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Starbank Developments
401 March Road

Development Servicing Study

And Stormwater Management Report

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STARBANK DEVELOPMENTS
401 MARCH ROAD

DEVELOPMENT SERVICING STUDY AND STORMWATER MANAGEMENT REPORT

Prepared by:

NOVATECH ENGINEERING CONSULTANTS LTD.
Suite 200, 240 Michael Cowpland Drive
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December 20, 2013

Ref: R-2013-210
Novatech File No. 113023

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December 20, 2013

City of Ottawa
Planning and Growth Management Department
Infrastructure Approvals Division
110 Laurier Avenue West, 4th Floor
Ottawa, Ontario
K1P 1J1

Attention: Mr. Santhosh Kuruvilla

Dear Sir.:

Re: Development Servicing and Stormwater Management Report
Starbank Developments
401 March Road
Ottawa, Ontario
Our File No.: 113023

Enclosed herein are eight (8) copies of the 'Development Servicing Study and Stormwater Management Report' for the proposed development located at 401 March Road. in the City of Ottawa. This report addresses the approach to site servicing and stormwater management for the subject property and is submitted in support of the site plan approval application and zoning by-law amendment.

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

Yours truly,

NOVATECH ENGINEERING CONSULTANTS LTD.

Miroslav Savic, P. Eng.
Project Manager

MS/sm

cc: Dung Lam (Starbank Development 401 Corp.) – 1 copy
Heinz Vogt (SMV architects) – 1 copy

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1.0 INTRODUCTION

A gas bar / car wash, office space and restaurant development is being proposed by Starbank Development 401 Corporation at the south-west corner of the intersection of March Road and Station Road in Kanata. Novatech Engineering Consultants Ltd. has been retained to complete the site servicing, grading and stormwater management design for this project.

1.1 Purpose

This report outlines the servicing aspects of the proposed development with respect to water, sanitary and storm drainage and addresses the approach to stormwater management. This report is being submitted in support of the site plan application and zoning by-law amendment for the subject property.

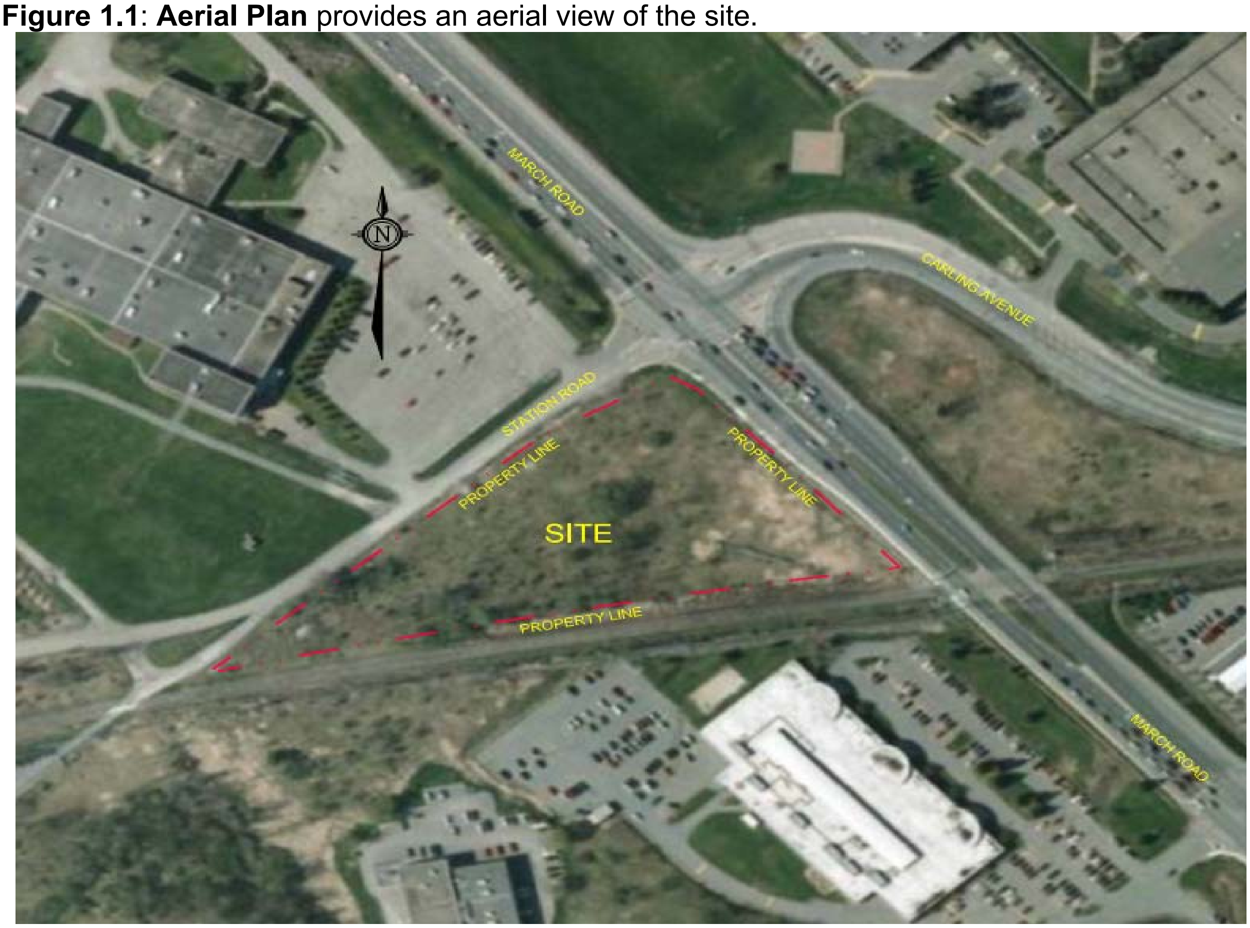
1.2 Location and Site Description

The site is located at 401 March Road, Kanata within the City of Ottawa limits. The subject site is bounded by the following:

- to the north: Station Road, and existing industrial developments
- to the east: March Road, recreational spaces and existing commercial developments
- to the south and west: limited use CN Spur Line on City of Ottawa railway lands

The subject site, shown in **Figure 1.1**, is currently vacant and has a total area of approximately 1.22 ha. The existing site ground surface slopes from west to east with drainage ditches running around the perimeter of the site.

Figure 1.1: **Aerial Plan** provides an aerial view of the site.



The site is currently zoned General Industrial Zone, Subzone 6, Exception 295- IG6 [295]. The site plan proposes a commercial plaza, consisting of a gas bar, two restaurants with a drive-through facility and commercial building (medical facility).

The zoning amendment requests to rezone the property from the Ig6[295] Zone to an IG Zone which would permit 'car wash', 'gas bar' and 'restaurant' as permitted uses. These uses are not permitted under the current zone.

1.3 Consultation and Reference Material

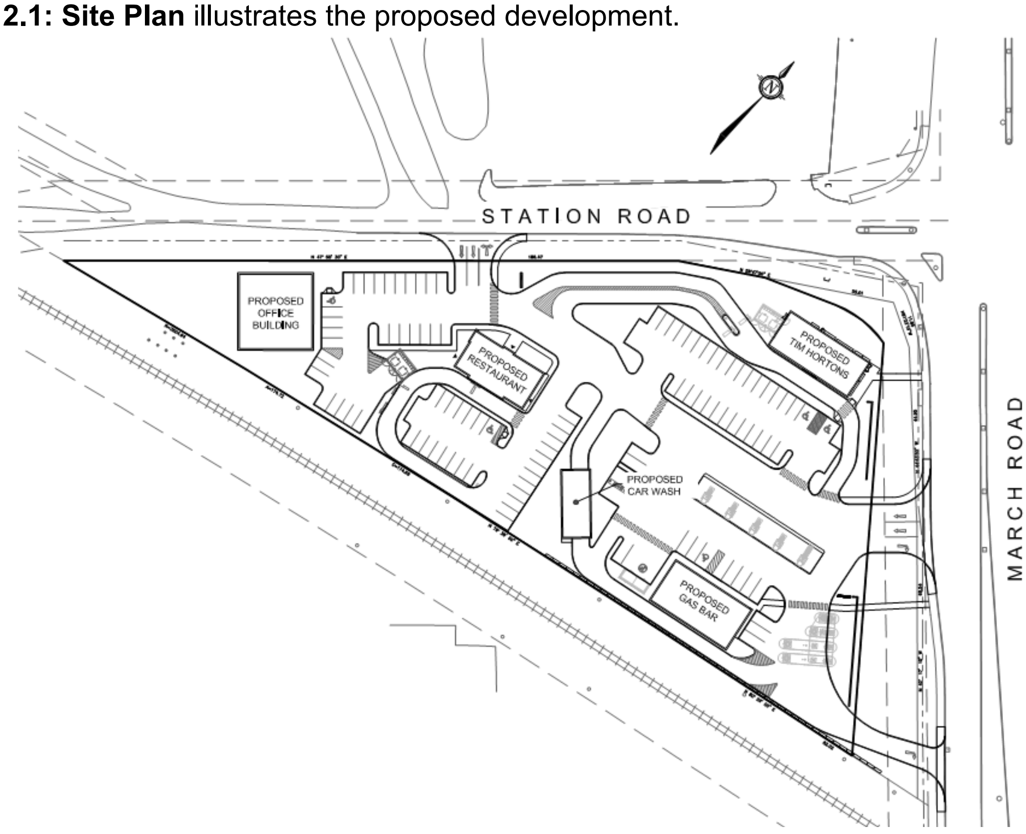
A pre-consultation meeting was held with the City of Ottawa on March 8th, 2013, at which time Novatech was advised of the general submission requirements. Further discussions were also held with the City of Ottawa and RVCA regarding the approach to stormwater management for the site. It is anticipated that an MOE Environmental Compliance Approval will be required due to the proposed gas bar installation. Refer to **Appendix A** for a summary of the e-mail correspondence.

2.0 PROPOSED DEVELOPMENT

The subject site has an area of approximately 1.228 ha, and is henceforth referred to in this Development Servicing Study & Stormwater Management Report (DSS & SWM Report) as the 401 March Road development. The proposed development consists of one single-storey building intended for use as office space, two restaurant buildings with drive through order lanes, and a gas bar with drive through car wash. The site will have access points off both March Road and Station Road.

Refer to **Figure 2.1** for the proposed site plan for the 401 March Road development.

Figure 2.1: Site Plan illustrates the proposed development.



3.0 SITE SERVICING

The objective of the site servicing design is to conform to the requirements of the City of Ottawa servicing design guidelines by providing a suitable domestic water supply, proper sewage outlets and ensuring that appropriate fire protection is provided.

The servicing criteria, expected sewage flows and water demands for the site have been established using the City of Ottawa municipal design guidelines for sewer and water distribution. The City of Ottawa Servicing Study Guidelines for Development Applications requires a Development Servicing Study Checklist to confirm that each applicable item is deemed complete and ready for review by City of Ottawa Infrastructure Approvals. A completed checklist is enclosed in **Appendix B** at the back of this report.

The existing site is undeveloped with no existing on-site services with the closest existing municipal sanitary, storm and water infrastructure being located within the adjacent March Road and Data Centre Road.

3.1 Sanitary Sewer

The proposed development will be serviced by connecting a 200 mm dia. PVC sanitary sewer to the existing 450mm diameter sanitary sewer in the western boulevard of March Road. The proposed 200 mm dia. sanitary sewer servicing the development will be a gravity pipe at a minimum slope of 1.0% with a full flow conveyance capacity of at least 34.2 L/s. The existing 450mm diameter sanitary sewer in March Road at 0.61% slope has a full flow capacity of approximately 232 L/s.

The total sanitary design flow, including infiltration, has been calculated based on the flow rates specified in Appendix 4-A of the Ottawa Sewer Design Guidelines and Table 8.2.1.3.B. in the OBC code and guide for sewage systems:

Table 3.1.1 – Sanitary Office Flows

Site Component	Floor Area (m^2)	Occupant Load (m^2/person)	Flow per Person (L/day)	Flow** (L/s)	Peaking Factor	Total Flow (L/s)
Proposed Office Building	372	9.3*	75*	0.04	1.5	0.06

Table 3.1.2 – Sanitary Restaurant Flows

Site Component	Approximate Number of Seats	Flow per Seat (L/day)	Flow** (L/s)	Peaking Factor	Total Flow (L/s)
Proposed Tim Horton's	60**	400*	0.28	1.5	0.42
Proposed A&W	40**	125	0.06	1.5	0.09

Table 3.1.3 – Sanitary Service Station Flows

Site Component	Maximum Number of Pumps in Use	Flow per Fuel Outlet (L/day)	Flow** (L/s)	Peaking Factor	Total Flow (L/s)
Proposed Gas Bar	12	950*	0.13	1.5	0.20

Table 3.1.4 – Sanitary Car Wash Flows

Site Component	Approximate Number of Car Washes	Flow per Car (L/day)	Flow** (L/s)	Peaking Factor	Total Flow (L/s)
Proposed Car Wash	120 (5/hr)	400	0.56	1.5	0.84

*Based on Table 8.2.1.3.B. in the OBC code and guide for sewage systems and a 24hr day
** Number of seats in the restaurants provided by the owner

Extraneous Flow: Q_{INFIL} = 0.28L/effective.gross.ha/s x 1.228 ha = 0.34 L/s

Total Peak Flow: Q_{DESIGN} = 0.06 L/s + 0.42 L/s + 0.09 + 0.20 L/s + 0.84 L/s + 0.34 L/s = 1.95 L/s

The proposed on-site 200mm diameter sanitary sewers have been designed in accordance with the City of Ottawa Sewer Design Guidelines and have sufficient capacity to convey all anticipated sanitary flows generated from the proposed development. The additional flow of 1.95L/s from the proposed development to the existing 405mm diameter March Road sanitary sewer can be considered negligible.

3.2 Water

The proposed development will be serviced by connecting to the existing 200mm dia. watermain in Station Road.

The theoretical water demand for the proposed development, calculated as per the Ottawa Design Guidelines is summarized in **Table 3.2**. Detailed calculations are shown in **Appendix C**.

Table 3.2.1: Water Demand

Average Day Demand	Maximum Day Demand	Peak Hour Demand
1.06 L/s	1.59 L/s	2.86 L/s

The proposed buildings will not be sprinklered. The fire protection will be provided from a single on-site fire hydrant located within 90m from the principal entrance for all buildings. A 200 mm dia. watermain will be extended on-site to service the fire hydrant and will be connected to the existing 200 mm dia. watermain in Station Road.

The Fire Underwriter's Survey (FUS) was used to estimate the fire flow demand for all the proposed buildings. The maximum calculated fire flow demand is 56.0 L/s (736 igpm). Refer to **Appendix C** for detailed calculations.

The hydraulic model EPANET was used for the purpose of analyzing the performance of the proposed watermain for two theoretical conditions: 1) Maximum Day + Fire Flow demand and 2) Peak Hour Demand. The model is based on hydraulic boundary conditions provided by the City of Ottawa (refer to **Appendix C**).

A schematic representation of the hydraulic network is presented in **Appendix C**. This figure depicts the node and pipe numbers used in the model.

The model indicates that acceptable pressure will exist throughout the proposed watermain system under the specified design conditions. The following tables summarize hydraulic model results (refer to **Appendix C** for details):

Table 3.2.2: Fire Flow + Maximum Day Demand

Operating Condition	Minimum Pressure
56.0 L/s at Node 7 (HYD) + Max Day Demand	405.35 kPa (58.79 psi) at Node 10

Table 3.2.3: Peak Hour Demand

Operating Condition	Minimum Pressure
Peak Hour Demand	409.27 kPa (59.36 psi) at Node 5

Based on the proceeding analysis it can be concluded that watermain, as designed, will provide adequate system pressures for the fire flow + maximum day demand and peak hour demand.

3.3 Storm and Stormwater Management

The undeveloped site is currently overlain with grasses and a few small trees. The site slopes generally from West to East with an approximate drop of three metres towards March Road. The site is bounded by existing drainage ditches along Station Road to the North, March Road to the East and the existing railway to the South. The existing ditches convey runoff from the site to 600mm diameter storm sewers which are connected to the 1050mm diameter municipal trunk sewer within March Road.

The proposed site will be serviced by connecting to the existing 600mm diameter culvert located in Station Road near the north-east corner of the property. The existing roadside ditch along Station Road will continue to drain to the existing culvert and be conveyed to the existing 1050mm diameter municipal storm sewer in March Road. Modifications to a small portion of the existing roadside ditches will be required to accommodate the proposed development.

An on-site storm sewer system of 375 - 600mm diameter pipes will control on-site stormwater flows and convey them through an oil/grit separator unit to the existing storm sewer system in March Road via the new outlet manhole.

Stormwater management will be provided by rooftop storage, surface storage and underground storage pipes, which outlet to the existing 1050mm diameter municipal storm sewer within March Road. Runoff from the uncontrolled landscaped areas adjacent to the property lines will be directed into the existing roadside ditches adjacent to the site. The existing ditch along Station Road north of the site will be re-graded to provide continuous positive drainage to the existing 600mm diameter culvert in Station Road via a new ditch inlet catchbasin. Further details on the sub catchment drainage areas captured within the on-site storm sewer systems are explained below. See the Stormwater Management Plan (113023-SWM) included with this report, in **Appendix H**, for catchment locations, areas, and runoff coefficients.

3.3.1 Stormwater Management Objectives

The criteria and objectives were provided by the City of Ottawa and the Mississippi Valley Conservation Authority (MVC). The proposed stormwater management design is based on the latest City of Ottawa Sewer Design Guidelines as follows:

- Control the post-development 1:5 and 1:100 year flows to the pre-development 1:5 year release rate.
- Provide a *Normal* level of water quality treatment corresponding to 70% long-term removal of total suspended solids (TSS).
- Provide guidelines to ensure that site preparation and construction is in accordance with the current Best Management Practices for Erosion and Sediment Control.

3.3.2 Storm Drainage Areas

The proposed site has been subdivided into ten distinct storm drainage areas for the post-development condition. The size and location of the catchment areas are based on the proposed grading design for the site. The runoff coefficients for each catchment area were calculated for the proposed conditions. The catchment areas are shown on the Stormwater Management Plan (113023-SWM) and a brief description of the areas are as follows:

- The uncontrolled catchment (Area A1) will outlet into the existing ditches along Station Road, March Road and the existing railway lands; and,
- The 5 proposed building's rooftops (Area B1 – Area B5) will be controlled using two control flow roof drains per building, with the exception of the small car wash roof (Area B3) which will be controlled by a single control flow roof drain. The controlled rooftop flows will be conveyed internally to the building storm services connecting to the on-site storm sewer system;
- Runoff from the proposed Tim Horton's drive through and grassed areas adjacent to building (Area A2) will be controlled and stored on the surface at CB 1;
- Runoff from the proposed Tim Horton's parking lot (Area A3) will be controlled and stored on the surface at CBMH's 2, 3 and 4;
- Runoff from the proposed Gas Bar parking area, drive aisles and grassed areas adjacent to building (Area A4) will be controlled and stored on the surface at CBMH's 5, 6, 7, 8, 9 and 10;
- Runoff from the proposed Office building and A&W parking lots as well as the grassed areas adjacent to the buildings (Area A5) will be controlled and stored on the surface at CBMH's 11, 12, 13 and 14;
- The controlled flow from all on-site surface drainage areas (Areas A2, A3, A4 and A5) will be conveyed to the on-site storm sewer system upstream of the proposed oil/grit separator unit.

Post-development runoff for the 1:100 year design event will be controlled to the calculated allowable release rate. The post-development runoff for the 1:5 year design event will be over-controlled to less than the allowable flow from the site. The entire site will be graded to provide a major system overflow route towards Station Road to the north.

3.3.3 Allowable Release Rate

The City of Ottawa has specified that the release rate from the site be limited to the 1:5 year pre-development release rate for both the 1:5 year and 1:100 year post-development design events. The allowable release rate is therefore calculated to be 71.1 L/s. Refer to **Appendix D** for detailed tables and calculations.

3.3.4 Post-Development Conditions

Under post-development conditions, the imperviousness of the site will increase. In order to mitigate the stormwater related impacts due to the proposed development, post-development flows will have to be controlled and stored on site via rooftop storage, surface storage and underground storage pipes prior to the runoff entering the existing March Road municipal storm sewers. The municipal storm sewers are ultimately tributary to the Kizell Drain in Kanata. Refer to **Appendix D** for uncontrolled runoff calculations for the sub catchments areas for the site.

Area A1 – Direct Runoff

The post-development runoff was calculated using the Rational Method to be 5.2 L/s and 10.5 L/s for the 1:5 year and 1:100 year design events respectively. Refer to **Appendix D** for Rational Method tables and calculations.

Area A2 – Tim Horton's Drive Through

The post-development flows from sub-catchment Area A2 will be attenuated by the use of an IPEX LMF 'Tempest' Vortex type ICD installed within the outlet pipe of proposed CB 1. Stormwater runoff from this drainage area will be temporarily stored underground and on the paved surface surrounding CB 1 prior to being discharged into the on-site storm sewer system.

The Modified Rational Method was used to determine the storage volume required for this catchment area. Based on a release rate of 4.1 L/s, the required storage volume for the 1:100 year design event was calculated to be approximately 38.3 m^3. Refer to **Appendix D** for detailed tables and calculations. The storage will be achieved within the proposed catchbasin as well as on the surface of the drive through lanes. The proposed structure along with the surface drive through area provides an approximate storage volume of 48.3 m^3 up to an elevation of 83.35 m.

Table 3.3.1 summarizes the post-development design flows from Area A2 as well as the type of ICD, the design flow, design head, storage volumes required and storage volume for both the 1:5 year and the 1:100 year design events.

Table 3.3.1: Area A2 Design Flow and ICD Information

Design Event	Drainage Area A2				
	Post-Development Flow				
	IPEX LMF Type ICD	Design Flow (L/s)	Water Design Head (m) *	Volume Required (m^3)	Volume Provided (m^3)
1:5 Year	'Tempest' Vortex	4.0 L/s	1.38 m	15.5 m^3	48.3 m^3
1:100 Year	'Tempest' Vortex	4.1 L/s	1.47 m	38.3 m^3	48.3 m^3

*Water Design Head is calculated from the water elevation to center of the orifice.

Refer to **Appendix D** for Rational Method calculations, Modified Rational Method calculations and stage storage curves and to **Appendix E** for Ipex LMF Tempest Vortex ICD information.

Area A3 – Tim Horton's Parking Lot

The post-development flows from sub-catchment Area A3 will be attenuated by the use of an IPEX LMF 'Tempest' Vortex type ICD installed within the outlet pipe of proposed CBMH 2. Stormwater runoff from this drainage area will be temporarily stored underground and on the parking surface surrounding CBMH 2, 3, and 4 prior to being discharged into the on-site storm sewer system.

The Modified Rational Method was used to determine the storage volume required for this catchment area. Based on a release rate of 4.4 L/s, the required storage volume for the 1:100 year design event was calculated to be approximately 56.1 m^3. Refer to **Appendix D** for detailed calculations. The proposed 40.8 m of 600 mm dia. oversized storm pipe between CBMH 2 and CBMH 4 along with the three 1200 mm dia. CBMH's and the parking lot surface provide an approximate storage volume of 103.1 m^3 up to an elevation of 83.50 m.

Table 3.3.2 summarizes the post-development design flows from Area A3 as well as the type of ICD, the design flow, design head, storage volumes required and storage volume provided for both the 1:5 year and the 1:100 year design events.

Table 3.3.2 - Area A3 Design Flow and ICD Information

Design Event	Drainage Area A3				
	Post-Development Flow				
	IPEX LMF Type ICD	Design Flow (L/s)	Water Design Head (m) *	Volume Required (m^3)	Volume Provided (m^3)
1:5 Year	'Tempest' Vortex	4.3 L/s	1.52 m	23.6 m^3	103.1 m^3
1:100 Year	'Tempest' Vortex	4.4 L/s	1.59 m	56.1 m^3	103.1 m^3

*Water Design Head is calculated from the water elevation to center of the orifice.

Refer to **Appendix D** for Rational Method calculations, Modified Rational Method calculations and stage storage curves and to **Appendix E** for Ipex LMF Tempest Vortex ICD information.

Area A4 – Gas Bar Parking Lot

The post-development flows from sub-catchment Area A4 will be attenuated by the use of a 112mm diameter Plug Type ICD installed within the outlet pipe of proposed STM MH 3. Stormwater runoff from this drainage area will be temporarily stored underground and on the parking surface surrounding CBMH's 5, 6, 7, 8, 9 and 10 prior to being discharged into the on-site storm sewer system.

The Modified Rational Method was used to determine the storage volume required for this catchment area. Based on a release rate of 33.9 L/s, the required storage volume for the 1:100 year design event was calculated to be approximately 94.8 m^3. Refer to **Appendix D** for detailed calculations. The proposed 137.9 m of 600 mm dia. oversized storm pipe between CBMH 2 and CBMH 10 along with the four 1200 mm dia. CBMH's, the three 1500 mm dia. CBMH's, one CB and the parking lot surface provide an approximate storage volume of 94.8 m^3 up to an elevation of 83.48 m.

Table 3.3.3 summarizes the post-development design flows from Area A4 as well as the type of ICD, the design flow, design head, storage volumes required and storage volume provided for both the 1:5 year and the 1:100 year design events.

Table 3.3.3 - Area A4 Design Flow and ICD Information

Design Event	Drainage Area A4				
	Post-Development Flow				
	Circular Plug Type ICD	Design Flow (L/s)	Water Design Head (m) *	Volume Required (m^3)	Volume Provided (m^3)
1:5 Year	112mm Diameter Orifice	22.2 L/s	0.67 m	45.0 m^3	94.8 m^3
1:100 Year	112mm Diameter Orifice	33.9 L/s	1.55 m	94.8 m^3	94.8 m^3

*Water Design Head is calculated from the water elevation to center of the orifice.

The 112mm diameter orifice located in the outlet pipe of STM MH 3 has been sized to include a small portion of off-site tributary drainage area (0.008 ha from the south access road to March Road) as well as the upstream controlled flow from the Gas Bar roof and the Car Wash roof. Refer to **Appendix D** for Rational Method tables, Modified Rational Method calculations and stage storage curves and **Appendix H** for details.

Area A5 – Office Building / A&W Parking Lot

The post-development flows from sub-catchment Area A5 will be attenuated by the use of a 75mm diameter Plug Type ICD installed within the outlet pipe of proposed STM MH 4. Stormwater runoff from this drainage area will be temporarily stored underground and on the parking surface surrounding CBMH's 11, 12, 13 and 14 prior to being discharged into the on-site storm sewer system.

The Modified Rational Method was used to determine the storage volume required for this catchment area. Based on a release rate of 16.7 L/s, the required storage volume for the 1:100 year design event was calculated to be approximately 131.3 m^3. Refer to **Appendix D** for detailed calculations. The proposed 105.2 m of 600 mm dia. oversized storm pipe between STM MH 4, CBMH 13 and CBMH 14 along with the three 1200 mm dia. CBMH's, one 1500 mm dia. CBMH, one 1500mm x 1800mm STM MH and the parking lot surface provide an approximate storage volume of 145.7 m^3 up to an elevation of 83.45 m.

Table 3.3.4 summarizes the post-development design flows from Area A5 as well as the type of ICD, the design flow, design head, storage volumes required and storage volume provided for both the 1:5 year and the 1:100 year design events.

Table 3.3.4 - Area A5 Design Flow and ICD Information

Design Event	Drainage Area A5				
	Post-Development Flow				
	Circular Plug Type ICD	Design Flow (L/s)	Water Design Head (m) *	Volume Required (m^3)	Volume Provided (m^3)
1:5 Year	78mm Diameter Orifice	15.9 L/s	1.46 m	51.8 m^3	145.7 m^3
1:100 Year	78mm Diameter Orifice	16.7 L/s	1.60 m	131.3 m^3	145.7 m^3

*Water Design Head is calculated from the water elevation to center of the orifice.

The 78mm diameter orifice located in the outlet pipe of STM MH 4 has been sized to include the upstream controlled flow from the Office building roof and the A&W roof. Refer to **Appendix D** for Rational Method tables, Modified Rational Method calculations and stage storage curves for details.

Area B1 – Tim Horton's Roof

The post-development flow from Area B1 will be attenuated by the use of controlled flow roof drains. A total of 2 adjustable flow control roof drains will control the flow from the proposed building to 1.52 L/s/ for both the 1:5 year design event and the 1:100 year design event.

The controlled release rate, ponding depth, required and maximum storage volumes for both the 1:5 year and 1:100 year design events are summarized in the following table.

Table 3.3.5: Area B1 Tim Horton's Roof Drains

Watts Flow Control Roof Drains			RD-100-A-ADJ set to Closed		
Design Event	Flow/Drain (L/s)	Total Flow (L/s)	Ponding (cm)	Storage (m^3)	
				Required	Provided
1:5 Year	0.76	1.52	7	3.4	9.4
1:100 Year	0.76	1.52	10	8.9	9.4

Refer to **Appendix D** for Modified Rational Method calculations and **Appendix F** for Watts adjustable flow control roof drain information.

Area B2 – Gas Bar Roof

The post-development flow from Area B2 will be attenuated by the use of controlled flow roof drains. A total of 2 adjustable flow control roof drains will control the flow from the proposed building to 1.52 L/s/ for both the 1:5 year design event and the 1:100 year design event.

