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300 Somme Street, Ottawa, ON

Servicing and Stormwater Management Report

Engineering excellence. Planning precision. Inspired landscapes.

SERVICING AND STORMWATER MANAGEMENT REPORT

COPART FACILITY
300 SOMME STREET
OTTAWA, ONTARIO

Prepared by:

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May 27, 2020

Novatech File: 119181
Ref No. R-2020-070

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May 27, 2020

Planning and Infrastructure Approvals
City of Ottawa
110 Laurier Avenue West
Ottawa, Ontario, K1P 1J1

Attention: Seana Turkington, Planner I – Planning Services

Reference: Copart Facility
300 Somme Street, Ottawa, ON
Servicing and Stormwater Management Report
Our File No.: 119181

Please find enclosed the 'Servicing and Stormwater Management Report', May 27, 2020, for the above noted project. The report outlines the detailed servicing and stormwater management design to meet the requirements of the City of Ottawa and South Nation Conservation Authority (SNCA) in support of a Site Plan Control application and is submitted for your review and approval.

Please forward a copy to the South Nation Conservation Authority.

Should you have any questions or require additional information, please contact the undersigned.

Yours truly,

NOVATECH

Alex McAuley, P. Eng.
Project Manager | Land Development Engineering

Encl.

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1.0 INTRODUCTION

Novatech has been retained to prepare a Servicing and Stormwater Management Report for the proposed outdoor storage area, with accessory office/warehouse building located at 300 Somme Street, Ottawa, Ontario. This report provides the detailed design for site servicing, storm drainage and stormwater management for the proposed site, in support a Site Plan Application for the subject development.

The site is a parcel within the existing Hawthorne Industrial Park and is described as Block 6, Plan 4M-1388. **Figure 1** Key Plan shows the site location.

1.1 Background Reports

This report references the following background documents:

- Stormwater Management Report, Hawthorne Industrial Park, JLR 20983, JL Richards (May 2009);
- Abbreviated Hydrogeological Assessment, 65080.01-R1, prepared by Gemtec (March 9, 2020);
- Geotechnical Report, 65080.01, prepared by Gemtec (April 24, 2020);
- City of Ottawa Sewer Design Guidelines

1.2 Existing Conditions

The site is approximately 17.8 hectares and is currently vacant.

There is an approximate grade change of 5.5m across the site from the southwest corner to the northeast corner. **Figure 2** shows the existing site conditions.

Soils

The soils on this site are primarily imported fill underlain by silty sand and clay. Boreholes and test pits were advanced during geotechnical investigations. Refer to the Geotechnical Report for more information.

Topography / Storm Outlet

Under existing conditions, the site is gradually sloped from the south west towards the north east and drains towards the existing roadside ditches on Somme Street. The existing industrial subdivision is serviced by roadside ditches and a quantity control stormwater facility.

The post-development storm drainage areas for the site are outlined in the JL Richards report for the Hawthorne Industrial Park subdivision. In this report, it is proposed that the site be divided into three drainage areas that all generally drain from the center of the site towards the existing roadside ditches that surround the site. The existing roadside ditches are designed to convey stormwater to the existing stormwater management facility on the north side of Somme Street. Excerpts from the JL Richards Report are in **Appendix A**.

1.3 Proposed Development

The proposed development is primarily a vehicle storage yard for short term storage (typically 50 to 60 days) and will include an accessory building which will contain office and warehouse space. The proposed 1,200m^2 building would be located on the northwest portion of the site along with an associated drilled well and septic system. The site access will be from Somme Street. Refer to **Figure 3** for the proposed site layout.

1.4 Site Constraints

The geotechnical report completed by Gemtec indicates that existing fill should be removed to native soil below sensitive structures. This means that under the building and the septic system, the existing fill must be removed and backfilled with suitable material.

1.5 Approvals

The proposed stormwater conveyance and stormwater management design will require approval from the City of Ottawa and the South Nation Conservation Authority (SNCA). A Ministry of the Environment Conservation and Parks (MECP) Environmental Compliance Approval (EC) will be required for the proposed stormwater management, as the site is zoned industrial.

The proposed septic system design will require approval from the Ottawa Septic System Office (OSSO).

2.0 GRADING AND SERVICING

Since municipal services are not available on Sappers Ridge or on Somme Street, it is proposed to service the accessory office/warehouse building with a drilled well and septic system.

The stormwater runoff will be conveyed overland via proposed perimeter swales, which will outlet to the existing roadside ditches.

2.1 Grading

The site will be graded to drain towards perimeter swales via overland flow. The detailed grading around the proposed accessory building allows for drainage away from the proposed building, and towards proposed grassed swales.

2.1.1 Pavement Design

The recommended pavement structure is noted on the Notes and Details Plan (Drawing 119181-ND), as follows:

Table 1: Pavement Structure

Pavement Material Description	Layer Thickness (mm)		
	Heavy Duty	Light Duty	Gravel
Asphalt Wear Course (Superpave 12.5)	40	50	-
Asphalt Base Course (Superpave 19.0)	60	-	-
OPSS Granular A	150	150	150
OPSS Granular B Type II	450	300	450
TOTAL	**700**	**500**	**600**

The proposed pavement structure is consistent with the recommendations provided in the Geotechnical Report.

2.2 Water Supply

The building will be serviced by a new drilled well consistent with the recommendations of the Abbreviated Hydrogeological Assessment report (Gemtec, March 2020). The approximate location of the well is shown on the Detailed Grading and Servicing Plan (119181-GS2).

Water supply for fire protection will be stored in underground precast tanks, to provide water for firefighting in accordance with the rural water storage requirements. A dry hydrant will be provided to draw water from the proposed tanks. The dry hydrant location has been located in consultation with City of Ottawa Fire Services.

Fire storage requirements are based on the Ontario Building Code for a ‘low hazard industrial occupancy’ with non-combustible construction and no sprinklers. The volume of water required for fire protection for this building is 132m^3.

The volume of water to be provided in the precast underground storage tanks is 150m^3 minimum. Refer to **Appendix B** for fire flow calculations. Correspondence with City of Ottawa Fire Services is included in **Appendix G.**

2.3 Wastewater Disposal

The building will be serviced by an individual sewage disposal system (septic system) in accordance with the recommendations of the Terrain Analysis Report. The septic system is shown on the Detailed Grading and Servicing Plan (119181-GS2) and is a fully raised conventional (Class IV) tile field system based on a design flow of 3,425 L/day.

A Sewage System Permit will be required from the Ottawa Septic System Office.

Refer to **Appendix C** for details on the proposed septic system design.

3.0 STORM DRAINAGE AND STORMWATER MANAGEMENT

The stormwater management criteria and storm drainage design are consistent with the JL Richards report. Relevant excerpts of the report are provided in **Appendix A**.

The stormwater management pond designed and constructed for the industrial subdivision is a dry pond, providing water quantity control, assuming 70% imperviousness. The Copart site is within the catchment area for the pond.

3.1 Stormwater Management Criteria

The following criteria have been applied to the stormwater management design:

Water Quantity

- Stormwater Quantity Control is provided in a downstream dry pond for storms up to and including the 100-year storm event. If the total imperviousness of the site exceeds 70%, provide storage to attenuate post-development peak flows to the equivalent of 70% imperviousness.
- Design the storm drainage system to convey post-development flows for all storms up-to and including the 100-year storm event.

Water Quality

- Provide on-site oil/grit separators to achieve a Normal level of water quality treatment corresponding to 70% long-term removal of total suspended solids (TSS).
- Implement best management practices.

Infiltration

- Infiltration is not proposed due to the proposed industrial use per the JL Richards report.

Erosion and Sediment Control

- Provide erosion and sediment control to minimize erosion and sediment transport during and after construction.

3.2 Proposed Drainage System

The proposed storm drainage system will consist of perimeter swales located within the 15m buffer along the perimeter of the outdoor storage area. The perimeter swales will outlet to the roadside ditches via oil-grit separators (OGS units) and spillways. A portion of the building roof and adjacent landscaped areas will drain directly to the Somme Street roadside ditch.

The area of proposed development will sheet drain from a high point on the site towards the perimeter swales. The swales have been designed to provide stormwater conveyance, some detention, and water quality treatment. The swales outlet through ditch-inlet catchbasins which will drain to OGS units and then to the adjacent roadside ditches. Flows which exceed the capacity of the OGS units will flow directly to the roadside ditch via a rip-rap lined spillway. Inlet control devices (ICDs) are proposed for the ditch-inlet catchbasins to control the peak flow rates to the OGS units to reduce the size of the units required.

Since the proposed site does not exceed 70% imperviousness, stormwater quantity control is not required. While not required, the flow attenuation discussed above will result in some storage of stormwater within the on-site perimeter swales.

3.3 Storm Drainage Area Plan

The Post-Development Storm Drainage Area Plan (119181-POST) generally maintains the storm drainage areas outlined in the JL Richards report. The drainage boundaries have been adjusted slightly to reflect the proposed grading design for the site.

3.4 Overland Flow Route

As mentioned above, flows which exceed the capacity of the OGS units will flow directly to the roadside ditches via a rip-rap spillway adjacent to each OGS unit. This spillway will be used for storm events which exceed the 25mm water quality event and provide an overland flow route to the subdivision stormwater management pond.

Events which exceed the 100-year storm event will overtop the spillway. The overland flow routes are shown on the Overall Grading, Erosion, Sediment Control and Servicing Plan (119181-GS1).

3.5 Stormwater Management Modeling

The PCSWMM hydrologic / hydraulic model was used to complete the storm drainage analysis for the proposed storm drainage system. The hydrologic analysis includes the delineation of storm drainage areas and the selection of modelling parameters for each subcatchment area. The PCSWMM model schematic and model output for post-development conditions are provided in **Appendix D**.

3.6 Allowable Flows

The allowable release rates for the site is based on a runoff coefficient of 0.70 which corresponds to an imperviousness of 70% per the JL Richards report. Since the post-development runoff coefficient is less than 0.70 for all drainage areas, the allowable flow is the post development flow. Therefore, flow attenuation is not required.

Table 2 provides a summary of the design parameters used in the JL Richards report and the post-development conditions for the site. Since the design parameters for the site under post-development conditions are similar to those used in the JL Richards report (as demonstrated by **Table 2** below), downstream analysis of the existing roadside ditches is not required.

Table 2: Comparison of Design Parameters

	Drainage Area				
	West	North		South/East	Total
JL Richards Design (Allowable)					
ID	2	3		1	
Runoff Coefficient	0.70	0.70		0.70	0.70
Area (ha)	3.75	6.91		7.13	17.79
Post-Development Conditions (Site)					
ID	U-1	U-2	U-4	U-3	
Runoff Coefficient	0.61	0.65	0.33	0.61	0.61 (max)
Area (ha)	3.48	8.45	0.32	5.48	17.73

3.7 Stormwater Conveyance and Quantity Control

Stormwater conveyance and quantity control will be provided for the site based on the following measures.

Building Rooftops:

Stormwater runoff from the building rooftops will runoff uncontrolled to the landscaped areas immediately adjacent to the building.

Parking / Landscaped Areas:

Stormwater runoff from the parking / landscaped areas will be directed towards a grassed swale which will outlet to the perimeter swale on the north side of the site.

3.7.1 Swales (Conveyance)

The proposed perimeter swales have been sized to convey the 100-year peak flows, based on Manning's equation. The proposed typical perimeter swale cross-sections are shown on the Notes and Details Plan (119181-ND).

In all cases, the maximum capacity of the perimeter swales exceeds the 100-year design flow. Supporting calculations for the swales are included in **Appendix D**.

3.7.2 Outlet Structures

The outlet control structures will consist of a 600mm by 600mm ditch inlet catchbasin, complete with 600mm sump, a plug type orifice and a 250mm diameter storm sewer. The sewer will connect to the OGS unit, which will outlet to the roadside ditch. Each outlet will have an adjacent rip-rap lined spillway to convey flows in excess of the controlled flow through the orifice and OGS unit. The spillways will be constructed of 150 mm diameter D_{50} rip-rap. The design of the outlet structure is based on the model results to control flows to the OGS units.

Details of the storm outlets are shown on the Notes and Details Plan (119181-ND).

4.0 Stormwater Quality Control

The site is located within the jurisdiction of South Nation Conservation Authority (SNCA) which requires a *normal* level of treatment (70% long term removal of total suspended solids). In addition, as this is an industrial site and per the JL Richards SWM Report, OGS units are required to provide stormwater quality control.

4.1 BMP Treatment Train

A treatment train approach will be used to provide to required quality control of stormwater. The treatment train consists of site level conveyance controls and Best Management Practices as follows:

- The overall site drainage patterns are generally consistent with those proposed by the JL Richards report.
- Stormwater from roof areas is considered 'clean' and quality control of stormwater for these areas is not required.
- The drainage system for the proposed works will consist of grassed perimeter swales. The proposed swales will be constructed at minimum grades.
- Oil-grit separator units will be provided at each outlet.

4.1.1 Grassed Swales

Although grassed swales are generally used for the conveyance of stormwater, under the appropriate conditions they permit significant amounts of total suspended solid (TSS) removal. Grassed swales are effective for treatment when the bottom width is maximized while the depth of flow and channel slope is minimized.

The grassed swales have been designed based on guidelines from the following publications:

- Young et. al., "Evaluation and Management of Highway Runoff Water Quality (FHWA, 1996)
- Stormwater Best Management Practices in an Urban Setting: Selection and Monitoring (FHWA, 1996)
- Stormwater Management Planning and Design Manual (MOE, 2003)

Case studies on the effectiveness of grassed ditches and swales for water quality control have provided variable results, which precludes the ability to precisely calculate pollutant removal efficiencies. However, the above referenced publications indicate that properly designed grassed channels can provide in excess of 80% long-term TSS removal, which will meet the requirements for an Enhanced level of quality control as per the MOE guidelines.

Both dry and wet swales demonstrate good pollutant removal, with dry swales providing significantly better performance for metals and nitrate. Dry swales typically remove 65 percent of total phosphorus (TP), 50 percent of total nitrogen (TN), and between 80 and 90 percent of metals. Wet swale removal rates are closer to 20 percent of TP, 40 percent of TN, and between 40 and 70 percent of metals. The total suspended solids removal for both swale types is typically between 80 and 90 percent. (FHWA, 1996)

The proposed swales have been designed to meet MOE standards for water quality treatment. The recommended MOE and FHWA criteria for water quality and the results of the analysis for the site are summarized in **Table 3**.

Table 3: Grassed Channel Design (Based on MOE & FHWA Guidelines)

Criteria	Recommended	West Swale OGS 1	North Swale OGS 2	South Swale OGS 3
Channel Dimensions				
Channel Slope	< 4.0% (MOE)	0.5%	0.5% to 1.0%	0.6%
Bottom Width	> 0.75 m (MOE)	2.0 m	2.0 m	2.0 m
Side Slopes (H:V)	> 2.5:1 (MOE)	3:1	3:1	3:1
Length	N/A	288	514	613
Water Quality Event (25mm – 4-hour Chicago)				
Peak Flow	-	0.061 m^3/s	0.187 m^3/s	0.112 m^3/s
Flow Depth*	± 0.1 m (FHWA)	0.05 – 0.58 m	0.06 – 0.61 m	0.05 – 0.69 m
Velocity	< 0.5 m/s (MOE)	0.16 – 0.32 m/s	0.13 – 0.51 m/s	0.17 – 0.45 m/s
100-year Event (3-hour Chicago)				
Peak Flow	-	0.439 m^3/s	1.208 m^3/s	0.856 m^3/s
Flow Depth*	< 0.5 m (MOE)	0.17 – 0.93 m	0.18 – 0.80 m	0.17 – 0.88 m
Velocity	N/A	0.26 – 0.56 m/s	0.29 – 0.89 m/s	0.29 – 0.83 m/s

*The recommended flow depths are only exceeded near the outlets due to the flow restriction and ponding as a result of the orifice controls.

The results summarized in **Table 3** indicate that the flow depths and velocities in the swales meet the recommended flow depth and velocity criteria for the 25mm event (water quality event). As the grassed swales meet the water quality criteria for frequent storm events, they should provide long-term water quality control.

4.1.2 Oil-grit Separators (OGS units)

As this is an industrial site and as required in the JL Richards report, OGS units are required to provide stormwater quality. Since the conveyance system to the OGS units consists of grassed water quality swales, a credit for the pre-treatment provided by the grassed swales has been applied to the design of the OGS units. Refer to **Appendix E** for details on the proposed OGS Units.

4.2 Maintenance

Pollutant removal efficiencies of swales are related to flow retardance, vegetation density and the stiffness of grass blades, providing a "scrub brush" effect (Khan, 1993). Best removal rates have been achieved through dense turf grasses where a uniform blade height is maintained at least 50mm (2 in) above the design water depth. Grasses too short do not provide sufficient flow reduction or pollutant filtration; grasses too long tend to bend and flatten, allowing the runoff to skim over the bent grass, reducing flow retardance and filtration. (FHWA, 1996).

Based on the above statement, the proposed perimeter swales should be planted with dense turf grass or similar vegetation. The height of vegetation in the swales should be maintained at approximately 150 to 200mm (6 to 8 inches) by the Owner.

Annual inspection of the swales and OGS units is recommended to monitor accumulation of sediment or debris:

- Sediment removal should be performed when sediment depths build up to no more than 100mm;
- Grass damaged during the sediment removal process should be promptly replaced using the same seed mix used during initial vegetation establishment;
- If any areas are eroded, they should be filled, compacted, and reseeded so that the final grade is level with the bottom of the swale;
- Inspect the outlet structure regularly and remove any blockage.

4.3 Conclusion

The proposed storm drainage system, in conjunction with site level best management practices, will provide the requisite level of water quality treatment.

5.0 Erosion and Sediment Control

Erosion and sediment control measures would be implemented during construction in accordance with the "Guidelines on Erosion and Sediment Control for Urban Construction Sites" (Government of Ontario, May 1987). Details and specific locations of temporary and permanent Erosion and Sediment Control measures are shown on the Overall Grading, Erosion, Sediment Control and Servicing Plan (119181-GS1).

5.1 Temporary Measures

Temporary erosion and sediment control measures will be implemented on-site during construction in accordance with the Best Management Practices for Erosion and Sediment Control, as follows.

- Placement of geotextile or filter bags (catch basin inserts) under the ditch inlet catch basins;
- Silt fences around the area under construction;
- Light duty straw bales at key locations in the ditches and swales as shown on the plans;
- Vegetating disturbed areas.

The erosion and sediment control measures are to be implemented prior to construction and will remain in place during all phases of construction. Regular inspection and maintenance of the erosion control measures are to be undertaken.

5.2 Permanent Measures

Permanent erosion and sediment control measures will include the following:

- Roof leaders are to be directed to the landscape areas.
- Ditches and swales have been designed at minimum grade, where possible.
- Ditches and swales are to be vegetated to provide permanent erosion and sediment control.
- Rip-rap will be installed at spillways.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The conclusions are as follows:

Servicing

- Potable water will be provided by means of a new drilled well in accordance with the recommendations of the Abbreviated Hydrogeological Assessment report (dated March 9, 2020) prepared by Gemtec.
- Water for fire protection will be stored onsite in underground tanks.
- The proposed septic system is based on design flow of 3,425 L/day for a fully raised conventional system. A Sewage System Permit application will be required from the Ottawa Septic System Office.

Stormwater Management

- Storm drainage will be provided via grassed perimeter swales.
- Quantity control of storm runoff is not required as the site imperviousness is within the subdivision design parameters.
- The grassed perimeter swales in combination with the oil-grit separator units will provide a normal level of water quality treatment corresponding to 70% long-term total suspended solids removal.
- Erosion and sediment control will be provided to minimize erosion and sediment transport during and after construction.

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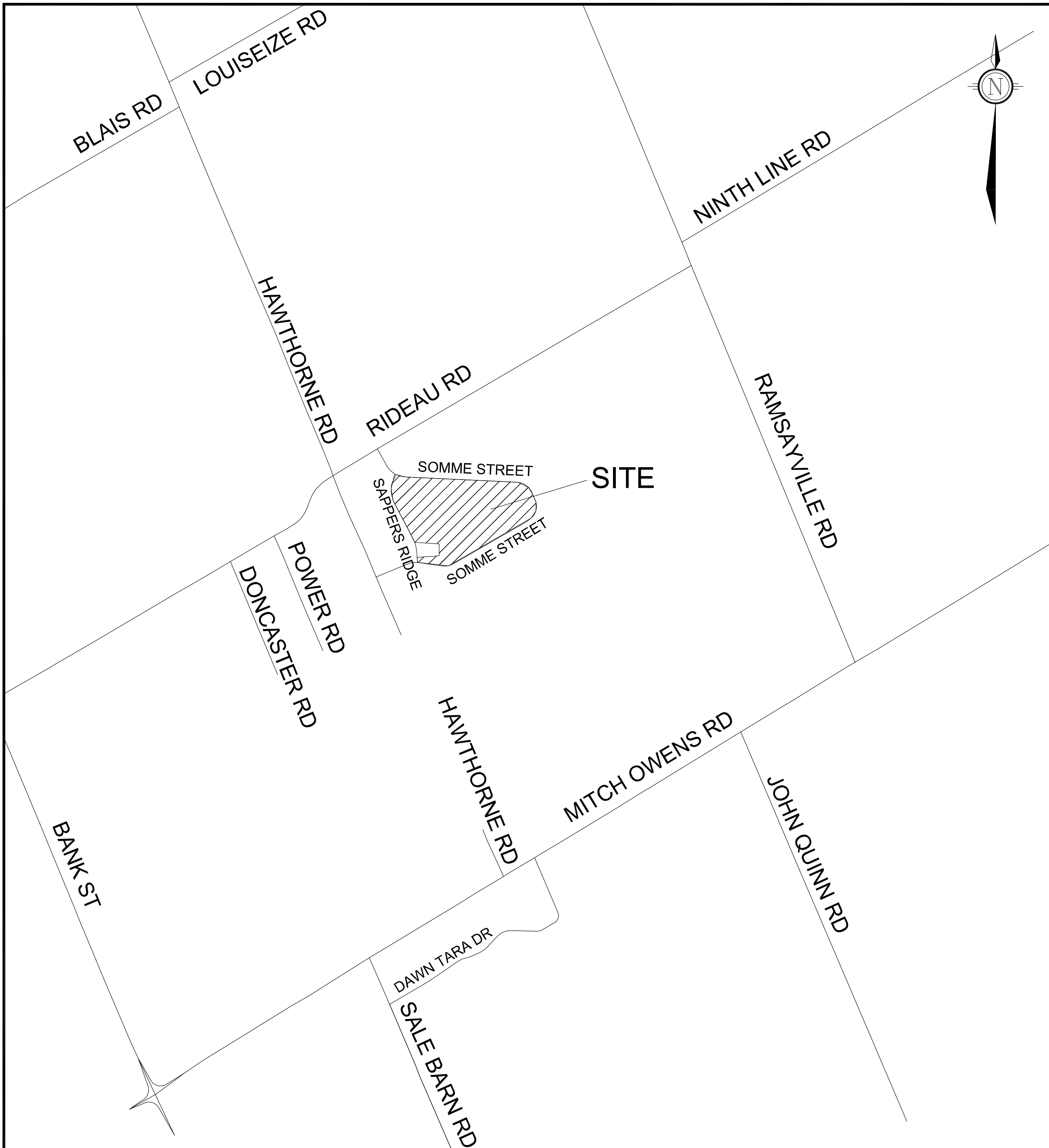

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CITY OF OTTAWA

300 SOMME STREET
COPART FACILITY

KEY PLAN

DATE	JOB	FIGURE
MAY 2020	119181	FIG-1

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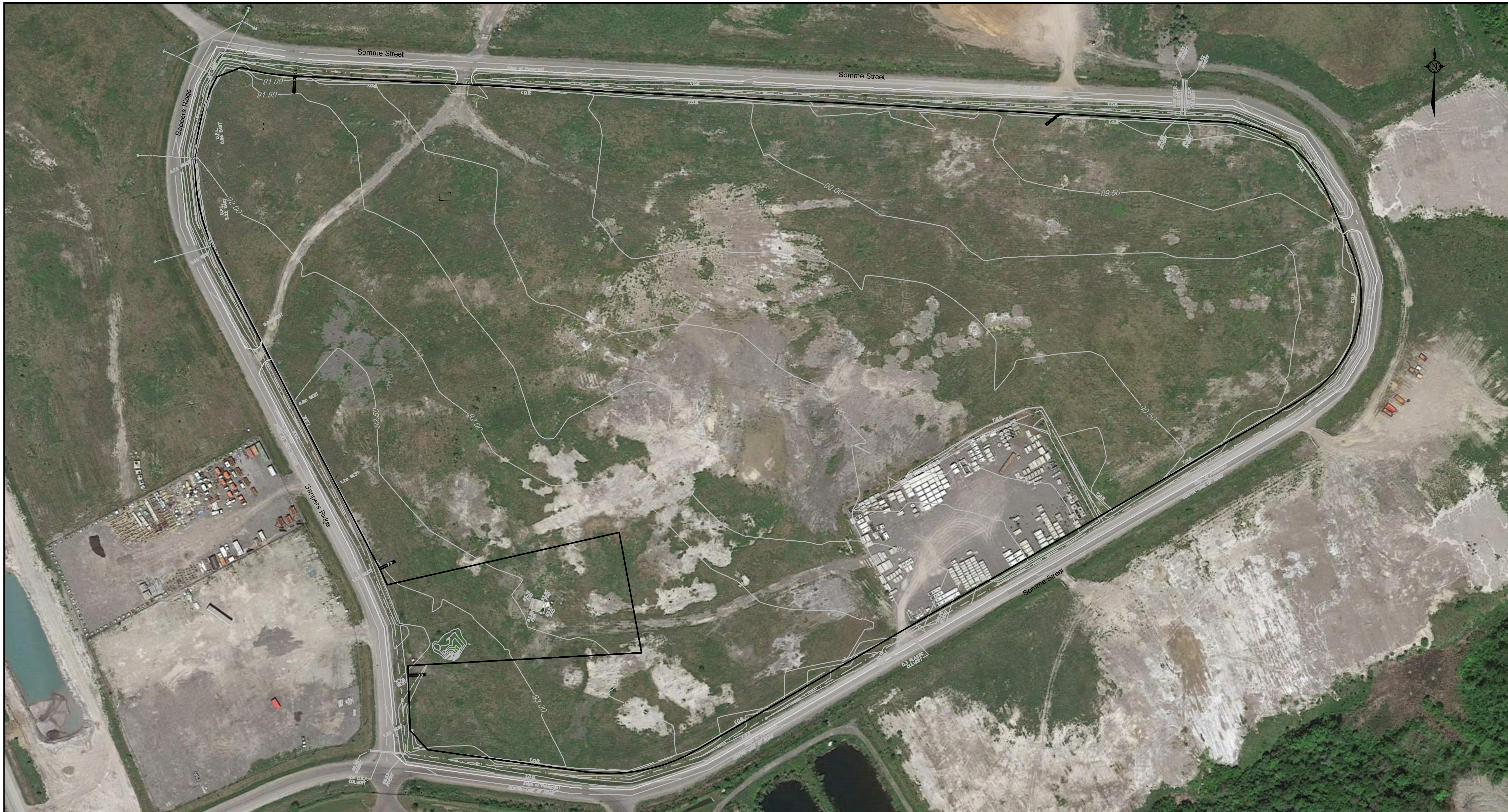

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CITY OF OTTAWA	
300 SOMME STREET COPART FACILITY	
EXISTING CONDITIONS	
SCALE	
DATE MAY 2020	JOB 119181
FIGURE FIG-2	

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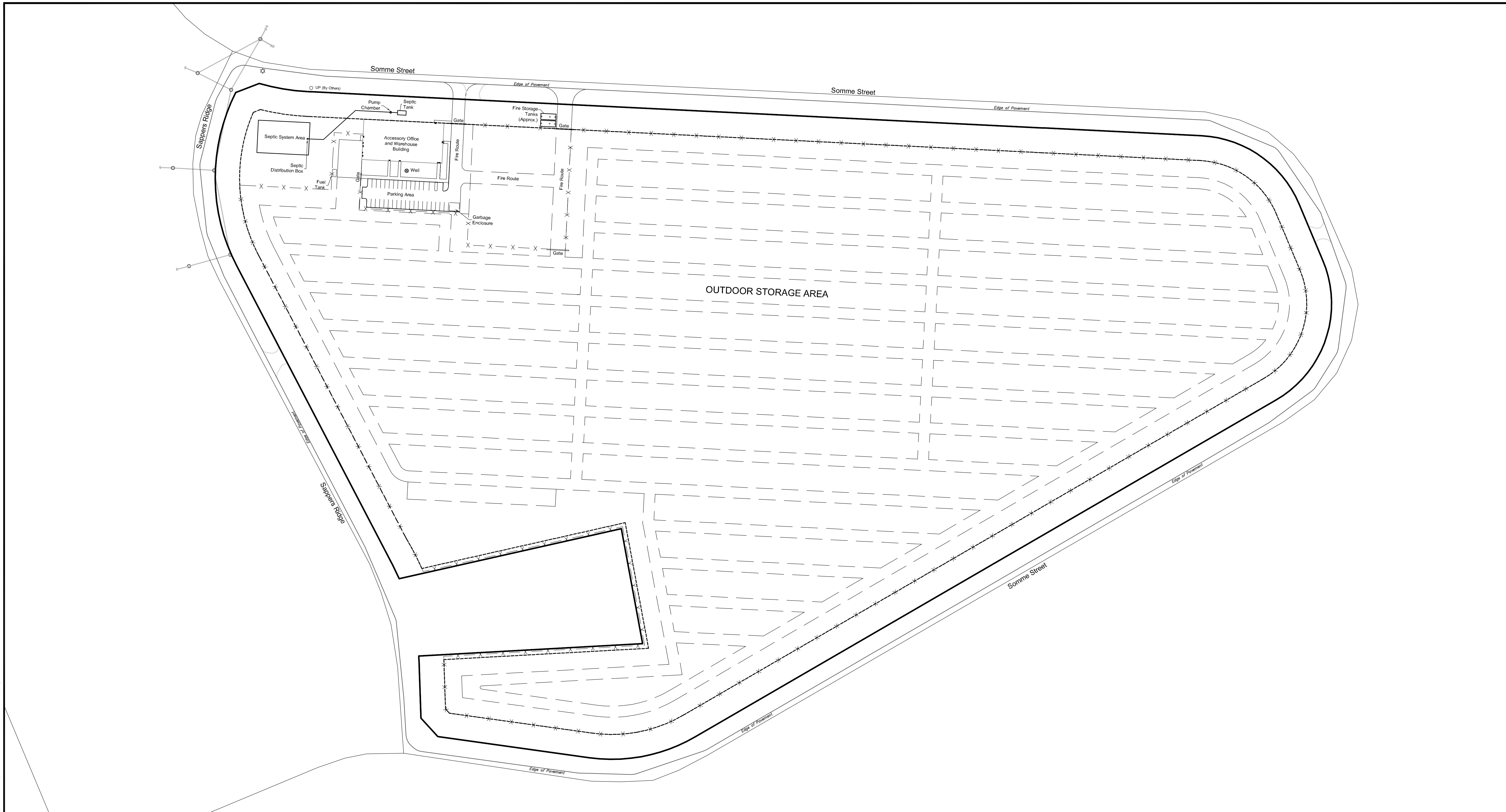

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CITY OF OTTAWA

300 SOMME STREET
COPART FACILITY

PROPOSED SITE LAYOUT

SCALE		
DATE MAY 2020	JOB 119181	FIGURE FIG-3

SHT11X17.DWG - 279mmX432mm

APPENDIX A

Excerpts from “Stormwater Management Report, Hawthorne Industrial Park” JL Richards (May 2009)

This Stormwater Management Report (SWMR) has been written to demonstrate that the subject land could be developed in compliance with the above surface water criteria and also prepared in accordance with the SWMPDM. The proposed stormwater management strategy for the HIP was developed to meet a "normal" level of protection, which corresponds to a standard approach used in land development to obtain a targeted TSS removal rate of 70%.

3.0 STORM SERVICING

3.1 General

Peak flow estimation is an important task that is carried out for any proposed development. There are several reasons that explain why flood flow rates are computed as part of site development. The main purpose of these calculations, however, is to allow for the proper configuration and sizing of the proposed conveyance systems to minimize the risk of flooding.

Drainage works are designed for a real or hypothetical storm event that may or may not happen during the lifetime of the facilities. At the onset of the design process, design criteria are adopted that may vary with the type of project, in recognition of the impacts of failure. For this particular project, the level of protection adopted (storm events up to a 1:100 year recurrence) was based on design storm characteristics of an infrequent storm event having a low probability to occur.

3.2 Description of Conveyance Systems and Design Basis

Flowing water can be conveyed to an outlet by either open-channel flow or pipe flow. Storm runoff generated by the subject lands is to be collected and conveyed by a roadside ditch/culvert system before discharging to Findlay Creek via an end-of-pipe stormwater management facility (SWMF).

Sizing of the conveyance systems was carried out using various levels of service. The open ditch system was sized with sufficient capacity to convey, under free-flowing conditions, storm runoff up to the 1:100 year recurrence, while roadway culverts were sized to provide conveyance of the 1:10 year peak flow rates without overtopping the roadway embankments.

As part of this sizing exercise, Storm Drainage Area Plans were prepared and included in this Report (refer to Drawing D-ST1 for the HIP and Drawing D-ST2 for Hawthorne and Rideau Road) that show the delineated area for each of the conveyance segments (i.e., from node location to node location), along with its assigned runoff coefficient (C-factor) based on the type of surface. Since the final development of Hawthorne Industrial Park is unknown at this time, a conservative on-site runoff coefficient (C-factor) of 0.70 was used. Table 2 illustrates the breakdown of a typical site that would generate a weighted runoff coefficient of 0.70.

Table 2 - Typical Potential Land Use Breakdown

Type of Surface	Area (%)	C-Factor
Building	10	1.0
Asphalt Parking	35	0.90
Gravel	35	0.70
Grass	20	0.20
Overall	100	**0.70**

It should be noted that the C-factors shown on the Storm Drainage Area Plans denote those associated with 1:10 year peak flow calculations. As recommended in Section 5.4.5.2.1 of the City of Ottawa's Sewer Design Guidelines, C-factors shown on drawings were increased by 10% and 25% for the 1:25 year and 1:100 year peak flow calculations, respectively (refer to Appendix 'A' for copies of the Rational Method Design Sheets).

3.2.1 Open Ditch System

An open ditch channel is a conduit used to convey flowing water from one location to another, with a free surface. A channel can be classified as either artificial (i.e., manmade) or natural. Artificial channels are those constructed or developed as a result of human activity. This type of conveyance system is usually implemented as a long and mild-sloped channel built in the ground, which provides conveyance of water between two points, with sections of regular geometry and shape. An open ditch system is generally designed to follow site topography and the vertical profile of the adjacent roadway. The most commonly used shapes for open channel ditches are trapezoidal and triangular, with the latter shape utilized mainly for ditches servicing small drainage areas.

that there was a high groundwater table at the proposed pond location. In addition, in-situ soils in the area exhibited poor drainage properties which would have resulted in long retention times at the base of the pond, making it difficult to meet the water balance deficit requirements for the entire site while attempting to mimic the pre-development hydrological cycle.

Representatives from the City and SNC were consulted, and it was concluded that the SCSS groundwater balance targets for this site would be difficult to meet. It was also recognized that on-site infiltration strategies for this industrial subdivision could have a detrimental effect on groundwater quality and jeopardize the natural ecological integrity of receiving waters. In light of the above, it was decided by the approval authorities that the requirement for the water balance would be waived for the HIP development.

