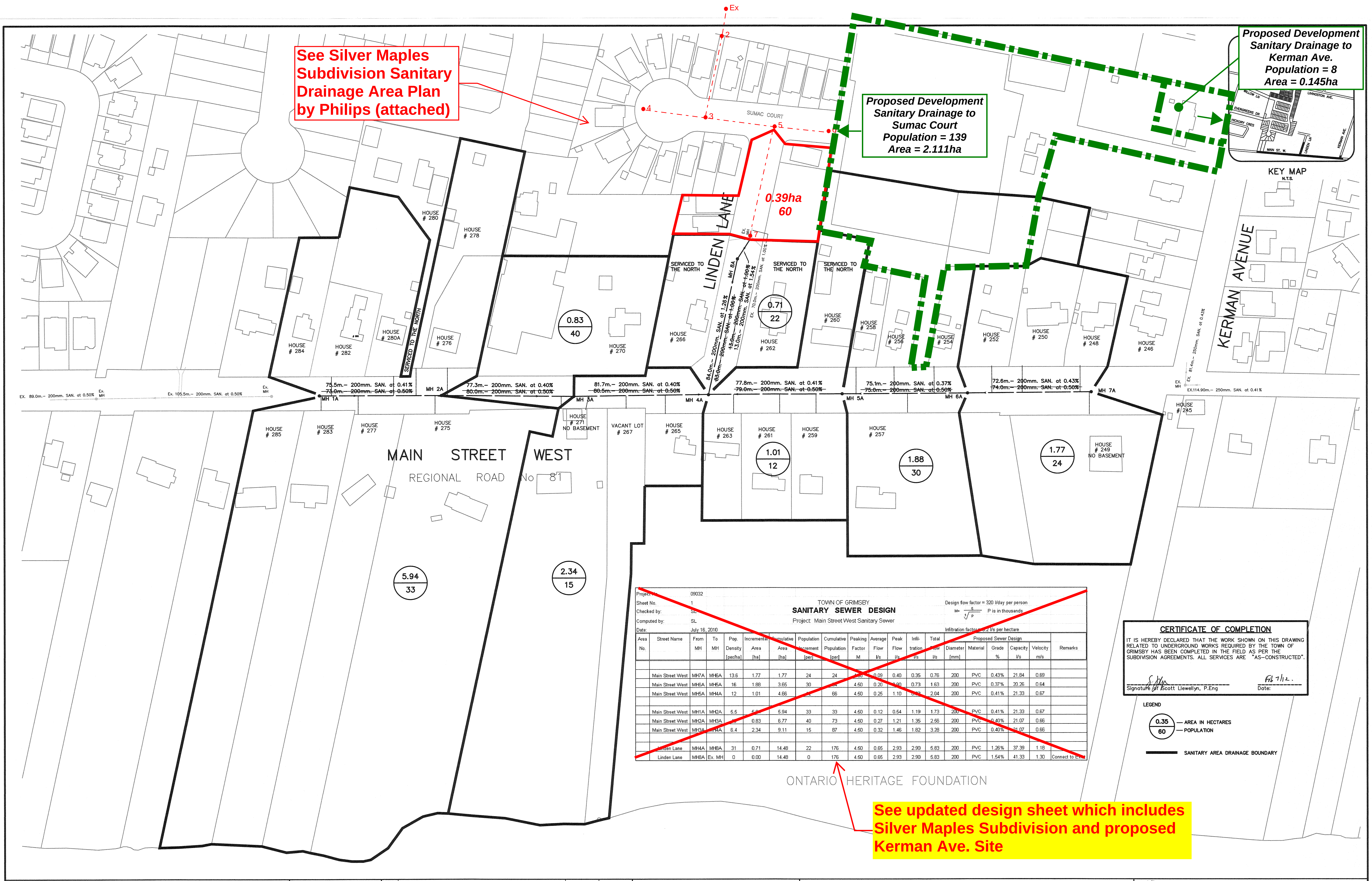
Main Street West + Silver Maples + Kerman Site Sanitary Sewer

Design flow factor = 320 l/day per person

$M = \frac{5}{\sqrt[5]{P}}$ P is in thousands

Infiltration factor = 0.2 l/s per hectare

Area No.	Street Name	From MH	To MH	Pop. Density [per/ha]	Incremental Area [ha]	Cumulative Area [ha]	Population Increment [per]	Cumulative Population [per]	Peaking Factor M	Average Flow l/s	Peak Flow l/s	Infil-tration l/s	Total Flow l/s	Proposed Sewer Design					% Capacity	Remarks
														Diameter [mm]	Material	Grade %	Capacity l/s	Velocity m/s		
	Main Street West	MH7A	MH6A	13.6	1.77	1.77	24	24	4.50	0.09	0.40	0.35	0.76	200	PVC	0.43%	21.84	0.69	3%	
	Main Street West	MH6A	MH5A	16	1.88	3.65	30	54	4.50	0.20	0.90	0.73	1.63	200	PVC	0.37%	20.26	0.64	8%	
	Main Street West	MH5A	MH4A	12	1.01	4.66	12	66	4.50	0.25	1.10	0.93	2.04	200	PVC	0.41%	21.33	0.67	10%	
	Main Street West	MH1A	MH2A	5.5	5.94	5.94	33	33	4.50	0.12	0.54	1.19	1.73	200	PVC	0.41%	21.33	0.67	8%	
	Main Street West	MH2A	MH3A	48	0.83	6.77	40	73	4.50	0.27	1.21	1.35	2.56	200	PVC	0.40%	21.07	0.66	12%	
	Main Street West	MH3A	MH4A	6.4	2.34	9.11	15	87	4.50	0.32	1.46	1.82	3.28	200	PVC	0.40%	21.07	0.66	16%	
	Linden Lane	MH4A	MH8A	31	0.71	14.48	22	176	4.50	0.65	2.93	2.90	5.83	200	PVC	1.26%	37.39	1.18	16%	
	Linden Lane	MH8A	Ex.MH (MH 7)	0	0.00	14.48	0	176	4.50	0.65	2.93	2.90	5.83	200	PVC	1.54%	41.33	1.30	14%	Connect to Exist
	Silver Maples Subdivsion and Proposed Kerman Avenue Site Added (See Silver Maples Subdivision Sanitary Drainage Area Plan by Philips)																			
	Linden Lane	MH7	MH5	60	0.39	14.87	23	199	4.50	0.74	3.32	2.97	6.29	200	PVC	0.89%	31.42	0.99	20%	
	Kerman Site	**Site**	**MH6**	**65.88**	2.11	2.11	**139**	139	4.50	0.52	2.32	0.42	2.74	200	PVC	0.89%	31.42	0.99	9%	(see Note below)
	Sumac Court	MH6	MH5	60	0.186	2.30	11	150	4.50	0.56	2.50	0.46	2.96	200	PVC	0.78%	29.42	0.93	10%	
	Sumac Court	MH5	MH3	60	0.319	17.49	19	369	4.50	1.36	6.14	3.50	9.64	200	PVC	0.78%	29.42	0.93	33%	
	Sumac Court	MH4	MH3	60	0.769	0.769	46	46	4.50	0.17	0.77	0.15	0.92	200	PVC	1.67%	43.04	1.35	2%	
	Sumac Crt / Easement	MH3	MH2	0	0.000	18.255	0	415	4.50	1.54	6.91	3.65	10.56	200	PVC	1.43%	39.83	1.25	27%	
	Easement	MH2	Ex MH	0	0.000	18.255	0	415	4.50	1.54	6.91	3.65	10.56	200	PVC	1.10%	34.93	1.10	30%	
	Easement	Ex. MH	Ex. Sanitary	0	0.000	18.255	0	415	4.50	1.54	6.91	3.65	10.56	200	PVC	1.00%	33.31	1.05	32%	
	Population for Kerman Site based on # of people per unit as outlined in report. Equilvalent to 65.58 pp/ha																			



See Silver Maples Subdivision Sanitary Drainage Area Plan by Philips (attached)

Proposed Development Sanitary Drainage to Sumac Court Population = 139 Area = 2.111ha

Proposed Development Sanitary Drainage to Kerman Ave. Population = 8 Area = 0.145ha

See updated design sheet which includes Silver Maples Subdivision and proposed Kerman Ave. Site

~~Project No. 09032~~
~~Sheet No. 1~~
~~Checked by: SL~~
~~Computed by: SL~~
~~Date: July 16, 2010~~

~~TOWN OF GRIMSBY~~
~~**SANITARY SEWER DESIGN**~~
~~Project: Main Street West Sanitary Sewer~~

~~Design flow factor = 320 l/day per person~~
~~$M = \frac{5}{\sqrt[5]{P}}$ P is in thousands~~
~~Infiltration factor = 0.2 l/s per hectare~~