The controlled release rate, ponding depth, required and maximum storage volumes for both the 1:5 year and 1:100 year design events are summarized in the following table.

Table 3.3.6: Area B2 Gas Bar Roof Drains

Watts Flow Control Roof Drains			RD-100-A-ADJ set to Closed		
Design Event	**Flow/Drain (L/s)**	**Total Flow (L/s)**	**Ponding (cm)**	**Storage (m^3)**	
				Required	**Provided**
1:5 Year	0.76	1.52	7	4.1	10.4
1:100 Year	0.76	1.52	10	10.4	10.4

Refer to **Appendix D** for Modified Rational Method calculations and **Appendix F** for Watts adjustable flow control roof drain information.

Area B3 – Car Wash Roof

The post-development flow from Area B3 will be attenuated by the use of a controlled flow roof drain. A single adjustable flow control roof drain will control the flow from the proposed building to 0.95 L/s/ for the 1:5 year design event and 1.14 L/s for the 1:100 year design event.

The controlled release rate, ponding depth, required and maximum storage volumes for both the 1:5 year and 1:100 year design events are summarized in the following table.

Table 3.3.7: Area B3 Car Wash Roof Drain

Watts Flow Control Roof Drain			RD-100-A-ADJ set to1/2 Exposed		
Design Event	**Flow/Drain (L/s)**	**Total Flow (L/s)**	**Ponding (cm)**	**Storage (m^3)**	
				Required	**Provided**
1:5 Year	0.95	0.95	8	1.6	3.9
1:100 Year	1.14	1.14	10	3.9	3.9

Refer to **Appendix D** for Modified Rational Method calculations and **Appendix F** for Watts adjustable flow control roof drain information.

Area B4 – A&W Roof

The post-development flow from Area B4 will be attenuated by the use of controlled flow roof drains. A total of 2 adjustable flow control roof drains will control the flow from the proposed building to 0.95 L/s/ for the 1:5 year design event and 1.52 L/s for the 1:100 year design event.

The controlled release rate, ponding depth, required and maximum storage volumes for both the 1:5 year and 1:100 year design events are summarized in the following table.

Table 3.3.8: Area B4 A&W Roof Drains

Watts Flow Control Roof Drains			RD-100-A-ADJ set to Fully Exposed		
Design Event	**Flow/Drain (L/s)**	**Total Flow (L/s)**	**Ponding (cm)**	**Storage (m^3)**	
				Required	**Provided**
1:5 Year	0.95	1.90	7	2.6	5.7
1:100 Year	1.52	3.04	10	5.6	5.7

Refer to **Appendix D** for Modified Rational Method calculations and **Appendix F** for Watts adjustable flow control roof drain information.

Area B5 – Office Building Roof

The post-development flow from Area B5 will be attenuated by the use of a controlled flow roof drain. A single adjustable flow control roof drain will control the flow from the proposed building to 2.08 L/s/ for the 1:5 year design event and 2.64 L/s for the 1:100 year design event.

The controlled release rate, ponding depth, required and maximum storage volumes for both the 1:5 year and 1:100 year design events are summarized in the following table.

Table 3.3.9: Area B5 Office Building Roof Drains

Watts Flow Control Roof Drains			RD-100-A-ADJ set to Fully Exposed		
Design Event	**Flow/Drain (L/s)**	**Total Flow (L/s)**	**Ponding (cm)**	**Storage (m^3)**	
				Required	**Provided**
1:5 Year	1.04	2.08	7	5.3	13.7
1:100 Year	1.32	2.64	9	12.3	13.7

Refer to **Appendix D** for Modified Rational Method calculations and **Appendix F** for Watts adjustable flow control roof drain information.

Summary of Post-Development Flows

Table 3.4: Post-Development Stormwater Flow Table

Post - Development Flows						
Area	Description	Flow (L/s)		Storage Required (m^3)		Provided (m^3)
		5 year	100 year	5 year	100 year	
A1	Direct Runoff	5.2	10.5	-	-	-
A2	Tim Horton's Drive Through	4.0	4.1	15.5	38.3	48.3
A3	Tim Horton's Parking	4.3	4.4	23.6	56.1	103.1
A4	Gas Bar Parking + Car Wash Roof + Gas Bar Roof	22.2	33.9	50.7	109.1	107.5
A5	Office / A&W Parking + Office Roof + A&W Roof	15.9	16.7	59.8	149.2	165.1
B1	Tim Horton's Roof	1.52	1.52	3.4	8.9	9.4
	Total Flow =	**53.1**	**71.1**			

As indicated in **Table 3.4** the total post-development flow from the sub-catchment areas will be released from the proposed development at a combined maximum rate of 71.1 L/s during the 1:100 year design event and 53.1 L/s during the 1:5 year design event; both of which are less than or equal to the allowable flow of 71.1 L/s for the site.

3.3.5 Water Quality

In order to provide on-site water quality control, a new CDS Model PMSU 2015_5 oil-grit separator is being proposed. The in-line treatment unit will be installed downstream of STM MH 1, directly on the proposed 375mm dia. outlet pipe for the on-site storm sewer system. Stormwater runoff from a 1.23 ha tributary area will be directed through the proposed treatment unit. The tributary area includes all of the proposed paved parking areas, the building roofs as well as the adjacent landscaped areas on-site.

The proposed CDS Model PMSU 2015_5 oil-grit separator will provide an enhanced level of water quality control prior to discharging the stormwater towards the municipal storm sewer system in March Road. The target level of protection is a long-term average removal of 70% of total suspended solids (TSS). Echelon Environmental and Contech Stormwater Solutions Inc. have modeled and analyzed the tributary area to provide a CDS unit capable of meeting the TSS removal requirements. The model parameters for the TSS removal were based on historical rainfall data for Ottawa from the Ontario Climate Centre. It was determined that a CDS Model PMSU 2015_5 will exceed the target removal rate, providing a net annual 71.5% TSS removal. The CDS unit has a treatment capacity of approximately 20 L/s, a sediment storage capacity of 1.3m^3, a minimum oil storage capacity of 348 L and will treat a net annual volume of approximately 90.5% for the tributary area.

It is recommended that the client conduct a routine inspection of the on-site storm drainage system (at least annually) to ensure that it is clean and operational. In order to maintain the stormwater management system, care should be taken to ensure proper condition and operation of the storm sewer system and the CDS treatment unit. The CDS unit should be inspected at regular intervals and maintained when necessary to ensure optimum performance.

Refer to **Appendix G** for the CDS unit operation, design, performance and maintenance summary parameters as well as the annual TSS removal efficiency data.

4.0 SITE GRADING

The intent of the grading design was to propose building finished floor elevations to best tie into the elevations along the existing adjacent roadways and property lines. The proposed grading design provides positive drainage away from the buildings and towards the on-site drainage structures. The site stormwater management criterion is stringent and requires a substantial amount of storage to limit the post-development flow to the allowable flow rate from the site. In order to achieve the required storage it is most feasible to provide surface storage where attainable. In the event of a rainfall event exceeding the 1:100 year storm event, stormwater runoff will cascade over the site high points towards the access point off Station Road.

4.1 Major System Overflow Route

In the case of a major rainfall event exceeding the design storms provided for, the stormwater will:

- pond to a maximum of 0.10 m on the rooftops before overflowing through the scuppers, off the building rooftops to the ground surface below;
- flow on the ground surface ponding to a maximum depth of 0.30 m within the paved parking areas before cascading to adjacent catchment areas and ultimately to Station Road to the north.

The major system overflow route is shown on the enclosed Grading Plan (113023-GR) and the Stormwater Management Plan (113023-SWM).

4.2 Erosion and Sediment Control

Erosion and sediment control measures will be implemented during construction in accordance with the "Guidelines on Erosion and Sediment Control for Urban Construction Sites" (Government of Ontario, May 1987). Details are provided on the Grading and Erosion & Sediment Control Plan (113023-GR).

- All erosion and sediment control measures are to be installed to the satisfaction of the engineer, the municipality and the conservation authority prior to undertaking any site alterations (filling, grading, removal of vegetation, etc.) and remain present during all phases of site preparation and construction.
- A qualified inspector should conduct daily visits during construction to ensure that the contractor is working in accord with the design drawings and that mitigation measures are being implemented as specified.
    - A light duty silt fence barrier is to be installed in the locations shown on the Erosion and Sediment Control Plan.
    - Filter cloth is to be placed under the grates of all proposed and existing catchbasins and catchbasin manhole drainage structures.
    - After complete build-out, all sewers are to be inspected and cleaned and all sediment and construction fencing is to be removed.

- The contractor shall ensure that proper dust control is provided with the application of water (and if required, calcium chloride) during dry periods.
- The contractor shall immediately report to the engineer or inspector any accidental discharges of sediment material into any ditch or sewer system. Appropriate response measures shall be carried out by the contractor without delay.
- The contractor acknowledges that failure to implement erosion and sediment control measures may result in penalties imposed by any applicable regulatory agency.

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

5.0 GEOTECHNICAL INVESTIGATIONS

A Geotechnical Investigation Report has been prepared for the proposed site. Refer to the Houle Chevrier Engineering 'Geotechnical Investigation Report' (Ref. No. 13-339), dated November 2013 for subsurface conditions, construction recommendations and geotechnical inspection requirements.

6.0 SUMMARY AND CONCLUSIONS

This report has been prepared in support of the site plan application and zoning by-law amendment for the proposed development located at 401 March Road, Kanata, in the City of Ottawa.

The conclusions are as follows:

- The proposed development will be serviced by connecting to the existing storm sewer system, and watermain along Station Road.
- The proposed development will be serviced by connecting to the existing sanitary sewer system along March Road.
- A new fire hydrant will be installed on-site to provide adequate fire protection for the proposed development.
- There will be an increase of approximately 1.95 L/s to the existing 450 mm dia. sanitary sewer along March Road. The existing 450 mm dia. sanitary sewer at the connection from the site has an approximate full flow capacity of approximately 232 L/s.
- Stormwater management for the site will be provided by rooftop storage, equipped with adjustable flow control roof drains, underground pipe storage and surface storage, which has been adequately sized to provide the required storage in order to control the 100-year post-development flow and over control the 5 year flow from the site to the allowable release rate of 71.1 L/s.
- Water quality control will be provided by the installation of a CDS Model PMSU 2015_5 treatment unit installed on-site downstream of sub catchment areas A2, A3, A4 and A5. The treatment unit will provide permanent erosion and sediment control measures (71.5% TSS removal) exceeding the minimum 70% TSS removal target, prior to releasing flow from the site.

- Temporary erosion and sediment control measures will be implemented during all phases of construction.

Servicing assessments discussed in the preceding sections show that there are no major obstacles to servicing the proposed development. It is recommended that the proposed site servicing and stormwater management design be approved for implementation.

NOVATECH ENGINEERING CONSULTANTS LTD.

Prepared by:

Stephen Matthews
Design Technologist

Reviewed by:

LICENSED PROFESSIONAL ENGINEER
M. SAVIC
100102651
DEC 20/13
PROVINCE OF ONTARIO

Miroslav Savic, P. Eng.
Project Manager

APPENDIX A

Correspondence

Miro Savic

From:	Kuruvilla, Santhosh <Santhosh.Kuruvilla@ottawa.ca>
Sent:	July-19-13 12:36 PM
To:	Miro Savic
Cc:	Xu, Lily
Subject:	RE: 401 March Road - SWM Criteria

Hi Miro,

Regarding the allowable discharge from the site, please follow City of Ottawa Sewer Design Guidelines, Second Edition, October 2012, Section 8.3.6.
Regarding the water quality requirements, please contact the Conservation Authority.
You may also contact the MOE for their requirements.

If you have any further questions, please let me know.

Thanks

Santhosh Kuruvilla, P.E., P.Eng.
(613)580-2424, ext. 27599

From: Miro Savic [mailto:m.savic@novatech-eng.com]
Sent: July 19, 2013 11:20 AM
To: Kuruvilla, Santhosh
Subject: 401 March Road - SWM Criteria

Hello Santhosh,

As per bullet 9 below from the 401 March Road pre-consultation meeting, I understand that we need to control the post-development flow from the site to the pre-development level: 1:5 year post = 1:5 year pre; 1:100 year post = 1:100 year pre.

Please confirm,
Miro

Miroslav Savic, P.Eng.
Project Manager
****
Novatech Engineering Consultants Ltd.
Suite 200, 240 Michael Cowpland Drive
Kanata . Ontario . Canada . K2M 1P6
Tel: (613) 254-9643 x265
Fax: (613) 254-5867
Email: m.savic@novatech-eng.com
Web: http://www.novatech-eng.com

From: Xu, Lily [mailto:Lily.Xu@ottawa.ca]
Sent: Wednesday, March 13, 2013 2:20 PM
To: Murray Chown
Cc: Alyson Mann; Jennifer Luong; Young, Mark; Alvey, Harry; Blaszynski, Ed; Siddique, Jabbar; ccunningham@mvc.on.ca
Subject: 401 March - pre-consult follow up - Study List & staff comments

Murray,

Following our Pre-Application Consultation on March 8, 2013, please find the attached "Applicant's Study and Plan Identification List" for Rezoning and Site Plan applications. This List identifies the number of copies required for each report and plan in order to deem the applications complete. PDF files are needed for all required reports and plans. Also attached are the draft conditions of previously approved site plan.

Furthermore, please find preliminary comments from staff:

Land Use:

1. Please ensure proposed uses are under the Official Plan's envelop for employment ancillary uses, such as "recreational, health and fitness uses, child care, and service commercial uses (e.g. convenience store, doctor and dentist office, shoe repair shop, coffee shop, restaurant, bank, dry-cleaning outlet, service station or gas bar)". Please refer to industrial parent zones (IG, IP, IL) for the list of uses. Note "retail" is not a defined use under the zoning by-law. A "retail store" is unlikely supportable.

Transportation

2. Kanata North Transitway will be an at-grade facility; however, the draft Environmental Project Report clearly states, "...a grade separation at the railway crossing will be protected for." The two access points proposed at March Road may restrict future grade separation of March Road at the railway crossing, and may be permitted only if the property owner agrees to close these access points without any compensation when grade separation is required. OP requires protection of additional rights-of-way in the shape of a triangle (15m x 170m) at each corner, where there is an existing at-grade crossing of a city road and a railway line.
3. OP also identifies that 44.5m ROW is required along March Road corridor between Urban area limit and Teron (south end). The EA study for Kanata North Transitway is underway and its functional design (approved by TRC/Council) has recommended a transitway station at Carling-Station/March Road intersection. The Transportation EA group (Jabbar) are working with our consultant to determine, if additional land (on top of 44.5m) is required to accommodate elements of roadway cross-section including transitway station which sits very close to the proposed site. Will update soon to confirm ROW requirements in this area.
4. Lands for road widening and grade separation will be taken at the time of site plan registration.
5. The 'Restaurant' building (abutting March Road) seems to be sitting very close to the existing property line which will require adjustments as per new ROW requirements.
6. It is preferred that the access from Station Road be lined up with the access point across the road; if this is not achievable, minimum separation distance (15 metres) between the two accesses has to be met.
7. If road work is required, existing bus bay on March Road may be eliminated.
8. Sidewalk is not required along Station Road

Servicing

9. The Mississippi Valley Conservation was consulted and recommended a requirement to match the post-development runoff quantity to the pre-development runoff quantity, or to demonstrate that all downstream channels and in-water structures have the capacity to withstand any change in flows and that all downstream landowners will accept the changes. This site will drain into Kizell Drain, which supports fish habitat. A long-term average removal of 70% of suspended solids is therefore required. Please touch base with MVC (contact: Craig Cunningham, ccunningham@mvc.on.ca) on this matter.
10. Please contact MOE regarding the storm and sanitary sewers and what the intent is for the property. If the site is to be set-up as a commercial condominium this will require a joint use agreement for any common use pipes; if the site is to be a rental property where the floor space is rented to the different retailers this is less of an

issue. Regarding Storm and Sanitary sewer impact statements please address the differences if any between what was originally proposed and what they are currently proposing. If there is no change or reduce volume then there is no issue, however if there is an increase in volume this will have to be addressed.

Urban Design

11. It is suggested to group the buildings at the perimeter (and corner) of site to achieve a better site orientation.
12. Please design the site to accommodate direct and convenient pedestrian access through the site.
13. Landscaping will be required along the perimeter of the site, though focus shall be placed at the intersection and along March road.
14. Please refer to City's urban design guidelines for gas stations and drive-through facilities.
15. Please provide bicycle parking as per the Zoning.

Other

16. 2% of Parkland dedication in cash-in-lieu will be taken at site plan registration.

Hope the above is of help. Please feel free to let us know should you have any further questions.

Yours truly

Lily Xu, MPL, MCIP, RPP, LEED Green Assoc.
Planner II, Development Review (Suburban Services)
Planning and Growth Management Department
City of Ottawa, 110 Laurier Ave W. Ottawa, ON K1P 1J1 mail code: 01-14
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Miro Savic

From: Craig Cunningham <CCunningham@mvc.on.ca>
Sent: October-01-13 3:13 PM
To: Miro Savic
Cc: Murray Chown; Myra Lavoie
Subject: RE: 401 March Road - Stormwater Quality Criteria

Miro,

I have spoken with our engineering staff. There will be a requirement to match the post-development runoff quantity to the pre-development runoff quantity, or to demonstrate that all downstream channels and in-water structures have the capacity to withstand any change in flows and that all downstream landowners will accept the changes. This site drains into Kizell Drain, which supports fish habitat. A long-term average removal of 70% of suspended solids is therefore required.

Hope this helps.

Craig

Craig Cunningham | Environmental Planner (Ottawa) | Mississippi Valley Conservation Authority
10970 Highway 7, Carleton Place, Ontario K7C 3P1
www.mvc.on.ca |t. 613 253 0006 ext. 229| f. 613 253 0122 | ccunningham@mvc.on.ca

Mississippi Valley Conservation Authority

From: Miro Savic [mailto:m.savic@novatech-eng.com]
Sent: September-30-13 10:45 AM
To: Craig Cunningham
Cc: Murray Chown
Subject: 401 March Road - Stormwater Quality Criteria

Hello Craig,

We are working on the proposed development located at 401 March Road (see attached aerial photo of the site). The development proposal consists of an office building, a gas station, a fast food restaurant, and a coffee shop with drive thru.

At the pre-consultation meeting with the City of Ottawa held on March 8, 2013 we were advised that a long term removal of 70% of TSS is required.
Please confirm the stormwater quality criteria for the site.

Regards,
Miro

Miroslav Savic, P.Eng.
Project Manager
****
Novatech Engineering Consultants Ltd.
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APPENDIX B

Development Servicing Study Checklist

Development Servicing Study Checklist

4.1 General Content	Addressed (Y/N/NA)	Comments
Executive Summary (for larger reports only).	N/A	
Date and revision number of the report.	Y	
Location map and plan showing municipal address, boundary, and layout of proposed development.	Y	
Plan showing the site and location of all existing services.	Y	
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.	N	Refer to Site Plan
Summary of Pre-consultation Meetings with City and other approval agencies.	Y	
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.	N/A	
Statement of objectives and servicing criteria.	Y	
Identification of existing and proposed infrastructure available in the immediate area.	Y	
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).	Y	
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 neighboring properties. This is also required to confirm that the proposed grading will not impede existing major system flow paths.	Y	Refer to Engineering Drawings

Development Servicing Study Checklist

4.1 General Content	Addressed (Y/N/NA)	Comments
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.	N/A	
Reference to geotechnical studies and recommendations concerning servicing.	Y	
All preliminary and formal site plan submissions should have the following information:		
Metric scale	Y	
North arrow (including construction North)	Y	
Key plan	Y	
Name and contact information of applicant and property owner	Y	
Property limits including bearings and dimensions	Y	
Existing and proposed structures and parking areas	Y	
Easements, road widening and rights-of-way	Y	
Adjacent street names	Y	

Development Servicing Study Checklist

4.2 Water	Addressed (Y/N/NA)	Comments
Confirm consistency with Master Servicing Study, if available.	N/A	
Availability of public infrastructure to service proposed development.	Y	
Identification of system constraints.	N/A	
Identify boundary conditions.	Y	Provided by City of Ottawa
Confirmation of adequate domestic supply and pressure.	Y	
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.	Y	
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.	Y	
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.	Y	
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.	Y	
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.	Y	
Provision of a model schematic showing the boundary conditions locations, streets, parcels, and building locations for reference.	Y	

Development Servicing Study Checklist

4.3 Wastewater	Addressed (Y/N/NA)	**Comments**
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).	Y	
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.	Y	
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.	Y	
Description of proposed sewer network including sewers, pumping stations, and forcemains.	Y	
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.	N/A	

Development Servicing Study Checklist

4.4 Stormwater	**Addressed (Y/N/NA)**	**Comments**
Description of drainage outlets and downstream constraints including legality of outlet (i.e. municipal drain, right-of-way, watercourse, or private property).	Y	
Analysis of the available capacity in existing public infrastructure.	N/A	The allowable flow was provided by the City of Ottawa.
A drawing showing the subject lands, its surroundings, the receiving watercourse, existing drainage patterns and proposed drainage patterns.	Y	
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.	Y	
Water Quality control objective (basic, normal or enhanced level of protection based on the sensitivities of the receiving watercourse) and storage requirements.	Y	
Description of stormwater management concept with facility locations and descriptions with references and supporting information.	Y	
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.	Y	Refer to Appendix A
Confirm consistency with sub-watershed and Master Servicing Study, if applicable study exists.	N/A	
Storage requirements (complete with calcs) and conveyance capacity for 5 yr and 100 yr events.	Y	
Identification of watercourse within the proposed development and how watercourses will be protected, or, if necessary, altered by the proposed development with applicable approvals.	N/A	
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.	Y	
Any proposed diversion of drainage catchment areas from one outlet to another.	N/A	
Proposed minor and major systems including locations and sizes of stormwater trunk sewers, and SWM facilities.	Y	
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	

Development Servicing Study Checklist

4.4 Stormwater	Addressed (Y/N/NA)	Comments
Identification of municipal drains and related approval requirements.	Y	
Description of how the conveyance and storage capacity will be achieved for the development.	Y	
100 year flood levels and major flow routing to protect proposed development from flooding for establishing minimum building elevations (MBE) and overall grading.	Y	
Inclusion of hydraulic analysis including HGL elevations.	N/A	
Description of approach to erosion and sediment control during construction for the protection of receiving watercourse or drainage corridors.	Y	
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.	N/A	
Identification of fill constrains related to floodplain and geotechnical investigation.	N/A	

Development Servicing Study Checklist

4.5 Approval and Permit Requirements	Addressed (Y/N/NA)	Comments
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.)	N/A	

4.6 Conclusion	Addressed (Y/N/NA)	Comments
Clearly stated conclusions and recommendations.	Y	
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.	T.B.D.	
All draft and final reports shall be signed and stamped by a professional Engineer registered in Ontario.	Y	

APPENDIX C

Watermain and Fire Flow Calculations

401 March Road
Water Demand

Gas Bar	280 m^2
Number of Fuel Outlets	12
Average Day Demand	950 L/outlet/day
Average Day Demand	0.13 L/s
Maximum Day Demand	0.20 L/s
Peak Hour Demand	0.36 L/s
Car Wash	130 m^2
Number of Car Washes	120 avg.5/hr in 24hrs
Average Day Demand	400 L/wash/day
Average Day Demand	0.56 L/s
Maximum Day Demand	0.83 L/s
Peak Hour Demand	1.50 L/s
Tim Horton's	250 m^2
Number of Seats	60
Average Day Demand	400 L/seat/day
Average Day Demand	0.28 L/s
Maximum Day Demand	0.42 L/s
Peak Hour Demand	0.75 L/s
A&W	223 m^2
Number of Seats	40
Average Day Demand	125 L/seat/day
Average Day Demand	0.06 L/s
Maximum Day Demand	0.09 L/s
Peak Hour Demand	0.16 L/s
Office Building	372 m^2
Occupant Load	40 9.3 m^2/person
Average Day Demand	75 L/person/day
Average Day Demand	0.03 L/s
Maximum Day Demand	0.05 L/s
Peak Hour Demand	0.09 L/s
Total Average Day Demand	**1.06 L/s**
Total Maximum Day Demand	**1.59 L/s**
Total Peak Hour Demand	**2.86 L/s**

Fire Flow Calculations

As per Fire Underwriter's Survey Guidelines

Tim Hortons

PROJECT: 401 March Road

JOB#: 113023

		[yes/no]		
C	**Coefficient related to type of construction**			
	• Wood frame		1.5	
	• Ordinary construction	yes	1	
	• Non-combustible construction		0.8	
	• Fire resistive construction (< 2 hrs)		0.7	
	• Fire resistive construction (> 2 hrs)		0.6	
	• Interpolation (Using FUS Tables)			
A	**Area of structure - New Building (m^2)** *(All floors excluding Basement, under 2-Storeys)*	*250*	<==>	2,691 ft^2
F	**Required fire flow (L/min)**			
	$F = 220\ C\ (A)^{0.5}$			***3,479 L/min***
	Occupancy hazard reduction of surcharge	[yes/no]		
	• Non-combustible	yes	-25%	
	• Limited combustible		-15%	
	• Combustible		0%	
	• Free burning		15%	
	• Rapid burning		25%	
				2,609 L/min (1)
	Sprinkler Reduction			
	• Non-combustible - Fire Resistive (3)	no	50%	***0 L/min*** (2)
	Exposure surcharge (cumulative (%), 2 sides)	[yes/no]		
	0 - 3 m		25%	
	3.1 - 10 m		20%	
	10.1 - 20 m		15%	
	20.1 - 30 m		10%	
	30.1- 45 m		5%	
			Cumulative Total	**0%**
				0 L/min
	Fire Wall Separation			
	• Number of Party Walls * 1000 L/min	0 walls		
				0 L/min (3)

REQUIRED FIRE FLOW [(1) - (2) + (3)]		***2,609 L/min***
(2,000 L/min < Fire Flow < 45,000 L/min)	*or*	***44 L/s***
	or	***574 IGPM***

Fire Flow Calculations

As per Fire Underwriter's Survey Guidelines

Gas Station

PROJECT: 401 March Road

JOB#: 113023

C	**Coefficient related to type of construction**	[yes/no]			
	• Wood frame		1.5		
	• Ordinary construction	yes	1		
	• Non-combustible construction		0.8		
	• Fire resistive construction (< 2 hrs)		0.7		
	• Fire resistive construction (> 2 hrs)		0.6		
	• Interpolation (Using FUS Tables)				
A	**Area of structure - New Building (m^2)**	***280***	<==>	3,014 ft^2	
	(All floors excluding Basement, under 2-Storeys)				
F	**Required fire flow (L/min)**				
	$F = 220\ C\ (A)^{0.5}$			***3,681 L/min***	
	Occupancy hazard reduction of surcharge	[yes/no]			
	• Non-combustible	yes	-25%		
	• Limited combustible		-15%		
	• Combustible		0%		
	• Free burning		15%		
	• Rapid burning		25%		
				2,761 L/min	(1)
	Sprinkler Reduction				
	• Non-combustible - Fire Resistive (3)	no	50%	***0 L/min***	(2)
	Exposure surcharge (cumulative (%), 2 sides)	[yes/no]			
	0 - 3 m		25%		
	3.1 - 10 m		20%		
	10.1 - 20 m		15%		
	20.1 - 30 m	yes	10%	1 side 10%	
	30.1- 45 m		5%		
			Cumulative Total	**10%**	
				276 L/min	
	Fire Wall Separation				
	• Number of Party Walls * 1000 L/min	0 walls			
				276 L/min	(3)

REQUIRED FIRE FLOW [(1) - (2) + (3)]		***3,037 L/min***
(2,000 L/min < Fire Flow < 45,000 L/min)	*or*	***51 L/s***
	or	***669 IGPM***

Fire Flow Calculations

As per Fire Underwriter's Survey Guidelines

Gas Station

PROJECT: 401 March Road
JOB#: 113023

		[yes/no]			
C	**Coefficient related to type of construction**				
	• Wood frame		1.5		
	• Ordinary construction	yes	1		
	• Non-combustible construction		0.8		
	• Fire resistive construction (< 2 hrs)		0.7		
	• Fire resistive construction (> 2 hrs)		0.6		
	• Interpolation (Using FUS Tables)				
A	**Area of structure - New Building (m^2)**	*223*	<==>	2,400 ft^2	
	(All floors excluding Basement, under 2-Storeys)				
F	**Required fire flow (L/min)**				
	$F = 220\ C\ (A)^{0.5}$			***3,285 L/min***	
	Occupancy hazard reduction of surcharge	[yes/no]			
	• Non-combustible	yes	-25%		
	• Limited combustible		-15%		
	• Combustible		0%		
	• Free burning		15%		
	• Rapid burning		25%		
				2,464 L/min	(1)
	Sprinkler Reduction				
	• Non-combustible - Fire Resistive (3)	no	50%	***0 L/min***	(2)
	Exposure surcharge (cumulative (%), 2 sides)	[yes/no]			
	0 - 3 m		25%		
	3.1 - 10 m		20%		
	10.1 - 20 m	yes	15%	1 side 15%	
	20.1 - 30 m		10%		
	30.1- 45 m	yes	5%	1 side 5%	
			Cumulative Total	**20%**	
				493 L/min	
	Fire Wall Separation				
	• Number of Party Walls * 1000 L/min	0 walls			
				493 L/min	(3)