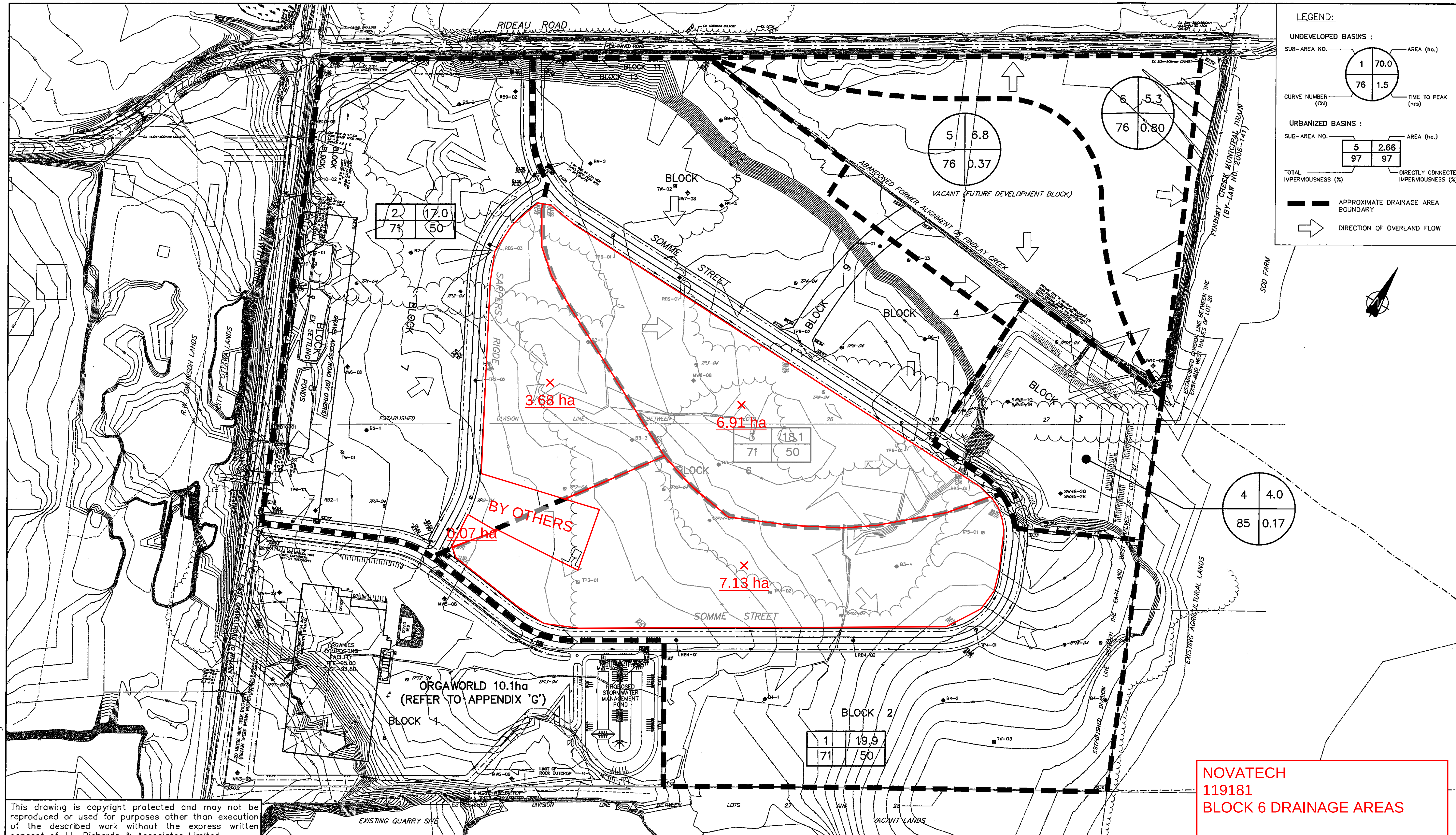
5.0 WATER QUALITY

5.1 General

Urbanization has been found to modify the hydrological regime of a receiving stream if inadequate stormwater management measures are implemented. The potential impacts associated with runoff arise primarily from the amount of urban area that is impervious to rain and snowmelt water. These impervious surfaces increase the amount of direct surface runoff that is generated and is conveyed more efficiently to the receiving stream. As part of the SCSS, fisheries resources have been inventoried along this watercourse, along with its associated tributaries. Given that the receiving watercourses were found to shelter fisheries, the approved document recommended that a "normal" level of protection be achieved. To fulfil this requirement, it is proposed that each individual site provide an oil/grit separator and infiltration storage be provided within the roadside open ditch system, as per the requirements presented in the SWMPDM.

5.2 Water Quality Requirement

Stormwater servicing for the HIP has been developed in accordance with the water quality recommendations of the SCSS (70% TSS removal). To fulfil this requirement, individual sites will be required to provide an oil/grit separator be installed to provide quality treatment (i.e., 70% TSS removal) of surface runoff before entering the roadside open ditch/culvert system. In addition, the oil/grit separator will be able to capture and contain hydrocarbons in the event of an on-site accidental spill.



This drawing is copyright protected and may not be reproduced or used for purposes other than execution of the described work without the express written consent of J.L. Richards & Associates Limited.

PROJECT: HAWTHORNE INDUSTRIAL PARK	DRAWING: POST DEVELOPMENT – PHASE 1 STORM DRAINAGE AREA PLAN	J.L. Richards & Associates Limited, 864 Lady Ellen Place, Ottawa, ON Canada K1Z 5M2, Tel: 613 728 3571, Fax: 613 728 6012 — J.L.Richards ENGINEERS·ARCHITECTS·PLANNERS	DESIGN: M.B. DRAWN: ARM CHECKED: G.F. PLOTTED: Apr 30, 2009	DRAWING NO.: FIGURE 3 JLR NO: 20983

APPENDIX B
Fire Protection Calculations

OBC Water Supply for Firefighting Calculation

Based on OBC 2012 (Div. B, Article 3.2.5.7)

References: Ontario Fire Marshal - OBC Fire Fighting Water Supply
Ontario Building Code 2012, Appendix A, Vol 2., A-3.2.5.7

NOVATECH
Engineers, Planners & Landscape Architects

Novatech Project #: 119181
Project Name: 300 Somme Street
Date: 5/27/2020
Input By: A. McAuley
Reviewed By: A.McAuley

Legend
Input by User
No Input Required

Building Description: Single Storey Occupancy F-3 and D, non combustible construction

Unsprinklered

Step		Calculation Inputs		Calculation Notes	Value
	Minimum Fire Protection Water Supply Volume				
1	**Water Supply Coefficient**				
	Building Classification =	F-3		From Table 3.1.2.1	
	Water Supply Coefficient - K =			From Table 1 (A3.2.5.7)	**19**
2	**Total Building Volume**				
	Building Width - W	25.30	m		
	Building Length - L	50.00	m	Area (W * L) = 1265 m	
	Building Height - H	5.5	m		
	Total Building Volume - V =			W * L * H	**6958 m³**
3	**Spatial Coefficient Value**				
	Exposure Distances: (Exterior building face to property/lot line, to street centre, or to mid-point between proposed building and another building on same lot)			**Spatial Coefficients:** From Figure 1 (Spatial Coefficient vs Exposure Distance)	
	North	46.00	m	Sside 1 = **0.00**	
	East	520.00	m	Sside 2 = **0.00**	
	South	250.00	m	Sside 3 = **0.00**	
	West	100.00	m	Sside 4 = **0.00**	
	Total of Spacial Coefficient Values - S-Tot as obtained from the formula =			1.0 + (Sside 1 + Sside 2 + Sside 3 + Sside 4) (Max. value = 2.0)	**1.00**
4	**Minimum Fire Protection Water Supply Volume**				
	Q =			K * V * S_{Tot}	**132,193 L**
	Required Minimum Water Supply Flow Rate				
5	**Minimum Water Supply Flow Rate =**			From Table 2 (For water supply from a municipal or industrial water supply system, min. pressure is 140 kPa)	**3,600 L/min** or **60 L/s**
	Minimum Fire Protection Water Supply Volume for 30 minutes				
6	**Q =**			= Minimum Water Supply Flow Rate (L/min) * 30 minutes	**108,000 L**
	Required Fire Protection Water Supply Volume				
7	**Q =**			Highest volume out of (4) and (6)	**132,193 L**
Notes	Fire Protection Water supply to be provided with underground storage tanks				

APPENDIX C
Septic System Design Brief

May 27, 2020

Septic System Design Brief

300 Somme Street, Ottawa

Report Reference: R-2020-068
Novatech File No.: 119181

Proposed Development Scenario

The proposed development, located at 300 Somme Street, is primarily a vehicle storage yard and will include an accessory building which will contain office and warehouse space. The proposed 1,200m^2 office/receiving building would be located on the northwest portion of the 17.84 hectare site and would be serviced by a conventional septic system. Refer to the Overall Grading, Erosion, Sediment Control and Servicing Plan (119181-GS1) attached for the location of the septic system on the site.

Existing Soil Conditions

Gemtec has prepared the following document in support of the site development and septic system design:

1. Geotechnical Report – Proposed Office/Receiving Building, 300 Somme Street (April 24, 2020)
2. Terrain Analysis – Vehicle Storage Yard, 300 Somme Street, (April 24, 2020)

Topsoil and Fill Material: The geotechnical report confirms an approximate topsoil depth of 0.1m below ground surface in the area of the septic bed. The underlying material is imported fill which consists of brown silty sand and gravel with trace clay extending approximately 2.3m below ground surface. It is recommended by the geotechnical consultant that the topsoil and fill material be removed below the proposed leaching bed down to insitu soil in order to limit settlement.

Insitu Soils: The geotechnical report notes insitu soils beginning approximately 2.3m below ground surface and consisting of grey silt, clay, and trace gravel.

Water Table Elevation: No groundwater was noted to a depth of approximately 3.7m below ground surface.

Suite 200, 240 Michael Cowpland Drive, Ottawa ON K2M 1P6 Tel: 613.254.9643 Fax: 613.254.5867 www.novatech-eng.com

Design Flow

The theoretical design flow is based on 35 employees per day working 8-hour shifts as well as 100 visitors per day.

Activity	People	Flow (L/day)	Total Flow (L/day)
Employees (per employee, per 8 hour shift)	35	75	2,625
Visitors (per day)	100	8	800
			3,425

The theoretical design flow based on usage is 3,425L/day.

Septic System Design

The proposed septic system consists of a septic tank, gravity sewer, pump chamber (complete with dual pumps), forcemain, and a conventional absorption trench bed. Details of the septic system design are indicated on the attached Septic System Plan (119181-SEP).

The design flow used to size the septic tank is 3,425L/day.

Septic Tank

Size required (Commercial): = 3 x 3,425L = 10,275L
Minimum tank size required: = 10,275L

Tank Size provided: = 11,500L
Maximum flow based on tank size = 11,500L÷ 3 = 3,834L/day
Septic tank is to be fitted with an effluent filter.

Absorption Trench Bed Design

The absorption trench will be sized based on a flow of 3,834L/day which is the maximum allowable flow for the tank size provided. This maximum allowable flow meets the theoretical design flow of 3,425L/day based on usage.

Length of distribution pipe (based on tank size):

Length of distribution pipe required: L = QT/200 = (3,834 x 8)/200 = 154m

Length of distribution pipe provided: L = 12 runs at 13m = 156m

Mantle Requirements

A 15.0-metre sand mantle is required. The sand will be extended to the top of the onsite swale (approximately 11m) in order to provide sufficient drainage through the sand mantle.

The imported sand, which is to be used to construct the septic system including the mantle, is to have a percolation rate of 8 min/cm, with less than 8% silt, tested and approved before placement.

Loading Rate Calculations

Contact area required:	$A = Q/6 = 3{,}425/6$ $A = 570.8m^2$
Contact area provided:	Width = 5 + 17.6 + 5 = 27.6m Length= 13 + 15 + 11 + 1 = 40m Area = 27.6m x 40m = 1,104m^2

Pump Chamber

A dosing pump is required due to the length of distribution pipe exceeding 150m and the proposed change in elevation between the pump chamber and the distribution box.

Pipe Volume

Length of Distribution Piping = 156m

75% of pipe volume = $(L \times \pi r^2 \times 75\%) = 156m \times 0.0044m^2 \times 0.75 = 0.515m^3$

Pump Rate

The tile field would be dosed with a maximum 515L per cycle (filling 75% of the pipe volume).

Therefore, the number of cycles per day is: 3,834L/day ÷ 515 L = 7 cycles per day.

Based on the Myers SSM33i pump performance curve (see attached), the pump would operate at a 1.8L/s.

Pump Specifications

- The pump would be equipped with variable floats to control the discharge of effluent to the septic bed. The elevations are indicated on the Septic System Plan – Septic Tank & Pump chamber Detail.
- The floats shall be set for a pump volume of 515L (ie 0.43m depth in the 1200mm diameter pump chamber) at a flow rate of 1.8 L/s, and this cycle will occur 7 times daily.
- A high float alarm should be installed a minimum of 0.05m below the inlet of the pump chamber.
- A low float should be set to ensure the pump does not run dry for any period of time.
- If at any time during the pumping cycle the effluent level in the tank reaches the low float level, the pump would turn off and remain off until the effluent rises to the high float elevation.
- For redundancy, two alternating pumps would be installed on the pump chamber.

Suite 200, 240 Michael Cowpland Drive, Ottawa ON K2M 1P6 Tel: 613.254.9643 Fax: 613.254.5867 www.novatech-eng.com

Setbacks

The following minimum setbacks are required based on the bed being raised up to 1.5m above original ground:

- Tile to any drilled well: 18.0m
- Tile to property line: 6.0m
- Septic tank to structure: 5.0m
- Septic tank to any drilled well: 15.0m

Septic System Installation

The septic system is to be installed in accordance with the following engineering drawings prepared by Novatech:

- Overall Grading, Erosion, Sediment Control and Servicing Plan (119181-GS1, rev 3)
- Detailed Grading and Servicing Plan (119181-GS2, rev 2)
- Septic System Plan (119181-SEP, rev 2)

The absorption trench bed is to be constructed at the elevations shown on the Grading Plans and the Septic System Plan. The elevations are not to be revised without written permission from Novatech.

The existing topsoil and underlying fill in the area of the septic bed, including the mantle and extended area to the onsite swale, is to be removed prior to placement of sand.

Installation of the septic system and materials used to construct the septic system are to be in accordance with current Ontario Building Code requirements.

The surface area of the septic system is to be graded to provide positive drainage and treated with 100mm permeable topsoil, seed, and mulch. No impermeable material is to be placed over or adjacent to the septic bed.

This septic system has been designed to treat domestic waste. The following are not to be connected to the septic system.

- Water softener
- Sump pump
- Roof drains
- Refrigeration or condensing unit
- Floor drains
- Industrial or automotive waste

Construction traffic and materials are to be kept away from the septic system, including the mantle.

Installation of septic system is to be inspected by Ottawa Septic System Office and Novatech.

Novatech's design and inspection services do not relieve the septic system installer of the responsibility for guaranteeing workmanship and materials.

Prepared by:

NOVATECH

Aden Rongve, B.Eng
Project Engineer

Reviewed by:

NOVATECH

LICENSED PROFESSIONAL ENGINEER
A.R. MCAULEY
100141256
May 27, 2020
PROVINCE OF ONTARIO

Alex McAuley, P.Eng.
Project Manager

Attachments

1. Myers SSM33i pump specification
2. Drawings
   - Septic System Plan (119181-SEP rev 2)
   - Overall Grading, Erosion, Sediment Control and Servicing Plan (119181-GS1 rev 3)
   - Detailed Grading and Servicing Plan (119181-GS2 rev 2)

Suite 200, 240 Michael Cowpland Drive, Ottawa ON K2M 1P6 Tel: 613.254.9643 Fax: 613.254.5867 www.novatech-eng.com

MYERS® SSM33I SERIES

The Myers SSM33I series pumps are engineered for performance in a variety of demanding drainage applications. The heavy-duty cast iron housing and oil-filled motor maximize heat dissipation for trouble-free operation and years of reliable service. Models available with tethered or vertical switch.

APPLICATIONS

Basement sumps, dewatering, light effluent

SPECIFICATIONS

Capacities – 31 GPM (117 LPM)
Shut-off Head – 23' (7 m)
Operation: On – 9.94" (252 mm)
Off – 4.06" (103 mm)
Solids Handling – 1/2" (12.7 mm)
Liquids Handling – Drainage effluent
Intermittent Liquid Temperature – Up to 140°F (60°C)
Motor/Electrical Data – 1/3 HP, shaded pole, 115V, 9A, 1Ø, 60Hz
Acceptable pH Range – 5-9
Shaft Seal – Type 11A, carbon and ceramic
Housing – Heavy cast iron
Power Cord – 10' and 20', 16/3, SJTW, SJTW-A
Discharge, NPT – 1-1/2"
Min. Sump Diameter – 12" (304.8 mm)

FEATURES

Rugged and Reliable
Durable oil-filled motor for continuous bearing lubrication and maximum heat dissipation

Versatile Performance
Designed for demanding drainage applications, light septic tank effluent and basement sump

Heavy-duty Design
Rugged cast iron housing and volute aid in heat dissipation and stand tough in harsh conditions

Choice of Switch Types
Available in manual, tethered automatic*, or vertical automatic*

Ease of Flow
Recessed vortex impeller for free flow-flow passage solids and liquid

Overload Protection
Shaded pole motor eliminates failure-prone starting switches and relays

Heat Safety
Heat sensor protection with automatic reset when motor cools to a safe operating temperature

ORDERING INFORMATION

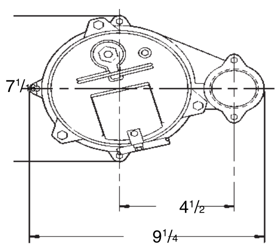
Catalog Number	HP	Volts	Phase/ Cycles	Amps	Discharge Size	Switch Type	Cord Length	Approx. Wt. Lbs.
SSM33IM1C	1/3	115	1/60	9	1-1/2"	Manual	20'	28
SSM33IP-1	1/3	115	1/60	9	1-1/2"	Teth/Auto*	10'	28
SSM33IPC-1	1/3	115	1/60	9	1-1/2"	Teth/Auto*	20'	28
SSM33IPV1	1/3	115	1/60	9	1-1/2"	Vert/Auto*	10'	28
SSM33IPV1C	1/3	115	1/60	9	1-1/2"	Vert/Auto*	20'	28

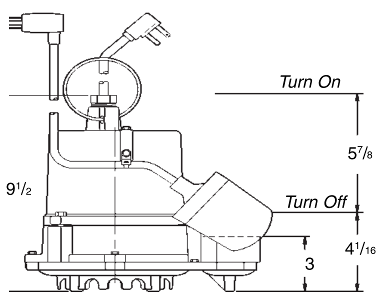
*Piggyback

MYERS® SSM33I SERIES

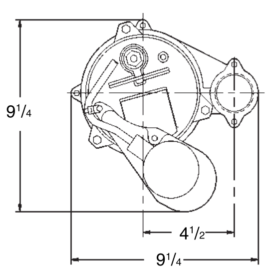
DIMENSIONS

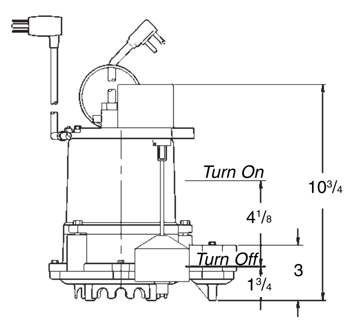
Tethered Automatic



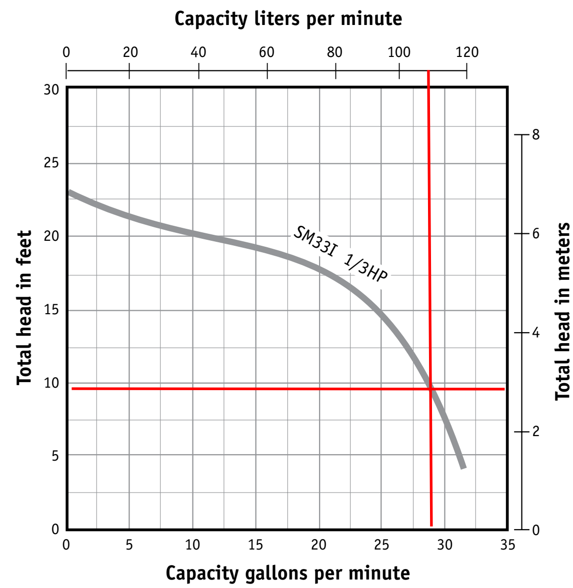


Vertical Automatic





PUMP PERFORMANCE



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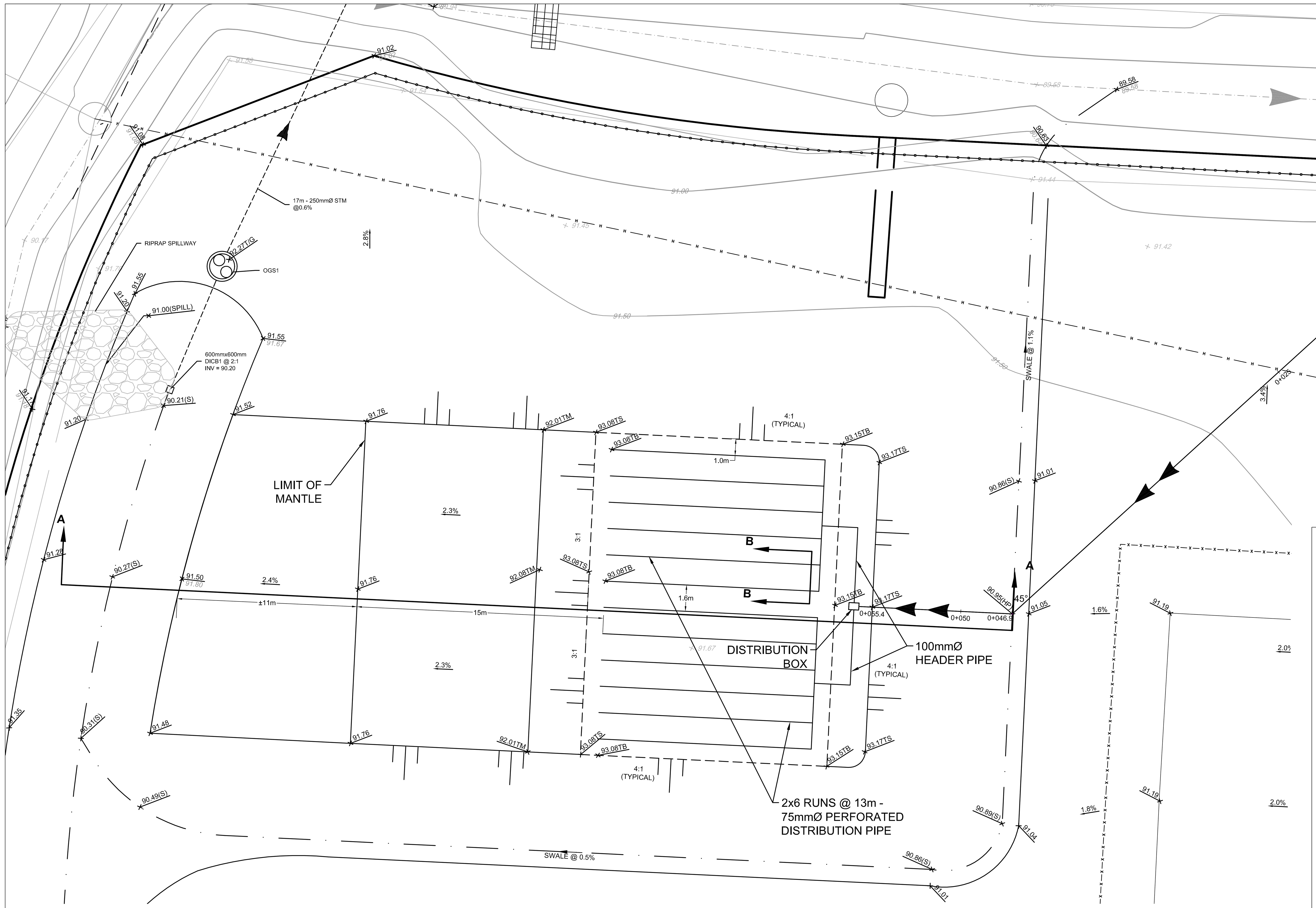

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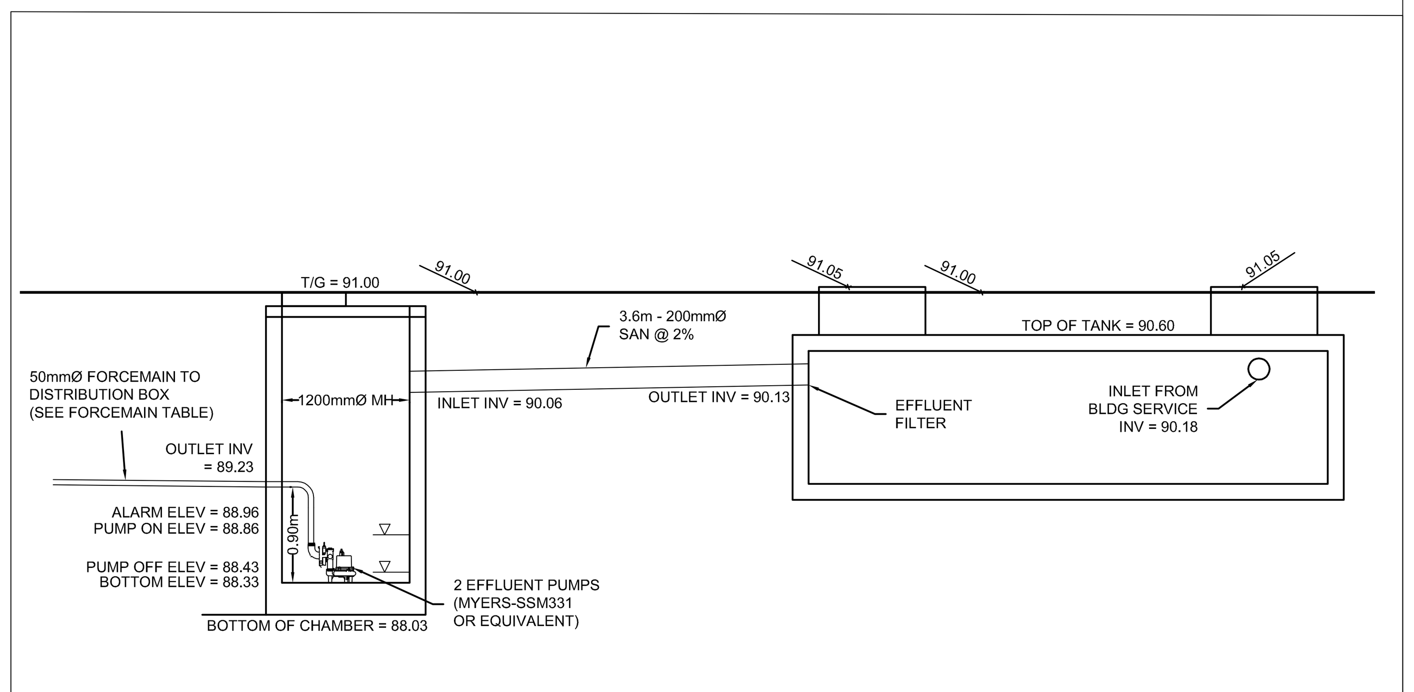

SEPTIC TANK & PUMP CHAMBER DETAIL
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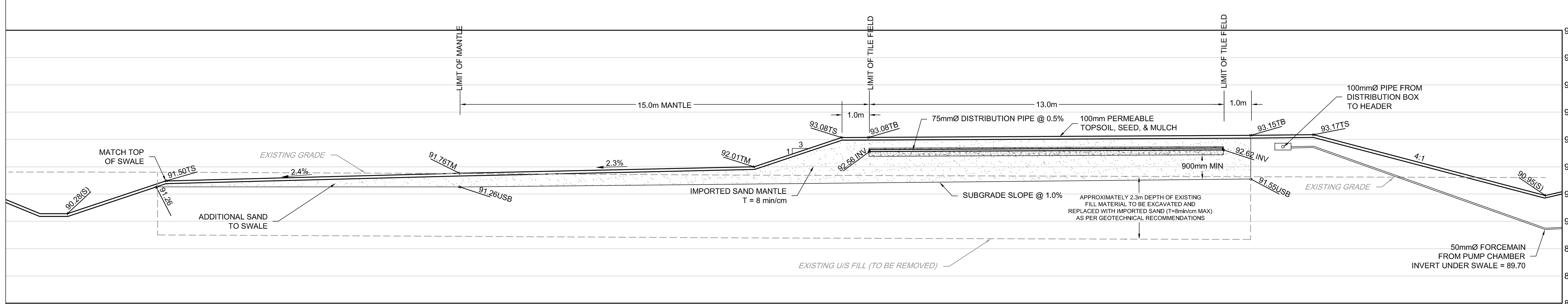

SECTION A-A
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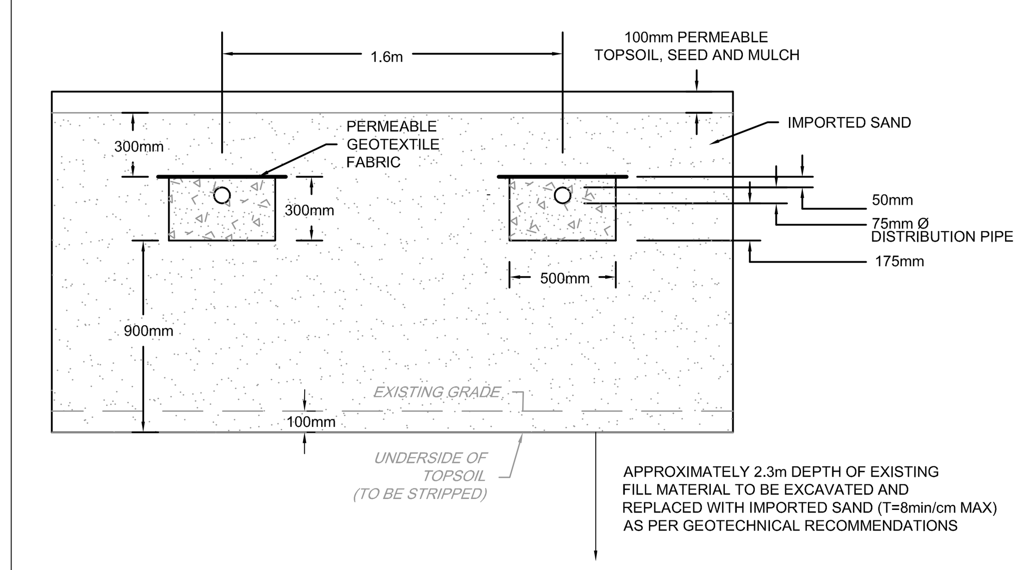

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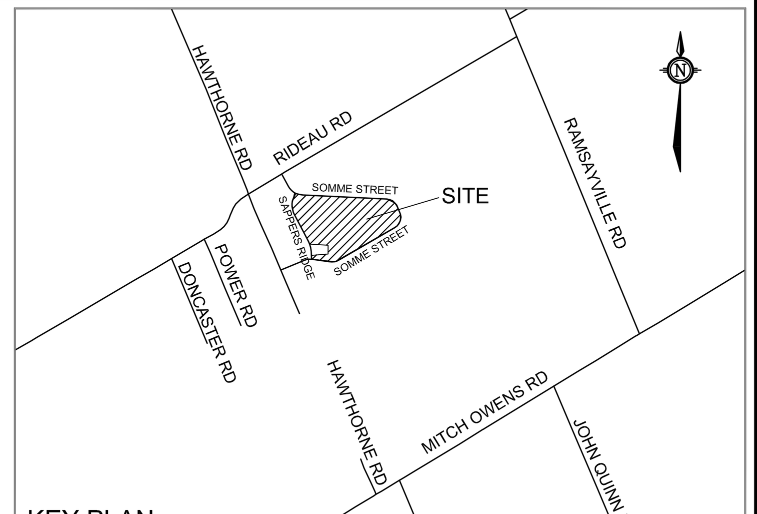

KEY PLAN
N.T.S.

LEGEND

- 127.55 / 126.75 — PROPOSED ELEVATION / EXISTING ELEVATION
- 110.31 TS — PROPOSED TOP OF SLOPE ELEVATION
- 110.45 TB — PROPOSED TOP OF BED ELEVATION
- 109.15 TM — PROPOSED TOP OF MANTLE ELEVATION
- 109.80 INV — PROPOSED INVERT
- 108.52 USB — PROPOSED UNDERSIDE OF BED ELEVATION
- TERRACING: MAXIMUM 3:1 SIDESLOPE
- 2.0% — SLOPE AND DIRECTION
- PROPOSED PUMP CHAMBER & FORCEMAIN
- U/G HYDRO SERVICE
- PROPOSED SILT FENCE PER OPSD 219.110

GENERAL NOTES

1. COORDINATE AND SCHEDULE ALL WORK WITH OTHER TRADES AND CONTRACTORS.
2. DETERMINE THE EXACT LOCATION, SIZE, MATERIAL AND ELEVATION OF ALL EXISTING UTILITIES PRIOR TO COMMENCING CONSTRUCTION. PROTECT AND ASSUME RESPONSIBILITY FOR ALL EXISTING UTILITIES WHETHER OR NOT SHOWN ON THIS DRAWING.
3. OBTAIN ALL NECESSARY PERMITS AND APPROVALS FROM THE CITY OF OTTAWA, OTTAWA SEPTIC SYSTEM OFFICE (OSSO), RIDEAU VALLEY CONSERVATION AUTHORITY (MVCA) AND THE MINISTRY OF THE ENVIRONMENT, CLIMATE AND PARKS (MECP) BEFORE COMMENCING CONSTRUCTION.
4. BEFORE COMMENCING CONSTRUCTION OBTAIN AND PROVIDE PROOF OF COMPREHENSIVE, ALL RISK AND OPERATIONAL LIABILITY INSURANCE FOR $2,000,000.00. INSURANCE POLICY TO NAME OWNERS, ENGINEERS AND ARCHITECTS AS CO-INSURED.
5. RESTORE ALL DISTURBED AREAS ON-SITE AND OFF-SITE, INCLUDING TRENCHES AND SURFACES ON PUBLIC ROAD ALLOWANCES TO EXISTING CONDITIONS OR BETTER TO THE SATISFACTION OF THE CITY OF OTTAWA AND ENGINEER.
6. REMOVE FROM SITE ALL EXCESS EXCAVATED MATERIAL, ORGANIC MATERIAL AND DEBRIS UNLESS OTHERWISE INSTRUCTED BY ENGINEER. EXCAVATE AND REMOVE FROM SITE ANY CONTAMINATED MATERIAL. ALL CONTAMINATED MATERIAL SHALL BE DISPOSED OF AT A LICENSED LANDFILL FACILITY.
7. ALL ELEVATIONS ARE GEODETIC.
8. REFER TO ARCHITECT'S AND LANDSCAPE ARCHITECT'S DRAWINGS FOR BUILDING AND HARDSURFACE AREAS AND DIMENSIONS.
9. PROVIDE LINE/PARKING PAINTING.
10. TOPOGRAPHIC SURVEY PROVIDED BY NOVATECH.