Area No.	Street Name	From MH	To MH	Pop. Density [per/ha]	Incremental Area [ha]	Cumulative Area [ha]	Population Increment [per]	Cumulative Population [per]	Peaking Factor M	Average Flow l/s	Peak Flow l/s	Infil-tration l/s	Total Flow l/s	Proposed Sewer Design Diameter [mm]	Material	Grade %	Capacity l/s	Velocity m/s	Remarks
	Main Street West	MH7A	MH6A	13.6	1.77	1.77	24	24	4.50	0.09	0.40	0.35	0.76	200	PVC	0.43%	21.84	0.69	
	Main Street West	MH6A	MH5A	16	1.88	3.65	30	54	4.50	0.20	0.90	0.73	1.63	200	PVC	0.37%	20.26	0.64	
	Main Street West	MH5A	MH4A	12	1.01	4.66	12	66	4.50	0.25	1.10	0.93	2.04	200	PVC	0.41%	21.33	0.67	
	Main Street West	MH1A	MH2A	5.5	5.94	5.94	33	33	4.50	0.12	0.54	1.19	1.73	200	PVC	0.41%	21.33	0.67	
	Main Street West	MH2A	MH3A	[illegible]	0.83	6.77	40	73	4.50	0.27	1.21	1.35	2.56	200	PVC	0.40%	21.07	0.66	
	Main Street West	MH3A	MH4A	6.4	2.34	9.11	15	87	4.50	0.32	1.46	1.82	3.28	200	PVC	0.40%	21.07	0.66	
	Linden Lane	MH4A	MH8A	31	0.71	14.48	22	176	4.50	0.65	2.93	2.90	5.83	200	PVC	1.26%	37.39	1.18	
	Linden Lane	MH8A	Ex. MH	0	0.00	14.48	0	176	4.50	0.65	2.93	2.90	5.83	200	PVC	1.54%	41.33	1.30	Connect to Exist

CERTIFICATE OF COMPLETION

IT IS HEREBY DECLARED THAT THE WORK SHOWN ON THIS DRAWING RELATED TO UNDERGROUND WORKS REQUIRED BY THE TOWN OF GRIMSBY HAS BEEN COMPLETED IN THE FIELD AS PER THE SUBDIVISION AGREEMENTS. ALL SERVICES ARE "AS–CONSTRUCTED".

Signature of Scott Llewellyn, P.Eng

Date: Feb 7/12.

LEGEND

0.35 — AREA IN HECTARES
60 — POPULATION

▬ SANITARY AREA DRAINAGE BOUNDARY

BENCH MARK NOTE:

SITE BENCH MARK

MANHOLE 12–59
TOP OF LID ELEVATION – 91.693
AS PROVIDED BY THE TOWN OF GRIMSBY

NOTES:

1. FOR GENERAL NOTES SEE DWG. No. 1

B.S. LLEWELLYN
Feb 7/12.

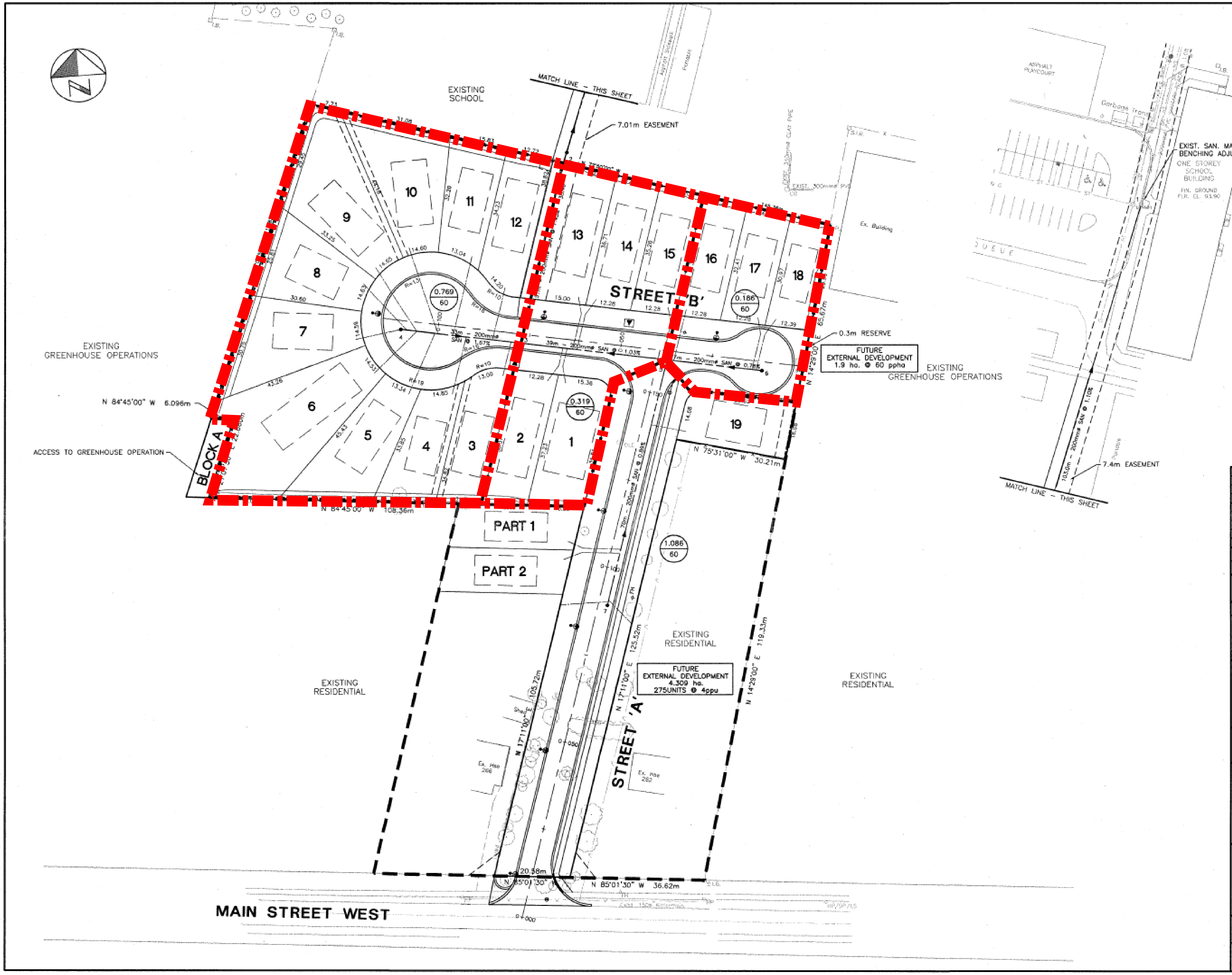
No.	REVISION	INITIAL	DATE
AC1	AS–CONSTRUCTED INFO ADDED	S.K.	2010
2.	REVISED TOP OF GRATE ON MANHOLES	B.E.K.	2009
1.	REVISED AS PER TOWN COMMENTS	B.E.K.	2009

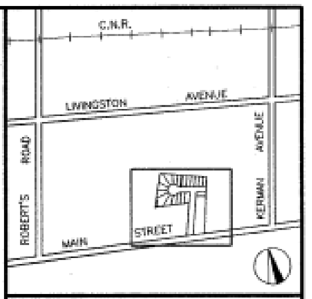
TOWN OF GRIMSBY
MAIN STREET WEST SANITARY SEWER
SANITARY AREA DRAINAGE PLAN
AS–CONSTRUCTED

Town of Grimsby
Engineering
Department of Public Works

		DATE	SCALE	DRAWING NO.
DESIGNED	S.L		1:1000	5 OF 5
CHECKED	S.L	JULY 09		
DRAWN	B.E.K.	JULY 09		

SD-YOI-56C





KEY PLAN

LEGEND

PLAN

SANITARY SEWER	——— — — ———
SANITARY SERVICE	- - - - - - - -
SANITARY DRAINAGE BOUNDARY	▬ ▬ ▬ ▬ ▬
DESIGN PARAMETERS	A — AREA IN ha. D — POPULATION DENSITY (ppha)
STREETLIGHT	•◐
TRANSFORMER	▲
NOISE BARRIER FENCE	-------------

NOTES

1. SINGLE CB LEAD 250ø PVC.
2. RLCB GRATE TO BE PYRAMID TYPE (DPW 627)
3. PAVEMENT DIMENSIONS:
   EP–EP: 8.0m
   EP–GUTTER: 0.25m
   TOTAL ROAD WIDTH: 8.5m

BENCHMARK

BENCHMARK #1 Elev.101.299
The South nut on top flange of fire hydrant on North side of Main Street.

6	10/01	KJS	AS CONSTRUCTED		X
5	09/01	JC	RESOLUTION: PW01-69 SIDEWALK REMOVED		X
4	03/00	JFB	ADJUST NOISE WALL LOCATIONS & HEIGHTS		X
3	10/99	JFB	2nd SUBMISSION COMMENTS		X
2	09/99	JFB	SAN SEW.&MAIN ST. ACCESS		X
1	09/99	JFB	FIRST SUBMISSION COMMENTS		X
NΩ	Date	By	REVISIONS	MANU	CAD

Design	C.A.T.	Ch'kd	J.F.B.	Date AUGUST 1999
Drawn	J.P.E.	Ch'kd	C.A.T.	