REQUIRED FIRE FLOW [(1) - (2) + (3)]		***2,957 L/min***
(2,000 L/min < Fire Flow < 45,000 L/min)	*or*	***50 L/s***
	or	***651 IGPM***

Fire Flow Calculations

As per Fire Underwriter's Survey Guidelines

Office Building

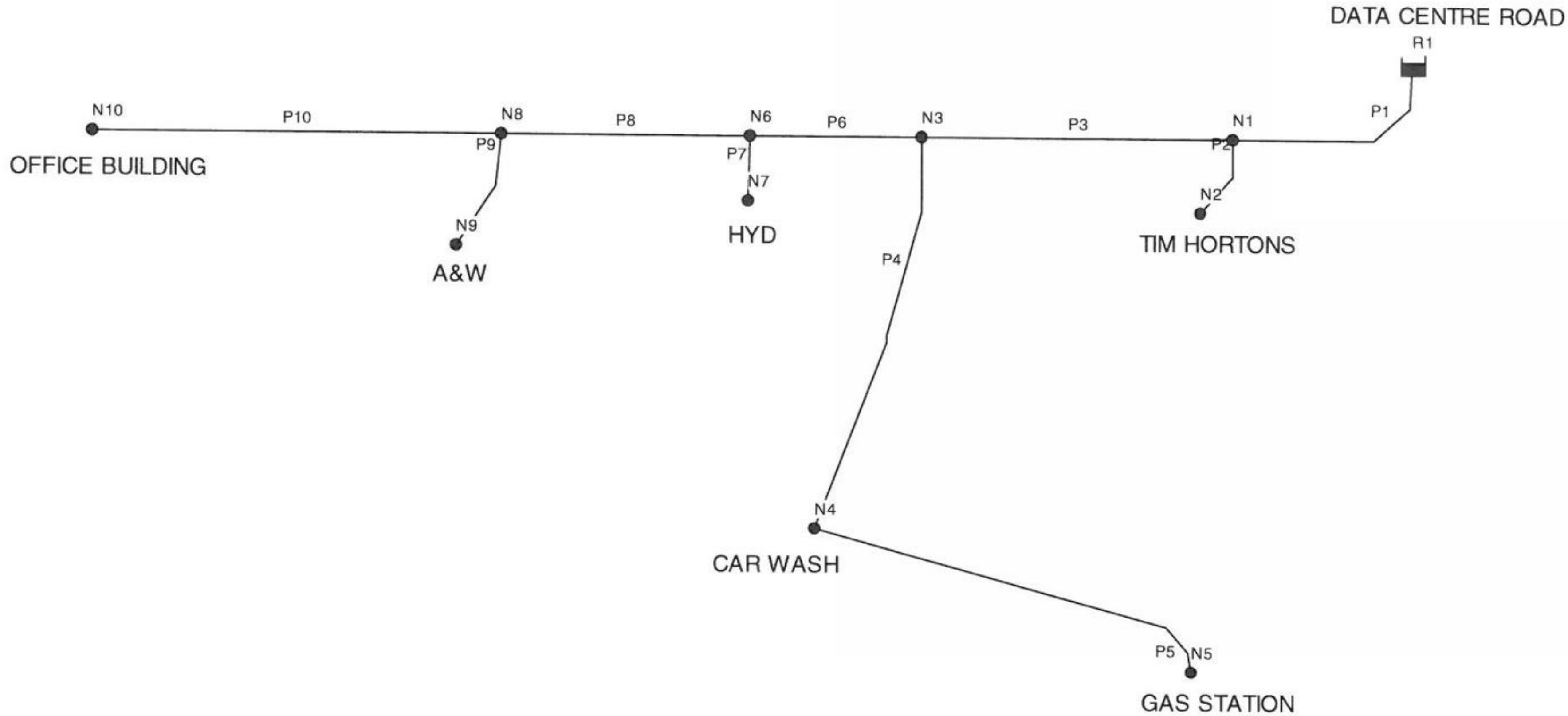
PROJECT: 401 March Road

JOB#: 113023

C	**Coefficient related to type of construction**	[yes/no]			
	• Wood frame		1.5		
	• Ordinary construction	yes	1		
	• Non-combustible construction		0.8		
	• Fire resistive construction (< 2 hrs)		0.7		
	• Fire resistive construction (> 2 hrs)		0.6		
	• Interpolation (Using FUS Tables)				
A	**Area of structure - New Building (m^2)**	*372*	<==>	4,004 ft^2	
	(All floors excluding Basement, under 2-Storeys)				
F	**Required fire flow (L/min)**				
	$F = 220\ C\ (A)^{0.5}$			***4,243 L/min***	
	Occupancy hazard reduction of surcharge	[yes/no]			
	• Non-combustible	yes	-25%		
	• Limited combustible		-15%		
	• Combustible		0%		
	• Free burning		15%		
	• Rapid burning		25%		
				3,182 L/min	(1)
	Sprinkler Reduction				
	• Non-combustible - Fire Resistive (3)	no	50%	***0 L/min***	(2)
	Exposure surcharge (cumulative (%), 2 sides)	[yes/no]			
	0 - 3 m		25%		
	3.1 - 10 m		20%		
	10.1 - 20 m		15%		
	20.1 - 30 m		10%		
	30.1- 45 m	yes	5%	1 side 5%	
			Cumulative Total	**5%**	
				159 L/min	
	Fire Wall Separation				
	• Number of Party Walls * 1000 L/min	0 walls			
				159 L/min	(3)

REQUIRED FIRE FLOW [(1) - (2) + (3)]		***3,342 L/min***
(2,000 L/min < Fire Flow < 45,000 L/min)	*or*	***56 L/s***
	or	***736 IGPM***

401 March Road



401 MARCH ROAD

Maximum Day + Fire Flow
Network Table - Nodes

	Elevation	Demand	Head	Pressure		
Node ID	m	LPS	m	m	kPa	psi
Junc N1	80.85	0	124.47	43.62	427.91	62.06
Junc N2	80.85	0.42	124.46	43.61	427.81	62.05
Junc N3	80.82	0	123.7	42.88	420.65	61.01
Junc N4	81.15	0.83	123.06	41.91	411.14	59.63
Junc N5	81.3	0.2	123.04	41.74	409.47	59.39
Junc N6	80.8	0	123.23	42.43	416.24	60.37
Junc N7	81.2	56	122.74	41.54	407.51	59.10
Junc N8	80.95	0	123.23	42.28	414.77	60.16
Junc N9	81.3	0.09	123.23	41.93	411.33	59.66
Junc N10	81.91	0.05	123.23	41.32	405.35	58.79
Resvr R1	125	-57.59	125	0	0.00	0.00

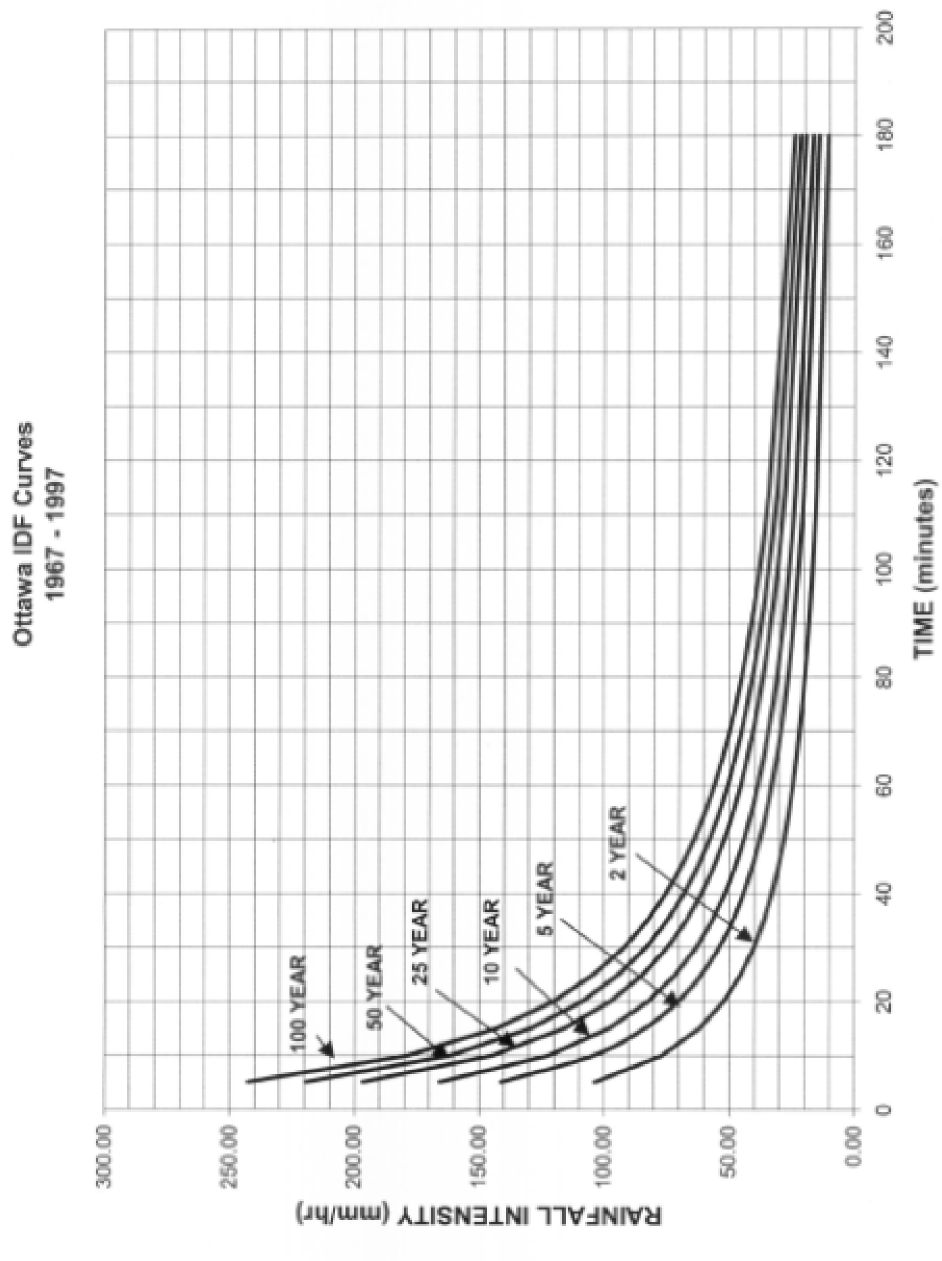
Peak Hour Demand
Network Table - Nodes

	Elevation	Demand	Head	Pressure		
Node ID	m	LPS	m	m	kPa	psi
Junc N1	80.85	0	125	44.15	433.11	62.82
Junc N2	80.85	0.75	124.97	44.12	432.82	62.77
Junc N3	80.82	0	125	44.18	433.41	62.86
Junc N4	81.15	1.5	123.08	41.93	411.33	59.66
Junc N5	81.30	0.36	123.02	41.72	409.27	59.36
Junc N6	80.80	0	125	44.2	433.60	62.89
Junc N7	81.20	0	125	43.8	429.68	62.32
Junc N8	80.95	0	125	44.05	432.13	62.68
Junc N9	81.30	0.16	124.99	43.69	428.60	62.16
Junc N10	81.91	0.09	124.99	43.08	422.61	61.30
Resvr R1	125.00	-2.86	125	0	0.00	0.00

APPENDIX D

Stormwater Calculations, IDF Curves, Storage Tables and Stage Storage Curves

APPENDIX 5-A OTTAWA INTENSITY DURATION FREQUENCY (IDF) CURVE



RATIONAL METHOD

The Rational Method was used to determine both the allowable runoff as well as the post-development runoff for the proposed site. The equation is as follows:

Q=2.78 CIA

Where:
Q is the runoff in L/s
C is the weighted runoff coefficient*
I is the rainfall intensity in mm/hr**
A is the area in hectares

*The weighted runoff coefficient is determined for each of the catchment areas as follows:

$$C = \frac{(A_p \times C_p) + (A_{gr} \times C_{gr}) + (A_f \times C_f) + (A_{imp} \times C_{imp})}{A_{tot}}$$

Where:
A_p is the pervious area in hectares
C_p is the pervious area runoff coefficient (C_{perv}=0.20)
A_{gr} is the gravel area in hectares
C_{gr} is the gravel area runoff coefficient (C_{gr}=0.60)
A_f is the soccer field area in hectares
C_f is the soccer field area runoff coefficient (C_f=0.80)
A_{imp} is the impervious area in hectares
C_{imp} is the impervious area runoff coefficient (C_{imp}=0.90)
A_{tot} is the catchment area (A_{perv} + A_{imp}) in hectares

** The rainfall intensity is taken from the City of Ottawa IDF Curves using a time of concentration (tc) of 10 minutes resulting in a rainfall intensity of 104.2mm/hr and 178.6mm/hr for the 1:5 year and 1:100 year design events respectively.

Note: The post-development C values are to be increased by 25% for the 1:100 year event (max. C_{imp}=1.0).

401 March Road Site

Pre - Development									
Area	Description	*A (ha)*	*Ai (ha)*	*Ap (ha)*	C_5	C_{100}	Uncontrolled Flow (L/s)		Allowable Site Flow (L/s)
							5 year	100 year	5 year
A0	Overall Site	1.228	0.000	1.228	0.20	0.25	71.1	152.4	**71.1**
			C=0.2	C=0.9					

Post - Development : Un-Controlled Site								
Area	Description	*A (ha)*	*Ai (ha)*	*Ap (ha)*	C_5	C_{100}	Uncontrolled Flow (L/s)	
							5 year	100 year
A1	Direct Runoff	0.056	0.010	0.046	0.32	0.38	5.2	10.5
A2	Tim Hortons DriveThru	0.124	0.085	0.039	0.68	0.76	24.4	47.0
A3	Tim Hortons Parking	0.144	0.123	0.021	0.80	0.89	33.3	63.7
A4	Gas Bar Parking	0.372	0.312	0.060	0.79	0.88	84.8	162.4
A5	Office/ A&W Parking	0.414	0.269	0.145	0.65	0.74	78.5	151.6
B1	Tim Horton's Roof	0.025	0.025	0.000	0.90	1.00	6.5	12.4
B2	Gas Bar Roof	0.028	0.028	0.000	0.90	1.00	7.3	13.9
B3	Car Wash Roof	0.013	0.013	0.000	0.90	1.00	3.4	6.5
B4	A&W Roof	0.023	0.023	0.000	0.90	1.00	6.0	11.4
B5	Office Building Roof	0.037	0.037	0.000	0.90	1.00	9.6	18.4
	A4 Offsite Tributary Area	-0.008						
	Area Check	1.228						
	Difference	0.000						

Post - Development : Controlled Site						
Area	Description	Flow (L/s)		Storage Required (m^3)		Provided (m^3)
		5 year	100 year	5 year	100 year	
A1	Direct Runoff	5.2	10.5	-	-	-
A2	Tim Hortons DriveThru	4.0	4.1	15.5	38.3	48.3
A3	Tim Hortons Parking	4.3	4.4	23.6	56.1	103.1
A4	Gas Bar Parking + Car Wash Roof + Gas Bar Roof	22.2	33.9	50.7	109.1	107.5
A5	Office / A&W Parking + Office Roof + A&W Roof	15.9	16.7	59.8	149.2	165.1
B1	Tim Horton's Roof	1.52	1.52	3.4	8.9	9.4
	Total Flow =	**53.1**	**71.1**			
	Over-Controlled	18.0	0.0			

401 March Road
PROJECT No. 113023
REQUIRED STORAGE - 1:5 YEAR EVENT
AREA A2 Controlled Flow - Surface Storage

OTTAWA IDF CURVE

Area =	0.124	ha	Qallow =	4.0	L/s
C =	0.68		Vol(max) =	15.5	m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	141.18	33.09	29.09	8.73
10	104.19	24.42	20.42	12.25
15	83.56	19.58	15.58	14.02
20	70.25	16.46	12.46	14.96
25	60.90	14.27	10.27	15.41
30	53.93	12.64	8.64	15.55
35	48.52	11.37	7.37	15.48
40	44.18	10.35	6.35	15.25
45	40.63	9.52	5.52	14.91
50	37.65	8.82	4.82	14.47
55	35.12	8.23	4.23	13.96
60	32.94	7.72	3.72	13.39
65	31.04	7.28	3.28	12.77
70	29.37	6.88	2.88	12.11
75	27.89	6.54	2.54	11.41
80	26.56	6.22	2.22	10.68
85	25.37	5.95	1.95	9.92
90	24.29	5.69	1.69	9.14

401 March Road
PROJECT No. 113023
REQUIRED STORAGE - 1:100 YEAR EVENT
AREA A2 Controlled Flow - Surface Storage

OTTAWA IDF CURVE

Area =	0.124	ha	Qallow =	4.1	L/s
C =	0.76		Vol(max) =	38.3	m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	242.70	63.93	59.83	17.95
10	178.56	47.03	42.93	25.76
15	142.89	37.64	33.54	30.19
20	119.95	31.60	27.50	32.99
25	103.85	27.35	23.25	34.88
30	91.87	24.20	20.10	36.18
35	82.58	21.75	17.65	37.07
40	75.15	19.79	15.69	37.66
45	69.05	18.19	14.09	38.04
50	63.95	16.85	12.75	38.24
55	59.62	15.71	11.61	38.30
60	55.89	14.72	10.62	38.24
65	52.65	13.87	9.77	38.09
70	49.79	13.11	9.01	37.86
75	47.26	12.45	8.35	37.56
80	44.99	11.85	7.75	37.20
85	42.95	11.31	7.21	36.79
90	41.11	10.83	6.73	36.34
95	39.43	10.39	6.29	35.84
100	37.90	9.98	5.88	35.30
105	36.50	9.61	5.51	34.74
110	35.20	9.27	5.17	34.14
115	34.01	8.96	4.86	33.51
120	32.89	8.66	4.56	32.87

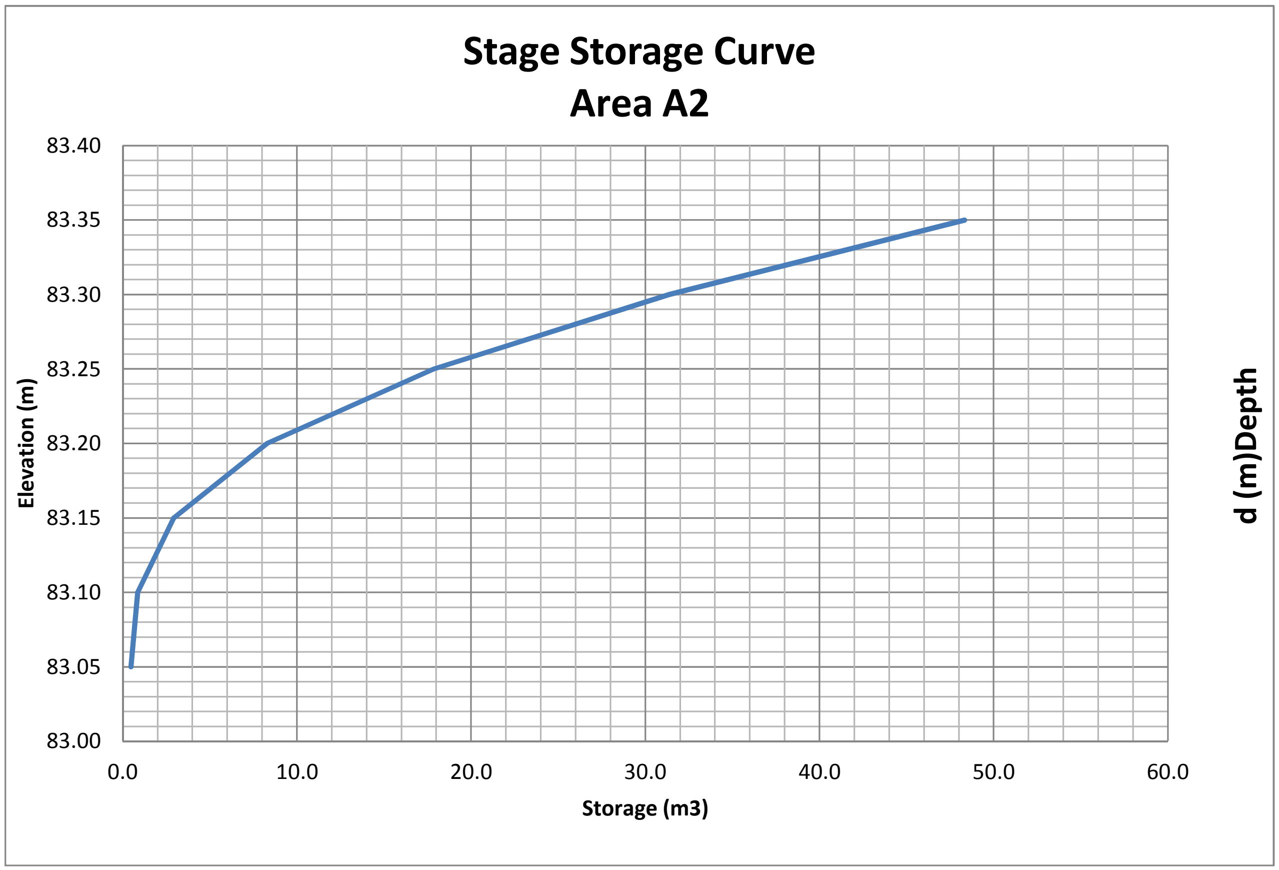
Structure	Size (mm)	Area (m2)	T/G	Invert
CB 1	600	0.36	**83.05**	**81.75**

Area A2 - Storage Table

Elevation (m)	Ponding Depth (m)	Structure Volume (m^3)	Undergound Volume (m^3)	Ponding Area A2 (m^2)	Surface Volume (m^3)	**Total Volume (m^3)**
83.05	0	0.47	0.47	0.0	0	**0.5**
83.10	0.05	0.47	0.47	15.92	0.40	**0.9**
83.15	0.10	0.47	0.47	66.83	2.47	**2.9**
83.20	0.15	0.47	0.47	147.80	7.83	**8.3**
83.25	0.20	0.47	0.47	234.10	17.38	**17.8**
83.30	0.25	0.47	0.47	308.01	30.93	**31.4**
83.35	0.30	0.47	0.47	369.42	47.87	**48.3**

Tempest LMF ICD	
1:100 Yr	
Flow (L/s) =	4.1
Head (m) =	1.47
Elevation (m) =	**83.32**
Outlet Pipe Dia.(mm) =	200
Volume (m3) =	38.3
1:5 Yr	
Flow (L/s) =	4.0
Head (m) =	1.38
Elevation (m) =	**83.23**
Outlet Pipe Dia.(mm) =	200
Volume (m3) =	15.5

Ponding Depth	
1:100 Yr	**27cm**
1:5 Yr	**18cm**



401 March Road
PROJECT No. 113023
REQUIRED STORAGE - 1:5 YEAR EVENT
AREA A3 Controlled Flow - Pipes + Surface Storage

OTTAWA IDF CURVE

Area =	0.144	ha	Qallow =	4.3	L/s
C =	0.80		Vol(max) =	23.6	m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	141.18	45.10	40.80	12.24
10	104.19	33.28	28.98	17.39
15	83.56	26.69	22.39	20.15
20	70.25	22.44	18.14	21.77
25	60.90	19.45	15.15	22.73
30	53.93	17.23	12.93	23.27
35	48.52	15.50	11.20	23.51
40	44.18	14.11	9.81	23.55
45	40.63	12.98	8.68	23.43
50	37.65	12.03	7.73	23.18
55	35.12	11.22	6.92	22.83
60	32.94	10.52	6.22	22.40
65	31.04	9.92	5.62	21.90
70	29.37	9.38	5.08	21.34
75	27.89	8.91	4.61	20.74
80	26.56	8.48	4.18	20.09
85	25.37	8.10	3.80	19.40
90	24.29	7.76	3.46	18.67

401 March Road
PROJECT No. 113023
REQUIRED STORAGE - 1:100 YEAR EVENT
AREA A3 Controlled Flow - Pipes + Surface Storage

OTTAWA IDF CURVE

Area =	0.144	ha	Qallow =	4.4	L/s
C =	0.89		Vol(max) =	56.1	m3

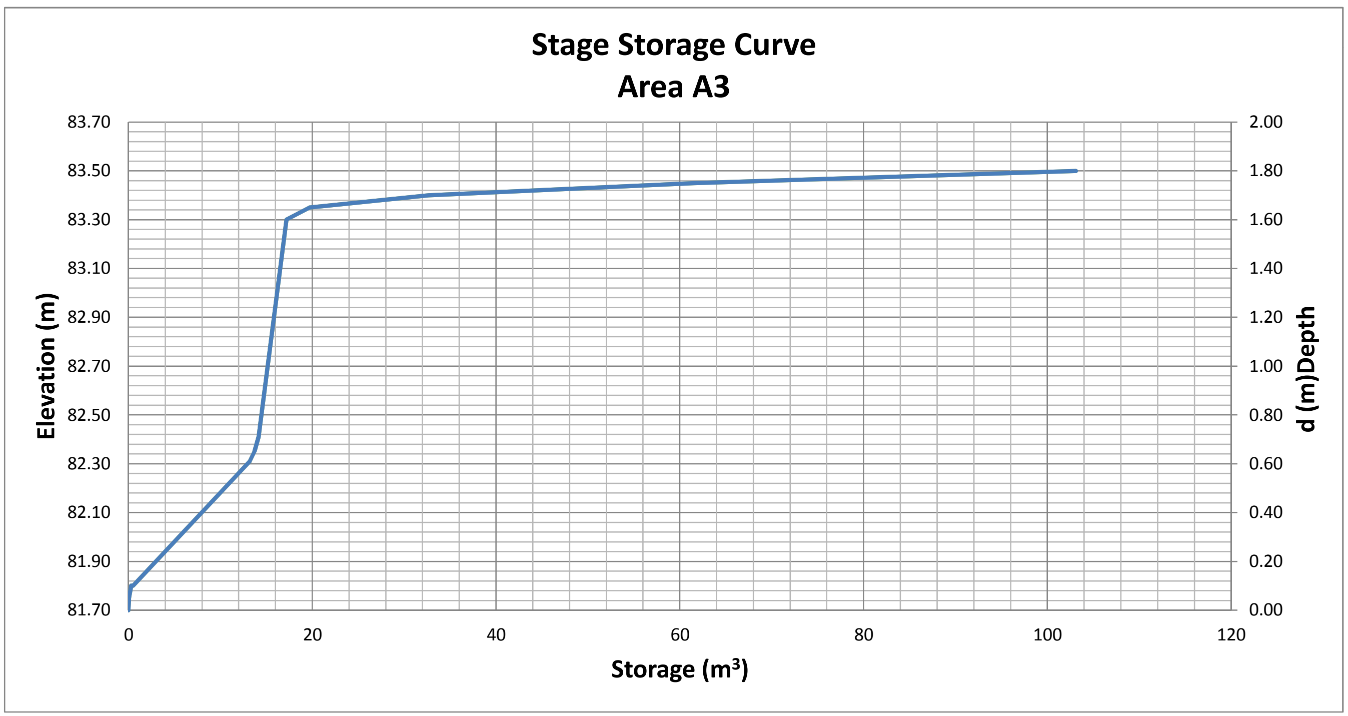
Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	242.70	86.53	82.13	24.64
10	178.56	63.66	59.26	35.56
15	142.89	50.95	46.55	41.89
20	119.95	42.77	38.37	46.04
25	103.85	37.03	32.63	48.94
30	91.87	32.75	28.35	51.04
35	82.58	29.44	25.04	52.59
40	75.15	26.79	22.39	53.74
45	69.05	24.62	20.22	54.59
50	63.95	22.80	18.40	55.21
55	59.62	21.26	16.86	55.63
60	55.89	19.93	15.53	55.90
65	52.65	18.77	14.37	56.04
70	49.79	17.75	13.35	56.08
75	47.26	16.85	12.45	56.02
80	44.99	16.04	11.64	55.88
85	42.95	15.31	10.91	55.66
90	41.11	14.66	10.26	55.39
95	39.43	14.06	9.66	55.06
100	37.90	13.51	9.11	54.68
105	36.50	13.01	8.61	54.26
110	35.20	12.55	8.15	53.80
115	34.01	12.12	7.72	53.30
120	32.89	11.73	7.33	52.76

Structures	Size Dia.(mm)	Area (m2)	T/G	Inv IN	Inv OUT
CBMH 2	1200	1.13	83.30	81.70	81.70
CBMH 3	1200	1.13	83.30	81.75	81.74
CBMH 4	1200	1.13	83.35	81.80	81.80

