NOVATECH
Engineers, Planners & Landscape Architects

Engineering
- Land / Site Development
- Municipal Infrastructure
- Environmental / Water Resources
- Traffic / Transportation
- Structural
- Recreational

Planning
- Land / Site Development
- Planning Application Management
- Municipal Planning Documents & Studies
- Expert Witness (OMB)
- Wireless Industry

Landscape Architecture
- Urban Design & Streetscapes
- Open Space, Parks & Recreation Planning
- Community & Residential Developments
- Commercial & Institutional Sites
- Environmental Restoration

37 Years

1055 Klondike – Orr Ridge

Site Servicing and Stormwater Management Report

Engineering excellence. Planning precision. Inspired landscapes.

MAPLE LEAF HOMES

1055 KLONDIKE ROAD – ORR RIDGE

SITE SERVICING AND STORMWATER MANAGEMENT REPORT

Prepared for:

Maple Leaf Homes

Prepared By:

NOVATECH
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario
K2M 1P6

Issued: September 3, 2020
Revised: March 12, 2021

Novatech File: 117034
Report Ref: R-2020-013

Engineers, Planners & Landscape Architects

March 12, 2021

City of Ottawa
Planning, Infrastructure and Economic Development Department
Planning Services Branch
110 Laurier Ave. West, 4th Floor
Ottawa, Ontario
K1P 1J1

Attention: **Mark Young, Planner**

Reference: **1055 Klondike Road – Orr Ridge**
Site Servicing and Stormwater Management Report
Novatech File No.: 117034

Novatech has prepared this Site Servicing and Stormwater Management Report on behalf of Maple Leaf Homes for 1055 Klondike Road – Orr Ridge.

The report outlines the detailed sanitary, water, and storm servicing / stormwater management for the proposed subdivision.

Should you have any questions or comments, please do not hesitate to contact us.

Sincerely,

NOVATECH

Lucas Wilson, P.Eng.
Project Coordinator

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

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICIES

LIST OF DRAWINGS

ENCLOSED CD

- Report (pdf)
- Drawings (pdf)
- PCSWMM Packaged Model Files
  - 100-year 3-hour Chicago Storm
  - 100-year 12-hour SCS Storm (JFSA)

1.0 INTRODUCTION

Novatech has been retained by Maple Leaf Homes to prepare a Site Servicing and Stormwater Management Report for 1055 Klondike Road – Orr Ridge in North Kanata, Ottawa.

This report outlines the servicing and proposed storm drainage and stormwater management strategy for the site.

1.1 Background

The proposed development is located within the Kanata North Community west of the intersection of Klondike Road and Sandhill Road. The development is approximately 1.85ha and is bounded by Klondike Road to the south, Shirley's Brook to the west and north, and park lands to the east. Refer to **Figure 1 –** Site Location and **Figure 2 –** Key Plan.

Figure 1 – Site Location: 1055 Klondike Rd

The proposed development will consist of 46 townhome units and 12 semi-detached units, with a future block containing 53 apartment units. The proposed development is shown in **Figure 2 –** Plan of Subdivision.

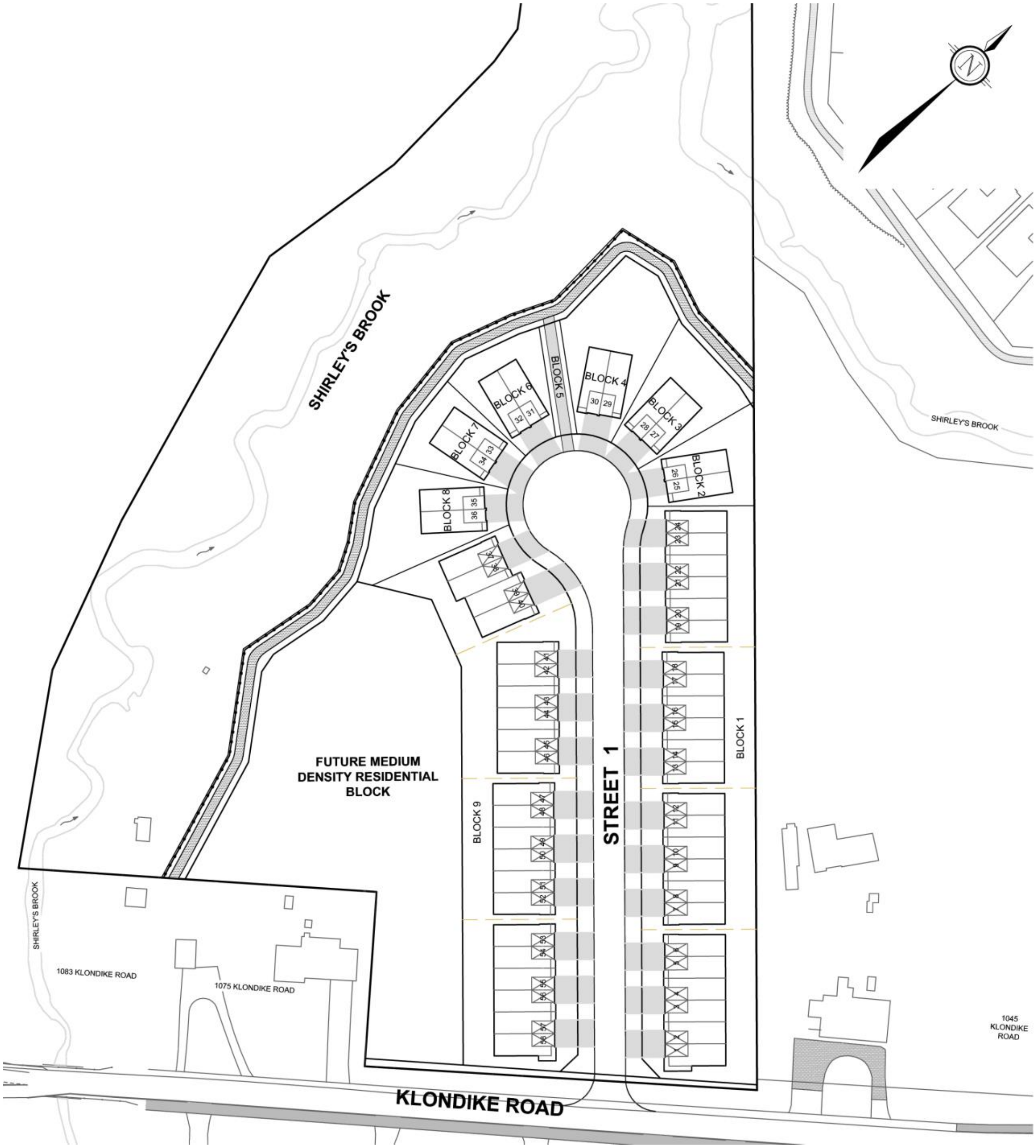


Figure 2 Plan of Subdivision

1.2 Existing / Planned Adjacent Land Uses

The following describes the existing and planned land uses adjacent to the subject site:

North: To the North of 1055 Klondike, Shirley's Brook Separates the Subject Site from Brookside subdivision. The existing Brookside Subdivision consists of Single-Family Homes and Town House units.

East: The lands east of the proposed subdivision are currently vacant with plans for further residential development.

South: Klondike Road, a two-lane urban collector road, bounds the Subject Site to the south. The Subject Site is located between March Road and Sandhill Road on the North Side of Klondike Road.

Southeast: To the Southeast of the Subject Site, across Klondike Road, are Brookside Baptist Church and The Greenwoods Academy.

West: The RioCentre Kanata (832-858 March Road) is located to the west of the Subject Site, separated by Shirley's Brook.

The proposed development is shown on **Figure 3** – Concept Plan. The proposed site will consist of 46 townhouse units, 12 semi-detached units and 53 apartment units within a future medium density block.

1.3 Additional Reports

This report provides information on the considerations and approach by which Novatech has designed and evaluated the proposed servicing for the Maple Leaf Homes Lands. This report should be read in conjunction with the following:

- *Maple Leaf Homes Development, 1055 Klondike Road – Orr Ridge, Noise Impact Assessment, completed by Novatech, Ref. No.: R-2020-014, dated September 3, 2020.*
- *Brookside Subdivision Infrastructure Servicing Study, completed by Novatech, Ref. No.: R-2006-071 dated November 2006.*
- *Shirley's Brook SWM Facility 'C', Detailed Design Report, completed by Novatech, Ref. No.: R-2006-105 dated November 2006.*

2.0 EXISTING CONDITIONS

2.1 Topography & Drainage

The proposed site is currently undeveloped and consists of grassed table land and a tree-lined municipal watercourse. Access to the site is currently provided off Klondike Road via a private gravel entrance.

The site gently slopes from the east, westerly towards a ridge running north south down the centre of the site. The ridge drops 4.0m at approximately 17% and then slopes gently towards Shirley's Brook.

The future Block 10 lands slope away from the subdivision westerly towards Shirley's Brook.

2.2 Subsurface Conditions

Gemtec completed three (3) geotechnical investigations in support of the proposed development. The first geotechnical investigation was conducted to provide a preliminary geotechnical investigation and slope stability assessment of the site:

- *Preliminary Geotechnical Investigation, Proposed Residential Subdivision, 1055 Klondike Road, Ottawa, Ontario, dated April 13, 2017 (Project: 60616.46).*

A second geotechnical investigation was conducted to obtain additional borehole information to provide engineering guidelines and recommendations on the geotechnical design aspects of this project and should be read in conjunction with the preliminary report:

- *Geotechnical Investigation, Proposed Residential Subdivision, 1055 Klondike Road, Ottawa Ontario, dated April 4, 2018 (Project: 64153.85).*

A third geotechnical investigation was conducted to supplement the existing subsurface information providing additional boreholes to obtain more precise grade raise restrictions within the site:

- *Supplemental Geotechnical Investigation, Proposed Residential Development, 1055 Klondike – Ottawa, dated April 10, 2019 (File: 64153.85).*

The principal findings of the geotechnical investigations are as follows:

- The work consisted of advancing eleven (11) boreholes to depths ranging from 4.0m to 10.2 m below ground surface.
- The existing soil profile consists of having a layer of topsoil ranging from 0.10m to 0.31m thick. Deposits of grey brown silty sand were encountered at all boreholes ranging from 0.8 to 2.0m thick. Native deposits of weathered, grey brown silt and clay with trace amounts of sand were encountered underlying the sand and silty sand at all locations ranging from 3.0m to 4.6m thick.
- Bedrock is expected to range from 4m-10m below grade.
- Groundwater is expected to range from 2.2m to 6.7m based on observations.
- Within the low-lying area at the bottom of the ridge (existing surface elevation less than 72.0m) there is an estimated grade raise fill restriction of 6.0m. In areas along the midsection of the ridge (existing surface elevation between 72m and 75m) there is an estimated grade raise fill restriction of 4.0m. In areas near the top of the ridge (existing ground elevation between 75m and 78m) a grade fill restriction of 2.0m would apply.

The report provides engineering guidelines based on Gemtec's interpretation of the borehole information and project requirements. Refer to the above-noted report for complete details.

3.0 SANITARY SERVICING

3.1 Previous Studies

The Subject Site is located within the Briar Ridge Pump Station catchment area. The Brookside Subdivision Infrastructure Servicing Study, prepared by Novatech, dated November 2006, accounted for sanitary flows from the subject site to outlet to the Klondike Road sanitary sewer and ultimately outletting to the Briar Ridge Pump Station. A sanitary flow of 4.1 L/s was calculated for the area comprising the subject site.

3.2 Existing Sanitary Sewer System for the Subject Lands

Currently, there is an existing 200mm sanitary sewer along Klondike Road with an existing manhole at Sandhill Road located approximately 117m from the site entrance. Flows from the site will be routed through the Klondike Road sewers to the 450mm trunk sanitary sewer within the pump station access road outletting to the Briar Ridge Pump Station.

Septic systems may be encountered on site, in the event a septic system is discovered, it should be decommissioned in accordance with Schedule 10 Decommissioning Requirements for Out-of-Service Septic Systems from the Ottawa Septic System Office (lands to be used for other purposes after decommissioning).

3.3 Proposed Sanitary Sewer Outlet

A 200mm sanitary sewer will be installed along Klondike Road connecting the subject site to the existing manhole located at Klondike Road and Sandhill Road. The proposed outlet is consistent with the approved Brookside Infrastructure Servicing Study (Novatech). The proposed sanitary layout can be seen on **Figure 3** below.

3.4 Design Criteria

Sanitary sewers, for the proposed development, are designed based on criteria established by the City of Ottawa in the following documents:

- Section 4.0 of the City of Ottawa Sewer Design Guidelines (October 2012).
- Technical Bulletin ISTB-2018-01 from the City of Ottawa regarding new sanitary design parameters. Design parameters from this technical bulletin will supersede values within the Sewer Design Guidelines (2012).

The resulting design parameters are summarized as follows:

Population Flow = 280 L/capita/day
Infiltration = 0.33 L/s/ha
Semi-Detached Home = 2.7 persons per unit
Townhouse = 2.7 persons per unit
Future Block 10 Apartment = 2.1 persons per unit
Maximum Residential Peak Factor = 4.0
Harmon Correction Factor = 0.8
Minimum velocity = 0.6m/s
Manning’s n = 0.013

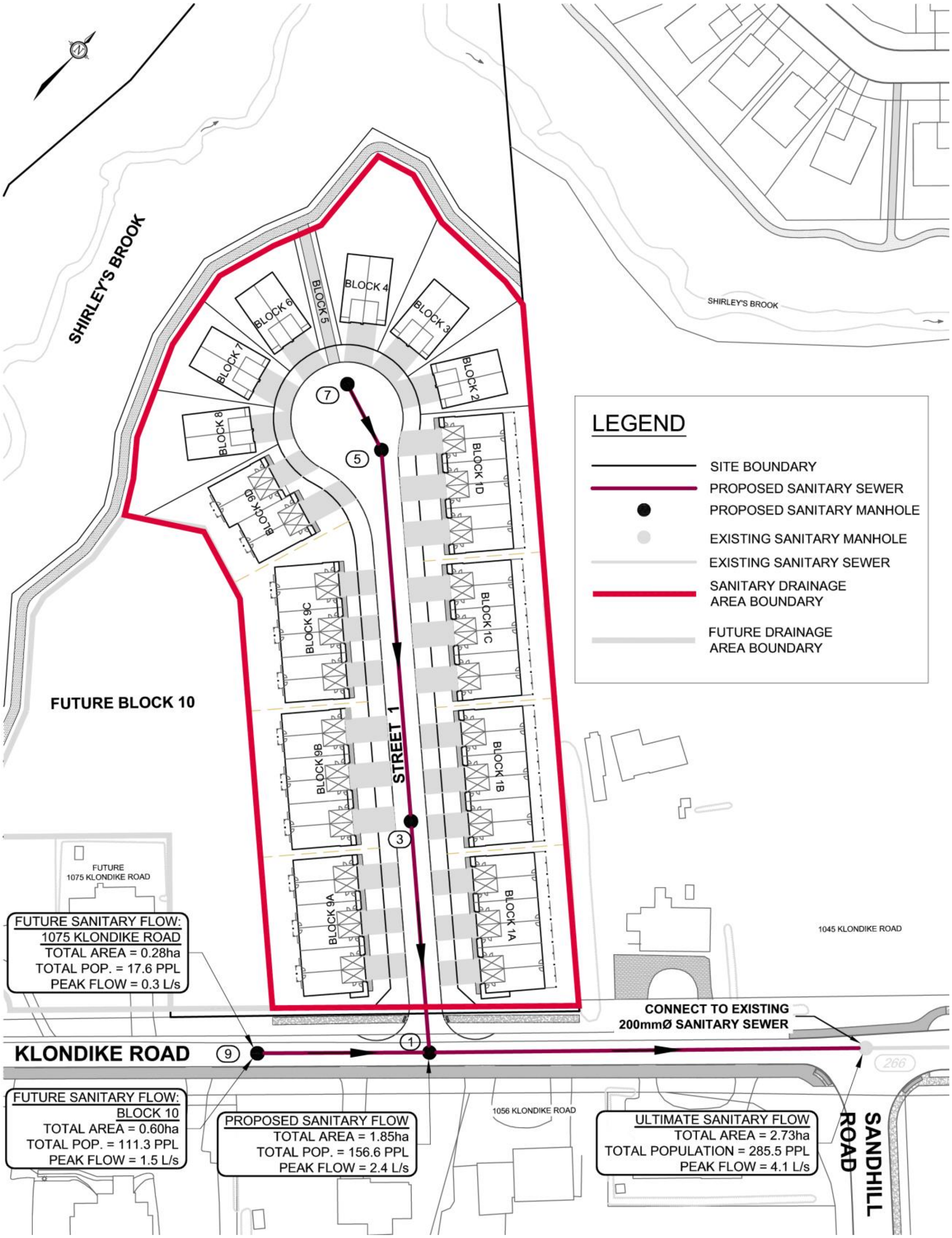


Figure 3 Proposed Sanitary System

3.5 Proposed Sanitary Sewer System

The calculated peak sanitary design flow for the development and future Block 10 is 3.8 L/s. An allowance has been provided for a future development at 1075 Klondike Road, with a unit density of 35 units/ha based on predictions in the Briarridge Sanitary Pumping Station Design Report (Nov. 2000), resulting in an ultimate peak sanitary design flow of 4.1 L/s directed to the Klondike Road sanitary sewer system. For detailed calculations refer to the Sanitary Sewer Design Sheet located in **Appendix B**.

As previously noted, sanitary flows from the site will be directed to an existing 200mm diameter sanitary sewer on Klondike Road at Sandhill Road.

As shown above, the ultimate peak design flow of 4.1 L/s matches the Novatech's Brookside Subdivision Infrastructure Servicing Study value of 4.1 L/s for Area 2. The downstream sanitary sewers within Klondike Road and the Briar Ridge Pump Station Access Road have adequate capacity to accommodate the proposed development as shown in the sanitary design sheet provided in **Appendix B**.

For design sheet, drainage plans and design parameters from the Brookside Infrastructure Servicing Study, refer to excerpts in **Appendix B**.

An HGL analysis of the sanitary sewer was conducted for the proposed development starting at the Briar Ridge Pump Station with an elevation of 67.44 as calculated in the Brookside Subdivision Infrastructure Servicing Study. The HGL analysis concludes the system surcharge is resolved at MH1 located at the outlet of the development on Klondike Road. The sanitary HGL upstream of this location is located within the sewer pipe; we have conservatively assigned the pipe obvert as the HGL value where there are free-flowing conditions. As such, the sanitary HGL under catastrophic failure conditions at the Briar Ridge Pumping Station is calculated as 71.80 at MH1 within Klondike Road; this provides adequate freeboard to the USF of all units within the development. The spreadsheet calculation is attached in **Appendix B**.

4.0 WATERMAIN

4.1 Existing Conditions

The proposed development is located inside the 2W Pressure Zone. An existing 400mm watermain stub is located at the intersections of Klondike Road and Sandhill Road and an existing 300mm watermain runs within Sandhill Road.

4.2 Proposed Watermain System

The development will be serviced with a combination of 50mm, 200mm and 400mm pipe with a connection to the existing 400mm diameter watermain at Klondike Road and Sandhill Road and a second connection to the existing 300mm diameter watermain in Sandhill Road. **Figure 4** highlights the proposed works and connection point. All existing watermain boundary conditions were provided by the City of Ottawa and are included in **Appendix C**.

4.3 Design Criteria

Fire flow demands have been calculated as per the Fire Underwriter's Survey (FUS) and are included in **Appendix C**. As per the City of Ottawa's Technical Bulletin ISDTB-2014-02, fire flows may be capped at 167 L/s (10,000 L/min) for townhomes/semi-detached if certain criteria are met. All 4-unit townhome and semi-detached units meet the criteria outlined in the above mentioned Technical Bulletin allowing the capped fire flow of 167 L/s to be used. The 6-unit townhome blocks are above the maximum required area outlined in Technical Bulletin ISDTB-2014-02 allowing fire flows to be capped at 167 L/s. All 6-unit townhomes include a continuous firewall through the center of the block, resulting in a fire flow of 167 L/s. An estimated fire flow of 250 L/s, based on similar Site Plans, will be used for the future apartment block. Watermain analysis was completed based on the following criteria:

<u>Demands:</u>

- Semi-Detached Unit Density 2.7 persons/unit
- Townhouse Density 2.7 persons/unit
- Future Block 10 Apartment Density 2.1 persons/unit
- Average Daily Demand 280 L/capita/day
- Max. Daily Demand 2.5 x Average Daily Demand
- Peak Hour Demand 2.2 x Maximum Daily Demand
- Fire Flow Demand Fire Underwriters Survey

<u>System Requirements:</u>

- Max. Pressure (Unoccupied Areas) 690 kPa (100 psi)
- Max. Pressure (Occupied Areas) 552 kPa (80 psi)
- Min. Pressure 276 kPa (40 psi) excluding fire flows
- Min. Pressure (Fire) 138 kPa (20 psi) including fire flows
- Max. Age (Quality) 192 hours (onsite)

Friction Factors:

- Watermain Size C-Factor
- 50mm 100
- 200 110

Hydraulic modeling of the Subject Site was completed using EPANET 2.0. EPANET is public domain software capable of modeling municipal water distribution systems by performing simulations of the water movement within a pressurized system. EPANET uses the Hazen-Williams equation to analyze the performance of the proposed watermain and considered the following input parameters: water demand, pipe length, pipe diameter, pipe roughness, and pipe elevation.

4.4 Hydraulic Analysis

A summary of the model results are shown below in **Table 4.1**, **Table 4.2** and **Table 4.3**. Full model results are included in **Appendix C**. Refer to **Figure 4** below for details about the node and pipe network.

Table 4.1: Summary of Hydraulic Model Results - Maximum Day + Fire Flow

Operating Condition	Minimum Pressure
250.87 L/s at NODE1	141.36 kPa (NODE1)

Table 4.2: Summary of Hydraulic Model Results - Peak Hour Demand

Operating Condition	Maximum Pressure	Minimum Pressure
4.775 L/s through system	504.92 kPa (T3)	450.00 kPa (HYD3)

The hydraulic modeling summarized above highlights the maximum and minimum system pressures during Peak Hour conditions, and the minimum system pressures during the Maximum Day + Fire condition. Since the Maximum Day + Fire Flow pressures are above the minimum 140 kPa, and the Peak Hour Pressures onsite fall within the normal operating pressure range (345 kPa to 552 kPa) the proposed development can be adequately serviced.

Table 4.3: Summary of Hydraulic Model Results – Maximum Pressure Check

Operating Condition	Maximum Pressure	Minimum Pressure	Maximum Age
0.868 L/s through system	547.10 kPa (T3)	515.03 kPa (NODE1)	14.04 Hours (NODE1)

The average day pressures throughout the system are below 552 kPa, therefore pressure reducing valves are not required.

Water retention was analyzed at each node during average day demand. The maximum age throughout the system is within City standards.

A copy of the boundary conditions provided by the City of Ottawa, fire flow calculations, detailed hydraulic analysis results, and watermain layout figure are included in **Appendix C**.

There are no deviations from the City of Ottawa Design Guidelines – Water Distribution (2010).

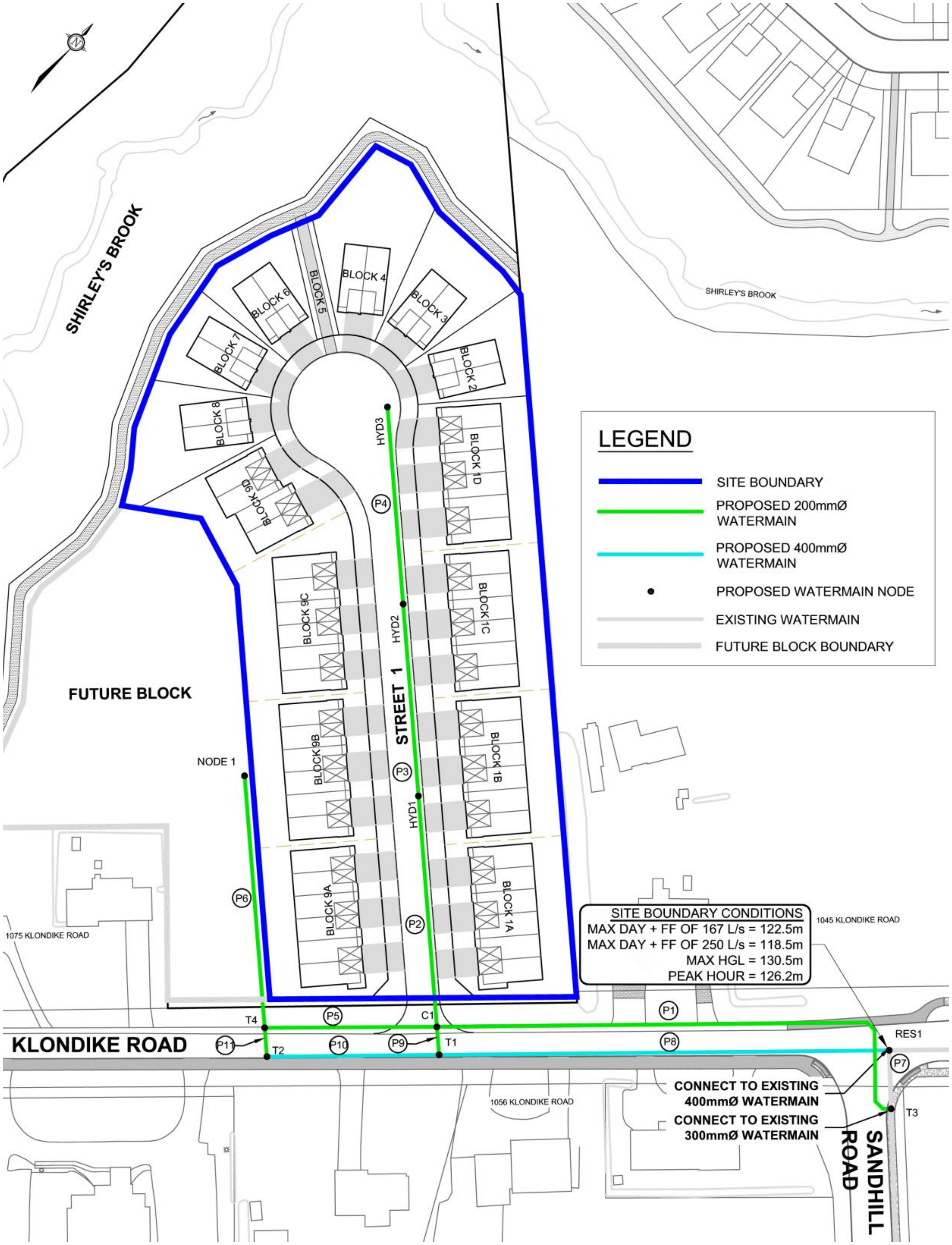


Figure 4 Proposed Watermain Network

5.0 STORM SEWER SYSTEM AND STORMWATER MANAGEMENT

The proposed development will consist of townhouse blocks and semi-detached homes. The townhouse blocks / semi-detached homes will front the proposed Street 1 with a connection to Klondike Road. The Site Plan Block will have a separate entrance to Klondike Road.

The storm drainage and stormwater management systems have been designed in accordance with the City of Ottawa Sewer Design Guidelines (October 2012) and associated Technical Bulletins and will adhere to previously established release rates for this area.

The stormwater management strategy is based on the development of both the subdivision and the Site Plan Block, as they are part of the same property. The future storm servicing and stormwater management design for the Site Plan Block is to adhere to the stormwater management criteria provided in this report (refer to **Section 5.4.4**).

5.1 Previous Studies

The proposed development is tributary to the existing storm sewer on Klondike Road, which outlets to Shirley's Brook Stormwater Management (SWM) Facility 'C'. Both the storm sewer and SWM Facility were designed by Novatech (2006), as part of the Brookside Subdivision (formerly Klondike Road Lands). The outlet for SWM Facility 'C' is Shirley's Brook; refer to *Shirley's Brook SWM Facility 'C' Detailed Design Report, prepared by Novatech (November 2006)* provided in **Appendix F**.

The Subject Site (1055 Klondike Road) was included in the overall storm drainage design for SWM Facility 'C'; specifically, Area's C-201 & C-202. Refer to the Drawing 103106-STM1 – *SWM Facilities Storm Drainage Area Plan, Brookside Subdivision (Rev. 12)*, prepared by Novatech (January 16, 2014) provided in **Appendix D**.

The Subject Site includes the proposed Subdivision and Site Plan Block. A comparison of the drainage areas and runoff coefficients is provided in **Table 5.1**.

Table 5.1: Drainage Area Comparison

Parameter	Klondike Road Lands SWMF 'C' (2006)	1055 Klondike Road (proposed conditions)
Area IDs	C-201 & C-202	part of C-201 & C-202
Drainage Area	1.96 ha *(C-201)*	1.84 ha *(Subdivision)*
	3.07 ha *(C-202)*	0.60 ha *(Site Plan Block)*
	5.03 ha ***(C-201 + C-202)***	**2.44 ha** ***(Subject Site)***
Runoff Coef.	0.50 (C-201)	0.60 *(Subdivision)*
	0.50 *(C-202)*	0.80 *(Site Plan Block)*
	0.50 ***(C-201 + C-202)***	**0.70** ***(Subject Site)***

5.2 Existing and Proposed Storm Infrastructure

Existing Conditions

Under existing conditions, storm runoff from the site generally flows overland to the main branch of Shirley's Brook along the north side of the site. A small amount of drainage is directed to Klondike Road.

There is an existing 825mm storm sewer on Klondike Road. The existing storm sewer stops at the intersection of Klondike Road and Sandhill Road (existing MH 159).

Proposed Conditions

The existing storm sewer on Klondike Road will be extended 163 m west in order to service both the proposed subdivision and Site Plan Block. A future storm sewer to service the Subject Site and adjacent lands was identified in the Novatech (2006) design. Refer to **Figure 5** for the storm servicing layout.

The storm servicing and stormwater management strategy for the proposed subdivision is provided in two different ways:

- Front Yards and Rear Yards at Blocks 1 & 9 (including the road / ROW) will be serviced via roadside catchbasins / rear-yards catchbasin manholes with inlet control devices (ICDs). A storm sewer within the roadway will collect controlled front yard drainage and foundation drains. A storm sewer within the rear-yards will collect controlled rear-yard drainage. These storm sewers will outlet to the new storm sewer on Klondike Road. The storm sewer on Klondike Road outlets to the existing Shirley's Brook SWM Facility 'C'.
- Rear Yards at Blocks 2 to 8 (including the pathway block) will be serviced via rear yard catchbasins / perforated pipe system. The storm drainage system for these rear yards will consist of 250/300mm perforated pipe surrounded by 50mm dia. clearstone. An outlet will be provided to Shirley's Brook. The flows to Shirley's Brook have been accounted for as part of the major system design; refer to **Section 5.4.3** for further information.

5.3 Stormwater Management Criteria

The storm servicing and stormwater management criteria for the Subject Site is based on City of Ottawa and previously established guidelines.

5.3.1 Stormwater Quality Control Criteria

At the time it was designed, Shirley's Brook SWM Facility 'C' upstream Shirley's Brook was required to provide a *Normal* level of water quality control (70% long-term TSS removal) for the contributing drainage area (26.2 ha, 52% imperviousness), including the Subject Site. The required permanent pool volume was 1,834 m^3.