SEPTIC SYSTEM NOTES

1. THE PROPOSED SEPTIC SYSTEM CONSISTS OF A SEPTIC TANK, GRAVITY SEWER, PUMP CHAMBER (c/w DUAL PUMPS), FORCEMAIN, AND AN ABSORPTION TRENCH LEACHING BED WHICH HAS BEEN DESIGNED BASED ON A THEORETICAL SEWAGE FLOW OF 3,425 L/DAY.
2. INSTALLATION IS TO BE IN ACCORDANCE WITH CURRENT ONTARIO BUILDING CODE REQUIREMENTS AND THE ENGINEER'S REPORT PREPARED BY NOVATECH, DATED MAY 2020.
3. SEPTIC SYSTEM ELEVATIONS ARE NOT TO BE REVISED WITHOUT THE WRITTEN PERMISSION OF NOVATECH.
4. ALL BENDS IN THE PIPE FROM THE BUILDING TO THE HEADER ARE TO BE 22.5 OR 45.0 DEGREES.
5. THE FOLLOWING SETBACKS ARE REQUIRED:
   - -TILE FIELD TO ANY DRILLED WELL = 18.0m (min)
   - -TILE FIELD TO PROPERTY LINE = 6.0m (min)
   - -SEPTIC TANK TO ANY DRILLED WELL= 15.0m (min)
   - -SEPTIC TANK TO BUILDING= 1.5m (min)
6. TANK SIZE = 11,500L (MACGREGOR CONCRETE OR APPROVED EQUIVALENT)
7. THE SEPTIC TANK IS TO BE FITTED WITH AN EFFLUENT FILTER IN ACCORDANCE WITH MANUFACTURERS SPECIFICATIONS.
8. TANK AND MANHOLE LIDS ARE TO BE LEFT ACCESSIBLE FOR PUMPING/ MAINTENANCE/ INSPECTION.
9. A MANTLE IS REQUIRED IN THE DIRECTION OF THE SURFACE DRAINAGE FLOW. IMPORTED SAND MATERIAL IS REQUIRED. THE IMPORTED SAND, WHICH IS TO BE USED TO CONSTRUCT THE SEPTIC SYSTEM INCLUDING THE MANTLE, IS TO HAVE A MAXIMUM PERCOLATION RATE OF 8 MIN/CM, WITH LESS THAN 8% SILT, TESTED AND APPROVED BEFORE PLACEMENT.
10. CONSTRUCTION TRAFFIC AND MATERIALS ARE TO BE KEPT AWAY FROM THE SEPTIC SYSTEM, INCLUDING THE MANTLE.
11. THE SEPTIC SYSTEM HAS BEEN DESIGNED TO TREAT DOMESTIC WASTE ONLY. THE FOLLOWING ARE NOT TO BE CONNECTED TO THE SEPTIC SYSTEM.
    - -WATER SOFTENER
    - -SUMP PUMP
    - -EAVESTROUGHS/ROOF DRAINS
    - -REFRIGERATION OR CONDENSING UNIT
    - -FLOOR DRAINS
    - -INDUSTRIAL OR AUTOMOTIVE WASTE
12. NOVATECH'S DESIGN AND INSPECTION SERVICES DO NOT RELIEVE THE SEPTIC SYSTEM INSTALLER OF THE RESPONSIBILITY FOR GUARANTEEING WORKMANSHIP AND MATERIALS.
13. INSTALLATION OF SEPTIC SYSTEM TO BE INSPECTED BY OTTAWA SEPTIC SYSTEM OFFICE (OSSO) AND NOVATECH
14. THE CONTRACTOR IS RESPONSIBLE FOR SURVEYING ASBUILT ELEVATIONS AND PROVIDING THE REQUIRED ASBUILT INFORMATION AND DRAWING(S) TO THE OSSO.
15. THE PUMPS ARE TO BE EQUIPED WITH A HIGH FLOAT ALARM WHICH IS TO BE INSTALLED A MINIMUM OF 0.05m BELOW THE INLET OF THE PUMP CHAMBER AS WELL AS A LOW FLOW ALARM.

SANITARY FORCEMAIN TABLE

Station	Invert of Forcemain Elevation (m)	Top of Forcemain Elevation (m)	Finished Ground Elevation (m)	Depth of Cover (m)
0+000.0	89.23	89.28	91.00	1.72
0+020.7	89.44	89.49	90.76	1.27
0+025.0	89.48	89.53	90.84	1.31
0+046.9	89.70	89.75	90.95	1.20
0+050.0	90.79	90.84	91.76	0.92
0+055.4	92.70	92.75	93.17	0.42

NOTE: NO SUMPS

NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

NOT FOR CONSTRUCTION

No.	REVISION	DATE	BY
2.	ISSUED FOR REVIEW	MAY 27/20	AAR
1.	ISSUED FOR CLIENT INFORMATION	MAY 20/20	AAR

SCALE: AS NOTED

DESIGN: AAR
CHECKED: ARM
DRAWN: AAR
CHECKED: ARM
APPROVED: SMG

FOR REVIEW ONLY

LICENSED PROFESSIONAL ENGINEER — S.M. GORDON — May 27, 2020 — PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER — A.R. MCAULEY — 100141256 — May 27, 2020 — PROVINCE OF ONTARIO

NOVATECH
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Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

LOCATION
300 SOMME STREET
BLOCK 6

DRAWING NAME
SEPTIC SYSTEM PLAN

PROJECT No. 119181
REV: REV # 2
DRAWING No. 119181-SEP

PLANB1.DWG - 1000mmx707mm

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LEGEND

- PROPOSED 100mmØ SUBDRAIN
- PROPOSED GRASSED SWALE
- PROPOSED SILT FENCE PER OPSD 219.110
- PROPOSED STRAW BALE PER OPSD 219.100

EROSION AND SEDIMENT CONTROL NOTES:

1. THE OWNER AGREES TO PREPARE AND IMPLEMENT AN EROSION AND SEDIMENT CONTROL PLAN TO THE SATISFACTION OF THE CITY OF OTTAWA, APPROPRIATE TO THE SITE CONDITIONS, PRIOR TO UNDERTAKING ANY SITE ALTERATIONS (FILLING, GRADING, REMOVAL OF VEGETATION, ETC.) AND DURING ALL PHASES OF SITE PREPARATION AND CONSTRUCTION IN ACCORDANCE WITH THE CURRENT BEST MANAGEMENT PRACTICES FOR EROSION AND SEDIMENT CONTROL SUCH AS BUT NOT LIMITED TO INSTALLING FILTER CLOTHS ACROSS MANHOLE/CATCHBASIN LIDS TO PREVENT SEDIMENTS FROM ENTERING STRUCTURES AND INSTALL AND MAINTAIN A LIGHT DUTY SILT FENCE BARRIER AS REQUIRED.
2. THE CONTRACTOR SHALL PLACE FILTER CLOTH UNDER THE CATCHBASIN AND MANHOLE GRATES FOR THE DURATION OF CONSTRUCTION AND WILL REMAIN IN PLACE DURING ALL PHASES OF CONSTRUCTION.
3. SILT FENCING FOR ENTIRE PERIMETER OF SITE, SHALL BE UTILIZED TO CONTROL EROSION FROM THE SITE DURING CONSTRUCTION.
4. THE CONTRACTOR ACKNOWLEDGES THAT FAILURE TO IMPLEMENT EROSION AND SEDIMENT CONTROL MEASURES MAY BE SUBJECT TO PENALTIES IMPOSED BY ANY APPLICABLE REGULATORY AGENCY.

REFER TO 119181-ND FOR ADDITIONAL NOTES AND DETAILS

NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

NOT FOR CONSTRUCTION

No.	REVISION	DATE	BY
3.	ISSUED FOR REVIEW	MAY 27/20	AAR
2.	ISSUED FOR CLIENT INFORMATION	MAY 20/20	AAR
1.	ISSUED FOR COORDINATION	MAY 8/20	AAR

SCALE 1:750

DESIGN AAR | CHECKED ARM | DRAWN AAR | CHECKED AAR | APPROVED SMG

FOR REVIEW ONLY

LICENSED PROFESSIONAL ENGINEER S.M. GORDON May 27, 2020 PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER A.R. MCAULEY 100141256 May 27, 2020 PROVINCE OF ONTARIO

NOVATECH
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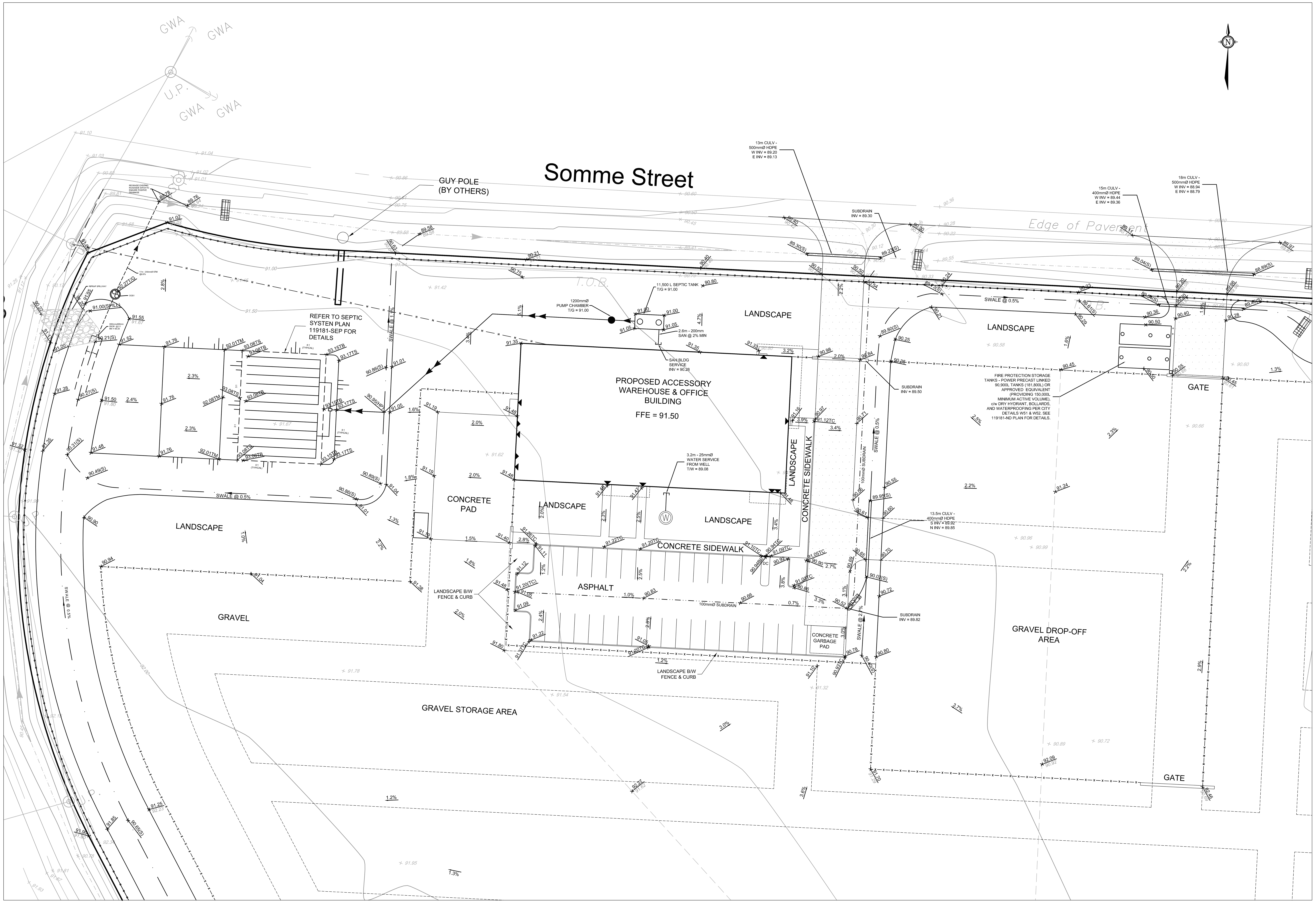
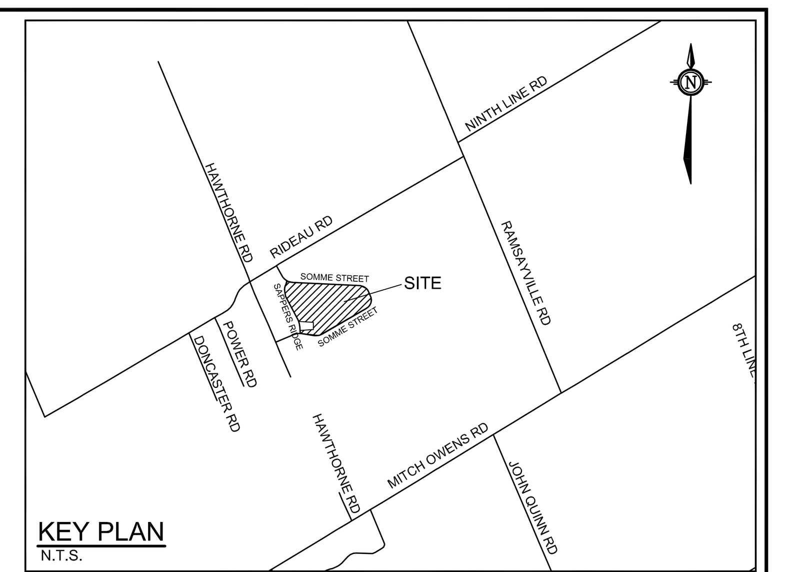
Facsimile (613) 254-5867
Website www.novatech-eng.com

LOCATION
300 SOMME STREET
BLOCK 6

DRAWING NAME
OVERALL GRADING, EROSION, SEDIMENT CONTROL AND SERVICING PLAN

PROJECT No. 119181
REV REV # 3
DRAWING No. 119181-GS1





KEY PLAN
N.T.S.

LEGEND

95.55 / 94.20	PROPOSED ELEVATION / *EXISTING ELEVATION*
93.00(S)	PROPOSED SWALE INVERT ELEVATION
110.45 TB	PROPOSED TOP OF SEPTIC BED ELEVATION
109.15 TM	PROPOSED TOP OF SEPTIC MANTLE ELEVATION
	TERRACING: MAXIMUM 3:1 SIDESLOPE
2.0%	GRADE AND DIRECTION
	PROPOSED PUMP CHAMBER & FORCEMAIN
	PROPOSED CENTERLINE OF SWALE
	PROPOSED 100mmØ SUBDRAIN
	PROPOSED U/G HYDRO SERVICE
	LIGHT DUTY ASPHALT (SEE 119181-ND PLAN FOR PAVEMENT STRUCTURE DETAILS)
	HEAVY DUTY ASPHALT (SEE 119181-ND PLAN FOR PAVEMENT STRUCTURE DETAILS)

GENERAL NOTES:

1. COORDINATE AND SCHEDULE ALL WORK WITH OTHER TRADES AND CONTRACTORS.
2. DETERMINE THE EXACT LOCATION, SIZE, MATERIAL AND ELEVATION OF ALL EXISTING UTILITIES PRIOR TO COMMENCING CONSTRUCTION. PROTECT AND ASSUME RESPONSIBILITY FOR ALL EXISTING UTILITIES WHETHER OR NOT SHOWN ON THIS DRAWING.
3. OBTAIN ALL NECESSARY PERMITS AND APPROVALS FROM THE CITY OF OTTAWA BEFORE COMMENCING CONSTRUCTION.
4. BEFORE COMMENCING CONSTRUCTION OBTAIN AND PROVIDE PROOF OF COMPREHENSIVE, ALL RISK AND OPERATIONAL LIABILITY INSURANCE FOR $5,000,000.00. INSURANCE POLICY TO NAME OWNERS, ENGINEERS AND ARCHITECTS AS CO-INSURED.
5. RESTORE ALL DISTURBED AREAS ON-SITE AND OFF-SITE, INCLUDING TRENCHES AND SURFACES ON PUBLIC ROAD ALLOWANCES TO EXISTING CONDITIONS OR BETTER TO THE SATISFACTION OF THE CITY OF OTTAWA AND ENGINEER.
6. REMOVE FROM SITE ALL EXCESS EXCAVATED MATERIAL, ORGANIC MATERIAL AND DEBRIS UNLESS OTHERWISE INSTRUCTED BY ENGINEER. EXCAVATE AND REMOVE FROM SITE ANY CONTAMINATED MATERIAL. ALL CONTAMINATED MATERIAL SHALL BE DISPOSED OF AT A LICENSED LANDFILL FACILITY.
7. ALL ELEVATIONS ARE GEODETIC.
8. REFER TO GEOTECHNICAL REPORT (No. 65080.01, DATED APRIL 24, 2020), PREPARED BY GEMTEC FOR SUBSURFACE CONDITIONS, CONSTRUCTION RECOMMENDATIONS, AND GEOTECHNICAL INSPECTION REQUIREMENTS. THE GEOTECHNICAL CONSULTANT IS TO REVIEW ON-SITE CONDITIONS AFTER EXCAVATION PRIOR TO PLACEMENT OF THE GRANULAR MATERIAL.
9. REFER TO ARCHITECT'S AND LANDSCAPE ARCHITECT'S DRAWINGS FOR BUILDING AND HARDSURFACE AREAS AND DIMENSIONS.
10. REFER TO STORMWATER MANAGEMENT REPORT(R-2020-070) PREPARED BY NOVATECH ENGINEERING CONSULTANTS LTD.
11. SAW CUT AND KEY GRIND ASPHALT AT ALL ROAD CUTS AND ASPHALT TIE IN POINTS AS PER CITY OF OTTAWA STANDARDS (R10).
12. PROVIDE LINE/PARKING PAINTING.

GRADING NOTES:

1. ALL TOPSOIL, ORGANIC OR DELETERIOUS MATERIAL MUST BE ENTIRELY REMOVED FROM BENEATH THE PROPOSED PAVED AREAS AS DIRECTED BY THE SITE ENGINEER OR GEOTECHNICAL ENGINEER.
2. EXPOSED SUBGRADES IN PROPOSED PAVED AREAS SHOULD BE PROOF ROLLED WITH A LARGE STEEL DRUM ROLLER AND INSPECTED BY THE GEOTECHNICAL ENGINEER PRIOR TO THE PLACEMENT OF GRANULARS.
3. ANY SOFT AREAS EVIDENT FROM THE PROOF ROLLING SHOULD BE SUB-EXCAVATED AND REPLACED WITH SUITABLE MATERIAL THAT IS FROST COMPATIBLE WITH THE EXISTING SOILS AS RECOMMENDED BY THE GEOTECHNICAL ENGINEER.
4. THE GRANULAR BASE SHOULD BE COMPACTED TO AT LEAST 100% OF THE STANDARD PROCTOR MAXIMUM DRY DENSITY VALUE. ANY ADDITIONAL GRANULAR FILL USED BELOW THE PROPOSED PAVEMENT SHOULD BE COMPACTED TO AT LEAST 95% OF THE STANDARD PROCTOR MAXIMUM DRY DENSITY VALUE.
5. MINIMUM OF 2% GRADE FOR ALL GRASS AREAS UNLESS OTHERWISE NOTED.
6. MAXIMUM TERRACING GRADE TO BE 3:1 UNLESS OTHERWISE NOTED.
7. ALL GRADES BY CURBS ARE EDGE OF PAVEMENT GRADES UNLESS OTHERWISE INDICATED.
8. ALL CURBS SHALL BE BARRIER CURB (150mm) UNLESS OTHERWISE NOTED AND CONSTRUCTED AS PER CITY OF OTTAWA STANDARDS (SC1.1).
9. REFER TO LANDSCAPE PLAN FOR PLANTING AND OTHER LANDSCAPE FEATURE DETAILS.
13. CONTRACTOR TO PROVIDE THE CONSULTANT WITH A GRADING PLAN INDICATING AS-BUILT ELEVATIONS OF ALL DESIGN GRADES SHOWN ON THIS PLAN.

REFER TO 119181-ND FOR ADDITIONAL NOTES AND DETAILS

M:\2019\119181\CAD\Design\119181-GS.dwg, GS2, May 27, 2020

NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

NOT FOR CONSTRUCTION

No.	REVISION	DATE	BY
2.	ISSUED FOR REVIEW	MAY 27/20	AAR
1.	ISSUED FOR CLIENT INFORMATION	MAY 20/20	AAR

SCALE: 1:300

DESIGN	AAR
CHECKED	ARM
DRAWN	AAR
CHECKED	AAR
APPROVED	SMG

FOR REVIEW ONLY

LICENSED PROFESSIONAL ENGINEER — S.M. GORDON — May 27, 2020 — PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER — A.R. MCAULEY — 100141256 — May 27, 2020 — PROVINCE OF ONTARIO

NOVATECH
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Website www.novatech-eng.com

LOCATION
300 SOMME STREET
BLOCK 6

DRAWING NAME
DETAILED GRADING AND SERVICING PLAN

PROJECT No.	119181
REV	REV # 2
DRAWING No.	119181-GS2

PLANB1.DWG - 1000mmx707mm

APPENDIX D
Stormwater Management Calculations

M E M O R A N D U M

DATE: MAY 27, 2020

TO: ALEX MCAULEY

FROM: MELANIE SCHROEDER / CONRAD STANG

RE: COPART FACILITY - 300 SOMME STREET
SUPPLEMENTAL SWM MODELING INFORMATION

PROJECT NO: 119181

This memorandum provides supplemental SWM modeling information in support the *Copart Facility Servicing and Stormwater Management Report (Novatech, May 28, 2020).*

The proposed storm drainage and stormwater management system for the Copart Facility (300 Somme Street) was analysed using the PCSWMM hydrologic / hydraulic modelling suite. The PCSWMM model parameters and results are provided in this memorandum.

Model schematics and output data are attached.

MODEL PARAMETERS:

Hydrology

The hydrologic analysis includes the delineation of storm drainage areas and the selection of modelling parameters for each subcatchment area that is based on a combination of soil type, land use, and topography; as follows:

- Soil types were identified as Hydrological Soil Group (HSG) Soil Type ‘C’ based on the “Geotechnical Report” prepared by Gemtec (April 24, 2020).
- Land use, ground cover, and slope were determined from the Overall Grading & Servicing Plan (119181-GS1).
- Subcatchments are represented as ‘ARM Subcatchments’ using the NASHYD routine (SCS Curve Number runoff-based calculations) with 3 linear reservoirs (N=3).
- SCS Curve Numbers (CN) were assigned for each ARM subcatchment based on combination of soil type (HSG) and land use.
- Initial abstraction (Ia) was calculated using Ia = 0.10 x S, where S = [(25400 / CN) – 254].
- Time-of-Concentration (T_c) was calculated using Airport Method, with a minimum time of concentration of 10 minutes (attached).

Subcatchment parameters are summarized in Table 1 below. It should be noted that Area U-4 is occupied by landscaped areas and part of the building roof. Stormwater runoff from this area is considered clean; therefore, does not require additional water quality treatment.

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Table 1: Subcatchment Parameters (NASHYD's)

Area ID	Area (ha)	CN (HSG 'C')	Ia (mm)	Tc (min)	Slope (%)
U-1a	0.24	78	7	22.9	1.0
U-1b	0.81	86	4	22.7	1.0
U-1c	1.52	87	4	19.8	1.0
U-1d	0.92	86	4	18.6	1.0
U-2a	0.73	88	3	11.9	2.0
U-2b	2.06	87	4	15.6	1.5
U-2c	4.34	88	3	18.6	1.5
U-2d	0.83	88	3	13.5	1.5
U-2e	0.48	84	5	12.0	1.5
U-3a	0.83	85	4	13.5	1.2
U-3b	1.63	87	4	18.0	1.2
U-3c	2.40	87	4	15.2	1.2
U-3d	0.62	85	4	13.0	1.2
U-4	0.32	79	7	10.0	2.0
TOTAL	**17.73**	**-**	**-**	**-**	**-**

Hydraulics

The PCSWMM model includes the inverts and dimensions of the on-site ditches, ditch inlet catchbasins, OGS units, pipes and spillways based on the information from the Overall Grading & Servicing Plan (119181-GS1).

DESIGN STORMS:

The hydrologic analysis was completed using the following design storms; generated using IDF parameters presented in the City of Ottawa Sewer Design Guidelines (October 2012).

- 3-hour Chicago Storm Distribution (10-minute time step)
- 12-hour SCS Type II Storm Distribution (30-minute time step)
- 24-hour SCS Type II Storm Distribution (60-minute time step)

Each storm distribution includes the 2-year, 5-year, 100-year return periods. In addition to the listed design storms, the 25 mm – 4-hour Chicago storm event was used as the water quality event for sizing the inlet control devices to the OGS units.

The 3-hour Chicago distribution generates the highest peak flows for both the minor and major systems and was determined to be the critical storm distribution for the design and analysis of the storm drainage system.

PCSWMM MODEL RESULTS:

Inlet Control Devices

Inlet control devices (ICDs) are proposed in the ditch inlet catchbasins. The ICDs were sized by maximizing the storage in the swales during the 25 mm 4-hour Chicago storm event. The OGS units have been designed to provide water quality treatment based on the following flow rates controlled by the ICDs (Table 2).

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Table 2: Controlled Peak Flows to OGS Units

OGS Unit ID	OGS Location	ICD Size (mm)	Design Head[1] (m)	Peak Flow (L/s)		
				25mm[1]	2-year[2]	100-year[2]
OGS-1	Area U-1	83	1.17	13	14	15
OGS-2	Area U-2	152	1.02	40	42	42
OGS-3	Area U-3	108	1.04	22	22	23

[1]*PCSWMM Model Results for a 25mm – 4-hour Chicago Storm.*
[2]*PCSWMM Model results for a 3-hour Chicago Storm*

Overflow Spillways (weirs)

The overflow spillways (weirs) will be trapezoidal in shape with 3H:1V side slopes and a depth of 0.20 m. The bottom width or length of the weir was designed to convey the 100-year event from the on-site ditches to the roadside ditch. Refer to Table 3 below.

Table 3: Peak Flow Over Weirs

Spillway ID	Spillway Location	Bottom Width (m)	100-year Depth[2] (m)	Peak Flow (L/s)		
				25mm[1]	2-year[2]	100-year[2]
W1	Area U-1	3	0.17	0	9	425
W2	Area U-2	10	0.17	0	180	1,365
W3	Area U-3	6	0.17	0	96	831

[1]*PCSWMM Model Results for a 25mm – 4-hour Chicago Storm.*
[2]*PCSWMM Model results for a 3-hour Chicago Storm*

Overall Peak Flows

The site outlets to the adjacent roadside ditches. Table 4 provides the total peak flow measured at each outfall.

Table 4: Total Peak Flow

Outfall	Location	Peak Flow (L/s)		
		25mm[1]	2-year[2]	100-year[2]
OF1	Area U-1	13	23	439
OF2	Area U-2	40	222	1,405
OF3	Area U-3	22	119	852
OF4	Area U-4	4	8	47

[1]*PCSWMM Model Results for a 25mm – 4-hour Chicago Storm.*
[2]*PCSWMM Model results for a 3-hour Chicago Storm*

On-Site Ditches

The results from the PCSWMM model and Manning's open channel capacity calculations (attached) show that the proposed on-site ditches will be able to convey the 100-year peak flow. In addition, the proposed swales have been designed to provide initial water quality treatment. A comparison of the recommended water quality treatment criteria and PCSWMM model results for the on-site ditches is summarized in Table 5.

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Table 5: PCSWMM Model Results for On-Site Ditches

Criteria	Recommended	West Swale OGS 1	North Swale OGS 2	South Swale OGS 3
Channel Dimensions				
Channel Slope	< 4.0% (MOE)	0.5%	0.5% to 1.0%	0.6%
Bottom Width	> 0.75 m (MOE)	2.0 m	2.0 m	2.0 m
Side Slopes (H:V)	> 2.5:1 (MOE)	3:1	3:1	3:1
Length	N/A	288	514	613
Water Quality Event (25mm – 4-hour Chicago)				
Peak Flow	-	0.061 m^3/s	0.187 m^3/s	0.112 m^3/s
Flow Depth	± 0.1 m (FHWA)	0.05 – 0.58 m	0.06 – 0.61 m	0.05 – 0.69 m
Velocity	< 0.5 m/s (MOE)	0.16 – 0.32 m/s	0.13 – 0.51 m/s	0.17 – 0.45 m/s
100-year Event (3-hour Chicago)				
Peak Flow	-	0.439 m^3/s	1.208 m^3/s	0.856 m^3/s
Flow Depth	< 0.5 m (MOE)	0.17 – 0.93 m	0.18 – 0.80 m	0.17 – 0.88 m
Velocity	N/A	0.26 – 0.56 m/s	0.29 – 0.89 m/s	0.29 – 0.83 m/s

CONCLUSIONS:

This memorandum has been prepared to provide supplemental SWM modeling information for *Copart Facility Servicing and Stormwater Management Report (Novatech, May 28, 2020).* The PCSWMM model results provided herein are to support the design of the proposed storm drainage and stormwater management system for the Copart Facility (300 Somme Street).

ATTACHMENTS:

- Time-of-Concentration Calculations
- On-Site Ditch Capacity (Manning's) Calculations
- PCSWMM Model Schematics
- PCSWMM Model Output Data:
  - 25mm 4-hour Chicago storm
  - 2-year 3-hour Chicago storm
  - 100-year 3-hour Chicago storm
- Packaged PCSWMM model (digital file)

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Copart Facility - 300 Somme Street (119181)
Time of Concentration Calculations (Airport Method)

NOVATECH
Engineers, Planners & Landscape Architects

Area ID	Airport Method				
	Drainage Area (ha)	Runoff Coef.	Slope (%)	Length (m)	Time of Concentration* (min)
U-1a	0.24	0.31	1.0%	79.2	22.9
U-1b	0.81	0.61	1.0%	202	22.7
U-1c	1.52	0.64	1.0%	174.2	19.8
U-1d	0.92	0.62	1.0%	140.7	18.6
U-2a	0.73	0.64	2.0%	99.7	11.9
U-2b	2.06	0.65	1.5%	147.4	15.6
U-2c	4.34	0.67	1.5%	229.9	18.6
U-2d	0.83	0.65	1.5%	111.4	13.5
U-2e	0.48	0.55	1.5%	58.9	12.0
U-3a	0.83	0.55	1.2%	63.8	13.5
U-3b	1.63	0.65	1.2%	170.1	18.0
U-3c	2.40	0.62	1.2%	106.2	15.2
U-3d	0.62	0.55	1.2%	59.6	13.0
U-4	0.32	0.34	2.0%	23.7	10.0

Min. time-of-concentration (T_c) = 10-minutes.

Airport Method

$$T_c = \frac{3.26\,(1.1 - C)L^{0.5}}{S_w{}^{0.33}}$$

Source: MTO Drainage Manual (1997)

Copart Facility - 300 Somme Street (119181)
On-Site Ditch Capacity (Manning's) Calculations

NOVATECH
Engineers, Planners & Landscape Architects

Area U-1
Junction J14 to DICB-1

100-year Peak Flow 439 L/s
0.439 m^3/s

Trapezoidal Channel - Flat bottom ditch

Depth	m	1
Bottom Width	m	2
Side slope (L)	1 to X	3
Side slope (R)	1 to X	3
Top Width (L)	m	3.0
Top Width (R)	m	3.0
Area	m^2	5.000
Perimeter	m	8.32
R=A/P	m	0.60
n		0.035
Slope	m/m	0.005
Q_{max}	m^3/s	7.191
V_{max}	m/s	1.438

Area U-2
Junction J13 to J12

100-year Peak Flow 150 L/s
0.150 m^3/s

Trapezoidal Channel - Flat bottom ditch

Depth	m	1
Bottom Width	m	2
Side slope (L)	1 to X	3
Side slope (R)	1 to X	3
Top Width (L)	m	3.0
Top Width (R)	m	3.0
Area	m^2	5.000
Perimeter	m	8.32
R=A/P	m	0.60
n		0.035
Slope	m/m	0.005
Q_{max}	m^3/s	7.191
V_{max}	m/s	1.438

Area U-2
Junction J12 to J10

100-year Peak Flow 497 L/s
0.497 m^3/s

Trapezoidal Channel - Flat bottom ditch

Depth	m	1
Bottom Width	m	2
Side slope (L)	1 to X	3
Side slope (R)	1 to X	3
Top Width (L)	m	3.0
Top Width (R)	m	3.0
Area	m^2	5.000
Perimeter	m	8.32
R=A/P	m	0.60
n		0.035
Slope	m/m	0.008
Q_{max}	m^3/s	9.096
V_{max}	m/s	1.819

Area U-2
Junction J10 to DICB-2

100-year Peak Flow 1208 L/s
1.208 m^3/s

Trapezoidal Channel - Flat bottom ditch

Depth	m	1
Bottom Width	m	2
Side slope (L)	1 to X	3
Side slope (R)	1 to X	3
Top Width (L)	m	3.0
Top Width (R)	m	3.0
Area	m^2	5.000
Perimeter	m	8.32
R=A/P	m	0.60
n		0.035
Slope	m/m	0.005
Q_{max}	m^3/s	7.191
V_{max}	m/s	1.438

Area U-2
Junction J07 to DICB-2

100-year Peak Flow 262 L/s
0.262 m^3/s

Trapezoidal Channel - Flat bottom ditch

Depth	m	1
Bottom Width	m	2
Side slope (L)	1 to X	3
Side slope (R)	1 to X	3
Top Width (L)	m	3.0
Top Width (R)	m	3.0
Area	m^2	5.000
Perimeter	m	8.32
R=A/P	m	0.60
n		0.035
Slope	m/m	0.01
Q_{max}	m^3/s	10.170
V_{max}	m/s	2.034

Area U-3
Junction J01 to DICB-3

100-year Peak Flow 856 L/s
0.856 m^3/s

Trapezoidal Channel - Flat bottom ditch

Depth	m	1
Bottom Width	m	2
Side slope (L)	1 to X	3
Side slope (R)	1 to X	3
Top Width (L)	m	3.0
Top Width (R)	m	3.0
Area	m^2	5.000
Perimeter	m	8.32
R=A/P	m	0.60
n		0.035
Slope	m/m	0.006
Q_{max}	m^3/s	7.877
V_{max}	m/s	1.575