Area A3 - Storage Table			Underground Storage Pipe (600mm Dia. @ 0.2%)				Combined	Surface Storage		Total Storage	
			ID (mm) = 610 Length (m)= 18.3		OD (mm) = 800 Length (m)= 22.5						
			2 → 3		3 → 4			Ponding Area A3			
Elevation (m)	Head (m)	Structure Volume (m^3)	A1 (m^2)	A2 (m^2)	A3 (m^2)	A4 (m^2)	Underground Volume (m^3)	Area (m^2)	Volume (m^3)	Ponding Volume (m^3)	**Total Volume (m^3)**
81.70	0.00	0.00	-	-	-	-	-	-	-	-	**0**
81.70	0.00	0.00	0.0	-	-	-	0	-	-	0	**0.0**
81.74	0.04	0.05	0.000	0.0	0.0	0.0	0.0	-	-	0	**0.0**
81.75	0.05	0.07	0.000	0.000	0.0	0.0	0.1	-	-	0	**0.1**
81.80	0.10	0.18	0.015	0.000	0.000	0.0	0.3	-	-	0	**0.3**
81.80	0.10	0.18	0.018	0.018	0.000	0.000	0.5	-	-	0	**0.5**
82.31	0.61	1.91	0.292	0.292	0.263	0.263	13.2	-	-	0	**13.2**
82.35	0.65	2.05			0.281	0.281	13.7	-	-	0	**13.7**
82.41	0.71	2.25			0.292	0.292	14.2	0.0	0.0	0	**14.2**
83.30	1.60	5.27					17.2	0.0	0.00	0.0	**17.2**
83.35	1.65	5.27					17.2	102.08	2.55	2.6	**19.7**
83.40	1.70	5.27					17.2	414.54	15.47	15.5	**32.7**
83.45	1.75	5.27					17.2	740.58	44.35	44.3	**61.5**
83.50	1.80	5.27					17.2	922.67	85.93	85.9	**103.1**

Tempest LMF ICD	
1:100 Yr	
Flow (L/s) =	4.4
Head (m) =	1.59
Elevation (m) =	**83.44**
Outlet Pipe Dia.(mm) =	300
Volume (m3) =	56.1
1:5 Yr	
Flow (L/s) =	4.3
Head (m) =	1.52
Elevation (m) =	**83.37**
Outlet Pipe Dia.(mm) =	300
Volume (m3) =	23.6

Ponding Depth	
1:100 Yr	**14cm**
1:5 Yr	**7cm**



401 March Road
PROJECT No. 113023
REQUIRED STORAGE - 1:5 YEAR EVENT
AREA A4 **Controlled Flow - Pipes + Surface**

OTTAWA IDF CURVE

Area = 0.372 ha Qallow = 22.2 L/s
C = 0.79 Vol(max) = 45.0 m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qroof (L/s)	Qtotal (L/s)	Qnet (L/s)	Vol (m3)
5	141.18	114.92	2.47	117.39	95.22	28.57
10	104.19	84.81	2.47	87.28	65.11	39.07
15	83.56	68.01	2.47	70.48	48.31	43.48
20	70.25	57.18	2.47	59.65	37.48	44.98
25	60.90	49.57	2.47	52.04	29.87	44.80
30	53.93	43.90	2.47	46.37	24.20	43.55
35	48.52	39.49	2.47	41.96	19.79	41.56
40	44.18	35.97	2.47	38.44	16.27	39.04
45	40.63	33.07	2.47	35.54	13.37	36.10
50	37.65	30.65	2.47	33.12	10.95	32.85
55	35.12	28.59	2.47	31.06	8.89	29.34
60	32.94	26.82	2.47	29.29	7.12	25.62
65	31.04	25.27	2.47	27.74	5.57	21.72
70	29.37	23.91	2.47	26.38	4.21	17.67
75	27.89	22.70	2.47	25.17	3.00	13.50
80	26.56	21.62	2.47	24.09	1.92	9.22
85	25.37	20.65	2.47	23.12	0.95	4.84
90	24.29	19.77	2.47	22.24	0.07	0.38

401 March Road
PROJECT No. 113023
REQUIRED STORAGE - 1:100 YEAR EVENT
AREA A4 **Controlled Flow - Pipes + Surface**

OTTAWA IDF CURVE

Area = 0.372 ha Qallow = 33.9 L/s
C = 0.88 Vol(max) = 94.8 m3

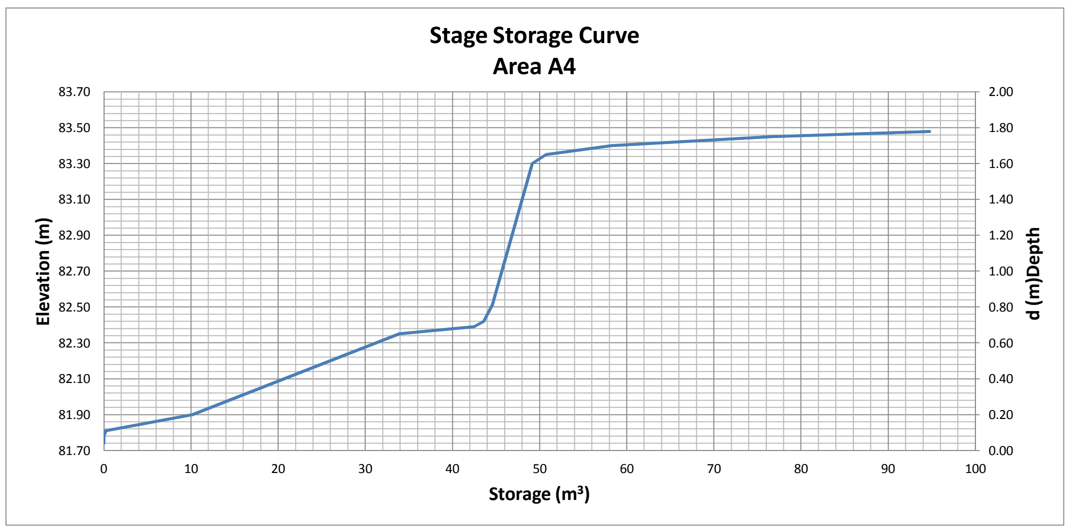
Time (min)	Intensity (mm/hr)	Q (L/s)	Qroof (L/s)	Qtotal (L/s)	Qnet (L/s)	Vol (m3)
5	242.70	220.63	2.66	223.29	189.43	56.83
10	178.56	162.32	2.66	164.98	131.12	78.67
15	142.89	129.90	2.66	132.56	98.70	88.83
20	119.95	109.04	2.66	111.70	77.84	93.41
25	103.85	94.40	2.66	97.06	63.20	94.80
30	91.87	83.51	2.66	86.17	52.31	94.16
35	82.58	75.07	2.66	77.73	43.87	92.12
40	75.15	68.31	2.66	70.97	37.11	89.07
45	69.05	62.77	2.66	65.43	31.57	85.24
50	63.95	58.14	2.66	60.80	26.94	80.81
55	59.62	54.20	2.66	56.86	23.00	75.91
60	55.89	50.81	2.66	53.47	19.61	70.60
65	52.65	47.86	2.66	50.52	16.66	64.97
70	49.79	45.26	2.66	47.92	14.06	59.06
75	47.26	42.96	2.66	45.62	11.76	52.91
80	44.99	40.90	2.66	43.56	9.70	46.56
85	42.95	39.05	2.66	41.71	7.85	40.02
90	41.11	37.37	2.66	40.03	6.17	33.33
95	39.43	35.85	2.66	38.51	4.65	26.50
100	37.90	34.46	2.66	37.12	3.26	19.54
105	36.50	33.18	2.66	35.84	1.98	12.46
110	35.20	32.00	2.66	34.66	0.80	5.29
115	34.01	30.91	2.66	33.57	-0.29	-1.98
120	32.89	29.90	2.66	32.56	-1.30	-9.34

Structures	Size Dia.(mm)	Area (m2)	T/G	Inv IN	Inv OUT
STM MH 3	1500	1.77	83.49	81.74	81.74
CBMH 5	1200	1.13	83.30	-	81.76
CBMH 6	1500	1.77	83.30	81.78	81.77
CBMH 7	1200	1.13	83.43	-	81.84
CBMH 8	1200	1.13	83.30	81.82	81.81
CBMH 9	1500	1.77	83.40	91.91	81.90
CBMH 10	1200	1.13	83.45	81.80	81.80
CB 2	600	0.36	83.50	-	82.06

Area A4 - Storage Table			Underground Storage Pipe (600mm Dia. @ 0.2%)												Combined	Surface Storage		Total Storage	
			ID (mm) = 610 Length (m)= 9.45		OD (mm) = 800 Length (m)= 15.45		OD (mm) = 610 Length (m)= 30.85		OD (mm) = 800 Length (m)= 15.7		OD (mm) = 610 Length (m)= 42.7		OD (mm) = 800 Length (m)= 23.75						
			3 → 5		3 → 6		6 → 7		6 → 8		8 → 9		9 → 10			Ponding Area A4			
Elevation (m)	Head (m)	Structure Volume (m^3)	A1 (m^2)	A2 (m^2)	A1 (m^2)	A2 (m^2)	A1 (m^2)	A2 (m^2)	A1 (m^2)	A2 (m^2)	A1 (m^2)	A2 (m^2)	A1 (m^2)	A2 (m^2)	Underground Volume (m^3)	Area (m^2)	Volume (m^3)	Ponding Volume (m^3)	**Total Volume (m^3)**
81.74	0.00	0.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**0**
81.78	0.04	0.09	0.0	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0	**0.0**
81.81	0.07	0.25	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	-	-	0	**0.3**
81.90	0.16	0.95	0.117	0.102	0.102	0.088	0.102	0.088	0.102	0.088	0.0	0.0	0.102	0.088	10.1	-	-	0	**10.1**
82.35	0.61	3.35	0.292	0.292	0.286	0.278	0.278	0.275	0.278	0.275	0.102	0.088	0.278	0.275	33.9	-	-	0	**33.9**
82.39	0.65	3.58			0.292	0.292	0.286	0.278	0.286	0.278	0.278	0.275	0.286	0.278	42.5	-	-	0	**42.5**
82.42	0.68	3.75					0.292	0.292	0.292	0.292	0.286	0.278	0.292	0.292	43.6	-	-	0	**43.6**
82.51	0.77	4.27									0.292	0.292			44.6	-	-	0	**44.6**
82.75	1.01	5.67													46.0	0.0	0.0	0	**46.0**
83.30	1.56	8.85													49.2	0.0	0.00	0.0	**49.2**
83.35	1.61	9.05													49.4	55.60	1.39	1.4	**50.7**
83.40	1.66	9.67													50.0	222.21	8.34	8.3	**58.3**
83.45	1.71	10.30													50.6	487.54	26.08	26.1	**76.7**
83.48	1.74	10.30													50.6	717.47	44.15	44.2	**94.8**

Tempest Plug ICD - 112mm dia Orifice	
1:100 Yr	
Flow (L/s) =	33.9
Head (m) =	1.55
Elevation (m) =	**83.48**
Outlet Pipe Dia.(mm) =	375
Volume (m3) =	94.8
1:5 Yr	
Flow (L/s) =	22.2
Head (m) =	0.67
Elevation (m) =	**82.60**
Outlet Pipe Dia.(mm) =	375
Volume (m3) =	45.0

Ponding Depth	
1:100 Yr	**18cm**
1:5 Yr	**0cm**



401 March Road
PROJECT No. 113023
REQUIRED STORAGE - 1:5 YEAR EVENT
AREA A5 **Controlled Flow - Pipes + Surface Storage**

OTTAWA IDF CURVE

Area = 0.414 ha   Qallow = 15.9 L/s
C = 0.65   Vol(max) = 51.8 m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qroof (L/s)	Qtotal (L/s)	Qnet (L/s)	Vol (m3)
5	141.18	106.40	3.98	110.38	94.50	28.35
10	104.19	78.53	3.98	82.51	66.63	39.98
15	83.56	62.97	3.98	66.95	51.07	45.97
20	70.25	52.95	3.98	56.93	41.05	49.25
25	60.90	45.89	3.98	49.87	33.99	50.99
30	53.93	40.64	3.98	44.62	28.74	51.74
35	48.52	36.57	3.98	40.55	24.67	51.80
40	44.18	33.30	3.98	37.28	21.40	51.36
45	40.63	30.62	3.98	34.60	18.72	50.54
50	37.65	28.38	3.98	32.36	16.48	49.43
55	35.12	26.47	3.98	30.45	14.57	48.08
60	32.94	24.83	3.98	28.81	12.93	46.54
65	31.04	23.40	3.98	27.38	11.50	44.84
70	29.37	22.14	3.98	26.12	10.24	42.99
75	27.89	21.02	3.98	25.00	9.12	41.03
80	26.56	20.02	3.98	24.00	8.12	38.97
85	25.37	19.12	3.98	23.10	7.22	36.82
90	24.29	18.31	3.98	22.29	6.41	34.59

401 March Road
PROJECT No. 113023
REQUIRED STORAGE - 1:100 YEAR EVENT
AREA A5 **Controlled Flow - Pipes + Surface Storage**

OTTAWA IDF CURVE

Area = 0.414 ha   Qallow = 16.7 L/s
C = 0.74   Vol(max) = 131.3 m3

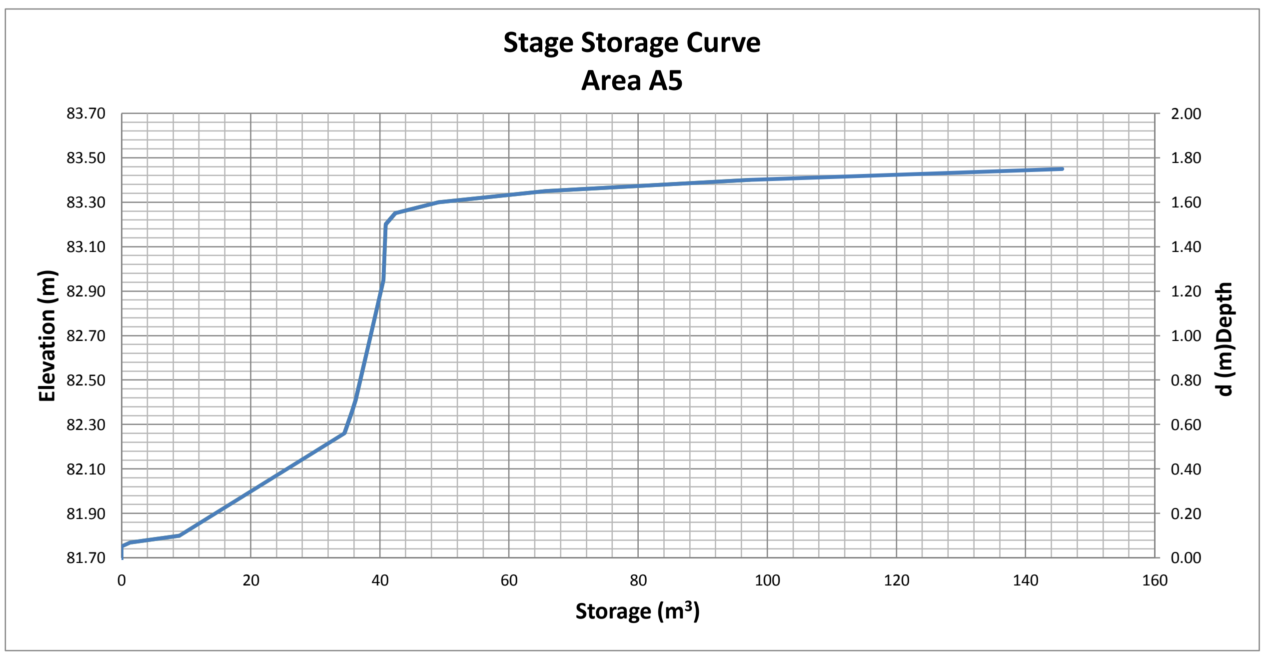
Time (min)	Intensity (mm/hr)	Q (L/s)	Qroof (L/s)	Qtotal (L/s)	Qnet (L/s)	Vol (m3)
5	242.70	205.96	5.68	211.64	194.96	58.49
10	178.56	151.52	5.68	157.20	140.52	84.31
15	142.89	121.26	5.68	126.94	110.26	99.23
20	119.95	101.79	5.68	107.47	90.79	108.95
25	103.85	88.12	5.68	93.80	77.12	115.69
30	91.87	77.96	5.68	83.64	66.96	120.53
35	82.58	70.08	5.68	75.76	59.08	124.06
40	75.15	63.77	5.68	69.45	52.77	126.64
45	69.05	58.60	5.68	64.28	47.60	128.51
50	63.95	54.27	5.68	59.95	43.27	129.81
55	59.62	50.60	5.68	56.28	39.60	130.67
60	55.89	47.43	5.68	53.11	36.43	131.15
65	52.65	44.68	5.68	50.36	33.68	131.33
70	49.79	42.25	5.68	47.93	31.25	131.26
75	47.26	40.10	5.68	45.78	29.10	130.95
80	44.99	38.18	5.68	43.86	27.18	130.46
85	42.95	36.45	5.68	42.13	25.45	129.80
90	41.11	34.89	5.68	40.57	23.89	128.99
95	39.43	33.46	5.68	39.14	22.46	128.05
100	37.90	32.16	5.68	37.84	21.16	126.99
105	36.50	30.97	5.68	36.65	19.97	125.82
110	35.20	29.87	5.68	35.55	18.87	124.56
115	34.01	28.86	5.68	34.54	17.86	123.21
120	32.89	27.91	5.68	33.59	16.91	121.78

Structures	Size Dia.(mm)	Area (m2)	T/G	Inv IN	Inv OUT
STM MH 4	1500 x 1800	2.79	83.45	81.65	81.65
CBMH 11	1200	1.13	83.20	81.69	81.68
CBMH 12	1500	1.77	83.20	81.77	81.76
CBMH 13	1200	1.13	83.20	-	81.80
CBMH 14	1200	1.13	83.25	82.15	81.75

Area A5 - Storage Table			Underground Storage Pipe (600mm Dia. @ 0.2%)								Combined	Surface Storage		Total Storage	
			ID (mm) = 610 Length (m)= 13.1		OD (mm) = 800 Length (m)= 32.35		ID (mm) = 610 Length (m)= 15.05		OD (mm) = 800 Length (m)= 44.7						
		Structure	4 → 11		11 → 12		12 → 13		4 → 14		Underground	Ponding Area A5		Ponding	**Total**
Elevation (m)	Head (m)	Volume (m^3)	A1 (m^2)	A2 (m^2)	A1 (m^2)	A2 (m^2)	A1 (m^2)	A2 (m^2)	A1 (m^2)	A2 (m^2)	Volume (m^3)	Area (m^2)	Volume (m^3)	Volume (m^3)	**Volume (m^3)**
81.65	0.00	0.00	-	-	-	-	-	-	-	-	-	-	-	-	**0**
81.75	0.10	0.36	0.0	-	-	-	-	-	-	-	0	-	-	0	**0.0**
81.77	0.12	0.46	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	-	-	0	**1.4**
81.80	0.15	0.68	0.073	0.058	0.102	0.088	0.102	0.088	0.029	0.015	9.0	-	-	0	**9.0**
82.26	0.61	4.34	0.292	0.292	0.286	0.278	0.278	0.275	0.073	0.058	34.5	-	-	0	**34.5**
82.36	0.71	5.13			0.292	0.292	0.286	0.278	0.292	0.292	35.7	-	-	0	**35.7**
82.41	0.76	5.53					0.292	0.292			36.3	-	-	0	**36.3**
82.65	1.00	7.44									38.2	-	-	0	**38.2**
82.95	1.30	9.82									40.6	0.0	0.0	0	**40.6**
83.20	1.55	10.17									40.9	0.0	0.00	0.0	**40.9**
83.25	1.60	10.36									41.1	51.09	1.28	1.3	**42.4**
83.30	1.65	10.50									41.2	212.16	7.86	7.9	**49.1**
83.35	1.70	10.64									41.4	446.23	24.32	24.3	**65.7**
83.40	1.75	10.78									41.5	810.64	55.74	55.7	**97.3**
83.45	1.80	10.92									41.7	1120.23	104.01	104.0	**145.7**

Tempest Plug ICD - 78mm dia Orifice	
1:100 Yr	
Flow (L/s) =	16.7
Head (m) =	1.60
Elevation (m) =	**83.44**
Outlet Pipe Dia.(mm) =	375
Volume (m3) =	131.3
1:5 Yr	
Flow (L/s) =	15.9
Head (m) =	1.46
Elevation (m) =	**83.30**
Outlet Pipe Dia.(mm) =	375
Volume (m3) =	51.8

Ponding Depth	
1:100 Yr	**24cm**
1:5 Yr	**10cm**



401 March Road
PROJECT No. 113023
REQUIRED STORAGE - 1:5 YEAR EVENT
AREA B1 **Controlled Roof Drains 1 & 2**

OTTAWA IDF CURVE

Area = 0.025 ha Qallow = 1.52 L/s
C = 0.90 Vol(max) = 3.4 m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	141.18	8.83	7.31	2.19
10	104.19	6.52	5.00	3.00
15	83.56	5.23	3.71	3.34
20	70.25	4.39	2.87	3.45
25	60.90	3.81	2.29	3.43
30	53.93	3.37	1.85	3.34
35	48.52	3.03	1.51	3.18
40	44.18	2.76	1.24	2.98
45	40.63	2.54	1.02	2.76
50	37.65	2.36	0.84	2.51
55	35.12	2.20	0.68	2.23
60	32.94	2.06	0.54	1.95
65	31.04	1.94	0.42	1.64
70	29.37	1.84	0.32	1.33
75	27.89	1.74	0.22	1.01
80	26.56	1.66	0.14	0.68
85	25.37	1.59	0.07	0.34
90	24.29	1.52	0.00	0.00

401 March Road
PROJECT No. 113023
REQUIRED STORAGE - 1:100 YEAR EVENT
AREA B1 **Controlled Roof Drains 1 & 2**

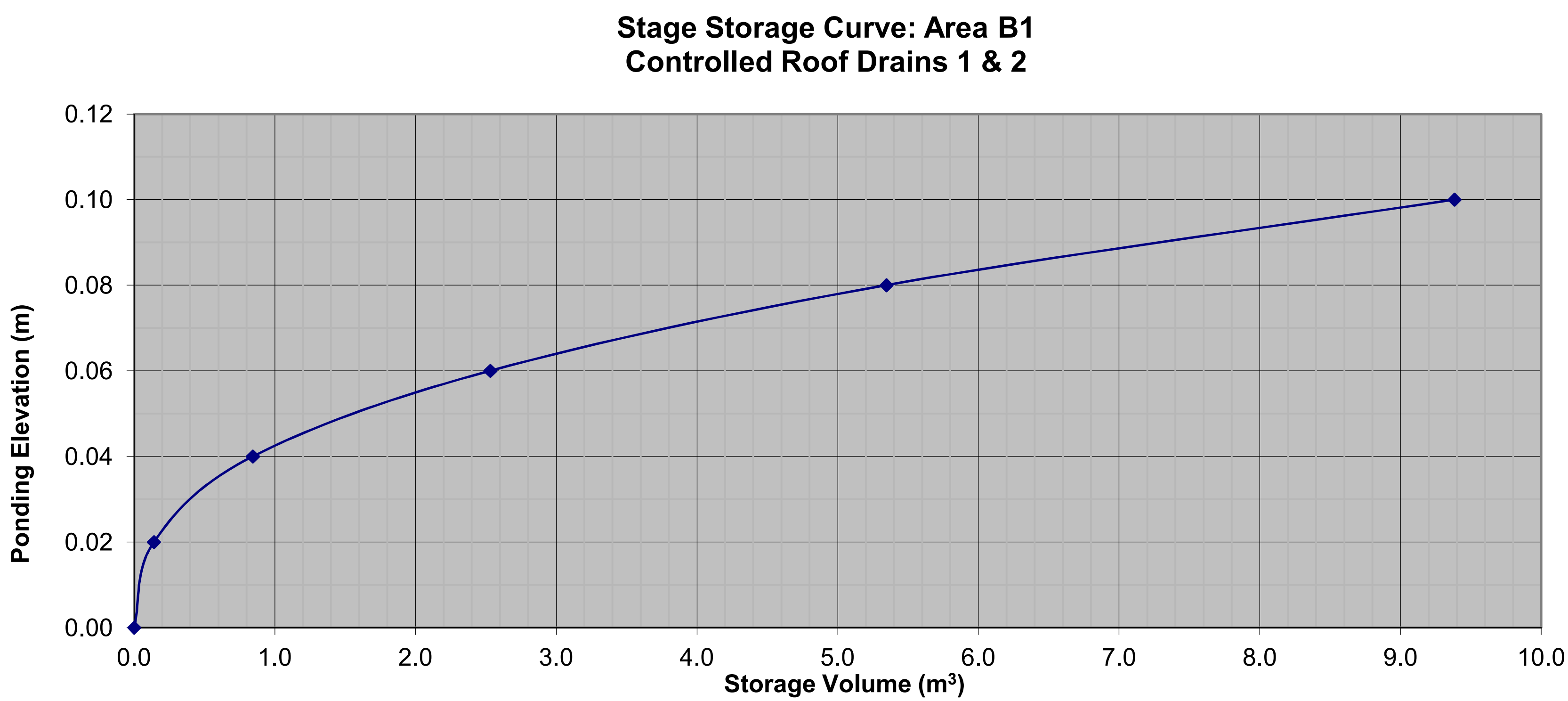
OTTAWA IDF CURVE

Area = 0.025 ha Qallow = 1.52 L/s
C = 1.00 Vol(max) = 8.9 m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	242.70	16.87	15.35	4.60
10	178.56	12.41	10.89	6.53
15	142.89	9.93	8.41	7.57
20	119.95	8.34	6.82	8.18
25	103.85	7.22	5.70	8.55
30	91.87	6.38	4.86	8.76
35	82.58	5.74	4.22	8.86
40	75.15	5.22	3.70	8.89
45	69.05	4.80	3.28	8.85
50	63.95	4.44	2.92	8.77
55	59.62	4.14	2.62	8.66
60	55.89	3.88	2.36	8.51
65	52.65	3.66	2.14	8.34
70	49.79	3.46	1.94	8.15
75	47.26	3.28	1.76	7.94
80	44.99	3.13	1.61	7.71
85	42.95	2.99	1.47	7.47
90	41.11	2.86	1.34	7.22

Watts Flow Control Roof Drain			RD-100-A-ADJ set to Closed		
Design Event	Flow/Drain (L/s)	Total Flow (L/s)	Ponding (cm)	Storage (m^3)	
				Required	Provided
1:5 Yr	0.76	1.52	7	3.4	9.4
1:100 Yr	0.76	1.52	10	8.9	9.4

Roof Drains Storage Table for Area B1				
Elevation	Area RD 1	Area RD 2	Total Area	Total Volume
m	m^2	m^2	m^2	m^3
0.00	0	0	0	0
0.02	6.94	7.12	14.06	0.1
0.04	27.77	28.46	56.23	0.8
0.06	56.26	56.26	112.52	2.5
0.08	84.47	84.47	168.94	5.3
0.10	117.39	117.39	234.78	9.4



401 March Road
PROJECT No. 113023
REQUIRED STORAGE - 1:5 YEAR EVENT
AREA B2 **Controlled Roof Drains 3 & 4**

OTTAWA IDF CURVE

Area = 0.028 ha   Qallow = 1.52 L/s
C = 0.90   Vol(max) = 4.1 m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	141.18	9.89	8.37	2.51
10	104.19	7.30	5.78	3.47
15	83.56	5.85	4.33	3.90
20	70.25	4.92	3.40	4.08
25	60.90	4.27	2.75	4.12
30	53.93	3.78	2.26	4.06
35	48.52	3.40	1.88	3.95
40	44.18	3.10	1.58	3.78
45	40.63	2.85	1.33	3.58
50	37.65	2.64	1.12	3.35
55	35.12	2.46	0.94	3.10
60	32.94	2.31	0.79	2.84
65	31.04	2.17	0.65	2.55
70	29.37	2.06	0.54	2.26
75	27.89	1.95	0.43	1.95
80	26.56	1.86	0.34	1.64
85	25.37	1.78	0.26	1.31
90	24.29	1.70	0.18	0.98

401 March Road
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REQUIRED STORAGE - 1:100 YEAR EVENT
AREA B2 **Controlled Roof Drains 3 & 4**