SWM Facility 'C' provides a permanent pool volume of 4,370 m^3 (report provided in **Appendix F)**, which exceeds the required volume for an *Enhanced* level of water quality treatment for a contributing drainage area with 55% imperviousness. The required extended detention storage (40 m^3/ha) is the same for both *Normal* and *Enhanced* water quality treatment.

The development of the subdivision and Site Plan Block will have a negligible increase in the overall impervious area to SWMF 'C'. As such, no additional water quality controls are required for the Subject Site.

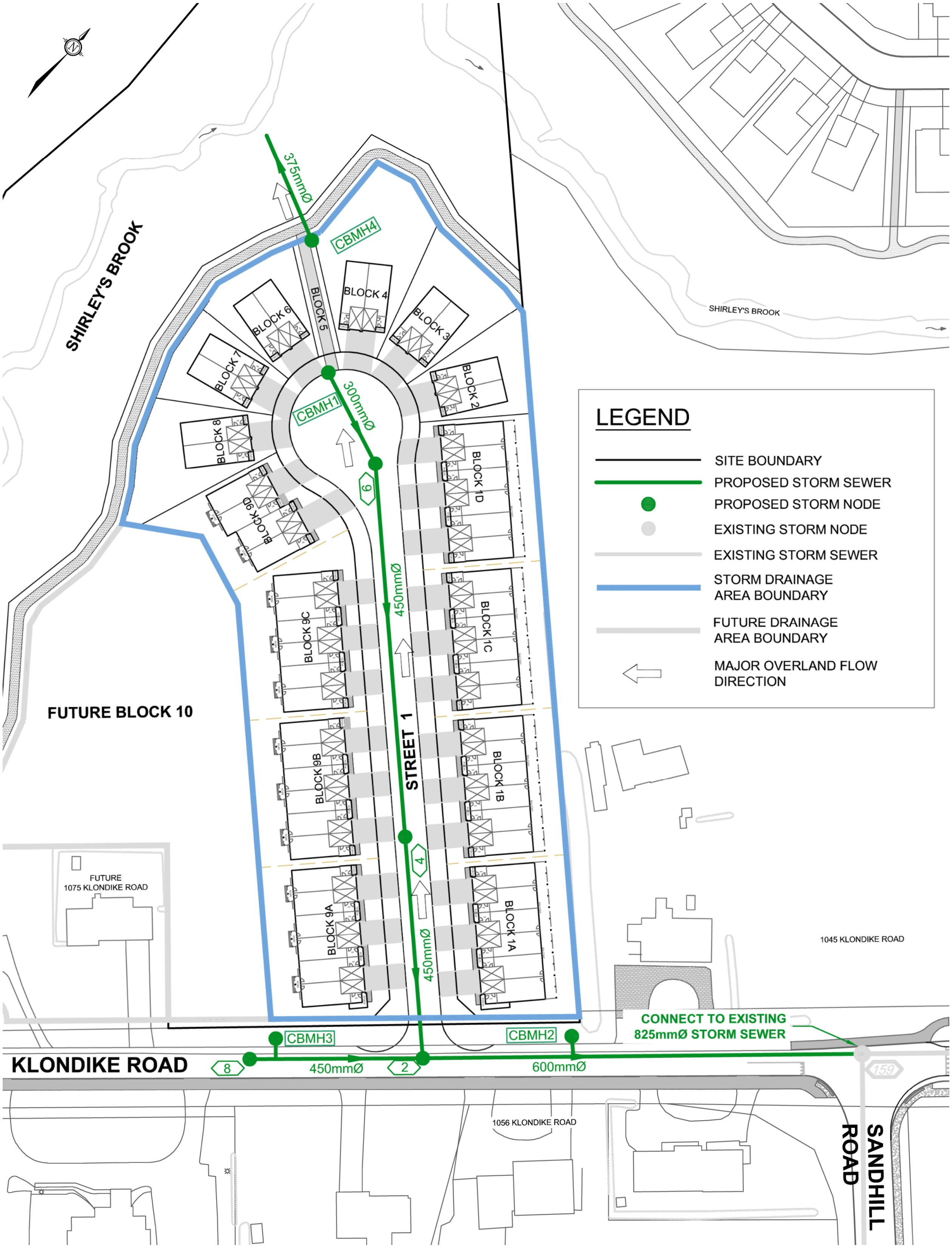


Figure 5 Proposed Storm System

Therefore, SWM Facility ‘C’ will meet the design requirements for an *Enhanced* level of water quality treatment for the contributing drainage area, including the Subject Site. As such, no additional on-site water quality controls for the Subject Site or modifications to SWM Facility ‘C’ are required.

5.3.2 Stormwater Quantity Control Criteria

The stormwater quantity control criteria have been established separately for the areas draining to Klondike Road and rear yard areas draining to Shirley’s Brook.

Areas Draining to Klondike Road (Allowable Release Rate)

The stormwater management model (SWMHYMO) for the Klondike Road Lands SWMF ‘C’ assigned the following stormwater management criteria to subcatchments C-201 & C-202, which include the Subject Site:

- Minor system inlet rate = 85 L/s/ha
- Major system storage = 50 m^3/ha
- After the two above criteria are met, major system overland flow to Shirley’s Brook is permitted.

The stormwater quantity control criteria for the proposed subdivision and Site Plan Block are summarized in **Table 5.2** below.

Table 5.2: Stormwater Quantity Control Criteria

Location	Drainage Area	Allowable Release Rate	Major System Storage
2006 Criteria	-	85 L/s/ha	50 m^3/ha
Portion of C-201	1.67	142.0 L/s	83.5
Portion of C-202	1.04	88.4 L/s	52
Subject Site	**2.71**	**230.4 L/s**	**135.5**

The 85 L/s/ha release rate for the 2.71 ha area (Lands included in design of SWMF ‘C’) corresponds to an allowable minor system peak flow of 230.4 L/s for the Subdivision and Site Plan Block.

Areas Draining to Shirley’s Brook

The Klondike Road Lands SWMF ‘C’ SWMHYMO model included a DUALHYD to divert minor and major system flows for subcatchments C-201 to C-205. The 100-year model results (3-hour Chicago storm) for major system overland flow to Shirley’s Brook is summarized below:

Drainage Area: 14.35 ha (ADDHYD “C-2”)

Major System Overland Flow 1.748 m^3/s (121.8 L/s/ha)
Subject Site *297.2 L/s*

The Subject Site (2.44 ha) would have an associated 100-year release rate to Shirley’s Brook of 297.2 L/s.

For the 2-year and 5-year storm events, the associated release rate to Shirley’s Brook will not exceed the pre-development peak flows currently being directed to Shirley’s Brook. The current

2-year and 5-year peak flows are 62.7 L/s and 84.5 L/s respectively. Refer to the Pre-Development Flow calculations provided in **Appendix D**.

5.3.3 Minor System (Storm Sewers)

Storm servicing has been provided using a dual-drainage system. Runoff from frequent events will be conveyed by the proposed storm sewers (minor system), while flows from large storm events that exceed the capacity of the minor system will be stored on the surface in road sags, and/or conveyed overland along defined overland flow routes (major system).

Storm Sewer Design Criteria

The following is the storm sewer design criteria [Ottawa Sewer Design Guidelines (Oct. 2012)]:

- Rational Method (Q) = 2.78CIA, where
  - Q = peak flow (L/s)
  - C = runoff coefficient
    - C = (0.70 * %Imp.) + 0.20
  - I = rainfall intensity for a 2-year return period (mm/hr)
    - $I_{2yr} = 732.951 / [(Tc(min) + 6.199)]^{0.810}$
  - A = site area (ha)
- Minimum Pipe Size = 250 mm; Minimum / Maximum Full Flow Velocity = 0.8 m/s / 3.0 m/s

The on-site storm sewers are sized to convey peak flows corresponding to a 2-year return period storm event based on the Rational Method. Per the current City of Ottawa Sewer Design Guidelines and associated Technical Bulletins, the proposed storm sewers on Klondike Road (Collector Road) are to be sized for the 5-year return period storm event. Refer to the storm sewer design sheets provided in **Appendix D**.

Inlet Control Devices

Inlet control devices (ICDs) are to be installed within the roadside catchbasins and rear-yard catchbasin manholes for the subdivision. The ICDs have been sized to control minor system peak flows to the Klondike Road storm sewer to the allowable release rate and to ensure that no ponding occurs during the 2-year storm event.

Hydraulic Grade Line

The storm sewers for the proposed subdivision have been designed to ensure the hydraulic grade line (HGL) for a 100-year storm event will provide a minimum 0.30 m clearance from the underside of footing (USF) elevation.

5.3.4 Major System (Overland Flow)

Under post-development conditions, the site will be graded to provide an overland flow path along Street 1. Street 1 has been graded to direct overland flow towards the pathway block, which will outlet to Shirley's Brook. Refer to the Grading Plan (Drawing 117034-GR).

Major System (Overland Flow) Criteria

Runoff from storms that exceed the minor system capacity are to be stored or conveyed overland within the rights-of-way and/or defined drainage easements. The following overland flow criteria has been applied to the design:

Klondike Road Lands SWMF 'C'

- Provide a minimum of 50 m^3/ha of major system storage.
- Ensure the 100-year release rate to Shirley's Brook is equal to or less than 121.8 L/s/ha.

Front yards

- Maximum depth of flow (static + dynamic) on local and collector streets shall not exceed 0.35 m during the 100-year event.
- The depth of flow may extend adjacent to the right-of-way provided that the water level must not touch any part of the building envelope and must remain below the lowest building opening during the stress test event.
- There must be at least 15cm of vertical clearance between the spill elevation on the street and the ground elevation at the building envelope that is in the proximity of the flow route or ponding area.
- Runoff that exceeds the available storage in the right-of-way will be conveyed overland along defined major system flow routes towards the proposed major system outlet (Shirley's Brook).
- The product of the 100-year flow depth (m) on street and flow velocity (m/s) shall not exceed 0.60.

Rear yards

- Maximum depth of flow (static + dynamic) in rear yards shall not exceed 0.30 m during the 100-year event.
- The water level must not touch any part of the building envelope and must remain below the lowest building opening during the stress test event (i.e. 100-year +20% event).
- Runoff that exceeds the available storage in the rear yards will be conveyed overland along defined major system flow routes towards the proposed major system outlet.
- There must be at least 30 cm of vertical clearance (typical) between the spill elevation in the rear yards and the ground elevation at the building envelope that is in the proximity of the flow route or ponding area.

5.4 Stormwater Management Modeling

A detailed stormwater management model (PCSWMM) model was developed for the proposed subdivision. It includes conceptual information for the Site Plan Block. The model provides estimated minor and major system peak flows, overland flow depths, HGL elevations, and on-site storage requirements. The model is based on the previously established SWM criteria.

5.4.1 PCSWMM Model Parameters

Design Storms

The PCSWMM model includes the following design storms based on the City of Ottawa IDF data presented in the City of Ottawa Sewer Design Guidelines (October 2012):

- 3-hour Chicago Storm Distribution (10-minute time step)
- 12-hour SCS Storm Distribution (30-minute time step)

Each storm distribution includes the 2-year, 5-year, 100-year, and 100-year (+20%) return periods.

The 3-hour Chicago storm distribution was determined to be the critical design storm for the proposed development. This is also consistent in the analysis by Novatech (2006), who designed SWM Facility 'C' using the SWMHYMO hydrologic model.

PCSWMM Model Schematics, Output Data and Modeling Files

PCSWMM model schematics and output data for the 100-year 3-hour Chicago storm distribution are provided in **Appendix D**. The PCSWMM modeling files are provided on the enclosed CD.

Table 5.3 provides a summary of the hydrologic modeling parameters (subcatchments).

Table 5.3: Hydrologic Modeling Parameters (subcatchments)

Area ID	Catchment Area (ha)	Runoff Coefficient (%)	Percent Imperviousness (%)	Zero Imperviousness (%)	Equivalent Width (m)	Average Slope (%)
Proposed Subdivision						
A-01	0.077	0.50	42.9	95	38.5	3.5
A-02	0.138	0.70	75.4	40	55.2	4
A-03	0.051	0.50	43.1	95	25.5	5
A-04	0.072	0.52	45.8	95	36	4
A-05	0.293	0.73	79.9	40	117.2	4
A-06	0.058	0.50	43.1	95	29	5
A-07	0.079	0.48	40.5	95	52.5	3
A-08	0.152	0.73	79.6	40	60.8	4
A-09	0.064	0.52	45.3	95	32	5
A-10	0.113	0.40	29.2	95	34.4	2.5
A-11	0.066	0.43	33.3	95	44	5
A-12	0.024	0.41	29.2	0	9.6	3.5
A-13	0.107	0.29	12.1	95	30.571	3.5
A-14	0.053	0.32	17	95	21.2	4
A-15	0.074	0.53	47.3	95	37	5.5
A-16	0.361	0.71	79.5	35	90.25	3
A-17	0.063	0.49	41.3	95	31.5	5
Subdivision	**1.840**	**0.59**	**55.7**	**-**	**-**	**-**
Future Site Plan Block						
A-18	0.600	0.80	85.7	50	200.0	2
Subject Site	**2.440**	**0.64**	**63.7**	**-**	**-**	**-**

Subcatchment Areas / Runoff Coefficients

- The proposed subdivision has been divided into subcatchments based on the tributary drainage areas to each inlet of the proposed storm sewer system, as shown on the Storm Drainage Area Plan (Drawing 117034-STM2).
- The rooftops have been split in the middle, as the location for roof leaders is unknown. It is recommended that roof leaders outlet to a grass surface; preferably the rear yards, to promote infiltration.
- Weighted runoff coefficients were assigned based on the percent impervious values used in the PCSWMM model. As per the City of Ottawa Sewer Design Guidelines (October 2012), the runoff coefficient is based on the following equation:

  C = (% Imp. * 0.7) – 0.2

  The Site Plan Block has been assigned a runoff coefficient of 0.80 (86% impervious).

Depression Storage

- The default values for depression storage (1.57 mm impervious / 4.67 mm pervious) have been applied to all catchments.

Subarea Routing

- Subarea routing for all subcatchments has been set to 'direct to outlet'.

Equivalent Width

- The equivalent width parameter for all subcatchments is based on the measured flow length. The front yard areas draining to proposed Street 1 has a 'double loaded' equivalent width parameter.

Outlet Rating Curves for Catchbasins On-Grade

- Inlets for catchbasins on-grade are represented as outlets, with rating curves based on capture / bypass characteristics of standard CB grates.
- The outlet flow rate is 'capped' at the restricted release rate due to the ICD's. The restricted release rate is based on a head value measured from the T/G elevation.

Minor System Conduits (Bend / Exit Losses)

- The minor system network was created in Civil3D and imported into PCSWMM.
- The following exit losses have been inputted into the model. They represent the loss coefficient based on the bend angle, as per the Appendix 6-B in the City of Ottawa Sewer Design Guidelines (October 2012).

Bend Angle	Loss Coefficient
0	0.00
15	0.09
30	0.21
45	0.39
60	0.64
75	0.96
90	1.32

Major System Conduits

- Major system conduits (road network) have been defined using an irregular transect representing an 18 m right-of-way with a 3% crossfall from the centerline of the road to the bottom of curb.
- Junctions at high points have an invert elevation that represents either the bottom of curb or the road centerline, depending on the path of the overland flow route.

Downstream Boundary Condition (Minor System)

- The storm sewer outlet for the proposed development is the existing maintenance hole (MH 159) on Klondike Road.
- Novatech (2006) estimated a 100-year Hydraulic Grade Line (HGL) elevation of 69.73 m at MH 159 on Klondike Road; refer to excerpt provided in **Appendix D**. This is equivalent to obvert elevation of the outgoing 825mm storm sewer (69.73 m); therefore, it is assumed that this storm sewer does not surcharge during the 100-year storm event. In addition, this HGL elevation is lower than the invert elevation of the outgoing pipe from MH 02 at the end of proposed Street 1 (70.98 m). As such, a 'Normal' outfall condition was used for all model simulations.

Downstream Boundary Condition (Major System)

- Shirley's Brook Flood Plan Mapping Study (November 2017) provides water elevations for the 1:100 year and other return periods flood events. The report estimates a 2-year, 5-year and 100-year water elevation at the subject site outlet location of 71.15m, 71.34m and 71.82m respectively; refer to excerpts provided in **Appendix D**. A 'Fixed' outfall condition was used for the major system outlet to Shirley's Brook (HW1) corresponding to the above noted elevations.

5.4.2 PCSWMM Model Results

Inlet Control Devices (ICDs)

ICDs are provided for catchbasins within the roadway and catchbasin manholes in the rear-yards. The ICD sizes and design flows are provided in **Table 5.4**. The ICDs have been sized to maximize surface storage and not have surface ponding during a 2-year storm event.

Table 5.4: Roadway Inlet Control Device Sizes and Design Flows

Structure ID	Catchment ID	ICD Size and Inlet Parameters		2-year Event		100-year Event	
		Diameter (mm)	T/G – Inv. (m)	$Q_{approach}$ (L/s)	$Q_{capture}$ (L/s)	$Q_{approach}$ (L/s)	$Q_{capture}$ (L/s)
Road Catchbasins (In-Sags)							
CB03/04	A-05	102 102	1.40 1.40	50.4	50.4	162.2	55.1
CBMH01	A-16	127	3.25	61.6	58.8	215.9	62.2
Road Catchbasins (On-Grade)							
CB01/02	A-02	Tempest LMF Tempest LMF	1.40 1.40	22.5	21.8	65.5	21.8
CB05/06	A-08	Tempest LMF Tempest LMF	1.40 1.40	26.1	25.1	75.8	26.0

**From PCSWMM model, 3-hour Chicago storm distribution.*

Table 5.5: Rear-yard Inlet Control Devices and Design Flows

Structure ID	ICD Size & Inlet Rate						
	ICD Type	T/G (m)	Orifice Invert (m)	100-year Head on Orifice (m)	2-year Orifice Peak Flow* (L/s)	5-year Orifice Peak Flow* (L/s)	100-year Orifice Peak Flow* (L/s)
CBMH02	Tempest LMF	76.96	71.86	3.03	5.0	5.6	6.5
CBMH03	Tempest LMF	77.80	74.31	3.12	4.6	6.0	6.6

**From PCSWMM model, 3-hour Chicago storm distribution.*

To prevent 2-year ponding at CBMH01 due to $Q_{capture}$ being less than $Q_{approach}$ as shown above in **Table 5.4**, CBMH01 will be installed as a 2400mm diameter structure providing approximately 10.6m^3 of underground storage. This will provide sufficient storage to contain the 2-year storm event and prevent any 2-year ponding at the surface.

Both IPEX Tempest LMF (i.e. Vortex ICD's) and MHF (i.e. 102mm & 127mm) ICDs are proposed for the subdivision. Sizing documentation and correspondence is provided in **Appendix D**.

Overland Flow (Major System)

The major system network was evaluated using the PCSWMM model to ensure that the overland flow depths and velocities conform to the City of Ottawa Sewer Design Guidelines (Oct. 2012). The results of the 100-year modeling indicate that the overland flow depths on all streets will be less than 0.35m, the product of depth x velocity will be less than 0.60. The model results for overland flow and at low points are summarized in **Table 5.6**.

Table 5.6: Overland Flow Results

Location	100-year					100-year +20%			
	Peak Flow (L/s)	Velocity (m/s)	Static Depth (m)	Total Depth (static + dynamic) (m)	Velocity x Depth (m²/s)	Peak Flow (L/s)	Velocity (m/s)	Total Depth (m)	Velocity x Depth (m²/s)
Road Catchbasins (In-Sags)									
CB03/04	162.2	0.07	0.07	0.21	0.01	204.7	0.10	0.23	0.02
CBMH01	215.9	0.12	0.28	0.29	0.03	272.5	0.40	0.33	0.13
High Points									
HP01	-	-	-	-	-	-	-	-	-
HP02	48.4	0.07	-	0.10	<0.01	101.8	0.08	0.13	0.01
HP03	19.9	1.24	-	0.01	0.01	209.1	3.2	0.02	0.06

**From PCSWMM model, 3-hour Chicago storm distribution.*

Hydraulic Grade Line

Table 5.7 provides a summary of the 100-year HGL elevations at each storm manhole. The results of this analysis were used to ensure that a minimum freeboard of 0.30m is provided between the 100-year HGL and the designed underside of footing (USF) elevation; as indicated on the Plan and Profiles (Drawings 117034-PR1 & 117034-PR2).

There is no surcharging within the on-site sewers during both the 100-year and 100-year (+20%). The minimum USF elevations have been set 0.30 m higher than the downstream obvert elevations. Refer to the Grading Plan (117034-GR).

Table 5.7: 100-year HGL Elevations

Manhole ID	Pipe / MH Information				HGL Elevation[1] (m)		Surcharge Above Pipe Obvert		Min. USF Elev. (m)
	D/S Pipe Size (mm)	D/S Pipe Invert Elev. (m)	D/S Pipe Obvert Elev. (m)	MH T/G Elev. (m)	100yr (m)	100yr (+20%) (m)	100yr (m)	100yr (+20%) (m)	
CBMH01	300	72.89	73.19	76.14	73.12	73.12	0.00	0.00	73.49
MH02	525	71.77	72.30	77.76	72.05	72.05	0.00	0.00	72.60
MH04	450	72.19	72.64	77.42	72.58	72.58	0.00	0.00	72.94
MH06	450	72.60	73.05	76.64	72.90	72.90	0.00	0.00	73.35
MH08	450	72.15	72.60	77.68	72.31	72.32	0.00	0.00	72.90

**From PCSWMM model, 3-hour Chicago storm distribution.*

Comparison of Peak Flows

Table 5.8 provides a comparison of the minor system flows from the proposed development to Klondike Road and major system flows / direct flows to Shirley's Brook.

Table 5.8: Comparison of Peak Flows

Proposed Development	Drainage Area (ha)	Allowable Release Rate[1] (L/s)		100-year Peak Flow[2] (L/s)		
		Minor System (Klondike Rd.)	Major System (Shirley's Brook)	Minor System (Klondike Rd.)	Major System (Shirley's Brook)	TOTAL
Subdivision	1.84	179.4	224.1	178.2	274.0	**452.2**
Site Plan Block	0.60	51.0	73.1	51.0	0	**51.0**
Subject Site	**2.44**	**230.4**	**297.2**	**229.2**	**274.0**	**503.2**

(1) Allowable release rate is based on drainage area (2006 SWMF 'C' Report) x 85 L/s/ha (Klondike Rd.) & 121.8 L/s/ha (Shirley's Brook).
(2) PCSWMM model results for the 3-hour Chicago storm distribution.

The 100-year minor system peak flow to Klondike Road is controlled to just under the allowable release rate of 230.4 L/s for the proposed subdivision. The total 100-year major system peak flow to Shirley's Brook, from the rear yard perforated pipe system, is also less than the 100-year major system allowable release rate for the Subject Site (121.8 L/s/ha or 297.2 L/s). The 2-year and 5-year major system peak flows to Shirley's Brook of 18.3 L/s and 39.9 L/s respectively, are also less than the pre-development peak flows to Shirley's Brook outlined in **Section 5.3.2** (62.7 L/s and 84.5 L/s).

5.4.3 Rear Yard Perforated Pipes

Drainage from the rear yards / rooftops will be collected with rear yard catchbasins connected to a perforated pipe system. The perforated pipe system will consist of 250mm perforated pipe surrounded by 50mm dia. clearstone. The proposed perforated pipes in the rear yards will promote infiltration. This will mitigate the reduction in groundwater infiltration / recharge resulting from the proposed increase in impervious areas. Infiltration has not been accounted for in the model.

5.4.4 Stormwater Management Requirements for Site Plan Block

The Site Plan Block (0.60 ha) is to adhere to the following stormwater management criteria:

- Minor system inlet rate = 51 L/s
- Major system storage = 81.6 m^3
- *No major system overland flow to Shirley's Brook during the 100-year storm event.*

The development of the Site Plan Block is to not include major system overland flow to Shirley's Brook during the 100-year storm event. The allowable 100-year flow rate to Shirley's Brook for the Subject Site is being used by the proposed subdivision.

6.0 ROADWAYS

6.1 Proposed Road Infrastructure

The proposed development will consist of a local roadway with an 18.0m right of way (ROW) to provide access to the townhome and semi-detached units. The access to the medium density block will consist of a private roadway. The proposed cross sections will conform to City of Ottawa Standards.

7.0 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). An Erosion and Sediment Control Plan will be prepared as part of the detailed design.

Typical erosion and sediment control measures recommended include, but are not limited to, the use of silt fences around perimeter of site (OPSD 219.110), catch basin inserts under catch basin/maintenance hole lids, heavy duty silt fence barrier (OPSD 219.130), straw bale check dams (OPSD 219.180), rock check dams (219.210 or OPSD 219.211), riprap (OPSS 511), mud mats, silt bags for dewatering operations, topsoil and sod to disturbed areas and natural grassed waterways. Dewatering and sediment control techniques will be developed for the individual situations based on the above guidelines and utilizing typical measures to ensure erosion and sediment control is controlled in an acceptable manner and there is no negative impact to adjacent Lands, water bodies or water treatment/conveyance facilities.

It will be the responsibility of the Contractor to submit a detailed construction schedule and appropriate staging, dewatering and erosion and sediment control plans to the Contract Administrator for review and approval prior to the commencement of work. A copy of the City of Ottawa Special Provision F-1005 is included in **Appendix E** which will become part of any contract and which outlines the contractual requirements which includes preparation of a detailed erosion and sediment control plan.

General Erosion and Sediment Control Measures

- 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, provided by the owner, should conduct daily visits during construction to ensure that the contractor is working in accordance 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.
    - Rock check dams and/or straw bales are to be installed in drainage ditches.
    - Catch basin inserts are to be placed under the grates of all proposed and existing catchbasins and 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.

8.0 CONCLUSIONS AND RECOMMENDATIONS

Sanitary Servicing

The analysis of the proposed sanitary servicing confirms the following:

- It is proposed that the development will outlet directly to the 200mm sanitary sewer along Klondike Road at Sandhill Road. The proposed outlet is consistent with the approved Brookside Subdivision Infrastructure Servicing Study (Novatech).
- The proposed development can be serviced with a 200mm sanitary sewer system.
- The total proposed sanitary flow from the subject lands and future blocks is 4.1 L/s, which equals the calculated flows in the Brookside Subdivision Servicing Study (4.1 L/s).
- The proposed and existing sanitary sewers have adequate capacity to accommodate the peak sanitary flow.

Watermain

The analysis of the proposed watermain network confirms the following:

- It is proposed to service the site with 50mm and 200mm pipe with a connection to the existing 400mm diameter watermain at Klondike and Sandhill Road and the 300mm diameter watermain in Sandhill Road.
- The analysis confirms the proposed watermain provides adequate fire protection and domestic service under all operating conditions.
- Distribution mains have been looped by connecting to the existing 300mm and 400mm diameter watermains at Klondike Road and Sandhill Road providing redundant supply and improved circulation and water quality.

Stormwater Management

The following provides a summary of the storm servicing and stormwater management system:

- Proposed storm sewer system will convey stormwater to existing MH 159 on Klondike Road.
    - Storm sewers (minor system) have been designed to convey the uncontrolled 2-year peak flow using the Rational Method.
    - Inflows to the minor system will be controlled using inlet control devices (ICDs) to an overall allowable release rate of 230.4 L/s.
    - A minimum clearance of 0.30m is provided between the 100-year hydraulic grade line (HGL) or storm sewer obvert and the designed underside of footing elevations.
- Roads graded in a saw-toothed pattern to provide surface stormwater storage during storm events that exceed the allowable minor system inlet rate.
    - The major overland flow outlet for the site is the pathway block to Shirley's Brook.
    - Ponding depths do not exceed 0.35m for all storms up to and including the 100-year event.
- Rear yard drainage at Blocks 2 to 8 will be collected by a perforated pipe system, which will outlet to Shirley's Brook.

Erosion and Sediment control

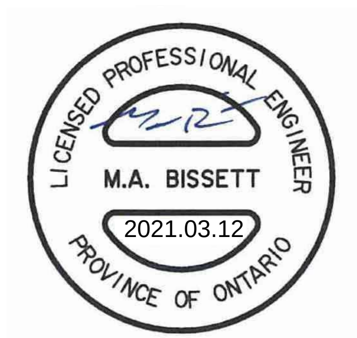
- Erosion and sediment control measures (i.e. filter fabric, silt fences, etc.) will be implemented prior to construction and are to remain in place until vegetation is established.
- The Erosion and Sediment Control Plan will ensure erosion and sediment control is controlled in an acceptable manner and there is no negative impact to adjacent lands, water bodies or water treatment/conveyance facilities.

9.0 CLOSURE

The preceding report is respectfully submitted for review and approval. Please contact the undersigned should you have questions or require additional information.

NOVATECH

Prepared by:



Lucas Wilson, P.Eng.
Project Coordinator

Mark Bissett, P.Eng.
Senior Project Manager

FOR REVIEW

Appendix A
Correspondence

MEMO

Date: August 12, 2019

To / Destinataire	Laurel McCreight, Planner	
From / Expéditeur	Ghislaine Miliu, Project Manager, Infrastructure Approvals	
Subject / Objet	**Pre-Application Consultation 1055 Klondike and Ward No. 4, Councillor Jenna Sudds,** *the proposal is to develop a residential subdivision consisting of semi-detached dwellings, and low-rise apartment dwellings. One main internal street is proposed, with a separate entrance to the apartment block.*	File No. PC2019-0204

Please note the following information regarding the engineering design submission for the above noted site:

1. The Servicing Study Guidelines for Development Applications are available at the following address: https://ottawa.ca/en/city-hall/planning-and-development/information-developers/development-application-review-process/development-application-submission/guide-preparing-studies-and-plans#servicing-study-guidelines-development-applications

2. Servicing and site works shall be in accordance with the following documents:

   ⇨ Ottawa Sewer Design Guidelines (October 2012)

   ⇨ Ottawa Design Guidelines – Water Distribution (2010)

   ⇨ Geotechnical Investigation and Reporting Guidelines for Development Applications in the City of Ottawa (2007)

   ⇨ City of Ottawa Slope Stability Guidelines for Development Applications (revised 2012)

   ⇨ City of Ottawa Environmental Noise Control Guidelines (January, 2016)

- ⇨ City of Ottawa Park and Pathway Development Manual (2012)
- ⇨ City of Ottawa Accessibility Design Standards (2012)
- ⇨ Ottawa Standard Tender Documents (latest version)
- ⇨ Ontario Provincial Standards for Roads & Public Works (2013)

3. Record drawings and utility plans are also available for purchase from the City (Contact the City's Information Centre by email at InformationCentre@ottawa.ca or by phone at (613) 580-2424 x.44455).