Scale
1:500

References

APPROVALS

APPROVED FOR CONSTRUCTION

Director of Public Works

Field Notes

Regional

Stamp

Philips
Planning
+ Engineering
Limited

SILVER MAPLES SUBDIVISION
THORNWOOD HOMES
TOWN OF GRIMSBY

TITLE

SANITARY DRAINAGE PLAN

Consultant File NΩ
99047

Regional Drawing NΩ

CONTRACT NΩ

Drawing NΩ
SHEET 3 OF 11

JAN 8/02 – B.G.N

G:\WORK\99047\HWY\DWG\AS_CONSTRUCTED\99047-03.DWG

APPENDIX C
PRELIMINARY FUS ESTIMATES

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

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:

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

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

Adjustments to the calculated fire flow can be made based on occupancy, sprinkler protection and exposure to other structures. The table below summarizes the adjustments made to the basic fire flow demand.

			(1)		(2)		(3)		(4)		Final Adjusted Fire Flow	
Building	Area "A"	C	Fire Flow "F"		Occupancy		Sprinkler		Exposure			
	(m^2)		(l/min)	(l/s)	%	Adjusted Fire Flow (l/min)	%	Adjustment (l/min)	%	Adjustment (l/min)	**(l/min)**	**(l/s)**
Lots 36-37, 38-39 and 40-41	1449	1.5	13000	216.7	-15	11050.0	0	0.0	55	6077.5	**17000**	**283**
Lots 7-8, 9-10, 11-12, 13-14, 15-16, 17-18	2898	1.5	18000	300.0	-15	15300.0	0	0.0	40	6120.0	**21000**	**350**
2 Units with combustible exterior	966	1.5	10000	166.7	-15	8500.0	0	0.0	55	4675.0	**13000**	**217**
1 Unit with non-combustible exterior	483	1.0	5000	83.3	-15	4250.0	0	0.0	55	2337.5	**7000**	**117**

- Each semi-detached bungaloft building (2 units) assumed to have a total Gross Floor Area (including garage) of 483 m^2

(2) Occupancy

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

(3) Sprinkler

40% credit for adequately designed system per NFPA 13. Additional 10% if water supply standard for both the system and fire department hose lines.

(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%

APPENDIX ??
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 188510-G

August 15, 2018
Reissued: May 18, 2021

TARBUTT CONSTRUCTION
189 South Service Road
Grimsby, Ontario
L3M 4H6

Attention: Mr. Jim Tarbutt

GEOTECHNICAL INVESTIGATIONS PROPOSED RESIDENTIAL DEVELOPMENT 9 KERMAN AVENUE AND 250 MAIN STREET GRIMSBY, ONTARIO

Dear Mr. Tarbutt,

We have completed the fieldwork, laboratory testing, and report preparation in connection with the above noted project. The work was undertaken in general accordance with our proposal P7471, dated June 8, 2018. Our comments and recommendations, based on our findings at the ten [10] borehole locations, are presented herein.

1. INTRODUCTION

We understand that the project will involve the construction of a residential redevelopment of the subject lands, which are presently a commercial greenhouse operation. The details of the proposed development have not been established at present but are anticipated to consist of townhouse units with single basement levels. Construction would also include the installation of underground services and asphalt paved roadways. The purpose of this geotechnical investigation work is to assess the subsurface soil conditions, and to provide our 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 description, 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 have been addressed in separate Phase One and Two ESA reports.

2. PROCEDURE

A total of ten [10] sampled boreholes were advanced at the locations shown on the enclosed Drawing No. 1, Borehole Location Plan. The borings were advanced on June 28 and 29, and July 12, 2018 under the supervision and direction of a representative of SOIL-MAT ENGINEERS, to depths of approximately 4.8 to 5.3 metres below the existing surface. Upon completion of drilling, groundwater monitoring wells were installed at Borehole Nos. 3, 5, 8 and 10 to allow for future measurements of the static groundwater elevation. The monitoring wells were installed to depths of approximately 3.7 to 5.3 metres, consisting of 50-millimetre diameter PVC pipe, screened in the lower 3.1 metres. The monitoring wells were then surrounded with well filter sand to approximately 0.3 metres above the screened section, and then with a bentonite ‘hole plug’ medium to ground surface, and fitted with a protective steel ‘stick up’ casing. All remaining boreholes were backfilled in general accordance with Ontario Regulation 903, and the grade reinstated even with the surrounding ground surface.

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, [CSA A119.1]. 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. The ground surface elevation at the borehole locations was referenced to a site specific benchmark, described as the top of the manhole located at the west side of Kerman Avenue, as illustrated on our Borehole Location Plan. This benchmark has been assigned an elevation of 100.00 metres for convenience. If topographic survey information for the site can be provided then these elevations can be revised to geodetic.

Details of the conditions encountered in the boreholes, together with the results of the field and laboratory tests, are presented in Log of Borehole Nos. 1 to 10, inclusive, 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 at the exact depths of geological change.

3. SITE DESCRIPTION AND SUBSURFACE CONDITIONS

The subject site is located on the properties identified as 9 and 11 Kerman Avenue, in Grimsby, Ontario. The property is currently occupied by a residential dwelling on the east side fronting to Main Street West [11 Kerman] and a commercial greenhouse occupying the majority of the site [9 Kerman]. The site is bounded to the north by vacant land, to the east by residential dwellings and Kerman Avenue, to the south by residential dwellings and Main Street West, and to the west by residential development. The site is relatively even with a total relief of approximately 2.5 metres dropping from south to north.

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

Pavement Structure

Borehole No. 1 was advanced through the pavement structure of the existing driveway, which was found to consist of approximately 50 millimetres of asphaltic concrete overlying 500 millimetres of compact granular base. Borehole No. 10 was advanced inside the existing greenhouse where the ground surface was found to consist of 90 millimetre thick interlocking paver stone overlaying approximately 100 millimetres of compact granular base. It is noted that the majority of the green house floor area was exposed soil.

Sand and Gravel Fill

A surficial veneer of sand and gravel fill was encountered in Borehole Nos. 2, 3, 6 and 7 to depths of approximately 75 to 300 millimetres. It should be noted the depth of sand and gravel fill may vary across the site and from the thickness measured at the borehole locations.

Topsoil

A surficial veneer of topsoil approximately 125 to 750 millimetres in thickness was encountered in Borehole Nos. 4, 5, 8 and 9. It should be noted that the depth of topsoil may vary across the site and from the thicknesses measured at these borehole locations. It should be noted too that the term “topsoil” has been used strictly from a geotechnical point of view and does not necessarily reflect the soils nutrient content or ability to support plant life.

Silty Sand

Silty sand was encountered beneath the pavement structure, sand and gravel fill or topsoil at all boreholes. This fine grained granular soil is brown in colour, contains trace clay and gravel, as well as some coarser sand seams, and is generally in a compact to dense state. The upper levels of the silty sand have a ‘reworked’ appearance, in a loose condition, likely associated with agricultural use, as well as being exposed to continual freeze/thaw cycles. It is noted too that the silty sand soils tend to be in a wet condition which makes them more sensitive to disturbance, such as from drilling. This may have influenced some of the measure N-values to be artificially low in the upper levels. The native silty sand was proven to termination to depths of approximately 4.8 to 5.3 metres at all borehole locations.

A review of available published information [Quaternary Geology of Ontario, Southern Sheet Map 2556] indicate the subsurface soils to consist of coarse-textured glaciolacustrine deposits of sand and gravel, with minor silt and clay, consistent with our experience in the area and observations during our fieldwork.

Groundwater Conditions

All boreholes were recorded as ‘wet’ at depths of between approximately 2.1 to 3.4 metres below the ground surface. It is noted that insufficient time would have passed for the static groundwater level to stabilise in the open boreholes. As noted above, Borehole Nos. 3, 5, 8, and 10 were fitted with monitoring wells to allow for measurement of the static groundwater level. A representative of SOIL-MAT measured the groundwater level in the wells on July 27 and August 1, 2018, which have been summarised as follows:

TABLE A
GROUND WATER LEVEL MEASUREMENTS

Borehole No.	Surface Elevation [m]	July 27, 2018		August 1, 2018	
		Ground Water Depth (m)	Ground Water Elevation (m)	Ground Water Depth (m)	Ground Water Elevation (m)
BH3	99.95	2.58	97.37	1.7	98.25
BH5	101.61	2.51	99.1	2.5	99.11
BH8	101.73	2.75	98.98	2.8	98.93
BH10	100.54	2.0	98.54	2	98.54

* It is noted that the referenced elevations above are relative to a temporary local benchmark and are not geodetic.

These monitoring well observations may be considered to have generally stabilised, given the time elapsed since installation within the silty sand deposit. The present data would indicate a static groundwater level at a depth of approximately 2.0 to 2.5 metres below the existing grade. It is noted that the static groundwater level would also be anticipated to be subject to seasonal fluctuations, being highest during the ‘wetter’ spring and fall periods of the year.