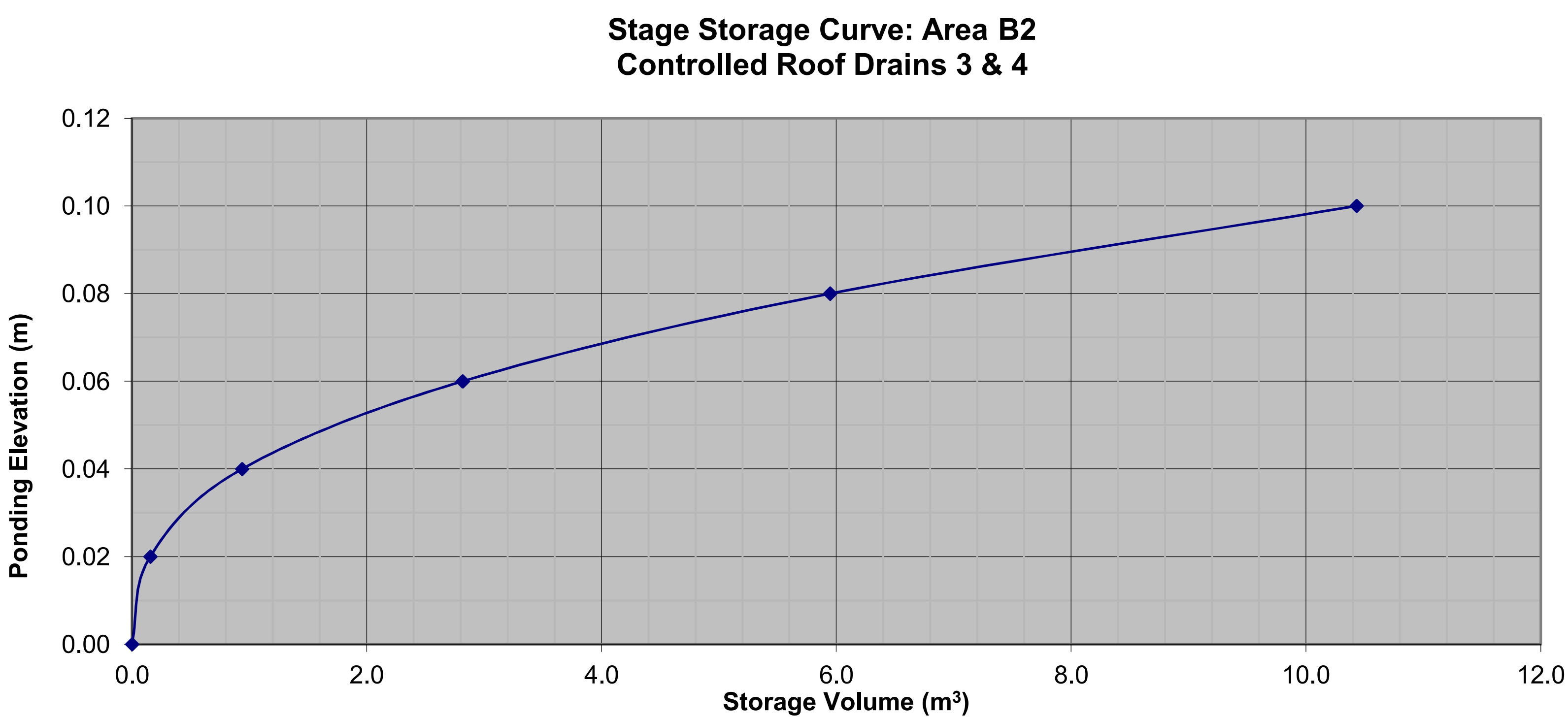
OTTAWA IDF CURVE

Area = 0.028 ha   Qallow = 1.52 L/s
C = 1.00   Vol(max) = 10.4 m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	242.70	18.89	17.37	5.21
10	178.56	13.90	12.38	7.43
15	142.89	11.12	9.60	8.64
20	119.95	9.34	7.82	9.38
25	103.85	8.08	6.56	9.85
30	91.87	7.15	5.63	10.14
35	82.58	6.43	4.91	10.31
40	75.15	5.85	4.33	10.39
45	69.05	5.37	3.85	10.41
50	63.95	4.98	3.46	10.37
55	59.62	4.64	3.12	10.30
60	55.89	4.35	2.83	10.19
65	52.65	4.10	2.58	10.05
70	49.79	3.88	2.36	9.89
75	47.26	3.68	2.16	9.71
80	44.99	3.50	1.98	9.51
85	42.95	3.34	1.82	9.30
90	41.11	3.20	1.68	9.07

Watts Flow Control Roof Drain			RD-100-A-ADJ set to Closed		
Design Event	Flow/Drain (L/s)	Total Flow (L/s)	Ponding (cm)	Storage (m^3) Required	Provided
1:5 Yr	0.76	1.52	7	4.1	10.4
1:100 Yr	0.76	1.52	10	10.4	10.4

Roof Drains Storage Table for Area B2				
Elevation	Area RD 3	Area RD 4	Total Area	Total Volume
m	m^2	m^2	m^2	m^3
0.00	0	0	0	0
0.02	7.82	7.82	15.64	0.2
0.04	31.3	31.3	62.6	0.9
0.06	62.59	62.59	125.18	2.8
0.08	93.89	93.89	187.78	5.9
0.10	130.4	130.4	260.8	10.4



401 March Road
PROJECT No. 113023
REQUIRED STORAGE - 1:5 YEAR EVENT
AREA B3 **Controlled Roof Drain 5**

OTTAWA IDF CURVE

Area =	0.013	ha	Qallow =	0.95	L/s
C =	0.90		Vol(max) =	1.6	m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	141.18	4.59	3.64	1.09
10	104.19	3.39	2.44	1.46
15	83.56	2.72	1.77	1.59
20	70.25	2.28	1.33	1.60
25	60.90	1.98	1.03	1.55
30	53.93	1.75	0.80	1.45
35	48.52	1.58	0.63	1.32
40	44.18	1.44	0.49	1.17
45	40.63	1.32	0.37	1.00
50	37.65	1.22	0.27	0.82
55	35.12	1.14	0.19	0.63
60	32.94	1.07	0.12	0.44
65	31.04	1.01	0.06	0.23
70	29.37	0.96	0.01	0.02
75	27.89	0.91	-0.04	-0.19
80	26.56	0.86	-0.09	-0.41
85	25.37	0.83	-0.12	-0.64
90	24.29	0.79	-0.16	-0.86

401 March Road
PROJECT No. 113023
REQUIRED STORAGE - 1:100 YEAR EVENT
AREA B3 **Controlled Roof Drain 5**

OTTAWA IDF CURVE

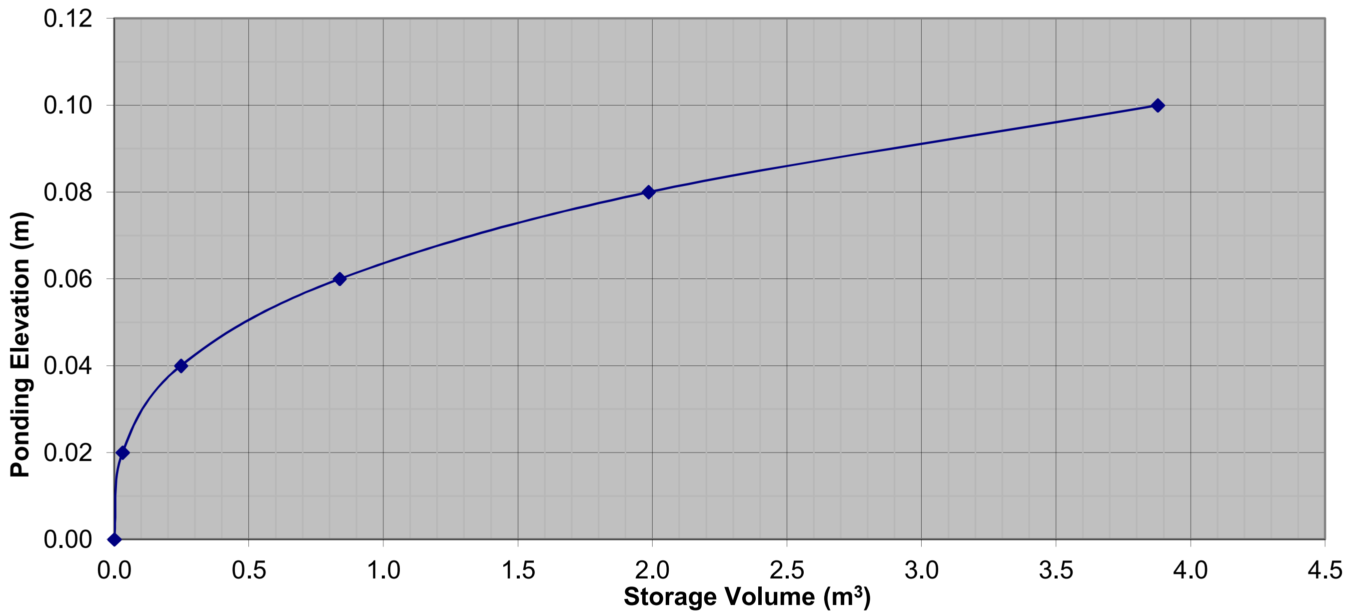
Area =	0.013	ha	Qallow =	1.14	L/s
C =	1.00		Vol(max) =	3.9	m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	242.70	8.77	7.63	2.29
10	178.56	6.45	5.31	3.19
15	142.89	5.16	4.02	3.62
20	119.95	4.34	3.20	3.83
25	103.85	3.75	2.61	3.92
30	91.87	3.32	2.18	3.92
35	82.58	2.98	1.84	3.87
40	75.15	2.72	1.58	3.78
45	69.05	2.50	1.36	3.66
50	63.95	2.31	1.17	3.51
55	59.62	2.15	1.01	3.35
60	55.89	2.02	0.88	3.17
65	52.65	1.90	0.76	2.97
70	49.79	1.80	0.66	2.77
75	47.26	1.71	0.57	2.56
80	44.99	1.63	0.49	2.33
85	42.95	1.55	0.41	2.10
90	41.11	1.49	0.35	1.87

Watts Flow Control Roof Drain			RD-100-A-ADJ set to 1/2 Exposed		
Design	**Flow/Drain (L/s)**	**Total Flow (L/s)**	**Ponding (cm)**	**Storage (m^3)**	
				Required	**Provided**
1:5 Year	0.95	0.95	8	1.6	3.9
1:100 Year	1.14	1.14	10	3.9	3.9

Roof Drain Storage Table for Area B3		
Elevation	Area RD 5	Total Volume
m	m^2	m^3
0.00	0	0
0.02	4.65	0.0
0.04	18.61	0.2
0.06	41.88	0.8
0.08	74.46	2.0
0.10	116.35	3.9

Stage Storage Curve: Area B3
Controlled Roof Drain 5



401 March Road
PROJECT No. 113023
REQUIRED STORAGE - 1:5 YEAR EVENT
AREA B4 **Controlled Roof Drains 6 & 7**

OTTAWA IDF CURVE

Area = 0.023 ha Qallow = 1.90 L/s
C = 0.90 Vol(max) = 2.6 m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	141.18	8.12	6.22	1.87
10	104.19	6.00	4.10	2.46
15	83.56	4.81	2.91	2.62
20	70.25	4.04	2.14	2.57
25	60.90	3.50	1.60	2.41
30	53.93	3.10	1.20	2.17
35	48.52	2.79	0.89	1.87
40	44.18	2.54	0.64	1.54
45	40.63	2.34	0.44	1.18
50	37.65	2.17	0.27	0.80
55	35.12	2.02	0.12	0.40
60	32.94	1.90	0.00	-0.02
65	31.04	1.79	-0.11	-0.44
70	29.37	1.69	-0.21	-0.88
75	27.89	1.60	-0.30	-1.33
80	26.56	1.53	-0.37	-1.78
85	25.37	1.46	-0.44	-2.24
90	24.29	1.40	-0.50	-2.71

401 March Road
PROJECT No. 113023
REQUIRED STORAGE - 1:100 YEAR EVENT
AREA B4 **Controlled Roof Drains 6 & 7**

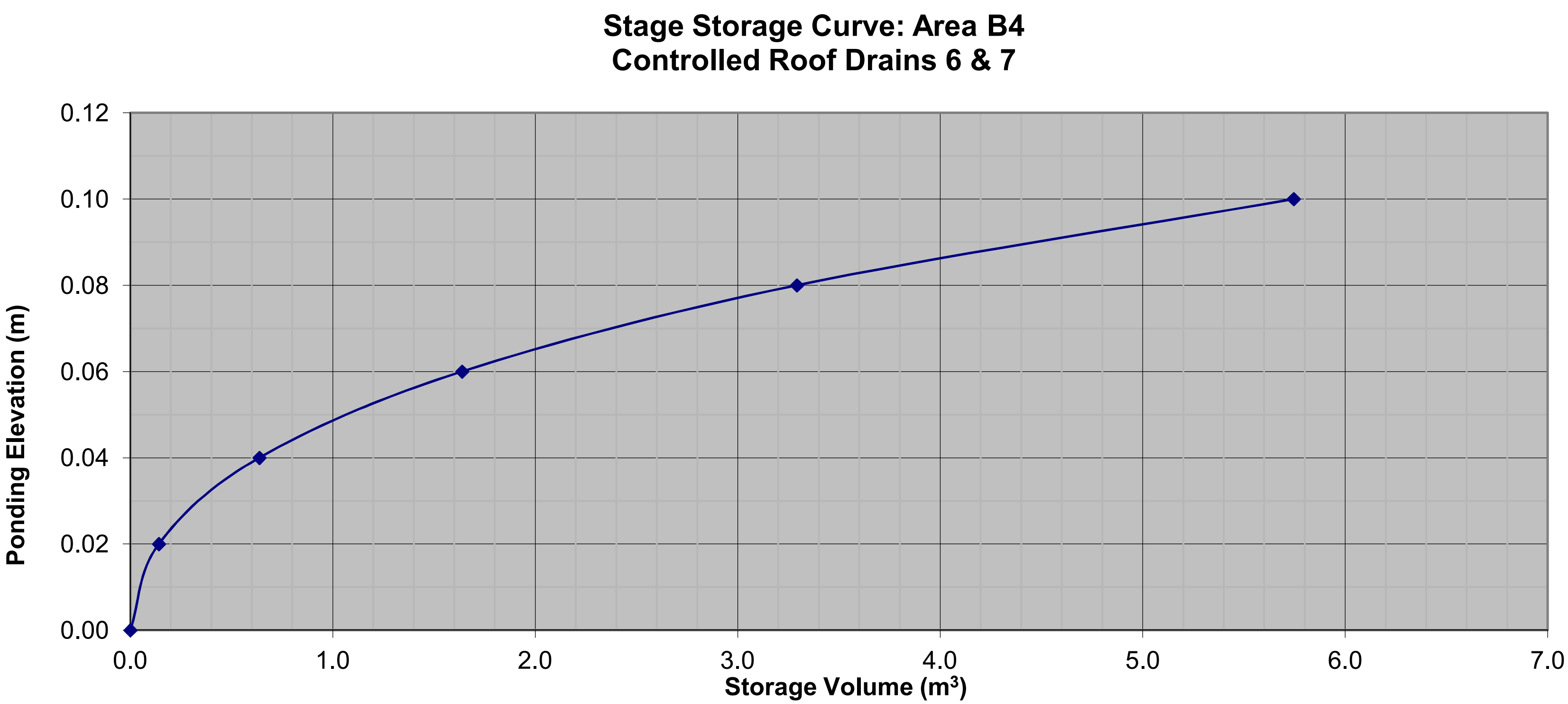
OTTAWA IDF CURVE

Area = 0.023 ha Qallow = 3.04 L/s
C = 1.00 Vol(max) = 5.6 m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	242.70	15.52	12.48	3.74
10	178.56	11.42	8.38	5.03
15	142.89	9.14	6.10	5.49
20	119.95	7.67	4.63	5.56
25	103.85	6.64	3.60	5.40
30	91.87	5.87	2.83	5.10
35	82.58	5.28	2.24	4.70
40	75.15	4.80	1.76	4.24
45	69.05	4.42	1.38	3.71
50	63.95	4.09	1.05	3.15
55	59.62	3.81	0.77	2.55
60	55.89	3.57	0.53	1.92
65	52.65	3.37	0.33	1.27
70	49.79	3.18	0.14	0.60
75	47.26	3.02	-0.02	-0.08
80	44.99	2.88	-0.16	-0.78
85	42.95	2.75	-0.29	-1.50
90	41.11	2.63	-0.41	-2.22

Watts Flow Control Roof Drain			RD-100-A-ADJ set to Fully Exposed		
Design Event	Flow/Drain (L/s)	Total Flow (L/s)	Ponding (cm)	Storage (m^3) Required	Storage (m^3) Provided
1:5 Yr	0.95	1.90	7	2.6	5.7
1:100 Yr	1.52	3.04	10	5.6	5.7

Roof Drains Storage Table for Area B4				
Elevation	Area RD 6	Area RD 7	Total Area	Total Volume
m	m^2	m^2	m^2	m^3
0.00	0	0	0	0
0.02	7.04	7.04	14.08	0.1
0.04	17.79	17.79	35.58	0.6
0.06	32.27	32.27	64.54	1.6
0.08	50.4	50.4	100.8	3.3
0.10	72.26	72.26	144.52	5.7



401 March Road
PROJECT No. 113023
REQUIRED STORAGE - 1:5 YEAR EVENT
AREA B5 Controlled Roof Drains 8 & 9

OTTAWA IDF CURVE

Area = 0.037 ha Qallow = 2.08 L/s
C = 0.90 Vol(max) = 5.3 m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	141.18	13.07	10.99	3.30
10	104.19	9.65	7.57	4.54
15	83.56	7.74	5.66	5.09
20	70.25	6.50	4.42	5.31
25	60.90	5.64	3.56	5.34
30	53.93	4.99	2.91	5.24
35	48.52	4.49	2.41	5.06
40	44.18	4.09	2.01	4.82
45	40.63	3.76	1.68	4.54
50	37.65	3.49	1.41	4.22
55	35.12	3.25	1.17	3.87
60	32.94	3.05	0.97	3.49
65	31.04	2.87	0.79	3.10
70	29.37	2.72	0.64	2.68
75	27.89	2.58	0.50	2.26
80	26.56	2.46	0.38	1.82
85	25.37	2.35	0.27	1.37
90	24.29	2.25	0.17	0.91

401 March Road
PROJECT No. 113023
REQUIRED STORAGE - 1:100 YEAR EVENT
AREA B5 Controlled Roof Drains 8 & 9

OTTAWA IDF CURVE

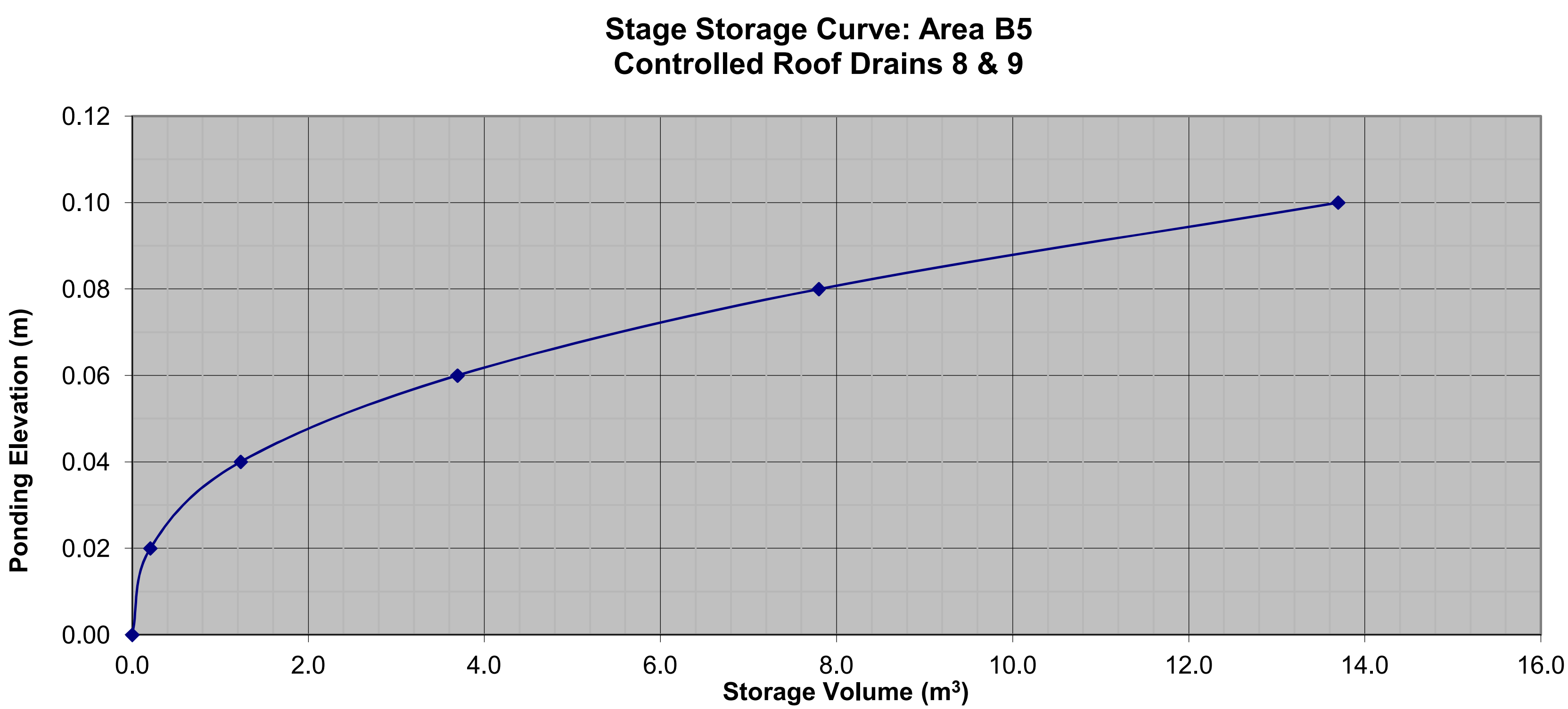
Area = 0.037 ha Qallow = 2.64 L/s
C = 1.00 Vol(max) = 12.3 m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	242.70	24.96	22.32	6.70
10	178.56	18.37	15.73	9.44
15	142.89	14.70	12.06	10.85
20	119.95	12.34	9.70	11.64
25	103.85	10.68	8.04	12.06
30	91.87	9.45	6.81	12.26
35	82.58	8.49	5.85	12.29
40	75.15	7.73	5.09	12.21
45	69.05	7.10	4.46	12.05
50	63.95	6.58	3.94	11.81
55	59.62	6.13	3.49	11.53
60	55.89	5.75	3.11	11.19
65	52.65	5.42	2.78	10.82
70	49.79	5.12	2.48	10.42
75	47.26	4.86	2.22	9.99
80	44.99	4.63	1.99	9.54
85	42.95	4.42	1.78	9.07
90	41.11	4.23	1.59	8.58

Watts Flow Control Roof Drain			RD-100-A-ADJ set to Fully Exposed		
Design Event	Flow/Drain (L/s)	Total Flow (L/s)	Ponding (cm)	Storage (m^3) Required	Storage (m^3) Provided
1:5 Yr	1.04	2.08	7	5.3	13.7
1:100 Yr	1.32	2.64	9	12.3	13.7

Roof Drains Storage Table for Area B5

Elevation	Area RD 8	Area RD 9	Total Area	Total Volume
m	m^2	m^2	m^2	m^3
0.00	0	0	0	0
0.02	10.26	10.26	20.52	0.2
0.04	41.04	41.04	82.08	1.2
0.06	82.08	82.08	164.16	3.7
0.08	123.12	123.12	246.24	7.8
0.10	171.8	171.8	343.6	13.7



APPENDIX E

Ipex Tempest ICD Information

PRODUCT INFORMATION: TEMPEST LOW, MEDIUM FLOW (LMF) ICD

Purpose

To control the amount of storm water runoff entering a sewer system by allowing a specified flow volume out of a catch basin or manhole at a specified head. This approach conserves pipe capacity so that catch basins downstream do not become uncontrollably surcharged, which can lead to basement floods, flash floods and combined sewer overflows.

Product Description

Our LMF ICD is designed to accommodate catch basins or manholes with sewer outlet pipes 6" in diameter and larger. Any storm sewer larger than 12" may require custom modification. However, IPEX can custom build a TEMPEST device to accommodate virtually any storm sewer size.

Available in 14 preset flow curves, the LMF ICD has the ability to provide flow rates: 2lps – 17lps (31gpm – 270gpm)

Product Function

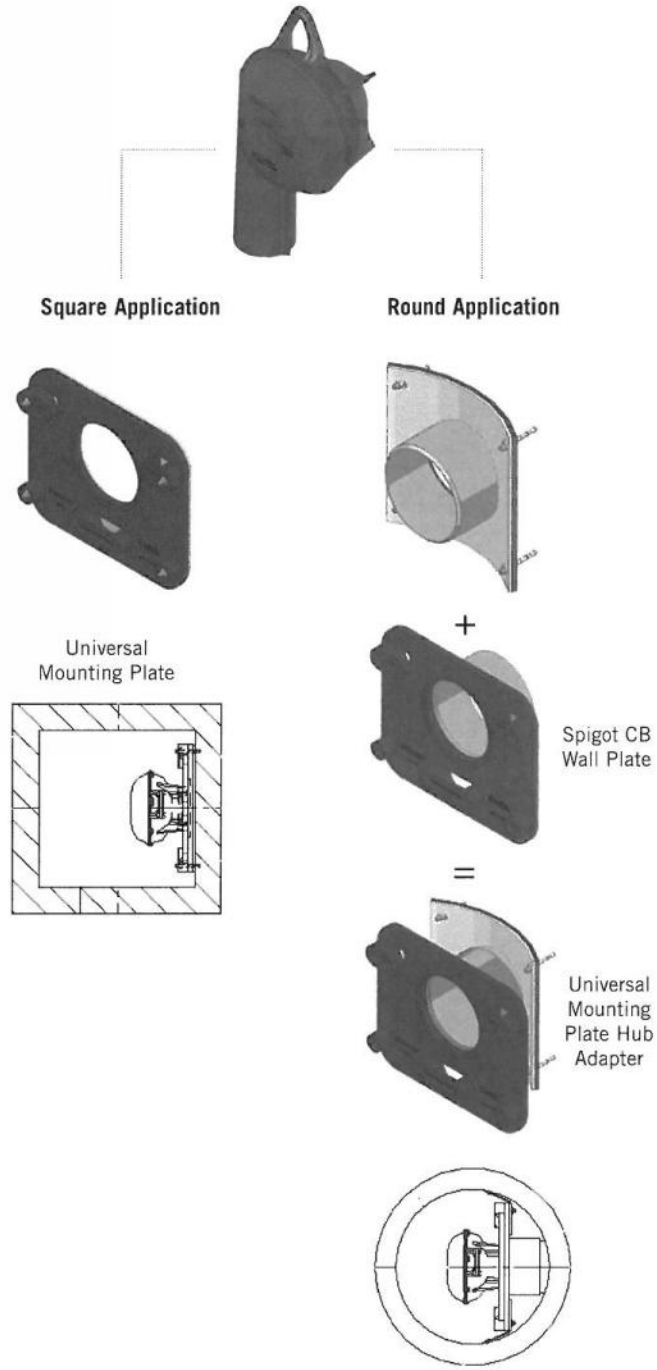
The LMF ICD vortex flow action allows the LMF ICD to provide a narrower flow curve using a larger orifice than a conventional orifice plate ICD, making it less likely to clog. When comparing flows at the same head level, the LMF ICD has the ability to restrict more flow than a conventional ICD during a rain event, preserving greater sewer capacity.

Product Construction

Constructed from durable PVC, the LMF ICD is light weight 8.9 Kg (19.7 lbs).

Product Applications

Will accommodate both square and round applications:



NOTE: Do not use or test the products in this manual with compressed air or other gases including air-over-water-boosters

Chart 1: LMF 14 Preset Flow Curves

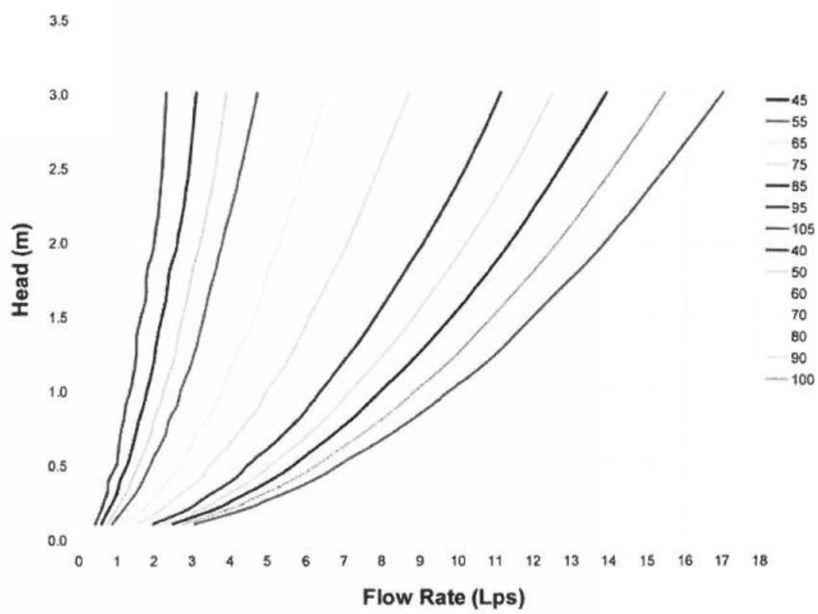
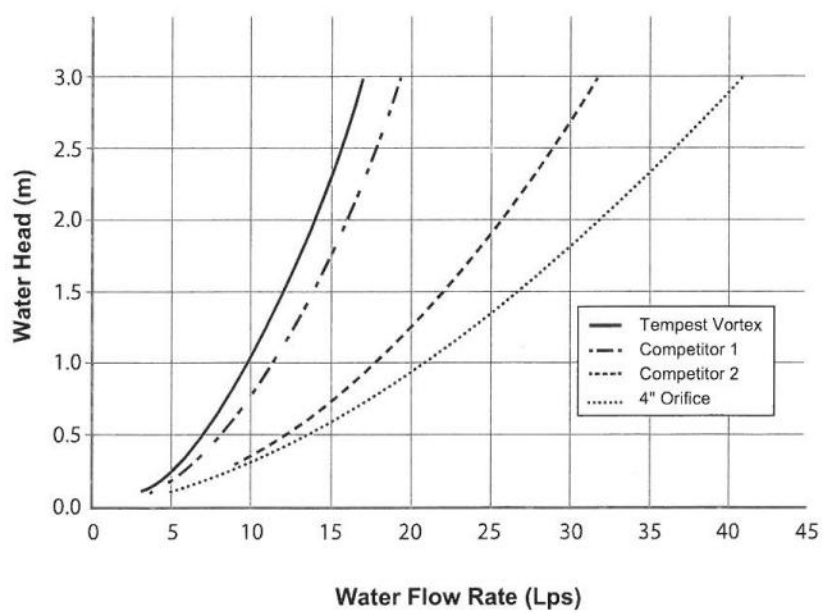


Chart 2: LMF Flow vs. ICD Alternatives



TEMPEST LMF ICD

PRODUCT INSTALLATION

Instructions to assemble a TEMPEST LMF ICD into a Square Catch Basin:

STEPS:

1. Materials and tooling verification:
   - Tooling: impact drill, 3/8" concrete bit, torque wrench for 9/16" nut, hand hammer, level, and marker.
   - Material: (4) concrete anchor 3/8 x 3-1/2, (4) washers, (4) nuts, universal mounting plate, ICD device.
2. Use the mounting wall plate to locate and mark the hole (4) pattern on the catch basin wall. You should use a level to ensure that the plate is at the horizontal.
3. Use an impact drill with a 3/8" concrete bit to make the four holes at a minimum of 1-1/2" depth up to 2-1/2". Clean the concrete dust from the holes.
4. Install the anchors (4) in the holes by using a hammer. Thread the nuts on the top of the anchors to protect the threads when you hit the anchors with the hammer. Remove the nuts from the ends of the anchors.
5. Install the universal mounting plate on the anchors and screw the 4 nuts in place with a maximum torque of 40 N.m (30 lbf-ft). There should be no gap between the wall mounting plate and the catch basin wall.
6. From the ground above using a reach bar, lower the ICD device by hooking the end of the reach bar to the handle of the ICD device. Align the triangular plate portion into the mounting wall plate. Push down the device to be sure it has centered in to the universal mounting plate and has created a seal.