4. The proposed site will require extension of all services (water, sanitary and stormwater).

5. The Stormwater Management Criteria, for the subject site, is to be based on the following:

   i. There is currently no storm sewer on Klondike Road directly in front of the 1055 Klondike Property. There is a storm sewer manhole / system at the intersection of Klondike Road and Sandhill Road conveying flow to a ditch upstream of "Pond C".

   ii. Based on both the Shirley's Brook Floodplain Analysis and SWM Report (Klondike Road Development Lands, prepared by Novatech, May 2006) and the Shirley's Brook SWM Facility "C" Detailed Design Report (prepared by Novatech, 2006), it appears that Pond "C" was sized to service the 1055 Klondike parcel. Please demonstrate that the existing storm sewer and pond have capacity to service this proposed development (quantity and quality control).

   iii. Barring any additional SWM requirements from the MVCA (please see the note below), refer to the SWM design criteria in the Shirley's Brook SWM Facility "C" Detailed Design Report (prepared by Novatech, 2006) for the proposed development area (including rear yards):

      - Minor system allowable release rate of 85 L/s/ha;
      - Onsite major system storage of 50 m3 / ha (please see the note below);

- ICDs will be installed in the roadway catchbasins to ensure flow into the storm sewer system does not exceed the 5-year runoff rates; and

- HGL for 100-year event must have at least 0.3 m freeboard to the underside of footings.

NOTE: that MVCA is reviewing the SWM design criteria provided in the Shirley's Brook SWM Facility "C" Detailed Design Report (prepared by Novatech, 2006). The MVCA may require further stormwater management requirements be imposed on lands draining to Shirley's Brook (for example, this may include additional onsite major system storage volume, potentially requiring collection and storage of all runoff for storm events up to and including the 100-year return period). Please contact the MVCA to confirm all SWM design criteria (ESC, quality and quantity control).

iv. IDF information derived from the Meteorological Services of Canada rainfall data, taken from the MacDonald Cartier Airport, collected 1966 to 1997.

v. A calculated time of concentration (Cannot be less than 10 minutes).

vi. Flows to the storm sewer in excess of the 5-year storm release rate, must be detained on site (please confirm with MVCA whether the onsite major system storage is 50 m3 / ha, or whether storage volume must be provided to attenuate all runoff up to and including the 100-year event).

vii. SWM calculations using modified rational method is acceptable however, if a combination of surface storage (roof or at-grade / parking lot) is proposed in addition to sub-surface / cistern storage then the consultant is reminded to either:

(a) use a dynamic computer model; or

(b) use modified rational method:

1. assuming an average release rate of 50% peak flow rate for a cistern / sub-surface storage facility.

2. provide calculations for each storage facility /area (roof vs sub-surface storage) with respect to its attributing drainage area; and

3. where storage facilities are inline (or in series), please add the upstream peak release rate to the downstream storage facilities modified rational method calculator.

6. Please note that there is a Special Area Development Charge for the subject site. Please refer to the current Development Charge attached (By-Law No. 2019 – 163). Note that this is the Charge for 2019 and may change over time.

7. Deep Services (Storm, Sanitary & Water Supply)

i. *Provide existing servicing information and the recommended location for the proposed connections. Services should ideally be grouped in a common trench to minimize the number of road cuts.*

ii. *Connections to trunk sewers and easement sewers are typically not permitted.*

iii. *Provide information on the monitoring manhole requirements – should be located in an accessible location on private property near the property line (i.e. Not in a parking area).*

iv. *Review provision of a high-level sewer.*

v. *Provide information on the type of connection permitted*

Sewer connections to be made above the springline of the sewermain as per:

a. Std Dwg S11.1 for flexible main sewers – *connections made using approved tee or wye fittings.*

b. Std Dwg S11 (For rigid main sewers) – *lateral must be less that 50% the diameter of the sewermain,*

c. Std Dwg S11.2 (for rigid main sewers using bell end insert method) – *for larger diameter laterals where manufactured inserts are not available; lateral must be less that 50% the diameter of the sewermain,*

d. Connections to manholes permitted when the connection is to rigid main sewers where the lateral exceeds 50% the diameter of the sewermain. – Connect obvert to obvert with the outlet pipe unless pipes are a similar size.

e. *No submerged outlet connections.*

8. As per Section 4.3.1 of the Water Design Guidelines: “Service areas with a basic day demand greater than 50 m³/day (about 50 homes) shall be connected with a minimum of two feedermains to avoid the creation of a vulnerable service area. Distribution mains shall be looped whenever possible to provide redundant supply and improved circulation and water quality.”

   Based on the proposed sub-division the site requires two watermain feeds. Linking the existing watermain stubs on Klondike Road (from March Road) to Sandhill Road.

   Note: one connection to the existing watermain stub on Klondike at the intersection of Sandhill will not be accepted.

9. Water Boundary condition requests must include the location of the service and the expected loads required by the proposed development. Please provide the following information:

   i. Location of service

   ii. Type of development and the amount of fire flow required (as per FUS, 1999).

   iii. Average daily demand: ___ l/s.

   iv. Maximum daily demand: ___l/s.

   v. Maximum hourly daily demand: ___ l/s.

10. The applicant will need to confirm with the City whether sufficient capacity is available in the local sanitary sewer on Sandhill or Klondike to accommodate flows generated from the subject site.

    Please note that residual capacity at the Briaridge PS is a constraint. A study is currently underway to increase the rated capacity at the station from 55 l/s to 175 l/s. The project to increase capacity is likely a few years away (target date 2021-2022). Note that an EA is not required as part of scope of work for this upgrade.

11. MOECC ECA Requirements

An MOECC Environmental Compliance Approval will be required for the proposed development due to new services and roads. Please contact Ontario Ministry of the Environment and Climate Change, Ottawa District Office to arrange a pre-submission consultation:

For residential applications: Charlie Primeau

(613) 521-3450, ext. 251

Charlie.Primeau@ontario.ca

Note that the typically the Public Consultation performed as part of the ESA process is submitted as part of the application for the ECA. Please confirm this with the MOECC Ottawa District Office as part of the pre-submission consultation.

12. Phase 1 ESAs and Phase 2 ESAs must conform to clause 4.8.4 of the Official Plan that requires that development applications conform to Ontario Regulation 153/04.

Should you have any questions or require additional information, please contact me directly at (613) 580-2424, x 28699 or by email at ghislaine.miliu@ottawa.ca.

Mississippi Valley Conservation Authority / Office de protection de la nature de la vallée Mississippi
Office de protection de la nature de la vallée Rideau / Rideau Valley Conservation Authority
South Nation Conservation / Conservation de la Nation Sud

File Number: PKNSH-63

December 12, 2019

Mark Young
City of Ottawa
Planning & Growth Management
110 Laurier Avenue West, 4th Floor
Ottawa, ON K1P 1J1

Dear Mr. Young:

Re: Plan of Subdivision and Zoning By-law Amendment D07-16-19-0024 & D02-02-19-0115
1055 Klondike Road, City of Ottawa

The staff of Mississippi Valley Conservation Authority (MVCA) has reviewed the above noted plan of subdivision and zoning by-law amendment applications for concerns related to natural heritage and natural hazards for the subject property and surrounding lands. The scope of the natural heritage review includes wetlands, watercourses and significant valleylands, while the focus of the natural hazards review includes flood plain, unstable slopes and unstable soils. MVCA has also reviewed the proposed stormwater management for the development, with a focus on water quality.

The following comments are offered for your consideration:

Summary of Proposal

The application summary indicates that the applicant proposes to construct 12 semi-detached dwellings and 46 townhouses on a 4.5 ha parcel. Future plans include an apartment building. Additional planning approvals will be required prior to the development of the apartment buildings.

Property Overview

The property is presently generally undeveloped table land with a plateau in the middle of the site. Existing runoff is conveyed as sheet flow to the west and northeast to Shirley's Brook.

Natural Heritage and Environmental Impact Statement

The main natural heritage feature in proximity to the subject lands is Shirley's Brook, which flows adjacent to the western and northern portion of the subject lands.

Mississippi Valley Conservation Authority (MVCA) has been circulated the following in support of the development:

- "1055 Klondike Road, Environmental Impact Statement and Tree Conservation Report" prepared by Bowfin Environmental Consulting Inc., September 2018.

Environmental Impact Statement

Site visits were conducted between April and August 2018 and included assessments of tree cavities, turtle habitat, fish habitat, vegetation communities and species at risk.

Wetlands and Watercourses

The western and the northern edges of the property are bounded by Shirley's Brook. This is a permanent watercourse that supports cool-warm water fish habitat. As there are no proposed alterations to the channel or the banks of the creek, it was agreed in pre-consultation with MVCA that the fish population would not need to be sampled.

Species at Risk (SAR)

Only one turtle, a dead red-eared slider (an exotic species), was observed along Shirley's Brook. The watercourse and corridor are considered Category 2 Blanding's Turtle habitat due to Blanding's Turtle observations to the north of the property. As such the Blanding's Turtle habitat within the Shirley's Brook corridor will be protected with a 30 m setback from the top of bank and installation of turtle exclusion fencing along the edge of the setback. A 6 m wide recreational path corridor is proposed within the buffer that will connect to the City of Ottawa park north of the property. This pathway will be in the portion of the buffer directly adjacent to the subdivision properties and predominantly outside of the erosion hazard limit.

Mitigation and Compensation

The EIS/TCR lists several mitigation measures that should be incorporated into the project design. Of note, it recommends that the recreational "pathway be constructed out of woodchips or other material that will help discourage turtles from nesting (gravel pathways should be avoided)." The Shirley's Brook Combined Setback Limits drawing (Novatech, July 2019) indicates a stone dust path.

Summary

"All of the impacts can be mitigated through the use of common mitigation measure and no residual negative impacts to the natural environment are anticipated as a result of the development."

MVCA Review and Recommendations

MVCA has reviewed the above documents and is in support of the recommended mitigation and compensation measures. MVCA also recommends the following:

Landscaping plan:

- Natural areas to be retained are to be isolated by sturdy construction fencing or similar barrier at least 1 m in height during construction in order to ensure their retention.
- Disturbed areas should be replanted with locally grown native species. Use of invasive non-native plant material should be discouraged.

Natural Hazards

All development is proposed outside of any identified Natural Hazards and outside the 30 m setback as outlined in the Shirley's Brook Combined Setback Limits Figure DSK-3, July 24, 2019.

The following report was reviewed by Mississippi Valley Conservation Authority (MVCA) engineering staff:

- *Slope Stability Assessment and Meander Belt Setback Proposed Residential Subdivision* (July 2019) prepared by Gemtec Consulting Engineers and Scientists.

Slope Stability/Meander Belt

The requisite hazard for setting the Regulation Limit under Ontario Regulation 153/06 along Shirley's Brook for the west development boundary is the stable slope line and for the north boundary the meander belt erosion hazard. In determining the Regulation Limit, the standard default values recommended by the Province for defining the stable slope line and meander belt limit were used.

To address the slope stability issues, Gemtec staff reviewed four cross-sections along the west side of the property.

The slope stability analyses indicated that for three of the four cross-sections reviewed, the existing slopes in their current configurations are considered stable, with factors of between 1.7 and 3.0. For the fifth cross-section (factor of safety of the existing slope 1.4) the stable slope allowance was calculated to be an additional 1.25 m beyond the crest of the existing slope. For the cross-section locations that were determined to be stable in their existing configuration, an 8 m toe erosion allowance was added to the east of the existing crest of the slope to define the erosion hazard limit. The 8 m toe erosion allowance is the applicable allowance for clays and clay-silt soils, where there is evidence of active erosion, as documented in the *Technical Guide River and Stream Systems: Erosion Hazard Limit* prepared by the Minister of Natural Resources and Forestry (Table 3). Although the MVCA, in previous comments, had suggested that the toe erosion allowance should be used to define the toe of the slope before completing stable slope calculations, the method of adding it to the stable slope line is supported in the City of Ottawa's *Slope Stability Guidelines for Development Applications*.

For the fifth cross-section location (cross-section A-A), the erosion hazard limit consists of the stable slope line (1.25 m beyond the crest of the existing slope) plus the 8 m toe erosion allowance plus the 6 erosion access allowance. The erosion access allowance was not added to the locations where the existing slope was determined to be stable, in its existing configuration, (factor of safety greater than 1.5) under the rationalization that the purposes of implementing the access allowance are not required if the slope is considered stable. The erosion hazard limit for the subject site is shown on the Shirley's Brook Combined Setback Limits Figure DSK-3 included in the submission.

For the northern section of the subject side, the factor of safety of the existing slope was calculated as 4.2. Therefore, the erosion hazard limit was established as a 27.5 m setback from Shirley's Brook which is half of the 55 m meander belt width calculated in the *Kanata North Community Design Plan – Environmental Management Plan Report* (June 2016) (Figure 3.18).

The delineation of meander belt and the north section of the property is acceptable as outlined on the combined setbacks Plan DSK – 3, July 24, 2019

Floodplain

The floodplain is confined within the 30 m setback and no floodproofing requirements are recommended for this development.

Stormwater Management

The following report was reviewed by Mississippi Valley Conservation Authority engineering staff:

- *1055 Klondike – Maple Leaf Homes Site Serviceability and Stormwater Management Report* (July 2019) prepared by Novatech Engineers, Planners and Landscape Architects

Post-development runoff from the subject site is tributary to the existing storm sewer on Klondike Road and the existing stormwater management (SWM) facility at the corner of Klondike Road and March Valley Road (Facility 'C'). This SWM facility outlets to Shirley's Brook upstream (west) of March Valley Road. Runoff from the subject site was included in the design of the Facility 'C' SWM facility and the storm sewer on Klondike Road assuming:

- A maximum minor system inlet rate of 85L/s/ha (minor system peak flow of 207.4 L/s for the 2.44 ha site);
- Major system storage of 50 m3/ha; and
- After the above two criteria are exceeded, major system flow is conveyed overland to Shirley's Brook.

The Facility 'C' SWM facility was designed assuming the subject site developed at an imperviousness value of 52%. Considering the proposed imperviousness value of 55% for the subject site, the permanent pool volume in the facility exceeds the storage required to provide enhanced water quality control for the tributary drainage area.

A conceptual PCSWMM model was assembled for the subject site including the medium density block. With this model, the 1:100 year hydraulic grade line in the storm sewer and the minor and major system peak flow rates were reviewed to confirm that the above noted criteria can be addressed. This analysis confirmed that the minor system peak flow criteria can be addressed, however, due to the limited road area (only Street 1) the available surface storage achievable on the subdivision area (townhouses and semi-detached residential portion) is only 51.6 m^3. Therefore, the design of the medium density block will have to provide a total storage of 70.4 m^3 to achieve the required 50 m^3/ha major system storage criteria for the entire site. Depending on the timing of the development of the overall site, to achieve this total storage a temporary dry pond may be required on the medium density block. It is stated in the report that the grading design and available storage will be confirmed during detailed design stage of the development.

It is also stated in the report that the implementation of best management practices (BMPs) and low impact development (LID) measures, to reduce the impacts of the proposed development on the hydrologic cycle and mitigate the reduction in groundwater infiltration/recharge, will be reviewed during the detailed design stage.

Summary

The analysis and the level of detail provided in the submissions is sufficient for MVCA engineering staff to be satisfied that the proposed subdivision layout as proposed can be designed to meet the required criteria. The detailed design of the subdivision and the SWM and drainage system should address the documented criteria and include the implementation of LID measures.

<u>Conclusion</u>

Thank you for providing the Conservation Authority the opportunity to review this proposal. We trust these comments will meet your requirements at this stage in the review process. Please keep MVCA apprised of the status of these applications, including any decisions that may be made. We would appreciate the opportunity to provide input on any draft conditions relating to the stormwater management for the plan of subdivision application.

Please contact the undersigned with any questions that may arise.

Regards,

Matt Craig
Manager of Planning and Regulations

Appendix B

Sanitary Design Sheets &
Excerpts from Relevant Reports

1055 Klondike Road - Orr Ridge: Sanitary Sewer Design Sheet

AREA			RESIDENTIAL											ICI							INFILTRATION				PIPE					
			Singles		Semi-Detached / Towns					TOTAL																				
ID	From	To	Units	Pop.	Units	Pop.	Future Block 10	Future 1075 Klondike Rd	Pop.	Pop.	Accum. Pop.	Peak Factor	Peak Flow (l/s)	Light Industrial Area (ha)	Accum. Area (ha)	Peak Factor	Commercial Area (ha)	Institutional Area (ha)	Accum. Area (ha)	Peak Flow (l/s)	Total Area (ha)	Accum. Area (ha)	Infilt. Flow (l/s)	**Total Flow (l/s)**	Size (mm)	Slope (%)	Length (m)	Capacity (l/s)	Full Flow Vel. (m/s)	Q/Q_{full} (%)
1055 Klondike Road Drainage Areas																														
A1-1	**7**	**5**	0	0.0	15	40.5	0.00		0.0	40.5	40.5	3.7	0.5				0.00	0.00	0.00	0.0	0.64	0.64	0.2	0.7	200	0.65	19.9	27.6	0.85	2.5%
A1-2	**5**	**3**	0	0.0	29	78.3	0.00		0.0	78.3	118.8	3.6	1.4				0.00	0.00	0.00	0.0	0.80	1.44	0.5	1.9	200	0.50	100.0	24.2	0.75	7.7%
A1-3	**3**	**1**	0	0.0	14	37.8	0.00		0.0	37.8	156.6	3.5	1.8				0.00	0.00	0.00	0.0	0.41	1.85	0.6	2.4	200	0.50	62.3	24.2	0.75	10.0%
A2-1, A2-2	**9**	**1**	0	0.0	0	0.0	53	10	128.9	128.9	128.9	3.6	1.5				0.00	0.00	0.00	0.0	0.88	0.88	0.3	1.8	200	0.65	46.2	27.6	0.85	6.5%
	1	**266**	0	0.0	0	0.0	0.00		0.0	0.0	285.5	3.5	3.2				0.00	0.00	0.00	0.0	0.00	2.73	0.9	4.1	200	0.65	117.0	27.6	0.85	14.9%
Off-site Drainage Areas (To Briar Ridge Pump Station)																														
A3-3	266	265	0	0.0	57	153.9	0.00		0.0	153.9	439.4	3.4	4.8				0.00	0.00	0.00	0.0	2.47	5.20	1.7	6.6	200	0.32	91.0	19.4	0.60	33.9%
A3-4	265	264	0	0.0	0	0.0	0.00		0.0	0.0	439.4	3.4	4.8				0.00	2.21	2.21	1.1	2.21	7.41	2.4	8.4	200	0.32	120.0	19.4	0.60	43.2%
A3-5	264	206	0	0.0	107	288.9	0.00		0.0	288.9	728.3	3.3	7.8				0.00	0.00	2.21	1.1	3.99	11.40	3.8	12.6	250	0.24	306.3	30.4	0.60	41.6%
A3-1, A3-2, A3-6	206	205	201	683.4	392	1058.4	0.00		0.0	1741.8	2470.1	3.0	24.1				9.02	0.00	11.23	5.5	37.33	48.73	16.1	45.6	450	0.20	52.5	133.0	0.81	34.3%
A3-7, A3-8	205	204	0	0.0	0	0.0	0.00		0.0	0.0	2470.1	3.0	24.1	5.4	5.4	4.7	0.00	0.00	11.23	15.7	5.40	54.13	17.9	57.7	450	0.20	79.7	133.0	0.81	43.4%
	204	203	0	0.0	0	0.0	0.00		0.0	0.0	2470.1	3.0	24.1		5.4	4.7	0.00	0.00	11.23	15.7	0.00	54.13	17.9	57.7	450	0.20	79.7	133.0	0.81	43.4%
	203	202	0	0.0	0	0.0	0.00		0.0	0.0	2470.1	3.0	24.1	7.9	13.3	3.9	0.00	0.00	11.23	26.5	7.90	62.03	20.5	71.0	450	0.26	90.0	151.7	0.92	46.8%
	202	201	0	0.0	0	0.0	0.00		0.0	0.0	2470.1	3.0	24.1		13.3	3.9	0.00	0.00	11.23	26.5	0.00	62.03	20.5	71.0	450	0.25	270.0	148.7	0.91	47.8%
	201	PS	0	0.0	0	0.0	0.00		0.0	0.0	2470.1	3.0	24.1		13.3	3.9	0.00	0.00	11.23	26.5	0.00	62.03	20.5	71.0	450	0.15	21.6	115.2	0.70	61.7%

Design Parameters:

Avg Flow/Person =	280	l/day
Comm./Inst. Flow =	28000	l/ha/day
Light Industrial Flow =	35000	l/ha/day
Infiltration =	0.33	l/s/ha
Pipe Friction n =	0.013	

Residential Peaking Factor = Harmon Equation (max 4, min 2)
Peaking Factor Comm./Inst. 1.5

Population Density:

	ppl/unit	units/ha
Future Block 10 Apartment Unit	2.1	
Future 1075 Klondike Road	1.8	35
Single	3.4	
Semi / Town	2.7	

Project: 1055 Klondike Road - Orr Ridge (117034)
Designed: LRW
Checked: MAB
Date: February 18, 2021

BROOKSIDE SUBDIVISION
SANITARY SEWER DESIGN SHEET

LOCATION			RESIDENTIAL AREA AND POPULATION								IND			INST		ICI	INFILTRATION			FLOW	PIPE						
Street	From Node	To Node	Area (ha)	Dwellings SFH	Dwellings TH	Pop.	Cumulative Area (ha)	Cumulative Pop.	Peak Factor	Peak Flow (l/s)	Area (ha)	Accu. Area (ha)	Peak Factor	Area (ha)	Accu. Area (ha)	Peak Flow (l/s)	Total Area (ha)	Accu. Area (ha)	Infiltration Flow (l/s)	Total Flow (l/s)	Length (m)	Dia Act (mm)	Dia Nom (mm)	Slope (%)	Velocity (Full) (m/s)	Capacity (Full) (l/s)	Ratio Q/Qfull (%)
Area 1 - March Road																											
	Offsite	MH 261	6.10			610	6.10	610.0	3.93	9.7							6.1	6.1	1.7	11.4							
	MH 261	MH 260	0.19				6.29	610.0	3.93	9.7							0.2	6.3	1.8	11.5	92.0	203	200	0.33	0.61	19.6	58%
	MH 260	MH 259	0.17				6.46	610.0	3.93	9.7							0.2	6.5	1.8	11.5	71.0	203	200	1.13	1.12	36.3	32%
	MH 259	MH 258	0.13				6.59	610.0	3.93	9.7							0.1	6.6	1.8	11.6	54.4	203	200	0.37	0.64	20.8	56%
Area 3 - Brookside Subdivision																											
Maxwell Bridge Rd	MH 258	MH 256	0.24	3		10.2	6.83	620.2	3.92	9.9							0.2	6.8	1.9	11.8	42.6	203	200	2.35	1.62	52.4	22%
Windance Cres	MH 249	MH 257	0.47	7		23.8	0.47	23.8	4.00	0.4							0.5	0.5	0.1	0.5	54.7	203	200	2.00	1.49	48.3	1%
	MH 257	MH 256	0.37	5		17.0	0.84	40.8	4.00	0.7							0.4	0.8	0.2	0.9	51.5	203	200	0.82	0.95	31.0	3%
Maxwell Bridge Rd	MH 256	MH 255	0.60	9		30.6	8.27	691.6	3.90	10.9							0.6	8.3	2.3	13.2	80.5	203	200	1.11	1.11	36.0	37%
	MH 255	MH 250	0.38	6		20.4	8.65	712	3.89	11.2							0.4	8.7	2.4	13.6	56.4	203	200	1.35	1.22	39.7	34%
Pendra Way	MH 246	MH 254	0.44	7		23.8	0.44	23.8	4.00	0.4							0.4	0.4	0.1	0.5	52.0	203	200	0.90	1.00	32.4	2%
	MH 254	MH 253	0.22	2		6.8	0.66	30.6	4.00	0.5							0.2	0.7	0.2	0.7	11.5	203	200	0.61	0.82	26.7	3%
	MH 253	MH 252	0.00			0.0	0.66	30.6	4.00	0.5							0.0	0.7	0.2	0.7	35.2	203	200	0.57	0.80	25.8	3%
	MH 252	MH 251	0.11	1		3.4	0.77	34.0	4.00	0.6							0.1	0.8	0.2	0.8	10.6	203	200	0.66	0.86	27.8	3%
	MH 251	MH 250	0.54	9		30.6	1.20	61.2	4.00	1.0							0.5	1.2	0.3	1.3	67.8	203	200	0.60	0.82	26.5	5%
Maxwell Bridge Rd	MH 250	MH 242	0.42	6		20.4	10.27	793.6	3.86	12.4							0.4	10.3	2.9	15.3	82.0	203	200	0.80	0.94	30.6	50%
Windance Cres	MH 249	MH 248	0.15	2		6.8	0.15	6.8	4.00	0.1							0.2	0.2	0.0	0.2	20.2	203	200	1.00	1.05	34.2	0%
	MH 248	MH 247	0.23	2		6.8	0.38	13.6	4.00	0.2							0.2	0.4	0.1	0.3	13.1	203	200	2.30	1.60	51.8	1%
	MH 247	MH 246	0.49	6		20.4	0.87	34.0	4.00	0.6							0.5	0.9	0.2	0.8	81.5	203	200	2.90	1.80	58.2	1%
	MH 246	MH 245	0.94	14		47.6	1.81	81.6	4.00	1.3							0.9	1.8	0.5	1.8	123.0	203	200	1.20	1.15	37.4	5%
	MH 245	MH 244	0.20		3	8.1	2.01	89.7	4.00	1.5							0.2	2.0	0.6	2.0	11.2	203	200	0.36	0.63	20.5	10%
	MH 244	MH 243	0.18		5	13.5	2.19	103.2	4.00	1.7							0.2	2.2	0.6	2.3	29.8	203	200	0.34	0.61	19.9	11%
	MH 243	MH 242	0.79	7	12	56.2	2.80	145.9	4.00	2.4							0.8	2.8	0.8	3.1	108.0	203	200	0.32	0.60	19.3	16%
Maxwell Bridge Rd	MH 242	MH 240	0.39	5		17.0	13.46	956.5	3.81	14.8							0.4	13.5	3.8	18.5	82.0	254	250	0.38	0.75	38.2	49%
Celtic Ridge Cres	MH 233	MH 241	0.63		20	54.0	0.63	54.0	4.00	0.9							0.6	0.6	0.2	1.1	73.3	203	200	0.33	0.61	19.6	5%
	MH 241	MH 240	0.45		13	35.1	1.08	89.1	4.00	1.4							0.5	1.1	0.3	1.7	63.7	203	200	1.21	1.16	37.6	5%
Maxwell Bridge Rd	MH 240	MH 238	0.40		9	24.3	14.94	1069.9	3.78	16.4							0.4	14.9	4.2	20.6	82.0	254	250	0.24	0.60	30.4	68%
Celtic Ridge Cres	MH 233	MH 232	0.19		3	8.1	0.19	8.1	4.00	0.1							0.2	0.2	0.1	0.2	12.4	203	200	0.65	0.85	27.6	1%
	MH 232	MH 231	0.46		12	32.4	0.65	40.5	4.00	0.7							0.5	0.7	0.2	0.8	73.3	203	200	0.40	0.67	21.6	4%
Celtic Ridge Cres	MH 230	MH 231	0.41		11	29.7	0.41	29.7	4.00	0.5							0.4	0.4	0.1	0.6	82.1	203	200	0.33	0.61	19.6	3%
Braecreek Ave	MH 231	MH 239	0.92		28	75.6	1.98	145.8	4.00	2.4							0.9	2.0	0.6	2.9	120.0	203	200	0.33	0.61	19.6	15%
	MH 239	MH 238	0.17		4	10.8	2.15	156.6	4.00	2.5							0.2	2.2	0.6	3.1	27.4	203	200	1.82	1.42	46.1	7%
Maxwell Bridge Rd	MH 238	MH 236	0.42		13	35.1	17.51	1261.6	3.73	19.1							0.4	17.5	4.9	24.0	82.0	254	250	0.24	0.60	30.4	79%
Fordell Ave	MH 230	MH 237	0.86		30	81.0	0.86	81.0	4.00	1.3							0.9	0.9	0.2	1.6	110.0	203	200	0.32	0.60	19.3	8%
	MH 237	MH 236	0.23		6	16.2	1.09	97.2	4.00	1.6							0.2	1.1	0.3	1.9	39.1	203	200	2.30	1.60	51.8	4%