4. EXCAVATIONS

Excavations for the installation of foundations and municipal services are generally expected to extend to depths of approximately 2 to 4 metres below the existing grade. Excavations into the native silty sand soils may be expected to remain stable for the short construction period at 45 degrees to the horizontal, or steeper. Where wet seams are encountered, during periods of extended precipitation, or where excavations extend below the static groundwater level, the excavations may tend to ‘slough’ in to as flat as 3 horizontal to 1 vertical, or flatter. Nevertheless, all excavations must comply with the current Occupational Health and Safety Act and Regulations for Construction Projects. Excavation slopes steeper than those required in the Safety Act must be supported or a trench box must be provided, and a senior geotechnical engineer from this office should monitor the work.

As noted above the static groundwater level is estimated at depths of between approximately 2 and 2.5 metres below the existing grade, generally near or slightly below the anticipated depths of construction for foundations and water services, while excavations for storm and sanitary sewers will likely extend below this level. The moderate to highly permeable sand soils will yield relatively high rates of infiltration, as well as infiltration from surface runoff. For excavations to depths of about 2 to 2.5 metres the rate of infiltration should be sufficiently low, such that it should be possible to adequately control groundwater infiltration for the short construction period using conventional construction dewatering methods, such as pumping from sumps in the base of the excavation.

Excavations extending below depths of about 2 to 2.5 metres or more should be anticipated to experience a greater rate of groundwater infiltration, requiring greater pumping efforts, and possibly more sophisticated dewatering methods for deeper excavations. The contractor should be prepared to undertake work in 'wet' conditions, requiring wider excavations, greater dewatering controls, base stabilisation, etc. Excavations should begin at the 'low-end' of the sewer alignment to allow drainage away from the working areas. In this regard it is recommended that a number of test pit excavations be advanced to allow observation of the conditions first hand to assess the requirements of excavation operations during the installation of underground services. 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 the excavations above the groundwater level in the native silty sand encountered in the boreholes should generally remain firm and stable, however may be prone to some disturbance and instability, requiring the use of additional bedding or ballast stone. Where excavations approach or extend below the groundwater level the base of excavations would be expected to experience instability and some stabilisation efforts such as the placement of coarse ballast stone, or additional bedding material, may be required depending on the groundwater conditions at the time of construction.

With firm and stable excavation bases, stabilised where required, standard pipe bedding, as typically specified by the Ontario Provincial Standard Specification [OPSS] or by Town of Grimsby, compacted to a minimum of 95 per cent of its standard Proctor density [SPMDD], should suffice. The bedding should be well compacted to provide sufficient support to the pipes and components (i.e. valve chambers, manholes etc.), and to minimise settlements of the roadway above the service trenches. Special attention should be paid to compaction under the pipe haunches.

It is recommended that the invert elevations of any storm sewer pipes for rear yard catch basins be located above the proposed underside of footing elevations of adjacent structures, or that the trench excavations should be filled with lean mix [~5 MPa] concrete or non-shrink fill product to the proposed underside of footing level where the excavations extend below an imaginary one horizontal to one vertical line extending outwards and down from a point 0.3 metres beyond the proposed foundations.

5. BACKFILL CONSIDERATIONS

The majority of the excavated soils will consist of the native silty sand encountered in the boreholes as described above. These soils are generally considered suitable for use as engineered fill, trench backfill, etc., provided that they are free of organics or otherwise deleterious material, and that their moisture content can be controlled to within 3 per cent of their standard Proctor optimum moisture content.

The fine grained granular soils are sensitive to moisture conditions and will become practically impossible to compact if they are 'wet' of their optimum moisture content. The wet to saturated silty and sandy soils will need to be spread out and allowed to air dry if they will not drain sufficiently 'fast' to allow for adequate compaction operations. Water conditioning [wetting or drying] will be required depending upon the weather conditions at the time of construction. It is also noted that these fine grained granular soils will present difficulties in achieving effective compaction where access with compaction equipment is restricted, such as at the end of compaction runs. Dust could a problem during the dry months of the year. The soils encountered on site are also considered to be highly frost susceptible and will have a tendency to 'heave' significantly under sub-freezing weather conditions.

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 silty sand soils may 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 in service trenches or to raise the subgrade elevation 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 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.

6. MANHOLES, CATCHBASINS AND VALVE CHAMBERS

Where manholes, catch basins, valve chambers, etc. are founded in the native soils with the founding surfaces carefully prepared to remove all loose and disturbed material, stabilised as required, the bearing surfaces should be practically non-yielding under the anticipated loads. Proper preparation of the founding soils will therefore accentuate the protrusion of these structures above the pavement surface if compaction of the fill around these structures is not adequate, causing settlement of the surrounding paved surfaces. Conversely, the pavement surfaces may rise above the valve chambers under frost action. To alleviate the potential for these types of differential movements, free draining, non-frost susceptible material should be provided as backfill around the structures located within the paved roadway limits, and compacted to 100 percent of its standard Proctor maximum dry density. A geofabric separator should be provided between the free draining material and the on-site fine soils to prevent the intrusion of fines.

Where thrust blocks are to be founded in the native soils, they may be conservatively sized as recommended by the applicable Ontario Provincial Standard Specification using an allowable bearing pressure of 100 kPa [~2,000 psf]. Any backfill required behind the blocks should be a crushed limestone product and should be compacted to 100 percent of its standard Proctor maximum dry density.

7. PAVEMENT CONSIDERATIONS

The roadway areas should be stripped of all topsoil or otherwise unsuitable materials. The exposed subgrade should 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 subexcavated and replaced with suitable backfill material, or additional depth of Granular B sub-base material. Alternatively, the soft areas may be stabilised by their displacement into the interstitial spaces of 50-millimetre clear crushed stone ‘punched’ into the soft areas. In more severe ‘wet’ conditions it may be necessary to make use of coarse ‘rip-rap’ stone to sufficiently stabilise the subgrade level. 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 minimising 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 proposed pavement structure would be required to adequately support cars, trucks and intermittent delivery and garbage trucks. For this project, a recommended pavement structure would consist of 300 millimetres of OPSS Granular ‘B’, Type II sub-base course, 150 millimetres of OPSS Granular ‘A’ base course, 65 millimetres of HL8 binder course asphaltic concrete, and 40 millimetres of HM3 surface course asphaltic concrete. Notwithstanding, the pavement structure should conform to the relevant Town of Grimsby requirements where they are to be assumed by the Town. It is our opinion that this design is suitable for use on a residential roadway section, provided that the subgrade has been prepared as specified and is good and firm before the sub-base course material is placed. If the subgrade is soft, remedial measures as discussed above may have to be implemented and/or the sub-base thickness may have to be increased. The granular sub-base and base courses and asphaltic concrete layers should be compacted to OPSS or Town of Grimsby requirements. Typical requirements would for granular base materials to be compacted to a minimum of 98 percent of

SPMDD, and asphalt layers to a minimum of 92 percent of Marshall maximum relative density [MRD]. A program of in-place density testing must be carried out to monitor that compaction requirements are being met. We note that this pavement structure is not to be considered as a construction roadway design.

To minimise segregation of the finished asphalt mat, a uniform asphalt temperature must be maintained throughout the mat during placement and compaction. Frequently, significant temperature gradients exist in the delivered and placed asphalt with cooler portions of the mat resisting compaction and presenting a ‘honey combed’ surface. As the spreader moves forward, a responsible member of the paving crew should monitor the pavement surface, to ensure smoothness and uniformity. 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.

Asphalt paving of driveways should be consistent with the general recommendations provided above. Proper preparation of the subgrade soils is essential to good long-term performance of the pavement. Likewise, sufficient depth and compaction of granular base materials and adequate drainage will be important in achieving good long-term performance, i.e. preventing/limiting premature cracking, subgrade failure, rutting, etc. A recommended light duty pavement structure for residential driveways would consist of a minimum of 200 millimetres of OPSS Granular ‘A’ base course, compacted to 100 percent standard Proctor maximum dry density, followed by 50 millimetres of HL3 or HL3F asphaltic concrete, compacted to a minimum of 93 percent of MRD.

8. HOUSE AND TOWNHOUSE CONSTRUCTION

The native soils encountered at the borehole locations are considered capable of supporting the loads typically associated with townhouse construction on conventional spread footings. Based on the subsurface conditions, including the potential influence of established groundwater conditions, it is recommended that foundations be designed on the basis of bearing pressures of 100 kPa [~2,000 psf] SLS and 150 kPa [~3,000 psf] ULS in the native soils. It is noted that the founding level must extend through any upper disturbed zone in the native soils. However, it is also important that the founding level ideally be designed at no deeper than 2.0 metres below the existing grade, in order to minimum difficulties with disturbance of the founding soils due to groundwater conditions. The founding surfaces must be hand cleaned of any loose or disturbed material, along with any ponded water, immediately prior to placement of foundation concrete.