WARNING

- Verify that the outlet pipe doesn't protrude into the catch basin. If it does, cut down the pipe flush to the catch basin wall.
- Call your IPEX representative for more information or if you have any questions about our products.

Instructions to assemble a TEMPEST LMF ICD into a Round Catch Basin:

STEPS:

1. Materials and tooling verification.
   - Tooling: impact drill, 3/8" concrete bit, torque wrench for 9/16" nut, hand hammer, level and marker.
   - Material: (4) concrete anchor 3/8 x 3-1/2, (4) washers and (4) nuts, spigot CB wall plate, universal mounting plate hub adapter, ICD device.
2. Use the spigot catch basin wall plate to locate and mark the hole (4) pattern on the catch basin wall. You should use a level to ensure that the plate is at the horizontal.
3. Use an impact drill with a 3/8" concrete bit to make the four holes at a depth between 1-1/2" to 2-1/2". Clean the concrete dust from the holes.
4. Install the anchors (4) in the holes by using a hammer. Thread the nuts on the top of the anchors to protect the threads when you hit the anchors with the hammer. Remove the nuts from the ends of the anchors.
5. Install the CB spigot wall plate on the anchors and screw the 4 nuts in place with a maximum torque of 40 N.m (30 lbf-ft). There should be no gap between the spigot wall plate and the catch basin wall.
6. Apply solvent cement on the hub of the universal mounting plate, hub adapter and the spigot of the CB wall plate, then slide the hub over the spigot. Make sure the universal mounting plate is at the horizontal and its hub is completely inserted onto the spigot. Normally, the corners of the universal mounting plate hub adapter should touch the catch basin wall.
7. From ground above using a reach bar, lower the ICD device by hooking the end of the reach bar to the handle of the ICD device. Align the triangular plate portion into the mounting wall plate. Push down the device to be sure it has centered in to the mounting plate and has created a seal.

WARNING

- Verify that the outlet pipe doesn't protrude into the catch basin. If it does, cut back the pipe flush to the catch basin wall.
- The solvent cement which is used in this installation is to be approved for PVC.
- The solvent cement should not be used below 0°C (32°F) or in a high humidity environment. Refer to the IPEX solvent cement guide to confirm the required curing time or visit the IPEX Online Solvent Cement Training Course available at www.ipexinc.com.
- Call your IPEX representative for more information or if you have any questions about our products.

PRODUCT TECHNICAL SPECIFICATION

General

Inlet control devices (ICD's) are designed to provide flow control at a specified rate for a given water head level and also provide odour and floatable control. All ICD's will be IPEX Tempest or approved equal.

All devices shall be removable from a universal mounting plate. An operator from street level using only a T-bar with a hook will be able to retrieve the device while leaving the universal mounting plate secured to the catch basin wall face. The removal of the TEMPEST devices listed above must not require any unbolting or special manipulation or any special tools.

High Flow (HF) Sump devices will consist of a removable threaded cap which can be accessible from street level with out entry into the catchbasin (CB). The removal of the threaded cap shall not require any special tools other than the operator's hand.

ICD's shall have no moving parts.

Materials

ICD's are to be manufactured from Polyvinyl Chloride (PVC) or Polyurethane material, designed to be durable enough to withstand multiple freeze-thaw cycles and exposure to harsh elements.

The inner ring seal will be manufactured using a Buna or Nitrile material with hardness between Duro 50 and Duro 70.

The wall seal is to be comprised of a 3/8" thick Neoprene Closed Cell Sponge gasket which is attached to the back of the wall plate.

All hardware will be made from 304 stainless steel.

Dimensioning

The Low Medium Flow (LMF), High Flow (HF) and the High Flow (HF) Sump shall allow for a minimum outlet pipe diameter of 200mm with a 600mm deep Catch Basin sump.

Installation

Contractor shall be responsible for securing, supporting and connecting the ICD's to the existing influent pipe and catchbasin/manhole structure as specified and designed by the Engineer.

APPENDIX F

Watts Control Flow Roof Drain Information

WATTS® DRAINAGE

Adjustable Accutrol Weir

Tag: RD-100-A-ADJ

Adjustable Flow Control for Roof Drains

ADJUSTABLE ACCUTROL(for Large Sump Roof Drains only)

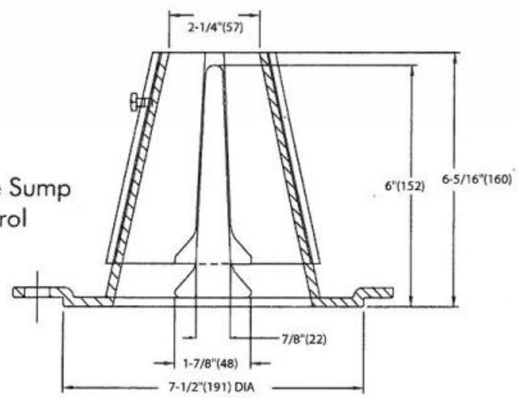
For more flexibility in controlling flow with heads deeper than 2", Watts Drainage offers the Adjustable Accutrol. The Adjustable Accutrol Weir is designed with a single parabolic opening that can be covered to restrict flow above 2" of head to less than 5 gpm per inch, up to 6" of head. To adjust the flow rate for depths over 2" of head, set the slot in the adjustable upper cone according to the flow rate required. Refer to Table 1 below.
Note: Flow rates are directly proportional to the amount of weir opening that is exposed.

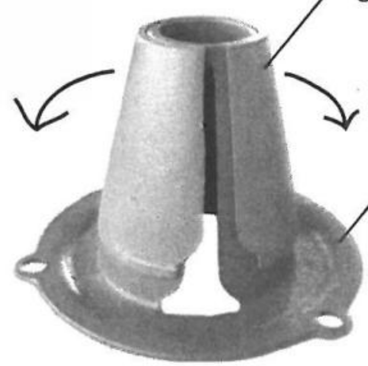
EXAMPLE:

For example, if the adjustable upper cone is set to cover 1/2 of the weir opening, flow rates above 2" of head will be restricted to 2-1/2 gpm per inch of head.

Therefore, at 3" of head, the flow rate through the Accutrol Weir that has 1/2 the slot exposed will be:
[5 gpm(per inch of head) x 2 inches of head] + 2-1/2 gpm(for the third inch of head) = 12-1/2 gpm.

Large Sump Accutrol





1/2 Weir Opening Exposed Shown Above

TABLE 1. Adjustable Accutrol Flow Rate Settings

Weir Opening Exposed	Head of Water 1"	2"	3"	4"	5"	6"
	Flow Rate (gallons per minute)					
Fully Exposed	5	10	15	20	25	30
3/4	5	10	13.75	17.5	21.25	25
1/2	5	10	12.5	15	17.5	20
1/4	5	10	11.25	12.5	13.75	15
Closed	5	10	10	10	10	10

Job Name ____________ Contractor ____________

Job Location ____________ Contractor's P.O. No. ____________

Engineer ____________ Representative ____________

WATTS Drainage reserves the right to modify or change product design or construction without prior notice and without incurring any obligation to make similar changes and modifications to products previously or subsequently sold. See your WATTS Drainage representative for any clarification. Dimensions are subject to manufacturing tolerances.

CANADA

WATTS DRAINAGE CANADA: 5435 North Service Road, Burlington, ON, L7L 5H7 TEL: 905-332-6718 TOLL-FREE: 1-888-208-8927 Website: www.wattsdrainage.ca

APPENDIX G

Oil-Grit Separator Information
CDS Unit

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
BASED ON THE RATIONAL RAINFALL METHOD
BASED ON A FINE PARTICLE SIZE DISTRIBUTION

Project Name:	March Road 401	**Engineer:**	**Novatech Engineering Consultants Ltd.**
Location:	Ottawa	**Contact:**	Stephen Matthews
OGS #:	-	**Report Date:**	12-Dec-13

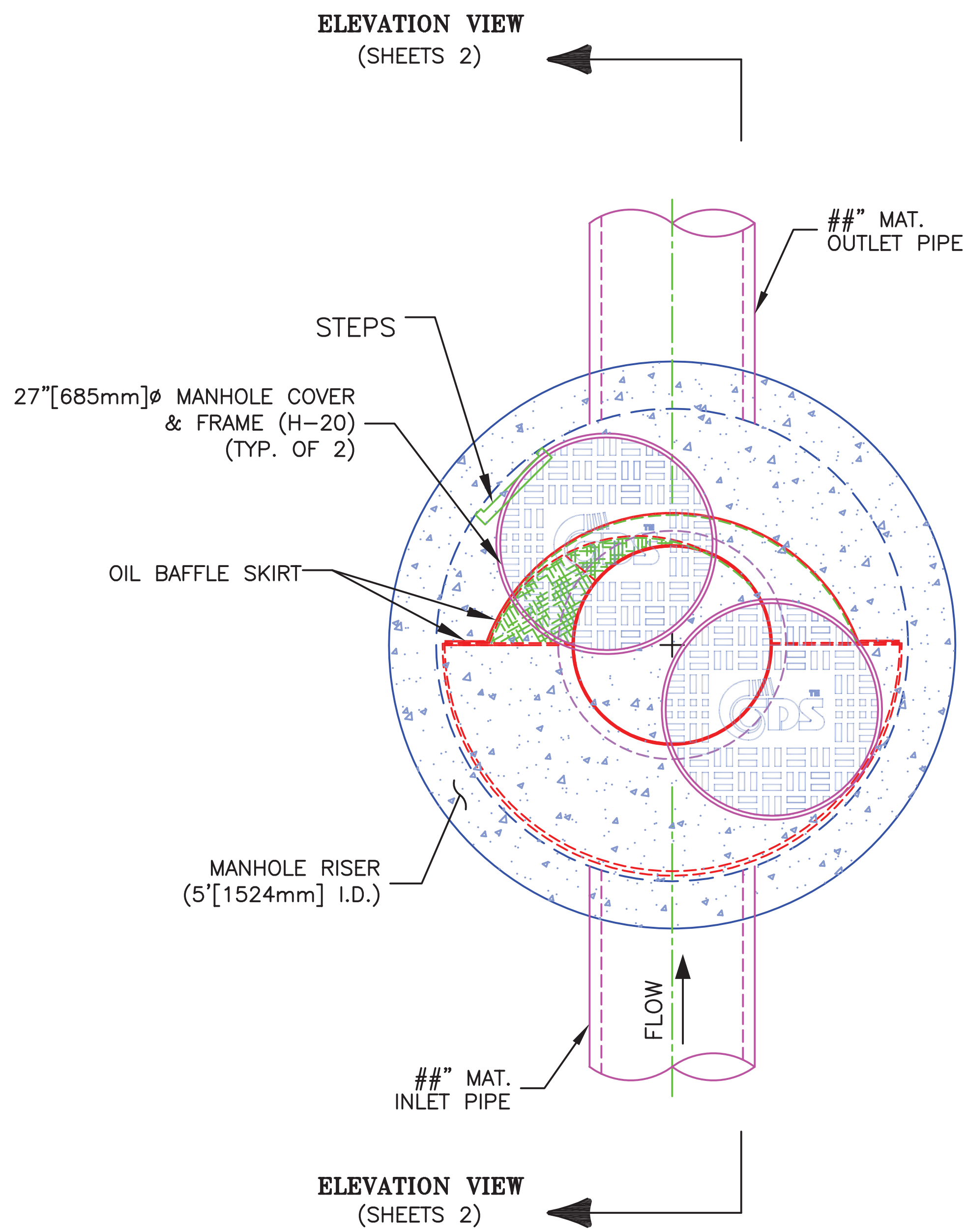
Area	1.23	ha	**Rainfall Station #**	215	
Weighted C	0.74		**Particle Size Distribution**	FINE	
CDS Model	2015		**CDS Treatment Capacity**	20	l/s

Rainfall	Percent	Cumulative	Total	Treated	Operating	Removal	Incremental
1.0	10.6%	19.8%	2.5	2.5	12.8	95.2	10.1
1.5	9.9%	29.7%	3.8	3.8	19.1	93.4	9.2
2.0	8.4%	38.1%	5.1	5.1	25.5	91.5	7.7
2.5	7.7%	45.8%	6.3	6.3	31.9	89.7	6.9
3.0	5.9%	51.7%	7.6	7.6	38.3	87.9	5.2
3.5	4.4%	56.1%	8.9	8.9	44.7	86.1	3.7
4.0	4.7%	60.7%	10.1	10.1	51.1	84.2	3.9
4.5	3.3%	64.0%	11.4	11.4	57.4	82.4	2.7
5.0	3.0%	67.1%	12.7	12.7	63.8	80.6	2.4
6.0	5.4%	72.4%	15.2	15.2	76.6	76.9	4.1
7.0	4.4%	76.8%	17.7	17.7	89.3	73.2	3.2
8.0	3.5%	80.3%	20.2	19.8	100.0	68.7	2.4
9.0	2.8%	83.2%	22.8	19.8	100.0	61.1	1.7
10.0	2.2%	85.3%	25.3	19.8	100.0	55.0	1.2
15.0	7.0%	92.3%	38.0	19.8	100.0	36.7	2.6
20.0	4.5%	96.9%	50.6	19.8	100.0	27.5	1.2
25.0	1.4%	98.3%	63.3	19.8	100.0	22.0	0.3
30.0	0.7%	99.0%	75.9	19.8	100.0	18.3	0.1
35.0	0.5%	99.5%	88.6	19.8	100.0	15.7	0.1
40.0	0.5%	100.0%	101.2	19.8	100.0	13.7	0.1
45.0	0.0%	100.0%	113.9	19.8	100.0	12.2	0.0
50.0	0.0%	100.0%	126.5	19.8	100.0	11.0	0.0
							78.0
						Predicted Net Annual Load Removal Efficiency =	**71.5%**
						Predicted % Annual Rainfall Treated =	**90.5%**

1 - Based on 42 years of hourly rainfall data from Canadian Station 6105976, Ottawa ON

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

PLAN VIEW

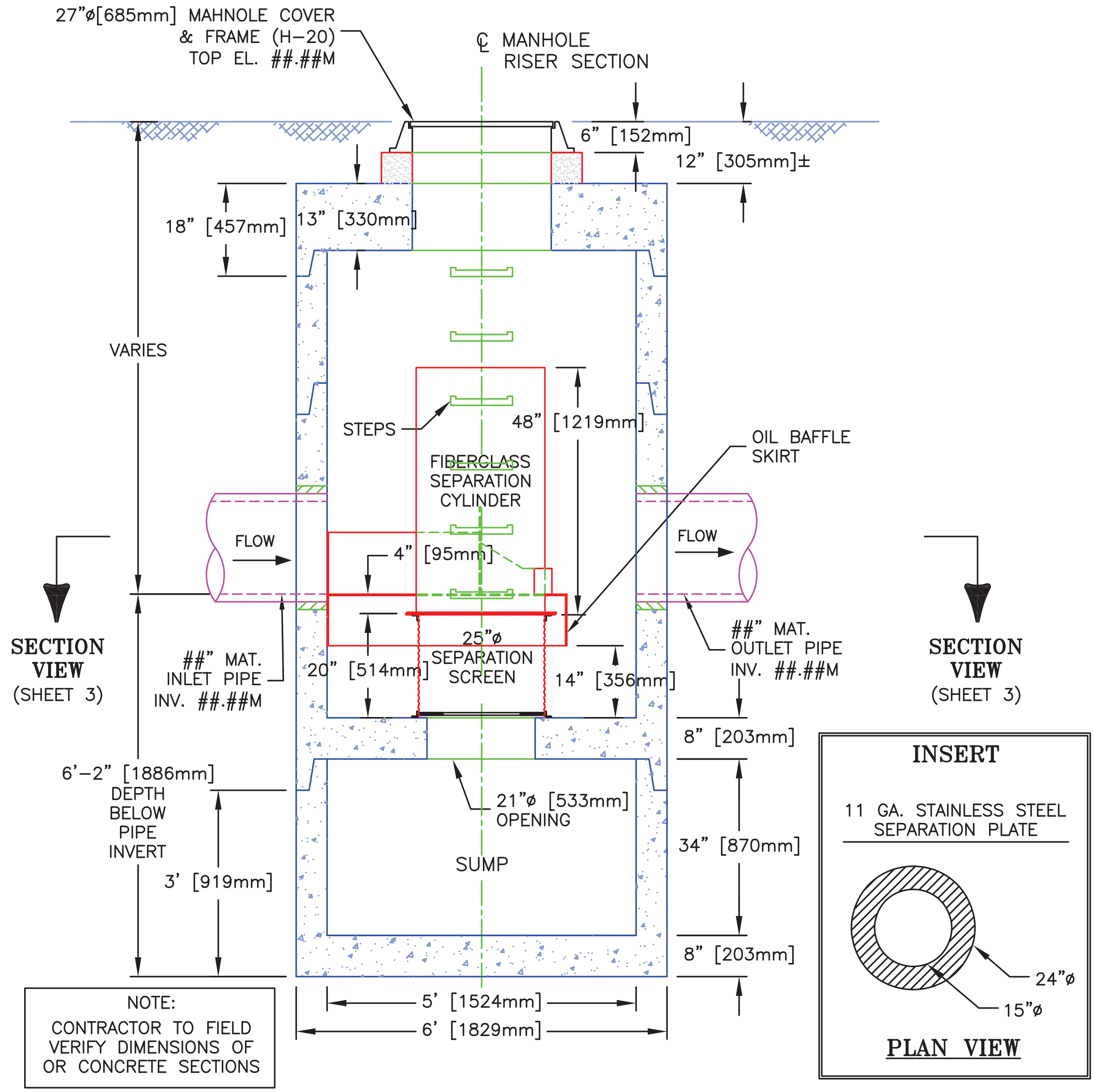


CDS MODEL PMSU20_15m, 0.7 CFS TREATMENT CAPACITY STORM WATER TREATMENT UNIT

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



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.		

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

ECHELON ENVIRONMENTAL

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

Estimate of Annual Grit Collection

Engineer:	Novatech Engineering
Contact:	Steve Matthews
Report Date:	Dec-12-2013

Project:	401 March Road
CDS Model:	20_15_5
OGS Location:	

Area :	1.23	ha
Imperviousness :	75	%
Runoff Coefficient :	0.74	

Assumptions:

1. Annual Rainfall	700	mm	
2. Typical Grit Concentration	250	mg/l	
3. Apparent Grit Density	1.8	kg/l	(estimated)
4. Grit Capture Efficiency	80%		

Runoff Volume = Area x Rainfall Depth x Runoff Coefficient = 6,371 cu.m

Grit Collected = Grit Concentration x Runoff Volume x Grit Capture Efficiency = 1,274 kg

Grit Volume = Mass / Apparent Density = 708 litres or 0.708 cu.m

Therefore it can be expected that this site will generate approximately 0.708cu.m of grit annually.

Sump Capacity of CDS unit = 1.309 cu.m

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

CONTECH®
CONSTRUCTION PRODUCTS INC.

CDS Guide
Operation, Design, Performance and Maintenance

CDS®

Using patented continuous deflective separation technology, the CDS system screens, separates and traps debris, sediment, and oil and grease from stormwater runoff. The indirect screening capability of the system allows for 100% removal of floatables and neutrally buoyant material without blinding. Flow and screening controls physically separate captured solids, and minimize the re-suspension and release of previously trapped pollutants. Inline units can treat up to 6 cfs, and internally bypass flows in excess of 50 cfs. Available precast or cast-in-place, offline units can treat flows from 1 to 300 cfs. The pollutant removal capacity of the CDS system has been proven in lab and field testing.

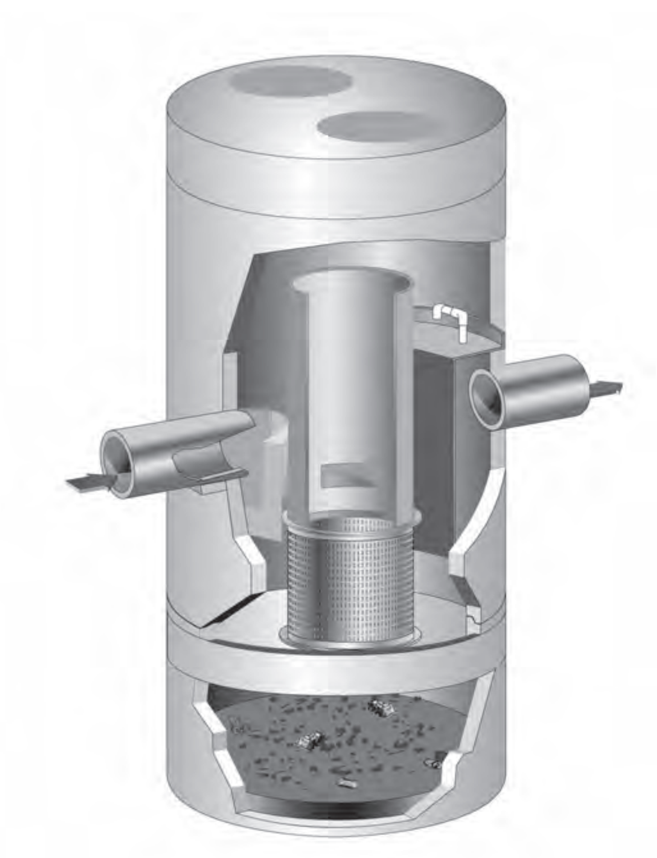
Operation Overview

Stormwater enters the diversion chamber where the diversion weir guides the flow into the unit's separation chamber and pollutants are removed from the flow. All flows up to the system's treatment design capacity enter the separation chamber and are treated.

Swirl concentration and screen deflection force floatables and solids to the center of the separation chamber where 100% of floatables and neutrally buoyant debris larger than the screen apertures are trapped.

Stormwater then moves through the separation screen, under the oil baffle and exits the system. The separation screen remains clog free due to continuous deflection.

During the flow events exceeding the design capacity, the diversion weir bypasses excessive flows around the separation chamber, so captured pollutants are retained in the separation cylinder.



Design Basics

There are three primary methods of sizing a CDS system. The Water Quality Flow Rate Method determines which model size provides the desired removal efficiency at a given flow rate for a defined particle size. The Rational Rainfall MethodTM and Probabalistic Method are used when a specific removal efficiency of the net annual sediment load is required.

Typically in the Unites States, CDS systems are designed to achieve an 80% annual solids load reduction based on lab generated performance curves for a gradation with an average particle size (d50) of 125-microns (μm). For some regulatory environments, CDS systems can also be designed to achieve an 80% annual solids load reduction based on an average particle size (d50) of 75-microns (μm).

Water Quality Flow Rate Method

In many cases, regulations require that a specific flow rate, often referred to as the water quality design flow (WQQ), be treated. This WQQ represents the peak flow rate from either an event with a specific recurrence interval (i.e. the six-month storm) or a water quality depth (i.e. 1/2-inch of rainfall).

The CDS is designed to treat all flows up to the WQQ. At influent rates higher than the WQQ, the diversion weir will direct most flow exceeding the treatment flow rate around the separation chamber. This allows removal efficiency to remain relatively constant in the separation chamber and reduces the risk of washout during bypass flows regardless of influent flow rates.

Treatment flow rates are defined as the rate at which the CDS will remove a specific gradation of sediment at a specific removal efficiency. Therefore they are variable based on the gradation and removal efficiency specified by the design engineer.

Rational Rainfall Method™

Differences in local climate, topography and scale make every site hydraulically unique. It is important to take these factors into consideration when estimating the long-term performance of any stormwater treatment system. The Rational Rainfall Method combines site-specific information with laboratory generated performance data, and local historical precipitation records to estimate removal efficiencies as accurately as possible.

Short duration rain gauge records from across the United States and Canada were analyzed to determine the percent of the total annual rainfall that fell at a range of intensities. US stations' depths were totaled every 15 minutes, or hourly, and recorded in 0.01-inch increments. Depths were recorded hourly with 1-mm resolution at Canadian stations. One trend was consistent at all sites; the vast majority of precipitation fell at low intensities and high intensity storms contributed relatively little to the total annual depth.

These intensities, along with the total drainage area and runoff coefficient for each specific site, are translated into flow rates using the Rational Rainfall Method. Since most sites are relatively small and highly impervious, the Rational Rainfall Method is appropriate. Based on the runoff flow rates calculated for each intensity, operating rates within a proposed CDS system are determined. Performance efficiency curve determined from full scale laboratory tests on defined sediment PSDs is applied to calculate solids removal efficiency. The relative removal efficiency at each operating rate is added to produce a net annual pollutant removal efficiency estimate.

Probabalistic Rational Method

The Probabalistic Rational Method is a sizing program CONTECH developed to estimate a net annual sediment load reduction for a particular CDS model based on site size, site runoff coefficient, regional rainfall intensity distribution, and anticipated pollutant characteristics.

The Probabilistic rational method is an extension of the rational method used to estimate peak discharge rates generated by storm events of varying statistical return frequencies (i.e.: 2-year storm event). Under this method, an adjustment factor is used to adjust the runoff coefficient estimated for the 10-year event, correlating a known hydrologic parameter with the target storm event. The rainfall intensities vary depending on the return frequency of the storm event under consideration. In general, these two frequency dependent parameters increase as the return frequency increases while the drainage area remains constant.

These intensities, along with the total drainage area and runoff coefficient for each specific site, are translated into flow rates using the Rational Method. Since most sites are relatively small and highly impervious, the Rational Method is appropriate. Based on the runoff flow rates calculated for each intensity, operating rates within a proposed CDS are determined. Performance efficiency curve on defined sediment PSDs is applied to calculate solids removal efficiency. The relative removal efficiency at each operating rate is added to produce a net annual pollutant removal efficiency estimate.

Treatment Flow Rate

The inlet throat area is sized to ensure that the WQQ passes through the separation chamber at a water surface elevation equal to the crest of the diversion weir. The diversion weir bypasses excessive flows around the separation chamber, thus helping to prevent re-suspension or re-entrainment of previously captured particles.

Hydraulic Capacity

CDS hydraulic capacity is determined by the length and height of the diversion weir and by the maximum allowable head in the system. Typical configurations allow hydraulic capacities of up to ten times the treatment flow rate. As needed, the crest of the diversion weir may be lowered and the inlet throat may be widened to increase the capacity of the system at a given water surface elevation. The unit is designed to meet project specific hydraulics.

Performance

Full-Scale Laboratory Test Results

A full-scale CDS unit (Model CDS2020-5B) was tested at the facility of University of Florida, Gainesville, FL. This full-scale CDS unit was evaluated under controlled laboratory conditions of pumped influent and the controlled addition of sediment.

Two different gradations of silica sand material (UF Sediment & OK-110) were used in the CDS performance evaluation. The particle size distributions (PSD) of the test materials were analyzed using standard method “Gradation ASTM D-422 with Hydrometer” by a certified laboratory. UF Sediment is a mixture of three different U.S. Silica Sand products referred as: “Sil-Co-Sil 106”, “#1 DRY” and “20/40 Oil Frac”. Particle size distribution analysis shows that the UF Sediment has a very fine gradation (d50 = 20 to 30 μm) covering a wide size range (uniform coefficient Cu averaged at 10.6). In comparison with the hypothetical TSS gradation specified in the NJDEP (New Jersey Department of Environmental Protection) and NJCAT (New Jersey Corporation for Advanced Technology) protocol for lab testing, the UF Sediment covers a similar range of particle size but with a finer d50 (d50 for NJDEP is approximately 50 μm) (NJDEP, 2003). The OK-110 silica sand is a commercial product of U.S. Silica Sand. The particle size distribution analysis of this material, also included in Figure 1, shows that 99.9% of the OK-110 sand is finer than 250 microns, with a mean particle size (d50) of 106 microns. The PSDs for the test material are shown in Figure 1.