BROOKSIDE SUBDIVISION
SANITARY SEWER DESIGN SHEET

LOCATION			RESIDENTIAL AREA AND POPULATION								IND			INST		ICI	INFILTRATION			FLOW	PIPE						
Street	From Node	To Node	Area (ha)	Dwellings SFH	Dwellings TH	Pop.	Cumulative Area (ha)	Cumulative Pop.	Peak Factor	Peak Flow (l/s)	Area (ha)	Accu. Area (ha)	Peak Factor	Area (ha)	Accu. Area (ha)	Peak Flow (l/s)	Total Area (ha)	Accu. Area (ha)	Infiltration Flow (l/s)	Total Flow (l/s)	Length (m)	Dia Act (mm)	Dia Nom (mm)	Slope (%)	Velocity (Full) (m/s)	Capacity (Full) (l/s)	Ratio Q/Qfull (%)
Maxwell Bridge Rd	MH 236	MH 234	0.39		12	32.4	18.99	1391.2	3.70	20.9							0.4	19.0	5.3	26.2	82.0	305	300	0.24	0.68	49.4	53%
Arncliffe Ave	MH 229	MH 235	0.87		30	81.0	0.87	81.0	4.00	1.3							0.9	0.9	0.2	1.6	120.0	203	200	0.33	0.61	19.6	8%
	MH 235	MH 234	0.22		6	16.2	1.09	97.2	4.00	1.6							0.2	1.1	0.3	1.9	29.3	203	200	2.90	1.80	58.2	3%
Maxwell Bridge Rd	MH 234	MH 225	0.26		6	16.2	20.34	1504.6	3.68	22.4							0.3	20.3	5.7	28.1	79.8	305	300	0.25	0.69	50.4	56%
Celtic Ridge Cres	MH 230	MH 229	0.43		12	32.4	0.43	32.4	4.00	0.5							0.4	0.4	0.1	0.6	81.9	203	200	0.32	0.60	19.3	3%
	MH 229	MH 228	0.38		11	29.7	0.81	62.1	4.00	1.0							0.4	0.8	0.2	1.2	70.3	203	200	0.33	0.61	19.6	6%
	MH 228	MH 227	0.10		0	0.0	0.91	62.1	4.00	1.0							0.1	0.9	0.3	1.3	12.3	203	200	0.33	0.61	19.6	6%
	MH 227	MH 226	0.46		13	35.1	1.37	97.2	4.00	1.6							0.5	1.4	0.4	2.0	97.0	203	200	0.32	0.60	19.3	10%
	MH 226	MH 225	0.21		5	13.5	1.58	110.7	4.00	1.8							0.2	1.6	0.4	2.2	43.7	203	200	0.94	1.02	33.1	7%
Celtic Ridge Cres	MH 225	MH 224	0.58		12	32.4	22.50	1647.7	3.65	24.4							0.6	22.5	6.3	30.7	97.5	381	375	0.20	0.72	81.7	38%
	MH 224	MH 209	0.22		4	10.8	22.72	1658.5	3.65	24.5							0.2	22.7	6.4	30.9	66.5	381	375	0.20	0.72	81.7	38%
Streamside Cres	MH 217	MH 218	0.26	2		6.8	0.26	6.8	4.00	0.1							0.3	0.3	0.1	0.2	12.4	203	200	1.00	1.05	34.2	1%
	MH 218	MH 219	0.96	20		68.0	1.22	74.8	4.00	1.2							1.0	1.2	0.3	1.6	120.0	203	200	0.80	0.94	30.6	5%
	MH 219	MH 220	0.62	11		37.4	1.84	112.2	4.00	1.8							0.6	1.8	0.5	2.3	77.8	203	200	0.32	0.60	19.3	12%
Glenbrae Ave	MH 220	MH 221	0.96		28	75.6	2.80	187.8	4.00	3.0							1.0	2.8	0.8	3.8	118.9	203	200	0.32	0.60	19.3	20%
	MH 221	MH 222	1.04		33	89.1	3.84	276.9	4.00	4.5							1.0	3.8	1.1	5.6	119.0	203	200	0.32	0.60	19.3	29%
	MH 222	MH 223	0.20		3	8.1	4.04	285.0	4.00	4.6							0.2	4.0	1.1	5.7	12.9	203	200	0.39	0.66	21.3	27%
	MH 223	MH 210	0.22		4	10.8	4.26	295.8	4.00	4.8							0.2	4.3	1.2	6.0	72.9	203	200	0.33	0.61	19.6	30%
Streamside Cres	MH 217	MH 216	0.37	5		17.0	0.37	17.0	4.00	0.3							0.4	0.4	0.1	0.4	40.1	203	200	0.65	0.85	27.6	1%
	MH 216	MH 215	0.17	2		6.8	0.54	23.8	4.00	0.4							0.2	0.5	0.2	0.5	13.6	203	200	0.65	0.85	27.6	2%
	MH 215	MH 214	0.17	2		6.8	0.71	30.6	4.00	0.5							0.2	0.7	0.2	0.7	31.6	203	200	0.50	0.75	24.2	3%
	MH 214	MH 213	1.02	18		61.2	1.73	91.8	4.00	1.5							1.0	1.7	0.5	2.0	119.0	203	200	0.90	1.00	32.4	6%
	MH 213	MH 212	0.50	7		23.8	2.23	115.6	4.00	1.9							0.5	2.2	0.6	2.5	56.5	203	200	0.32	0.60	19.3	13%
Celtic Ridge Cres	MH 212	MH 211	1.04	16		54.4	3.27	170.0	4.00	2.8							1.0	3.3	0.9	3.7	124.9	203	200	0.32	0.60	19.3	19%
	MH 211	MH 210	0.94	16		54.4	4.21	224.4	4.00	3.6							0.9	4.2	1.2	4.8	122.0	203	200	0.33	0.61	19.6	25%
Celtic Ridge Cres	MH 210	MH 209	0.58	11		37.4	9.05	557.6	3.95	8.9							0.6	9.1	2.5	11.5	80.9	203	200	0.75	0.91	29.6	39%
Easement	MH 209	MH 208	0.06			0.0	31.83	2216.1	3.55	31.9							0.1	31.8	8.9	40.8	50.3	381	375	0.20	0.72	81.7	50%
	MH 208	MH 207	0.24			0.0	32.07	2216.1	3.55	31.9							0.2	32.1	9.0	40.9	111.6	381	375	0.20	0.72	81.7	50%
Area 4a - Phase 2 Lands																											
	MH 273	MH 272	0.57		9	24.3	0.57	24.3	4.00	0.4							0.6	0.6	0.2	0.6	66.0	203	200	0.65	0.85	27.6	2%
	MH 272	MH 271	0.92		16	43.2	1.49	67.5	4.00	1.1							0.9	1.5	0.4	1.5	90.2	203	200	0.40	0.67	21.6	7%
	MH 271	MH 270	1.06		19	51.3	2.55	118.8	4.00	1.9							1.1	2.6	0.7	2.6	113.0	203	200	0.40	0.67	21.6	12%
	MH 270	MH 207	0.00		0	0.0	2.55	118.8	4.00	1.9							0.0	2.6	0.7	2.6	16.0	254	250	0.32	0.69	35.1	8%
Easement	MH 207	MH 206	0.22			0.0	34.84	2240.4	3.55	32.2							0.2	34.8	9.8	41.9	100.0	457	450	0.20	0.81	132.9	32%
Area 2																											
	Area 2	MH 266	3.10			202	3.10	202.0	4.00	3.3							3.1	3.1	0.9	4.1	-	203	200	0.32	0.60	19.3	21%
Klondike Road & Area 4b																											
	MH 266	MH 265	0.24				3.34	202.0	4.00	3.3							0.2	3.3	0.9	4.2	93.7	203	200	0.32	0.60	19.3	22%
	Park	MH 265	1.89				1.89	0.0	4.00	0.0							1.9	1.9	0.5	0.5	13.0	203	200	0.32	0.60	19.3	3%
	MH 265	MH 264	0.31				5.54	202.0	4.00	3.3							0.3	5.5	1.6	4.8	120.0	203	200	0.32	0.60	19.3	25%

M:\2001\101108\Data\Calculations\SAN Design_20070829.xls

BROOKSIDE SUBDIVISION
SANITARY SEWER DESIGN SHEET

LOCATION			RESIDENTIAL AREA AND POPULATION								IND			INST		ICI	INFILTRATION			FLOW	PIPE						
Street	From Node	To Node	Area (ha)	Dwellings SFH	Dwellings TH	Pop.	Cumulative Area (ha)	Cumulative Pop.	Peak Factor	Peak Flow (l/s)	Area (ha)	Accu. Area (ha)	Peak Factor	Area (ha)	Accu. Area (ha)	Peak Flow (l/s)	Total Area (ha)	Accu. Area (ha)	Infiltration Flow (l/s)	Total Flow (l/s)	Length (m)	Dia Act (mm)	Dia Nom (mm)	Slope (%)	Velocity (Full) (m/s)	Capacity (Full) (l/s)	Ratio Q/Qfull (%)
Marconi Ave	MH 269	MH 268	0.14		3	8.1	0.14	8.1	4.00	0.1							0.1	0.1	0.0	0.2	21.3	203	200	1.00	1.05	34.2	0%
	MH 268	MH 267	0.11		2	5.4	0.25	13.5	4.00	0.2							0.1	0.3	0.1	0.3	26.6	203	200	0.56	0.79	25.6	1%
	MH 267	MH 264	0.95		26	70.2	1.20	83.7	4.00	1.4							1.0	1.2	0.3	1.7	120.0	203	200	0.67	0.86	28.0	6%
	MH 264	MH 263	0.78		20	54.0	7.52	339.7	4.00	5.5							0.8	7.5	2.1	7.6	100.0	254	250	0.24	0.60	30.4	25%
	MH 263	MH 262	0.91		27	72.9	8.43	412.6	4.00	6.7							0.9	8.4	2.4	9.0	88.3	254	250	0.24	0.60	30.4	30%
	MH 262	MH 206	0.95		29	78.3	9.38	490.9	3.98	7.9							1.0	9.4	2.6	10.5	118.0	254	250	0.24	0.60	30.4	35%
	MH 206	MH 205	0.10			0.0	44.32	2731.3	3.48	38.5							0.1	44.3	12.4	50.9	52.5	457	450	0.20	0.81	132.9	38%
Area 5a & 5b (KRP) - Klondike Road																											
	Area 5	MH 205									5.4	5.4	4.7			10.3	5.4	5.4	1.5	11.8	-	254	250	0.25	0.61	31.0	38%
Briar Ridge Pump Station Access Road + Area 6 (KRP)																											
	MH 205	MH 204					44.32	2731.3	3.48	38.5		5.4	4.7			10.3	0.0	49.7	13.9	62.7	79.7	457	450	0.20	0.81	132.9	47%
	MH 204	MH 203					44.32	2731.3	3.48	38.5		5.4	4.7			10.3	0.0	49.7	13.9	62.7	79.7	457	450	0.20	0.81	132.9	47%
	Area 6	MH 203									7.9	7.9	4.4			14.1	7.9	7.9	2.2	16.3	-	254	250	0.25	0.61	31.0	53%
	MH 203	MH 202					44.32	2731.3	3.48	38.5		13.3	3.9			21.0	0.0	57.6	16.1	75.6	90.0	457	450	0.26	0.92	151.6	50%
	MH 202	MH 201B					44.32	2731.3	3.48	38.5		13.3	3.9			21.0	0.0	57.6	16.1	75.6	95.0	457	450	0.26	0.92	151.6	50%
	MH 201B	MH 201A					44.32	2731.3	3.48	38.5		13.3	3.9			21.0	0.0	57.6	16.1	75.6	85.0	457	450	0.25	0.91	148.6	51%
	MH 201A	MH 201					44.32	2731.3	3.48	38.5		13.3	3.9			21.0	0.0	57.6	16.1	75.6	90.0	457	450	0.25	0.91	148.6	51%
	MH 201	PS					44.32	2731.3	3.48	38.5		13.3	3.9			21.0	0.0	57.6	16.1	75.6	21.6	457	450	0.15	0.70	115.1	66%
Area 7 (KRP - Ex. Golf Course)																											
	Ex. MH	PS									15.2	15.2	3.9			24.0	15.2	15.2	4.3	28.3							
Area 8 (Claridge Lands)																											
	Ex. MH	PS	45.57			3100	45.57	3100.0	3.43	43.1							45.6	45.6	12.8	55.8							
Pump Station (Areas 1-8)							89.89	5831.3	3.18	75.2		28.5	3.4			39.3	0.0	118.4	33.1	147.6							

DESIGN PARAMETERS

Average Daily Flow=	350	L/cap/day	Industrial Peak Factor= per MOE graph		
Comm/Inst Flow=	50000	L/ha/day	Extraneous Flow=	0.28 L/s/ha	0.28 L/s/ha
Industrial Flow=	35000	L/ha/day	Minimum Velocity=	0.60 m/s	0.60 m/s
Max Res Peak Factor=	4.00		Manning's n=	0.013	0.01
Comm/Inst Peak Factor=	1.50				

Designed: MAB

Checked: JGR

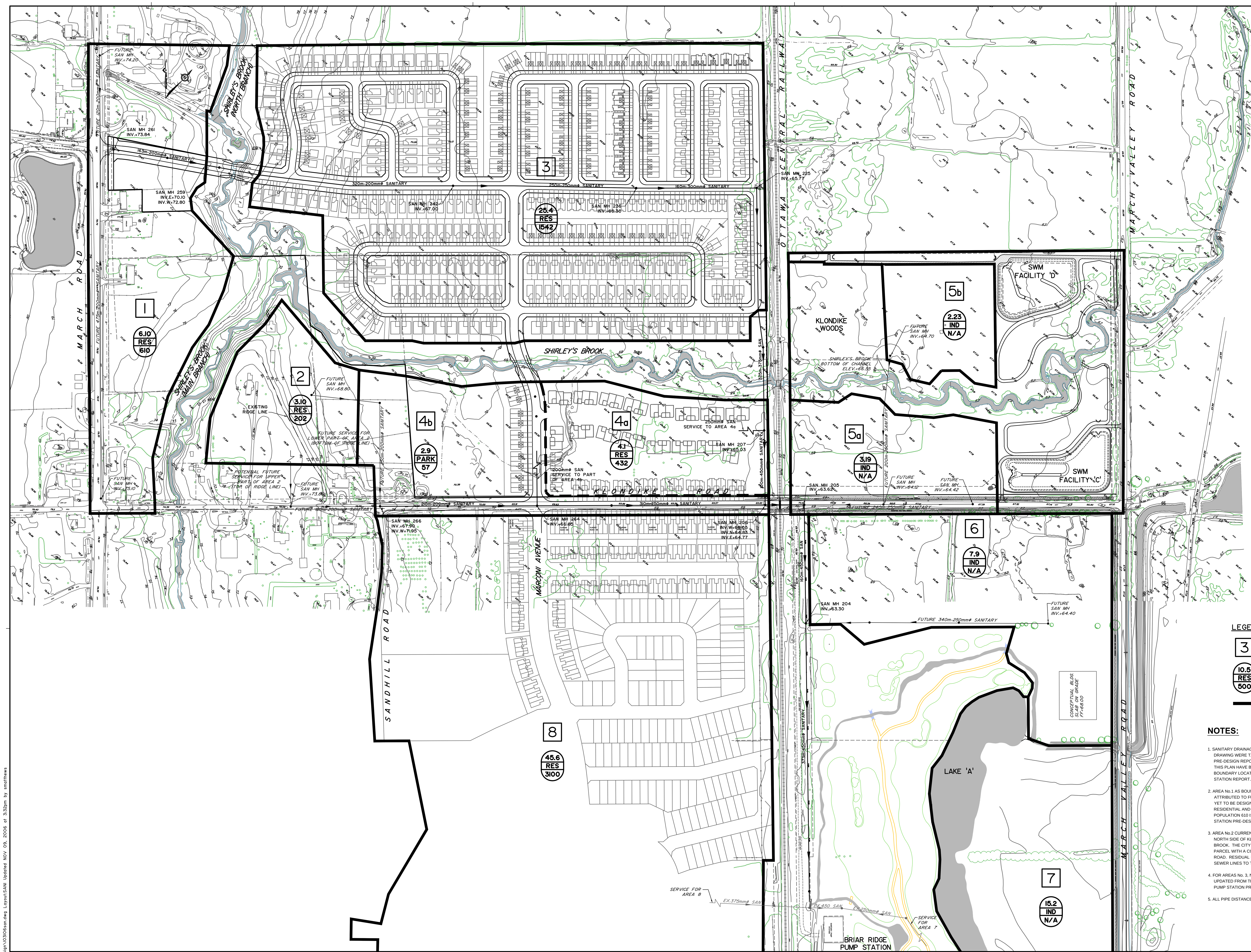
Dwg. Reference: 103106-SAN1
103106-SAN2

PROJECT:
Brookside Subdivision

CLIENT:
Klondike Developments Inc

Date: August 29, 2007

M:\2001\101108\Data\Calculations\SAN Design_20070829.xls



LEGEND

3 — AREA I.D.

10.5 — AREA IN HECTARES
RES — LANDUSE TYPE: RES = RESIDENTIAL, IND = LIGHT INDUSTRIAL
500 — POPULATION ESTIMATE

SANITARY DRAINAGE AREA BOUNDARY

NOTES:

1. SANITARY DRAINAGE AREAS AND POPULATION VALUES DEPICTED ON THIS DRAWING WERE TAKEN FROM THE "BRIAR RIDGE SANITARY PUMP STATION PRE-DESIGN REPORT" BY CCL (REPORT No. xxxxxxx). THE BOUNDARY LINES ON THIS PLAN HAVE BEEN APPROXIMATED FROM THAT REPORT. PRECISE BOUNDARY LOCATIONS SHOULD BE TAKEN FROM THE APPROVED PUMPING STATION REPORT.

2. AREA No.1 AS BOUNDED HAS A LAND AREA OF 9.0ha. A SIZEABLE PORTION IS ATTRIBUTED TO FUTURE STORMWATER MANAGEMENT FACILITY 'A' WHICH HAS YET TO BE DESIGNED. THE BALANCE OF THE LAND AREA IS ATTRIBUTED TO RESIDENTIAL AND ROADWAY USES. THE DEVELOPMENT AREA=6.10ha WITH POPULATION 610 IS TAKEN DIRECTLY FROM THE "BRIAR RIDGE SANITARY PUMP STATION PRE-DESIGN REPORT".

3. AREA No.2 CURRENTLY EXCLUDES A SMALL PARCEL OF LAND (±1.1ha) ON THE NORTH SIDE OF KLONDIKE ROAD BETWEEN SANDHILL ROAD AND SHIRLEY'S BROOK. THE CITY OF OTTAWA MAY CHOOSE TO EXPLORE SERVICING THIS PARCEL WITH A CONNECTION TO A FUTURE SANITARY SEWER WITHIN KLONDIKE ROAD. RESIDUAL FREE FLOW CAPACITY APPEARS TO EXIST IN THE SANITARY SEWER LINES TO THE PUMP STATION.

4. FOR AREAS No. 3, No. 5 AND No.6 THE POPULATION AND AREA VALUES HAVE BEEN UPDATED FROM THE NOVEMBER 2000 CCL REPORT "BRIAR RIDGE SANITARY PUMP STATION PRE-DESIGN REPORT" TO REFLECT THE LATEST LANDUSE PLANS.

5. ALL PIPE DISTANCES AND SLOPE VALUES IDENTIFIED ON THIS PLAN ARE NOMINAL.

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.

No.	REVISION	DATE	BY	No.	REVISION	DATE	BY
				7.	ISSUED TO CLIENT	OCT 10/06	MAB
				6.	ISSUED FOR CONSTRUCTION	AUG 17/06	MAB
				5.	ISSUED WITH MOE APPLICATION	AUG 08/06	MAB
				4.	ISSUED FOR TENDER	MAY 26/06	MAB
				3.	ISSUED FOR MOE APPROVAL	MAY 01/06	MAB
9.	AS-BUILT	JAN 16/14	MAB	2.	REVISED PER CITY COMMENTS	APR 24/06	MAB
8.	ISSUED FOR MOE APPROVAL	NOV 09/06	MAB	1.	ISSUED TO CITY FOR REVIEW	MAR 20/06	MAB

LICENSED PROFESSIONAL ENGINEER — M.A. BISSETT — PROVINCE OF ONTARIO

REGISTERED PROFESSIONAL ENGINEER — J.G. RIDDELL — PROVINCE OF ONTARIO

NOVATECH ENGINEERING CONSULTANTS LTD.
ENGINEERS & PLANNERS
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada
K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Email: novainfo@novatech-eng.com

DESIGN	MAB
CHECKED	SAY
DRAWN	SM
CHECKED	MAB
APPROVED	JGR

SCALE 1:2000

CITY OF OTTAWA

BROOKSIDE SUBDIVISION

BRIAR RIDGE PUMP STATION SANITARY DRAINAGE PLAN

PROJECT No. 103106-0
DATE AUGUST 2005
DRAWING No. 103106-SANI

Drawing:M:\2003\103106\CAD\design\103106san.dwg Layout:SANI Updated NOV 09, 2006 at 3:32pm by smatthews

BRIAR RIDGE PUMP STATION
HYDRAULIC GRADE LINE ANALYSIS

This spreadsheet uses the Darcy-Weisbach equation to calculate hydraulic losses throuh a pipe network with a specified flow rate. Minor losses are accounted for including both pipe bend losses and structure losses.
The spreadsheet returns the upstream hydraulic grade line if surcharged or the pipe obvert if free flow conditions exist. The HGL slope is calculated and the minimum USF elevation must be at least +0.30m above the HGL.

Bend Coefficients

0	45	90	<----Bend (in degrees)
0.00	0.29	1.02	900 mm pipe or greater (benching)
0.00	0.40	1.32	825 mm pipe or smaller (300 mm sump)

BROOKSIDE SUBDIVISION - SANITARY SEWER DESIGN

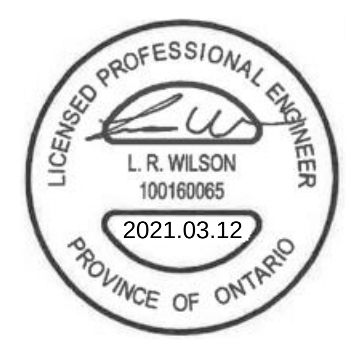
LOCATION	MANHOLE		INVERT ELEVATION		GROUND ELEVATION	COVER	PIPE PARAMETERS			TOTAL FLOW	Q_{cap}	Q_{in}/Q_{cap}	COMPUTATIONAL COLUMNS					HEAD LOSS	SURCHARGE	HGL			PIPE	MIN. USF
	U/S	D/S	U/S (m)	D/S (m)	U/S (m)	U/S (m)	Dia (mm)	Length (m)	'n'	(m^3/s)	(m^3/s)		Pipe Area (m^2)	L/D	Friction Factor (f)	Velocity V (m/s)	$V^2/2g$	HL (m)	U/S (m)	U/S (m)	D/S (m)	SLOPE (%)	SLOPE (%)	U/S (m)
BRIAR RIDGE SEWER																				67.44	<- OUTLET			
	MH 201A	MH 201	62.61	62.38	69.05	5.990	450	90.00	0.013	0.071	0.150	0.47	0.164	200	0.02747	0.43	0.01	0.05	4.43	67.49	67.44	0.06	0.26	67.79
	MH 201B	MH 201A	62.82	62.61	68.80	5.530	450	85.00	0.013	0.071	0.148	0.48	0.164	189	0.02747	0.43	0.01	0.05	4.28	67.55	67.49	0.06	0.25	67.85
	MH 202	MH 201B	63.07	62.82	68.90	5.380	450	95.00	0.013	0.071	0.153	0.47	0.164	211	0.02747	0.43	0.01	0.06	4.08	67.60	67.55	0.06	0.26	67.90
	MH 203	MH 202	63.30	63.07	68.95	5.200	450	90.00	0.013	0.071	0.150	0.47	0.164	200	0.02747	0.43	0.01	0.05	3.91	67.66	67.60	0.06	0.26	67.96
	MH 204	MH 203	63.60	63.30	69.00	4.950	450	79.70	0.013	0.057	0.182	0.31	0.164	177	0.02747	0.35	0.01	0.03	3.64	67.69	67.66	0.04	0.38	67.99
	MH 205	MH 204	63.90	63.60	70.10	5.750	450	79.70	0.013	0.057	0.182	0.31	0.164	177	0.02747	0.35	0.01	0.04	3.38	67.73	67.69	0.05	0.38	68.03
KLONDIKE ROAD																								
	MH 206	MH 205	64.77	64.70	70.24	5.020	450	35.90	0.013	0.045	0.131	0.34	0.164	80	0.02747	0.27	0.00	0.01	2.53	67.75	67.73	0.040	0.19	68.05
	MH 262	MH 206	66.24	65.86	70.18	3.740	200	120.00	0.013	0.012	0.019	0.62	0.032	600	0.03600	0.37	0.01	0.15	1.46	67.90	67.75	0.13	0.32	68.20
	MH 263	MH 262	66.52	66.24	70.43	3.710	200	120.00	0.013	0.012	0.017	0.73	0.032	600	0.03600	0.37	0.01	0.15	1.34	68.06	67.90	0.13	0.23	68.36
	MH 264	MH 263	66.84	66.52	70.38	3.340	200	68.30	0.013	0.012	0.023	0.51	0.032	342	0.03600	0.37	0.01	0.10	1.11	68.15	68.06	0.15	0.47	68.45
	MH 265	MH 264	67.56	66.84	71.84	4.080	200	120.00	0.013	0.008	0.027	0.30	0.032	600	0.03600	0.25	0.00	0.07	0.46	68.22	68.15	0.06	0.60	68.52
	MH 266	MH 265	67.85	67.56	74.78	6.730	200	93.70	0.013	0.006	0.019	0.32	0.032	469	0.03600	0.19	0.00	0.03	0.20	68.25	68.22	0.03	0.31	68.55
	MH 1	MH 266	71.60	70.43	77.76	5.960	200	117.00	0.013	0.004	0.034	0.12	0.032	585	0.03600	0.12	0.00	0.02	0.00	71.80	70.63	1.00	1.00	72.10
STREET 1																								
	MH 3	MH1	72.81	71.66	77.45	4.440	200	62.30	0.013	0.003	0.046	0.06	0.032	312	0.03600	0.09	0.00	0.01	0.00	73.01	71.86	1.85	1.85	73.31
	MH 5	MH3	73.47	72.82	76.59	2.920	200	100.00	0.013	0.002	0.028	0.07	0.032	500	0.03600	0.06	0.00	0.00	0.00	73.67	73.02	0.65	0.65	73.97
	MH 7	MH5	73.64	73.50	76.29	2.450	200	21.90	0.013	0.001	0.027	0.04	0.032	110	0.03600	0.03	0.00	0.00	0.00	73.84	73.70	0.64	0.64	74.14

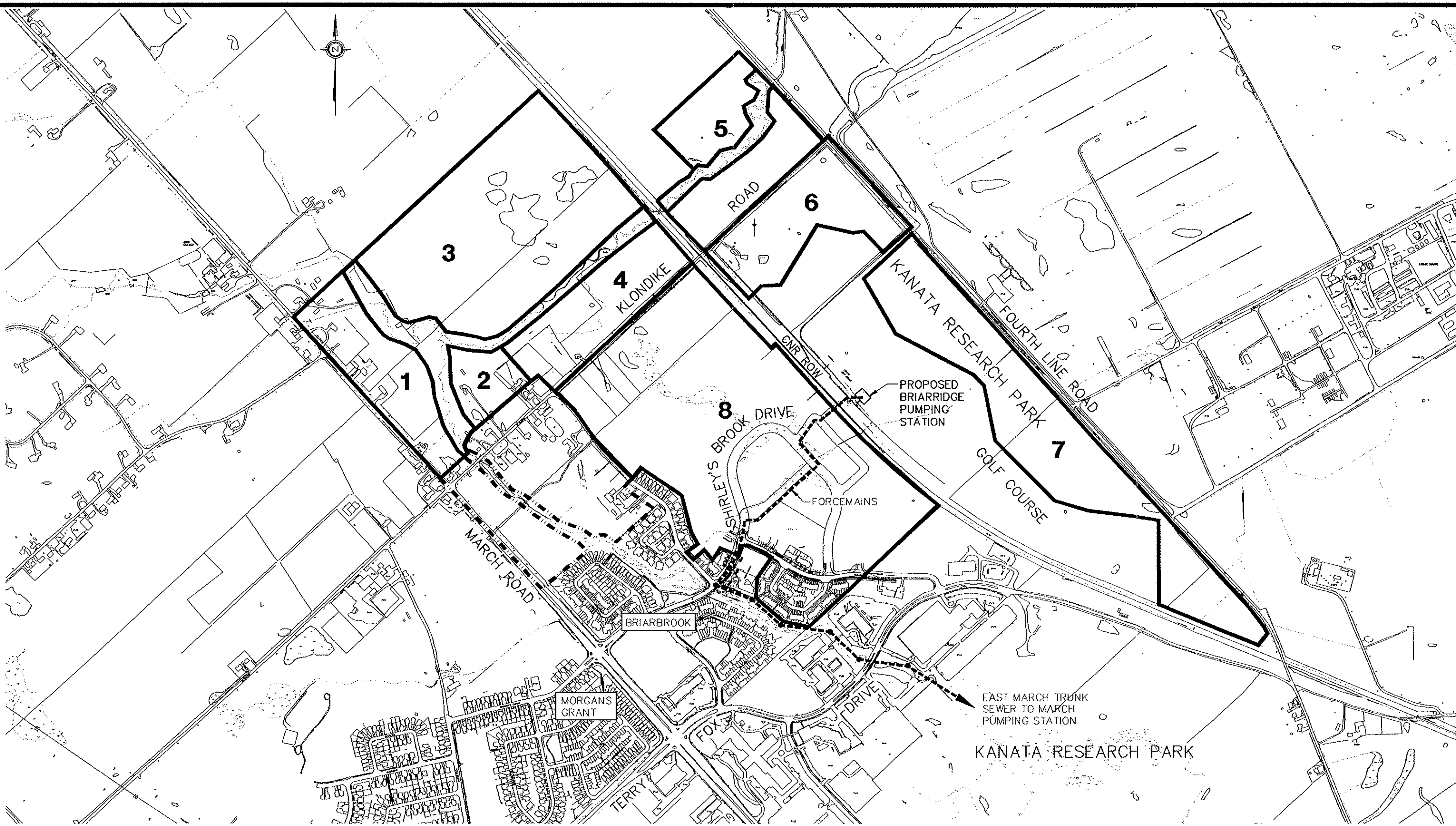
Manhole Loss

Manhole (U/S – D/S)	Diameters (mm) U/S MH	Pipe In	Pipe Out	Bend Angle	K_O	C_D	K_b	K_{tot}	HL_{MH} (m)
MH 201A – MH 201	1200	450	450	0	0.267	1.00	0.00	**0.267**	0.003
MH 201B – MH 201A	1200	450	450	0	0.267	1.00	0.00	**0.267**	0.003
MH 202 – MH 201B	1200	450	450	0	0.267	1.00	0.00	**0.267**	0.003
MH 203 – MH 202	1200	450	450	0	0.267	1.00	0.00	**0.267**	0.003
MH 204 – MH 203	1200	450	450	0	0.267	1.00	0.00	**0.267**	0.002
MH 205 – MH 204	1200	450	450	90	0.267	1.00	1.32	**1.587**	0.010
MH 206 – MH 205	1200	450	450	90	0.267	1.00	1.32	**1.587**	0.006
MH 262 – MH 206	1200	200	200	0	0.600	1.00	0.00	**0.600**	0.004
MH 263 – MH 262	1200	200	200	0	0.600	1.00	0.00	**0.600**	0.004
MH 264 – MH 263	1200	200	200	90	0.600	1.00	1.32	**1.920**	0.013
MH 265 – MH 264	1200	200	200	0	0.600	1.00	0.00	**0.600**	0.002
MH 266 – MH 265	1200	200	200	0	0.600	1.00	0.00	**0.600**	0.001
MH 1 – MH 266	1200	200	200	0	0.600	1.00	0.00	**0.600**	0.000
MH 3 – MH1	1200	200	200	90	0.600	1.00	1.32	**1.920**	0.001
MH 5 – MH3	1200	200	200	0	0.600	1.00	0.00	**0.600**	0.000
MH 7 – MH5	1200	200	200	45	0.600	1.00	0.40	**1.000**	0.000

DESIGN PARAMETERS

Average Daily Flow= 280 L/cap/day	Industrial Peak Factor= per MOE graph	HGL=Major + Minor Losses	Designed: LRW	PROJECT: 1055 Klondike Road - Orr Ridge
Comm/Inst Flow= 28000 L/ha/day	Extraneous Flow= 0.33 L/s/ha	Major Loss= Pipe Friction (Darcy-Weisbach)		
Industrial Flow= 35000 L/ha/day	Minimum Velocity= 0.60 m/s	Minor Loss= Head loss correction for flow through MH, changes in pipe size, and pipe bends	Checked: MAB	CLIENT: Maple Leaf Homes
Max Res Peak Factor= 4.00	Manning's n= 0.013	Friction Factor= 8g/c^2, where c=(1/n)*(D/4)^1/6		
Comm Peak Factor= 1.50				
Indst Peak Factor= 1.50			Dwg. Reference: 117034-SAN	Date: September 3, 2020





LEGEND:

7 DRAINAGE AREAS

BRIARRIDGE SANITARY PUMPING STATION PRE-DESIGN REPORT
CITY OF KANATA

Cumming Cockburn Limited
Consulting Engineers, Planners, and Environmental Scientists

SANITARY DRAINAGE AREAS

DATE NOV. 2000

FIGURE 3

Appendix C

Watermain Boundary Conditions,
FUS Calculations, &
Modelling Results

Lucas Wilson

From: Surprenant, Eric <Eric.Surprenant@ottawa.ca>
Sent: Thursday, January 9, 2020 11:07 AM
To: Lucas Wilson
Subject: FW: 1055 Klondike Road - Boundary Conditions
Attachments: KlondikeWatermain.pdf; 1055 Klondike Road _Boundary Conditions_09Jan2020.docx

Follow Up Flag: Follow up
Flag Status: Flagged

Hi Lucas,

As indicated by Gabrielle, the proponent will need to construct the 406 mm on Klondike (refer to attached PDF). Please find attached the requested updated boundary conditions.

Thanks

Eric Surprenant, C.E.T. / 613 580-2424 ext.:27794
Project Manager, Infrastructure Approvals

Development Review Suburban Services Branch
Planning, Infrastructure and Economic Development Dept.