The support conditions afforded by the native soils are generally not uniform across the building footprint, nor are the loads on the various foundations elements. As such it is recommended that consideration be given to the provision of nominal reinforcement in the footings and foundation walls to account for variable support and loading conditions. The use of nominal reinforcement is considered good construction practice as it will act to reduce the potential for cracking in the foundation walls due to minor settlements, heaving, shrinkage, etc. and will assist in resisting the pressures generated against the foundation walls by the backfill. Such nominal reinforcement is an economical approach to the reduction and prevention of costly foundation repairs after completion and later in the life of the buildings. This reinforcement would typically consist of two continuous 15M steel bars placed in the footings [directly below the foundation wall], and similarly two steel bars placed approximately 300 millimeters from the top of the foundation walls at a minimum, depending on ground conditions exposed during construction. These reinforcement bars would be bent to reinforce all corners and under basement windows, and be provided with sufficient overlap at staggered splice locations. At ‘steps’ in the foundations and at window locations, the reinforcing steel should transition diagonally, rather than at 90 degrees, to maintain the continuous tensile capacity of the reinforcement. Where footings are founded on, or partially on, engineered fill the above provision for nominal reinforcement would be required.

All basement foundation walls should be suitably damp proofed, including the provision of a ‘dimple board’ type drainage product, and provided with a perimeter drainage tile system outlet to a gravity sewer connection or positive sump pit a minimum of 150 millimetres below the basement floor slab. The clear stone material surrounding the weeping tile should be encased with a geotextile material to prevent the migration of fines from the foundation wall backfill into the clear stone product. It is likely that sump pit systems will be required, and as such we would recommend that the sump pump system should be constructed with an ‘oversized’ reservoir and a ‘back-flow’ prevention valve so that the sump pump will not cycle repeatedly within short time periods. The enclosed Drawing Nos. 2 shows schematics of the typical requirements for foundation construction with a basement level.

All footings exposed to the environment must be provided with a minimum of 1.2 meters of earth or equivalent insulation to protect against frost penetration. This frost protection would also be required if construction were undertaken during the winter months. All footings must be proportioned to satisfy the requirements of the Ontario Provincial Building Code.

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 outlined in this report, and to allow changes to be made in the event that subsurface conditions differ from the conditions identified at the borehole locations.

9. 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.

Yaroslav Mormil, B. Eng.

Ian Shaw, P. Eng.
Senior Engineer

LICENSED PROFESSIONAL ENGINEER
MAY 18/21
I. D. SHAW
100042315
PROVINCE OF ONTARIO

Reissued

Enclosures: Drawing No. 1, Borehole Location Plan
Borehole Log Nos. 1 to 10, inclusive

Distribution: Tarbutt Construction [pdf by email]

LEGEND

⊕ BH# Borehole Location

⊕ TBM Temporary Benchmark [Catch Basin on west side of Kerman Avenue. Assumed elevation of 100.00 metres]

NOTES

1. This drawing should be read in conjunction with Soil-Mat Engineers & Consultants Ltd. Report No. SM 188510-G.

2. Borehole locations are approximate.

SOIL-MAT
ENGINEERS & CONSULTANTS LTD.

Preliminary Geotechnical Investigation
Proposed Residential Development
9 Kerman Avenue
Grimsby, Ontario

Borehole Location Plan

Project No. SM 188510-G

Date: August 2018

Drawn: MC | Checked: IS

SM 188510-G Borehole Location Plan

Drawing No. 1

Log of Borehole No. 1

Project No: SM 188510-G
Project: Proposed Residential Development
Location: 9 & 11 KermanAvenue,Grimsby
Client: Tarbutt Construction

Project Manager: Ian Shaw, P.Eng.
Borehole Location: See Drawing No.1
:
:

Soil-Mat

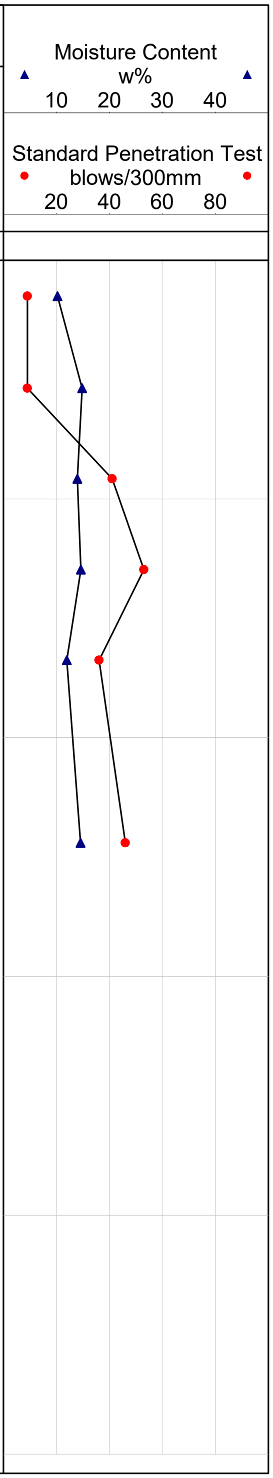
Depth (ft)	Depth (m)	Elevation (m)	Description	Well Data	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0	0	99.72	Ground Surface								
0–1.8	0–0.55	99.17	**Pavement Structure** Approximately 50 millimetres of asphaltic concrete over 500 millimetres of compact granular base.		SS	1	10,6,3,2	9			
1.8–17	0.55–5.2	94.52	**Silty Sand** Brown, reworked in upper levels, trace clay and gravel, loose to very dense.		SS	2	4,4,5,5	9			
					SS	3	18,21,20,30	41			
					SS	4	26,26,27,29	53			
					SS	5	14,19,17,24	36			
					SS	6	17,21,25,30	46			
			End of Borehole								

NOTES:

1. Borehole was advanced using direct push probe equipment on June 28, 2018 to termination at a depth of 5.2 metres.

2. Borehole was recorded as open to 3.4 metres and 'wet' at a depth of 2.7 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.



Drill Method: Direct Push Method
Drill Date: June 28, 2018
Hole Size: 100 millimetres
Drilling Contractor: DDSI

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

Datum: Temporary Benchmark
Field Logged by: MC
Checked by: IS
Sheet: 1 of 1

Log of Borehole No. 2

Project No: SM 188510-G
Project: Proposed Residential Development
Location: 9 & 11 KermanAvenue,Grimsby
Client: Tarbutt Construction

Project Manager: Ian Shaw, P.Eng.
Borehole Location: See Drawing No.1
:
:

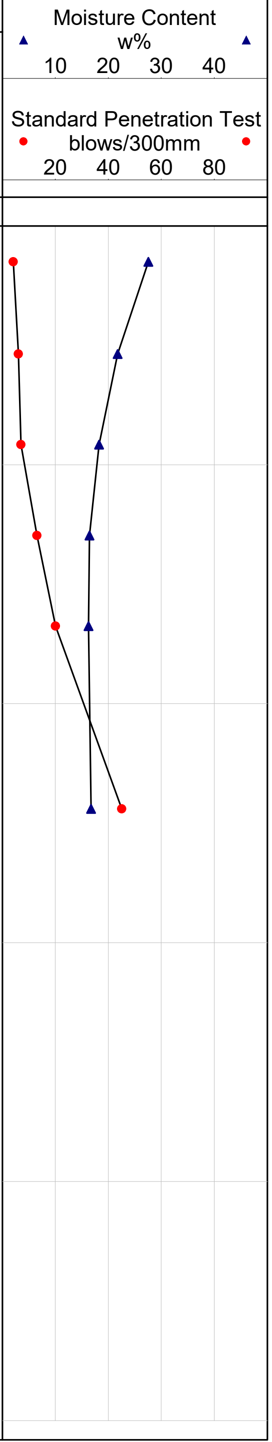
Depth (ft)	Depth (m)	Elevation (m)	Description	Well Data	SAMPLE Type	SAMPLE Number	SAMPLE Blow Counts	SAMPLE Blows/300mm	SAMPLE Recovery	SAMPLE PP (kgf/cm2)	SAMPLE U.Wt.(kN/m3)
0	0	99.98	Ground Surface								
0	0	99.68	**Sand and Gravel Fill** Approximately 300 millimetres of sand and gravel fill.		SS	1	6,2,2,2	4	▨		
1	0.3		**Silty Sand** Brown, reworked in upper levels, trace clay and gravel, very loose to dense.		SS	2	3,2,4,3	6	▨		
					SS	3	2,3,4,3	7	▨		
					SS	4	11,7,6,7	13	▨		
					SS	5	7,11,9,11	20	▨		
					SS	6	34,24,21,32	45	▨		
17	5.2	94.78	End of Borehole								

NOTES:

1. Borehole was advanced using direct push probe equipment on June 28, 2018 to termination at a depth of 5.2 metres.

2. Borehole was recorded as 'wet' at a depth of 2.1 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.



Drill Method: Direct Push Method
Drill Date: June 28, 2018
Hole Size: 100 millimetres
Drilling Contractor: DDSI