Date: 5/27/2020
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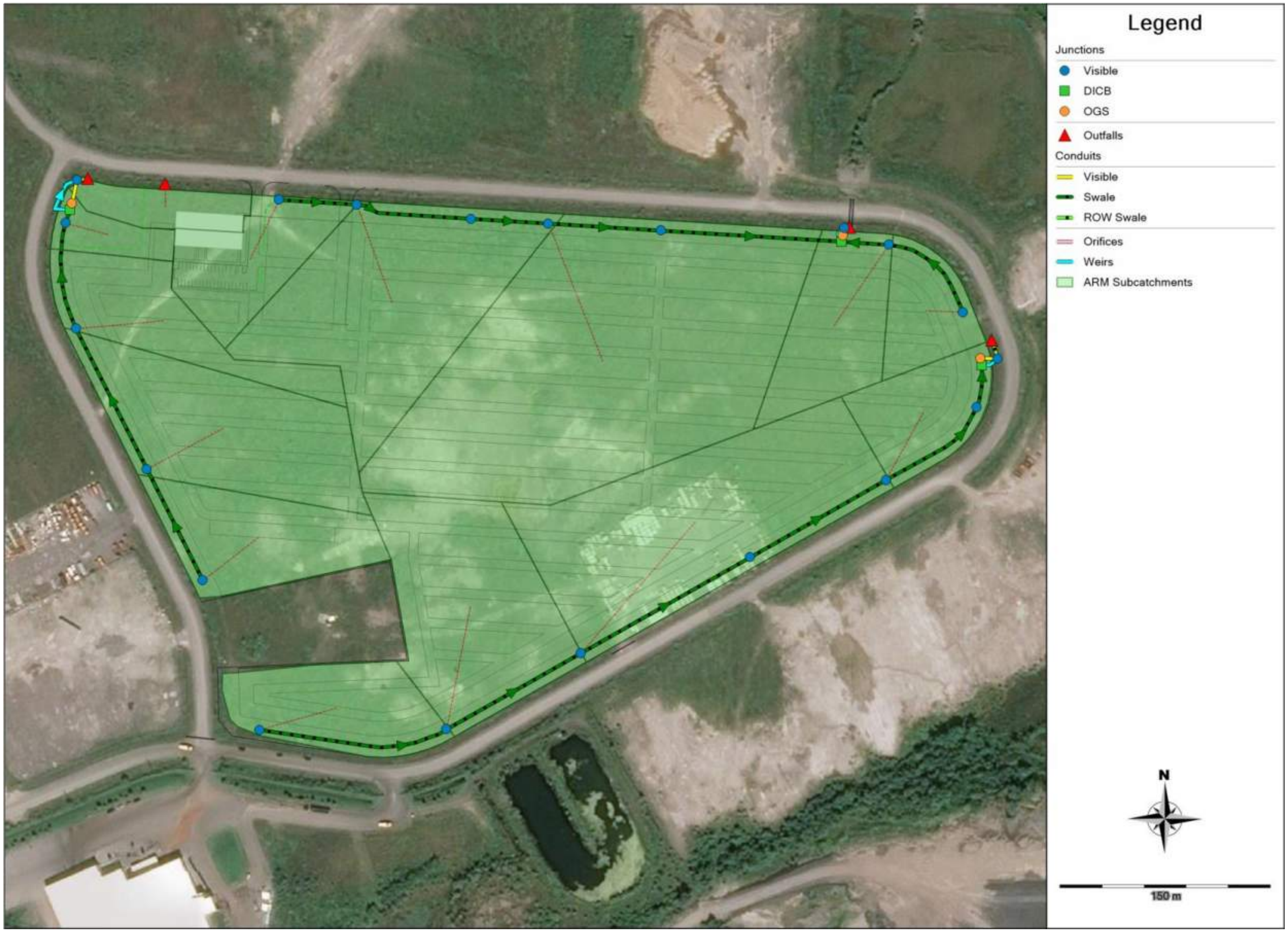
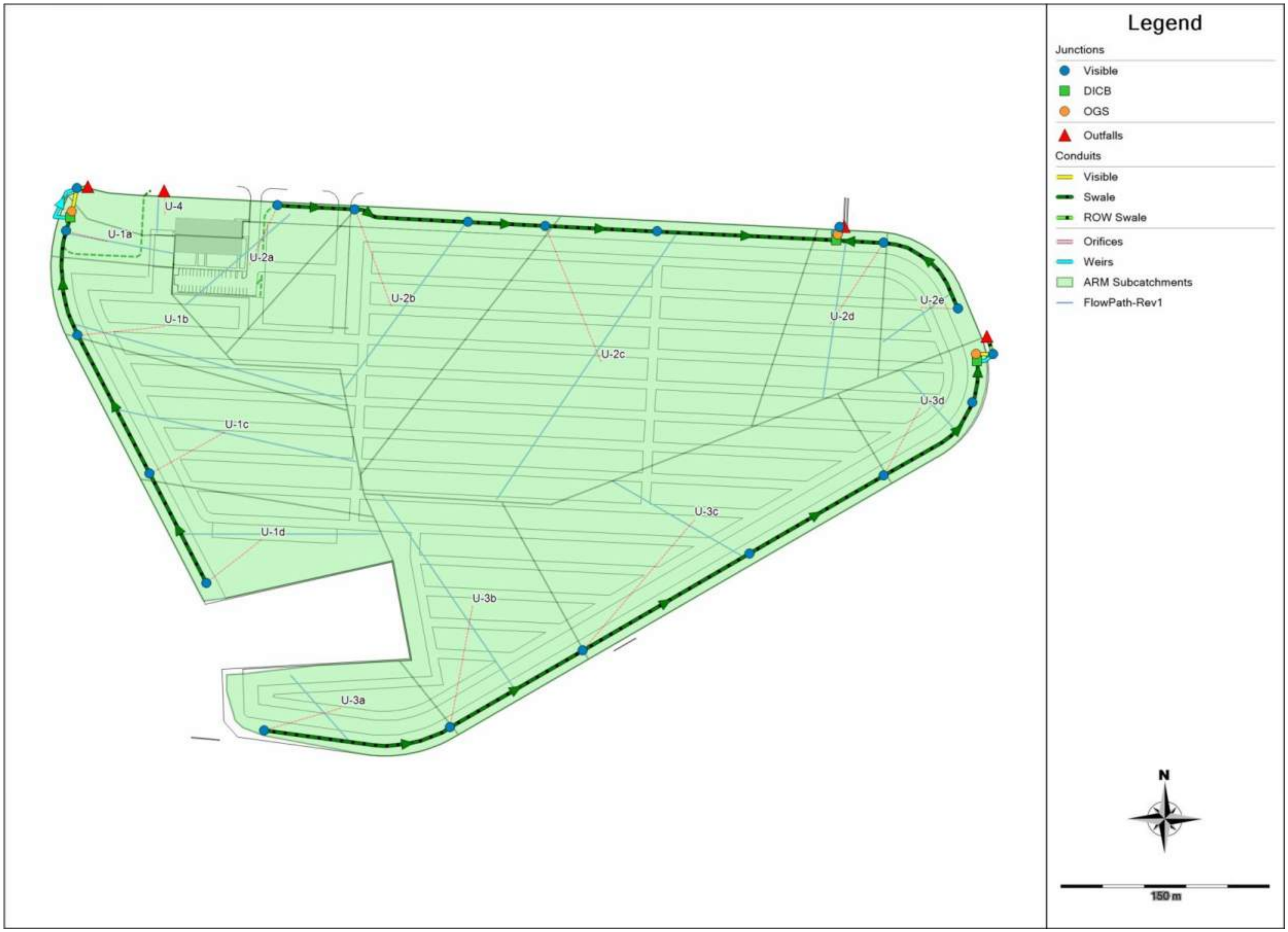
Overall Model Schematic



Copart Facility - 300 Somme Street (119181)
PCSWMM Model Schematics

Subcatchments and Flow Paths



Date: 2020-05-26
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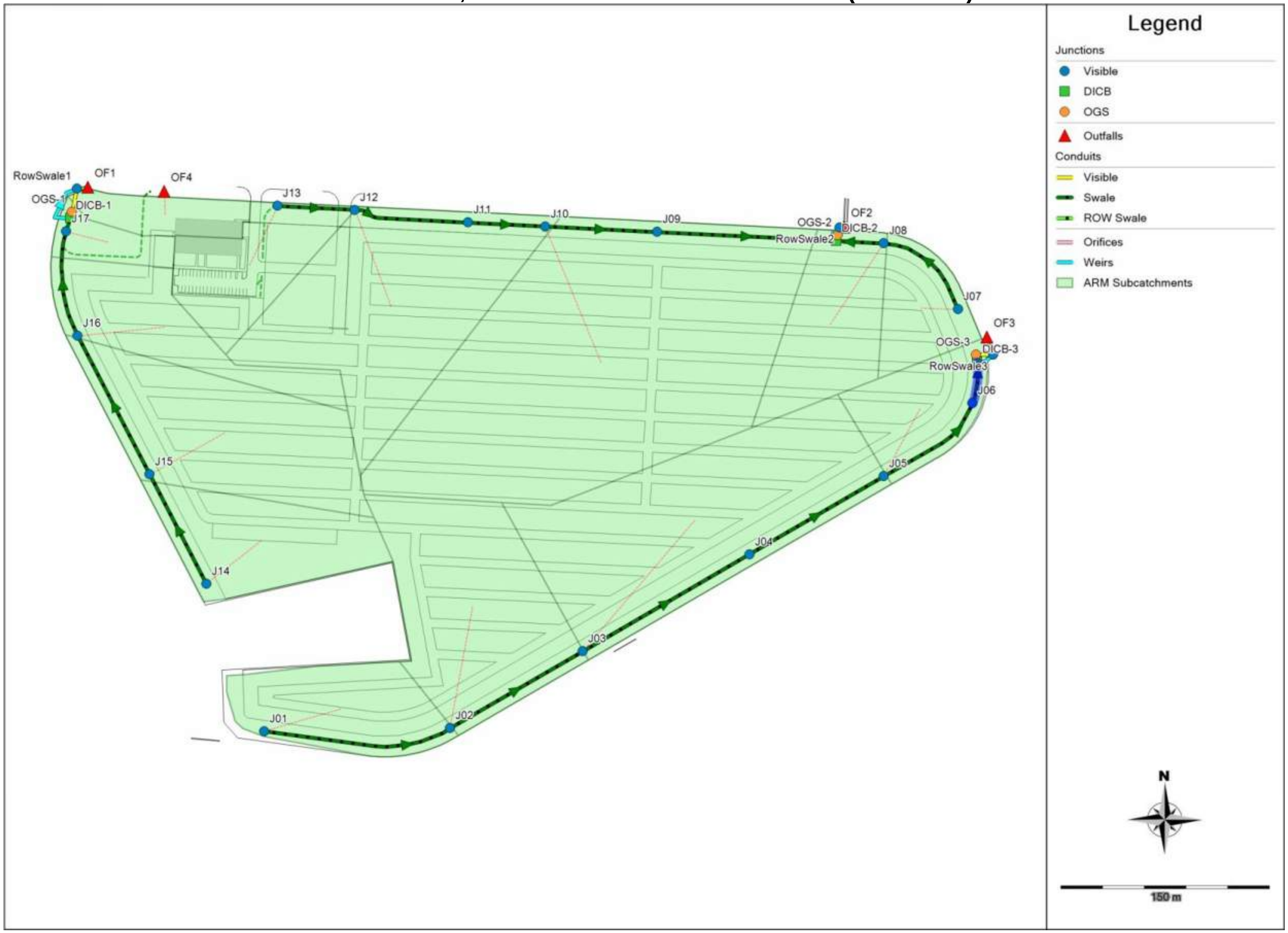
Swale Points, OGS and Ditch Inlet Catchbasins (Junctions)



ALTERNATIVE RUNOFF METHOD (ARM) - PCSWMM BETA VERSION 7.2.2785

This is a *BETA* version of ARM - your feedback and suggestions are solicited.
Create a ticket, post on the PCSWMM feature request forum, or email us directly!

Simulation start time:	05/04/2020 00:00:00
Simulation end time:	05/05/2020 00:00:00
Runoff wet weather time steps:	300 seconds
Report time steps:	60 seconds
Number of data points:	1441

****
Unit Hydrographs Runoff Method
****

Subcatchment	Runoff Method	Raingage	Area (ha)	Time of Concentration (min)	Time to Peak (min)	Time after Pe (min)
U-4	Nash IUH	Design_Storms	0.32	10	6.67	38.33
U-2e	Nash IUH	Design_Storms	0.48	12	8	47
U-2c	Nash IUH	Design_Storms	4.34	18.6	12.4	82.6
U-2a	Nash IUH	Design_Storms	0.73	11.9	7.93	47.07
U-2b	Nash IUH	Design_Storms	2.06	15.6	10.4	64.6
U-2d	Nash IUH	Design_Storms	0.83	13.5	9	56
U-3b	Nash IUH	Design_Storms	1.63	18	12	73
U-3d	Nash IUH	Design_Storms	0.62	13	8.67	51.33
U-3c	Nash IUH	Design_Storms	2.4	15.2	10.13	64.87
U-3a	Nash IUH	Design_Storms	0.83	13.5	9	56
U-1c	Nash IUH	Design_Storms	1.52	19.8	13.2	76.8
U-1a	Nash IUH	Design_Storms	0.24	22.9	15.27	69.73
U-1b	Nash IUH	Design_Storms	0.81	22.7	15.13	79.87
U-1d	Nash IUH	Design_Storms	0.92	18.6	12.4	72.6

****
ARM Runoff Summary
****

Subcatchment	Total Precip (mm)	Total Losses (mm)	Total Runoff (mm)	Total Runoff 10^6 ltr	Peak Runoff LPS	Runoff Coeff (fraction)
U-4	25.003	21.213	3.722	0.012	3.707	0.149
U-2e	25.003	19.152	5.796	0.028	9.246	0.232
U-2c	25.003	16.456	8.532	0.37	110.123	0.341
U-2a	25.003	16.456	8.466	0.062	22.594	0.339
U-2b	25.003	17.521	7.456	0.154	47.309	0.298
U-2d	25.003	16.456	8.498	0.071	24.721	0.34
U-3b	25.003	17.521	7.466	0.122	35.478	0.299
U-3d	25.003	18.302	6.655	0.041	13.914	0.266
U-3c	25.003	17.521	7.454	0.179	56.112	0.298
U-3a	25.003	18.302	6.661	0.055	18.313	0.266
U-1c	25.003	17.521	7.474	0.114	31.34	0.299
U-1a	25.003	21.388	3.606	0.009	1.889	0.144
U-1b	25.003	17.928	7.065	0.057	14.586	0.283
U-1d	25.003	17.928	7.061	0.065	18.485	0.282

WARNING ARM01: Computed UH depth for ARM subcatchment U-4 is not unity. Consider reducing wet weather time step.

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.013)

WARNING 02: maximum depth increased for Node DICB-2
WARNING 02: maximum depth increased for Node DICB-3

****
Element Count
****
Number of rain gages 1
Number of subcatchments ... 0
Number of nodes 30
Number of links 29
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
Design_Storms	C4hr-25mm	INTENSITY	10 min.

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
DICB-1	JUNCTION	90.00	1.20	0.0	
DICB-2	JUNCTION	87.25	1.05	0.0	
DICB-3	JUNCTION	88.60	1.07	0.0	
J01	JUNCTION	92.15	1.00	0.0	
J02	JUNCTION	91.37	1.00	0.0	
J03	JUNCTION	90.74	1.00	0.0	
J04	JUNCTION	89.95	1.00	0.0	
J05	JUNCTION	89.32	1.00	0.0	
J06	JUNCTION	88.85	1.00	0.0	
J07	JUNCTION	88.40	1.00	0.0	
J08	JUNCTION	87.64	1.00	0.0	
J09	JUNCTION	87.94	1.00	0.0	
J10	JUNCTION	88.33	1.00	0.0	
J11	JUNCTION	88.79	1.00	0.0	
J12	JUNCTION	89.46	1.00	0.0	
J13	JUNCTION	89.73	1.00	0.0	
J14	JUNCTION	91.65	1.00	0.0	
J15	JUNCTION	91.21	1.00	0.0	
J16	JUNCTION	90.65	1.00	0.0	
J17	JUNCTION	90.27	1.00	0.0	
OGS-1	JUNCTION	89.93	2.33	0.0	
OGS-2	JUNCTION	87.23	2.33	0.0	
OGS-3	JUNCTION	88.56	2.33	0.0	
RowSwale1	JUNCTION	89.78	1.00	0.0	
RowSwale2	JUNCTION	87.15	1.00	0.0	
RowSwale3	JUNCTION	88.43	1.00	0.0	
OF1	OUTFALL	89.76	1.00	0.0	
OF2	OUTFALL	86.98	1.00	0.0	
OF3	OUTFALL	87.87	1.54	0.0	
OF4	OUTFALL	0.00	0.00	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C01	J01	J02	CONDUIT	136.9	0.5698	0.0350
C02	J02	J03	CONDUIT	110.4	0.5707	0.0350
C03	J03	J04	CONDUIT	138.9	0.5688	0.0350
C04	J04	J05	CONDUIT	111.6	0.5645	0.0350
C05	J05	J06	CONDUIT	85.3	0.5510	0.0350
C06	J06	DICB-3	CONDUIT	30.1	0.5980	0.0350
C07	OGS-3	RowSwale3	CONDUIT	15.0	0.5333	0.0130
C08	RowSwale3	OF3	CONDUIT	4.2	0.4762	0.0350
C09	J07	J08	CONDUIT	76.3	0.9961	0.0350
C10	J08	DICB-2	CONDUIT	34.0	1.0001	0.0350
C11	J13	J12	CONDUIT	55.7	0.4847	0.0350
C12	J12	J11	CONDUIT	83.0	0.8073	0.0350
C13	J11	J10	CONDUIT	55.5	0.8289	0.0350
C14	J10	J09	CONDUIT	80.6	0.4839	0.0350
C15	J09	DICB-2	CONDUIT	129.3	0.4950	0.0350
C16	OGS-2	RowSwale2	CONDUIT	5.5	0.5455	0.0130
C17	RowSwale2	OF2	CONDUIT	3.0	5.6758	0.0350
C18	J14	J15	CONDUIT	88.6	0.4966	0.0350
C19	J15	J16	CONDUIT	112.3	0.4987	0.0350
C20	J16	J17	CONDUIT	77.3	0.4916	0.0350
C21	J17	DICB-1	CONDUIT	9.9	0.7071	0.0350
C22	OGS-1	RowSwale1	CONDUIT	16.0	0.6250	0.0130
C23	RowSwale1	OF1	CONDUIT	5.2	0.3846	0.0350
OR1	DICB-1	OGS-1	ORIFICE			
OR2	DICB-2	OGS-2	ORIFICE			
OR3	DICB-3	OGS-3	ORIFICE			
W1	DICB-1	RowSwale1	WEIR			
W2	DICB-2	RowSwale2	WEIR			
W3	DICB-3	RowSwale3	WEIR			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C01	TRAPEZOIDAL	1.00	5.00	0.60	8.00	1	7676.85
C02	TRAPEZOIDAL	1.00	5.00	0.60	8.00	1	7682.87
C03	TRAPEZOIDAL	1.00	5.00	0.60	8.00	1	7670.08
C04	TRAPEZOIDAL	1.00	5.00	0.60	8.00	1	7641.45
C05	TRAPEZOIDAL	1.00	5.00	0.60	8.00	1	7549.39
C06	TRAPEZOIDAL	1.00	5.00	0.60	8.00	1	7864.86
C07	CIRCULAR	0.25	0.05	0.06	0.25	1	43.43
C08	TRIANGULAR	1.00	3.00	0.47	6.00	1	3597.77
C09	TRAPEZOIDAL	1.00	5.00	0.60	8.00	1	10150.55
C10	TRAPEZOIDAL	1.00	5.00	0.60	8.00	1	10170.56

```
C11             TRAPEZOIDAL         1.00     5.00     0.60     8.00        1  7080.94
C12             TRAPEZOIDAL         1.00     5.00     0.60     8.00        1  9137.76
C13             TRAPEZOIDAL         1.00     5.00     0.60     8.00        1  9259.21
C14             TRAPEZOIDAL         1.00     5.00     0.60     8.00        1  7074.59
C15             TRAPEZOIDAL         1.00     5.00     0.60     8.00        1  7155.29
C16             CIRCULAR            0.25     0.05     0.06     0.25        1    43.92
C17             TRIANGULAR          1.00     3.00     0.47     6.00        1 12420.90
C18             TRAPEZOIDAL         1.00     5.00     0.60     8.00        1  7167.15
C19             TRAPEZOIDAL         1.00     5.00     0.60     8.00        1  7181.93
C20             TRAPEZOIDAL         1.00     5.00     0.60     8.00        1  7130.81
C21             TRAPEZOIDAL         1.00     5.00     0.60     8.00        1  8552.06
C22             CIRCULAR            0.25     0.05     0.06     0.25        1    47.02
C23             TRIANGULAR          1.00     3.00     0.47     6.00        1  3233.37


*********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
*********************************************************

****************
Analysis Options
****************
Flow Units ............... LPS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Flow Routing Method ...... DYNWAVE
Surcharge Method ......... EXTRAN
Starting Date ............ 05/04/2020 00:00:00
Ending Date .............. 05/05/2020 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Routing Time Step ........ 5.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 4
Head Tolerance ........... 0.001500 m
```

```
**************************        Volume         Volume
Flow Routing Continuity        hectare-m      10^6 ltr
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.000         0.000
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.134         1.337
External Outflow .........         0.134         1.338
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....        -0.108


*************************
Highest Continuity Errors
*************************
Node J09 (-1.12%)


***************************
Time-Step Critical Elements
***************************
Link C17 (57.43%)


********************************
Highest Flow Instability Indexes
********************************
Link C21 (2)
Link C06 (1)


*************************
Routing Time Step Summary
*************************
Minimum Time Step           :     1.29 sec
Average Time Step           :     2.96 sec
Maximum Time Step           :     5.00 sec
Percent in Steady State     :    -0.00
Average Iterations per Step :     2.00
Percent Not Converging      :     0.00
```

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days	Time of Max Occurrence hr:min	Reported Max Depth Meters
DICB-1	JUNCTION	0.36	0.81	90.81	0	03:09	0.81
DICB-2	JUNCTION	0.33	0.83	88.08	0	02:49	0.83
DICB-3	JUNCTION	0.36	0.85	89.45	0	03:07	0.85
J01	JUNCTION	0.00	0.04	92.19	0	01:45	0.04
J02	JUNCTION	0.01	0.07	91.44	0	01:50	0.07
J03	JUNCTION	0.02	0.12	90.86	0	01:46	0.12
J04	JUNCTION	0.02	0.10	90.05	0	01:54	0.10
J05	JUNCTION	0.03	0.13	89.45	0	03:08	0.13
J06	JUNCTION	0.22	0.60	89.45	0	03:10	0.60
J07	JUNCTION	0.00	0.02	88.42	0	01:41	0.02
J08	JUNCTION	0.13	0.44	88.08	0	02:49	0.44
J09	JUNCTION	0.03	0.15	88.09	0	01:48	0.15
J10	JUNCTION	0.02	0.16	88.49	0	01:41	0.16
J11	JUNCTION	0.01	0.07	88.86	0	01:44	0.07
J12	JUNCTION	0.01	0.08	89.54	0	01:38	0.08
J13	JUNCTION	0.00	0.04	89.77	0	01:40	0.04
J14	JUNCTION	0.01	0.04	91.69	0	01:47	0.04
J15	JUNCTION	0.01	0.07	91.28	0	01:50	0.07
J16	JUNCTION	0.05	0.16	90.81	0	03:08	0.16
J17	JUNCTION	0.22	0.54	90.81	0	03:09	0.54
OGS-1	JUNCTION	0.05	0.09	90.02	0	03:09	0.09
OGS-2	JUNCTION	0.08	0.17	87.40	0	02:49	0.17
OGS-3	JUNCTION	0.06	0.12	88.68	0	03:07	0.12
RowSwale1	JUNCTION	0.07	0.13	89.91	0	03:09	0.13
RowSwale2	JUNCTION	0.06	0.12	87.27	0	02:49	0.12
RowSwale3	JUNCTION	0.08	0.14	88.57	0	03:10	0.14
OF1	OUTFALL	0.07	0.13	89.89	0	03:09	0.13
OF2	OUTFALL	0.06	0.12	87.10	0	02:49	0.12
OF3	OUTFALL	0.00	0.00	87.87	0	00:00	0.00
OF4	OUTFALL	0.00	0.00	0.00	0	00:00	0.00

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days	Time of Max Occurrence hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
DICB-1	JUNCTION	0.00	21.69	0	01:42	0	0.244	-0.054
DICB-2	JUNCTION	0.00	208.55	0	01:46	0	0.727	0.722
DICB-3	JUNCTION	0.00	60.85	0	01:48	0	0.396	-0.108
J01	JUNCTION	18.31	18.31	0	01:40	0.0553	0.0553	-0.117
J02	JUNCTION	35.48	52.65	0	01:45	0.122	0.177	0.077
J03	JUNCTION	56.11	100.94	0	01:45	0.179	0.356	-0.176
J04	JUNCTION	0.00	110.47	0	01:50	0	0.356	0.095
J05	JUNCTION	13.91	113.47	0	01:53	0.0412	0.397	-0.681
J06	JUNCTION	0.00	111.70	0	01:55	0	0.4	0.873
J07	JUNCTION	9.24	9.24	0	01:40	0.0278	0.0278	-1.191
J08	JUNCTION	24.72	91.79	0	01:47	0.0705	0.135	0.775
J09	JUNCTION	0.00	187.33	0	01:45	0	0.586	-1.104
J10	JUNCTION	110.12	181.23	0	01:45	0.37	0.585	-0.154
J11	JUNCTION	0.00	72.87	0	01:41	0	0.215	0.125
J12	JUNCTION	47.31	69.73	0	01:40	0.154	0.215	-0.060
J13	JUNCTION	22.59	22.59	0	01:40	0.0618	0.0618	-0.053
J14	JUNCTION	18.48	18.48	0	01:45	0.0649	0.0649	-0.045
J15	JUNCTION	31.34	49.16	0	01:46	0.114	0.178	-0.266
J16	JUNCTION	14.59	62.36	0	01:50	0.0572	0.236	-0.497
J17	JUNCTION	1.89	63.03	0	01:53	0.00865	0.246	0.776
OGS-1	JUNCTION	0.00	12.83	0	03:09	0	0.244	-0.000
OGS-2	JUNCTION	0.00	40.28	0	02:49	0	0.685	0.001
OGS-3	JUNCTION	0.00	21.64	0	03:07	0	0.397	-0.004
RowSwale1	JUNCTION	0.00	12.83	0	03:09	0	0.244	0.002
RowSwale2	JUNCTION	0.00	40.28	0	02:49	0	0.685	0.001
RowSwale3	JUNCTION	0.00	21.64	0	03:08	0	0.397	0.002
OF1	OUTFALL	0.00	12.83	0	03:09	0	0.244	0.000
OF2	OUTFALL	0.00	40.28	0	02:49	0	0.685	0.000
OF3	OUTFALL	0.00	21.64	0	03:10	0	0.397	0.000
OF4	OUTFALL	3.71	3.71	0	01:40	0.0119	0.0119	0.000

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
OF1	60.08	10.21	12.83	0.244
OF2	57.64	30.22	40.28	0.685
OF3	67.50	14.78	21.64	0.397
OF4	28.00	1.02	3.71	0.012
System	53.30	56.22	3.71	1.338

****
Link Flow Summary
****

Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C01	CONDUIT	17.17	0 01:45	0.17	0.00	0.05
C02	CONDUIT	49.23	0 01:50	0.25	0.01	0.09
C03	CONDUIT	110.47	0 01:50	0.45	0.01	0.11
C04	CONDUIT	104.41	0 01:54	0.42	0.01	0.11
C05	CONDUIT	111.70	0 01:55	0.43	0.01	0.36
C06	CONDUIT	60.85	0 01:48	0.25	0.01	0.69
C07	CONDUIT	21.64	0 03:08	0.92	0.50	0.48
C08	CONDUIT	21.64	0 03:10	0.49	0.01	0.12
C09	CONDUIT	8.95	0 01:41	0.13	0.00	0.22
C10	CONDUIT	63.44	0 01:47	0.31	0.01	0.61
C11	CONDUIT	22.42	0 01:40	0.16	0.00	0.06
C12	CONDUIT	72.87	0 01:41	0.43	0.01	0.08
C13	CONDUIT	71.25	0 01:44	0.26	0.01	0.12
C14	CONDUIT	187.33	0 01:45	0.51	0.03	0.15
C15	CONDUIT	180.63	0 01:48	0.32	0.03	0.46
C16	CONDUIT	40.28	0 02:49	1.15	0.92	0.67
C17	CONDUIT	40.28	0 02:49	0.99	0.00	0.12
C18	CONDUIT	18.07	0 01:47	0.16	0.00	0.05
C19	CONDUIT	47.86	0 01:50	0.29	0.01	0.09
C20	CONDUIT	61.14	0 01:53	0.32	0.01	0.35
C21	CONDUIT	21.69	0 01:42	0.24	0.00	0.58
C22	CONDUIT	12.83	0 03:09	0.82	0.27	0.36
C23	CONDUIT	12.83	0 03:09	0.27	0.00	0.13
OR1	ORIFICE	12.83	0 03:09			1.00
OR2	ORIFICE	40.28	0 02:49			1.00
OR3	ORIFICE	21.64	0 03:07			1.00
W1	WEIR	0.00	0 00:00			0.00
W2	WEIR	0.00	0 00:00			0.00
W3	WEIR	0.00	0 00:00			0.00

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
		Fraction of Time in Flow Class								
C01	1.00	0.03	0.16	0.00	0.81	0.00	0.00	0.00	0.94	0.00
C02	1.00	0.03	0.00	0.00	0.97	0.00	0.00	0.00	0.95	0.00
C03	1.00	0.03	0.00	0.00	0.97	0.00	0.00	0.00	0.92	0.00
C04	1.00	0.03	0.00	0.00	0.97	0.00	0.00	0.00	0.95	0.00
C05	1.00	0.03	0.00	0.00	0.97	0.00	0.00	0.00	0.81	0.00
C06	1.00	0.03	0.00	0.00	0.53	0.00	0.00	0.43	0.02	0.00
C07	1.00	0.04	0.00	0.00	0.00	0.00	0.00	0.96	0.00	0.00
C08	1.00	0.04	0.00	0.00	0.00	0.00	0.00	0.96	0.00	0.00
C09	1.00	0.30	0.07	0.00	0.63	0.00	0.00	0.00	0.94	0.00
C10	1.00	0.30	0.00	0.00	0.57	0.00	0.00	0.13	0.09	0.00
C11	1.00	0.21	0.15	0.00	0.63	0.00	0.00	0.00	0.94	0.00
C12	1.00	0.12	0.09	0.00	0.78	0.00	0.00	0.00	0.92	0.00
C13	1.00	0.03	0.10	0.00	0.88	0.00	0.00	0.00	0.94	0.00
C14	1.00	0.03	0.00	0.00	0.97	0.00	0.00	0.00	0.92	0.00
C15	1.00	0.03	0.00	0.00	0.57	0.00	0.00	0.40	0.17	0.00
C16	1.00	0.03	0.00	0.00	0.00	0.00	0.00	0.97	0.00	0.00
C17	1.00	0.03	0.00	0.00	0.40	0.57	0.00	0.00	0.66	0.00
C18	1.00	0.03	0.25	0.00	0.72	0.00	0.00	0.00	0.94	0.00
C19	1.00	0.03	0.00	0.00	0.97	0.00	0.00	0.00	0.93	0.00

C20	1.00	0.03	0.00	0.00	0.97	0.00	0.00	0.00	0.69	0.00
C21	1.00	0.05	0.00	0.00	0.53	0.00	0.00	0.42	0.00	0.00
C22	1.00	0.04	0.00	0.00	0.00	0.00	0.00	0.96	0.00	0.00
C23	1.00	0.04	0.00	0.00	0.96	0.00	0.00	0.00	0.65	0.00

```
*************************
Conduit Surcharge Summary
*************************

No conduits were surcharged.


Analysis begun on:  Wed May 27 13:18:15 2020
Analysis ended on:  Wed May 27 13:18:17 2020
Total elapsed time: 00:00:02
```

ALTERNATIVE RUNOFF METHOD (ARM) - PCSWMM BETA VERSION 7.2.2785

This is a *BETA* version of ARM - your feedback and suggestions are solicited.
Create a ticket, post on the PCSWMM feature request forum, or email us directly!

Simulation start time:	05/04/2020 00:00:00
Simulation end time:	05/05/2020 00:00:00
Runoff wet weather time steps:	300 seconds
Report time steps:	60 seconds
Number of data points:	1441

****
Unit Hydrographs Runoff Method
****

Subcatchment	Runoff Method	Raingage	Area (ha)	Time of Concentration (min)	Time to Peak (min)	Time after Pe (min)
U-4	Nash IUH	Design_Storms	0.32	10	6.67	38.33
U-2e	Nash IUH	Design_Storms	0.48	12	8	47
U-2c	Nash IUH	Design_Storms	4.34	18.6	12.4	82.6
U-2a	Nash IUH	Design_Storms	0.73	11.9	7.93	47.07
U-2b	Nash IUH	Design_Storms	2.06	15.6	10.4	64.6
U-2d	Nash IUH	Design_Storms	0.83	13.5	9	56
U-3b	Nash IUH	Design_Storms	1.63	18	12	73
U-3d	Nash IUH	Design_Storms	0.62	13	8.67	51.33
U-3c	Nash IUH	Design_Storms	2.4	15.2	10.13	64.87
U-3a	Nash IUH	Design_Storms	0.83	13.5	9	56
U-1c	Nash IUH	Design_Storms	1.52	19.8	13.2	76.8
U-1a	Nash IUH	Design_Storms	0.24	22.9	15.27	69.73
U-1b	Nash IUH	Design_Storms	0.81	22.7	15.13	79.87
U-1d	Nash IUH	Design_Storms	0.92	18.6	12.4	72.6

****
ARM Runoff Summary
****

Subcatchment	Total Precip (mm)	Total Losses (mm)	Total Runoff (mm)	Total Runoff 10^6 ltr	Peak Runoff LPS	Runoff Coeff (fraction)
U-4	31.857	25.168	6.566	0.021	7.772	0.206
U-2e	31.857	22.27	9.496	0.046	17.332	0.298
U-2c	31.857	18.742	13.092	0.568	186.374	0.411
U-2a	31.857	18.742	12.989	0.095	38.205	0.408
U-2b	31.857	20.065	11.752	0.242	84.528	0.369
U-2d	31.857	18.742	13.036	0.108	41.982	0.409
U-3b	31.857	20.065	11.767	0.192	62.53	0.369
U-3d	31.857	21.18	10.602	0.066	24.942	0.333
U-3c	31.857	20.065	11.746	0.282	100.136	0.369
U-3a	31.857	21.18	10.613	0.088	32.886	0.333
U-1c	31.857	20.065	11.77	0.179	55.486	0.369
U-1a	31.857	25.454	6.387	0.015	3.926	0.201
U-1b	31.857	20.644	11.198	0.091	25.754	0.351
U-1d	31.857	20.644	11.196	0.103	32.837	0.351

WARNING ARM01: Computed UH depth for ARM subcatchment U-4 is not unity. Consider reducing wet weather time step.

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.013)

WARNING 02: maximum depth increased for Node DICB-2
WARNING 02: maximum depth increased for Node DICB-3

****
Element Count
****
Number of rain gages 1
Number of subcatchments ... 0
Number of nodes 30
Number of links 29
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
Design_Storms	C3hr-2yr	INTENSITY	10 min.