Gestionaire de projets, Approbation de l'infrastructure
Examen des demandes d'aménagement (Services Suburbains Ouest)
Services de la planification, de l'infrastructure et du développement économique

City of Ottawa | Ville d'Ottawa

613.580.2424 ext./poste 27794
ottawa.ca/planning / ottawa.ca/urbanisme

From: Lucas Wilson <l.wilson@novatech-eng.com>
Sent: December 19, 2019 3:27 PM
To: Surprenant, Eric <Eric.Surprenant@ottawa.ca>
Subject: FW: 1055 Klondike Road - Boundary Conditions

Eric,

Just sent an updated boundary condition request to Gabrielle and got directed to send engineering requests to you.

As stated below, the water demands for 1055 Klondike Road have changed slightly since our last boundary conditions and have been asked to get updated ones. Hopefully all the information is provided below but let me know if you need anything else.

Thanks,

Lucas Wilson, P.Eng., Project Coordinator | Engineering
NOVATECH
Engineers, Planners & Landscape Architects | 200-240 Michael Cowpland Drive, Ottawa, ON K2M 1P6
Office 613.254.9643 x282 | **Fax** 613.254.5867 | **Email** l.wilson@novatech-eng.com

---

From: Lucas Wilson
Sent: Thursday, December 19, 2019 3:22 PM
To: 'Schaeffer, Gabrielle' <gabrielle.schaeffer@Ottawa.ca>
Subject: RE: 1055 Klondike Road - Boundary Conditions

Good Afternoon Gabrielle,

Since the development water demands have changed since the original boundary conditions were provided, we are looking for updated boundary conditions in the same locations as provided previously (Klondike and Sandhill, Klondike and March Road). There are now 12 semi-detached units and 46 townhome units proposed within the development with a future condo block. Water demands are as follows:

Average Day Demand: 0.834L/s
Max Day Demand: 2.085L/s
Peak Hour Demand: 4.588L/s

Residential fire flow for semis and towns is 167L/s and a fire flow of 250L/s for the condo block.

Please let me know if you need anything else.

Thanks,

Lucas Wilson, P.Eng., Project Coordinator | Engineering
NOVATECH
Engineers, Planners & Landscape Architects | 200-240 Michael Cowpland Drive, Ottawa, ON K2M 1P6
Office 613.254.9643 x282 | **Fax** 613.254.5867 | **Email** l.wilson@novatech-eng.com

---

From: Schaeffer, Gabrielle <gabrielle.schaeffer@Ottawa.ca>
Sent: Friday, February 2, 2018 10:00 AM
To: Lucas Wilson <l.wilson@novatech-eng.com>
Cc: Mark Bissett <m.bissett@novatech-eng.com>
Subject: RE: 1055 Klondike Road - Boundary Conditions

Hi Lucas,

Please find the attached boundary conditions. Just as a reminder I want to mention that the applicant is to connect the watermains along Klondike Road (stub near March Rd. to stub near Sandhill) and 2 connections to this watermain is required from the proposed development.

Regards,
Gabrielle

From: Lucas Wilson [mailto:l.wilson@novatech-eng.com]
Sent: Tuesday, January 30, 2018 9:29 AM
To: Schaeffer, Gabrielle <gabrielle.schaeffer@Ottawa.ca>
Cc: Mark Bissett <m.bissett@novatech-eng.com>
Subject: 1055 Klondike Road - Boundary Conditions

Gabrielle,

We are looking for boundary conditions for a residential development consisting of approximately 12 singles and 72 towns. The boundary condition is located at the intersection of Sandhill Road and Klondike Road with connection to the existing 400mm watermain (see attached figure).

Water demands are as follows:
Average Day Demand: 0.953L/s
Max Day Demand: 2.382L/s
Peak Hour Demand: 5.240L/s

Residential fire flow for singles and towns are being capped at 167L/s. Since this is for Draft Plan Approval, we do not have detailed lot layouts at this time so there may be condos replacing some townhouse units therefore an additional fire flow of 250L/s is anticipated for potential condo blocks.
Fire Flow (singles, towns): 167L/s
Fire Flow (condos): 250L/s (based on past experience with similar condo blocks)

I have attached PDF's of the water demand as well as a location map for your review.

Let me know if you need any additional information.

Thanks,
Lucas Wilson, P.Eng., Project Coordinator | Engineering
NOVATECH
Engineers, Planners & Landscape Architects | 200-240 Michael Cowpland Drive, Ottawa, ON K2M 1P6
Office 613.254.9643 x282 | **Fax** 613.254.5867 | **Email** l.wilson@novatech-eng.com

'

Boundary Conditions for 1055 Klondike Road

Provided Information:
Date Provided: Jan 9, 2020

Scenario	Demand	
	L/min	L/s
Average Daily Demand	50	0.83
Maximum Daily Demand	125	2.09
Peak Hour	275	4.59
Fire Flow Demand #1	10,020	167.00
Fire Flow Demand #2	15,000	250.00

Location:

Results:

Connection 1 - March Road

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	130.5	76.8
Peak Hour	126.1	70.5
Max Day plus Fire 1	123.3	66.5
Max Day plus Fire 2	120.1	62.0

[1] Ground Elevation = 76.5m

Connection 2 - Sandhill Road

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	130.5	79.1
Peak Hour	126.2	72.8
Max Day plus Fire 1	122.5	67.7
Max Day plus Fire 2	118.5	61.9

[1] Ground Elevation = 74.9m

Notes:

1. Construct a 406 mm watermain on Klondike Road from March Road to Sandhill Road.

Disclaimer

The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation. Fire Flow analysis is a reflection of available flow in the watermain; there may be additional restrictions that occur between the watermain and the hydrant that the model cannot take into account.

FUS - Fire Flow Calculations

As per 1999 Fire Underwriter's Survey Guidelines

Engineers, Planners & Landscape Architects

Novatech Project #: 117034
Project Name: 1055 Klondike Road
Date: 26/07/2019
Input By: Lucas Wilson
Reviewed By: Mark Bissett

Building Description: Semi-Detached
Wood frame

Step			Input		Value Used	Total Fire Flow (L/min)
	Base Fire Flow					
1	**Construction Material**			**Multiplier**		
	Coefficient related to type of construction C	Wood frame	Yes	1.5	1.5	
		Ordinary construction		1		
		Non-combustible construction		0.8		
		Modified Fire resistive construction (2 hrs)		0.6		
		Fire resistive construction (> 3 hrs)		0.6		
2	**Floor Area**					
	A	Building Footprint (m^2)	205			
		Number of Floors/Storeys	2			
		Area of structure considered (m^2)			**410**	
	F	**Base fire flow without reductions**				**7,000**
		$F = 220\ C\ (A)^{0.5}$				
	Reductions or Surcharges					
3	**Occupancy hazard reduction or surcharge**			**Reduction/Surcharge**		
	(1)	Non-combustible		-25%	-15%	**5,950**
		Limited combustible	Yes	-15%		
		Combustible		0%		
		Free burning		15%		
		Rapid burning		25%		
4	**Sprinkler Reduction**			**Reduction**		
	(2)	Adequately Designed System (NFPA 13)		-30%		**0**
		Standard Water Supply		-10%		
		Fully Supervised System		-10%		
				Cumulative Total	**0%**	
5	**Exposure Surcharge (cumulative %)**				**Surcharge**	
	(3)	North Side	0 - 3 m		25%	**3,570**
		East Side	20.1 - 30 m		10%	
		South Side	0 - 3 m		25%	
		West Side	> 45.1m		0%	
				Cumulative Total	**60%**	
	Results					
6	**(1) + (2) + (3)**	**Total Required Fire Flow, rounded to nearest 1000L/min**			**L/min**	**10,000**
		(2,000 L/min < Fire Flow < 45,000 L/min)		or	L/s	**167**
				or	USGPM	2,642
7	**Storage Volume**	Required Duration of Fire Flow (hours)			Hours	2
		Required Volume of Fire Flow (m^3)			m^3	1200

FUS - Fire Flow Calculations

As per 1999 Fire Underwriter's Survey Guidelines

NOVATECH
Engineers, Planners & Landscape Architects

Novatech Project #: 117034
Project Name: 1055 Klondike Road
Date: 26/07/2019
Input By: Lucas Wilson
Reviewed By: Mark Bissett

Building Description: 4-Unit Townhouse Block
Wood frame

Step			Input		Value Used	Total Fire Flow (L/min)
Base Fire Flow						
1	**Construction Material**			**Multiplier**		
	Coefficient related to type of construction C	Wood frame	Yes	1.5	1.5	
		Ordinary construction		1		
		Non-combustible construction		0.8		
		Modified Fire resistive construction (2 hrs)		0.6		
		Fire resistive construction (> 3 hrs)		0.6		
2	**Floor Area**					
	A	Building Footprint (m^2)	375			
		Number of Floors/Storeys	2			
		Area of structure considered (m^2)			**750**	
	F	**Base fire flow without reductions**				**9,000**
		$F = 220\ C\ (A)^{0.5}$				
Reductions or Surcharges						
3	**Occupancy hazard reduction or surcharge**			**Reduction/Surcharge**		
	(1)	Non-combustible		-25%	-15%	**7,650**
		Limited combustible	Yes	-15%		
		Combustible		0%		
		Free burning		15%		
		Rapid burning		25%		
4	**Sprinkler Reduction**			**Reduction**		
	(2)	Adequately Designed System (NFPA 13)		-30%		**0**
		Standard Water Supply		-10%		
		Fully Supervised System		-10%		
				Cumulative Total	**0%**	
5	**Exposure Surcharge (cumulative %)**				**Surcharge**	
	(3)	North Side	30.1- 45 m		5%	**4,590**
		East Side	3.1 - 10 m		20%	
		South Side	20.1 - 30 m		10%	
		West Side	0 - 3 m		25%	
				Cumulative Total	**60%**	
Results						
6	**(1) + (2) + (3)**	**Total Required Fire Flow, rounded to nearest 1000L/min**			**L/min**	**12,000**
		(2,000 L/min < Fire Flow < 45,000 L/min)		or	L/s	**200**
				or	USGPM	3,170
7	**Storage Volume**	Required Duration of Fire Flow (hours)			Hours	2.5
		Required Volume of Fire Flow (m^3)			m^3	1800

FUS - Fire Flow Calculations

As per 1999 Fire Underwriter's Survey Guidelines

NOVATECH
Engineers, Planners & Landscape Architects

Novatech Project #: 117034
Project Name: 1055 Klondike Road
Date: 26/07/2019
Input By: Lucas Wilson
Reviewed By: Mark Bissett

Building Description: 6-Unit Townhouse Block with Firewall
Wood frame

Step			Input		Value Used	Total Fire Flow (L/min)
Base Fire Flow						
1	**Construction Material**			**Multiplier**		
	Coefficient related to type of construction C	Wood frame	Yes	1.5	1.5	
		Ordinary construction		1		
		Non-combustible construction		0.8		
		Modified Fire resistive construction (2 hrs)		0.6		
		Fire resistive construction (> 3 hrs)		0.6		
2	**Floor Area**					
	A	Building Footprint (m^2)	312			
		Number of Floors/Storeys	2			
		Area of structure considered (m^2)			**624**	
	F	**Base fire flow without reductions**				**8,000**
		$F = 220\, C\, (A)^{0.5}$				
Reductions or Surcharges						
3	**Occupancy hazard reduction or surcharge**			**Reduction/Surcharge**		
	(1)	Non-combustible		-25%	-15%	**6,800**
		Limited combustible	Yes	-15%		
		Combustible		0%		
		Free burning		15%		
		Rapid burning		25%		
4	**Sprinkler Reduction**			**Reduction**		
	(2)	Adequately Designed System (NFPA 13)		-30%		0
		Standard Water Supply		-10%		
		Fully Supervised System		-10%		
				Cumulative Total	**0%**	
5	**Exposure Surcharge (cumulative %)**				**Surcharge**	
	(3)	North Side	2Hr Fire Wall		10%	**3,060**
		East Side	30.1- 45 m		5%	
		South Side	0 - 3 m		25%	
		West Side	30.1- 45 m		5%	
				Cumulative Total	**45%**	
Results						
6	(1) + (2) + (3)	**Total Required Fire Flow, rounded to nearest 1000L/min**			**L/min**	**10,000**
		(2,000 L/min < Fire Flow < 45,000 L/min)		or	L/s	**167**
				or	USGPM	2,642
7	**Storage Volume**	Required Duration of Fire Flow (hours)			Hours	2
		Required Volume of Fire Flow (m^3)			m^3	1200

FUS - Fire Flow Calculations

As per 1999 Fire Underwriter's Survey Guidelines

NOVATECH
Engineers, Planners & Landscape Architects

Novatech Project #: 117034
Project Name: 1055 Klondike Road
Date: 26/07/2019
Input By: Lucas Wilson
Reviewed By: Mark Bissett

Building Description: Condo Block
Wood frame

Step			Input		Value Used	Total Fire Flow (L/min)
Base Fire Flow						
1	**Construction Material**			**Multiplier**		
	Coefficient related to type of construction C	Wood frame	Yes	1.5	1.5	
		Ordinary construction		1		
		Non-combustible construction		0.8		
		Modified Fire resistive construction (2 hrs)		0.6		
		Fire resistive construction (> 3 hrs)		0.6		
2	**Floor Area**					
	A	Building Footprint (m^2)	485			
		Number of Floors/Storeys	3			
		Area of structure considered (m^2)			**1,455**	
	F	**Base fire flow without reductions**				**13,000**
		$F = 220\ C\ (A)^{0.5}$				
Reductions or Surcharges						
3	**Occupancy hazard reduction or surcharge**			**Reduction/Surcharge**		
	(1)	Non-combustible		-25%	-15%	**11,050**
		Limited combustible	Yes	-15%		
		Combustible		0%		
		Free burning		15%		
		Rapid burning		25%		
4	**Sprinkler Reduction**			**Reduction**		
	(2)	Adequately Designed System (NFPA 13)		-30%		**0**
		Standard Water Supply		-10%		
		Fully Supervised System		-10%		
				Cumulative Total	**0%**	
5	**Exposure Surcharge (cumulative %)**				**Surcharge**	
	(3)	North Side	10.1 - 20 m		15%	**3,868**
		East Side	10.1 - 20 m		15%	
		South Side	> 45.1m		0%	
		West Side	30.1- 45 m		5%	
				Cumulative Total	**35%**	
Results						
6	**(1) + (2) + (3)**	**Total Required Fire Flow, rounded to nearest 1000L/min**			**L/min**	**15,000**
		(2,000 L/min < Fire Flow < 45,000 L/min)		or	L/s	**250**
				or	USGPM	3,963
7	**Storage Volume**	Required Duration of Fire Flow (hours)			Hours	3
		Required Volume of Fire Flow (m^3)			m^3	2700

1055 KLONDIKE ROAD - ORR RIDGE Water Demand						
	Area (ha)	Units	Population	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)
Semi-Detached	N/A	12	32	0.105	0.263	0.578
Towns	N/A	46	124	0.403	1.006	2.214
Future Medium Density Block:						
Residential Unit	N/A	53	111	0.361	0.902	1.984
Total	**0.00**	**111**	**268**	**0.868**	**2.170**	**4.775**

Water Demand Parameters

Semi-Detached	2.7	ppl/unit
Towns	2.7	ppl/unit
Future Block 10 Apartment Unit	2.1	ppl/unit
Residential Demand	280	L/c/day
Residential Max Day	2.5	x Avg Day
Residential Peak Hour	2.2	x Max Day
Residential Fire Flow	167/250	L/s

1055 Klondike Road - Orr Ridge: Watermain Demand

Node	Semi-Detached	Towns	Future Block 10 Apartment Unit	Total Population	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)	Fire Flow (L/s)
C1				0	0.000	0.000	0.000	N/A
HYD1		24		65	0.210	0.525	1.155	167
HYD2		12		32	0.105	0.263	0.578	167
HYD3	12	10		59	0.193	0.481	1.059	167
NODE1			53	111	0.361	0.902	1.984	250
T1				0	0.000	0.000	0.000	N/A
T2				0	0.000	0.000	0.000	N/A
T3				0	0.000	0.000	0.000	N/A
T4				0	0.000	0.000	0.000	N/A
Total	**12**	**46**	**53**	**268**	**0.868**	**2.170**	**4.775**	

Water Demand Parameters

Semi-Detached	2.7	ppl/unit	Residential Max Day	2.5	x Avg Day
Towns	2.7	ppl/unit	Residential Peak Hour	2.2	x Max Day
Future Block 10 Apartment Unit	2.1	ppl/unit	Residential Fire Flow	167	L/s
Residential Demand	280	L/c/day	Condo Fire Flow	250	L/s

NOVATECH
Engineers, Planners & Landscape Architects

1055 Klondike Road - Orr Ridge: Watermain Analysis

Network Table - Nodes - (Peak Hour)

Node ID	Elevation m	Demand LPS	Head m	Pressure m	Pressure kPa	Pressure psi
Junc C1	77.7	0	126.2	48.49	475.69	68.99
Junc HYD1	77.32	1.15	126.19	48.87	479.41	69.53
Junc HYD2	77.03	0.58	126.19	49.16	460.00	66.72
Junc HYD3	76.4	1.06	126.19	49.79	450.00	65.27
Junc NODE1	78	1.91	126.2	48.2	472.84	68.58
Junc T1	77.74	0	126.2	48.46	475.39	68.95
Junc T2	77.76	0	126.2	48.44	475.20	68.92
Junc T3	74.73	0	126.2	51.47	504.92	73.23
Junc T4	77.7	0	126.2	48.5	475.79	69.01
Resvr RES1	126.2	-4.7	126.2	0	0.00	0.00

Network Table - Links - (Peak Hour)

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe P1	142	204	110	0.72	0.02	0.01	0.051
Pipe P2	62	204	110	2.79	0.09	0.08	0.042
Pipe P3	52	204	110	1.64	0.05	0.03	0.045
Pipe P4	51	204	110	1.06	0.03	0.01	0.048
Pipe P5	46	204	110	0.03	0.00	0.00	0.000
Pipe P6	95	204	110	-1.91	0.06	0.04	0.044
Pipe P7	16	300	120	0.72	0.01	0.00	0.033
Pipe P8	121	400	120	-3.98	0.03	0.00	0.037
Pipe P9	8	204	110	2.10	0.06	0.04	0.043
Pipe P10	46	400	120	1.88	0.01	0.00	0.042
Pipe P11	8	204	110	1.88	0.06	0.04	0.044

1055 Klondike Road - Orr Ridge: Watermain Analysis

Network Table - Nodes - (Max Pressure Check)

Node ID	Elevation m	Demand LPS	Head m	Pressure m	Pressure kPa	Pressure psi	Age Hours
Junc C1	77.71	0	130.5	52.79	517.87	75.11	7.58
Junc HYD1	77.32	0.21	130.5	53.18	521.70	75.67	8.69
Junc HYD2	77.03	0.1	130.5	53.47	524.54	76.08	10.26
Junc HYD3	76.4	0.19	130.5	54.1	530.72	76.97	12.67
Junc NODE1	78	0.35	130.5	52.5	515.03	74.70	14.04
Junc T1	77.74	0	130.5	52.76	517.58	75.07	5.82
Junc T2	77.76	0	130.5	52.74	517.38	75.04	10.53
Junc T3	74.73	0	130.5	55.77	547.10	79.35	2.34
Junc T4	77.7	0	130.5	52.8	517.97	75.12	11.59
Resvr RES1	130.5	-0.85	130.5	0	0.00	0.00	0

Network Table - Links - (Max Pressure Check)

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe P1	142	204	110	0.13	0.00	0.00	0.065
Pipe P2	62	204	110	0.51	0.02	0.00	0.055
Pipe P3	52	204	110	0.30	0.01	0.00	0.052
Pipe P4	51	204	110	0.19	0.01	0.00	0.063
Pipe P5	46	204	110	0.00	0.00	0.00	0.000
Pipe P6	95	204	110	-0.35	0.01	0.00	0.056
Pipe P7	16	300	120	0.13	0.00	0.00	0.000
Pipe P8	121	400	120	0.72	0.01	0.00	0.055
Pipe P9	8	204	110	0.38	0.01	0.00	0.037
Pipe P10	46	400	120	0.34	0.00	0.00	0.000
Pipe P11	8	204	110	0.34	0.01	0.00	0.044

1055 Klondike Road - Orr Ridge: Watermain Analysis

Network Table - Nodes - (Fire Flow Summary)

Fire Flow		Minimum Pressure		
Node	**Flow (L/s)**	**Pressure (kPa)**	**Pressure (PSI)**	**Node**
HYD1	167	329.91	47.85	HYD2
HYD2	167	260.75	37.82	HYD3
HYD3	167	250.25	36.30	HYD3
NODE1	250	141.36	20.50	NODE1

1055 Klondike Road - Orr Ridge: Watermain Analysis

Network Table - Nodes (Max Day + FF 'HYD1')

Node ID	Elevation m	Demand LPS	Head m	Pressure m	Pressure kPa	Pressure psi
Junc C1	77.71	0	121.63	43.92	430.86	62.49
Junc HYD1	77.32	95.53	112.3	34.98	343.15	49.77
Junc HYD2	77.03	72.26	110.66	33.63	329.91	47.85
Junc HYD3	76.4	0.48	110.66	34.26	336.09	48.75
Junc NODE1	78	0.87	122.01	44.01	431.74	62.62
Junc T1	77.74	0	122.09	44.35	435.07	63.10
Junc T2	77.76	0	122.08	44.32	434.78	63.06
Junc T3	74.73	0	122.49	47.76	468.53	67.95
Junc T4	77.7	0	122.01	44.31	434.68	63.05
Resvr RES1	122.5	-169.14	122.5	0	0.00	0.00

Network Table - Links (Max Day + FF 'HYD1')

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe P1	142	204	110	29.63	0.91	6.02	0.029
Pipe P2	62	204	110	168.27	5.15	150.22	0.023
Pipe P3	52	204	110	72.74	2.23	31.78	0.026
Pipe P4	51	204	110	0.48	0.01	0.00	0.054
Pipe P5	46	204	110	-35.05	1.07	8.22	0.029
Pipe P6	75	204	110	-0.87	0.03	0.01	0.049
Pipe P7	16	300	120	29.63	0.42	0.78	0.026
Pipe P8	121	400	120	139.51	1.11	3.40	0.022
Pipe P9	8	204	110	103.59	3.17	61.17	0.024
Pipe P10	46	400	120	35.92	0.29	0.28	0.026
Pipe P11	8	204	110	35.92	1.10	8.60	0.029

1055 Klondike Road - Orr Ridge: Watermain Analysis

Network Table - Nodes (Max Day + FF 'HYD2')

Node ID	Elevation m	Demand LPS	Head m	Pressure m	Pressure kPa	Pressure psi
Junc C1	77.71	0	121.63	43.92	430.86	62.49
Junc HYD1	77.32	0.52	112.3	34.98	343.15	49.77
Junc HYD2	77.03	95.26	104.6	27.57	270.46	39.23
Junc HYD3	76.4	72.48	102.98	26.58	260.75	37.82
Junc NODE1	78	0.87	122.01	44.01	431.74	62.62
Junc T1	77.74	0	122.09	44.35	435.07	63.10
Junc T2	77.76	0	122.08	44.32	434.78	63.06
Junc T3	74.73	0	122.49	47.76	468.53	67.95
Junc T4	77.7	0	122.01	44.31	434.68	63.05
Resvr RES1	122.5	-169.14	122.5	0	0.00	0.00

Network Table - Links (Max Day + FF 'HYD2')

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe P1	142	204	110	29.63	0.91	6.02	0.029
Pipe P2	62	204	110	168.27	5.15	150.22	0.023
Pipe P3	52	204	110	167.74	5.13	149.35	0.023
Pipe P4	51	204	110	72.48	2.22	31.57	0.026
Pipe P5	46	204	110	-35.05	1.07	8.22	0.029
Pipe P6	75	204	110	-0.87	0.03	0.01	0.049
Pipe P7	16	300	120	29.63	0.42	0.78	0.026
Pipe P8	121	400	120	139.51	1.11	3.40	0.022
Pipe P9	8	204	110	103.59	3.17	61.17	0.024
Pipe P10	46	400	120	35.92	0.29	0.28	0.026
Pipe P11	8	204	110	35.92	1.10	8.60	0.029

1055 Klondike Road - Orr Ridge: Watermain Analysis

Network Table - Nodes (Max Day + FF 'HYD3')

Node ID	Elevation m	Demand LPS	Head m	Pressure m	Pressure kPa	Pressure psi
Junc C1	77.71	0	121.63	43.92	430.86	62.49
Junc HYD1	77.32	0.52	112.3	34.98	343.15	49.77
Junc HYD2	77.03	72.26	104.6	27.57	270.46	39.23
Junc HYD3	76.4	95.48	101.91	25.51	250.25	36.30
Junc NODE1	78	0.87	122.01	44.01	431.74	62.62
Junc T1	77.74	0	122.09	44.35	435.07	63.10
Junc T2	77.76	0	122.08	44.32	434.78	63.06
Junc T3	74.73	0	122.49	47.76	468.53	67.95
Junc T4	77.7	0	122.01	44.31	434.68	63.05
Resvr RES1	122.5	-169.14	122.5	0	0.00	0.00

Network Table - Links (Max Day + FF 'HYD3')

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe P1	142	204	110	29.63	0.91	6.02	0.029
Pipe P2	62	204	110	168.27	5.15	150.22	0.023
Pipe P3	52	204	110	167.74	5.13	149.35	0.023
Pipe P4	51	204	110	95.48	2.92	52.60	0.025
Pipe P5	46	204	110	-35.05	1.07	8.22	0.029
Pipe P6	75	204	110	-0.87	0.03	0.01	0.049
Pipe P7	16	300	120	29.63	0.42	0.78	0.026
Pipe P8	121	400	120	139.51	1.11	3.40	0.022
Pipe P9	8	204	110	103.59	3.17	61.17	0.024
Pipe P10	46	400	120	35.92	0.29	0.28	0.026
Pipe P11	8	204	110	35.92	1.10	8.60	0.029

1055 Klondike Road - Orr Ridge: Watermain Analysis

Network Table - Nodes (Max Day + FF 'Node1')

Node ID	Elevation m	Demand LPS	Head m	Pressure m	Pressure kPa	Pressure psi
Junc C1	77.71	0	117.47	39.76	390.05	56.57
Junc HYD1	77.32	0.52	117.47	40.15	393.87	57.13
Junc HYD2	77.03	0.26	117.46	40.43	396.62	57.52
Junc HYD3	76.4	0.48	117.46	41.06	402.80	58.42
Junc NODE1	78	250.87	92.41	14.41	141.36	20.50
Junc T1	77.74	0	117.55	39.81	390.54	56.64
Junc T2	77.76	0	117.3	39.54	387.89	56.26
Junc T3	74.73	0	118.49	43.76	429.29	62.26
Junc T4	77.7	0	116.01	38.31	375.82	54.51
Resvr RES1	118.5	-252.14	118.5	0	0.00	0.00

Network Table - Links (Max Day + FF 'Node1')

Link ID	Length m	Diameter mm	Roughness	Flow LPS	Velocity m/s	Headloss m/km	Friction Factor
Pipe P1	142	204	110	32.54	1.00	7.16	0.029
Pipe P2	62	204	110	1.27	0.04	0.02	0.047
Pipe P3	52	204	110	0.74	0.02	0.01	0.050
Pipe P4	51	204	110	0.48	0.01	0.00	0.054
Pipe P5	46	204	110	72.38	2.21	31.49	0.026
Pipe P6	75	204	110	-250.87	7.68	314.73	0.021
Pipe P7	16	300	120	32.54	0.46	0.93	0.026
Pipe P8	121	400	120	219.60	1.75	7.88	0.020
Pipe P9	8	204	110	41.11	1.26	11.05	0.028
Pipe P10	46	400	120	178.49	1.42	5.37	0.021
Pipe P11	8	204	110	178.49	5.46	167.55	0.022

NOVATECH
Engineers, Planners & Landscape Architects

Appendix D

STM Design Sheets, SWM Excerpts &
PCSWMM Modelling Info

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.

No.	REVISION	DATE	BY	No.	REVISION	DATE	BY
				7.	ISSUED TO CLIENT	OCT 10/06	MAB
				6.	ISSUED FOR CONSTRUCTION	AUG 17/06	MAB
12.	AS-BUILT	JAN 16/14	MAB	5.	ISSUED WITH MOE APPLICATION	AUG 08/06	MAB
11.	ISSUED WITH MOE APPLICATION - PHASE 2	OCT 31/07	MAB	4.	ISSUED FOR TENDER	MAY 26/06	MAB
10.	PHASE 2 DESIGN REVISIONS	MAY 02/07	MAB	3.	ISSUED FOR MOE APPROVAL	MAY 01/06	MAB
9.	BRIAR RIDGE DRAINAGE AREA ADDED	NOV 17/06	MAB	2.	REVISED PER CITY COMMENTS	APR 24/06	MAB
8.	ISSUED FOR MOE APPROVAL	NOV 09/06	MAB	1.	ISSUED TO CITY FOR REVIEW	MAR 20/06	MAB

LICENSED PROFESSIONAL ENGINEER M.A. BISSETT PROVINCE OF ONTARIO

REGISTERED PROFESSIONAL ENGINEER J.G. RIDDELL PROVINCE OF ONTARIO

NOVATECH ENGINEERING CONSULTANTS LTD.
ENGINEERS & PLANNERS
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada
K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Email: novainfo@novatech-eng.com

DESIGN	MAB
CHECKED	SAY
DRAWN	SM
CHECKED	MAB
APPROVED	JGR
SCALE	1:2000

CITY OF OTTAWA

BROOKSIDE SUBDIVISION

SWM FACILITIES
STORM DRAINAGE AREA PLAN

PROJECT No. 103106-0
DATE AUGUST 2005
DRAWING No. 103106-STM1

PLAN81.DWG - 1000mmX707mm

STORM SEWER: HYDRAULIC GRADE LINE ANALYSIS (100-YEAR EVENT - ULTIMATE CONDITION)

This spreadsheet uses the Darcy-Weisbach equation to calculate hydraulic losses through a pipe network with a specified flow rate. Minor losses are accounted for including both pipe bend losses and structure losses.
The spreadsheet returns the upstream hydraulic grade line if surcharged, or the pipe obvert if free flow conditions exist. The slope of the HGL is calculated and the minimum USF elevations can be established +0.30m above the HGL.
The theoretical 100-year event storm sewer peak flows will be controlled to the actual 5-year flow rates using various roadway inlet controls within CBs. Additional flows will be directed using overland flow routes.
The Ultimate Condition accounts for the entire drainage areas flowing through the completed storm sewer network.