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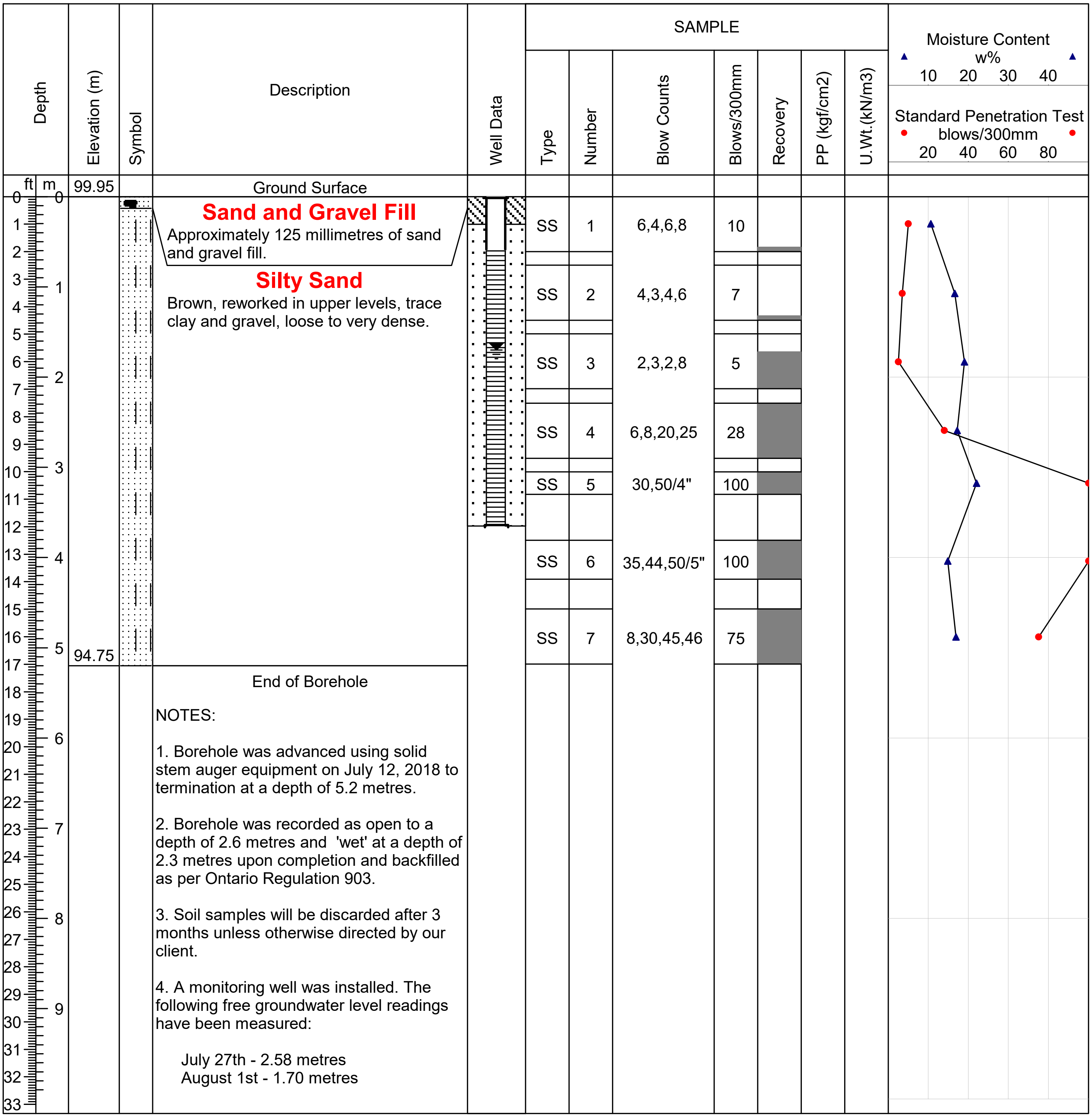
Datum: Temporary Benchmark
Field Logged by: MC
Checked by: IS
Sheet: 1 of 1

Log of Borehole No. 3

Project No: SM 188510-G
Project: Proposed Residential Development
Location: 9 & 11 KermanAvenue,Grimsby
Client: Tarbutt Construction

Project Manager: Ian Shaw, P.Eng.
Borehole Location: See Drawing No.1
:
:



Depth	Elevation (m)	Description	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0	99.95	Ground Surface							
		Sand and Gravel Fill Approximately 125 millimetres of sand and gravel fill.	SS	1	6,4,6,8	10			
		Silty Sand Brown, reworked in upper levels, trace clay and gravel, loose to very dense.	SS	2	4,3,4,6	7			
			SS	3	2,3,2,8	5			
			SS	4	6,8,20,25	28			
			SS	5	30,50/4"	100			
			SS	6	35,44,50/5"	100			
	94.75		SS	7	8,30,45,46	75			
		End of Borehole							

NOTES:

1. Borehole was advanced using solid stem auger equipment on July 12, 2018 to termination at a depth of 5.2 metres.

2. Borehole was recorded as open to a depth of 2.6 metres and 'wet' at a depth of 2.3 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:

July 27th - 2.58 metres
August 1st - 1.70 metres

Drill Method: Solid Stem Augers
Drill Date: July 12, 2018
Hole Size: 100 millimetres
Drilling Contractor: Kodiak Drilling

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Datum: Temporary Benchmark
Field Logged by: MC
Checked by: IS
Sheet: 1 of 1

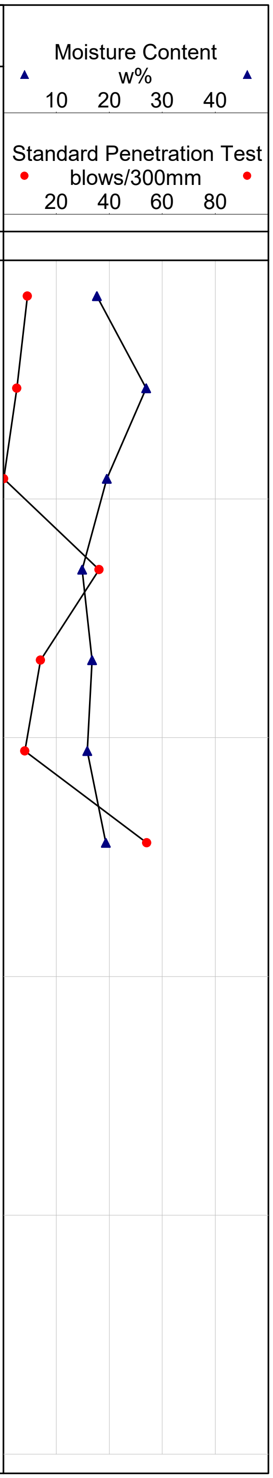
Log of Borehole No. 4

Project No: SM 188510-G
Project: Proposed Residential Development
Location: 9 & 11 KermanAvenue,Grimsby
Client: Tarbutt Construction

Project Manager: Ian Shaw, P.Eng.
Borehole Location: See Drawing No.1

Depth (ft / m)	Elevation (m)	Description
0	100.72	Ground Surface
	100.47	**Topsoil** Approximately 250 millimetres of topsoil.
		Silty Sand Brown, reworked in upper levels, trace clay and gravel, very loose to very dense.
	95.52	End of Borehole

		SAMPLE					
Well Data	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
	SS	1	2,5,4,3	9			
	SS	2	2,2,3,2	5			
	SS	3	1,0,0,6	0			
	SS	4	12,18,18,20	36			
	SS	5	8,9,5,10	14			
	SS	6	1,3,5,19	8			
	SS	7	16,28,26,27	54			



NOTES:

1. Borehole was advanced using solid stem auger equipment on June 28, 2018 to termination at a depth of 5.2 metres.

2. Borehole was recorded as open to 3.7 metres and 'wet' at a depth of 3.0 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.