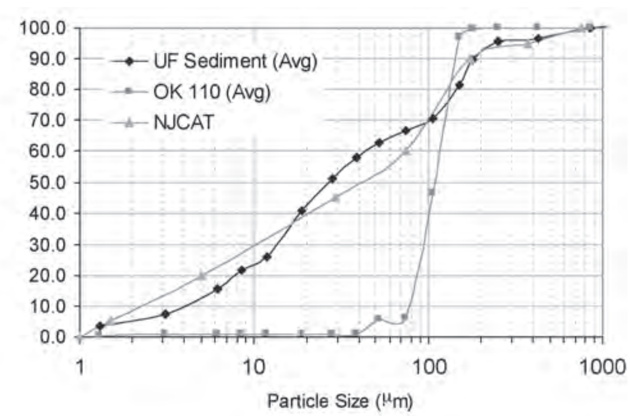


Figure 1. Particle size distributions for the test materials, as compared to the NJCAT/NJDEP theoretical distribution.

Tests were conducted to quantify the CDS unit (1.1 cfs (31.3-L/s) design capacity) performance at various flow rates, ranging from 1% up to 125% of the design capacity of the unit, using the 2400 micron screen. All tests were conducted with controlled influent concentrations approximately 200 mg/L. Effluent samples were taken at equal time intervals across the entire duration of each test run. These samples were then processed with a Dekaport Cone sample splitter to obtain representative sub-samples for Suspended Sediment Concentration (SSC – ASTM Standard Method D3977-97) and particle size distribution analysis.

Results and Modeling

Based on the testing data from the University of Florida, a performance model was developed for the CDS system. A regression analysis was used to develop a fitting curve for the scattered data points at various design flow rates. This model, which demonstrated good agreement with the laboratory data, can then be used to predict CDS system performance with respect to SSC removal for any particle size gradation assuming sandy-silt type of inorganic components of SSC. Figure 2 shows CDS predictive performance for two typical particle size gradations (NJCAT gradation and OK-110 sand).

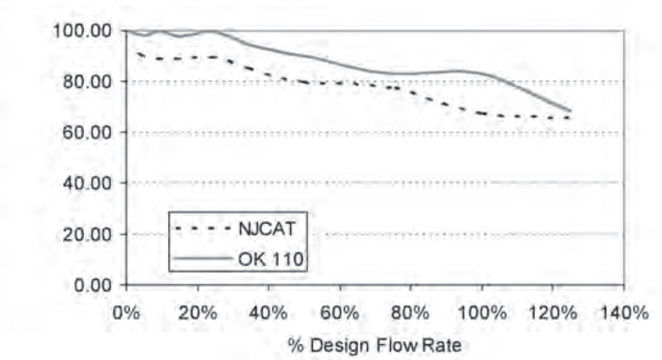


Figure 2. CDS stormwater treatment predictive performance for various particle gradations as a function of operating rate.

Many regulatory jurisdictions set a performance standard for hydrodynamic devices by stating that the devices shall be capable of achieving an 80% removal efficiency for particles having a mean particle size (d50) of 125 microns (WADOE, 2008). The model can be used to calculate the expected performance of such a PSD (shown in Figure 3). Supported by the laboratory data, the model indicates (Figure 4) that the CDS system with 2400 micron screen achieves approximately 80% removal at 100% of design flow rate, for this particle size distribution (d50 = 125 μm).

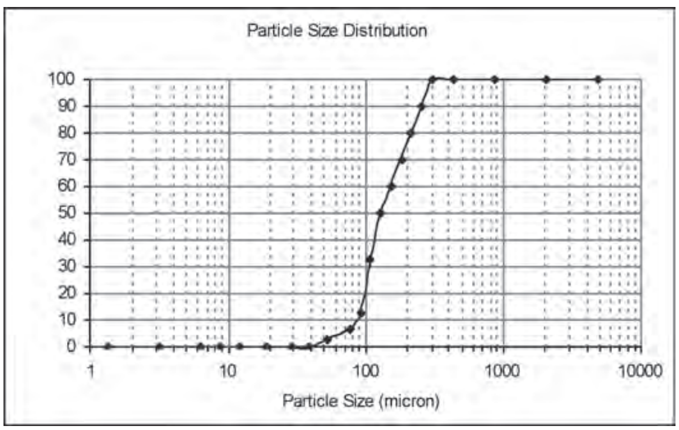


Figure 3. PSD with d50 = 125 microns, used to model performance for Ecology submittal.

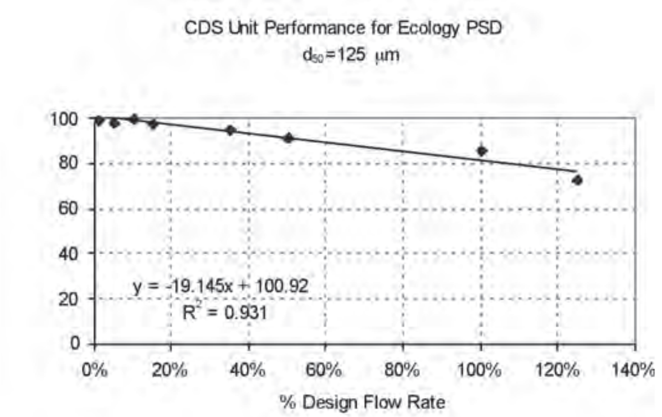


Figure 4. Modeled performance for CDS unit with 2400 microns screen, using Ecology PSD.

Maintenance

The CDS system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size of the unit, e.g., unstable soils or heavy winter sanding will cause the grit chamber to fill more quickly but regular sweeping of paved surfaces will slow accumulation.

Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant deposition and transport may vary from year to year and regular inspections will help insure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (i.e. spring and fall) however more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment washdown areas. Additionally, installations should be inspected more frequently where excessive amounts of trash are expected.

The visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions to inlet and/or separation screen. The inspection should also identify evidence of vector infestation and accumulations of hydrocarbons, trash, and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. If sorbent material is used for enhanced removal of hydrocarbons then the level of discoloration of the sorbent material should also

be identified during inspection. It is useful and often required as part of a permit to keep a record of each inspection. A simple form for doing so is provided.

Access to the CDS unit is typically achieved through two manhole access covers. One opening allows for inspection and cleanout of the separation chamber (screen/cylinder) and isolated sump. The other allows for inspection and cleanout of sediment captured and retained behind the screen. For units possessing a sizable depth below grade (depth to pipe), a single manhole access point would allow both sump cleanout and access behind the screen.

The CDS system should be cleaned when the level of sediment has reached 75% of capacity in the isolated sump and/or when an appreciable level of hydrocarbons and trash has accumulated. If sorbent material is used, it should be replaced when significant discoloration has occurred. Performance will not be impacted until 100% of the sump capacity is exceeded however it is recommended that the system be cleaned prior to that for easier removal of sediment. The level of sediment is easily determined by measuring from finished grade down to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Finer, silty particles at the top of the pile typically offer less resistance to the end of the rod than larger particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the as-built drawing for the unit to determine if the height of the sediment pile off the bottom of the sump floor exceeds 75% of the total height of isolated sump.

Cleaning

Cleaning of the CDS systems should be done during dry weather conditions when no flow is entering the system. Cleanout of the CDS with a vacuum truck is generally the most effective and convenient method of excavating pollutants from the system. Simply remove the manhole covers and insert the vacuum hose into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The area outside the screen should be pumped out also if pollutant build-up exists in this area.

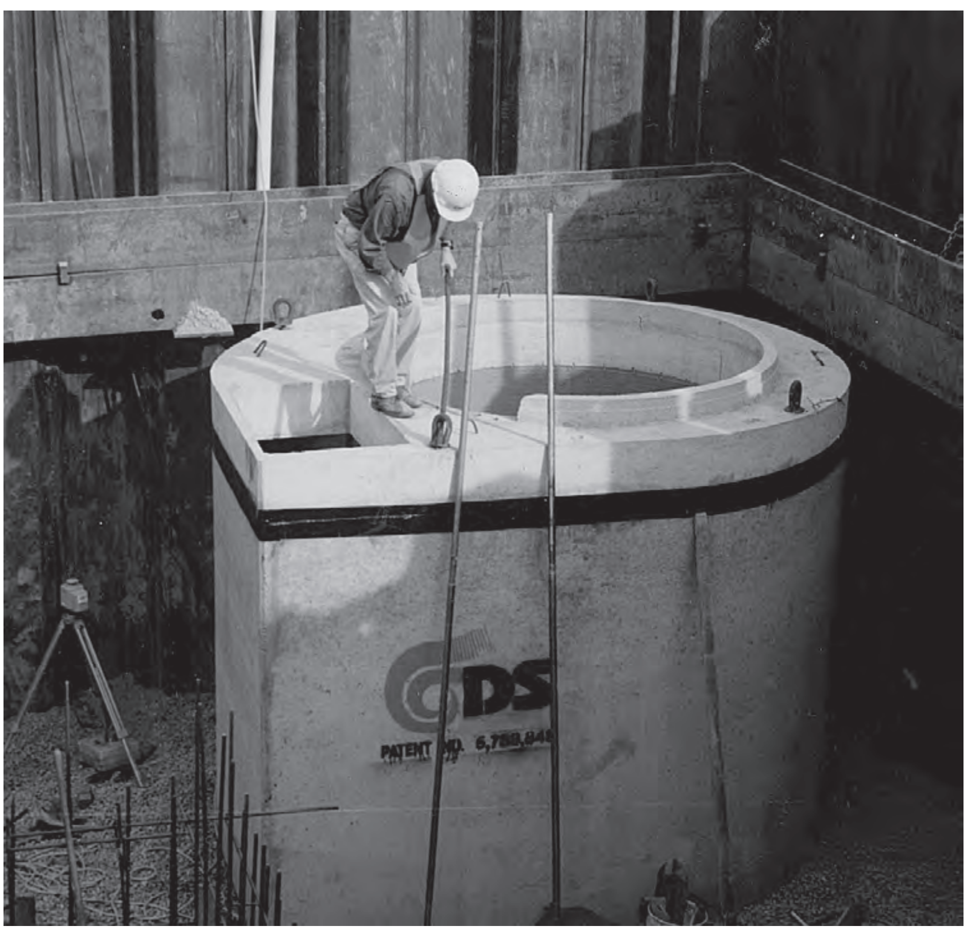
In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, an oil or gasoline spill should be cleaned out immediately. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use adsorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash can be netted out if you wish to separate it from the other pollutants. The screen should be power washed to ensure it is free of trash and debris.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure proper safety precautions. Confined Space Entry procedures need to be followed. Disposal of all material removed from the CDS system should be done is accordance with local regulations. In many locations, disposal of evacuated sediments may be handled in the same manner as disposal of sediments removed from catch basins or deep sump manholes. Check your local regulations for specific requirements on disposal.

CDS Model	Diameter		Distance from Water Surface to Top of Sediment Pile		Sediment Storage Capacity	
	ft	m	ft	m	yd3	m3
CDS2015-4	4	1.2	3.0	0.9	0.5	0.4
CDS2015	5	1.5	3.0	0.9	1.3	1.0
CDS2020	5	1.5	3.5	1.1	1.3	1.0
CDS2025	5	1.5	4.0	1.2	1.3	1.0
CDS3020	6	1.8	4.0	1.2	2.1	1.6
CDS3030	6	1.8	4.6	1.4	2.1	1.6
CDS3035	6	1.8	5.0	1.5	2.1	1.6
CDS4030	8	2.4	4.6	1.4	5.6	4.3
CDS4040	8	2.4	5.7	1.7	5.6	4.3
CDS4045	8	2.4	6.2	1.9	5.6	4.3

Table 1: CDS Maintenance Indicators and Sediment Storage Capacities

Note: To avoid underestimating the volume of sediment in the chamber, carefully lower the measuring device to the top of the sediment pile. Finer silty particles at the top of the pile may be more difficult to feel with a measuring stick. These finer particles typically offer less resistance to the end of the rod than larger particles toward the bottom of the pile.



6

CDS Inspection & Maintenance Log

CDS Model: ______________________ Location: ______________________

Date	Water depth to sediment[1]	Floatable Layer Thickness[2]	Describe Maintenance Performed	Maintenance Personnel	Comments

1. The water depth to sediment is determined by taking two measurements with a stadia rod: one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the difference between these measurements is less than eighteen inches the system should be cleaned out. **Note: To avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile.**

2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.

7

Support

- Drawings and specifications are available at www.contechstormwater.com.
- Site-specific design support is available from our engineers.

CONTECH CONSTRUCTION PRODUCTS INC.

800.925.5240

contechstormwater.com

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The product(s) described may be protected by one or more of the following US patents: 5,322,629; 5,624,576; 5,707,527; 5,759,415; 5,788,848; 5,985,157; 6,027,639; 6,350,374; 6,406,218; 6,641,720; 6,511,595; 6,649,048; 6,991,114; 6,998,038; 7,186,058; 7,296,692; 7,297,266; related foreign patents or other patents pending.

cds_manual 10/08 3M

RECYCLED PAPER

Steve Matthews

From: Daniel Oh [daniel@echelonenvironmental.ca]
Sent: Thursday, December 12, 2013 2:58 PM
To: Steve Matthews
Subject: RE: CDS Sizing Request - 401 March Road
Attachments: CDS TSS Removal - R1 - March Road 401 - Novatech.pdf; CDS Annual Grit Collection Estimation - March Road 401.pdf

Good Afternoon Steve,

Thank you again for the call and the design update.
After revision, the selected unit is CDS PMSU 2015_5 with a treatment flowrate of 20 L/s.
Please find attached our CDS TSSR calculation and sample cut sheet drawings for your file. The budgetary quote of this unit is $18,500

Our smallest unit, CDS PMSU 2015_4 which has a same treatment flowrate of 20 L/s can also meet the 70% TSS removal criteria. However, based on a grit loading analysis with the given site conditions, we have decided to size a 1500mm or 5ft MH unit. (Please see attached CDS Annual Grit Collection Estimation) As noted on this calculation it would be expected that the site would generate approximately 0.708 m3 of grit annually. OGS manufacturers will generally recommend a once a year cleanout cycle or potentially a 2-year cleanout cycle. (If grit and organics are left for an extended period they tend to agglomerate which make removal more difficult increasing overall maintenance costs.)

If you have any questions or concerns, please don't hesitate to contact our office at your convenience. Thank you.

Best regards,

Daniel Oh
Project Manager, EIT/EPt

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Office: 905-948-0000 ext. 223
Fax: 905-948-0577

daniel@echelonenvironmental.ca

-----Original Message-----
From: Steve Matthews [mailto:S.Matthews@novatech-eng.com]
Sent: December-05-13 12:39 PM
To: Daniel Oh
Cc: Miro Savic
Subject: CDS Sizing Request - 401 March Road

Hi Daniel,

We are currently working on a project in Ottawa that requires an oil/grit separator. I have had these type of units sized from your offices in the past. The project is for Starbank Developments. and is located in a developed industrial area on the west side of the City of Ottawa in Kanata. The project details are as follows:

Tributary area = 1.23ha
Imperviousness = 75%
Time of concentration = 10min
IDF Curve = City of Ottawa (104.2mm/hr Intensity for 5yr) (178.6mm/hr Intensity for 100yr)

We have a requirement to provide 80% TSS removal and the oil/grit separator will be installed on a new 375mm dia. PVC pipe with 180 degrees straight through the structure and approximately 1.6m cover on the pipes. A standard particle distribution (Fines) should be adequate for the design. Anticipated peak flow should be in the order of 71 L/s based on the City's requirement to control the site to pre-development runoff levels.

Can you please size a CDS unit for us and provide the design details as well as an approximate cost estimate. I have attached a preliminary sketch of the site showing the proposed location of the unit. Thank you for your time and consideration in this matter. If there is any further information you require, please do not hesitate to call.

Regards,
Steve

Stephen Matthews
Design/Drafting Technologist
****

Novatech Engineering Consultants Ltd.
Suite 200, 240 Michael Cowpland Drive
Kanata . Ontario . Canada . K2M 1P6
Tel: (613) 254-9643 x223
Fax: (613) 254-5867

APPENDIX H

Engineering Drawings

200mmØ WATERMAIN TABLE			
STATION	SURFACE ELEVATION	TOP OF WM ELEVATION	DESCRIPTION
0+00	82.70	±80.30 *	TEE CONNECTION TO EXISTING 200mmØ WATERMAIN
0+09	82.82	80.42	45° HORIZONTAL BEND
0+12.9	82.85	80.45	V&VB @ PROPERTY LINE
0+15	82.95	80.55	45° HORIZONTAL BEND
0+20	83.15	80.75	CROSS BELOW 200mmØ STM SEWER (CLEARANCE = 0.95m±)
0+23.5	83.30	80.90	50mmØ SERVICE (1+00)
0+25	83.35	80.95	- - -
0+50	83.25	80.85	- - -
0+54.2	83.24	80.84	CROSS BELOW 375mmØ STM SEWER (CLEARANCE = 0.80m±)
0+57.7	83.23	80.83	50mmØ SERVICE (2+00)
0+64.4	83.16	80.76	CROSS BELOW 375mmØ STM SEWER (CLEARANCE = 0.85m±)
0+66.7	83.14	80.74	CROSS BELOW 200mmØ STM SEWER (CLEARANCE = 0.95m±)
0+75	83.18	80.78	- - -
0+79.1	83.19	80.79	200x200x150 TEE - FIRE HYDRANT LEAD (4+00)
0+98	83.38	80.98	50mmØ SERVICE (5+00)
0+99	83.39	80.99	50mmØ SERVICE (6+00)
0+100	83.40	81.00	200mmØ CAP AND THRUSTBLOCK

* EXACT DEPTH OF EXISTING WATERMAIN TO BE DETERMINED AT TIME OF EXCAVATION, CONTRACTOR TO CONFIRM TOP OF WATERMAIN. PROVIDE THERMAL INSULATION AS PER CITY OF OTTAWA DETAIL W22 WHERE COVER IS LESS THAN 2.4m

150mmØ FIRE HYDRANT LEAD			
STATION	SURFACE ELEVATION	TOP OF WM ELEVATION	DESCRIPTION
4+00	83.19	80.79	200x200x150 TEE - FIRE HYDRANT LEAD (0+79.1)
4+02.7	83.52	81.00	CROSS BELOW 600mmØ STM SEWER (CLEARANCE = 0.56m±)
4+04.7	83.58	81.15	FIRE HYDRANT

50mmØ WATER SERVICE TABLE			
STATION	SURFACE ELEVATION	TOP OF WM ELEVATION	DESCRIPTION
1+00	83.30	80.90	50mmØ SERVICE (0.23.5)
1+02.3	83.50	80.95	50mmØ STAND POST
1+03.3	83.60	80.95	50mmØ CAP FOR BUILDING SERVICE
2+00	83.23	80.83	50mmØ SERVICE (0.57.7)
2+25	83.53	81.13	- - -
2+28.9	83.48	81.08	CROSS ABOVE 200mmØ SAN SEWER (CLEARANCE = 0.40m±)
2+45	83.68	81.15	50mmØ STAND POST
2+47.6	83.55	81.15	50mmØ CAP FOR BUILDING SERVICE
3+00	83.68	81.15	50mmØ CAP FOR BUILDING SERVICE
3+09.6	83.37	80.97	CROSS BELOW 200mmØ STM SEWER (CLEARANCE = 1.05m±)
3+19.7	83.45	81.05	CROSS ABOVE 200mmØ SAN SEWER (CLEARANCE = 0.33m±)
3+25	83.58	81.15	- - -
3+31.5	83.65	81.25	50mmØ STAND POST
3+33.1	83.75	81.25	50mmØ CAP FOR BUILDING SERVICE
5+00	83.38	80.98	50mmØ SERVICE (0+98)
5+25	83.38	80.98	- - -
5+44	84.10	81.70	50mmØ STAND POST
5+47.9	84.47	81.95	50mmØ CAP FOR BUILDING SERVICE
6+00	83.39	80.99	50mmØ SERVICE (0+99)
6+02.7	83.45	81.26 **	CROSS BELOW 600mmØ STM SEWER (CLEARANCE = 0.45m±)
6+05.1	83.48	81.44 **	CROSS ABOVE 200mmØ SAN SEWER (CLEARANCE = 0.25m±)
6+09	83.55	81.30 **	50mmØ STAND POST
6+9.8	83.65	81.25	50mmØ CAP FOR BUILDING SERVICE

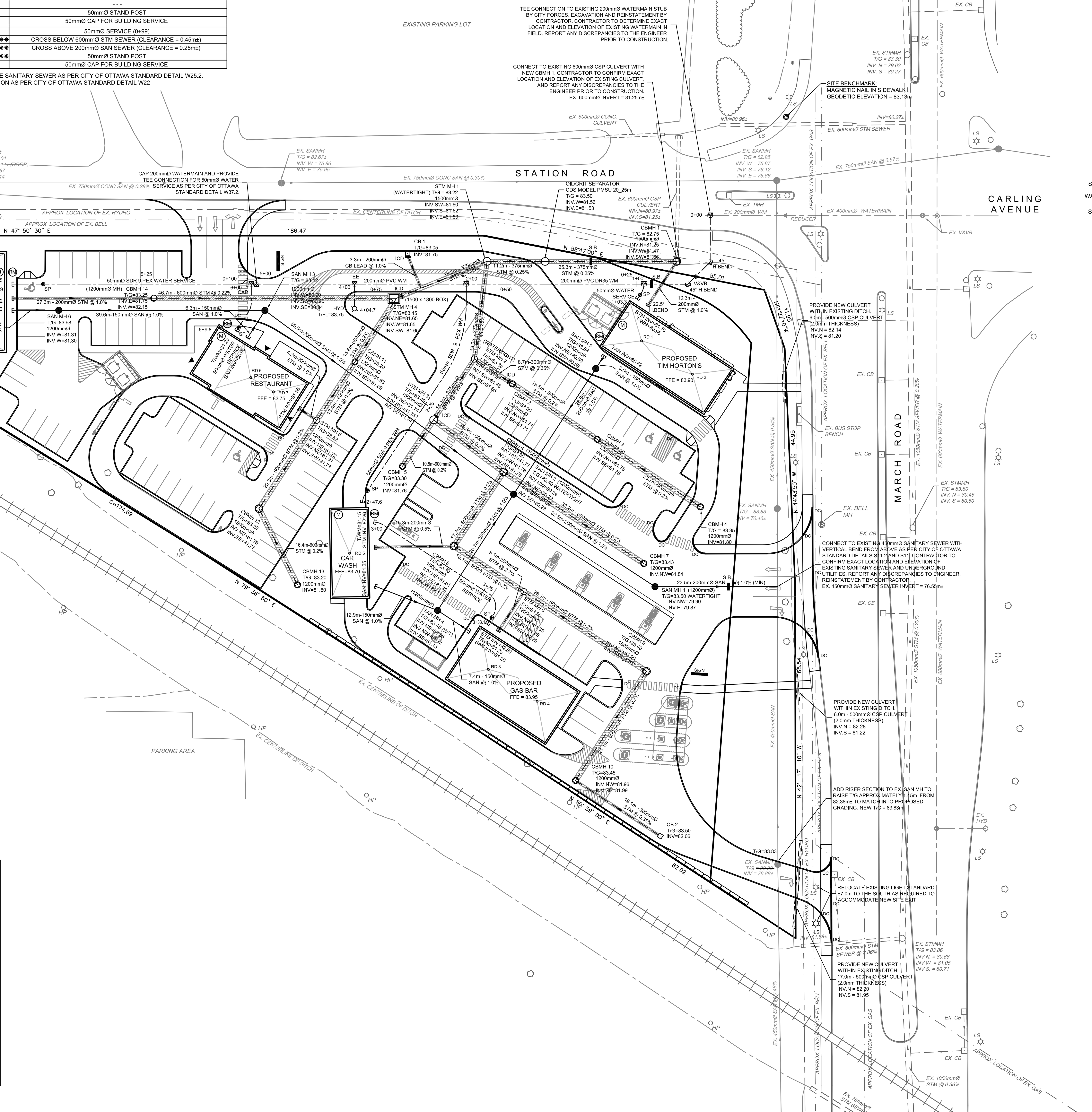
** WATERMAIN CROSSING ABOVE SANITARY SEWER AS PER CITY OF OTTAWA STANDARD DETAIL W25.2. PROVIDE ADEQUATE INSULATION AS PER CITY OF OTTAWA STANDARD DETAIL W22

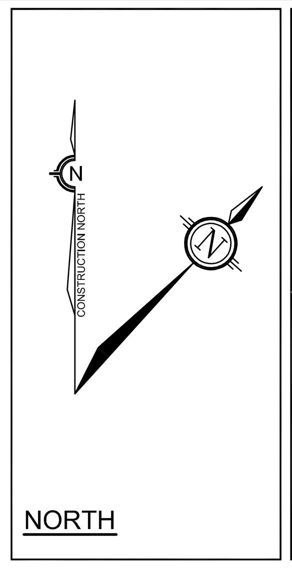
WATERMAIN NOTES:

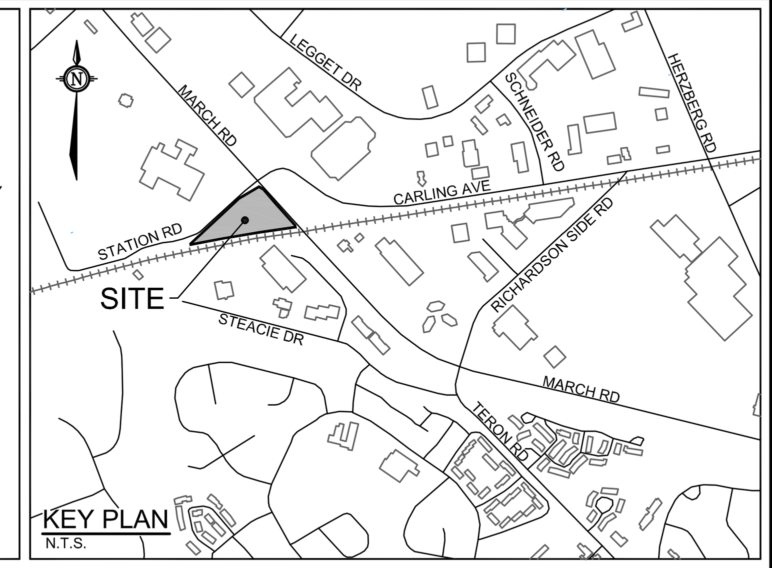
1. SUPPLY AND CONSTRUCT ALL WATERMAINS AND APPURTENANCES IN ACCORDANCE WITH ALL CITY OF OTTAWA STANDARDS AND SPECIFICATIONS. EXCAVATION, INSTALLATION, BACKFILL AND RESTORATION OF ALL WATERMAINS BY THE CONTRACTOR. CONNECTIONS, SHUT-OFFS AT THE MAIN AND CHLORINATION OF THE WATER SYSTEM SHALL BE PERFORMED BY CITY OFFICIALS.
2. SPECIFICATIONS:

ITEM	SPEC. No.	REFERENCE
WATERMAIN TRENCHING	W17	CITY OF OTTAWA
THERMAL INSULATION IN SHALLOW TRENCHES	W22	CITY OF OTTAWA
THERMAL INSULATION OF WATERMAIN AT OPEN STRUCTURES	W23	CITY OF OTTAWA
WATERMAIN CROSSING BELOW SEWER	W25	CITY OF OTTAWA
HYDRANT INSTALLATION	W19	CITY OF OTTAWA
WATERMAIN 150mmØ AND LARGER	PVC DR 18	
WATERMAIN 50mmØ AND SMALLER	PEX SDR 9	

3. WATERMAIN SHALL BE MINIMUM 2.4m DEPTH BELOW GRADE UNLESS OTHERWISE INDICATED.
4. WATER SERVICES ARE TO BE CONSTRUCTED TO WITHIN 1.0m OF FOUNDATION WALL AND CAPPED, UNLESS OTHERWISE INDICATED.







LEGEND

PROPOSED CURB	PROPOSED CATCHBASIN AND LEAD (CB 1)
PROPOSED DEPRESSED CURB (DC)	PROPOSED CATCHBASIN MANHOLE (CBMH 1)
PROPOSED WATERMAIN AND DIAMETER (150mmØ)	PROPOSED ROOF DRAIN (RD1)
PROPOSED STANDPOST (SP)	PROPOSED BUILDING ENTRANCE
PROPOSED VALVE AND VALVE BOX (V&VB)	*EXISTING UTILITY POLE C/W GUY WIRES*
PROPOSED CAP	*EXISTING WATERMAIN C/W VALVE & VALVE BOX* (V&VB)
PROPOSED WATER METER (M)	*EXISTING HYDRANT C/W VALVE & LEAD*
PROPOSED REMOTE METER (RM)	*EXISTING SANITARY MANHOLE & SEWER* (SAN MH)
PROPOSED SANITARY MANHOLE & SEWER (SANMH 1)	*EXISTING STORM MANHOLE & SEWER* (STM MH)
PROPOSED WATERTIGHT FRAME AND COVER (WATERTIGHT (W/T))	*EXISTING CATCHBASIN C/W CATCHBASIN LEAD* (CB 1)
PROPOSED STORM MANHOLE & SEWER (STMMH 1)	*EXISTING LIGHT STANDARD*
PROPOSED INLET CONTROL DEVICE (ICD)	
DIRECTION OF FLOW	
PROPOSED SHALLOW SEWER INSULATION	
PROPOSED RETAINING WALL (MAX. 1.0m HEIGHT)	
PROPOSED SEEPAGE BARRIER (PER GEOTECHNICAL REPORT) (S.B.)	