LOCATION	MANHOLE		INVERT ELEVATION		GROUND ELEVATION	COVER	PIPE PARAMETERS			TOTAL FLOW	Q_{cap}	Q_{in}/Q_{cap}	COMPUTATIONAL COLUMNS					HEAD LOSS	SURCHARGE	HGL			PIPE SLOPE	MIN. USF ELEVATION
	Upstream	Downstream	U/S (m)	D/S (m)	Upstream (m)	Upstream (m)	Dia (mm)	Length (m)	'n'	(m^3/s)	(m^3/s)		Pipe Area (m^2)	L/D	Friction Factor (f)	Velocity V (m/s)	$V^2/2g$	HL (m)	Upstream (m)	U/S (m)	D/S (m)	SLOPE (%)	(%)	Upstream (m)
KLONDIKE ROAD																				67.57	<- OUTLET TO POND			
	FUT.MH C	OUTLET	65.93	65.90	67.95	0.670	1350	13.80	0.013	1.714	2.596	0.66	1.478	10	0.01905	1.16	0.07	0.05	0.34	67.62	67.57	0.35	0.14	67.92
	FUT.MH B	FUT.MH C	66.02	65.93	68.55	1.180	1350	51.00	0.013	1.738	2.339	0.74	1.478	38	0.01905	1.18	0.07	0.09	0.34	67.71	67.62	0.17	0.13	68.01
	FUT.MH A	FUT.MH B	66.24	66.05	68.87	1.280	1350	117.00	0.013	1.797	2.244	0.80	1.478	87	0.01905	1.22	0.08	0.14	0.26	67.85	67.71	0.12	0.13	68.15
	MH 153	FUT.MH A	66.40	66.24	70.01	2.260	1350	108.50	0.013	1.447	2.138	0.68	1.478	80	0.01905	0.98	0.05	0.09	0.19	67.94	67.85	0.08	0.13	68.24
	MH 154	MH 153	66.63	66.55	70.18	2.350	1200	39.90	0.013	1.441	1.821	0.79	1.167	33	0.01981	1.23	0.08	0.07	0.17	68.00	67.94	0.17	0.20	68.30
PHASE2																								
	MH 163	MH 154	66.97	66.90	70.25	2.380	900	65.0	0.013	0.180	0.620	0.29	0.657	72	0.02181	0.27	0.00	0.01	0.14	68.01	68.00	0.01	0.11	68.31
	MH 164	MH 163	67.33	67.27	69.82	1.890	600	41.5	0.013	0.159	0.244	0.65	0.292	69	0.02496	0.54	0.02	0.04	0.12	68.05	68.01	0.09	0.14	68.35
	MH 165	MH 164	67.59	67.41	70.15	2.035	525	110.0	0.013	0.161	0.181	0.89	0.223	210	0.02610	0.72	0.03	0.15	0.09	68.20	68.05	0.14	0.16	68.50
	MH 166	MH 165	67.87	67.67	70.50	2.180	450	90.3	0.013	0.126	0.140	0.90	0.164	201	0.02747	0.77	0.03	0.19	0.08	68.40	68.20	0.21	0.22	68.70
	MH 167	MH 166	68.25	68.02	70.50	1.950	300	66.4	0.013	0.045	0.059	0.75	0.073	221	0.03145	0.61	0.02	0.13	0.00	68.55	68.40	0.23	0.35	68.85
KLONDIKE ROAD																								
	MH 155	MH 154	66.78	66.63	70.12	2.140	1200	117.00	0.013	1.335	1.456	0.92	1.167	98	0.01981	1.14	0.07	0.14	0.17	68.15	68.00	0.11	0.13	68.45
	MH 156	MH 155	66.90	66.78	70.39	2.290	1200	91.30	0.013	1.279	1.475	0.87	1.167	76	0.01981	1.10	0.06	0.10	0.15	68.25	68.15	0.11	0.13	68.55
	MH 157	MH 156	67.03	66.90	70.29	2.060	1200	97.00	0.013	1.214	1.489	0.82	1.167	81	0.01981	1.04	0.06	0.10	0.12	68.35	68.25	0.10	0.13	68.65
MARCONI AVENUE																								
	MH 160	MH 157	68.08	67.78	70.64	2.110	450	120.00	0.013	0.129	0.149	0.87	0.164	267	0.02747	0.79	0.03	0.28	0.10	68.63	68.35	0.23	0.25	68.93
	MH 161	MH 160	68.35	68.23	70.87	2.220	300	23.90	0.013	0.023	0.071	0.32	0.073	80	0.03145	0.32	0.01	0.01	0.00	68.65	68.63	0.10	0.50	68.95
	MH 162	MH 161	68.50	68.38	71.50	2.700	300	24.60	0.013	0.000	0.070	0.00	0.073	82	0.03145	0.00	0.00	0.00	0.00	68.80	68.68	0.49	0.49	69.10
KLONDIKE ROAD																								
	MH 158	MH 157	68.30	67.40	71.78	2.655	825	120.00	0.013	1.064	1.297	0.82	0.552	145	0.02245	1.93	0.19	0.66	0.00	69.13	68.35	0.65	0.75	69.43
	MH 159	MH 158	68.90	68.30	74.79	5.065	825	94.00	0.013	0.932	1.196	0.78	0.552	114	0.02245	1.69	0.15	0.40	0.00	69.73	69.13	0.64	0.64	70.03
TER LEVEL at Outlet = 67.57m																								

EXISTING CONDITIONS

Existing Catchment Parameters

Catchment ID	Areas (ha)			Runoff Coefficient		%Imperv.
	Total	Hard Surfaces (C=0.90)	Soft Surfaces (C=0.20)	C_{avg}	C_{100yr} [1]	
Area Flowing East (EXT-01)	1.330	0.000	1.330	0.20	0.25	0.0%
Area Flowing West (EXT-02)	1.110	0.000	1.110	0.20	0.25	0.0%
TOTAL	**2.440**	**0.000**	**2.440**	**0.20**	**0.25**	**0.0%**

[1] *Runoff coefficient increases by 25%, up to a maximum value of 1.00, for the 100-year event.*

Time-of-Concentration (Tc) - Airport Method

Area ID	C_{avg}	Slope (%)	Length (m)	Tc (min)
Area Flowing East (EXT-01)	0.20	9.50	200	20
Area Flowing West (EXT-02)	0.20	0.80	100	32

Pre-Development Peak Flows

Catchment ID	Rainfall Intensity (mm/hr)[1]		Peak Flows (L/s)	
	2-year	5-year	2-year	5-year
Area Flowing East (EXT-01)	52.45	70.83	38.8	52.4
Area Flowing West (EXT-02)	38.68	52.07	23.9	32.1
TOTAL	**-**	**-**	**62.7**	**84.5**

**Allowable 100-year release rate to river = 297.2 L/s.*

Notes:

Rainfall Intensity based on City of Ottawa Sewer Design Guidelines (Oct. 2012)
- 100 year Intensity = $1735.688 / (Tc + 6.014)^{0.820}$
- 5 year Intensity = $998.071 / (Tc + 6.053)^{0.814}$
- 2 year Intensity = $732.951 / (Tc + 6.199)^{0.810}$

Q(peak flow) = 2.78 x C x I x A
- C is the runoff coefficient
- I is the rainfall intensity
- A is the total drainage area

1055 Klondike Road - Orr Ridge
Maple Leaf Homes
Project No.: 117034

STORM SEWER DESIGN SHEET
(Maple Leaf Homes)
FLOW RATES BASED ON RATIONAL METHOD

Engineers, Planners & Landscape Architects

LOCATION				AREA (ha)			FLOW							TOTAL FLOW	SEWER DATA								
Street	Catchment ID	From Manhole	To Manhole	Area (ha)	C	AC (ha)	Indiv 2.78 AC	Accum 2.78 AC	Time of Concentration	Rainfall Intensity 2 Year (mm/hr)	Rainfall Intensity 5 Year (mm/hr)	Rainfall Intensity 10 Year (mm/hr)	Peak Flow (L/s)	Total Peak Flow, Q (L/s)	Dia. (m) Actual	Dia. (mm)	Type	Slope (%)	Length (m)	Capacity (L/s)	Velocity (m/s)	Flow Time (min)	Ratio Q/Q full
Street 1	**A-16**	CBMH1	6	0.361	0.76	0.27	0.763	0.763	10.00	76.81			58.6	58.6	0.305	300	PVC	0.50	27.4	71.3	0.98	0.47	82%
						0.00	0.000	0.000	10.00														
						0.00	0.000	0.000	10.00														
Street 1	**A-05, A-08**	6	4	0.445	0.76	0.34	0.940	1.703	10.47	75.06			127.8	127.8	0.457	450	Conc	0.40	100.0	188.0	1.14	1.46	68%
						0.00	0.000	0.000	10.47														
						0.00	0.000	0.000	10.47														
Street 1	**A-02**	4	2	0.138	0.73	0.10	0.280	1.983	11.92	70.13			139.1	139.1	0.457	450	Conc	0.45	59.3	199.4	1.21	0.81	70%
						0.00	0.000	0.000	11.92														
						0.00	0.000	0.000	11.92														
Block 10 / 1075 Klondike Road	**A-01, A-04, A-07, A-18, A-20**	8	2	1.090	0.73	0.80	2.212	2.212	10.00	76.81			169.9	169.9	0.457	450	Conc	0.50	46.2	210.2	1.28	0.60	81%
						0.00	0.000	0.000	10.00														
						0.00	0.000	0.000	10.00														
Klondike Road	**A-03, A-06, A-09, A-15, A-17, A-19**	2	EXMH159	0.310	0.51	0.16	0.440	4.635	12.74	67.68			313.7	372.5	0.610	600	Conc	0.68	117.1	527.9	1.81	1.08	71%
				0.355	0.65	0.23	0.641	0.641	12.74		91.66		58.8										
						0.00	0.000	0.000	12.74														
									13.82														

Q = 2.78 AIC, where
Q = Peak Flow in Litres per Second (L/s)
A = Area in hectares (ha)
I = Rainfall Intensity (mm/hr), 5 year storm
C = Runoff Coefficient

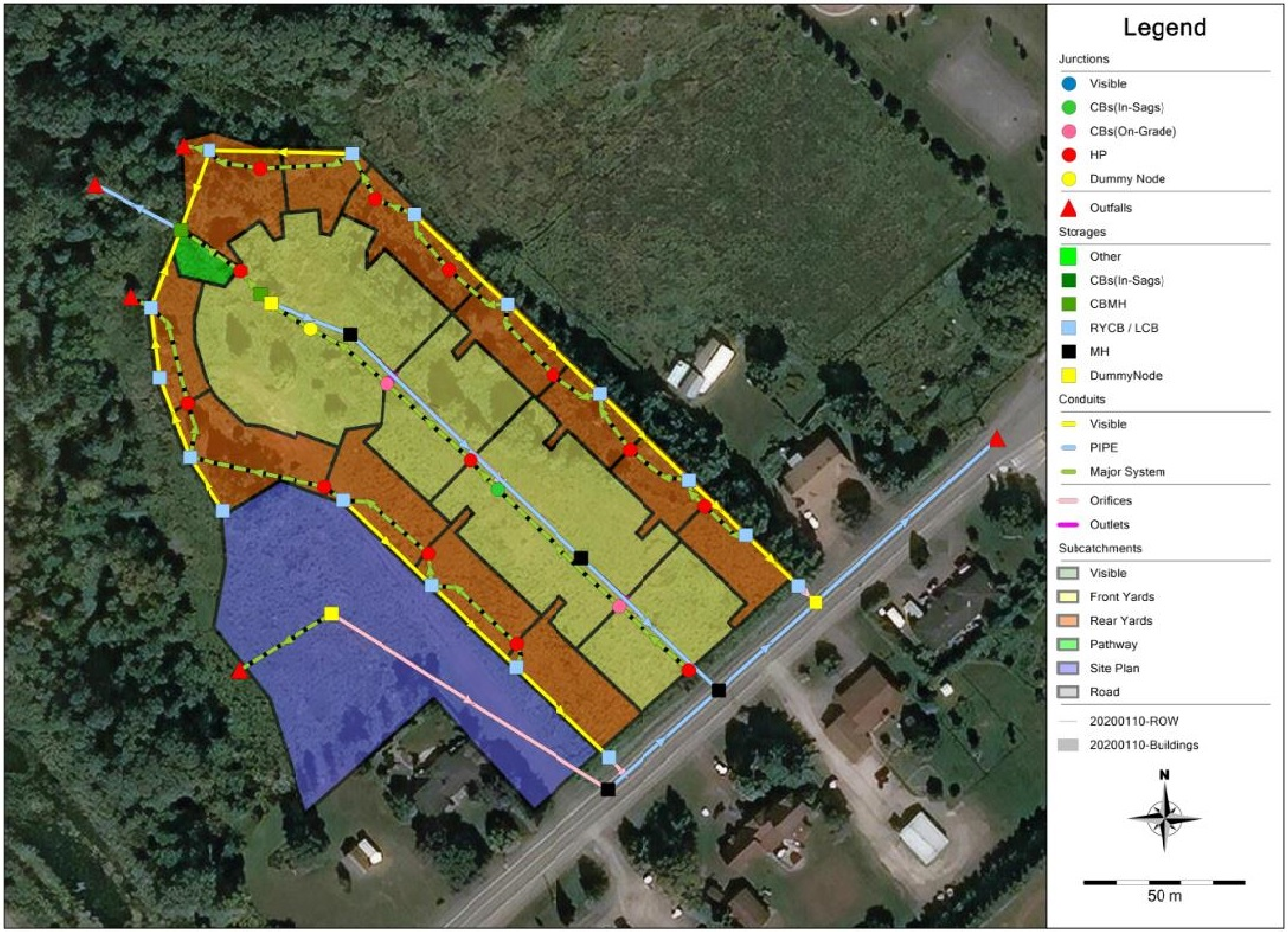
Consultant:	**Novatech**
Date:	March 5, 2021
Design By:	Lucas Wilson
Client: Maple Leaf Homes	**Dwg. Reference:** 117034-STM
	Checked By: MAB

Legend:

*	Indicates 100 Year intensity for storm sewers
10.00	Storm sewers designed to the 2 year event (without ponding) for local roads
10.00	Storm sewers designed to the 5 year event (without ponding) for collector roads
10.00	Storm sewers designed to the 10 year event (without ponding) for arterial roads

1055 Klondike – Maple Leaf Homes (117034)
PCSWMM Model Schematic

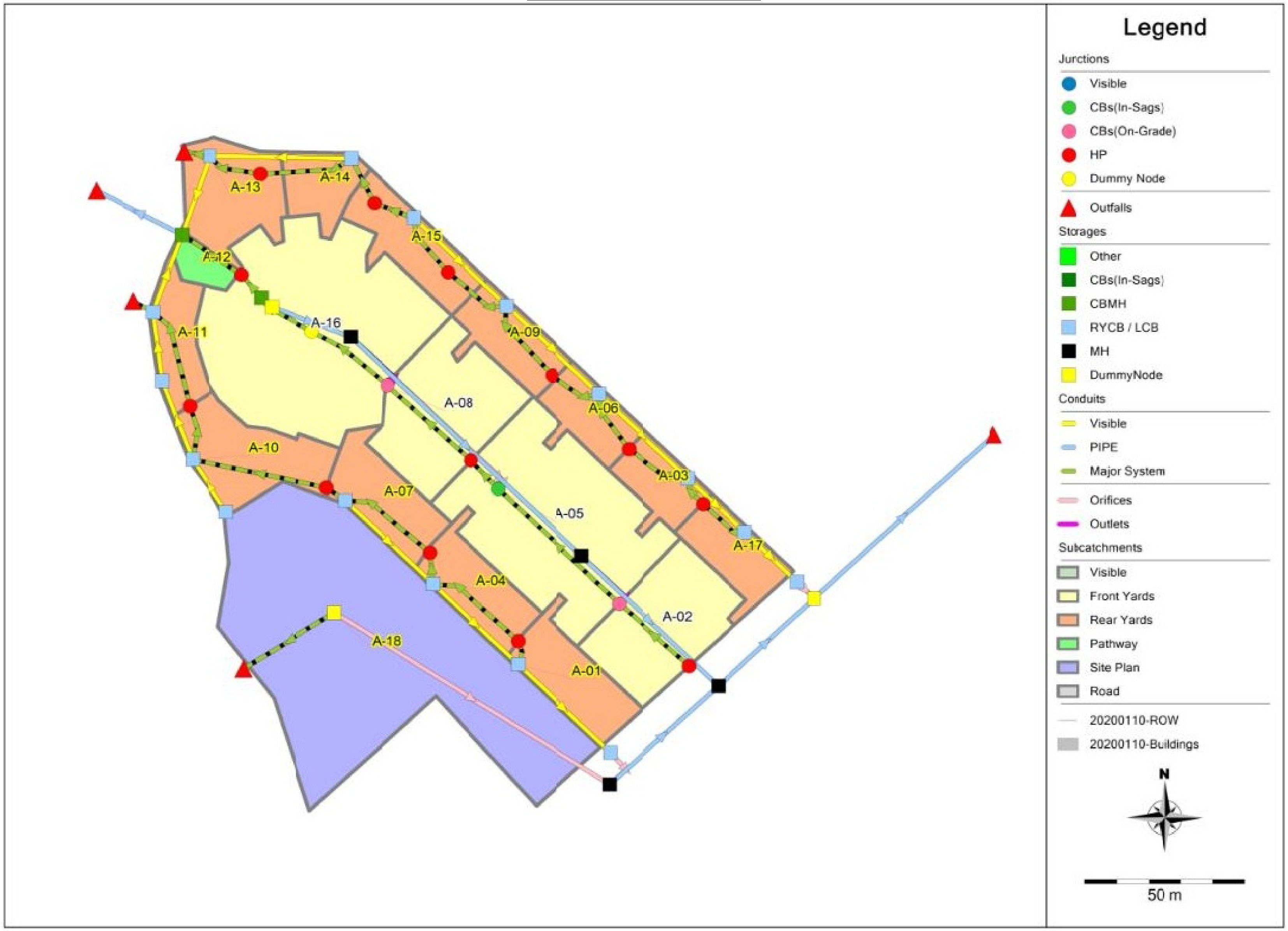
Overall Model Schematic



Date: 2021-03-12
M:\2017\117034\DATA\Calculations\Sewer Calcs\SWM\Detailed Design\Model Schematic Output\Model Schematic.docx

1055 Klondike – Maple Leaf Homes (117034)
PCSWMM Model Schematic

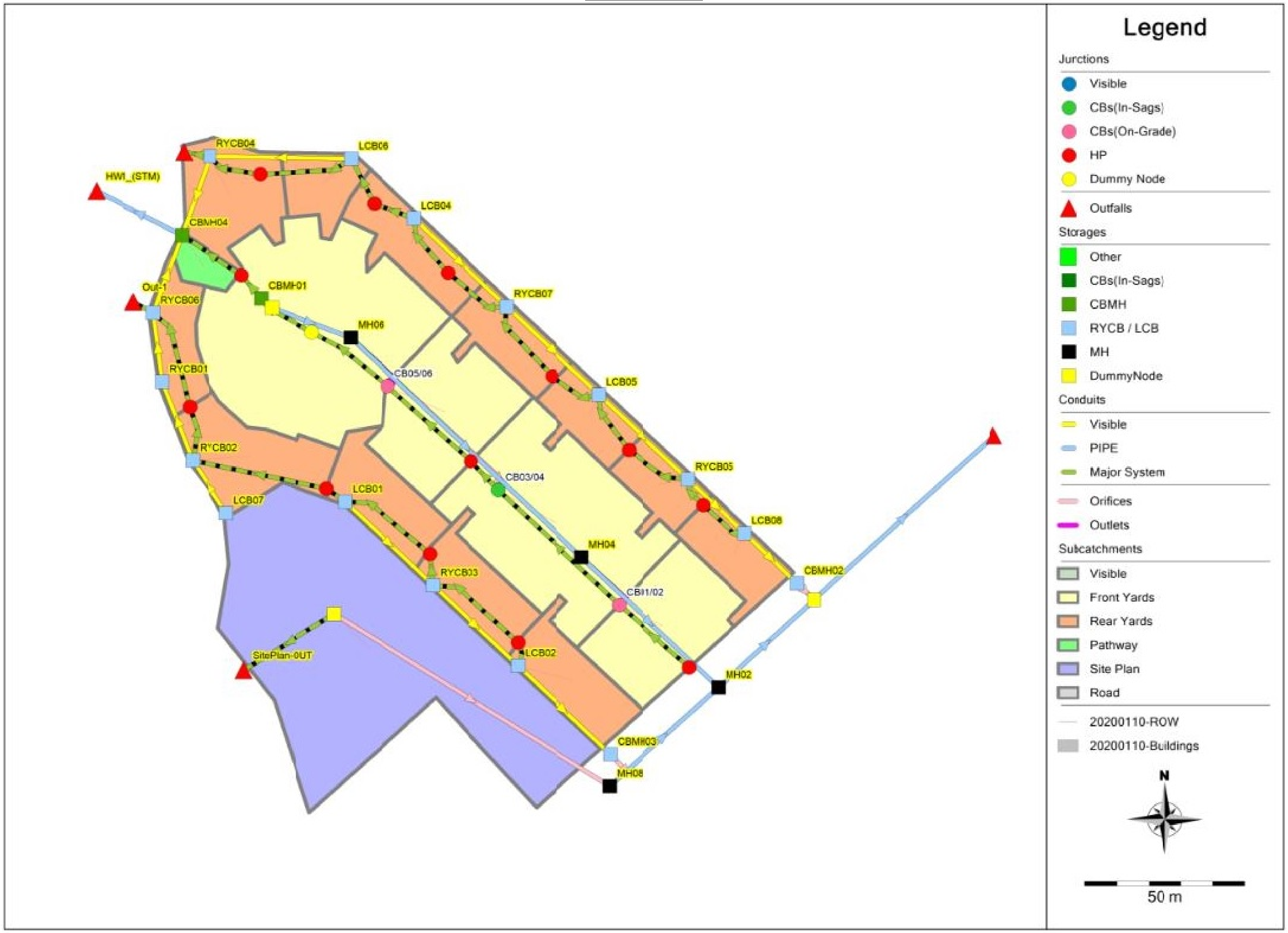
Subcatchments (ID's)



Date: 2021-03-12
M:\2017\117034\DATA\Calculations\Sewer Calcs\SWM\Detailed Design\Model Schematic Output\Model Schematic.docx

1055 Klondike – Maple Leaf Homes (117034)
PCSWMM Model Schematic

Nodes ID's



Date: 2021-03-12
M:\2017\117034\DATA\Calculations\Sewer Calcs\SWM\Detailed Design\Model Schematic Output\Model Schematic.docx

1055 Klondike Road – Orr Ridge (117034)
PCSWMM Model Output
100yr 3-hour Chicago Storm

NOVATECH
Engineers, Planners & Landscape Architects

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)

M:\2017\117034\CAD\Design\117034-GP.dwg

****
Element Count
****
Number of rain gages 1
Number of subcatchments ... 18
Number of nodes 47
Number of links 60
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

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

****
Subcatchment Summary
****

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
A-01	0.08	38.50	42.90	3.5000	Raingage	LCB02
A-02	0.14	55.20	75.40	4.0000	Raingage	CB01/02
A-03	0.05	25.50	43.10	5.0000	Raingage	RYCB05
A-04	0.07	36.00	45.80	4.0000	Raingage	RYCB03
A-05	0.29	117.20	79.90	4.0000	Raingage	CB03/04
A-06	0.06	29.00	43.10	5.0000	Raingage	LCB05
A-07	0.08	39.50	40.50	3.0000	Raingage	LCB01
A-08	0.15	60.80	79.60	4.0000	Raingage	CB05/06
A-09	0.06	32.00	45.30	5.0000	Raingage	RYCB07
A-10	0.11	45.20	29.20	2.5000	Raingage	RYCB02
A-11	0.07	44.00	33.30	5.0000	Raingage	RYCB01
A-12	0.02	9.60	29.20	3.5000	Raingage	CBMH04
A-13	0.11	30.57	12.10	3.5000	Raingage	RYCB04
A-14	0.05	21.20	17.00	4.0000	Raingage	LCB06
A-15	0.07	37.00	47.30	5.5000	Raingage	LCB04
A-16	0.36	90.25	79.50	3.0000	Raingage	CBMH01
A-17	0.06	31.50	41.30	5.0000	Raingage	LCB08
A-18	0.60	200.00	85.70	2.0000	Raingage	Site_Plan_CB