Drill Method: Soild Stem Augers
Drill Date: June 28, 2018
Hole Size: 100 millimetres
Drilling Contractor: DDSI

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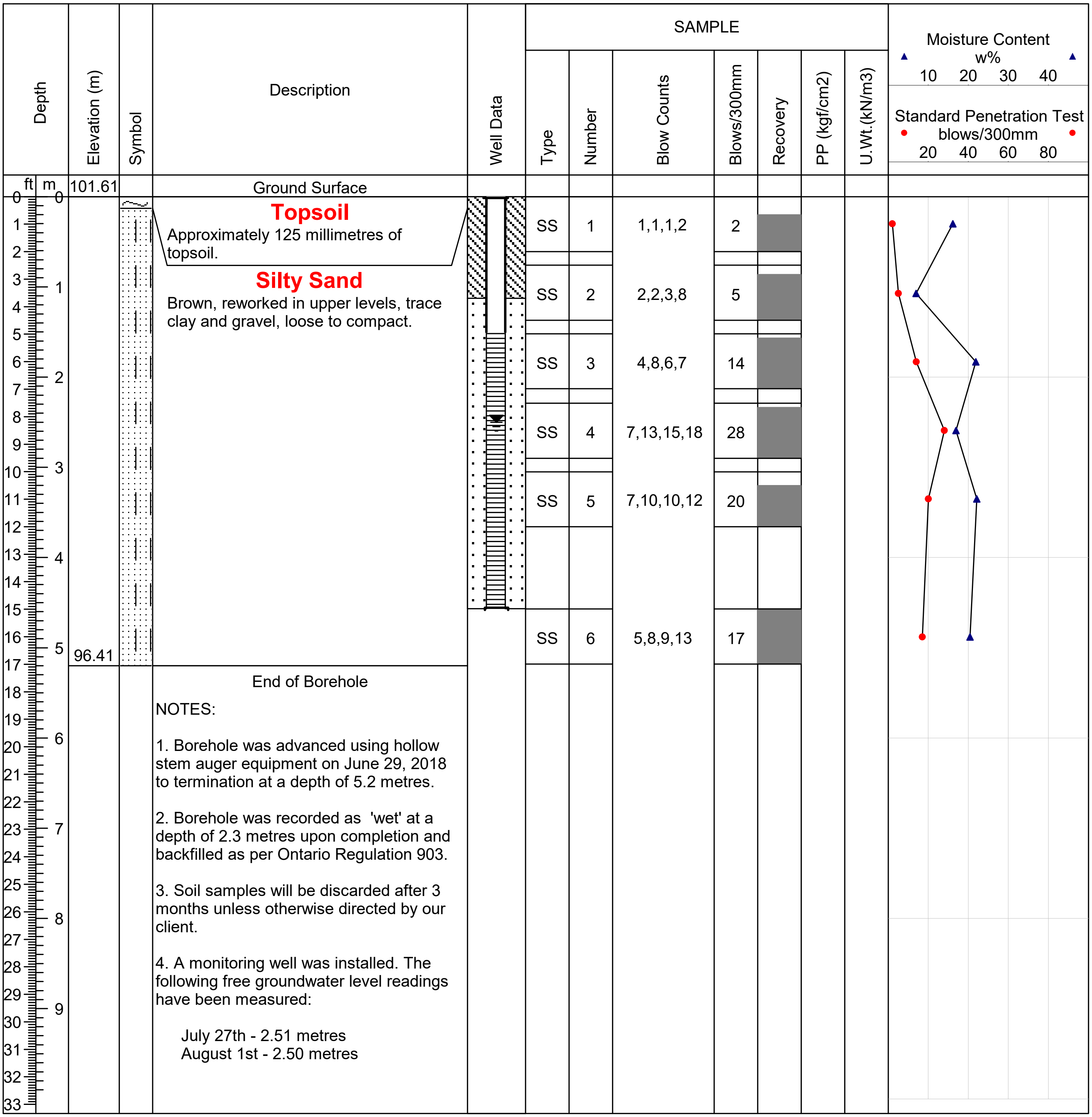
Datum: Temporary Benchmark
Field Logged by: MC
Checked by: IS
Sheet: 1 of 1

Log of Borehole No. 5

Project No: SM 188510-G
Project: Proposed Residential Development
Location: 9 & 11 Kerman Avenue,Grimsby
Client: Tarbutt Construction

Project Manager: Ian Shaw, P.Eng.
Borehole Location: See Drawing No.1
:
:



Elevation (m)	Description
101.61	Ground Surface
	Topsoil Approximately 125 millimetres of topsoil.
	Silty Sand Brown, reworked in upper levels, trace clay and gravel, loose to compact.
96.41	End of Borehole

NOTES:

1. Borehole was advanced using hollow stem auger equipment on June 29, 2018 to termination at a depth of 5.2 metres.

2. Borehole was recorded as 'wet' at a depth of 2.3 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:

July 27th - 2.51 metres
August 1st - 2.50 metres

SAMPLE

Type	Number	Blow Counts	Blows/300mm
SS	1	1,1,1,2	2
SS	2	2,2,3,8	5
SS	3	4,8,6,7	14
SS	4	7,13,15,18	28
SS	5	7,10,10,12	20
SS	6	5,8,9,13	17

Drill Method: Hollow Stem Augers
Drill Date: June 29, 2018
Hole Size: 175 millimetres
Drilling Contractor: DDSI

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Datum: Temporary Benchmark
Field Logged by: MC
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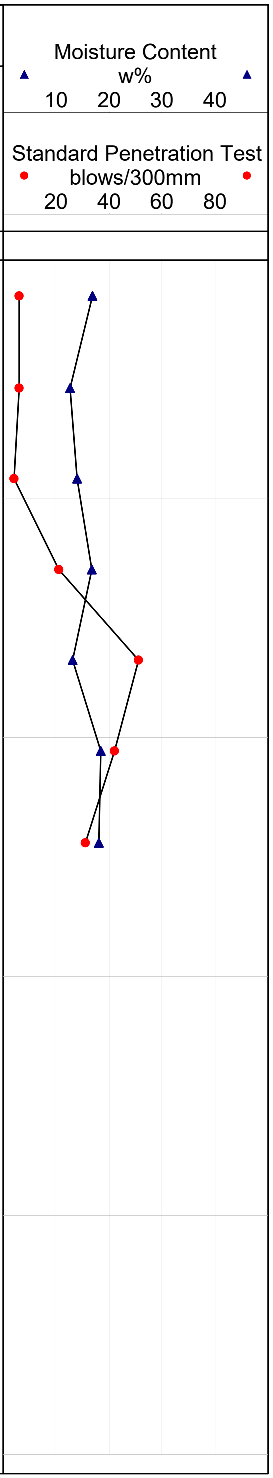
Sheet: 1 of 1

Log of Borehole No. 6

Project No: SM 188510-G
Project: Proposed Residential Development
Location: 9 & 11 KermanAvenue,Grimsby
Client: Tarbutt Construction

Project Manager: Ian Shaw, P.Eng.
Borehole Location: See Drawing No.1
:
:

Depth ft	Depth m	Elevation (m)	Symbol	Description	Well Data	SAMPLE Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0	0	101.76		Ground Surface								
				Sand and Gravel Fill Approximately 75 millimtres of sand and gravel fill.		SS	1	4,4,2,2	6	■		
				Silty Sand Brown, reworked in upper levels, trace clay and gravel, loose to very dense.		SS	2	3,3,3,2	6	■		
						SS	3	3,3,1,2	4	■		
						SS	4	10,9,12,16	21	■		
						SS	5	26,24,27,32	51	■		
						SS	6	38,24,18,20	42	■		
						SS	7	22,15,16,27	31	■		
		96.56		End of Borehole								



NOTES:

1. Borehole was advanced using direct push probe equipment on June 28, 2018 to termination at a depth of 5.2 metres.

2. Borehole was recorded as open to 3.0 metres and 'wet' at a depth of 2.4 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.

Drill Method: Direct Push Method
Drill Date: June 28, 2018
Hole Size: 100 millimetres
Drilling Contractor: DDSI

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Field Logged by: MC
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Sheet: 1 of 1

Log of Borehole No. 7

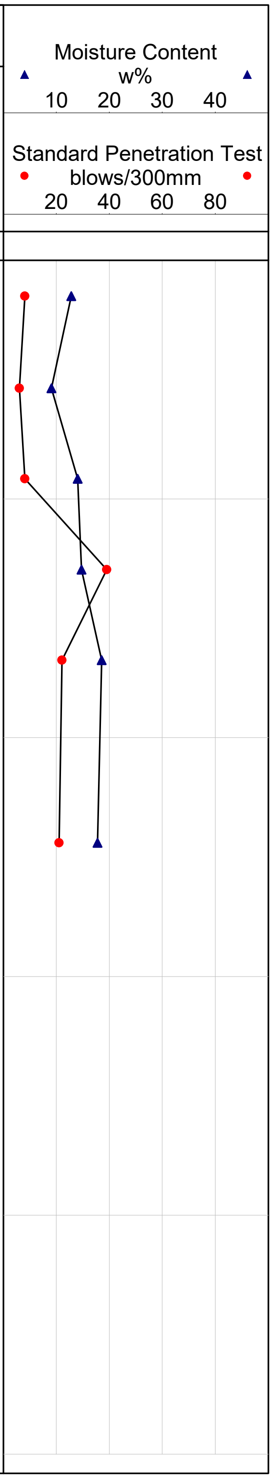
Project No: SM 188510-G
Project: Proposed Residential Development
Location: 9 & 11 KermanAvenue,Grimsby
Client: Tarbutt Construction

Project Manager: Ian Shaw, P.Eng.
Borehole Location: See Drawing No.1
:
:

Soil-Mat

Depth (ft / m)	Elevation (m)	Description	Type	Number	Blow Counts	Blows/300mm	Recovery
0 / 0	102.61	Ground Surface					
	102.38	**Sand and Gravel Fill** Approximately 225 millimetres of sand and gravel fill.	SS	1	7,5,3,3	8	▨
		Silty Sand Brown, reworked in upper levels, trace clay and gravel, loose to dense.	SS	2	2,3,3,3	6	▨
			SS	3	3,4,4,3	8	▨
			SS	4	9,19,20,22	39	▨
			SS	5	9,12,10,12	22	▨
			SS	6	3,9,12,18	21	▨
	97.41	End of Borehole					

Well Data | PP (kgf/cm2) | U.Wt.(kN/m3)



NOTES:

1. Borehole was advanced using hollow stem auger equipment on June 29, 2018 to termination at a depth of 5.2 metres.

2. Borehole was recorded as open to 3.4 metres and 'wet' at a depth of 3.4 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.