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
DICB-1	JUNCTION	90.00	1.20	0.0	
DICB-2	JUNCTION	87.25	1.05	0.0	
DICB-3	JUNCTION	88.60	1.07	0.0	
J01	JUNCTION	92.15	1.00	0.0	
J02	JUNCTION	91.37	1.00	0.0	
J03	JUNCTION	90.74	1.00	0.0	
J04	JUNCTION	89.95	1.00	0.0	
J05	JUNCTION	89.32	1.00	0.0	
J06	JUNCTION	88.85	1.00	0.0	
J07	JUNCTION	88.40	1.00	0.0	
J08	JUNCTION	87.64	1.00	0.0	
J09	JUNCTION	87.94	1.00	0.0	
J10	JUNCTION	88.33	1.00	0.0	
J11	JUNCTION	88.79	1.00	0.0	
J12	JUNCTION	89.46	1.00	0.0	
J13	JUNCTION	89.73	1.00	0.0	
J14	JUNCTION	91.65	1.00	0.0	
J15	JUNCTION	91.21	1.00	0.0	
J16	JUNCTION	90.65	1.00	0.0	
J17	JUNCTION	90.27	1.00	0.0	
OGS-1	JUNCTION	89.93	2.33	0.0	
OGS-2	JUNCTION	87.23	2.33	0.0	
OGS-3	JUNCTION	88.56	2.33	0.0	
RowSwale1	JUNCTION	89.78	1.00	0.0	
RowSwale2	JUNCTION	87.15	1.00	0.0	
RowSwale3	JUNCTION	88.43	1.00	0.0	
OF1	OUTFALL	89.76	1.00	0.0	
OF2	OUTFALL	86.98	1.00	0.0	
OF3	OUTFALL	87.87	1.54	0.0	
OF4	OUTFALL	0.00	0.00	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C01	J01	J02	CONDUIT	136.9	0.5698	0.0350
C02	J02	J03	CONDUIT	110.4	0.5707	0.0350
C03	J03	J04	CONDUIT	138.9	0.5688	0.0350
C04	J04	J05	CONDUIT	111.6	0.5645	0.0350
C05	J05	J06	CONDUIT	85.3	0.5510	0.0350
C06	J06	DICB-3	CONDUIT	30.1	0.5980	0.0350
C07	OGS-3	RowSwale3	CONDUIT	15.0	0.5333	0.0130
C08	RowSwale3	OF3	CONDUIT	4.2	0.4762	0.0350
C09	J07	J08	CONDUIT	76.3	0.9961	0.0350
C10	J08	DICB-2	CONDUIT	34.0	1.0001	0.0350
C11	J13	J12	CONDUIT	55.7	0.4847	0.0350
C12	J12	J11	CONDUIT	83.0	0.8073	0.0350
C13	J11	J10	CONDUIT	55.5	0.8289	0.0350
C14	J10	J09	CONDUIT	80.6	0.4839	0.0350
C15	J09	DICB-2	CONDUIT	129.3	0.4950	0.0350
C16	OGS-2	RowSwale2	CONDUIT	5.5	0.5455	0.0130
C17	RowSwale2	OF2	CONDUIT	3.0	5.6758	0.0350
C18	J14	J15	CONDUIT	88.6	0.4966	0.0350
C19	J15	J16	CONDUIT	112.3	0.4987	0.0350
C20	J16	J17	CONDUIT	77.3	0.4916	0.0350
C21	J17	DICB-1	CONDUIT	9.9	0.7071	0.0350
C22	OGS-1	RowSwale1	CONDUIT	16.0	0.6250	0.0130
C23	RowSwale1	OF1	CONDUIT	5.2	0.3846	0.0350
OR1	DICB-1	OGS-1	ORIFICE			
OR2	DICB-2	OGS-2	ORIFICE			
OR3	DICB-3	OGS-3	ORIFICE			
W1	DICB-1	RowSwale1	WEIR			
W2	DICB-2	RowSwale2	WEIR			
W3	DICB-3	RowSwale3	WEIR			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C01	TRAPEZOIDAL	1.00	5.00	0.60	8.00	1	7676.85
C02	TRAPEZOIDAL	1.00	5.00	0.60	8.00	1	7682.87
C03	TRAPEZOIDAL	1.00	5.00	0.60	8.00	1	7670.08
C04	TRAPEZOIDAL	1.00	5.00	0.60	8.00	1	7641.45
C05	TRAPEZOIDAL	1.00	5.00	0.60	8.00	1	7549.39
C06	TRAPEZOIDAL	1.00	5.00	0.60	8.00	1	7864.86
C07	CIRCULAR	0.25	0.05	0.06	0.25	1	43.43
C08	TRIANGULAR	1.00	3.00	0.47	6.00	1	3597.77
C09	TRAPEZOIDAL	1.00	5.00	0.60	8.00	1	10150.55
C10	TRAPEZOIDAL	1.00	5.00	0.60	8.00	1	10170.56

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C11            TRAPEZOIDAL        1.00     5.00     0.60     8.00         1  7080.94
C12            TRAPEZOIDAL        1.00     5.00     0.60     8.00         1  9137.76
C13            TRAPEZOIDAL        1.00     5.00     0.60     8.00         1  9259.21
C14            TRAPEZOIDAL        1.00     5.00     0.60     8.00         1  7074.59
C15            TRAPEZOIDAL        1.00     5.00     0.60     8.00         1  7155.29
C16            CIRCULAR           0.25     0.05     0.06     0.25         1    43.92
C17            TRIANGULAR         1.00     3.00     0.47     6.00         1 12420.90
C18            TRAPEZOIDAL        1.00     5.00     0.60     8.00         1  7167.15
C19            TRAPEZOIDAL        1.00     5.00     0.60     8.00         1  7181.93
C20            TRAPEZOIDAL        1.00     5.00     0.60     8.00         1  7130.81
C21            TRAPEZOIDAL        1.00     5.00     0.60     8.00         1  8552.06
C22            CIRCULAR           0.25     0.05     0.06     0.25         1    47.02
C23            TRIANGULAR         1.00     3.00     0.47     6.00         1  3233.37


*********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
*********************************************************

****************
Analysis Options
****************
Flow Units ............... LPS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Flow Routing Method ...... DYNWAVE
Surcharge Method ......... EXTRAN
Starting Date ............ 05/04/2020 00:00:00
Ending Date .............. 05/05/2020 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Routing Time Step ........ 5.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 4
Head Tolerance ........... 0.001500 m
```

```
**************************        Volume         Volume
Flow Routing Continuity        hectare-m       10^6 ltr
**************************     ---------      ---------
Dry Weather Inflow .......         0.000          0.000
Wet Weather Inflow .......         0.000          0.000
Groundwater Inflow .......         0.000          0.000
RDII Inflow ..............         0.000          0.000
External Inflow ..........         0.209          2.094
External Outflow .........         0.210          2.096
Flooding Loss ............         0.000          0.000
Evaporation Loss .........         0.000          0.000
Exfiltration Loss ........         0.000          0.000
Initial Stored Volume ....         0.000          0.000
Final Stored Volume ......         0.000          0.000
Continuity Error (%) .....        -0.070


***************************
Time-Step Critical Elements
***************************
Link C17 (58.68%)
Link C23 (4.41%)


********************************
Highest Flow Instability Indexes
********************************
Link C21 (2)


*************************
Routing Time Step Summary
*************************
Minimum Time Step           :     0.88 sec
Average Time Step           :     2.82 sec
Maximum Time Step           :     5.00 sec
Percent in Steady State     :    -0.00
Average Iterations per Step :     2.00
Percent Not Converging      :     0.00


******************
Node Depth Summary
******************
```

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
DICB-1	JUNCTION	0.53	1.01	91.01	0 02:38	1.01
DICB-2	JUNCTION	0.36	0.90	88.15	0 01:41	0.90
DICB-3	JUNCTION	0.39	0.91	89.51	0 01:50	0.91
J01	JUNCTION	0.01	0.05	92.20	0 01:22	0.05
J02	JUNCTION	0.01	0.09	91.46	0 01:27	0.09
J03	JUNCTION	0.02	0.16	90.90	0 01:23	0.16
J04	JUNCTION	0.02	0.15	90.10	0 01:30	0.15
J05	JUNCTION	0.05	0.19	89.51	0 01:49	0.19
J06	JUNCTION	0.26	0.66	89.51	0 01:50	0.66
J07	JUNCTION	0.00	0.03	88.43	0 01:20	0.03
J08	JUNCTION	0.16	0.51	88.15	0 01:41	0.51
J09	JUNCTION	0.05	0.21	88.15	0 01:43	0.21
J10	JUNCTION	0.03	0.21	88.54	0 01:20	0.21
J11	JUNCTION	0.01	0.10	88.89	0 01:23	0.10
J12	JUNCTION	0.01	0.11	89.57	0 01:17	0.11
J13	JUNCTION	0.01	0.06	89.79	0 01:20	0.06
J14	JUNCTION	0.01	0.05	91.70	0 01:26	0.05
J15	JUNCTION	0.01	0.10	91.31	0 01:29	0.10
J16	JUNCTION	0.14	0.36	91.01	0 02:40	0.36
J17	JUNCTION	0.36	0.74	91.01	0 02:38	0.74
OGS-1	JUNCTION	0.06	0.10	90.03	0 02:59	0.10
OGS-2	JUNCTION	0.09	0.18	87.41	0 01:41	0.18
OGS-3	JUNCTION	0.07	0.14	88.70	0 01:50	0.14
RowSwale1	JUNCTION	0.08	0.16	89.94	0 02:39	0.16
RowSwale2	JUNCTION	0.07	0.22	87.37	0 01:41	0.22
RowSwale3	JUNCTION	0.09	0.25	88.68	0 01:50	0.25
OF1	OUTFALL	0.08	0.16	89.92	0 02:39	0.16
OF2	OUTFALL	0.07	0.22	87.20	0 01:41	0.22
OF3	OUTFALL	0.00	0.00	87.87	0 00:00	0.00
OF4	OUTFALL	0.00	0.00	0.00	0 00:00	0.00

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
DICB-1	JUNCTION	0.00	30.13	0 01:32	0	0.388	-0.031
DICB-2	JUNCTION	0.00	319.10	0 01:21	0	1.11	0.748
DICB-3	JUNCTION	0.00	118.76	0 01:50	0	0.627	-0.076
J01	JUNCTION	32.88	32.88	0 01:20	0.088	0.088	-0.141
J02	JUNCTION	62.53	93.50	0 01:25	0.192	0.28	0.093
J03	JUNCTION	100.13	183.75	0 01:25	0.282	0.561	-0.205
J04	JUNCTION	0.00	197.43	0 01:27	0	0.563	0.022
J05	JUNCTION	24.94	207.20	0 01:30	0.0657	0.628	-0.584
J06	JUNCTION	0.00	203.04	0 01:32	0	0.632	0.811
J07	JUNCTION	17.33	17.33	0 01:20	0.0456	0.0456	-1.501
J08	JUNCTION	41.97	153.69	0 01:22	0.108	0.198	0.726
J09	JUNCTION	0.00	312.64	0 01:24	0	0.906	-0.948
J10	JUNCTION	186.37	307.62	0 01:25	0.568	0.905	-0.210
J11	JUNCTION	0.00	123.64	0 01:21	0	0.337	0.119
J12	JUNCTION	84.52	122.64	0 01:20	0.242	0.337	-0.062
J13	JUNCTION	38.20	38.20	0 01:20	0.0948	0.0948	-0.052
J14	JUNCTION	32.84	32.84	0 01:25	0.103	0.103	-0.051
J15	JUNCTION	55.48	87.49	0 01:25	0.179	0.282	-0.709
J16	JUNCTION	25.75	111.04	0 01:29	0.0907	0.375	-0.075
J17	JUNCTION	3.93	113.16	0 01:32	0.0153	0.39	0.664
OGS-1	JUNCTION	0.00	14.42	0 02:38	0	0.364	-0.001
OGS-2	JUNCTION	0.00	42.08	0 01:40	0	0.722	0.001
OGS-3	JUNCTION	0.00	22.38	0 01:46	0	0.415	-0.004
RowSwale1	JUNCTION	0.00	23.27	0 02:38	0	0.388	0.002
RowSwale2	JUNCTION	0.00	222.11	0 01:41	0	1.06	0.000
RowSwale3	JUNCTION	0.00	118.52	0 01:50	0	0.627	0.001
OF1	OUTFALL	0.00	23.26	0 02:39	0	0.388	0.000
OF2	OUTFALL	0.00	222.12	0 01:41	0	1.06	0.000
OF3	OUTFALL	0.00	118.52	0 01:50	0	0.627	0.000
OF4	OUTFALL	7.77	7.77	0 01:20	0.021	0.021	0.000

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
OF1	66.45	13.15	23.26	0.388
OF2	59.03	50.93	222.12	1.060
OF3	67.94	25.69	118.52	0.627
OF4	24.51	2.26	7.77	0.021
System	54.48	92.04	7.77	2.096

****
Link Flow Summary
****

Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C01	CONDUIT	31.30	0 01:23	0.21	0.00	0.07
C02	CONDUIT	89.45	0 01:27	0.31	0.01	0.13
C03	CONDUIT	197.43	0 01:27	0.54	0.03	0.15
C04	CONDUIT	189.12	0 01:30	0.52	0.02	0.15
C05	CONDUIT	203.04	0 01:32	0.50	0.03	0.43
C06	CONDUIT	118.76	0 01:50	0.27	0.02	0.75
C07	CONDUIT	22.39	0 01:52	0.93	0.52	0.66
C08	CONDUIT	118.52	0 01:50	0.80	0.03	0.22
C09	CONDUIT	17.00	0 01:20	0.17	0.00	0.26
C10	CONDUIT	97.24	0 01:22	0.35	0.01	0.68
C11	CONDUIT	38.11	0 01:20	0.20	0.01	0.08
C12	CONDUIT	123.64	0 01:21	0.52	0.01	0.10
C13	CONDUIT	122.29	0 01:23	0.32	0.01	0.16
C14	CONDUIT	312.64	0 01:24	0.60	0.04	0.20
C15	CONDUIT	306.66	0 01:27	0.36	0.04	0.53
C16	CONDUIT	42.11	0 01:45	1.17	0.96	0.70
C17	CONDUIT	222.12	0 01:41	1.51	0.02	0.22
C18	CONDUIT	32.29	0 01:26	0.20	0.00	0.08
C19	CONDUIT	85.32	0 01:29	0.36	0.01	0.20
C20	CONDUIT	109.26	0 01:32	0.36	0.02	0.55
C21	CONDUIT	30.13	0 01:32	0.25	0.00	0.78
C22	CONDUIT	14.42	0 02:39	0.84	0.31	0.40
C23	CONDUIT	23.26	0 02:39	0.31	0.01	0.16
OR1	ORIFICE	14.42	0 02:38			1.00
OR2	ORIFICE	42.08	0 01:40			1.00
OR3	ORIFICE	22.38	0 01:46			1.00
W1	WEIR	8.85	0 02:38			0.07
W2	WEIR	180.07	0 01:41			0.23
W3	WEIR	96.16	0 01:50			0.21

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
		---------- Fraction of Time in Flow Class ----------								
C01	1.00	0.02	0.17	0.00	0.81	0.00	0.00	0.00	0.95	0.00
C02	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.96	0.00
C03	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.94	0.00
C04	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.96	0.00
C05	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.81	0.00
C06	1.00	0.02	0.00	0.00	0.55	0.00	0.00	0.43	0.02	0.00
C07	1.00	0.03	0.00	0.00	0.12	0.00	0.00	0.86	0.00	0.00
C08	1.00	0.03	0.00	0.00	0.00	0.00	0.00	0.97	0.00	0.00
C09	1.00	0.29	0.08	0.00	0.63	0.00	0.00	0.00	0.96	0.00
C10	1.00	0.29	0.00	0.00	0.58	0.00	0.00	0.13	0.08	0.00
C11	1.00	0.22	0.15	0.00	0.64	0.00	0.00	0.00	0.95	0.00
C12	1.00	0.13	0.09	0.00	0.78	0.00	0.00	0.00	0.93	0.00
C13	1.00	0.02	0.11	0.00	0.87	0.00	0.00	0.00	0.96	0.00
C14	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.94	0.00
C15	1.00	0.02	0.00	0.00	0.58	0.00	0.00	0.40	0.16	0.00
C16	1.00	0.02	0.00	0.00	0.01	0.00	0.00	0.97	0.00	0.00
C17	1.00	0.02	0.00	0.00	0.39	0.59	0.00	0.00	0.67	0.00
C18	1.00	0.02	0.26	0.00	0.72	0.00	0.00	0.00	0.95	0.00
C19	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.95	0.00
C20	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.61	0.00
C21	1.00	0.04	0.00	0.00	0.62	0.00	0.00	0.34	0.00	0.00
C22	1.00	0.03	0.00	0.00	0.07	0.01	0.00	0.90	0.01	0.00
C23	1.00	0.03	0.00	0.00	0.97	0.00	0.00	0.00	0.58	0.00

```
************************
Conduit Surcharge Summary
************************

No conduits were surcharged.


Analysis begun on:  Wed May 27 14:11:30 2020
Analysis ended on:  Wed May 27 14:11:32 2020
Total elapsed time: 00:00:02
```

ALTERNATIVE RUNOFF METHOD (ARM) - PCSWMM BETA VERSION 7.2.2785

This is a *BETA* version of ARM - your feedback and suggestions are solicited.
Create a ticket, post on the PCSWMM feature request forum, or email us directly!

Simulation start time:	05/04/2020 00:00:00
Simulation end time:	05/05/2020 00:00:00
Runoff wet weather time steps:	300 seconds
Report time steps:	60 seconds
Number of data points:	1441

****
Unit Hydrographs Runoff Method
****

Subcatchment	Runoff Method	Raingage	Area (ha)	Time of Concentration (min)	Time to Peak (min)	Time after Pe (min)
U-4	Nash IUH	Design_Storms	0.32	10	6.67	38.33
U-2e	Nash IUH	Design_Storms	0.48	12	8	47
U-2c	Nash IUH	Design_Storms	4.34	18.6	12.4	82.6
U-2a	Nash IUH	Design_Storms	0.73	11.9	7.93	47.07
U-2b	Nash IUH	Design_Storms	2.06	15.6	10.4	64.6
U-2d	Nash IUH	Design_Storms	0.83	13.5	9	56
U-3b	Nash IUH	Design_Storms	1.63	18	12	73
U-3d	Nash IUH	Design_Storms	0.62	13	8.67	51.33
U-3c	Nash IUH	Design_Storms	2.4	15.2	10.13	64.87
U-3a	Nash IUH	Design_Storms	0.83	13.5	9	56
U-1c	Nash IUH	Design_Storms	1.52	19.8	13.2	76.8
U-1a	Nash IUH	Design_Storms	0.24	22.9	15.27	69.73
U-1b	Nash IUH	Design_Storms	0.81	22.7	15.13	79.87
U-1d	Nash IUH	Design_Storms	0.92	18.6	12.4	72.6

****
ARM Runoff Summary
****

Subcatchment	Total Precip (mm)	Total Losses (mm)	Total Runoff (mm)	Total Runoff 10^6 ltr	Peak Runoff LPS	Runoff Coeff (fraction)
U-4	71.667	40.031	31.056	0.099	46.744	0.433
U-2e	71.667	33.035	38.271	0.184	80.7	0.534
U-2c	71.667	26.023	45.553	1.977	710.426	0.636
U-2a	71.667	26.023	45.205	0.33	152.051	0.631
U-2b	71.667	28.316	43.199	0.89	355.23	0.603
U-2d	71.667	26.023	45.373	0.377	160.023	0.633
U-3b	71.667	28.316	43.264	0.705	256.872	0.604
U-3d	71.667	30.963	40.419	0.251	106.086	0.564
U-3c	71.667	28.316	43.167	1.036	419.142	0.602
U-3a	71.667	30.963	40.458	0.336	140.696	0.565
U-1c	71.667	28.316	43.283	0.658	227.502	0.604
U-1a	71.667	40.988	30.596	0.073	21.837	0.427
U-1b	71.667	29.666	41.938	0.34	108.014	0.585
U-1d	71.667	29.666	41.924	0.386	136.087	0.585

WARNING ARM01: Computed UH depth for ARM subcatchment U-4 is not unity. Consider reducing wet weather time step.

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.013)

WARNING 02: maximum depth increased for Node DICB-2
WARNING 02: maximum depth increased for Node DICB-3

****
Element Count
****
Number of rain gages 1
Number of subcatchments ... 0
Number of nodes 30
Number of links 29
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Name	Data Source	Data Type	Recording Interval
Design_Storms	C3hr-100yr	INTENSITY	10 min.

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
DICB-1	JUNCTION	90.00	1.20	0.0	
DICB-2	JUNCTION	87.25	1.05	0.0	
DICB-3	JUNCTION	88.60	1.07	0.0	
J01	JUNCTION	92.15	1.00	0.0	
J02	JUNCTION	91.37	1.00	0.0	
J03	JUNCTION	90.74	1.00	0.0	
J04	JUNCTION	89.95	1.00	0.0	
J05	JUNCTION	89.32	1.00	0.0	
J06	JUNCTION	88.85	1.00	0.0	
J07	JUNCTION	88.40	1.00	0.0	
J08	JUNCTION	87.64	1.00	0.0	
J09	JUNCTION	87.94	1.00	0.0	
J10	JUNCTION	88.33	1.00	0.0	
J11	JUNCTION	88.79	1.00	0.0	
J12	JUNCTION	89.46	1.00	0.0	
J13	JUNCTION	89.73	1.00	0.0	
J14	JUNCTION	91.65	1.00	0.0	
J15	JUNCTION	91.21	1.00	0.0	
J16	JUNCTION	90.65	1.00	0.0	
J17	JUNCTION	90.27	1.00	0.0	
OGS-1	JUNCTION	89.93	2.33	0.0	
OGS-2	JUNCTION	87.23	2.33	0.0	
OGS-3	JUNCTION	88.56	2.33	0.0	
RowSwale1	JUNCTION	89.78	1.00	0.0	
RowSwale2	JUNCTION	87.15	1.00	0.0	
RowSwale3	JUNCTION	88.43	1.00	0.0	
OF1	OUTFALL	89.76	1.00	0.0	
OF2	OUTFALL	86.98	1.00	0.0	
OF3	OUTFALL	87.87	1.54	0.0	
OF4	OUTFALL	0.00	0.00	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C01	J01	J02	CONDUIT	136.9	0.5698	0.0350
C02	J02	J03	CONDUIT	110.4	0.5707	0.0350
C03	J03	J04	CONDUIT	138.9	0.5688	0.0350
C04	J04	J05	CONDUIT	111.6	0.5645	0.0350
C05	J05	J06	CONDUIT	85.3	0.5510	0.0350
C06	J06	DICB-3	CONDUIT	30.1	0.5980	0.0350
C07	OGS-3	RowSwale3	CONDUIT	15.0	0.5333	0.0130
C08	RowSwale3	OF3	CONDUIT	4.2	0.4762	0.0350
C09	J07	J08	CONDUIT	76.3	0.9961	0.0350
C10	J08	DICB-2	CONDUIT	34.0	1.0001	0.0350
C11	J13	J12	CONDUIT	55.7	0.4847	0.0350
C12	J12	J11	CONDUIT	83.0	0.8073	0.0350
C13	J11	J10	CONDUIT	55.5	0.8289	0.0350
C14	J10	J09	CONDUIT	80.6	0.4839	0.0350
C15	J09	DICB-2	CONDUIT	129.3	0.4950	0.0350
C16	OGS-2	RowSwale2	CONDUIT	5.5	0.5455	0.0130
C17	RowSwale2	OF2	CONDUIT	3.0	5.6758	0.0350
C18	J14	J15	CONDUIT	88.6	0.4966	0.0350
C19	J15	J16	CONDUIT	112.3	0.4987	0.0350
C20	J16	J17	CONDUIT	77.3	0.4916	0.0350
C21	J17	DICB-1	CONDUIT	9.9	0.7071	0.0350
C22	OGS-1	RowSwale1	CONDUIT	16.0	0.6250	0.0130
C23	RowSwale1	OF1	CONDUIT	5.2	0.3846	0.0350
OR1	DICB-1	OGS-1	ORIFICE			
OR2	DICB-2	OGS-2	ORIFICE			
OR3	DICB-3	OGS-3	ORIFICE			
W1	DICB-1	RowSwale1	WEIR			
W2	DICB-2	RowSwale2	WEIR			
W3	DICB-3	RowSwale3	WEIR			

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C01	TRAPEZOIDAL	1.00	5.00	0.60	8.00	1	7676.85
C02	TRAPEZOIDAL	1.00	5.00	0.60	8.00	1	7682.87
C03	TRAPEZOIDAL	1.00	5.00	0.60	8.00	1	7670.08
C04	TRAPEZOIDAL	1.00	5.00	0.60	8.00	1	7641.45
C05	TRAPEZOIDAL	1.00	5.00	0.60	8.00	1	7549.39
C06	TRAPEZOIDAL	1.00	5.00	0.60	8.00	1	7864.86
C07	CIRCULAR	0.25	0.05	0.06	0.25	1	43.43
C08	TRIANGULAR	1.00	3.00	0.47	6.00	1	3597.77
C09	TRAPEZOIDAL	1.00	5.00	0.60	8.00	1	10150.55
C10	TRAPEZOIDAL	1.00	5.00	0.60	8.00	1	10170.56

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C11             TRAPEZOIDAL         1.00     5.00     0.60     8.00        1  7080.94
C12             TRAPEZOIDAL         1.00     5.00     0.60     8.00        1  9137.76
C13             TRAPEZOIDAL         1.00     5.00     0.60     8.00        1  9259.21
C14             TRAPEZOIDAL         1.00     5.00     0.60     8.00        1  7074.59
C15             TRAPEZOIDAL         1.00     5.00     0.60     8.00        1  7155.29
C16             CIRCULAR            0.25     0.05     0.06     0.25        1    43.92
C17             TRIANGULAR          1.00     3.00     0.47     6.00        1 12420.90
C18             TRAPEZOIDAL         1.00     5.00     0.60     8.00        1  7167.15
C19             TRAPEZOIDAL         1.00     5.00     0.60     8.00        1  7181.93
C20             TRAPEZOIDAL         1.00     5.00     0.60     8.00        1  7130.81
C21             TRAPEZOIDAL         1.00     5.00     0.60     8.00        1  8552.06
C22             CIRCULAR            0.25     0.05     0.06     0.25        1    47.02
C23             TRIANGULAR          1.00     3.00     0.47     6.00        1  3233.37


*********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
*********************************************************

****************
Analysis Options
****************
Flow Units ............... LPS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ NO
  Water Quality .......... NO
Flow Routing Method ...... DYNWAVE
Surcharge Method ......... EXTRAN
Starting Date ............ 05/04/2020 00:00:00
Ending Date .............. 05/05/2020 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Routing Time Step ........ 5.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 4
Head Tolerance ........... 0.001500 m
```

```
**************************        Volume         Volume
Flow Routing Continuity         hectare-m      10^6 ltr
**************************      ---------      ---------
Dry Weather Inflow .......          0.000          0.000
Wet Weather Inflow .......          0.000          0.000
Groundwater Inflow .......          0.000          0.000
RDII Inflow ..............          0.000          0.000
External Inflow ..........          0.764          7.639
External Outflow .........          0.764          7.641
Flooding Loss ............          0.000          0.000
Evaporation Loss .........          0.000          0.000
Exfiltration Loss ........          0.000          0.000
Initial Stored Volume ....          0.000          0.000
Final Stored Volume ......          0.000          0.000
Continuity Error (%) .....         -0.028


***************************
Time-Step Critical Elements
***************************
Link C17 (63.52%)
Link C23 (4.15%)


********************************
Highest Flow Instability Indexes
********************************
All links are stable.


*************************
Routing Time Step Summary
*************************
Minimum Time Step           :     0.50 sec
Average Time Step           :     2.53 sec
Maximum Time Step           :     5.00 sec
Percent in Steady State     :    -0.00
Average Iterations per Step :     2.00
Percent Not Converging      :     0.02


******************
Node Depth Summary
******************
```

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
DICB-1	JUNCTION	0.62	1.17	91.17	0 01:33	1.17
DICB-2	JUNCTION	0.44	1.02	88.27	0 01:24	1.02
DICB-3	JUNCTION	0.47	1.04	89.64	0 01:27	1.04
J01	JUNCTION	0.02	0.12	92.27	0 01:20	0.12
J02	JUNCTION	0.03	0.22	91.59	0 01:23	0.22
J03	JUNCTION	0.05	0.33	91.07	0 01:21	0.33
J04	JUNCTION	0.05	0.32	90.27	0 01:25	0.32
J05	JUNCTION	0.09	0.36	89.68	0 01:27	0.36
J06	JUNCTION	0.32	0.79	89.64	0 01:27	0.79
J07	JUNCTION	0.01	0.08	88.48	0 01:17	0.08
J08	JUNCTION	0.22	0.63	88.27	0 01:24	0.63
J09	JUNCTION	0.09	0.42	88.36	0 01:24	0.42
J10	JUNCTION	0.07	0.42	88.75	0 01:21	0.42
J11	JUNCTION	0.03	0.23	89.02	0 01:21	0.23
J12	JUNCTION	0.03	0.23	89.69	0 01:20	0.23
J13	JUNCTION	0.02	0.13	89.86	0 01:16	0.13
J14	JUNCTION	0.02	0.13	91.78	0 01:25	0.13
J15	JUNCTION	0.04	0.22	91.43	0 01:25	0.22
J16	JUNCTION	0.19	0.52	91.17	0 01:33	0.52
J17	JUNCTION	0.44	0.90	91.17	0 01:33	0.90
OGS-1	JUNCTION	0.08	0.33	90.26	0 01:33	0.33
OGS-2	JUNCTION	0.12	0.39	87.62	0 01:24	0.39
OGS-3	JUNCTION	0.10	0.38	88.94	0 01:20	0.38
RowSwale1	JUNCTION	0.14	0.47	90.25	0 01:33	0.47
RowSwale2	JUNCTION	0.11	0.44	87.59	0 01:24	0.44
RowSwale3	JUNCTION	0.14	0.49	88.92	0 01:27	0.49
OF1	OUTFALL	0.14	0.47	90.23	0 01:33	0.47
OF2	OUTFALL	0.11	0.44	87.42	0 01:24	0.44
OF3	OUTFALL	0.00	0.00	87.87	0 00:00	0.00
OF4	OUTFALL	0.00	0.00	0.00	0 00:00	0.00

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
DICB-1	JUNCTION	0.00	438.79	0 01:33	0	1.46	-0.007
DICB-2	JUNCTION	0.00	1433.73	0 01:23	0	3.8	0.364
DICB-3	JUNCTION	0.00	851.88	0 01:27	0	2.33	-0.022
J01	JUNCTION	140.69	140.69	0 01:20	0.336	0.336	-0.158
J02	JUNCTION	256.87	395.33	0 01:20	0.705	1.04	0.103
J03	JUNCTION	419.13	787.58	0 01:21	1.04	2.08	-0.184
J04	JUNCTION	0.00	798.54	0 01:23	0	2.08	0.072
J05	JUNCTION	106.08	876.96	0 01:24	0.25	2.33	-0.304
J06	JUNCTION	0.00	856.36	0 01:26	0	2.34	0.401
J07	JUNCTION	80.70	80.70	0 01:15	0.184	0.184	-1.080
J08	JUNCTION	160.02	476.78	0 01:16	0.376	0.588	0.406
J09	JUNCTION	0.00	1207.83	0 01:22	0	3.2	-0.401
J10	JUNCTION	710.42	1203.76	0 01:21	1.98	3.2	-0.107
J11	JUNCTION	0.00	497.49	0 01:20	0	1.22	0.059
J12	JUNCTION	355.22	499.62	0 01:20	0.89	1.22	-0.037
J13	JUNCTION	152.05	152.05	0 01:15	0.33	0.33	-0.047
J14	JUNCTION	136.09	136.09	0 01:25	0.386	0.386	-0.047
J15	JUNCTION	227.50	363.48	0 01:25	0.658	1.04	-0.553
J16	JUNCTION	108.01	466.92	0 01:25	0.34	1.39	0.149
J17	JUNCTION	21.84	445.53	0 01:31	0.0734	1.46	0.285
OGS-1	JUNCTION	0.00	14.81	0 01:23	0	0.389	-0.001
OGS-2	JUNCTION	0.00	42.18	0 01:16	0	0.778	-0.000
OGS-3	JUNCTION	0.00	22.73	0 01:20	0	0.446	-0.007
RowSwale1	JUNCTION	0.00	438.75	0 01:33	0	1.46	0.001
RowSwale2	JUNCTION	0.00	1404.99	0 01:24	0	3.76	0.001
RowSwale3	JUNCTION	0.00	851.64	0 01:27	0	2.33	0.000
OF1	OUTFALL	0.00	438.74	0 01:33	0	1.46	0.000
OF2	OUTFALL	0.00	1405.01	0 01:24	0	3.76	0.000
OF3	OUTFALL	0.00	851.64	0 01:27	0	2.33	0.000
OF4	OUTFALL	46.74	46.74	0 01:15	0.0993	0.0993	0.000

****
Node Surcharge Summary
****

Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Meters	Min. Depth Below Rim Meters
OGS-1	JUNCTION	0.43	0.082	1.998
OGS-2	JUNCTION	0.59	0.136	1.944
OGS-3	JUNCTION	0.53	0.129	1.951

****
Node Flooding Summary
****

No nodes were flooded.

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
OF1	70.61	74.40	438.74	1.456
OF2	64.01	235.15	1405.01	3.758
OF3	71.71	127.95	851.64	2.327
OF4	31.92	11.44	46.74	0.099
System	59.56	448.94	46.74	7.641

****
Link Flow Summary
****

Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C01	CONDUIT	138.74	0 01:20	0.34	0.02	0.17
C02	CONDUIT	385.77	0 01:23	0.51	0.05	0.27
C03	CONDUIT	798.54	0 01:23	0.83	0.10	0.32
C04	CONDUIT	787.04	0 01:25	0.79	0.10	0.34
C05	CONDUIT	856.36	0 01:26	0.66	0.11	0.58
C06	CONDUIT	851.88	0 01:27	0.29	0.11	0.88
C07	CONDUIT	23.52	0 01:20	0.93	0.54	1.00
C08	CONDUIT	851.64	0 01:27	1.32	0.24	0.46
C09	CONDUIT	79.58	0 01:17	0.29	0.01	0.35
C10	CONDUIT	261.68	0 01:20	0.34	0.03	0.80
C11	CONDUIT	149.90	0 01:16	0.33	0.02	0.18
C12	CONDUIT	497.49	0 01:20	0.81	0.05	0.23
C13	CONDUIT	495.04	0 01:21	0.51	0.05	0.33
C14	CONDUIT	1207.83	0 01:22	0.89	0.17	0.42
C15	CONDUIT	1195.11	0 01:24	0.42	0.17	0.69
C16	CONDUIT	42.09	0 02:23	1.17	0.96	1.00
C17	CONDUIT	1405.01	0 01:24	2.40	0.11	0.44
C18	CONDUIT	135.98	0 01:25	0.32	0.02	0.17
C19	CONDUIT	359.38	0 01:25	0.56	0.05	0.36
C20	CONDUIT	424.08	0 01:31	0.43	0.06	0.71
C21	CONDUIT	438.79	0 01:33	0.26	0.05	0.93
C22	CONDUIT	14.77	0 02:31	0.84	0.31	1.00
C23	CONDUIT	438.74	0 01:33	0.65	0.14	0.47
OR1	ORIFICE	14.81	0 01:23			1.00
OR2	ORIFICE	42.18	0 01:16			1.00
OR3	ORIFICE	22.73	0 01:20			1.00
W1	WEIR	424.84	0 01:33			0.83
W2	WEIR	1365.29	0 01:24			0.86
W3	WEIR	830.86	0 01:27			0.85

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
		---------- Fraction of Time in Flow Class ----------								
C01	1.00	0.01	0.15	0.00	0.84	0.00	0.00	0.00	0.96	0.00
C02	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.97	0.00
C03	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.94	0.00
C04	1.00	0.01	0.00	0.00	0.98	0.00	0.00	0.00	0.96	0.00
C05	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.79	0.00
C06	1.00	0.02	0.00	0.00	0.60	0.00	0.00	0.38	0.02	0.00
C07	1.00	0.02	0.00	0.00	0.29	0.00	0.00	0.69	0.00	0.00
C08	1.00	0.02	0.00	0.00	0.00	0.00	0.00	0.98	0.00	0.00
C09	1.00	0.25	0.07	0.00	0.68	0.00	0.00	0.00	0.97	0.00
C10	1.00	0.25	0.00	0.00	0.63	0.00	0.00	0.12	0.08	0.00
C11	1.00	0.19	0.13	0.00	0.68	0.00	0.00	0.00	0.96	0.00
C12	1.00	0.11	0.08	0.00	0.81	0.00	0.00	0.00	0.94	0.00
C13	1.00	0.01	0.10	0.00	0.89	0.00	0.00	0.00	0.97	0.00
C14	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.94	0.00
C15	1.00	0.02	0.00	0.00	0.63	0.00	0.00	0.35	0.17	0.00
C16	1.00	0.01	0.00	0.00	0.17	0.00	0.00	0.82	0.00	0.00
C17	1.00	0.02	0.00	0.00	0.35	0.64	0.00	0.00	0.70	0.00

C18	1.00	0.01	0.23	0.00	0.76	0.00	0.00	0.00	0.96	0.00
C19	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.95	0.00
C20	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.61	0.00
C21	1.00	0.03	0.00	0.00	0.67	0.00	0.00	0.31	0.00	0.00
C22	1.00	0.02	0.00	0.00	0.29	0.00	0.00	0.69	0.04	0.00
C23	1.00	0.02	0.00	0.00	0.98	0.00	0.00	0.00	0.57	0.00

****
Conduit Surcharge Summary
****

Conduit	Hours Full Both Ends	Hours Full Upstream	Hours Full Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
C07	0.53	0.53	0.80	0.01	0.01
C16	0.59	0.59	0.60	0.01	0.01
C22	0.43	0.43	0.82	0.01	0.01

Analysis begun on: Wed May 27 14:14:25 2020
Analysis ended on: Wed May 27 14:14:27 2020
Total elapsed time: 00:00:02

APPENDIX E

OGS Units

ECHELON ENVIRONMENTAL

Phone: 905-948-0000
Fax: 905-948-0577
info@echelonenvironmental.ca
www.echelonenvironmental.ca

Estimate of Annual Grit Collection

Engineer:	Novatech	**Project:**	5123 Hawthorne Road OGS 1
Contact:	Alex McAuley, P.Eng	**CDS Model:**	20_15_5
Report Date:	27-May-20	**OGS Location:**	Ottawa, ON

Area : 3.48 ha
Runoff Coefficient : 0.61

Assumptions:

1. Annual Rainfall	943.4	mm	
2. Typical Grit Concentration	120	mg/l	
3. Apparent Grit Density	1.6	kg/l	(estimated)
4. Grit Capture Efficiency	80%		

Runoff Volume = Area x Rainfall Depth x Runoff Coefficient = 20,026 cu.m

Grit Collected = Grit Concentration x Runoff Volume x Grit Capture Efficiency = 1,923 kg

Grit Volume = Mass / Apparent Density = 1,202 litres or 1.202 cu.m

30% Upstream Swale Pretreatment Credit = 1,202 x 70% 0.841 cu.m

<u>Therefore it can be expected that this site will generate approximately 0.841cu.m of grit annually.</u>

Sump Capacity of CDS unit = 1.668 cu.m

Therefore the design sump capacity will accommodate a cleaning frequency of one time per 20 to 24 months.