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
CB01/02	JUNCTION	77.52	1.00	0.0	
CB03/04	JUNCTION	75.62	2.40	0.0	
CB05/06	JUNCTION	76.73	1.00	0.0	
D01	JUNCTION	76.70	1.00	0.0	
HP01	JUNCTION	77.79	1.00	0.0	
HP02	JUNCTION	77.09	1.00	0.0	
HP-03	JUNCTION	76.42	1.00	0.0	
HP-LCB01	JUNCTION	77.03	1.00	0.0	
HP-LCB02	JUNCTION	77.53	1.00	0.0	
HP-LCB04	JUNCTION	74.00	1.00	0.0	
HP-LCB05	JUNCTION	74.70	1.00	0.0	
HP-LCB06	JUNCTION	73.77	1.00	0.0	
HP-LCB08	JUNCTION	75.56	1.00	0.0	
HP-RYCB02	JUNCTION	76.71	1.00	0.0	
HP-RYCB03	JUNCTION	77.44	1.00	0.0	
HP-RYCB05	JUNCTION	75.00	1.00	0.0	
HP-RYCB07	JUNCTION	74.33	1.00	0.0	
EX-MH159	OUTFALL	70.98	0.60	0.0	
HW1_(STM)	OUTFALL	70.79	0.38	0.0	
Out-1	OUTFALL	76.56	1.00	0.0	
Out-3	OUTFALL	73.47	1.00	0.0	
SitePlan-OUT	OUTFALL	78.30	1.00	0.0	
CBMH01	STORAGE	72.89	4.25	0.0	
CBMH01-Dummy	STORAGE	72.89	3.25	0.0	
CBMH02	STORAGE	71.86	5.10	0.0	
CBMH02-Dummy	STORAGE	71.49	5.41	0.0	
CBMH03	STORAGE	74.31	3.49	0.0	
CBMH04	STORAGE	70.94	5.40	0.0	
LCB01	STORAGE	75.43	2.40	0.0	
LCB02	STORAGE	74.69	3.64	0.0	
LCB04	STORAGE	72.75	2.00	0.0	
LCB05	STORAGE	72.35	3.15	0.0	
LCB06	STORAGE	71.90	2.58	0.0	
LCB07	STORAGE	75.18	2.40	0.0	
LCB08	STORAGE	72.05	4.31	0.0	
MH02	STORAGE	71.77	5.99	0.0	
MH04	STORAGE	72.19	5.23	0.0	
MH06	STORAGE	72.60	4.04	0.0	
MH08	STORAGE	72.15	5.53	0.0	
RYCB01	STORAGE	74.72	2.73	0.0	
RYCB02	STORAGE	74.94	2.59	0.0	
RYCB03	STORAGE	75.09	3.03	0.0	
RYCB04	STORAGE	71.34	2.94	0.0	
RYCB05	STORAGE	72.19	3.61	0.0	
RYCB06	STORAGE	74.42	2.96	0.0	
RYCB07	STORAGE	72.55	2.58	0.0	
Site_Plan_CB	STORAGE	76.60	2.40	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
1	Site_Plan_CB	SitePlan-OUT	CONDUIT	5.0	-6.0108	0.0150
1_(104)_(1)_(STM)	CBMH02-Dummy	EX-MH159	CONDUIT	76.3	0.6684	0.0130
1_(104)_(STM)	MH02	CBMH02-Dummy	CONDUIT	40.8	0.6863	0.0130
1_(11)_(STM)	MH04	MH02	CONDUIT	59.3	0.4555	0.0130
1_(131)_(STM)	CBMH01-Dummy	MH06	CONDUIT	27.4	0.5115	0.0130
1_(135)_(STM)	HP-03	CBMH04	CONDUIT	3.0	38.5872	0.0150
1_(87)_(STM)	CBMH04	HW1_(STM)	CONDUIT	30.5	0.4918	0.0130
1_(9)_(STM)	MH06	MH04	CONDUIT	100.0	0.4000	0.0130
2	LCB08	HP-LCB08	CONDUIT	3.0	-6.6815	0.0350
3	CBMH01	HP-03	CONDUIT	3.0	-9.3743	0.0150
4	HP-LCB08	RYCB05	CONDUIT	3.0	26.1876	0.0350
4_1	CB05/06	D01	CONDUIT	3.0	1.0001	0.2500
4_2	D01	CBMH01	CONDUIT	3.0	19.0006	0.2500
5	HP02	CB05/06	CONDUIT	35.3	1.0199	0.2500
6	CB03/04	HP02	CONDUIT	12.4	-0.5645	0.2500
7	CB01/02	CB03/04	CONDUIT	52.4	0.9542	0.2500
8	HP01	CB01/02	CONDUIT	29.5	0.9153	0.2500
HP-LCB01-RYCB02	HP-LCB01	RYCB02	CONDUIT	3.0	16.9031	0.0350
HP-LCB02-RYCB03	HP-LCB02	RYCB03	CONDUIT	3.0	13.7961	0.0350
HP-LCB04-LCB06	HP-LCB04	LCB06	CONDUIT	3.0	17.5997	0.0350
HP-LCB05-RYCB07	HP-LCB05	RYCB07	CONDUIT	3.0	19.3525	0.0350
HP-LCB06-RYCB04	HP-LCB06	RYCB04	CONDUIT	3.0	16.5557	0.0350
HP-RYCB02-RYCB06	HP-RYCB02	RYCB06	CONDUIT	3.0	11.0672	0.0350
HP-RYCB03-LCB01	HP-RYCB03	LCB01	CONDUIT	3.0	20.7672	0.0350
HP-RYCB05-LCB05	HP-RYCB05	LCB05	CONDUIT	3.0	16.9031	0.0350
HP-RYCB07-LCB04	HP-RYCB07	LCB04	CONDUIT	3.0	19.7051	0.0350
LCB01-HP	LCB01	HP-LCB01	CONDUIT	3.0	-6.6815	0.0350
LCB01-LCB02	LCB01	RYCB03	CONDUIT	34.0	1.0001	0.0130
LCB02-HP	LCB02	HP-LCB02	CONDUIT	3.0	-6.6815	0.0350
LCB02-RYCB03	RYCB03	LCB02	CONDUIT	40.4	0.9901	0.0130
LCB04-HP	LCB04	HP-LCB04	CONDUIT	3.0	-8.3624	0.0350
LCB04-LCB08	LCB04	RYCB07	CONDUIT	39.4	0.5076	0.0130
LCB05-HP	LCB05	HP-LCB05	CONDUIT	3.0	-6.6815	0.0350
LCB05-RYCB05	LCB05	RYCB05	CONDUIT	32.8	0.4878	0.0130
LCB06-HP	LCB06	HP-LCB06	CONDUIT	3.0	-9.7122	0.0350
LCB06-RYCB04	LCB06	RYCB04	CONDUIT	49.5	1.0102	0.0130
LCB07-RYCB02	LCB07	RYCB02	CONDUIT	23.7	1.0127	0.0130
LCB08-CBMH02	LCB08	CBMH02	CONDUIT	27.8	0.5036	0.0150
LCB08-LCB05	RYCB07	LCB05	CONDUIT	39.4	0.5076	0.0130
MH08-MH02	MH08	MH02	CONDUIT	46.2	0.4978	0.0130
RYCB01-RYCB06	RYCB01	RYCB06	CONDUIT	24.9	1.0041	0.0130
RYCB02-HP	RYCB02	HP-RYCB02	CONDUIT	3.0	-6.0108	0.0350
RYCB02-RYCB01	RYCB02	RYCB01	CONDUIT	22.2	0.9910	0.0130
RYCB03-CBMH03	LCB02	CBMH03	CONDUIT	32.9	1.0031	0.0150
RYCB03-HP	RYCB03	HP-RYCB03	CONDUIT	3.0	-10.7279	0.0350
RYCB04-CBMH04	RYCB04	CBMH04	CONDUIT	24.1	0.9959	0.0130
RYCB04-Out-3	RYCB04	Out-3	CONDUIT	3.0	-6.3461	0.0350
RYCB05-HP	RYCB05	HP-RYCB05	CONDUIT	3.0	-6.6815	0.0350
RYCB05-LCB08	RYCB05	LCB08	CONDUIT	28.3	0.4947	0.0150
RYCB06-CBMH04	RYCB06	CBMH04	CONDUIT	23.1	0.9957	0.0130
RYCB06-Out-1	RYCB06	Out-1	CONDUIT	3.0	-6.0108	0.0350

```
RYCB07-HP        RYCB07           HP-RYCB07        CONDUIT            3.0    -6.6815     0.0350
CB3-O            CB03/04          MH06             ORIFICE
CB4-O            CB03/04          MH06             ORIFICE
CBMH02-ICD       CBMH02           CBMH02-Dummy     ORIFICE
CBMH1-O(1)       CBMH01           CBMH01-Dummy     ORIFICE
CBMH3-ICD        CBMH03           MH08             ORIFICE
Outlet-1         Site_Plan_CB     MH08             ORIFICE
CB01/02-O        CB01/02          MH04             OUTLET
CB05/06-O        CB05/06          MH06             OUTLET


*********************
Cross Section Summary
*********************
                                        Full     Full     Hyd.     Max.   No. of     Full
Conduit          Shape                 Depth     Area     Rad.    Width  Barrels     Flow
---------------------------------------------------------------------------------------
1                RECT_OPEN              1.00     3.00     0.60     3.00        1 34883.83
1_(104)_(1)_(STM) CIRCULAR               0.60     0.28     0.15     0.60        1   502.03
1_(104)_(STM)    CIRCULAR               0.60     0.28     0.15     0.60        1   508.69
1_(11)_(STM)     CIRCULAR               0.45     0.16     0.11     0.45        1   192.43
1_(131)_(STM)    CIRCULAR               0.30     0.07     0.07     0.30        1    69.16
1_(135)_(STM)    RECT_OPEN              1.00     3.00     0.60     3.00        1 88384.99
1_(87)_(STM)     CIRCULAR               0.38     0.11     0.09     0.38        1   122.96
1_(9)_(STM)      CIRCULAR               0.45     0.16     0.11     0.45        1   180.33
2                TRAPEZOIDAL            1.00     3.30     0.50     6.30        1 15316.10
3                RECT_OPEN              1.00     3.00     0.60     3.00        1 43563.76
4                TRAPEZOIDAL            1.00     3.30     0.50     6.30        1 30322.01
4_1              18mROW                 1.00    15.42     7.47    18.00        1 23562.63
4_2              18mROW                 1.00    15.42     7.47    18.00        1 102706.27
5                18mROW                 1.00    15.42     7.47    18.00        1 23795.13
6                18mROW                 1.00    15.42     7.47    18.00        1 17703.31
7                18mROW                 1.00    15.42     7.47    18.00        1 23016.65
8                18mROW                 1.00    15.42     7.47    18.00        1 22542.02
HP-LCB01-RYCB02  TRAPEZOIDAL            1.00     3.30     0.50     6.30        1 24360.89
HP-LCB02-RYCB03  TRAPEZOIDAL            1.00     3.30     0.50     6.30        1 22008.41
HP-LCB04-LCB06   TRAPEZOIDAL            1.00     3.30     0.50     6.30        1 24857.83
HP-LCB05-RYCB07  TRAPEZOIDAL            1.00     3.30     0.50     6.30        1 26066.28
HP-LCB06-RYCB04  TRAPEZOIDAL            1.00     3.30     0.50     6.30        1 24109.24
HP-RYCB02-RYCB06 TRAPEZOIDAL            1.00     3.30     0.50     6.30        1 19711.89
HP-RYCB03-LCB01  TRAPEZOIDAL            1.00     3.30     0.50     6.30        1 27002.18
HP-RYCB05-LCB05  TRAPEZOIDAL            1.00     3.30     0.50     6.30        1 24360.89
HP-RYCB07-LCB04  TRAPEZOIDAL            1.00     3.30     0.50     6.30        1 26302.65
LCB01-HP         TRAPEZOIDAL            1.00     3.30     0.50     6.30        1 15316.10
LCB01-LCB02      CIRCULAR               0.25     0.05     0.06     0.25        1    59.47
LCB02-HP         TRAPEZOIDAL            1.00     3.30     0.50     6.30        1 15316.10
LCB02-RYCB03     CIRCULAR               0.25     0.05     0.06     0.25        1    59.18
LCB04-HP         TRAPEZOIDAL            1.00     3.30     0.50     6.30        1 17134.69
LCB04-LCB08      CIRCULAR               0.25     0.05     0.06     0.25        1    42.37
LCB05-HP         TRAPEZOIDAL            1.00     3.30     0.50     6.30        1 15316.10
LCB05-RYCB05     CIRCULAR               0.25     0.05     0.06     0.25        1    41.54
LCB06-HP         TRAPEZOIDAL            1.00     3.30     0.50     6.30        1 18465.79
LCB06-RYCB04     CIRCULAR               0.25     0.05     0.06     0.25        1    59.77
LCB07-RYCB02     CIRCULAR               0.25     0.05     0.06     0.25        1    59.85
LCB08-CBMH02     CIRCULAR               0.25     0.05     0.06     0.25        1    36.58
LCB08-LCB05      CIRCULAR               0.25     0.05     0.06     0.25        1    42.37
MH08-MH02        CIRCULAR               0.45     0.16     0.11     0.45        1   201.18
RYCB01-RYCB06    CIRCULAR               0.25     0.05     0.06     0.25        1    59.59
RYCB02-HP        TRAPEZOIDAL            1.00     3.30     0.50     6.30        1 14527.05
RYCB02-RYCB01    CIRCULAR               0.25     0.05     0.06     0.25        1    59.20
RYCB03-CBMH03    CIRCULAR               0.25     0.05     0.06     0.25        1    51.62
RYCB03-HP        TRAPEZOIDAL            1.00     3.30     0.50     6.30        1 19407.38
RYCB04-CBMH04    CIRCULAR               0.25     0.05     0.06     0.25        1    59.35
RYCB04-Out-3     TRAPEZOIDAL            1.00     3.30     0.50     6.30        1 14926.66
RYCB05-HP        TRAPEZOIDAL            1.00     3.30     0.50     6.30        1 15316.10
RYCB05-LCB08     CIRCULAR               0.25     0.05     0.06     0.25        1    36.25
RYCB06-CBMH04    CIRCULAR               0.30     0.07     0.07     0.30        1    96.50
RYCB06-Out-1     TRAPEZOIDAL            1.00     3.30     0.50     6.30        1 14527.05
RYCB07-HP        TRAPEZOIDAL            1.00     3.30     0.50     6.30        1 15316.10


****************
Transect Summary
****************

Transect 18mROW
Area:
            0.0008     0.0034     0.0076     0.0136     0.0219
            0.0328     0.0461     0.0605     0.0758     0.0919
            0.1090     0.1269     0.1458     0.1655     0.1862
            0.2077     0.2301     0.2533     0.2767     0.3000
            0.3233     0.3466     0.3699     0.3933     0.4166
            0.4399     0.4632     0.4866     0.5099     0.5332
            0.5566     0.5799     0.6032     0.6266     0.6499
            0.6732     0.6966     0.7199     0.7432     0.7666
            0.7899     0.8133     0.8366     0.8599     0.8833
            0.9066     0.9300     0.9533     0.9767     1.0000
Hrad:
            0.0013     0.0026     0.0039     0.0051     0.0072
            0.0108     0.0163     0.0239     0.0327     0.0427
            0.0539     0.0662     0.0795     0.0938     0.1091
            0.1252     0.1421     0.1639     0.1905     0.2174
            0.2445     0.2718     0.2991     0.3265     0.3538
            0.3812     0.4084     0.4356     0.4627     0.4896
            0.5165     0.5432     0.5698     0.5963     0.6226
            0.6488     0.6749     0.7008     0.7265     0.7521
            0.7776     0.8029     0.8281     0.8531     0.8779
            0.9026     0.9272     0.9516     0.9759     1.0000
Width:
            0.0728     0.1455     0.2183     0.3006     0.4114
            0.5222     0.5967     0.6350     0.6733     0.7116
            0.7499     0.7882     0.8265     0.8648     0.9031
            0.9414     0.9797     0.9989     0.9989     0.9990
            0.9990     0.9990     0.9991     0.9991     0.9991
            0.9992     0.9992     0.9992     0.9993     0.9993
            0.9994     0.9994     0.9994     0.9995     0.9995
            0.9995     0.9996     0.9996     0.9996     0.9997
            0.9997     0.9997     0.9998     0.9998     0.9998
            0.9999     0.9999     0.9999     1.0000     1.0000


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

****************
Analysis Options
****************
Flow Units ............... LPS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ YES
  Water Quality .......... NO
Infiltration Method ...... HORTON
Flow Routing Method ...... DYNWAVE
Surcharge Method ......... EXTRAN
Starting Date ............ 07/22/2019 00:00:00
Ending Date .............. 07/23/2019 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:01:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 2.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 4
Head Tolerance ........... 0.001500 m


*********************
Control Actions Taken
*********************


**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         0.175        71.667
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.038        15.357
Surface Runoff ...........         0.137        55.916
Final Storage ............         0.001         0.477
Continuity Error (%) .....        -0.116


**************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
```

```
**************************      ---------      ---------
Dry Weather Inflow .......          0.000          0.000
Wet Weather Inflow .......          0.137          1.366
Groundwater Inflow .......          0.000          0.000
RDII Inflow ..............          0.000          0.000
External Inflow ..........          0.000          0.002
External Outflow .........          0.137          1.368
Flooding Loss ............          0.000          0.000
Evaporation Loss .........          0.000          0.000
Exfiltration Loss ........          0.000          0.000
Initial Stored Volume ....          0.001          0.006
Final Stored Volume ......          0.001          0.006
Continuity Error (%) .....          0.030


*************************
Highest Continuity Errors
*************************
Node CB05/06 (-2.56%)
Node CB01/02 (-2.51%)


***************************
Time-Step Critical Elements
***************************
Link HP-LCB04-LCB06 (2.59%)
Link HP-LCB01-RYCB02 (1.38%)


********************************
Highest Flow Instability Indexes
********************************
Link CBMH1-O(1) (2)


*************************
Routing Time Step Summary
*************************
Minimum Time Step           :     0.22 sec
Average Time Step           :     1.97 sec
Maximum Time Step           :     2.00 sec
Percent in Steady State     :     0.00
Average Iterations per Step :     2.00
Percent Not Converging      :     0.01
Time Step Frequencies       :
    2.000 -  1.516 sec      :    96.82 %
    1.516 -  1.149 sec      :     1.38 %
    1.149 -  0.871 sec      :     1.79 %
    0.871 -  0.660 sec      :     0.00 %
    0.660 -  0.500 sec      :     0.00 %


***************************
Subcatchment Runoff Summary
***************************
```

Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff LPS	Runoff Coeff
A-01	71.67	0.00	0.00	25.43	30.76	15.52	46.29	0.04	32.21	0.646
A-02	71.67	0.00	0.00	10.85	53.40	6.80	60.20	0.08	65.48	0.840
A-03	71.67	0.00	0.00	4.21	30.90	36.60	67.50	0.03	25.24	0.942
A-04	71.67	0.00	0.00	24.09	32.84	14.79	47.63	0.03	30.85	0.665
A-05	71.67	0.00	0.00	8.85	56.59	5.57	62.16	0.18	140.58	0.867
A-06	71.67	0.00	0.00	25.26	30.90	15.55	46.46	0.03	24.84	0.648
A-07	71.67	0.00	0.00	26.56	29.04	16.11	45.15	0.04	32.20	0.630
A-08	71.67	0.00	0.00	8.99	56.38	5.65	62.03	0.09	72.88	0.866
A-09	71.67	0.00	0.00	24.27	32.48	14.97	47.45	0.03	27.69	0.662
A-10	71.67	0.00	0.00	32.01	20.94	18.76	39.70	0.04	39.24	0.554
A-11	71.67	0.00	0.00	29.56	23.87	18.29	42.16	0.03	27.94	0.588
A-12	71.67	0.00	0.00	31.85	20.50	18.92	39.42	0.01	8.72	0.550
A-13	71.67	0.00	0.00	40.30	8.67	22.72	31.39	0.03	28.27	0.438
A-14	71.67	0.00	0.00	37.43	12.19	22.08	34.27	0.02	17.50	0.478
A-15	71.67	0.00	0.00	23.36	33.92	14.45	48.37	0.04	32.44	0.675
A-16	71.67	0.00	0.00	9.09	56.23	5.61	61.84	0.22	170.67	0.863
A-17	71.67	0.00	0.00	26.07	29.61	16.03	45.64	0.03	26.74	0.637
A-18	71.67	0.00	0.00	6.31	60.81	3.95	64.77	0.39	290.13	0.904

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

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days	Time of Max Occurrence hr:min	Reported Max Depth Meters
CB01/02	JUNCTION	0.00	0.10	77.62	0	01:10	0.10
CB03/04	JUNCTION	0.07	1.61	77.23	0	01:10	1.61
CB05/06	JUNCTION	0.00	0.14	76.87	0	01:10	0.14
D01	JUNCTION	0.00	0.08	76.78	0	01:10	0.08
HP01	JUNCTION	0.00	0.00	77.79	0	00:00	0.00
HP02	JUNCTION	0.01	0.10	77.19	0	01:16	0.10
HP-03	JUNCTION	0.00	0.01	76.43	0	01:14	0.01
HP-LCB01	JUNCTION	0.00	0.08	77.11	0	01:10	0.08
HP-LCB02	JUNCTION	0.00	0.00	77.53	0	00:00	0.00
HP-LCB04	JUNCTION	0.00	0.10	74.10	0	01:10	0.10
HP-LCB05	JUNCTION	0.00	0.02	74.72	0	01:10	0.02
HP-LCB06	JUNCTION	0.00	0.09	73.86	0	01:10	0.08
HP-LCB08	JUNCTION	0.00	0.00	75.56	0	00:00	0.00
HP-RYCB02	JUNCTION	0.00	0.00	76.71	0	00:00	0.00
HP-RYCB03	JUNCTION	0.00	0.00	77.44	0	00:00	0.00
HP-RYCB05	JUNCTION	0.00	0.00	75.00	0	00:00	0.00
HP-RYCB07	JUNCTION	0.00	0.05	74.38	0	01:10	0.05
EX-MH159	OUTFALL	0.03	0.28	71.26	0	01:13	0.28
HW1_(STM)	OUTFALL	1.03	1.03	71.82	0	00:00	1.03
Out-1	OUTFALL	0.00	0.00	76.56	0	00:00	0.00
Out-3	OUTFALL	0.00	0.08	73.55	0	01:10	0.08
SitePlan-OUT	OUTFALL	0.00	0.00	78.30	0	00:00	0.00
CBMH01	STORAGE	0.19	3.54	76.43	0	01:14	3.54
CBMH01-Dummy	STORAGE	0.02	0.23	73.12	0	01:14	0.23
CBMH02	STORAGE	0.31	3.03	74.89	0	01:10	3.01
CBMH02-Dummy	STORAGE	0.03	0.28	71.77	0	01:13	0.28
CBMH03	STORAGE	0.29	3.12	77.43	0	01:10	3.10
CBMH04	STORAGE	0.89	1.60	72.54	0	01:13	1.59
LCB01	STORAGE	0.13	1.73	77.16	0	01:10	1.73
LCB02	STORAGE	0.22	2.74	77.43	0	01:10	2.73
LCB04	STORAGE	0.14	1.40	74.15	0	01:10	1.40
LCB05	STORAGE	0.21	2.37	74.72	0	01:10	2.37
LCB06	STORAGE	0.04	1.99	73.89	0	01:10	1.98
LCB07	STORAGE	0.01	1.13	76.31	0	01:11	1.13
LCB08	STORAGE	0.27	2.84	74.89	0	01:10	2.83
MH02	STORAGE	0.03	0.28	72.05	0	01:14	0.28
MH04	STORAGE	0.03	0.39	72.58	0	01:14	0.39
MH06	STORAGE	0.02	0.30	72.90	0	01:12	0.30
MH08	STORAGE	0.02	0.16	72.31	0	01:11	0.16
RYCB01	STORAGE	0.02	0.98	75.70	0	01:11	0.98
RYCB02	STORAGE	0.02	1.36	76.30	0	01:10	1.36
RYCB03	STORAGE	0.17	2.29	77.38	0	01:10	2.28
RYCB04	STORAGE	0.51	2.23	73.57	0	01:10	2.22
RYCB05	STORAGE	0.24	2.67	74.86	0	01:10	2.66
RYCB06	STORAGE	0.01	0.34	74.76	0	01:11	0.34
RYCB07	STORAGE	0.17	1.86	74.41	0	01:10	1.85
Site_Plan_CB	STORAGE	0.15	1.57	78.17	0	01:23	1.57

```
*******************
Node Inflow Summary
```

****

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
CB01/02	JUNCTION	65.48	65.48	0 01:10	0.083	0.083	-2.449
CB03/04	JUNCTION	140.58	162.15	0 01:10	0.182	0.201	0.591
CB05/06	JUNCTION	72.88	75.75	0 01:10	0.0942	0.112	-2.492
D01	JUNCTION	0.00	45.80	0 01:10	0	0.0341	-0.789
HP01	JUNCTION	0.00	0.00	0 00:00	0	0	0.000 ltr
HP02	JUNCTION	0.00	48.42	0 01:11	0	0.0243	18.844
HP-03	JUNCTION	0.00	19.84	0 01:14	0	0.00787	0.002
HP-LCB01	JUNCTION	0.00	78.22	0 01:10	0	0.0447	0.005
HP-LCB02	JUNCTION	0.00	0.00	0 00:00	0	0	0.000 ltr
HP-LCB04	JUNCTION	0.00	114.17	0 01:10	0	0.0831	0.022
HP-LCB05	JUNCTION	0.00	6.17	0 01:10	0	0.000393	0.223
HP-LCB06	JUNCTION	0.00	84.56	0 01:10	0	0.0198	0.135
HP-LCB08	JUNCTION	0.00	0.00	0 00:00	0	0	0.000 ltr
HP-RYCB02	JUNCTION	0.00	0.00	0 00:00	0	0	0.000 ltr
HP-RYCB03	JUNCTION	0.00	0.00	0 00:00	0	0	0.000 ltr
HP-RYCB05	JUNCTION	0.00	0.00	0 00:00	0	0	0.000 ltr
HP-RYCB07	JUNCTION	0.00	36.13	0 01:10	0	0.00857	0.026
EX-MH159	OUTFALL	0.00	228.20	0 01:13	0	1.1	0.000
HW1_(STM)	OUTFALL	0.00	226.58	0 01:13	0	0.267	0.000
Out-1	OUTFALL	0.00	0.00	0 00:00	0	0	0.000 ltr
Out-3	OUTFALL	0.00	47.44	0 01:10	0	0.00578	0.000
SitePlan-OUT	OUTFALL	0.00	0.00	0 00:00	0	0	0.000 ltr
CBMH01	STORAGE	170.67	215.85	0 01:10	0.223	0.257	0.152
CBMH01-Dummy	STORAGE	0.00	62.28	0 01:14	0	0.249	0.002
CBMH02	STORAGE	0.00	13.96	0 01:04	0	0.0731	0.001
CBMH02-Dummy	STORAGE	0.00	228.20	0 01:13	0	1.1	0.005
CBMH03	STORAGE	0.00	17.17	0 01:06	0	0.0608	0.007
CBMH04	STORAGE	8.72	227.59	0 01:13	0.00946	0.267	-0.000
LCB01	STORAGE	32.20	78.69	0 01:10	0.0357	0.0609	-0.066
LCB02	STORAGE	32.21	40.90	0 01:06	0.0356	0.0701	0.052
LCB04	STORAGE	32.44	114.77	0 01:10	0.0358	0.096	-0.055
LCB05	STORAGE	24.84	61.18	0 01:10	0.0269	0.076	0.018
LCB06	STORAGE	17.50	131.02	0 01:10	0.0182	0.101	-0.037
LCB07	STORAGE	0.00	24.34	0 01:08	0	0.00172	0.394
LCB08	STORAGE	26.74	30.16	0 01:04	0.0287	0.0816	0.069
MH02	STORAGE	0.00	222.07	0 01:14	0	1.02	-0.001
MH04	STORAGE	0.00	165.02	0 01:12	0	0.573	-0.215
MH06	STORAGE	0.00	143.24	0 01:12	0	0.506	0.212
MH08	STORAGE	0.00	57.30	0 01:10	0	0.449	-0.002
RYCB01	STORAGE	27.94	122.69	0 01:10	0.0278	0.117	0.213
RYCB02	STORAGE	39.24	117.08	0 01:10	0.0448	0.0913	0.061
RYCB03	STORAGE	30.85	51.58	0 01:10	0.0343	0.0598	0.006
RYCB04	STORAGE	28.27	155.80	0 01:10	0.0336	0.136	-0.025
RYCB05	STORAGE	25.24	40.83	0 01:10	0.0344	0.0776	0.011
RYCB06	STORAGE	0.00	114.54	0 01:10	0	0.117	-0.003
RYCB07	STORAGE	27.69	85.18	0 01:10	0.0304	0.0845	-0.021
Site_Plan_CB	STORAGE	290.13	290.13	0 01:10	0.388	0.388	0.015

****
Node Surcharge Summary
****

No nodes were surcharged.

****
Node Flooding Summary
****

No nodes were flooded.

****
Storage Volume Summary
****

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow LPS
CBMH01	0.003	3	0	0	0.076	97	0 01:14	82.13
CBMH01-Dummy	0.000	1	0	0	0.000	7	0 01:14	62.28
CBMH02	0.000	6	0	0	0.000	59	0 01:10	6.49
CBMH02-Dummy	0.000	1	0	0	0.000	5	0 01:13	228.20
CBMH03	0.000	8	0	0	0.000	89	0 01:10	6.59
CBMH04	0.000	16	0	0	0.000	30	0 01:13	226.58
LCB01	0.000	5	0	0	0.000	72	0 01:10	78.22
LCB02	0.000	6	0	0	0.000	75	0 01:10	28.76
LCB04	0.000	7	0	0	0.000	70	0 01:10	114.17
LCB05	0.000	7	0	0	0.000	75	0 01:10	59.35
LCB06	0.000	2	0	0	0.000	77	0 01:10	129.38
LCB07	0.000	0	0	0	0.000	47	0 01:11	6.41
LCB08	0.000	6	0	0	0.000	66	0 01:10	23.80
MH02	0.000	0	0	0	0.000	5	0 01:14	222.08
MH04	0.000	1	0	0	0.000	8	0 01:14	164.90
MH06	0.000	1	0	0	0.000	7	0 01:12	143.22
MH08	0.000	0	0	0	0.000	3	0 01:11	57.29
RYCB01	0.000	1	0	0	0.000	36	0 01:11	114.54
RYCB02	0.000	1	0	0	0.000	53	0 01:10	104.03
RYCB03	0.000	6	0	0	0.000	76	0 01:10	47.85
RYCB04	0.000	17	0	0	0.000	76	0 01:10	153.16
RYCB05	0.000	7	0	0	0.000	74	0 01:10	37.87
RYCB06	0.000	0	0	0	0.000	12	0 01:11	113.59
RYCB07	0.000	7	0	0	0.000	72	0 01:10	84.16
Site_Plan_CB	0.009	2	0	0	0.161	32	0 01:23	51.01

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
EX-MH159	24.87	63.43	228.20	1.097
HW1_(STM)	73.40	6.94	226.58	0.267
Out-1	0.00	0.00	0.00	0.000
Out-3	0.60	21.52	47.44	0.006
SitePlan-OUT	0.00	0.00	0.00	0.000
System	19.77	91.89	494.11	1.369

****
Link Flow Summary
****

Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
1	CONDUIT	0.00	0 00:00	0.00	0.00	0.09
1_(104)_(1)_(STM)	CONDUIT	228.20	0 01:13	1.73	0.45	0.47
1_(104)_(STM)	CONDUIT	222.08	0 01:14	1.71	0.44	0.47
1_(11)_(STM)	CONDUIT	164.90	0 01:15	1.28	0.86	0.75
1_(131)_(STM)	CONDUIT	62.28	0 01:14	1.18	0.90	0.70
1_(135)_(STM)	CONDUIT	19.84	0 01:14	1.24	0.00	0.01
1_(87)_(STM)	CONDUIT	226.58	0 01:13	2.05	1.84	1.00
1_(9)_(STM)	CONDUIT	143.22	0 01:12	1.20	0.79	0.76
2	CONDUIT	0.00	0 00:00	0.00	0.00	0.00
3	CONDUIT	19.84	0 01:14	0.05	0.00	0.15
4	CONDUIT	0.00	0 00:00	0.00	0.00	0.03
4_1	CHANNEL	45.80	0 01:10	0.11	0.00	0.11
4_2	CHANNEL	45.63	0 01:10	0.12	0.00	0.18
5	CHANNEL	23.40	0 01:16	0.06	0.00	0.11
6	CHANNEL	48.42	0 01:11	0.07	0.00	0.15
7	CHANNEL	22.74	0 01:10	0.03	0.00	0.16
8	CHANNEL	0.00	0 00:00	0.00	0.00	0.05
HP-LCB01-RYCB02	CONDUIT	78.20	0 01:10	1.70	0.00	0.08
HP-LCB02-RYCB03	CONDUIT	0.00	0 00:00	0.00	0.00	0.13
HP-LCB04-LCB06	CONDUIT	114.17	0 01:10	1.81	0.00	0.25
HP-LCB05-RYCB07	CONDUIT	6.12	0 01:10	0.06	0.00	0.15
HP-LCB06-RYCB04	CONDUIT	84.55	0 01:10	1.54	0.00	0.19
HP-RYCB02-RYCB06	CONDUIT	0.00	0 00:00	0.00	0.00	0.00
HP-RYCB03-LCB01	CONDUIT	0.00	0 00:00	0.00	0.00	0.16
HP-RYCB05-LCB05	CONDUIT	0.00	0 00:00	0.00	0.00	0.11
HP-RYCB07-LCB04	CONDUIT	36.11	0 01:10	0.16	0.00	0.23
LCB01-HP	CONDUIT	78.22	0 01:10	0.41	0.01	0.21
LCB01-LCB02	CONDUIT	47.85	0 01:10	0.97	0.80	1.00
LCB02-HP	CONDUIT	0.00	0 00:00	0.00	0.00	0.05
LCB02-RYCB03	CONDUIT	21.16	0 01:10	0.51	0.36	1.00

LCB04-HP	CONDUIT	114.17	0	01:10	0.44	0.01	0.25
LCB04-LCB08	CONDUIT	48.16	0	01:10	0.98	1.14	1.00
LCB05-HP	CONDUIT	6.17	0	01:10	0.08	0.00	0.12
LCB05-RYCB05	CONDUIT	37.87	0	01:10	0.77	0.91	1.00
LCB06-HP	CONDUIT	84.56	0	01:10	0.33	0.00	0.25
LCB06-RYCB04	CONDUIT	75.98	0	01:08	1.55	1.27	1.00
LCB07-RYCB02	CONDUIT	24.34	0	01:08	0.55	0.41	1.00
LCB08-CBMH02	CONDUIT	13.96	0	01:04	0.38	0.38	1.00
LCB08-LCB05	CONDUIT	53.35	0	01:10	1.09	1.26	1.00
MH08-MH02	CONDUIT	57.29	0	01:11	1.09	0.28	0.36
RYCB01-RYCB06	CONDUIT	114.54	0	01:10	2.33	1.92	1.00
RYCB02-HP	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
RYCB02-RYCB01	CONDUIT	98.41	0	01:10	2.00	1.66	1.00
RYCB03-CBMH03	CONDUIT	17.17	0	01:06	0.44	0.33	1.00
RYCB03-HP	CONDUIT	0.00	0	00:00	0.00	0.00	0.13
RYCB04-CBMH04	CONDUIT	106.22	0	01:10	2.16	1.79	1.00
RYCB04-Out-3	CONDUIT	47.44	0	01:10	0.29	0.00	0.19
RYCB05-HP	CONDUIT	0.00	0	00:00	0.00	0.00	0.03
RYCB05-LCB08	CONDUIT	16.59	0	01:10	0.38	0.46	1.00
RYCB06-CBMH04	CONDUIT	113.59	0	01:11	1.66	1.18	0.93
RYCB06-Out-1	CONDUIT	0.00	0	00:00	0.00	0.00	0.00
RYCB07-HP	CONDUIT	36.13	0	01:10	0.27	0.00	0.17
CB3-O	ORIFICE	27.54	0	01:10			1.00
CB4-O	ORIFICE	27.54	0	01:10			1.00
CBMH02-ICD	ORIFICE	6.49	0	01:10			1.00
CBMH1-O(1)	ORIFICE	62.28	0	01:14			1.00
CBMH3-ICD	ORIFICE	6.59	0	01:10			1.00
Outlet-1	ORIFICE	51.01	0	01:23			1.00
CB01/02-O	DUMMY	21.80	0	01:01			
CB05/06-O	DUMMY	26.00	0	01:01			

****
Flow Classification Summary
****

Conduit	Adjusted /Actual Length	---------- Fraction of Time in Flow Class ---------- Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
1	1.00	0.91	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1_(104)_(1)_(STM)	1.00	0.01	0.00	0.00	0.78	0.21	0.00	0.00	0.90	0.00
1_(104)_(STM)	1.00	0.01	0.00	0.00	0.85	0.14	0.00	0.00	0.94	0.00
1_(11)_(STM)	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
1_(131)_(STM)	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
1_(135)_(STM)	1.00	0.99	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
1_(87)_(STM)	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
1_(9)_(STM)	1.00	0.01	0.00	0.00	0.13	0.00	0.00	0.86	0.06	0.00
2	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	1.00	0.95	0.03	0.00	0.01	0.00	0.00	0.00	0.94	0.00
4	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4_1	1.00	0.01	0.50	0.00	0.49	0.00	0.00	0.00	0.87	0.00
4_2	1.00	0.01	0.00	0.00	0.05	0.00	0.00	0.94	0.03	0.00
5	1.00	0.01	0.04	0.00	0.96	0.00	0.00	0.00	0.02	0.00
6	1.00	0.04	0.00	0.00	0.04	0.00	0.00	0.92	0.00	0.00
7	1.00	0.76	0.00	0.00	0.04	0.00	0.00	0.20	0.02	0.00
8	1.00	0.76	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HP-LCB01-RYCB02	1.00	0.96	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00
HP-LCB02-RYCB03	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HP-LCB04-LCB06	1.00	0.95	0.00	0.00	0.01	0.00	0.00	0.04	0.01	0.00
HP-LCB05-RYCB07	1.00	0.98	0.01	0.00	0.01	0.00	0.00	0.00	0.95	0.00
HP-LCB06-RYCB04	1.00	0.99	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00
HP-RYCB02-RYCB06	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HP-RYCB03-LCB01	1.00	0.95	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HP-RYCB05-LCB05	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HP-RYCB07-LCB04	1.00	0.92	0.06	0.00	0.02	0.00	0.00	0.00	0.95	0.00
LCB01-HP	1.00	0.95	0.01	0.00	0.04	0.00	0.00	0.00	0.93	0.00
LCB01-LCB02	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.12	0.00
LCB02-HP	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LCB02-RYCB03	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.88	0.00
LCB04-HP	1.00	0.92	0.03	0.00	0.05	0.00	0.00	0.00	0.92	0.00
LCB04-LCB08	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.86	0.00
LCB05-HP	1.00	0.99	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
LCB05-RYCB05	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.13	0.00
LCB06-HP	1.00	0.98	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
LCB06-RYCB04	1.00	0.00	0.74	0.00	0.26	0.00	0.00	0.00	0.98	0.00
LCB07-RYCB02	1.00	0.01	0.94	0.00	0.05	0.00	0.00	0.00	0.95	0.00
LCB08-CBMH02	1.00	0.01	0.00	0.00	0.22	0.00	0.00	0.77	0.01	0.00
LCB08-LCB05	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.84	0.00
MH08-MH02	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
RYCB01-RYCB06	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
RYCB02-HP	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RYCB02-RYCB01	1.00	0.01	0.00	0.00	0.97	0.03	0.00	0.00	0.98	0.00
RYCB03-CBMH03	1.00	0.01	0.00	0.00	0.18	0.00	0.00	0.81	0.03	0.00
RYCB03-HP	1.00	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RYCB04-CBMH04	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00
RYCB04-Out-3	1.00	0.05	0.00	0.00	0.01	0.00	0.00	0.94	0.00	0.00
RYCB05-HP	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RYCB05-LCB08	1.00	0.01	0.01	0.00	0.98	0.00	0.00	0.00	0.81	0.00
RYCB06-CBMH04	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
RYCB06-Out-1	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RYCB07-HP	1.00	0.98	0.00	0.00	0.02	0.00	0.00	0.00	0.01	0.00