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 $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 GEOTECHNICAL REPORT (No. 13-339, DATED NOVEMBER, 2013), PREPARED BY HOULE CHEVRIER ENGINEERING LTD. 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 HARD SURFACE AREAS AND DIMENSIONS.
10. REFER TO DEVELOPMENT SERVICING STUDY AND STORMWATER MANAGEMENT REPORT (R-2013-210) PREPARED BY NOVATECH ENGINEERING CONSULTANTS LTD.
11. SAW CUT AND KEY GRIND ASPHALT AT ALL ASPHALT TIE IN POINTS AS PER CITY OF OTTAWA STANDARDS (R10).
12. PROVIDE LINE PAINTING AND PARKING LOT MARKINGS.
13. CONTRACTOR TO PROVIDE THE CONSULTANT WITH A GENERAL PLAN OF SERVICES INDICATING ALL SERVICING AS-BUILT INFORMATION SHOWN ON THIS PLAN. AS-BUILT INFORMATION MUST INCLUDE: PIPE MATERIAL, SIZES, LENGTHS, SLOPES, INVERT AND T/G ELEVATIONS, STRUCTURE LOCATIONS, VALVE AND HYDRANT LOCATIONS, T/WM ELEVATIONS AND ANY ALIGNMENT CHANGES, ETC.

SEWER NOTES:

1. SPECIFICATIONS:

ITEM	SPEC. No.	REFERENCE
CATCHBASIN (600x600mm)	705.010	OPSD
STORM / SANITARY MANHOLE (1200Ø)	701.010	OPSD
STORM MANHOLE (1500Ø)	701.011	OPSD
STORM MANHOLE (1500x1800 BOX)	-	-
CB, FRAME & COVER	400.020	OPSD
STORM / SANITARY MH FRAME & COVER	401.010	OPSD
WATERTIGHT FRAME & COVER	401.030	OPSD
SEWER TRENCH	S6, S7	CITY OF OTTAWA
STORM SEWER 600mmØ AND LARGER	CONC. 65-D	
STORM SEWER 375mmØ AND SMALLER	PVC DR 35	
SANITARY SEWER	PVC DR 35	

2. SERVICES ARE TO BE CONSTRUCTED TO 1.0m FROM FACE OF BUILDING AT A MINIMUM SLOPE OF 1.0%.
3. FLEXIBLE CONNECTIONS ARE REQUIRED FOR CONNECTING PIPES TO MANHOLES (FOR EXAMPLE KOR-N-SEAL, PSX: POSITIVE SEAL AND DURASEAL). THE CONCRETE CRADLE FOR THE PIPE CAN BE ELIMINATED.
4. THE OWNER SHALL REQUIRE THAT THE SITE SERVICING CONTRACTOR PERFORM FIELD TESTS FOR QUALITY CONTROL OF ALL SANITARY SEWERS. LEAKAGE TESTING SHALL BE COMPLETED IN ACCORDANCE WITH OPSS 410.07.16, 410.07.16.04 AND 407.07.24. DYE TESTING IS TO BE COMPLETED ON ALL SANITARY SERVICES TO CONFIRM PROPER CONNECTION TO THE SANITARY SEWER MAIN. THE FIELD TESTS SHALL BE PERFORMED IN THE PRESENCE OF A CERTIFIED PROFESSIONAL ENGINEER WHO SHALL SUBMIT A CERTIFIED COPY OF THE TEST RESULTS.
5. STORM MANHOLES AND CATCHBASIN MANHOLES ARE TO HAVE 300mm SUMPS UNLESS OTHERWISE INDICATED.
6. ALL CATCHBASINS AND CATCHBASIN MANHOLES TO BE PROVIDED WITH MINIMUM 3 METER LONG PERFORATED SUBDRAINS WHICH EXTEND IN AT LEAST TWO DIRECTIONS FROM EACH CATCHBASIN AT PAVEMENT SUBGRADE LEVEL.
7. CONTRACTOR TO TELEVISE (CCTV) ALL PROPOSED SEWERS, 200mmØ OR GREATER PRIOR TO BASE COURSE ASPHALT. UPON COMPLETION OF CONTRACT, THE CONTRACTOR IS RESPONSIBLE TO FLUSH AND CLEAN ALL SEWERS & APPURTENANCES.

AREA A2 - INLET CONTROL DEVICE DATA - CB 1						
DESIGN EVENT	IPEX TEMPEST MODEL	DIAMETER OF OUTLET PIPE (mm)	DESIGN FLOW (L/s)	UPSTREAM HEAD (m)	SURFACE PONDING (m)	VOLUME (m3)
1:5 YR	LMF - VORTEX ICD	200	4.0	1.38	0.18	15.5
1:100 YR	LMF - VORTEX ICD	200	4.1	1.47	0.27	38.3

AREA A3 - INLET CONTROL DEVICE DATA - STM MH 2						
DESIGN EVENT	IPEX TEMPEST MODEL	DIAMETER OF OUTLET PIPE (mm)	DESIGN FLOW (L/s)	UPSTREAM HEAD (m)	SURFACE PONDING (m)	VOLUME (m3)
1:5 YR	LMF - VORTEX ICD	300	4.3	1.52	0.07	23.6
1:100 YR	LMF - VORTEX ICD	300	4.4	1.59	0.14	56.1

AREA A4 - INLET CONTROL DEVICE DATA - STM MH 3						
DESIGN EVENT	IPEX TEMPEST MODEL	DIAMETER OF OUTLET PIPE (mm)	DESIGN FLOW (L/s)	UPSTREAM HEAD (m)	SURFACE PONDING (m)	VOLUME (m3)
1:5 YR	PLUG ICD-112mmØ ORIFICE	375	22.2	0.67	- - -	45.0
1:100 YR	PLUG ICD-112mmØ ORIFICE	375	33.9	1.55	0.18	94.8

AREA A5 - INLET CONTROL DEVICE DATA - STM MH 4						
DESIGN EVENT	IPEX TEMPEST MODEL	DIAMETER OF OUTLET PIPE (mm)	DESIGN FLOW (L/s)	UPSTREAM HEAD (m)	SURFACE PONDING (m)	VOLUME (m3)
1:5 YR	PLUG ICD - 78mmØ ORIFICE	375	15.9	1.46	0.10	51.8
1:100 YR	PLUG ICD - 78mmØ ORIFICE	375	16.7	1.60	0.24	131.3

ROOF DRAIN TABLE - RD 1 - 9						
AREA ID	ROOF DRAIN No.	ROOF DRAIN OPENING	1:5 YEAR RELEASE RATE	APPROX. 5 YR PONDING DEPTH	1:100 YEAR RELEASE RATE	APPROX. 100 YR PONDING DEPTH
B1	RD 1	CLOSED	0.76 L/s	0.07 m	0.76 L/s	0.10 m
B1	RD 2	CLOSED	0.76 L/s	0.07 m	0.76 L/s	0.10 m
B2	RD 3	CLOSED	0.76 L/s	0.07 m	0.76 L/s	0.10 m
B2	RD 4	CLOSED	0.76 L/s	0.07 m	0.76 L/s	0.10 m
B3	RD 5	1/2 EXPOSED	0.95 L/s	0.08 m	1.14 L/s	0.10 m
B4	RD 6	FULLY EXPOSED	0.95 L/s	0.07 m	1.52 L/s	0.10 m
B4	RD 7	FULLY EXPOSED	0.95 L/s	0.07 m	1.52 L/s	0.10 m
B5	RD 8	FULLY EXPOSED	1.04 L/s	0.07 m	1.32 L/s	0.09 m
B5	RD 9	FULLY EXPOSED	1.04 L/s	0.07 m	1.32 L/s	0.09 m

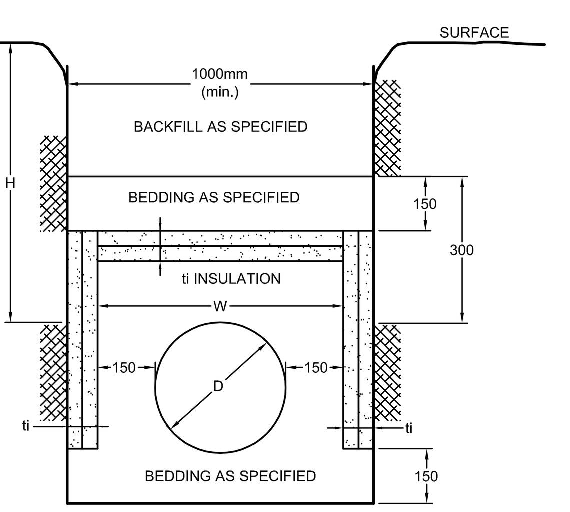
* ALL PROPOSED ROOF DRAINS TO BE WATTS ACCUTROL ADJUSTABLE FLOW CONTROL ROOF DRAINS. REFER TO APPENDIX 'F' IN THE STORMWATER MANAGEMENT REPORT (R-2013-210) FOR ROOF DRAIN DETAILS.

ti = THICKNESS OF INSULATION (mm)
h = DEPTH OF COVER
W = D + 300 (1000 min.)
W = WIDTH OF INSULATION (mm)
D = O.D OF PIPE (mm)

COVER (mm)	INSULATION THICKNESS (mm)
1500-1200	50
1200-900	75
900-600	100

NOTES:

1. INSULATE ALL SEWER PIPES THAT HAVE LESS THAN 1.5m COVER WITH EXPANDED POLYSTYRENE INSULATION AS SHOWN.
2. THE THICKNESS OF INSULATION SHALL BE THE EQUIVALENT OF 25mm FOR EVERY 300mm REDUCTION IN THE REQUIRED DEPTH OF COVER (SEE TABLE)



TYPICAL INSULATION DETAIL (SEWERS ONLY)
NOT TO SCALE

NOTE:
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OWNER INFORMATION
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329 BROOKE AVENUE
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DUNG LAM
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No.	REVISION	DATE	BY
2.	ISSUED FOR SITE PLAN APPROVAL	DEC 20/13	MS
1.	ISSUED FOR REVIEW	DEC 13/13	MS

SCALE 1:400

DESIGN	MS
CHECKED	SM / MS
DRAWN	MTM / SM
CHECKED	SM / MS
APPROVED	MS

FOR REVIEW ONLY

LICENSED PROFESSIONAL ENGINEER
M. SAVIC
100102651
DEC 20/13
PROVINCE OF ONTARIO

NOVATECH ENGINEERING CONSULTANTS LTD.
ENGINEERS & PLANNERS
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Ottawa, Ontario, Canada
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Facsimile (613) 254-5867
Email: novainfo@novatech-eng.com

LOCATION
401 MARCH ROAD, KANATA
STARBANK DEVELOPMENTS

DRAWING NAME
GENERAL PLAN OF SERVICES

PROJECT No. 113023-00
REV: REV # 2
DRAWING No. 113023-GP

PLANB1.DWG - 1000mmx707mm

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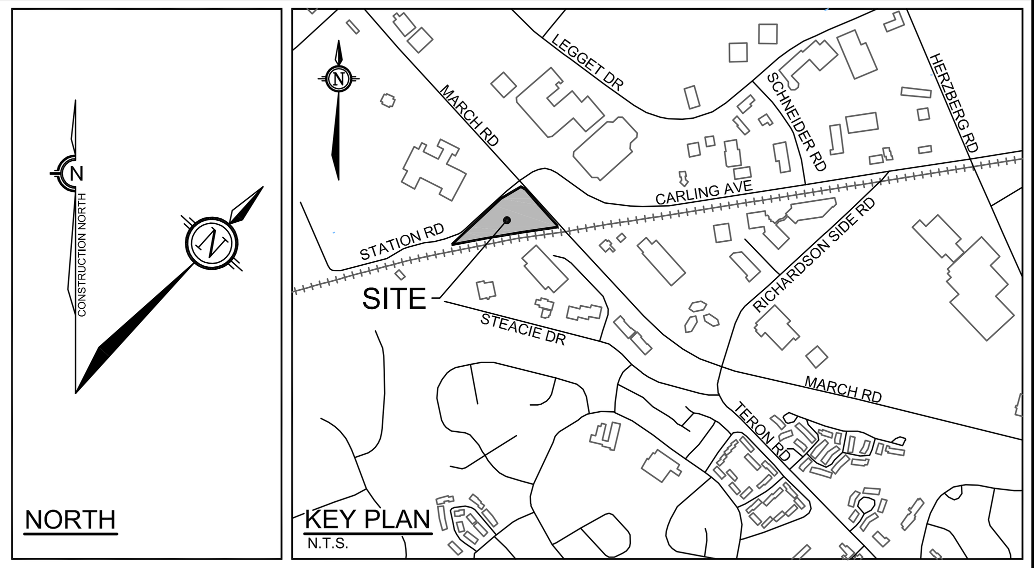

LEGEND

- PROPOSED ELEVATION
- GRADE AND DIRECTION
- MAXIMUM 3:1 SIDESLOPE
- PROPOSED SWALE
- PROPOSED CURB
- DC — PROPOSED DEPRESSED CURB
- PROPOSED CULVERT
- STMMH 1 — PROPOSED STORM MANHOLE
- CBMH 1 — PROPOSED CATCHBASIN MANHOLE
- WATERTIGHT (W/T) — PROPOSED WATERTIGHT FRAME AND COVER
- V&VB — PROPOSED VALVE & VALVE BOX
- SP — PROPOSED STAND POST
- HYD T/FL=83.75 — PROPOSED FIRE HYDRANT
- DIRECTION OF MAJOR OVERLAND FLOW
- PROPOSED RETAINING WALL (MAX. 1.0m HEIGHT)
- RD1 — PROPOSED ROOF DRAIN
- PROPOSED BUILDING ENTRANCE
- ICD — PROPOSED INLET CONTROL DEVICE
- 100 YEAR / 5 YEAR — APPROXIMATE LIMITS OF SURFACE PONDING
- *EXISTING ELEVATION*
- *EXISTING TOP OF CURB ELEVATION*
- *EXISTING STORM MANHOLE*
- *EXISTING SANITARY MANHOLE*
- EX.CB — *EXISTING CATCHBASIN*
- EX.DICB — *EXISTING DITCH INLET CATCH BASIN*
- T/G — *EXISTING TOP OF GRATE*
- VVB — *EXISTING VALVE & VALVE BOX*
- HYD — *EXISTING HYDRANT C/W VALVE*
- EX UP — *EXISTING UTILITY POLE C/W GUY WIRES*
- LS — *EXISTING LIGHT STANDARD*
- *EXISTING FENCE*
- OHW — *EXISTING OVERHEAD WIRES*

PAVEMENT STRUCTURE:

LIGHT DUTY PAVEMENT
50mm SUPERPAVE 12.5 (PG 58-34)
150mm GRANULAR "A"
300mm GRANULAR "B" TYPE II

HEAVY DUTY PAVEMENT
40mm SUPERPAVE 12.5 (PG 58-34)
50mm SUPERPAVE 19.0 (PG 58-34)
150mm GRANULAR "A"
450mm GRANULAR "B" TYPE II

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11. SAW CUT AND KEY GRIND ASPHALT AT ALL ASPHALT TIE IN POINTS AS PER CITY OF OTTAWA STANDARDS (R10).
12. PROVIDE LINE PAINTING AND PARKING LOT MARKINGS.
13. CONTRACTOR TO PROVIDE THE CONSULTANT WITH A GRADING PLAN INDICATING THE AS-BUILT ELEVATION OF EVERY DESIGN GRADE SHOWN ON THIS PLAN.

GRADING NOTES:

1) ALL TOPSOIL, ORGANIC OR DELETERIOUS MATERIAL MUST BE ENTIRELY REMOVED FROM BENEATH THE PROPOSED PAVED AREAS.
2) EXPOSED SUBGRADES IN PROPOSED PAVED AREAS SHOULD BE PROOF ROLLED WITH A LARGE STEEL DRUM ROLLER AND INSPECTED BY THE GEOTECHNICAL CONSULTANT.
3) ANY SOFT AREAS EVIDENT FROM THE PROOF ROLLING SHOULD BE SUBEXCAVATED AND REPLACED WITH SUITABLE MATERIAL THAT IS FROST COMPATIBLE WITH THE EXISTING SOILS.
4) THE GRANULAR BASE SHOULD BE COMPACTED TO AT LEAST 98% OF THE STANDARD PROCTOR MAXIMUM DRY DENSITY VALUE. ANY ADDITIONAL GRANULAR FILL USED BELOW THE PROP OSED PAVEMENT SHOULD BE COMPACTED TO AT LEAST 98% OF THE STANDARD PROCTOR MAXIMUM DRY DENSITY VALUE.
5) GRADE AND/OR FILL BEHIND PROPOSED CURB AND BETWEEN BUILDINGS AND CURBS, WHERE REQUIRED TO PROVIDE POSITIVE DRAINAGE.
6) MINIMUM OF 2% GRADE FOR ALL GRASS AREAS 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).

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.

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SCALE 1:400

DESIGN MS
CHECKED SM / MS
DRAWN MTM / SM
CHECKED SM / MS
APPROVED MS

FOR REVIEW ONLY

LICENSED PROFESSIONAL ENGINEER
M. SAVIC
100102651
DEC 20/13
PROVINCE OF ONTARIO

NOVATECH
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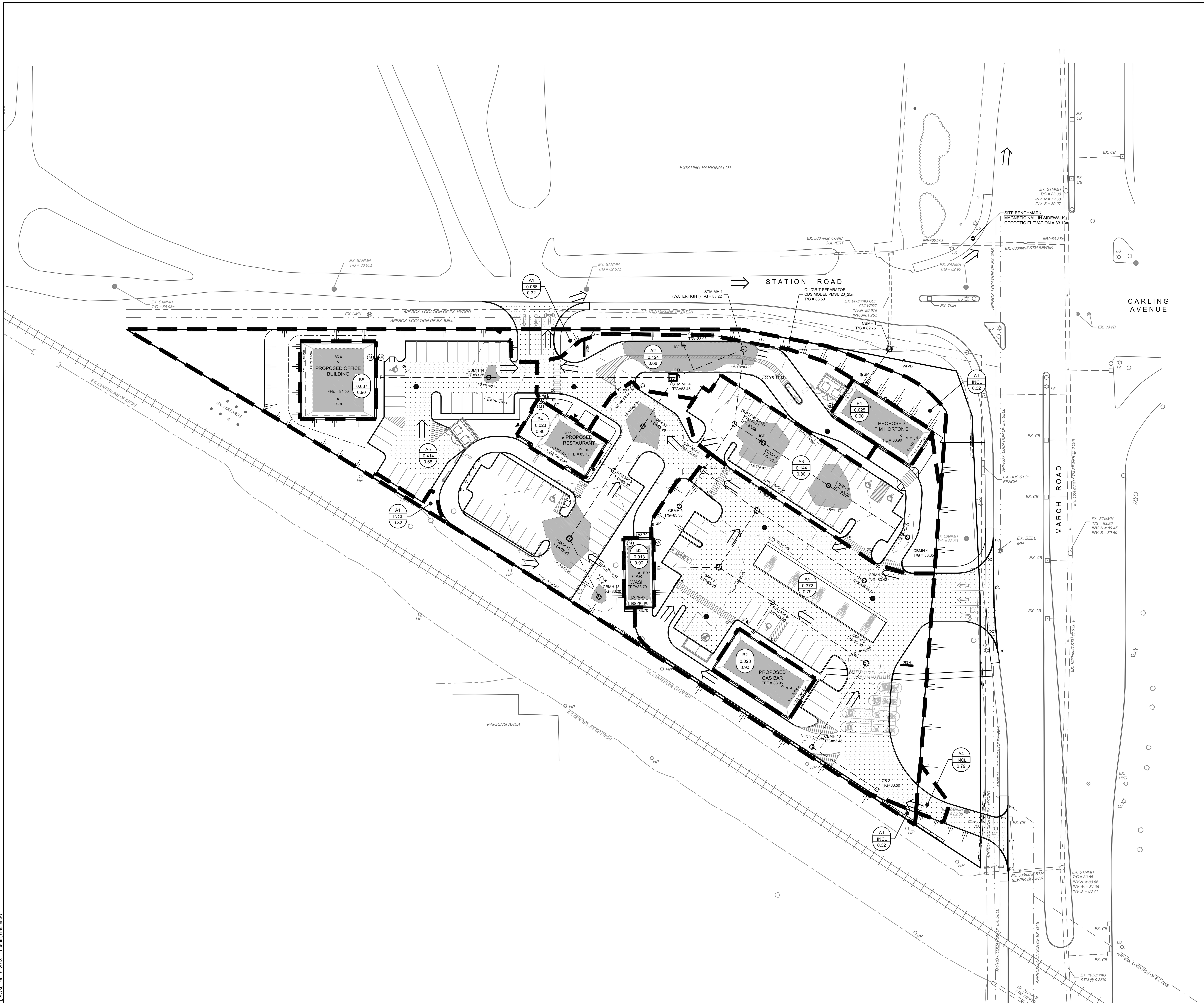
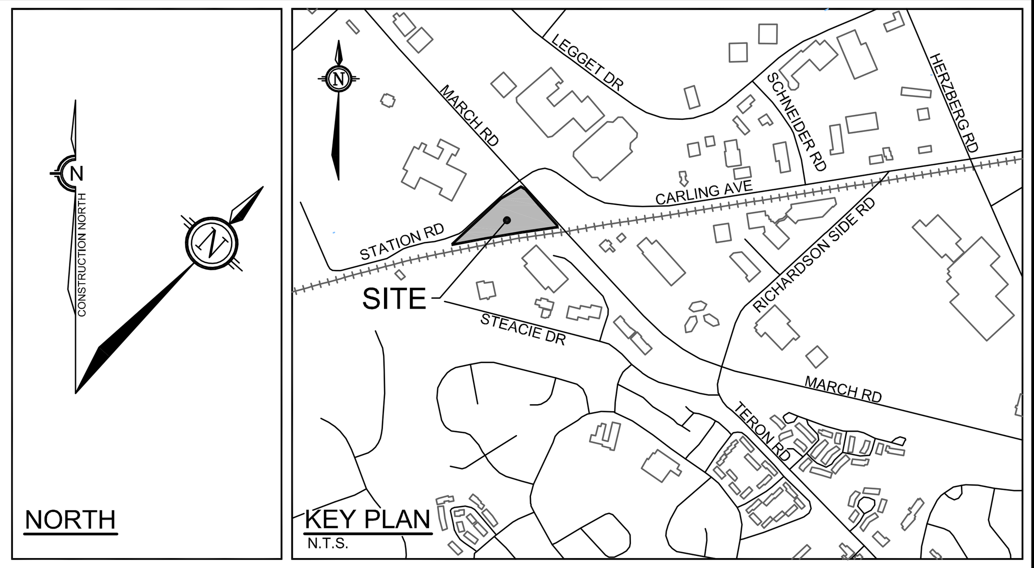
LOCATION
401 MARCH ROAD, KANATA
STARBANK DEVELOPMENTS

DRAWING NAME
GRADING PLAN

PROJECT No. 113023-00
REV REV # 2
DRAWING No. 113023-GR

PLANB1.DWG - 1000mmx707mm





LEGEND

- PROPOSED CURB
- DC — PROPOSED DEPRESSED CURB
- VVB — VALVE & VALVE BOX
- STMMH 1 — PROPOSED STORM MANHOLE & SEWER
- DIRECTION OF FLOW
- CB 1 — PROPOSED CATCHBASIN C/W CATCHBASIN LEAD
- CBMH 1 — PROPOSED CATCHBASIN MH
- RD1 — PROPOSED ROOF DRAIN
- PROPOSED BUILDING ENTRANCE
- A1 — AREA IDENTIFIER
- 0.056 — DRAINAGE AREA (hectares)
- 0.32 — 5 YR WEIGHTED RUN-OFF COEFFICIENT
- STORM DRAINAGE AREA
- DIRECTION OF MAJOR OVERLAND FLOW
- *EXISTING UTILITY POLE C/W GUY WIRES*
- *EXISTING HYDRANT C/W VALVE & LEAD*
- STM MH — *EXISTING STORM MANHOLE & SEWER*
- CB 1 — *EXISTING CATCHBASIN C/W CATCHBASIN LEAD*
- *EXISTING LIGHT STANDARD*

GENERAL NOTES:

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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.

7) ALL ELEVATIONS ARE GEO DETIC.

8) REFER TO GEOTECHNICAL INVESTIGATION (No. 13-339, DATED NOVEMBER, 2013) PREPARED BY HOULE CHEVRIER ENGINEERING LTD. 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 THE DEVELOPMENT SERVICING STUDY AND STORMWATER MANAGEMENT REPORT (R-2013-210) PREPARED BY NOVATECH ENGINEERING CONSULTANTS LTD.

AREA A2 - INLET CONTROL DEVICE DATA - CB 1

DESIGN EVENT	IPEX TEMPEST MODEL	DIAMETER OF OUTLET PIPE (mm)	DESIGN FLOW (L/s)	UPSTREAM HEAD (m)	SURFACE PONDING (m)	VOLUME (m3)
1:5 YR	LMF - VORTEX ICD	200	4.0	1.38	0.18	15.5
1:100 YR	LMF - VORTEX ICD	200	4.1	1.47	0.27	38.3

AREA A3 - INLET CONTROL DEVICE DATA - STM MH 2

DESIGN EVENT	IPEX TEMPEST MODEL	DIAMETER OF OUTLET PIPE (mm)	DESIGN FLOW (L/s)	UPSTREAM HEAD (m)	SURFACE PONDING (m)	VOLUME (m3)
1:5 YR	LMF - VORTEX ICD	300	4.3	1.52	0.07	23.6
1:100 YR	LMF - VORTEX ICD	300	4.4	1.59	0.14	56.1

AREA A4 - INLET CONTROL DEVICE DATA - STM MH 3

DESIGN EVENT	IPEX TEMPEST MODEL	DIAMETER OF OUTLET PIPE (mm)	DESIGN FLOW (L/s)	UPSTREAM HEAD (m)	SURFACE PONDING (m)	VOLUME (m3)
1:5 YR	PLUG ICD-112mmØ ORIFICE	375	22.2	0.67	- - -	45.0
1:100 YR	PLUG ICD-112mmØ ORIFICE	375	33.9	1.55	0.18	94.8

AREA A5 - INLET CONTROL DEVICE DATA - STM MH 4

DESIGN EVENT	IPEX TEMPEST MODEL	DIAMETER OF OUTLET PIPE (mm)	DESIGN FLOW (L/s)	UPSTREAM HEAD (m)	SURFACE PONDING (m)	VOLUME (m3)
1:5 YR	PLUG ICD - 78mmØ ORIFICE	375	15.9	1.46	0.10	51.8
1:100 YR	PLUG ICD - 78mmØ ORIFICE	375	16.7	1.60	0.24	131.3

ROOF DRAIN TABLE - RD 1 - 9

AREA ID	ROOF DRAIN No.	ROOF DRAIN OPENING	1:5 YEAR RELEASE RATE	APPROX. 5 YR PONDING DEPTH	1:100 YEAR RELEASE RATE	APPROX. 100 YR PONDING DEPTH
B1	RD 1	CLOSED	0.76 L/s	0.07 m	0.76 L/s	0.10 m
B1	RD 2	CLOSED	0.76 L/s	0.07 m	0.76 L/s	0.10 m
B2	RD 3	CLOSED	0.76 L/s	0.07 m	0.76 L/s	0.10 m
B2	RD 4	CLOSED	0.76 L/s	0.07 m	0.76 L/s	0.10 m
B3	RD 5	1/2 EXPOSED	0.95 L/s	0.08 m	1.14 L/s	0.10 m
B4	RD 6	FULLY EXPOSED	0.95 L/s	0.07 m	1.52 L/s	0.10 m
B4	RD 7	FULLY EXPOSED	0.95 L/s	0.07 m	1.52 L/s	0.10 m
B5	RD 8	FULLY EXPOSED	1.04 L/s	0.07 m	1.32 L/s	0.09 m
B5	RD 9	FULLY EXPOSED	1.04 L/s	0.07 m	1.32 L/s	0.09 m

* ALL PROPOSED ROOF DRAINS TO BE WATTS ACCUTROL ADJUSTABLE FLOW CONTROL ROOF DRAINS. REFER TO APPENDIX 'F' IN THE STORMWATER MANAGEMENT REPORT (R-2013-210) FOR ROOF DRAIN DETAILS.

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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.

OWNER INFORMATION
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329 BROOKE AVENUE
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DUNG LAM
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No.	REVISION	DATE	BY
2.	ISSUED WITH SWM REPORT	DEC 20/13	MS
1.	ISSUED FOR REVIEW	DEC 13/13	MS

SCALE 1:400

DESIGN: MS
CHECKED: SM / MS
DRAWN: MTM / SM
CHECKED: SM / MS
APPROVED: MS

FOR REVIEW ONLY

LICENSED PROFESSIONAL ENGINEER
M. SAVIC
100102651
DEC 20/13
PROVINCE OF ONTARIO

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STARBANK DEVELOPMENTS

DRAWING NAME
STORMWATER MANAGEMENT PLAN

PROJECT No. 113023-00
REV: REV # 2
DRAWING No. 113023-SWM

PLANB1.DWG - 1000mmx707mm