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

Project:	**5123 Hawthorne Road**			
Location:	**Ottawa, ON**			
Date:	**5/27/2020**			
By:	**PG**		**OGS ID:**	1 - Revision 2
PSD:	**FINE**		**Area:**	3.480 ha
CDS Model:	**PMSU20_15**		**C-Value**	0.61
CDS Design Flow:	**20 l/s**		**IDF Data:**	Ottawa, ON

Return	Period	Peak Flow	TSS Percentage Captured	Treated Flow Volume	Total Flow Volume	Annual Exceedance Probability	System Flow	CDS Flow	By-Pass Flow	Volume Percentage Treated
month / yr	Yr	l/s	%	litres	litres	%	l/s	l/s	l/s	%
1-M	0.08	4.69	92.94	25335	25335	**100.00**	4.69	4.69	0.00	100.00
2-M	0.17	6.17	91.05	33229	33229	**99.75**	6.17	6.17	0.00	100.00
3-M	0.25	7.39	89.49	39707	39707	**98.17**	7.39	7.39	0.00	100.00
4-M	0.33	8.47	88.09	45518	45518	**95.04**	8.47	8.47	0.00	100.00
5-M	0.42	9.28	87.03	49937	49937	**90.91**	9.28	9.28	0.00	100.00
6-M	0.50	10.09	85.96	54356	54356	**86.47**	10.09	10.09	0.00	100.00
7-M	0.58	10.68	85.19	57592	57592	**82.01**	10.68	10.68	0.00	100.00
8-M	0.67	11.27	84.41	60828	60828	**77.67**	11.27	11.27	0.00	100.00
9-M	0.75	11.86	83.63	64064	64064	**73.64**	11.86	11.86	0.00	100.00
10-M	0.83	12.31	83.03	66553	66553	**69.90**	12.31	12.31	0.00	100.00
11-M	0.92	12.76	82.43	69042	69042	**66.40**	12.76	12.76	0.00	100.00
1-Yr	1	13.20	81.83	71531	71531	**63.21**	13.20	13.20	0.00	100.00
2-Yr	2	16.68	77.10	91214	91214	**39.35**	16.68	16.68	0.00	100.00
5-Yr	5	19.83	72.71	109539	109540	**18.13**	19.83	19.82	0.01	100.00
10-Yr	10	22.33	67.18	118122	124442	**9.52**	22.33	19.82	2.50	94.92
25-Yr	25	24.89	60.11	119379	140109	**3.92**	24.89	19.82	5.07	85.20
50-Yr	50	27.54	53.96	119895	156654	**1.98**	27.54	19.82	7.72	76.53
100-Yr	100	27.29	54.50	119853	155045	**1.00**	27.29	19.82	7.47	77.30

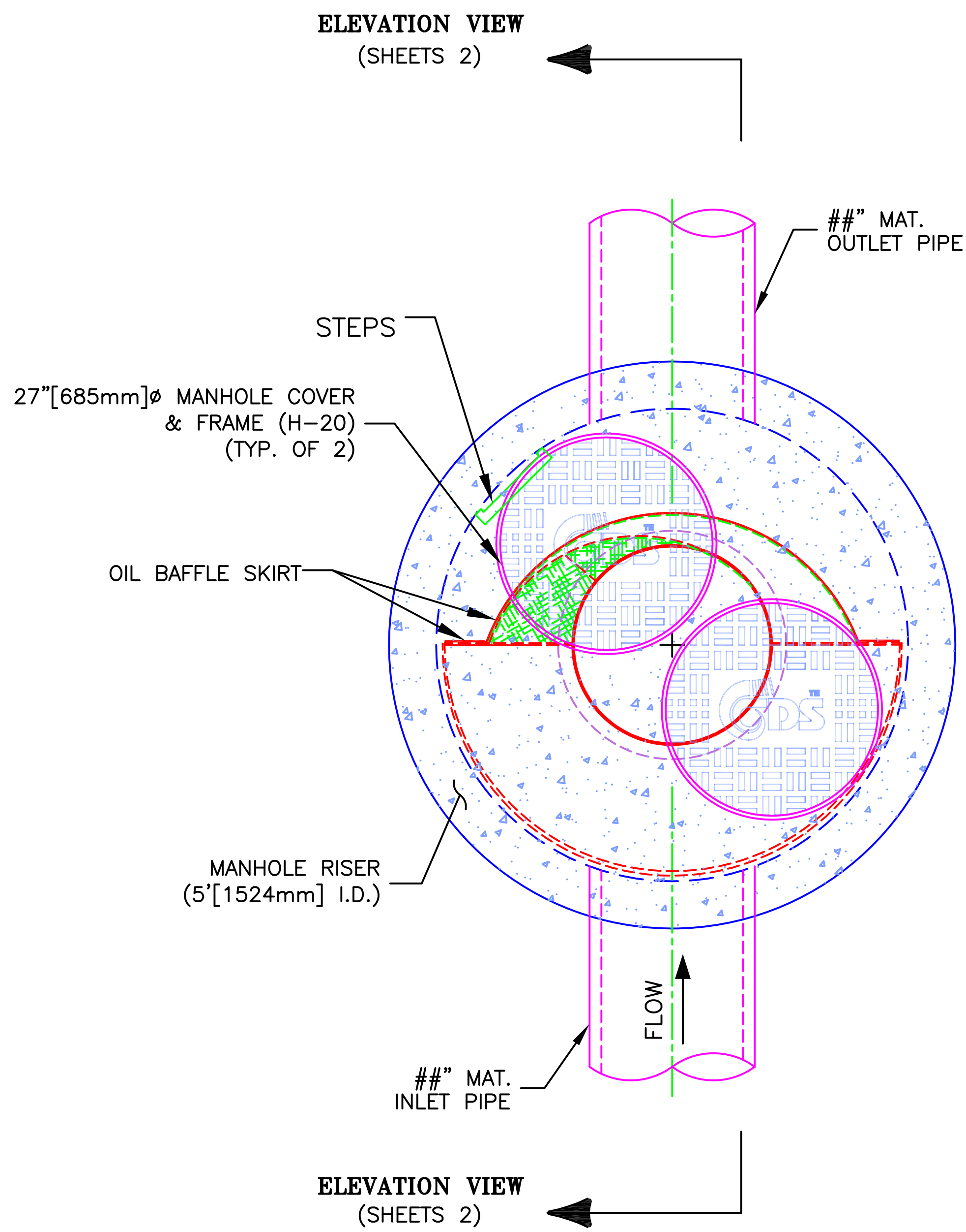
Average Annual TSS Removal Efficiency [%]: **86.3** Ave. Ann. T. Volume [%]: **99.87%**

1 - CDS Efficiency based on testing conducted at the University of Central Florida
2 - CDS design flowrate and scaling based on standard manufacturer model & product specifications

ECHELON ENVIRONMENTAL

CDS TECHNOLOGIES

PLAN VIEW

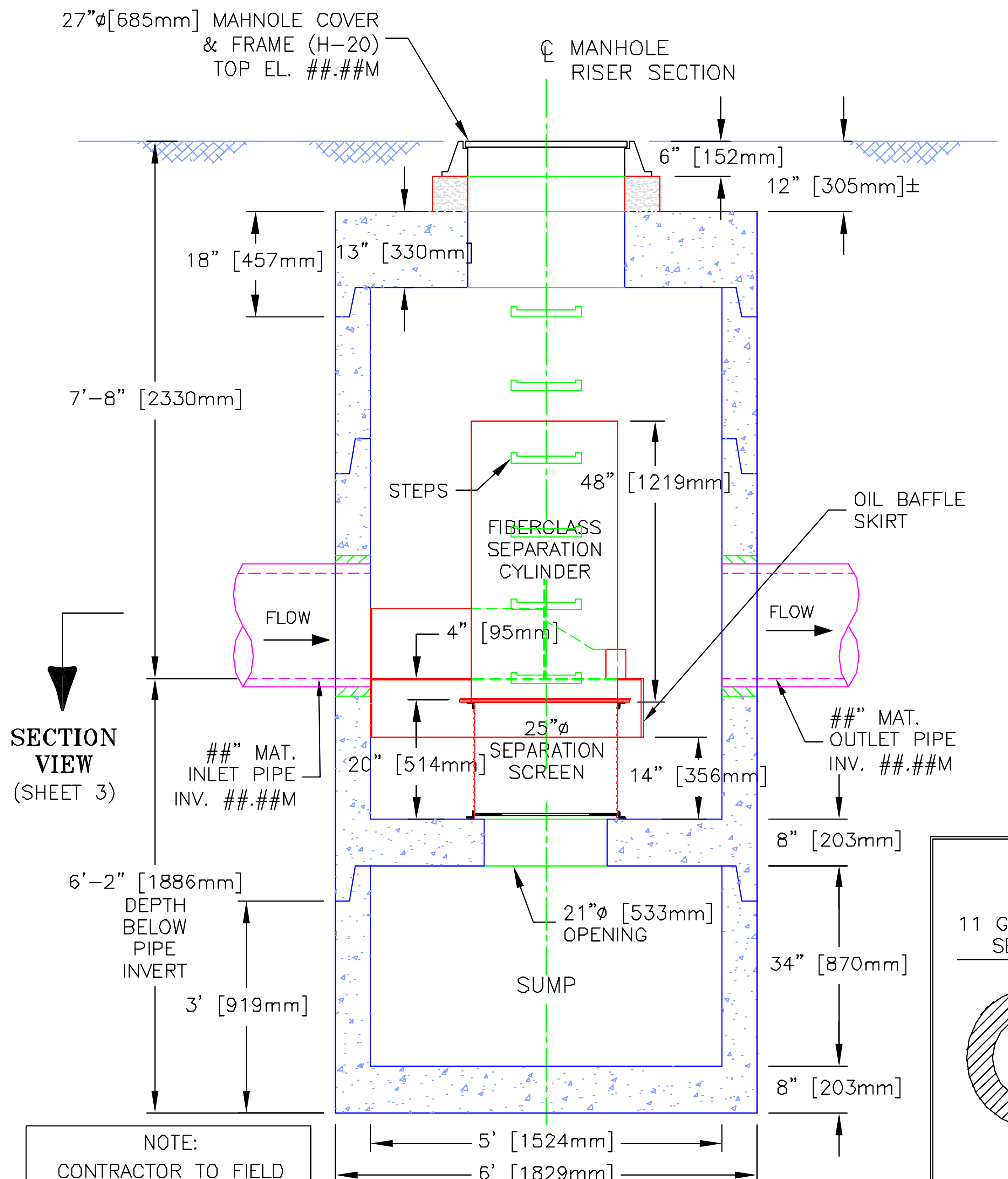


CDS MODEL PMSU20_15m, 0.7 CFS TREATMENT CAPACITY STORM WATER TREATMENT UNIT

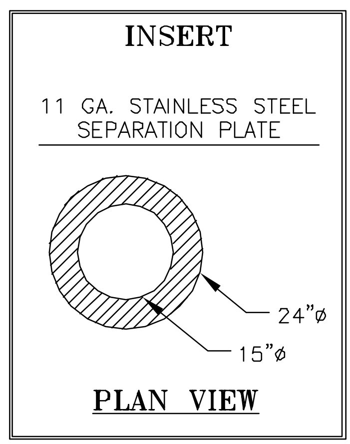
CONTECH STORMWATER SOLUTIONS	PROJECT NAME CITY, STATE	JOB#	XX-##-###	SCALE 1" = 2'
		DATE	##/##/##	SHEET
		DRAWN	INITIALS	1
		APPROV.		

Echelon Environmental 505 Hood Road, Unit 26, Markham, Ontario L3R 5V6 Tel: (905) 948-0000 Fax: (905) 948-0577
CONTECH Stormwater Solutions Inc. 200 Enterprise Drive, Scarborough, Maine 04074 Tel: (877) 907-8676 Fax: (207) 885-9825

ELEVATION VIEW



NOTE:
CONTRACTOR TO FIELD VERIFY DIMENSIONS OF OR CONCRETE SECTIONS



CDS MODEL PMSU20_15m, 0.7 CFS TREATMENT CAPACITY STORM WATER TREATMENT UNIT

CONTECH STORMWATER SOLUTIONS

PROJECT NAME
CITY, STATE

JOB#	XX-##-###	SCALE 1" = 2.5'	
DATE	##/##/##	SHEET	
DRAWN	INITIALS	2	
APPROV.			

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ECHELON ENVIRONMENTAL

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info@echelonenvironmental.ca
www.echelonenvironmental.ca

Estimate of Annual Grit Collection

Engineer:	Novatech	**Project:**	5123 Hawthorne Road OGS 2
Contact:	Alex McAuley, P.Eng	**CDS Model:**	20_20_5 Ext. Sump.
Report Date:	27-May-20	**OGS Location:**	Ottawa, ON

Area :	8.45	ha
Runoff Coefficient :	0.65	

Assumptions:

1. Annual Rainfall	943.4	mm	
2. Typical Grit Concentration	120	mg/l	
3. Apparent Grit Density	1.6	kg/l	(estimated)
4. Grit Capture Efficiency	80%		

Runoff Volume = Area x Rainfall Depth x Runoff Coefficient = 51,816 cu.m

Grit Collected = Grit Concentration x Runoff Volume x Grit Capture Efficiency = 4,974 kg

Grit Volume = Mass / Apparent Density = 3,109 litres or 3.109 cu.m

30% Upstream Swale Pretreatment Credit = 3,109 x 70% 2.176 cu.m

Therefore it can be expected that this site will generate approximately 2.176cu.m of grit annually.

Sump Capacity of CDS unit = 2.224 cu.m

Therefore the design sump capacity will accommodate a cleaning frequency of one time per 12 to 16 months.

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

Project:	**5123 Hawthorne Road**		
Location:	**Ottawa, ON**		
Date:	**5/27/2020**		
By:	**PG**	**OGS ID:**	2
PSD:	**FINE**	**Area:**	8.330 ha
CDS Model:	**PMSU20_20**	**C-Value**	0.65
CDS Design Flow:	**31 l/s**	**IDF Data:**	Ottawa, ON

Return	Period	Peak Flow	TSS Percentage Captured	Treated Flow Volume	Total Flow Volume	Annual Exceedance Probability	System Flow	CDS Flow	By-Pass Flow	Volume Percentage Treated
month / yr	Yr	l/s	%	litres	litres	%	l/s	l/s	l/s	%
1-M	0.08	9.62	91.45	48917	48917	**100.00**	9.62	9.62	0.00	100.00
2-M	0.17	13.62	88.30	69325	69325	**99.75**	13.62	13.62	0.00	100.00
3-M	0.25	16.40	86.07	83734	83734	**98.17**	16.40	16.40	0.00	100.00
4-M	0.33	18.91	84.05	96873	96873	**95.04**	18.91	18.91	0.00	100.00
5-M	0.42	20.48	82.76	105237	105237	**90.91**	20.48	20.48	0.00	100.00
6-M	0.50	22.06	81.47	113600	113600	**86.47**	22.06	22.06	0.00	100.00
7-M	0.58	24.14	79.74	124934	124934	**82.01**	24.14	24.14	0.00	100.00
8-M	0.67	26.23	78.00	136267	136267	**77.67**	26.23	26.23	0.00	100.00
9-M	0.75	28.31	76.26	147601	147601	**73.64**	28.31	28.31	0.00	100.00
10-M	0.83	32.32	71.18	160797	170526	**69.90**	32.32	31.15	1.17	95.50
11-M	0.92	36.33	66.10	173994	193452	**66.40**	36.33	31.15	5.18	91.01
1-Yr	1	40.33	61.02	187190	216377	**63.21**	40.33	31.15	9.18	86.51
2-Yr	2	42.03	58.38	187513	226510	**39.35**	42.03	31.15	10.88	82.78
5-Yr	5	42.22	58.09	187544	227661	**18.13**	42.22	31.15	11.07	82.38
10-Yr	10	42.22	58.09	187544	227661	**9.52**	42.22	31.15	11.07	82.38
25-Yr	25	43.47	56.28	187746	235206	**3.92**	43.47	31.15	12.33	79.82
50-Yr	50	42.48	57.71	187585	229188	**1.98**	42.48	31.15	11.33	81.85
100-Yr	100	43.06	56.86	187679	232716	**1.00**	43.06	31.15	11.91	80.65

Average Annual TSS Removal Efficiency [%]: **80.0** Ave. Ann. T. Volume [%]: **97.70%**

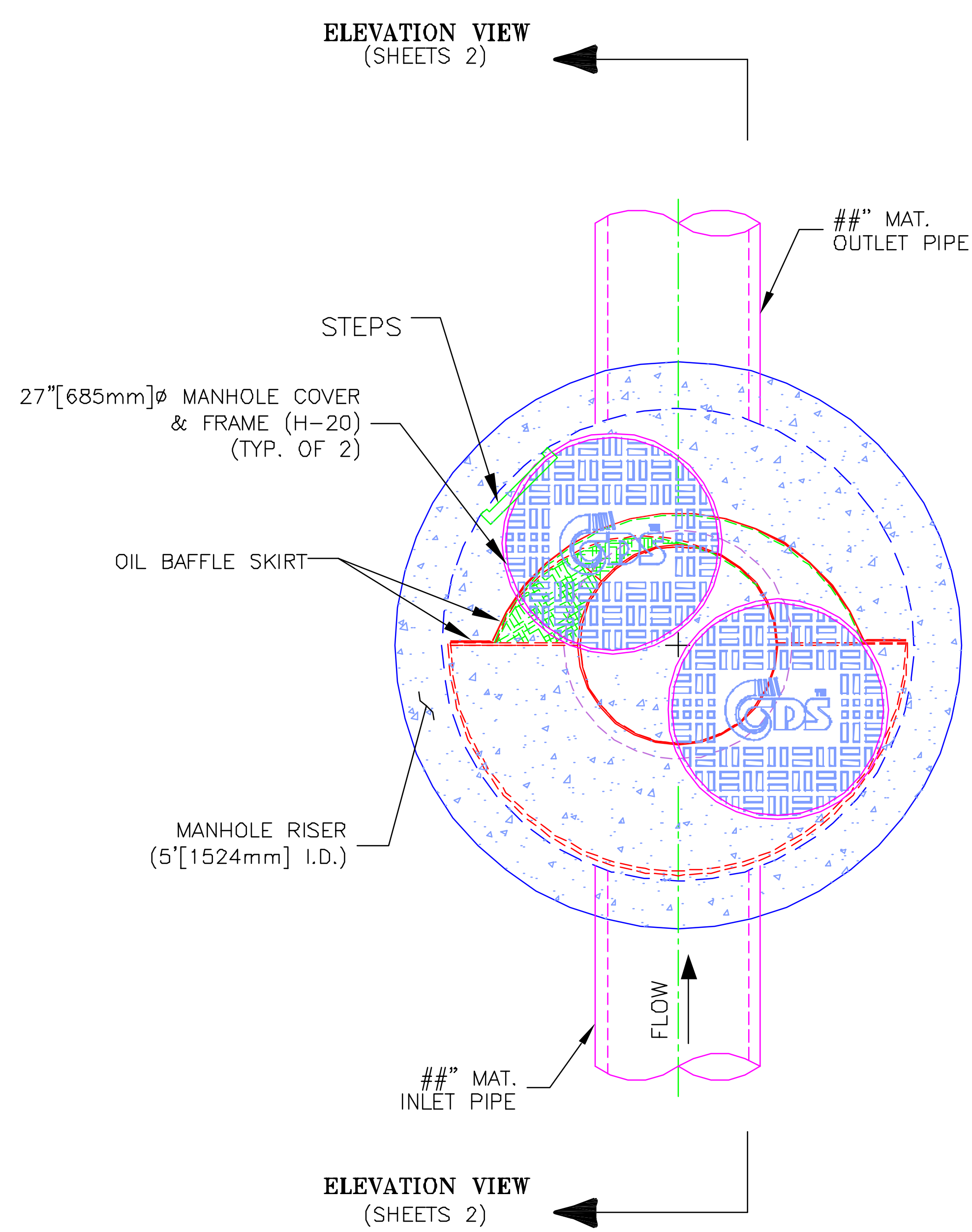
1 - CDS Efficiency based on testing conducted at the University of Central Florida

2 - CDS design flowrate and scaling based on standard manufacturer model & product specifications

ECHELON ENVIRONMENTAL

CDS TECHNOLOGIES

PLAN VIEW

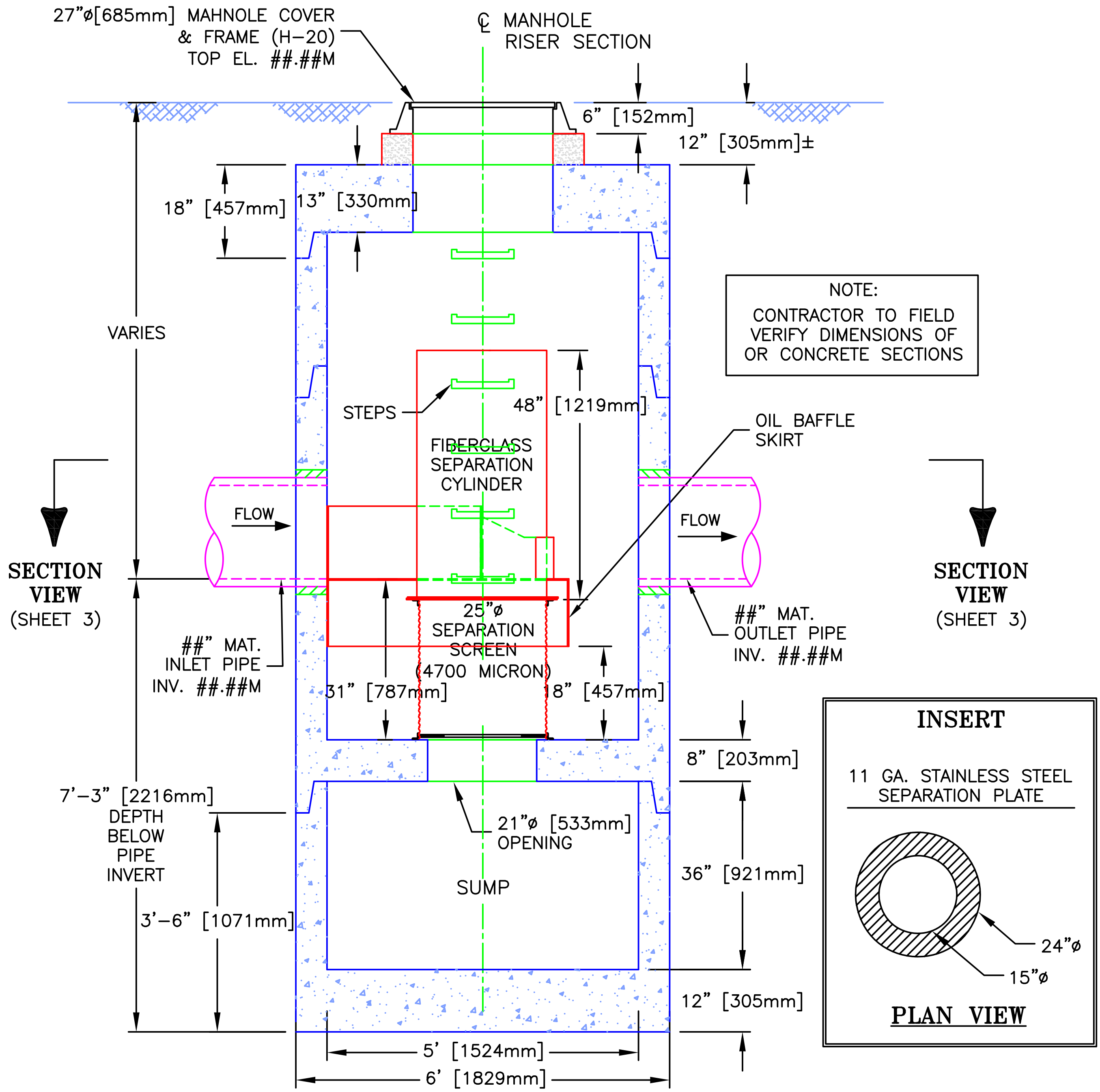


MODEL CDS20_20m, 31 L/s TREATMENT CAPACITY
STORM WATER TREATMENT UNIT

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

Echelon Environmental 505 Hood Road, Unit 26, Markham, Ontario L3R 5V6 Tel: (905) 948-0000 Fax: (905) 948-0577

ELEVATION VIEW



MODEL CDS20_20m, 31 L/s TREATMENT CAPACITY
STORM WATER TREATMENT UNIT

CONTECH STORMWATER SOLUTIONS	PROJECT NAME CITY, STATE	JOB#	XX–##–###	SCALE 1" = 2.5'
		DATE	##/##/##	SHEET
		DRAWN	INITIALS	2
		APPROV.		

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ECHELON ENVIRONMENTAL

Phone: 905-948-0000
Fax: 905-948-0577
info@echelonenvironmental.ca
www.echelonenvironmental.ca

Estimate of Annual Grit Collection

Engineer: Novatech
Contact: Alex McAuley, P.Eng
Report Date: 27-May-20

Project: 5123 Hawthorne Road OGS 3
CDS Model: 20_15_5
OGS Location: Ottawa, ON

Area : 5.48 ha
Runoff Coefficient : 0.61

Assumptions:

1. Annual Rainfall	943.4	mm	
2. Typical Grit Concentration	120	mg/l	
3. Apparent Grit Density	1.6	kg/l	(estimated)
4. Grit Capture Efficiency	80%		

Runoff Volume = Area x Rainfall Depth x Runoff Coefficient = 31,536 cu.m

Grit Collected = Grit Concentration x Runoff Volume x Grit Capture Efficiency = 3,027 kg

Grit Volume = Mass / Apparent Density = 1,892 litres or 1.892 cu.m

30% Upstream Swale Pretreatment Credit = 1,892 x 70% 1.325 cu.m

Therefore it can be expected that this site will generate approximately 1.325cu.m of grit annually.

Sump Capacity of CDS unit = 1.668 cu.m

Therefore the design sump capacity will accommodate a cleaning frequency of one time per 16 to 20 months.

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

Project:	**5123 Hawthorne Road**		
Location:	**Ottawa, ON**		
Date:	**5/27/2020**		
By:	**PG**	**OGS ID:**	3 - Revision 1
PSD:	**FINE**	**Area:**	5.480 ha
CDS Model:	**PMSU20_15**	**C-Value**	0.61
CDS Design Flow:	**20 l/s**	**IDF Data:**	Ottawa, ON

Return	Period	Peak Flow	TSS Percentage Captured	Treated Flow Volume	Total Flow Volume	Annual Exceedance Probability	System Flow	CDS Flow	By-Pass Flow	Volume Percentage Treated
month / yr	Yr	l/s	%	litres	litres	%	l/s	l/s	l/s	%
1-M	0.08	6.03	91.52	31161	31161	**100.00**	6.03	6.03	0.00	100.00
2-M	0.17	8.17	88.89	42059	42059	**99.75**	8.17	8.17	0.00	100.00
3-M	0.25	9.90	86.73	51010	51010	**98.17**	9.90	9.90	0.00	100.00
4-M	0.33	11.44	84.78	59046	59046	**95.04**	11.44	11.44	0.00	100.00
5-M	0.42	12.60	83.31	65162	65162	**90.91**	12.60	12.60	0.00	100.00
6-M	0.50	13.76	81.83	71279	71279	**86.47**	13.76	13.76	0.00	100.00
7-M	0.58	14.59	80.75	75762	75762	**82.01**	14.59	14.59	0.00	100.00
8-M	0.67	15.43	79.67	80245	80245	**77.67**	15.43	15.43	0.00	100.00
9-M	0.75	16.26	78.58	84728	84728	**73.64**	16.26	16.26	0.00	100.00
10-M	0.83	18.50	74.96	95006	97103	**69.90**	18.50	18.50	0.00	98.28
11-M	0.92	20.73	71.33	105284	109478	**66.40**	20.73	19.82	0.90	96.56
1-Yr	1	22.96	67.70	115562	121853	**63.21**	22.96	19.82	3.13	94.84
2-Yr	2	23.05	67.49	115783	122389	**39.35**	23.05	19.82	3.23	94.60
5-Yr	5	23.09	67.40	115870	122606	**18.13**	23.09	19.82	3.27	94.51
10-Yr	10	23.15	67.27	116000	122930	**9.52**	23.15	19.82	3.32	94.36
25-Yr	25	23.14	67.29	115985	122894	**3.92**	23.14	19.82	3.32	94.38
50-Yr	50	23.15	67.27	116000	122930	**1.98**	23.15	19.82	3.32	94.36
100-Yr	100	25.22	62.37	119097	134862	**1.00**	25.22	19.82	5.40	88.31

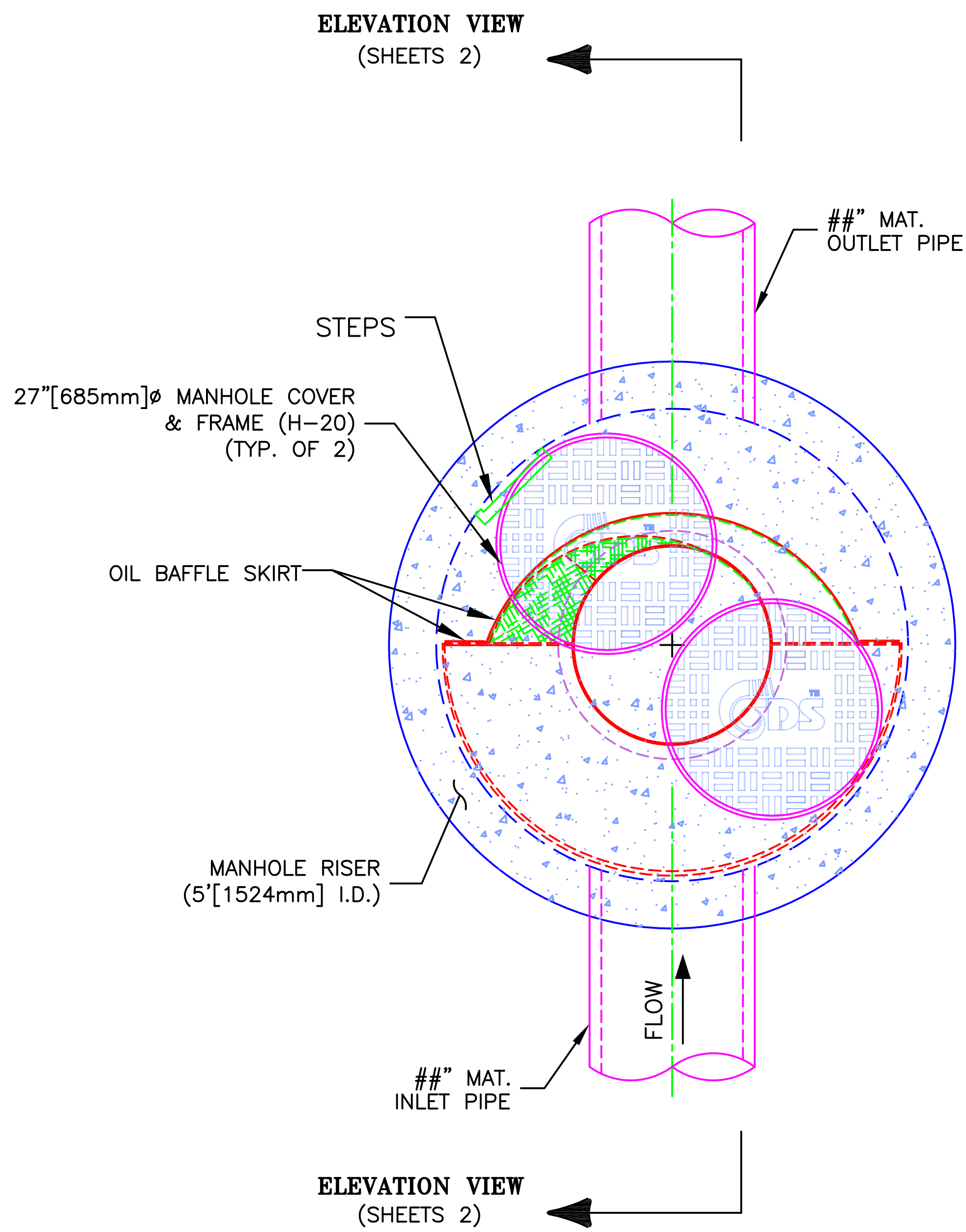
Average Annual TSS Removal Efficiency [%]: **81.8** Ave. Ann. T. Volume [%]: **99.17%**

1 - CDS Efficiency based on testing conducted at the University of Central Florida
2 - CDS design flowrate and scaling based on standard manufacturer model & product specifications

ECHELON ENVIRONMENTAL

CDS TECHNOLOGIES

PLAN VIEW

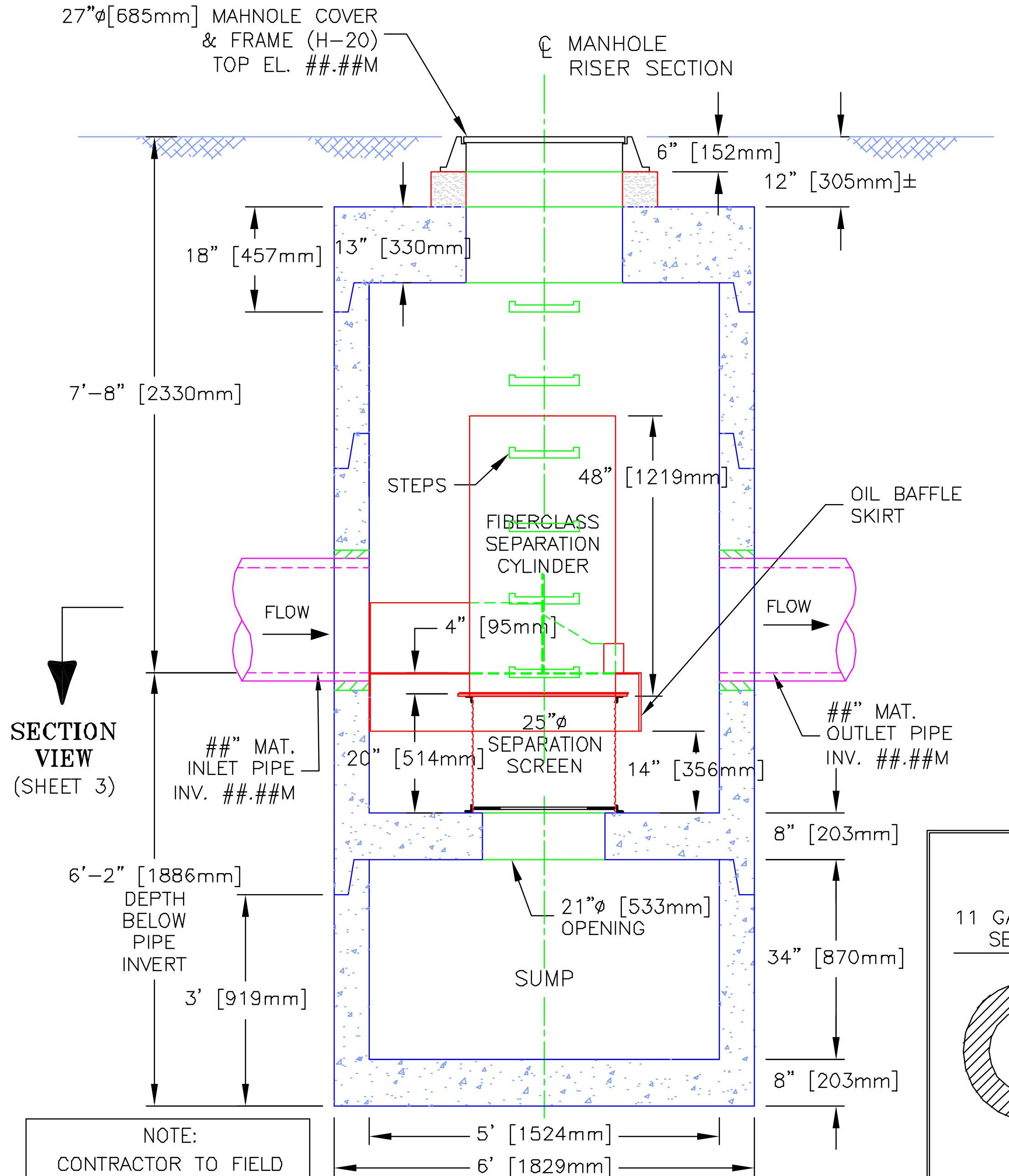


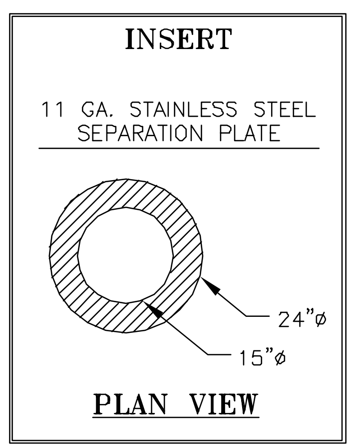
CDS MODEL PMSU20_15m, 0.7 CFS TREATMENT CAPACITY STORM WATER TREATMENT UNIT

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

Echelon Environmental 505 Hood Road, Unit 26, Markham, Ontario L3R 5V6 Tel: (905) 948-0000 Fax: (905) 948-0577
CONTECH Stormwater Solutions Inc. 200 Enterprise Drive, Scarborough, Maine 04074 Tel: (877) 907-8676 Fax: (207) 885-9825

ELEVATION VIEW





NOTE:
CONTRACTOR TO FIELD
VERIFY DIMENSIONS OF
OR CONCRETE SECTIONS

CDS MODEL PMSU20_15m, 0.7 CFS TREATMENT CAPACITY STORM WATER TREATMENT UNIT

CONTECH STORMWATER SOLUTIONS

PROJECT NAME
CITY, STATE

JOB#	XX-##-###	SCALE 1" = 2.5'
DATE	##/##/##	SHEET
DRAWN	INITIALS	2
APPROV.		