Drill Method: Hollow Stem Augers
Drill Date: June 29, 2018
Hole Size: 175 millimetres
Drilling Contractor: DDSI

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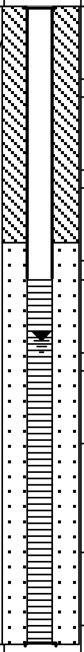
Datum: Temporary Benchmark
Field Logged by: MC
Checked by: IS
Sheet: 1 of 1

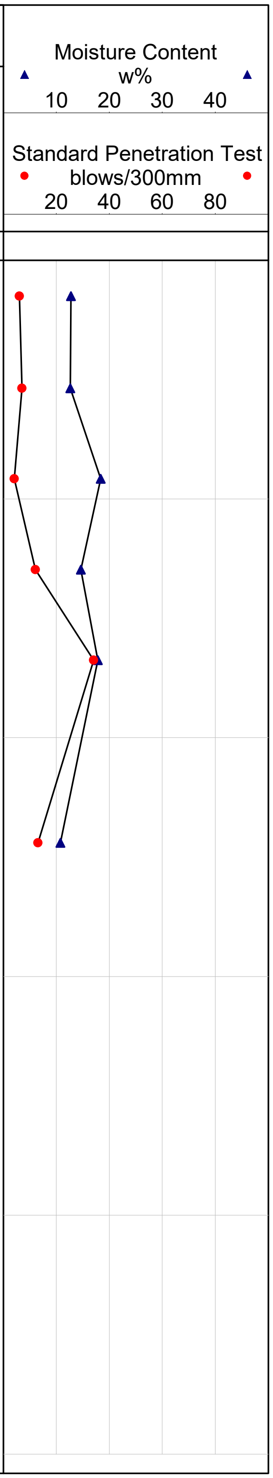
Log of Borehole No. 8

Project No: SM 188510-G
Project: Proposed Residential Development
Location: 9 & 11 KermanAvenue,Grimsby
Client: Tarbutt Construction

Project Manager: Ian Shaw, P.Eng.
Borehole Location: See Drawing No.1

Depth (ft / m)	Elevation (m)	Description	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0 / 0	101.73	Ground Surface							
	101.50	**Topsoil** Approximately 225 millimetres of topsoil.	SS	1	2,3,3,3	6	■		
		Silty Sand Brown, reworked in upper levels, trace clay and gravel, loose to dense.	SS	2	3,4,3,3	7	■		
			SS	3	3,2,2,5	4	■		
			SS	4	8,6,6,13	12	■		
			SS	5	11,15,19,20	34	■		
			SS	6	3,5,8,32	13	■		
	96.39	End of Borehole							





NOTES:

1. Borehole was advanced using hollow stem auger equipment on June 29, 2018 to termination at a depth of 5.3 metres.

2. Borehole was recorded as 'wet' at a depth of 3.0 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:

July 27th - 2.75 metres
August 1st - 2.80 metres

Drill Method: Hollow Stem Augers
Drill Date: June 29, 2018
Hole Size: 175 millimetres
Drilling Contractor: DDSI

Soil-Mat Engineers & Consultants Ltd.
130 Lancing Drive, Hamilton, ON L8W 3A1
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Datum: Temporary Benchmark
Field Logged by: MC
Checked by: IS
Sheet: 1 of 1

Log of Borehole No. 9

Project No: SM 188510-G
Project: Proposed Residential Development
Location: 9 & 11 KermanAvenue,Grimsby
Client: Tarbutt Construction

Project Manager: Ian Shaw, P.Eng.
Borehole Location: See Drawing No.1
:
:

Soil-Mat

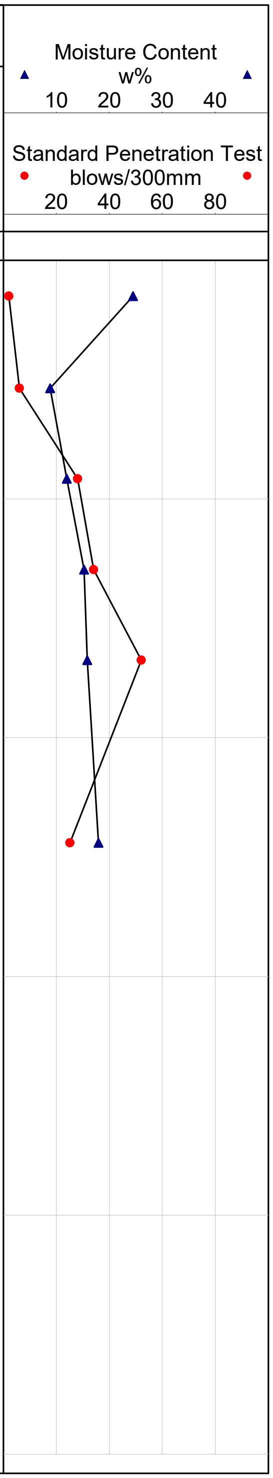
Depth	Elevation (m)	Symbol	Description	Well Data	SAMPLE Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
ft m 0	100.19		Ground Surface								
			Topsoil Approximately 750 millimetres of topsoil.		SS	1	1,1,1,0	2	■		
	99.44										
			Silty Sand Brown, reworked in upper levels, trace clay and gravel, loose to very dense.		SS	2	2,2,4,8	6	■		
					SS	3	12,14,14,20	28	■		
					SS	4	18,16,18,23	34	■		
					SS	5	32,28,24,20	52	■		
					SS	6	15,15,10,17	25	■		
	94.99		End of Borehole								

NOTES:

1. Borehole was advanced using direct push probe equipment on June 29, 2018 to termination at a depth of 5.2 metres.

2. Borehole was recorded as open to 3.4 metres and 'wet' at a depth of 2.6 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.



Drill Method: Direct Push Method
Drill Date: June 29, 2018
Hole Size: 175 millimetres
Drilling Contractor: DDSI

Soil-Mat Engineers & Consultants Ltd.
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Datum: Temporary Benchmark
Field Logged by: MC
Checked by: IS
Sheet: 1 of 1

Log of Borehole No. 10

Project No: SM 188510-G
Project: Proposed Residential Development
Location: 9 & 11 KermanAvenue,Grimsby
Client: Tarbutt Construction

Project Manager: Ian Shaw, P.Eng.
Borehole Location: See Drawing No.1
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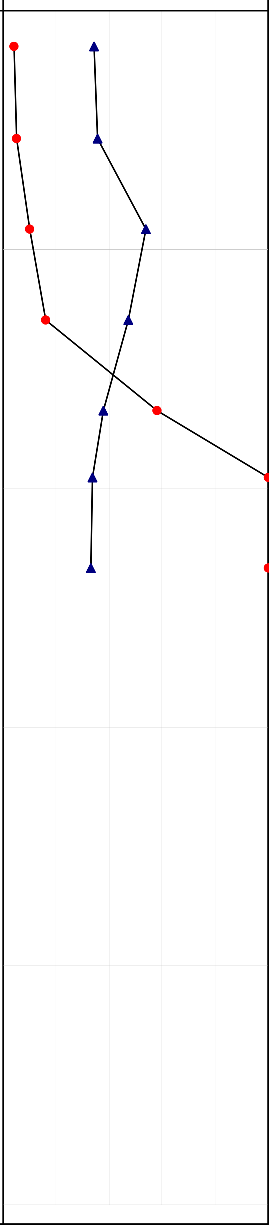
Soil-Mat

Depth (ft / m)	Elevation (m)	Description
0 / 0	100.54	Ground Surface
	100.35	**Pavement Structure** Approximately 90 millimetre thick interlocking tile over 100 millimetres of compact granular base.
	95.74	**Silty Sand** Brown, reworked in upper levels, trace clay and gravel, loose to very dense.
		End of Borehole

SAMPLE Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
SS	1	2,2,2,2	4			
SS	2	1,2,3,3	5			
SS	3	14,4,6,4	10			
SS	4	5,6,10,12	16			
SS	5	13,24,34,40	58			
SS	6	50/5"	100			
SS	7	24,50/5"	100			

Moisture Content ▲
w%
10 20 30 40

Standard Penetration Test ●
blows/300mm
20 40 60 80



NOTES:

1. Borehole was advanced using soilid stem auger equipment on July 12, 2018 to termination at a depth of 4.8 metres.

2. Borehole was recorded as open to a depth of 2.4 metres and 'wet' at a depth of 2.3 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:

July 27th - 2.00 metres
August 1st - 2.00 metres

Drill Method: Solid Stem Augers
Drill Date: July 12, 2018
Hole Size: 100 millimetres
Drilling Contractor: Kodiak Drilling

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