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APPENDIX F
Development Servicing Study Checklist

4. Development Servicing Study Checklist

The following section describes the checklist of the required content of servicing studies. It is expected that the proponent will address each one of the following items for the study to be deemed complete and ready for review by City of Ottawa Infrastructure Approvals staff.

The level of required detail in the Servicing Study will increase depending on the type of application. For example, for Official Plan amendments and re-zoning applications, the main issues will be to determine the capacity requirements for the proposed change in land use and confirm this against the existing capacity constraint, and to define the solutions, phasing of works and the financing of works to address the capacity constraint. For subdivisions and site plans, the above will be required with additional detailed information supporting the servicing within the development boundary.

4.1 General Content

N/A ☐ Executive Summary (for larger reports only).

☒ Date and revision number of the report.

☒ Location map and plan showing municipal address, boundary, and layout of proposed development.

☒ Plan showing the site and location of all existing services.

☒ Development statistics, land use, density, adherence to zoning and official plan, and reference to applicable subwatershed and watershed plans that provide context to which individual developments must adhere.

☒ Summary of Pre-consultation Meetings with City and other approval agencies.

☒ Reference and confirm conformance to higher level studies and reports (Master Servicing Studies, Environmental Assessments, Community Design Plans), or in the case where it is not in conformance, the proponent must provide justification and develop a defendable design criteria.

☒ Statement of objectives and servicing criteria.

☒ Identification of existing and proposed infrastructure available in the immediate area.

☒ Identification of Environmentally Significant Areas, watercourses and Municipal Drains potentially impacted by the proposed development (Reference can be made to the Natural Heritage Studies, if available).

☒ Concept level master grading plan to confirm existing and proposed grades in the development. This is required to confirm the feasibility of proposed stormwater management and drainage, soil removal and fill constraints, and potential impacts to neighbouring properties. This is also required to confirm that the proposed grading will not impede existing major system flow paths.

N/A ☐ Identification of potential impacts of proposed piped services on private services (such as wells and septic fields on adjacent lands) and mitigation required to address potential impacts.

N/A ☐ Proposed phasing of the development, if applicable.

☒ Reference to geotechnical studies and recommendations concerning servicing.

☒ All preliminary and formal site plan submissions should have the following information:

- Metric scale
- North arrow (including construction North)
- Key plan
- Name and contact information of applicant and property owner
- Property limits including bearings and dimensions
- Existing and proposed structures and parking areas
- Easements, road widening and rights-of-way
- Adjacent street names

4.2 Development Servicing Report: Water

N/A ☐ Confirm consistency with Master Servicing Study, if available

N/A ☐ Availability of public infrastructure to service proposed development

N/A ☐ Identification of system constraints

N/A ☐ Identify boundary conditions

☒ Confirmation of adequate domestic supply and pressure

☒ Confirmation of adequate fire flow protection and confirmation that fire flow is calculated as per the Fire Underwriter's Survey. Output should show available fire flow at locations throughout the development.

N/A ☐ Provide a check of high pressures. If pressure is found to be high, an assessment is required to confirm the application of pressure reducing valves.

N/A ☐ Definition of phasing constraints. Hydraulic modeling is required to confirm servicing for all defined phases of the project including the ultimate design

N/A ☐ Address reliability requirements such as appropriate location of shut-off valves

N/A ☐ Check on the necessity of a pressure zone boundary modification.

N/A ☐ Reference to water supply analysis to show that major infrastructure is capable of delivering sufficient water for the proposed land use. This includes data that shows that the expected demands under average day, peak hour and fire flow conditions provide water within the required pressure range

N/A ☐ Description of the proposed water distribution network, including locations of proposed connections to the existing system, provisions for necessary looping, and appurtenances (valves, pressure reducing valves, valve chambers, and fire hydrants) including special metering provisions.

N/A ☐ Description of off-site required feedermains, booster pumping stations, and other water infrastructure that will be ultimately required to service proposed development, including financing, interim facilities, and timing of implementation.

N/A ☐ Confirmation that water demands are calculated based on the City of Ottawa Design Guidelines.

N/A ☐ Provision of a model schematic showing the boundary conditions locations, streets, parcels, and building locations for reference.

4.3 Development Servicing Report: Wastewater

N/A ☐ Summary of proposed design criteria (Note: Wet-weather flow criteria should not deviate from the City of Ottawa Sewer Design Guidelines. Monitored flow data from relatively new infrastructure cannot be used to justify capacity requirements for proposed infrastructure).

N/A ☐ Confirm consistency with Master Servicing Study and/or justifications for deviations.

N/A ☐ Consideration of local conditions that may contribute to extraneous flows that are higher than the recommended flows in the guidelines. This includes groundwater and soil conditions, and age and condition of sewers.

N/A ☐ Description of existing sanitary sewer available for discharge of wastewater from proposed development.

N/A ☐ Verify available capacity in downstream sanitary sewer and/or identification of upgrades necessary to service the proposed development. (Reference can be made to previously completed Master Servicing Study if applicable)

N/A ☐ Calculations related to dry-weather and wet-weather flow rates from the development in standard MOE sanitary sewer design table (Appendix 'C') format.

☒ Description of proposed sewer network including sewers, pumping stations, and forcemains.

N/A ☐ Discussion of previously identified environmental constraints and impact on servicing (environmental constraints are related to limitations imposed on the development in order to preserve the physical condition of watercourses, vegetation, soil cover, as well as protecting against water quantity and quality).

N/A ☐ Pumping stations: impacts of proposed development on existing pumping stations or requirements for new pumping station to service development.

N/A ☐ Forcemain capacity in terms of operational redundancy, surge pressure and maximum flow velocity.

N/A ☐ Identification and implementation of the emergency overflow from sanitary pumping stations in relation to the hydraulic grade line to protect against basement flooding.

N/A ☐ Special considerations such as contamination, corrosive environment etc.

4.4 Development Servicing Report: Stormwater Checklist

☒ Description of drainage outlets and downstream constraints including legality of outlets (i.e. municipal drain, right-of-way, watercourse, or private property)

☒ Analysis of available capacity in existing public infrastructure.

☒ A drawing showing the subject lands, its surroundings, the receiving watercourse, existing drainage patterns, and proposed drainage pattern.

☒ Water quantity control objective (e.g. controlling post-development peak flows to pre-development level for storm events ranging from the 2 or 5 year event (dependent on the receiving sewer design) to 100 year return period); if other objectives are being applied, a rationale must be included with reference to hydrologic analyses of the potentially affected subwatersheds, taking into account long-term cumulative effects.

☒ Water Quality control objective (basic, normal or enhanced level of protection based on the sensitivities of the receiving watercourse) and storage requirements.

☒ Description of the stormwater management concept with facility locations and descriptions with references and supporting information.

☒ Set-back from private sewage disposal systems.

N/A ☐ Watercourse and hazard lands setbacks.

N/A ☐ Record of pre-consultation with the Ontario Ministry of Environment and the Conservation Authority that has jurisdiction on the affected watershed.

N/A ☐ Confirm consistency with sub-watershed and Master Servicing Study, if applicable study exists.

N/A ☐ Storage requirements (complete with calculations) and conveyance capacity for minor events (1:5 year return period) and major events (1:100 year return period).

N/A ☐ Identification of watercourses within the proposed development and how watercourses will be protected, or, if necessary, altered by the proposed development with applicable approvals.

☒ Calculate pre and post development peak flow rates including a description of existing site conditions and proposed impervious areas and drainage catchments in comparison to existing conditions.

N/A ☐ Any proposed diversion of drainage catchment areas from one outlet to another.

☒ Proposed minor and major systems including locations and sizes of stormwater trunk sewers, and stormwater management facilities.

☒ If quantity control is not proposed, demonstration that downstream system has adequate capacity for the post-development flows up to and including the 100-year return period storm event.

N/A ☐ Identification of potential impacts to receiving watercourses

N/A ☐ Identification of municipal drains and related approval requirements.

☒ Descriptions of how the conveyance and storage capacity will be achieved for the development.

☒ 100 year flood levels and major flow routing to protect proposed development from flooding for establishing minimum building elevations (MBE) and overall grading.

N/A ☐ Inclusion of hydraulic analysis including hydraulic grade line elevations.

☒ Description of approach to erosion and sediment control during construction for the protection of receiving watercourse or drainage corridors.

N/A ☐ Identification of floodplains – proponent to obtain relevant floodplain information from the appropriate Conservation Authority. The proponent may be required to delineate floodplain elevations to the satisfaction of the Conservation Authority if such information is not available or if information does not match current conditions.

☒ Identification of fill constraints related to floodplain and geotechnical investigation.

4.5 Approval and Permit Requirements: Checklist

The Servicing Study shall provide a list of applicable permits and regulatory approvals necessary for the proposed development as well as the relevant issues affecting each approval. The approval and permitting shall include but not be limited to the following:

[X] Conservation Authority as the designated approval agency for modification of floodplain, potential impact on fish habitat, proposed works in or adjacent to a watercourse, cut/fill permits and Approval under Lakes and Rivers Improvement Act. The Conservation Authority is not the approval authority for the Lakes and Rivers Improvement Act. Where there are Conservation Authority regulations in place, approval under the Lakes and Rivers Improvement Act is not required, except in cases of dams as defined in the Act.

N/A [ ] Application for Certificate of Approval (CofA) under the Ontario Water Resources Act.

N/A [ ] Changes to Municipal Drains.

N/A [ ] Other permits (National Capital Commission, Parks Canada, Public Works and Government Services Canada, Ministry of Transportation etc.)

4.6 Conclusion Checklist

[X] Clearly stated conclusions and recommendations

N/A [ ] Comments received from review agencies including the City of Ottawa and information on how the comments were addressed. Final sign-off from the responsible reviewing agency.

[X] All draft and final reports shall be signed and stamped by a professional Engineer registered in Ontario

APPENDIX G
Correspondence

Alex McAuley

From: Evans, Allan <Allan.Evans@ottawa.ca>
Sent: Saturday, May 9, 2020 9:59 PM
To: Alex McAuley
Cc: Susan Gordon; Lisa Bowley; Aden Rongve; Roy, Larry
Subject: RE: 300 Sommes Street - Fire protection pre consult
Attachments: 20200507-119181-SP2-markup.pdf; 119181-SP-1.pdf; W51 to 54 Combined (2).pdf

Some clarifications and additional comments below in blue

Allan Evans

Fire Protection Engineer / Ingénieur de Protection d'Incendies
Prevention Division / Prévention des Incendies
Ottawa Fire Services / Service des Incendies d'Ottawa
1445 Carling Avenue / 1445 Avenue Carling
Ottawa, ON K1Z 7L9
Allan.Evans@Ottawa.ca
☎ (613) 913-2747 | ☎ (613) 580-2424 x24119 | 🖷 (613) 580-2866 | 🖃 Mail Code: 25-102 | @OFSFPE

OTTAWA FIRE SERVICES
SERVICE DES INCENDIES D'OTTAWA
Protecting Our Nation's Capital With Pride
Protéger notre capitale nationale avec fierté
CFAI
An internationally accredited agency 2014-2019

From: Alex McAuley <a.mcauley@novatech-eng.com>
Sent: May 07, 2020 10:18 AM
To: Evans, Allan <Allan.Evans@ottawa.ca>
Cc: Susan Gordon <s.gordon@novatech-eng.com>; Lisa Bowley <l.bowley@novatech-eng.com>; Aden Rongve <a.rongve@novatech-eng.com>
Subject: 300 Sommes Street - Fire protection pre consult

CAUTION: This email originated from an External Sender. Please do not click links or open attachments unless you recognize the source.

ATTENTION : Ce courriel provient d'un expéditeur externe. Ne cliquez sur aucun lien et n'ouvrez pas de pièce jointe, excepté si vous connaissez l'expéditeur.

Allan,
Thank you for taking the time on Tuesday to speak with us. We wanted to followup our call with some notes for each of the sites located on Somme Street in the Tomlinson Industrial Business Park.

General:

- Fire fighting methodology:
  - First truck fights fire at the source (building).
  - Second truck connects to water source and becomes the fire pump.
- Fire protection water source:
  - Preference is to have the water source be 60m to 100m away from the building entrance.

Incorrect – we want the water source 60-100m away from the building in all aspects (collapse zone), not the building entrance necessarily. It should typically be on the approach path for

the fire trucks to the building along the fire route and must have enough clearance (4.5m min) for other trucks to get by. I probably said the entrance because that is where the FACP and/or FDC are typically located.

- Dry hydrant to be located 3m to 4m off the edge of the fire route and protected by curb or bollards.

Incorrect – dry hydrant to be located 1-1.5m from the edge of the fire route protected by curb or bollards. Our hard suction hose that connects the truck to the hydrant/tank is 3m long. (in the rare case where we cannot get the 1-1.5m, we have gone to a 4-4.5m distance and we use two hard suction hoses instead, but not our preference)

- If a layby is provided for the pumper truck, then it needs to accommodate a 3.0m x 11m truck.

Including ability to drive-in and get close enough. Due to turning radii, etc, the layby would have to be significantly longer than 11m long.

- Dry hydrant to be located near the mid point of the layby.

Roughly – it could be a bit closer to the far end, but the draft point on the truck is roughly 5-6m from the front bumper.

- Gates:
  - We will confirm the type of gates, and locking mechanism with the clients.
  - The swing opening of the gates needs to not impede fire access.
  - You indicated that a lock box could be provided for Ottawa Fire department access (key or swipe card) to allow access.
  - If a chain and lock is used, the chain may be cut if needed.

Yes – but lockbox for a key to access still required – also good to note we can put the key for the draft box (assuming you are doing W51/W52 style) in the same lockbox.

Site specific:
The followings notes are for the CoPart (Car Auction Site), located at 300 Sommes Street.

- Attached Overall Site Plan (119181-SP1, May 2020), Enlarged Site Plan (119181-SP2, marked up May 7, 2020). We are anticipating a Site Plan submission in the next month.
- The accessory warehouse/office building will be split with a 2 hour fire wall between the uses.
- The warehouse portion would be rated Group F, Division 3 with a low combustible content, and the office would be Group D. No sprinklers are proposed.
- The proposed building will be unrated steel frame (ie non-combustible construction) approximately 5.5m in height.
- The preliminary fire flow rate is 3,600L/min (60L/s), with a volume requirement of approximately 132,000L, which would be accommodated in two interconnected tanks. The tanks currently being proposed are each 90,900L precast tanks.
- We are proposing to provide the required volume in pre-fabricated underground storage tanks.
- The outdoor storage area will be gravel, and used for short term storage of vehicles. We will confirm the typical length of storage.
- The fencing which surrounds the entire site will be confirmed, but is likely 8' metal panel privacy fencing.
- We have marked up the Enlarged Site Plan (119181-SP2) to show:
  - How vehicles in the outdoor storage area will typically be parked,
  - Preliminary fire storage tank distance to building, (this distance would be adjusted based on our conversation)
  - Distance from road to fire storage tanks.

A second email will be provided regarding the Mini storage building site.

Please let us know if any of the above needs correction, or if you had any further questions.

I think it is worth discussing having informal fire access routes throughout the site as well. If a vehicle was to catch on fire, we could potentially have dozens of cars burning at once – site

access for trucks to move around and lay hose to fight the fire could be critical. As a rough guideline, I have attached the information for tire storage yards below. That's not the application here, but can serve as a guideline.

Chief - due to the very transient nature of the vehicles, I don't think we need a remote hydrant system here – vehicles are intended to come in and be auctioned off within a week or two. I would suggest possibly putting extinguishers mounted on poles like we would at a salvage yard. Thoughts on all this?

Fire department access

3.2.1.7. (1) Each storage yard shall be provided with fire access routes.

(2) The fire access routes shall

- (a) have a clear width of at least 6 m,
- (b) be designed to support the loads imposed by fire fighting equipment,
- (c) be surfaced with material designed to permit accessibility under all climatic conditions,
- (d) be connected with a public thoroughfare in at least two places that are located as remotely from each other as is possible in the circumstances,
- (e) be located within all storage pile clearances identified in Clauses 3.2.1.4.(2)(a) and (b) and Article 3.2.1.5.,
- (f) be at least 6 m away from any storage pile,
- (g) be accessible and unobstructed at all times, and
- (h) be located so that every point in the storage yard where storage piles are located is within 50 m of a fire access route.

(3) Despite Sentences (1) and (2), alternate fire access routes may be provided if

- (a) the routes permit fire fighting vehicles and equipment access and permit the use of fire suppression techniques appropriate in the circumstances, and
- (b) the routes are **approved**.

Fencing and gateways

3.2.1.8. (1) If the bulk volume of stored tires and shredded tires is more than 600 m^3, the storage yard shall be surrounded by a firmly anchored fence or other **approved** method of security that controls unauthorized access to the storage yard.

(2) If a fence is used, the fence shall be at least 1.8 m high and constructed to discourage climbing.

(3) The fence shall have gateways with a clear width of at least 3.5 m.

(4) The gateways shall be high enough to permit the entry of **fire department** vehicles.

(5) The gateways shall be kept clear of obstructions so that the gates may be fully opened at all times.

(6) The gateways shall be locked when the storage yard is not staffed.

Water supply

3.2.1.9. (1) A public or private water supply shall be provided so that any part of the storage yard can be reached by using not more than 150 m of hose.

(2) If the bulk volume of stored tires and shredded tires is between 300 m^3 and 1200 m^3, the water supply system shall be capable of supplying at least 1860 L/min for a minimum of 3 h.

(3) If the quantity of stored product is 1200 m^3 or more, the water supply system shall be capable of supplying at least 3780 L/min for a minimum of 3 h.

(4) If on-site reservoirs or other established water supplies are used as a **fire department** draft source to meet the requirements of Sentences (1), (2) and (3), they shall be equipped with dry hydrants in accordance with Chapter 9 of NFPA 1142, "Standard on Water Supplies for Suburban and Rural Fire Fighting".

Thank you,

Alex McAuley, P.Eng., Project Manager | Land Development Engineering
NOVATECH Engineers, Planners & Landscape Architects
240 Michael Cowpland Drive, Suite 200, Ottawa, ON, K2M 1P6 | Tel: 613.254.9643 Ext: 292 | Cell: 613.261.9166 | Fax: 613.254.5867
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APPENDIX H
Drawings

LEGEND

- PROPOSED 100mmØ SUBDRAIN
- PROPOSED GRASSED SWALE
- PROPOSED SILT FENCE PER OPSD 219.110
- PROPOSED STRAW BALE PER OPSD 219.100

EROSION AND SEDIMENT CONTROL NOTES:

1. THE OWNER AGREES TO PREPARE AND IMPLEMENT AN EROSION AND SEDIMENT CONTROL PLAN TO THE SATISFACTION OF THE CITY OF OTTAWA, APPROPRIATE TO THE SITE CONDITIONS, PRIOR TO UNDERTAKING ANY SITE ALTERATIONS (FILLING, GRADING, REMOVAL OF VEGETATION, ETC.) AND DURING ALL PHASES OF SITE PREPARATION AND CONSTRUCTION IN ACCORDANCE WITH THE CURRENT BEST MANAGEMENT PRACTICES FOR EROSION AND SEDIMENT CONTROL SUCH AS BUT NOT LIMITED TO INSTALLING FILTER CLOTHS ACROSS MANHOLE/CATCHBASIN LIDS TO PREVENT SEDIMENTS FROM ENTERING STRUCTURES AND INSTALL AND MAINTAIN A LIGHT DUTY SILT FENCE BARRIER AS REQUIRED.
2. THE CONTRACTOR SHALL PLACE FILTER CLOTH UNDER THE CATCHBASIN AND MANHOLE GRATES FOR THE DURATION OF CONSTRUCTION AND WILL REMAIN IN PLACE DURING ALL PHASES OF CONSTRUCTION.
3. SILT FENCING FOR ENTIRE PERIMETER OF SITE, SHALL BE UTILIZED TO CONTROL EROSION FROM THE SITE DURING CONSTRUCTION.
4. THE CONTRACTOR ACKNOWLEDGES THAT FAILURE TO IMPLEMENT EROSION AND SEDIMENT CONTROL MEASURES MAY BE SUBJECT TO PENALTIES IMPOSED BY ANY APPLICABLE REGULATORY AGENCY.

REFER TO 119181-ND FOR ADDITIONAL NOTES AND DETAILS

NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

NOT FOR CONSTRUCTION

No.	REVISION	DATE	BY
3.	ISSUED FOR REVIEW	MAY 27/20	AAR
2.	ISSUED FOR CLIENT INFORMATION	MAY 20/20	AAR
1.	ISSUED FOR COORDINATION	MAY 8/20	AAR

SCALE 1:750

DESIGN AAR
CHECKED ARM
DRAWN AAR
CHECKED AAR
APPROVED SMG

FOR REVIEW ONLY

LICENSED PROFESSIONAL ENGINEER S.M. GORDON May 27, 2020 PROVINCE OF ONTARIO

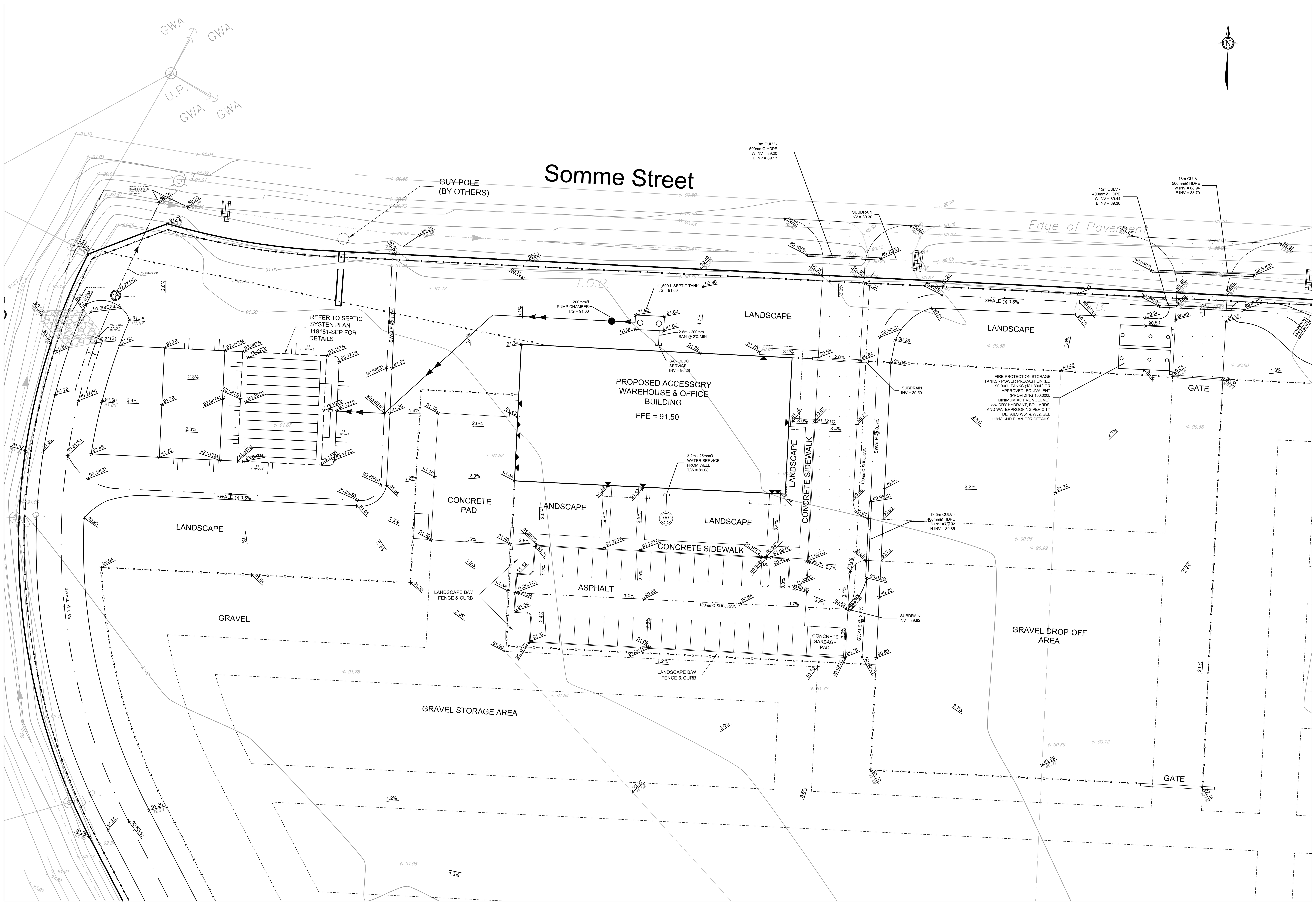
LICENSED PROFESSIONAL ENGINEER A.R. MCAULEY 100141256 May 27, 2020 PROVINCE OF ONTARIO

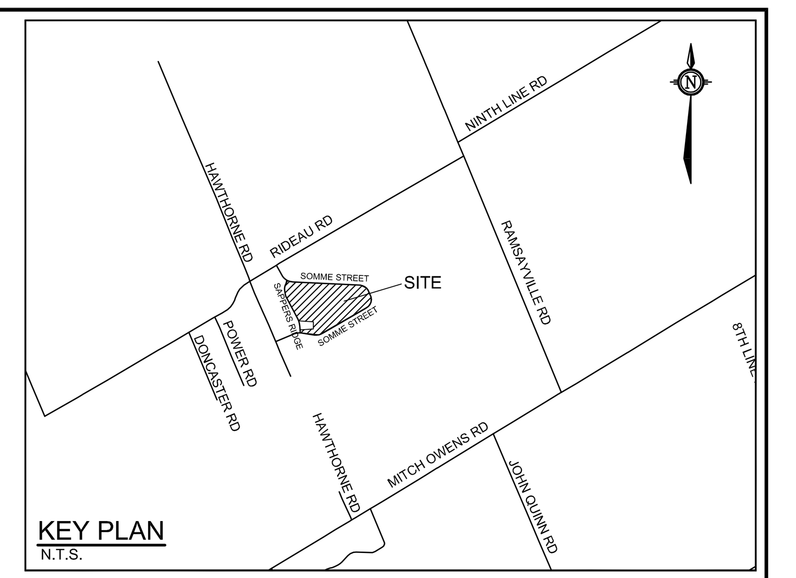
NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

LOCATION
300 SOMME STREET
BLOCK 6

DRAWING NAME
OVERALL GRADING, EROSION, SEDIMENT CONTROL AND SERVICING PLAN

PROJECT No. 119181
REV # 3
DRAWING No. 119181-GS1





KEY PLAN
N.T.S.

LEGEND

- 95.55 / *94.20* — PROPOSED ELEVATION / *EXISTING ELEVATION*
- 93.00(S) — PROPOSED SWALE INVERT ELEVATION
- 110.45 TB — PROPOSED TOP OF SEPTIC BED ELEVATION
- 109.15 TM — PROPOSED TOP OF SEPTIC MANTLE ELEVATION
- TERRACING: MAXIMUM 3:1 SIDESLOPE
- 2.0% — GRADE AND DIRECTION
- PROPOSED PUMP CHAMBER & FORCEMAIN
- PROPOSED CENTERLINE OF SWALE
- PROPOSED 100mmØ SUBDRAIN
- PROPOSED U/G HYDRO SERVICE
- LIGHT DUTY ASPHALT (SEE 119181-ND PLAN FOR PAVEMENT STRUCTURE DETAILS)
- HEAVY DUTY ASPHALT (SEE 119181-ND PLAN FOR PAVEMENT STRUCTURE DETAILS)

GENERAL NOTES:

1. COORDINATE AND SCHEDULE ALL WORK WITH OTHER TRADES AND CONTRACTORS.
2. DETERMINE THE EXACT LOCATION, SIZE, MATERIAL AND ELEVATION OF ALL EXISTING UTILITIES PRIOR TO COMMENCING CONSTRUCTION. PROTECT AND ASSUME RESPONSIBILITY FOR ALL EXISTING UTILITIES WHETHER OR NOT SHOWN ON THIS DRAWING.
3. OBTAIN ALL NECESSARY PERMITS AND APPROVALS FROM THE CITY OF OTTAWA BEFORE COMMENCING CONSTRUCTION.
4. BEFORE COMMENCING CONSTRUCTION OBTAIN AND PROVIDE PROOF OF COMPREHENSIVE, ALL RISK AND OPERATIONAL LIABILITY INSURANCE FOR $5,000,000.00. INSURANCE POLICY TO NAME OWNERS, ENGINEERS AND ARCHITECTS AS CO-INSURED.
5. RESTORE ALL DISTURBED AREAS ON-SITE AND OFF-SITE, INCLUDING TRENCHES AND SURFACES ON PUBLIC ROAD ALLOWANCES TO EXISTING CONDITIONS OR BETTER TO THE SATISFACTION OF THE CITY OF OTTAWA AND ENGINEER.
6. REMOVE FROM SITE ALL EXCESS EXCAVATED MATERIAL, ORGANIC MATERIAL AND DEBRIS UNLESS OTHERWISE INSTRUCTED BY ENGINEER. EXCAVATE AND REMOVE FROM SITE ANY CONTAMINATED MATERIAL. ALL CONTAMINATED MATERIAL SHALL BE DISPOSED OF AT A LICENSED LANDFILL FACILITY.
7. ALL ELEVATIONS ARE GEODETIC.
8. REFER TO GEOTECHNICAL REPORT (No. 65080.01, DATED APRIL 24, 2020), PREPARED BY GEMTEC FOR SUBSURFACE CONDITIONS, CONSTRUCTION RECOMMENDATIONS, AND GEOTECHNICAL INSPECTION REQUIREMENTS. THE GEOTECHNICAL CONSULTANT IS TO REVIEW ON-SITE CONDITIONS AFTER EXCAVATION PRIOR TO PLACEMENT OF THE GRANULAR MATERIAL.
9. REFER TO ARCHITECT'S AND LANDSCAPE ARCHITECT'S DRAWINGS FOR BUILDING AND HARDSURFACE AREAS AND DIMENSIONS.
10. REFER TO STORMWATER MANAGEMENT REPORT(R-2020-070) PREPARED BY NOVATECH ENGINEERING CONSULTANTS LTD.
11. SAW CUT AND KEY GRIND ASPHALT AT ALL ROAD CUTS AND ASPHALT TIE IN POINTS AS PER CITY OF OTTAWA STANDARDS (R10).
12. PROVIDE LINE/PARKING PAINTING.

GRADING NOTES:

1. ALL TOPSOIL, ORGANIC OR DELETERIOUS MATERIAL MUST BE ENTIRELY REMOVED FROM BENEATH THE PROPOSED PAVED AREAS AS DIRECTED BY THE SITE ENGINEER OR GEOTECHNICAL ENGINEER.
2. EXPOSED SUBGRADES IN PROPOSED PAVED AREAS SHOULD BE PROOF ROLLED WITH A LARGE STEEL DRUM ROLLER AND INSPECTED BY THE GEOTECHNICAL ENGINEER PRIOR TO THE PLACEMENT OF GRANULARS.
3. ANY SOFT AREAS EVIDENT FROM THE PROOF ROLLING SHOULD BE SUB-EXCAVATED AND REPLACED WITH SUITABLE MATERIAL THAT IS FROST COMPATIBLE WITH THE EXISTING SOILS AS RECOMMENDED BY THE GEOTECHNICAL ENGINEER.
4. THE GRANULAR BASE SHOULD BE COMPACTED TO AT LEAST 100% OF THE STANDARD PROCTOR MAXIMUM DRY DENSITY VALUE. ANY ADDITIONAL GRANULAR FILL USED BELOW THE PROPOSED PAVEMENT SHOULD BE COMPACTED TO AT LEAST 95% OF THE STANDARD PROCTOR MAXIMUM DRY DENSITY VALUE.
5. MINIMUM OF 2% GRADE FOR ALL GRASS AREAS UNLESS OTHERWISE NOTED.
6. MAXIMUM TERRACING GRADE TO BE 3:1 UNLESS OTHERWISE NOTED.
7. ALL GRADES BY CURBS ARE EDGE OF PAVEMENT GRADES UNLESS OTHERWISE INDICATED.
8. ALL CURBS SHALL BE BARRIER CURB (150mm) UNLESS OTHERWISE NOTED AND CONSTRUCTED AS PER CITY OF OTTAWA STANDARDS (SC1.1).
9. REFER TO LANDSCAPE PLAN FOR PLANTING AND OTHER LANDSCAPE FEATURE DETAILS.
13. CONTRACTOR TO PROVIDE THE CONSULTANT WITH A GRADING PLAN INDICATING AS-BUILT ELEVATIONS OF ALL DESIGN GRADES SHOWN ON THIS PLAN.

REFER TO 119181-ND FOR ADDITIONAL NOTES AND DETAILS

NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

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No.	REVISION	DATE	BY
2.	ISSUED FOR REVIEW	MAY 27/20	AAR
1.	ISSUED FOR CLIENT INFORMATION	MAY 20/20	AAR

SCALE 1:300

DESIGN AAR · CHECKED ARM · DRAWN AAR · CHECKED AAR · APPROVED SMG

FOR REVIEW ONLY

LICENSED PROFESSIONAL ENGINEER S.M. GORDON May 27, 2020 PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER A.R. MCAULEY 100141256 May 27, 2020 PROVINCE OF ONTARIO

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Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

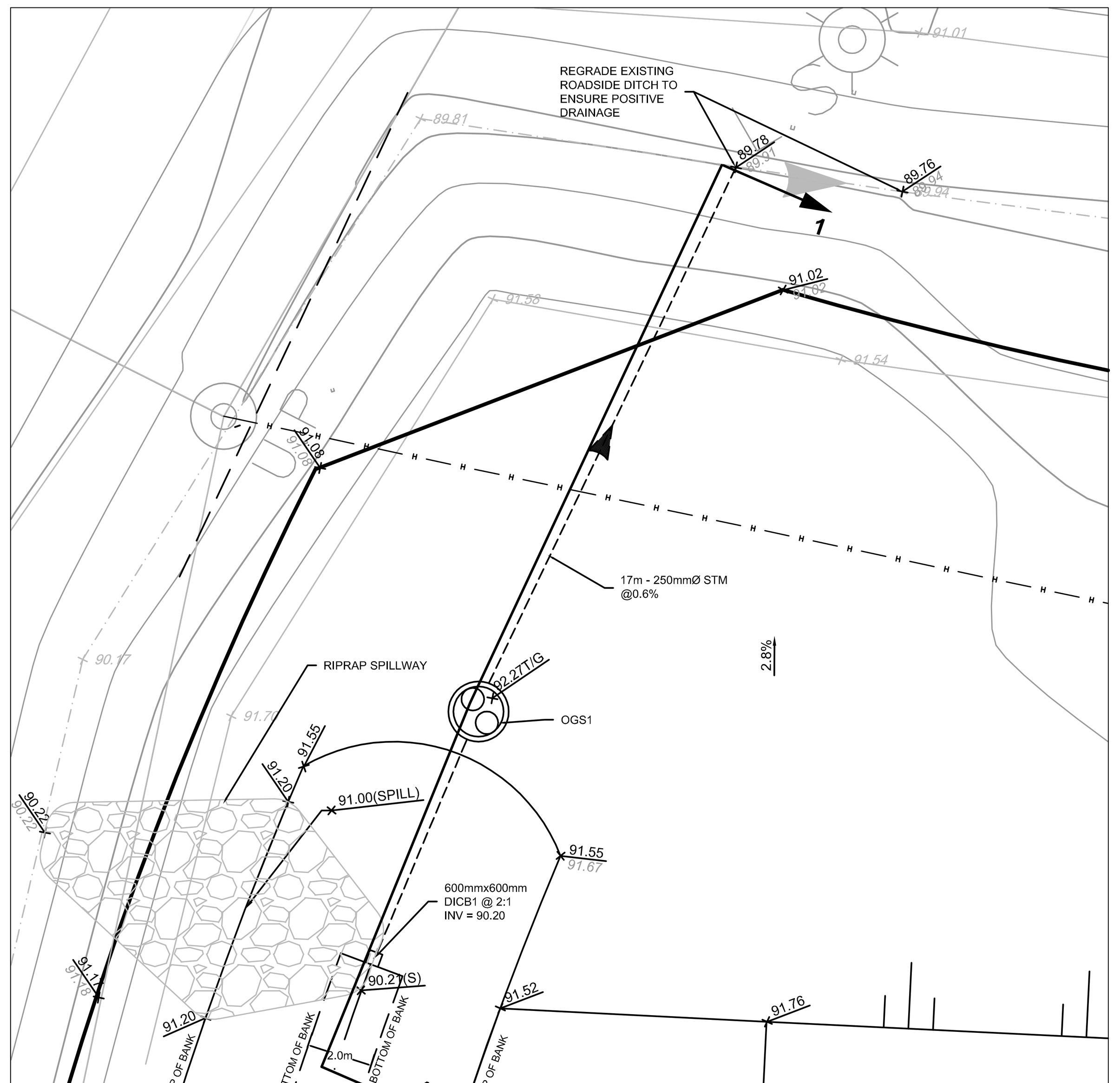
LOCATION
300 SOMME STREET
BLOCK 6

DRAWING NAME
DETAILED GRADING AND SERVICING PLAN

PROJECT No. 119181
REV REV # 2
DRAWING No. 119181-GS2

M:\2019\119181\CAD\Design\119181-GS.dwg, GS2, May 27, 2020 - 11:07am

PLANB1.DWG - 1000mmx707mm



OGS DETAIL 1
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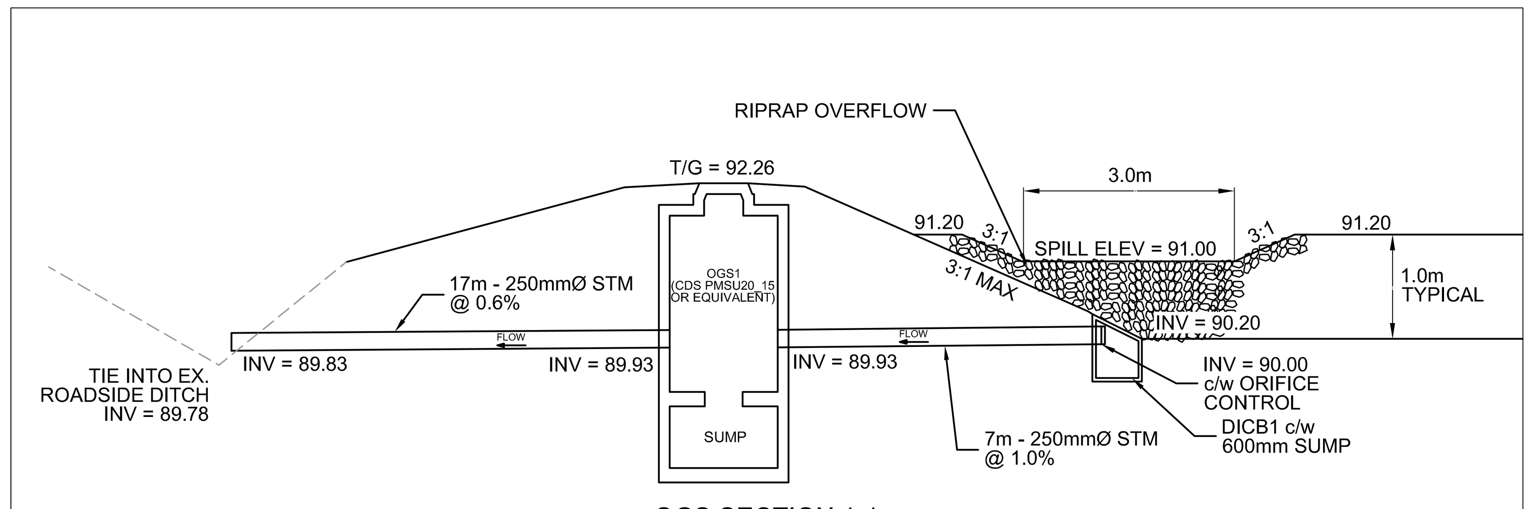


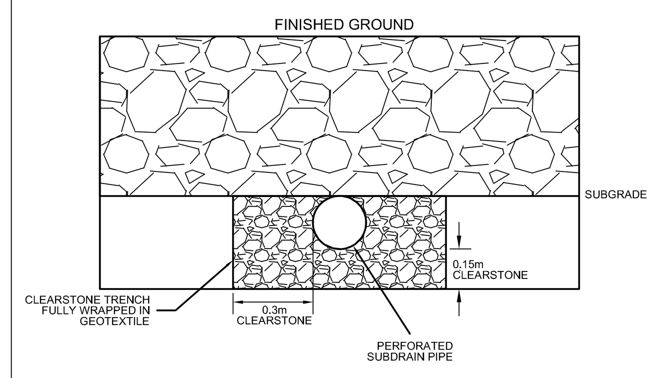
OGS SECTION 1-1
NTS

PAVEMENT STRUCTURE:

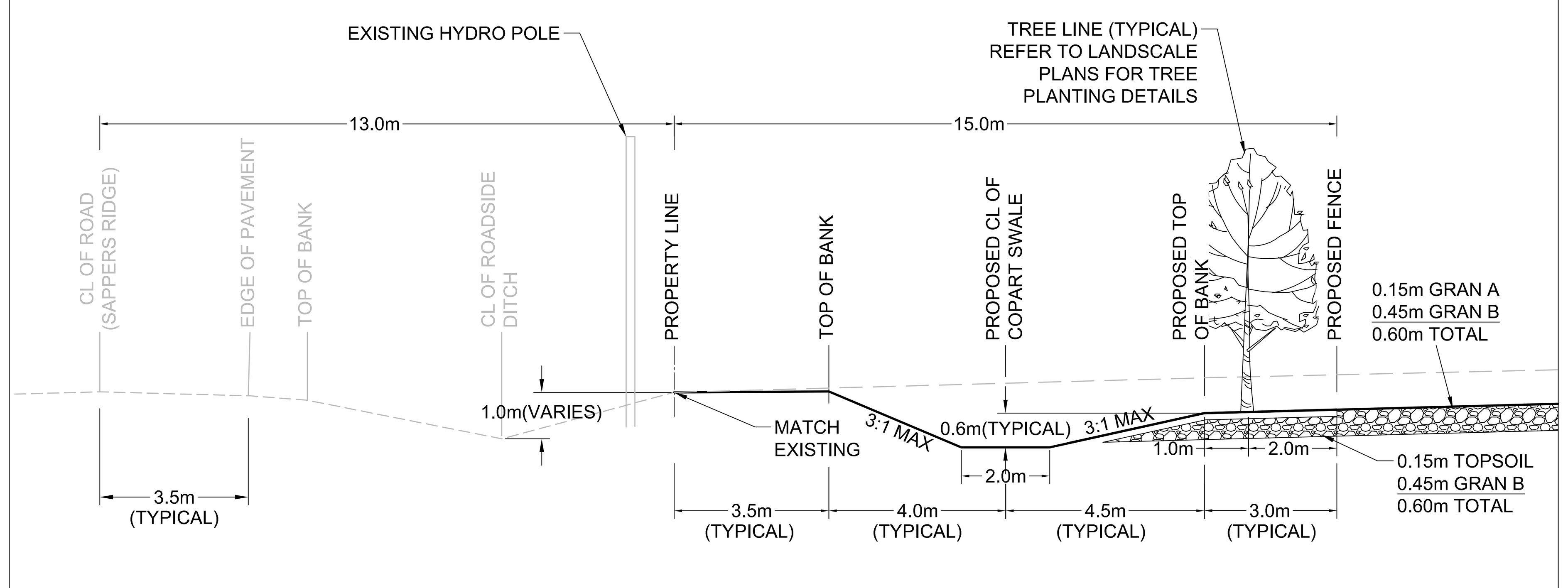
- LIGHT DUTY: 50mm SUPERPAVE 12.5; 150mm GRAN "A"; 300mm GRAN "B" TYPE II OR III SUBBASE
- HEAVY DUTY: 40mm SUPERPAVE 12.5; 60mm SUPERPAVE 19.0; 150mm GRAN "A"; 450mm GRAN "B" TYPE II
- GRAVEL STORAGE AREA: 150mm GRAN "A"; 450mm GRAN "B" TYPE II

INLET CONTROL DEVICE TABLE:

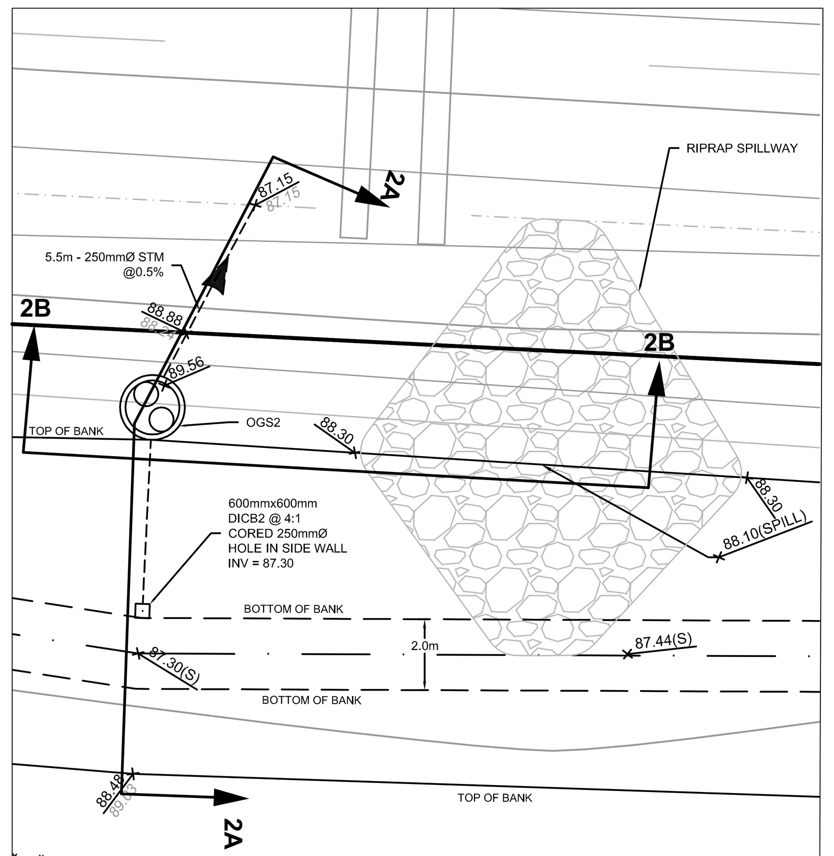
ICD Location	ICD Size (mm)	ICD Type
DICB 1	83	Slot
DICB 2	152	Slot
DICB 3	108	Slot



SUBDRAIN TRENCH DETAIL
1:20



SAPPERS RIDGE
TYPICAL DITCH CROSS SECTION
SCALE = 1:100



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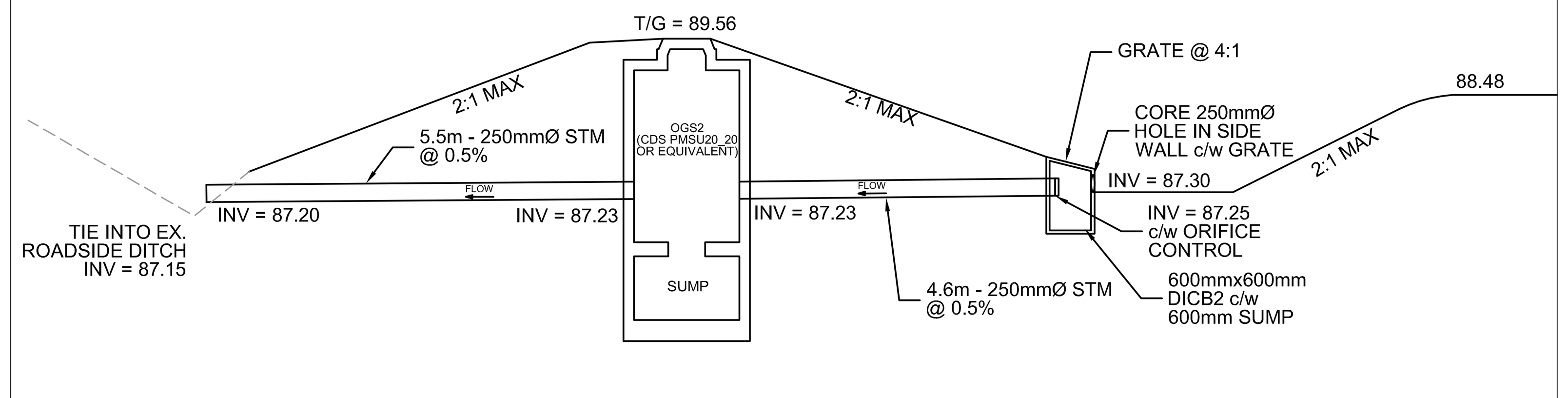
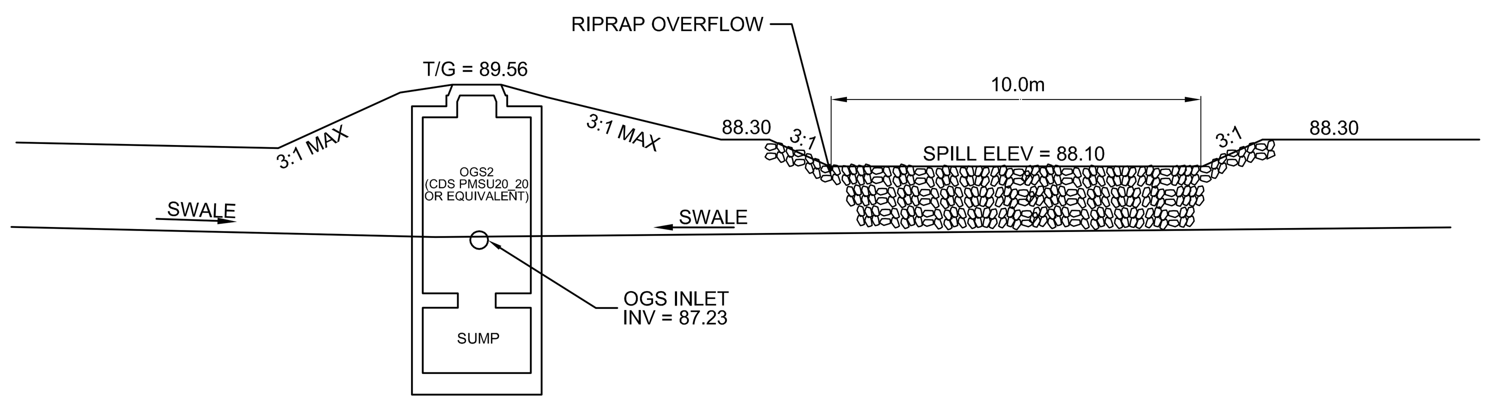
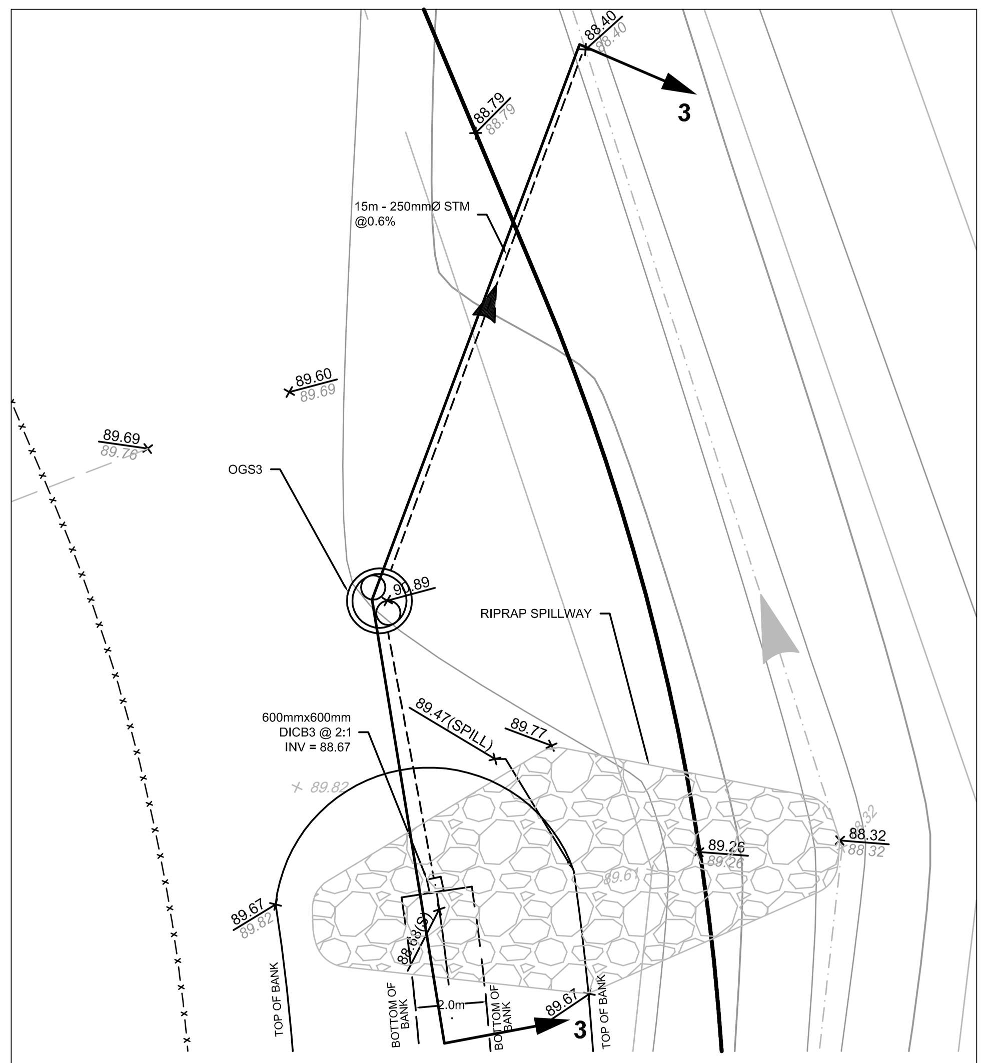


OGS SECTION 2A-2A
NTS



OGS SECTION 2B-2B
NTS



OGS DETAIL 3
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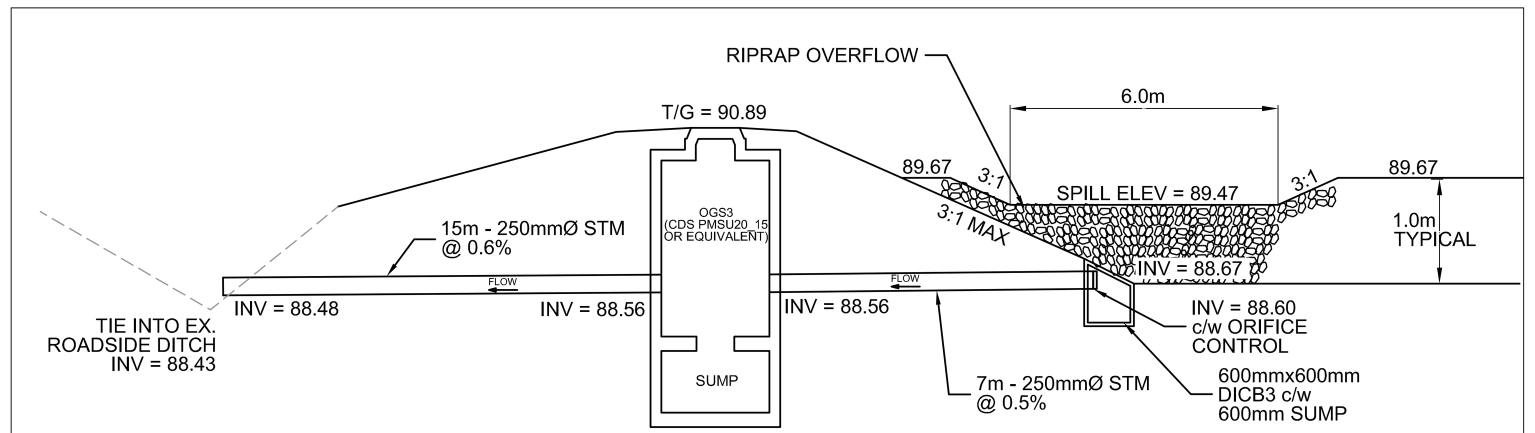
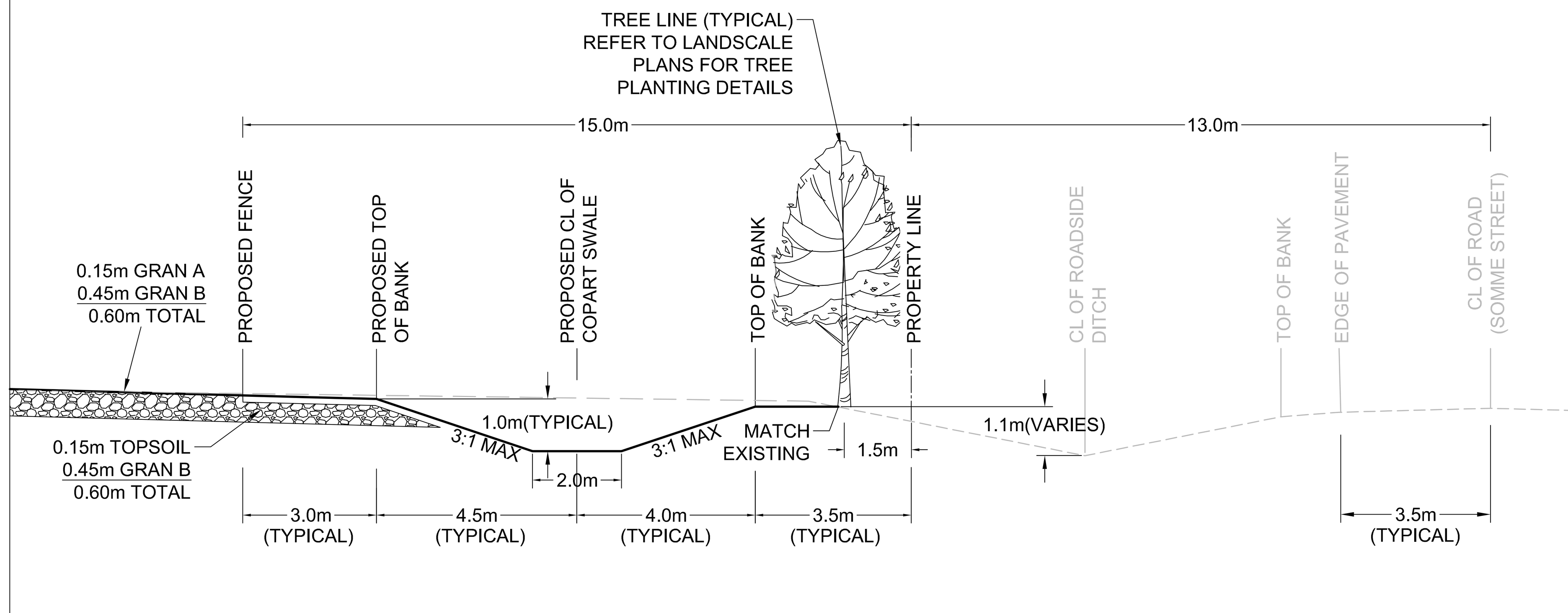
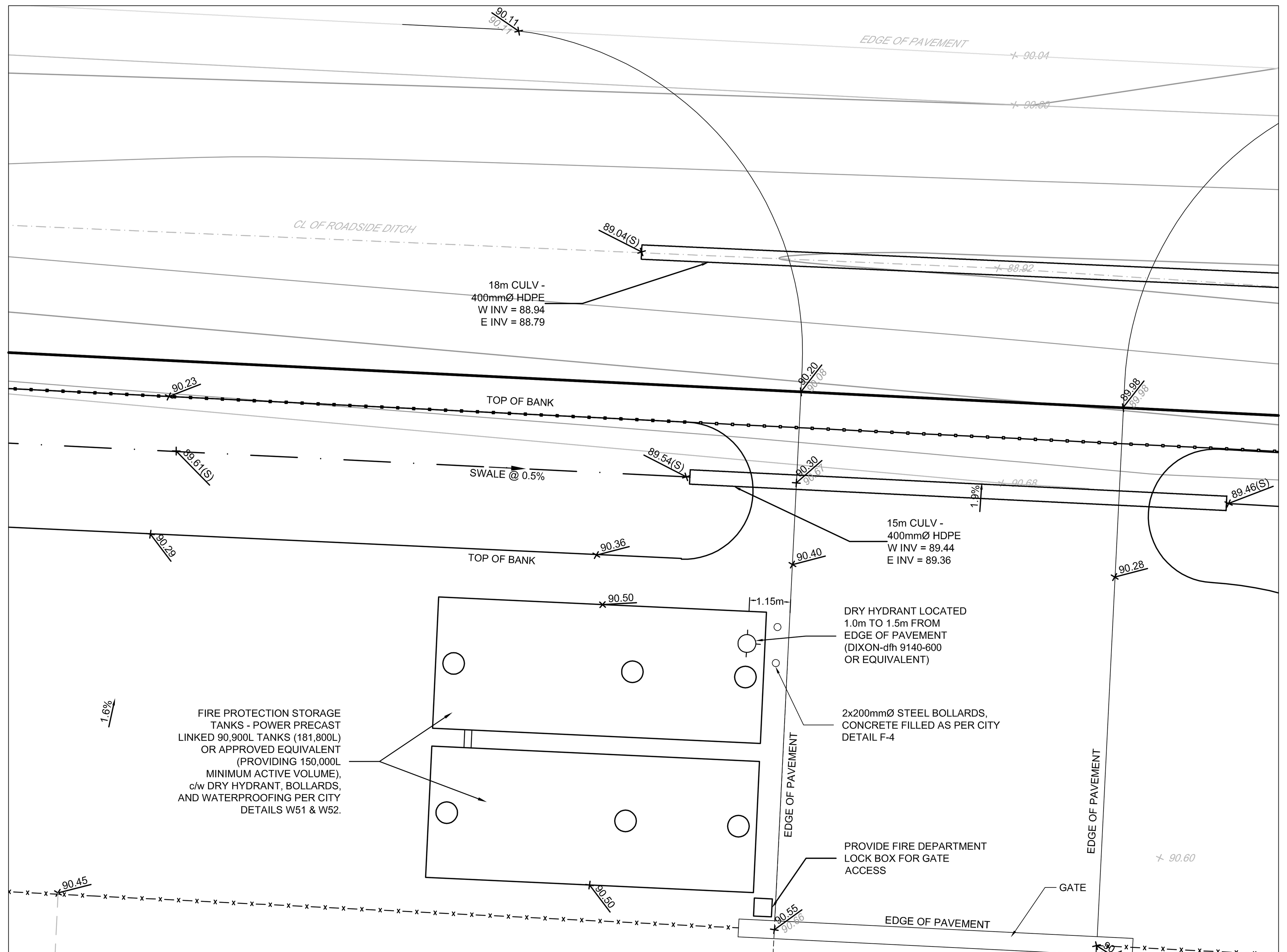


OGS SECTION 3-3
NTS



SOMME STREET
TYPICAL DITCH CROSS SECTION
SCALE = 1:100



FIRE STORAGE TANK DETAIL
SCALE = 1:100

NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

NOT FOR CONSTRUCTION

No.	REVISION	DATE	BY
2.	ISSUED FOR REVIEW	MAY 27/20	AAR
1.	ISSUED FOR CLIENT INFORMATION	MAY 20/20	AAR

SCALE: AS NOTED

DESIGN: AAR
CHECKED: ARM
DRAWN: AAR
CHECKED: ARM
APPROVED: SMG

FOR REVIEW ONLY

LICENSED PROFESSIONAL ENGINEER S.M. GORDON May 27, 2020 PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER A.R. MCAULEY 100141256 May 27, 2020 PROVINCE OF ONTARIO

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LOCATION
300 SOMME STREET
BLOCK 6

DRAWING NAME
NOTES AND DETAILS PLAN

PROJECT No. 119181
REV: REV # 2
DRAWING No. 119181-ND

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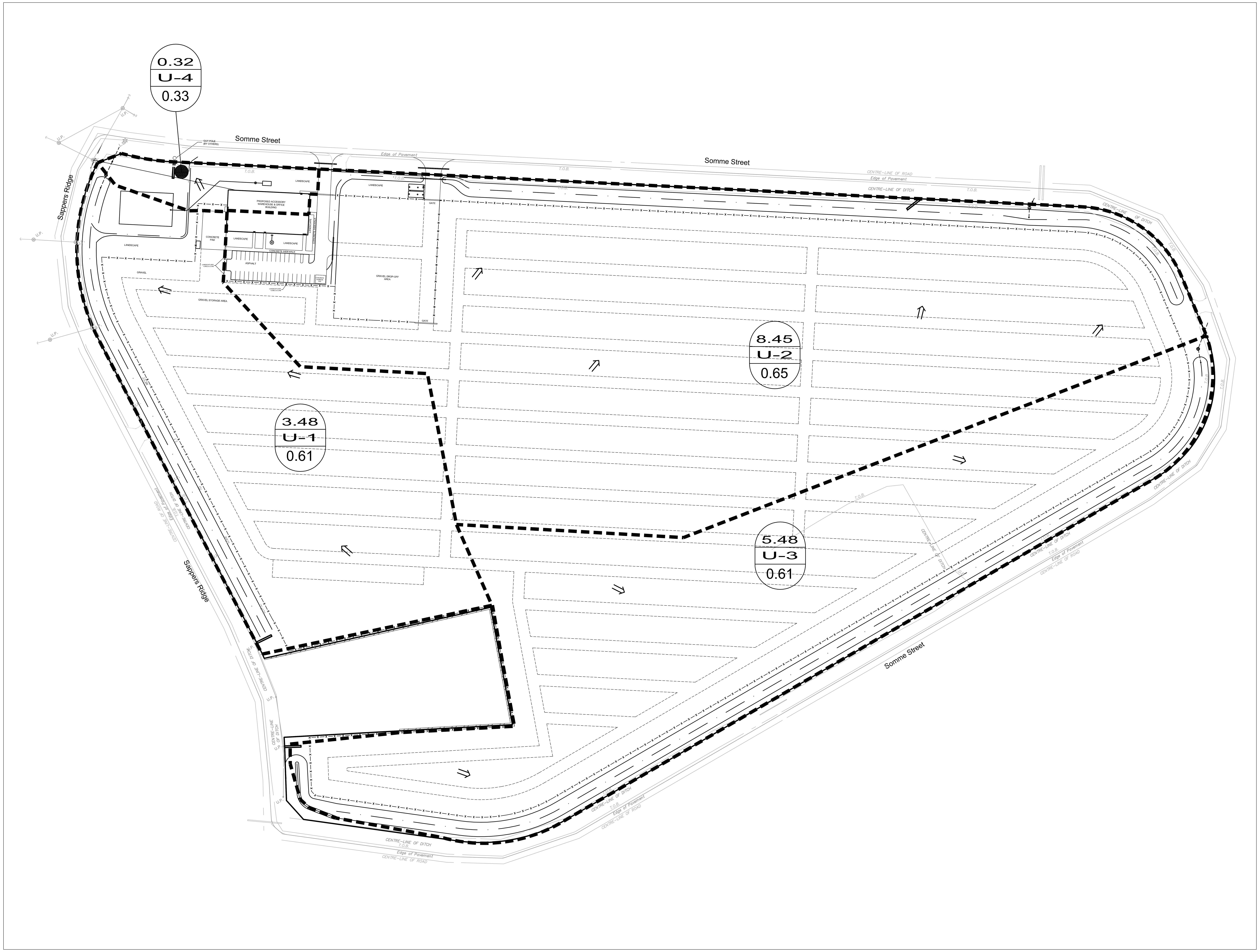

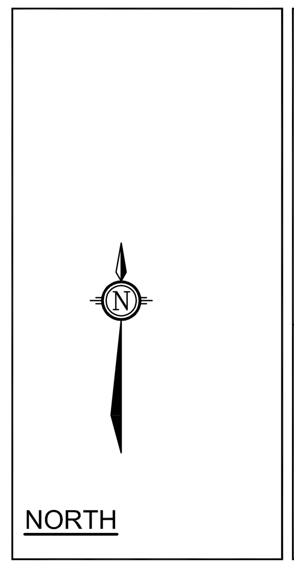

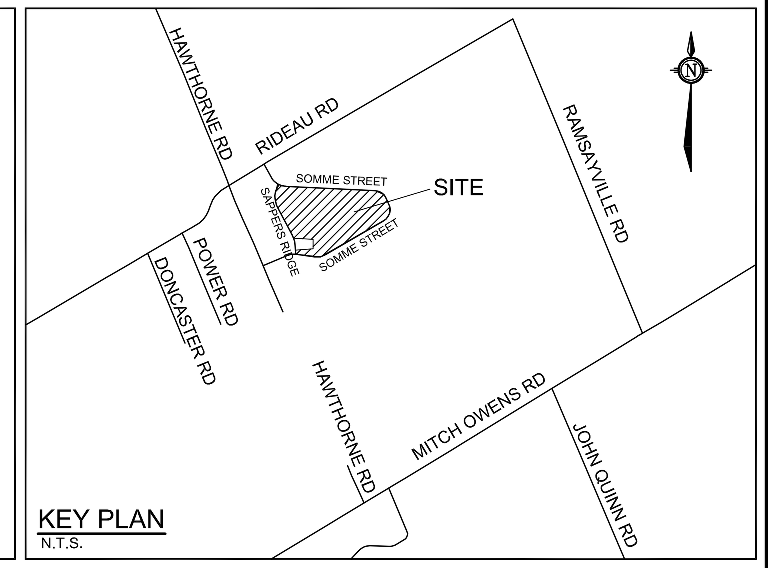

LEGEND

6.71 / EX-2 / 0.70	DRAINAGE AREA (hectares) / ID / RUNOFF COEFFICIENT (C)
- - - -	STORM DRAINAGE AREA
⇒	OVERLAND FLOW DIRECTION

NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

NOT FOR CONSTRUCTION

No.	REVISION	DATE	BY
3.	ISSUED FOR REVIEW	MAY 27/20	AAR
2.	ISSUED FOR CLIENT REVIEW	MAY 20/20	AAR
1.	ISSUED FOR DISCUSSION	MAY 7/20	AAR

SCALE 1:1000

DESIGN AAR · CHECKED ARM · DRAWN AAR · CHECKED ARM · APPROVED SMG

FOR REVIEW ONLY

LICENSED PROFESSIONAL ENGINEER S.M. GORDON May 27, 2020 PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER A.R. MCAULEY 100141256 May 27, 2020 PROVINCE OF ONTARIO

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LOCATION
300 SOMME STREET
BLOCK 6

DRAWING NAME
POST-DEVELOPMENT STORM DRAINAGE AREA PLAN

PROJECT No. 119181
REV REV # 3
DRAWING No. 119181-POST