****
Conduit Surcharge Summary
****

Conduit	--------- Hours Full -------- Both Ends	Upstream	Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
1_(87)_(STM)	24.00	24.00	24.00	0.23	0.26
LCB01-LCB02	2.07	2.07	2.42	0.01	0.01
LCB02-RYCB03	2.42	2.42	2.91	0.01	0.01
LCB04-LCB08	2.74	2.74	3.07	0.15	0.01
LCB05-RYCB05	3.49	3.49	3.80	0.01	0.01
LCB06-RYCB04	0.33	0.33	23.83	0.10	0.12
LCB07-RYCB02	0.11	0.11	0.15	0.01	0.01
LCB08-CBMH02	4.13	4.13	4.52	0.01	0.01
LCB08-LCB05	3.07	3.07	3.49	0.09	0.01
RYCB01-RYCB06	0.05	0.16	0.05	0.18	0.05
RYCB02-RYCB01	0.15	0.15	0.16	0.14	0.14
RYCB03-CBMH03	2.91	2.91	3.45	0.01	0.01
RYCB04-CBMH04	24.00	24.00	24.00	0.27	0.29
RYCB05-LCB08	3.80	3.80	4.13	0.01	0.01
RYCB06-CBMH04	0.01	0.04	0.01	0.08	0.01

Analysis begun on: Fri Mar 12 14:14:15 2021
Analysis ended on: Fri Mar 12 14:14:20 2021
Total elapsed time: 00:00:05

```
2    Metric units
*#****************************************************************************
*#  Project Name: [Shirley's Brook - SWMF C]            Project Number: [103106]
*#  Date        : 05-28-2006
*#  Modeller    : [M.Petepiece]
*#  Company     : NOVATECH ENGINEERING CONSULTANTS LTD
*#  License #   :  5320763
*#
*# Post-Development Conditions to SWM Facility 'C'
*#****************************************************************************
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[1]
                    25mm-4.stm
*
READ STORM          STORM_FILENAME=["storm.001"]
*=============================================================================
*
*                            KLONDIKE ROAD SUBDIVISION
*                             LANDS TO SWM FACILITY C
*                               ULTIMATE CONDITIONS
*
*=============================================================================
* Klondike Area C-300
* (Institutional/Residential)
*   7.48 ha x 85 L/s/ha = 636 L/s
*   7.48 ha @ 50 m3/ha  = 374 m3
** VERIFIED OK (Oct 03, 2006) **
* ------------------------------
DESIGN STANDHYD     ID=[1], NHYD=["C-300"], DT=[5]min, AREA=[7.48](ha),
                    XIMP=[0.30], TIMP=[0.37], DWF=[0](cms), LOSS=[2], CN=[65],
                    SLOPE=[1.0](%), END=-1
*
COMPUTE DUALHYD     IDin=[1], CINLET=[0.636](cms), NINLET=[1],
                    MAJID=[2], MajNHYD=["C-3maj"],
                    MINID=[9], MinNHYD=["C-3min"],
                    TMJSTO=[374](cu-m)
*
*%-----------------|-----------------------------------------------------------|
* Klondike Area C-201
* medium density residential)
** VERIFIED OK (Oct 03, 2006) **
* ------------------------------
DESIGN STANDHYD     ID=[1], NHYD=["C-201"], DT=[5]min, AREA=[1.96](ha),
                    XIMP=[0.57], TIMP=[0.64], DWF=[0](cms), LOSS=[2], CN=[65],
                    SLOPE=[1.5](%), END=-1
*
* Klondike Area C-202
* (medium density residential)
** VERIFIED OK (Oct 03, 2006) **
* ------------------------------
DESIGN STANDHYD     ID=[2], NHYD=["C-202"], DT=[5]min, AREA=[3.07](ha),
                    XIMP=[0.57], TIMP=[0.64], DWF=[0](cms), LOSS=[2], CN=[65],
                    SLOPE=[1.0](%), END=-1
*
* Klondike Area C-203
* (park)
** VERIFIED OK (Oct 03, 2006) **
* ------------------------------
DESIGN STANDHYD     ID=[3], NHYD=["C-203"], DT=[5]min, AREA=[1.90](ha),
                    XIMP=[0.24], TIMP=[0.30], DWF=[0](cms), LOSS=[2], CN=[65],
                    SLOPE=[1.0](%), END=-1
*
* Klondike Area C-204
* (medium density residential)
** VERIFIED OK (Oct 03, 2006) **
* ------------------------------
DESIGN STANDHYD     ID=[4], NHYD=["C-204"], DT=[5]min, AREA=[5.20](ha),
                    XIMP=[0.57], TIMP=[0.64], DWF=[0](cms), LOSS=[2], CN=[65],
                    SLOPE=[1.0](%), END=-1
*
* Klondike Area C-205
* (Klondike Road U/S of OCR)
** VERIFIED OK (Oct 03, 2006) **
* ------------------------------
DESIGN STANDHYD     ID=[5], NHYD=["C-205"], DT=[5]min, AREA=[2.22](ha),
                    XIMP=[0.70], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[65],
                    SLOPE=[1.0](%), END=-1
*
* Klondike Area C-2 (ALL)
* ------------------------------
ADD HYD             IDsum=[6], NHYD=["C-2"], IDs to add=[1,2,3,4,5]
*
* Minor System Capture for Area C-2:
*  14.35 ha @ 85 L/s/ha = 1220 L/s
*  14.35 ha @ 50 m3/ha  =  718 m3
** VERIFIED OK (Oct 03, 2006) **
* ----------------------------------------
COMPUTE DUALHYD     IDin=[6], CINLET=[1.220](cms), NINLET=[1],
                    MAJID=[7], MajNHYD=["C2maj"],
                    MINID=[8], MinNHYD=["C2min"],
                    TMJSTO=[718](cu-m)
*%-----------------|-----------------------------------------------------------|
* Klondike Area C-101
* (Industrial)
** VERIFIED OK (Oct 03, 2006) **
* --------------------
DESIGN STANDHYD     ID=[1], NHYD=["C-101"], DT=[5]min, AREA=[3.16](ha),
                    XIMP=[0.70], TIMP=[0.70], DWF=[0](cms), LOSS=[2], CN=[65],
                    SLOPE=[0.6](%), END=-1
*
* 3.16 ha @ 85 L/s/ha = 269 L/s
* 3.16 ha @ 50 m3/ha  = 158 m3
* ----------------------------
COMPUTE DUALHYD     IDin=[1], CINLET=[0.269](cms), NINLET=[1],
                    MAJID=[2], MajNHYD=["C101ma"],
                    MINID=[7], MinNHYD=["C101mi"],
                    TMJSTO=[158](cu-m)
*%-----------------|-----------------------------------------------------------|
* Klondike Area C-103 (Klondike Road D/S of OCR)
** VERIFIED OK (Oct 03, 2006) **
* ----------------------------
DESIGN STANDHYD     ID=[6], NHYD=["C-103"], DT=[5]min, AREA=[1.20](ha),
                    XIMP=[0.70], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[65],
                    SLOPE=[1.0](%), END=-1
*%-----------------|-----------------------------------------------------------|
* Klondike Area C-102 (SWMF C)
** VERIFIED OK (Oct 03, 2006) **
* ----------------------------
DESIGN NASHYD       ID=[5], NHYD=["C-102"], DT=[5]min, AREA=[0.90](ha),
                    DWF=[0](cms), CN/C=[80], TP=[0.17]hrs,
                    RAINFALL=[ ,  ,  ,  ,  ](mm/hr), END=-1
*%-----------------|-----------------------------------------------------------|
*
ADD HYD             IDsum=[10], NHYD=["SWMC_IN"], IDs to add=[5,6,7,8,9]
*
* -------------------------------------------------------
* SWMF C
* -------------------------------------------------------
* Drainage Area :     26.2 ha (not incl. SWMF C)
* Extended Detention: Q=  29 L/s max
* Erosion Control:    Q= 262 L/s (10 L/s/ha)
* >5yr Storm:         Qin=Qout
* -----------------------------------------------------
ROUTE RESERVOIR     IDout=[1],   NHYD=["SWMC_OUT"],  IDin=[10],
                    RDT=[5](min),
                          TABLE of ( OUTFLOW-STORAGE ) values
                                    (cms) - (ha-m)
                                  [ 0.000 , 0.0000 ]
                                  [ 0.020 , 0.1030 ]
                                  [ 0.029 , 0.1860 ]
                                  [ 0.060 , 0.3910 ]
                                  [ 0.100 , 0.4200 ]
                                  [ 0.160 , 0.5460 ]
                                  [ 0.262 , 0.7090 ]
                                  [ 3.000 , 0.7430 ]
                                  [   -1  ,  -1    ]  (max twenty pts)
*%-----------------|-----------------------------------------------------------|
SAVE HYD            ID=[10],   # OF PCYCLES=[1],  ICASEsh=[-1]
                    HYD_FILENAME=["SWMC_IN"]
                    HYD_COMMENT=["Inflow to SWMF C"]
*%-----------------|-----------------------------------------------------------|
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[2]
                    C5-3.stm
*
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[3]
                    C100-3.stm
*
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[4]
                    S100-12.stm
*
FINISH
```

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

 SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    888  =========
 S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  8   8  =========
 SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  8   8  Ver.  4.0
     S   W W   M   M  H   H    Y    M   M  O   O       9999    888  Sept 1998
 SSSSS   W W   M   M  H   H    Y    M   M   OOO           9  8   8  =========
                                                      9   9  8   8  # 5320763
      StormWater Management HYdrologic Model            999    888  =========

 **************************************************************************
 ************************** SWMHYMO-98  Ver/4.0 ***************************
 *******  A single event and continuous hydrologic simulation model  *******
 *******     based on the principles of HYMO and its successors      *******
 *******                OTTHYMO-83 and OTTHYMO-89.                    *******
 **************************************************************************
 ******* Distributed by:  J.F. Sabourin and Associates Inc.          *******
 *******                 Ottawa,  Ontario: (613) 727-5199           *******
 *******                 Gatineau, Quebec: (819) 243-6858           *******
 *******                 E-Mail: swmhymo@jfsa.Com                   *******
 **************************************************************************

 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++ Licensed user: NOVATECH ENGINEERING CONSULTANTS LTD         +++++++
 +++++++                Nepean                 SERIAL#:5320763       +++++++
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 **************************************************************************
 *******          ++++++ PROGRAM ARRAY DIMENSIONS ++++++              *******
 *******          Maximum value for ID numbers  :     10              *******
 *******          Max. number of rainfall points:  15000              *******
 *******          Max. number of flow points    :  15000              *******
 **************************************************************************

 *** DESCRIPTION SUMMARY TABLE HEADERS (units depend on METOUT in START) ***
 ***-----------------------------------------------------------------------***
 ***    ID:  Hydrograph IDentification numbers, (1-10).                 ***
 ***  NHYD:  Hydrograph reference numbers, (6 digits or characters).    ***
 ***  AREA:  Drainage area associated with hydrograph, (ac.) or (ha.).  ***
 *** QPEAK:  Peak flow of simulated hydrograph, (ft^3/s) or (m^3/s).    ***
 *** TpeakDate_hh:mm is the date and time of the peak flow.             ***
 ***  R.V.:  Runoff Volume of simulated hydrograph, (in) or (mm).       ***
 ***  R.C.:  Runoff Coefficient of simulated hydrograph, (ratio).       ***
 ***     *:  see WARNING or NOTE message printed at end of run.         ***
 ***    **:  see  ERROR  message printed at end of run.                 ***
 **************************************************************************
 **************************************************************************

::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::

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

 ********************   S U M M A R Y   O U T P U T   ********************
 **************************************************************************
 *      DATE: 2006-10-05     TIME: 09:39:06     RUN COUNTER: 000419      *
 **************************************************************************
 * Input   filename: M:\2003\103106\DATA\CALCUL~1\SWMHYMO\SMWFC~1\SWM_C.dat*
 * Output  filename: M:\2003\103106\DATA\CALCUL~1\SWMHYMO\SMWFC~1\SWM_C.out*
 * Summary filename: M:\2003\103106\DATA\CALCUL~1\SWMHYMO\SMWFC~1\SWM_C.sum*
 * User comments:                                                         *
 * 1:_____________________________________________________________________*
 * 2:_____________________________________________________________________*
 * 3:_____________________________________________________________________*
 **************************************************************************


#***************************************************************************
#  Project Name: [Shirley's Brook - SWMF C]           Project Number: [103106]
#  Date        : 05-28-2006
#  Modeller    : [M.Petepiece]
#  Company     : NOVATECH ENGINEERING CONSULTANTS LTD
#  License #   :  5320763
#
# Post-Development Conditions to SWM Facility 'C'
#***************************************************************************
 RUN:COMMAND#
 001:0001------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   1 ]
 001:0002------------------------------------------------------------------
     READ STORM
      Filename = storm.001
      Comment  = City of Ottawa:  25mm storm (Chicago distribution - 10 minut
      [SDT=10.00:SDUR=   4.00:PTOT=  24.98]
 001:0003--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     DESIGN STANDHYD    01:C-300      7.48     .319 No_date    1:40    9.92 .397
      [XIMP=.30:TIMP=.37]
      [SLP=1.00:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
 001:0004--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     COMPUTE DUALHYD    01:C-300      7.48     .319 No_date    1:40    9.92  n/a
        Major System /  02:C-3maj      .00     .000 No_date    0:00     .00  n/a
        Minor System \  09:C-3min     7.48     .319 No_date    1:40    9.92  n/a
      {MjSysSto=.0000E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
 001:0005--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  *  DESIGN STANDHYD    01:C-201      1.96     .173 No_date    1:40   15.54 .622
      [XIMP=.57:TIMP=.64]
      [SLP=1.50:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
 001:0006--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  *  DESIGN STANDHYD    02:C-202      3.07     .261 No_date    1:40   15.54 .622
      [XIMP=.57:TIMP=.64]
      [SLP=1.00:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
 001:0007--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  *  DESIGN STANDHYD    03:C-203      1.90     .070 No_date    1:40    8.63 .346
      [XIMP=.24:TIMP=.30]
      [SLP=1.00:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
 001:0008--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  *  DESIGN STANDHYD    04:C-204      5.20     .428 No_date    1:40   15.54 .622
      [XIMP=.57:TIMP=.64]
      [SLP=1.00:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
 001:0009--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
```

```
  *  DESIGN STANDHYD    05:C-205      2.22     .235 No_date    1:40   18.43 .738
      [XIMP=.70:TIMP=.80]
      [SLP=1.00:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
 001:0010--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     ADD HYD            01:C-201      1.96     .173 No_date    1:40   15.54  n/a
                      + 02:C-202      3.07     .261 No_date    1:40   15.54  n/a
                      + 03:C-203      1.90     .070 No_date    1:40    8.63  n/a
                      + 04:C-204      5.20     .428 No_date    1:40   15.54  n/a
                      + 05:C-205      2.22     .235 No_date    1:40   18.43  n/a
      [DT= 5.00]  SUM=  06:C-2       14.35    1.166 No_date    1:40   15.07  n/a
 001:0011--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     COMPUTE DUALHYD    06:C-2       14.35    1.166 No_date    1:40   15.07  n/a
        Major System /  07:C2maj       .00     .000 No_date    0:00     .00  n/a
        Minor System \  08:C2min     14.35    1.166 No_date    1:40   15.07  n/a
      {MjSysSto=.0000E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
 001:0012--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  *  DESIGN STANDHYD    01:C-101      3.16     .317 No_date    1:40   17.96 .719
      [XIMP=.70:TIMP=.70]
      [SLP= .60:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
 001:0013--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     COMPUTE DUALHYD    01:C-101      3.16     .317 No_date    1:40   17.96  n/a
        Major System /  02:C101ma      .00     .000 No_date    0:00     .00  n/a
        Minor System \  07:C101mi     3.16     .269 No_date    1:40   17.63  n/a
      {MjSysSto=.8342E+01, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
 001:0014--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  *  DESIGN STANDHYD    06:C-103      1.20     .130 No_date    1:40   18.43 .738
      [XIMP=.70:TIMP=.80]
      [SLP=1.00:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
 001:0015--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     DESIGN NASHYD      05:C-102       .90     .020 No_date    1:45    6.34 .254
      [CN= 80.0: N= 3.00]
      [Tp=  .17:DT= 5.00]
 001:0016--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     ADD HYD            05:C-102       .90     .020 No_date    1:45    6.34  n/a
                      + 06:C-103      1.20     .130 No_date    1:40   18.43  n/a
                      + 07:C101mi     3.16     .269 No_date    1:40   17.63  n/a
                      + 08:C2min     14.35    1.166 No_date    1:40   15.07  n/a
                      + 09:C-3min     7.48     .319 No_date    1:40    9.92  n/a
      [DT= 5.00]  SUM=  10:SWMC_I    27.09    1.900 No_date    1:40   13.81  n/a
 001:0017--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     ROUTE RESERVOIR -> 10:SWMC_I    27.09    1.900 No_date    1:40   13.81  n/a
      [RDT= 5.00] out<- 01:SWMC_O    27.09     .050 No_date    4:05   13.81  n/a
     {MxStoUsed=.3270E+00}
 001:0018--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     SAVE HYD           10:SWMC_I    27.09    1.900 No_date    1:40   13.81  n/a
      fname :M:\2003\103106\DATA\CALCUL~1\SWMHYMO\SMWFC~1\SWMC_IN.001
      remark:Inflow to SWMF C
  ** END OF RUN :   1

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




 RUN:COMMAND#
 002:0001------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   2 ]
#***************************************************************************
#  Project Name: [Shirley's Brook - SWMF C]           Project Number: [103106]
#  Date        : 05-28-2006
#  Modeller    : [M.Petepiece]
#  Company     : NOVATECH ENGINEERING CONSULTANTS LTD
#  License #   :  5320763
#
# Post-Development Conditions to SWM Facility 'C'
#***************************************************************************
 002:0002------------------------------------------------------------------
     READ STORM
      Filename = storm.001
      Comment  = City of Ottawa:  5yr-3hr Chicago (DT=10 min, TPRAT=0.4, Peak
      [SDT=10.00:SDUR=   3.00:PTOT=  42.50]
 002:0003--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  *  DESIGN STANDHYD    01:C-300      7.48     .657 No_date    1:10   19.73 .464
      [XIMP=.30:TIMP=.37]
      [SLP=1.00:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
 002:0004--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     COMPUTE DUALHYD    01:C-300      7.48     .657 No_date    1:10   19.73  n/a
        Major System /  02:C-3maj      .00     .000 No_date    0:00     .00  n/a
        Minor System \  09:C-3min     7.48     .636 No_date    1:10   19.65  n/a
      {MjSysSto=.7624E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
 002:0005--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  *  DESIGN STANDHYD    01:C-201      1.96     .334 No_date    1:10   28.47 .670
      [XIMP=.57:TIMP=.64]
      [SLP=1.50:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
 002:0006--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  *  DESIGN STANDHYD    02:C-202      3.07     .505 No_date    1:10   28.47 .670
      [XIMP=.57:TIMP=.64]
      [SLP=1.00:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
 002:0007--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  *  DESIGN STANDHYD    03:C-203      1.90     .143 No_date    1:10   17.70 .416
      [XIMP=.24:TIMP=.30]
      [SLP=1.00:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
 002:0008--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  *  DESIGN STANDHYD    04:C-204      5.20     .840 No_date    1:10   28.47 .670
      [XIMP=.57:TIMP=.64]
      [SLP=1.00:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
 002:0009--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  *  DESIGN STANDHYD    05:C-205      2.22     .454 No_date    1:10   33.09 .778
      [XIMP=.70:TIMP=.80]
      [SLP=1.00:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
 002:0010--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     ADD HYD            01:C-201      1.96     .334 No_date    1:10   28.47  n/a
                      + 02:C-202      3.07     .505 No_date    1:10   28.47  n/a
                      + 03:C-203      1.90     .143 No_date    1:10   17.70  n/a
```

```
                 +  04:C-204       5.20      .840 No_date    1:10   28.47  n/a
                 +  05:C-205       2.22      .454 No_date    1:10   33.09  n/a
     [DT= 5.00]  SUM=  06:C-2     14.35     2.276 No_date    1:10   27.76  n/a
 002:0011---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    06:C-2     14.35     2.276 No_date    1:10   27.76  n/a
      Major System /  07:C2maj      .00      .000 No_date    0:00     .00  n/a
      Minor System \  08:C2min    14.35     1.220 No_date    1:05   27.79  n/a
     {MjSysSto=.4711E+03, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
 002:0012---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  * DESIGN STANDHYD    01:C-101    3.16      .614 No_date    1:10   32.03 .754
     [XIMP=.70:TIMP=.70]
     [SLP= .60:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
 002:0013---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    01:C-101    3.16      .614 No_date    1:10   32.03  n/a
      Major System /  02:C101ma     .05      .047 No_date    1:15   32.03  n/a
      Minor System \  07:C101mi    3.11      .269 No_date    1:05   31.82  n/a
     {MjSysSto=.1580E+03, TotOvfVol=.1685E+02, N-Ovf=    1, TotDurOvf=    0.hrs
 002:0014---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  * DESIGN STANDHYD    06:C-103    1.20      .248 No_date    1:10   33.09 .778
     [XIMP=.70:TIMP=.80]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
 002:0015---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    DESIGN NASHYD      05:C-102     .90      .058 No_date    1:15   16.09 .379
     [CN= 80.0: N= 3.00]
     [Tp=  .17:DT= 5.00]
 002:0016---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    ADD HYD            05:C-102     .90      .058 No_date    1:15   16.09  n/a
                 +  06:C-103       1.20      .248 No_date    1:10   33.09  n/a
                 +  07:C101mi      3.11      .269 No_date    1:05   31.82  n/a
                 +  08:C2min      14.35     1.220 No_date    1:05   27.79  n/a
                 +  09:C-3min      7.48      .636 No_date    1:10   19.65  n/a
     [DT= 5.00]  SUM=  10:SWMC_I  27.04     2.419 No_date    1:10   25.84  n/a
 002:0017---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    ROUTE RESERVOIR -> 10:SWMC_I  27.04     2.419 No_date    1:10   25.84  n/a
     [RDT= 5.00] out<- 01:SWMC_O  27.04      .184 No_date    2:55   25.84  n/a
     {MxStoUsed=.5850E+00}
 002:0018---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    SAVE HYD           10:SWMC_I  27.04     2.419 No_date    1:10   25.84  n/a
     fname :M:\2003\103106\DATA\CALCUL~1\SWMHYMO\SMWFC~1\SWMC_IN.002
     remark:Inflow to SWMF C
  ** END OF RUN :    2

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



 RUN:COMMAND#
 003:0001-----------------------------------------------------------------------
    START
     [TZERO =    .00 hrs on        0]
     [METOUT=   2    (1=imperial, 2=metric output)]
     [NSTORM=   1 ]
     [NRUN  =   3 ]
#******************************************************************************
#  Project Name: [Shirley's Brook - SWMF C]           Project Number: [103106]
#  Date        : 05-28-2006
#  Modeller    : [M.Petepiece]
#  Company     : NOVATECH ENGINEERING CONSULTANTS LTD
#  License #   :  5320763
#
# Post-Development Conditions to SWM Facility 'C'
#******************************************************************************
 003:0002-----------------------------------------------------------------------
    READ STORM
     Filename = storm.001
     Comment  = City of Ottawa:  100yr-3hr Chicago (10 minute time step - 20
     [SDT=10.00:SDUR=   3.00:PTOT=  71.67]
 003:0003---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  * DESIGN STANDHYD    01:C-300    7.48     1.076 No_date    1:10   39.16 .546
     [XIMP=.30:TIMP=.37]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
 003:0004---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    01:C-300    7.48     1.076 No_date    1:10   39.16  n/a
      Major System /  02:C-3maj     .00      .000 No_date    0:00     .00  n/a
      Minor System \  09:C-3min    7.48      .636 No_date    0:55   39.26  n/a
     {MjSysSto=.3154E+03, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
 003:0005---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  * DESIGN STANDHYD    01:C-201    1.96      .444 No_date    1:10   51.92 .725
     [XIMP=.57:TIMP=.64]
     [SLP=1.50:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
 003:0006---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  * DESIGN STANDHYD    02:C-202    3.07      .664 No_date    1:10   51.92 .725
     [XIMP=.57:TIMP=.64]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
 003:0007---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  * DESIGN STANDHYD    03:C-203    1.90      .247 No_date    1:10   36.14 .504
     [XIMP=.24:TIMP=.30]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
 003:0008---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  * DESIGN STANDHYD    04:C-204    5.20     1.121 No_date    1:10   51.92 .725
     [XIMP=.57:TIMP=.64]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
 003:0009---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  * DESIGN STANDHYD    05:C-205    2.22      .578 No_date    1:10   58.86 .821
     [XIMP=.70:TIMP=.80]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
 003:0010---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    ADD HYD            01:C-201    1.96      .444 No_date    1:10   51.92  n/a
                 +  02:C-202       3.07      .664 No_date    1:10   51.92  n/a
                 +  03:C-203       1.90      .247 No_date    1:10   36.14  n/a
                 +  04:C-204       5.20     1.121 No_date    1:10   51.92  n/a
                 +  05:C-205       2.22      .578 No_date    1:10   58.86  n/a
     [DT= 5.00]  SUM=  06:C-2     14.35     3.053 No_date    1:10   50.91  n/a
 003:0011---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    06:C-2     14.35     3.053 No_date    1:10   50.91  n/a
      Major System /  07:C2maj     2.28     1.748 No_date    1:10   50.91  n/a
      Minor System \  08:C2min    12.07     1.220 No_date    0:55   51.44  n/a
     {MjSysSto=.7180E+03, TotOvfVol=.1161E+04, N-Ovf=    1, TotDurOvf=    0.hrs
 003:0012---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  * DESIGN STANDHYD    01:C-101    3.16      .755 No_date    1:10   56.74 .792
     [XIMP=.70:TIMP=.70]
     [SLP= .60:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
 003:0013---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    01:C-101    3.16      .755 No_date    1:10   56.74  n/a
      Major System /  02:C101ma     .67      .475 No_date    1:10   56.74  n/a
      Minor System \  07:C101mi    2.49      .269 No_date    0:55   57.52  n/a
     {MjSysSto=.1580E+03, TotOvfVol=.3793E+03, N-Ovf=    1, TotDurOvf=    0.hrs
 003:0014---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  * DESIGN STANDHYD    06:C-103    1.20      .313 No_date    1:10   58.86 .821
     [XIMP=.70:TIMP=.80]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
 003:0015---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    DESIGN NASHYD      05:C-102     .90      .132 No_date    1:10   36.83 .514
     [CN= 80.0: N= 3.00]
     [Tp=  .17:DT= 5.00]
 003:0016---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    ADD HYD            05:C-102     .90      .132 No_date    1:10   36.83  n/a
                 +  06:C-103       1.20      .313 No_date    1:10   58.86  n/a
                 +  07:C101mi      2.49      .269 No_date    0:55   57.52  n/a
                 +  08:C2min      12.07     1.220 No_date    0:55   51.44  n/a
                 +  09:C-3min      7.48      .636 No_date    0:55   39.26  n/a
     [DT= 5.00]  SUM=  10:SWMC_I  24.14     2.570 No_date    1:10   48.12  n/a
 003:0017---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    ROUTE RESERVOIR -> 10:SWMC_I  24.14     2.570 No_date    1:10   48.12  n/a
     [RDT= 5.00] out<- 01:SWMC_O  24.14     2.313 No_date    1:40   48.12  n/a
     {MxStoUsed=.7360E+00}
 003:0018---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    SAVE HYD           10:SWMC_I  24.14     2.570 No_date    1:10   48.12  n/a
     fname :M:\2003\103106\DATA\CALCUL~1\SWMHYMO\SMWFC~1\SWMC_IN.003
     remark:Inflow to SWMF C
  ** END OF RUN :    3

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



 RUN:COMMAND#
 004:0001-----------------------------------------------------------------------
    START
     [TZERO =    .00 hrs on        0]
     [METOUT=   2    (1=imperial, 2=metric output)]
     [NSTORM=   1 ]
     [NRUN  =   4 ]
#******************************************************************************
#  Project Name: [Shirley's Brook - SWMF C]           Project Number: [103106]
#  Date        : 05-28-2006
#  Modeller    : [M.Petepiece]
#  Company     : NOVATECH ENGINEERING CONSULTANTS LTD
#  License #   :  5320763
#
# Post-Development Conditions to SWM Facility 'C'
#******************************************************************************
 004:0002-----------------------------------------------------------------------
    READ STORM
     Filename = storm.001
     Comment  = City of Ottawa:  100yr-12hr SCS Type II (10 min time step)
     [SDT=10.00:SDUR=  12.00:PTOT=  96.00]
 004:0003---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  * DESIGN STANDHYD    01:C-300    7.48      .922 No_date    6:00   57.36 .598
     [XIMP=.30:TIMP=.37]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
 004:0004---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    01:C-300    7.48      .922 No_date    6:00   57.36  n/a
      Major System /  02:C-3maj     .00      .000 No_date    0:00     .00  n/a
      Minor System \  09:C-3min    7.48      .636 No_date    5:45   57.27  n/a
     {MjSysSto=.2175E+03, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
 004:0005---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  * DESIGN STANDHYD    01:C-201    1.96      .331 No_date    6:00   72.71 .757
     [XIMP=.57:TIMP=.64]
     [SLP=1.50:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
 004:0006---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  * DESIGN STANDHYD    02:C-202    3.07      .512 No_date    6:00   72.71 .757
     [XIMP=.57:TIMP=.64]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
 004:0007---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  * DESIGN STANDHYD    03:C-203    1.90      .220 No_date    6:00   53.69 .559
     [XIMP=.24:TIMP=.30]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
 004:0008---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  * DESIGN STANDHYD    04:C-204    5.20      .865 No_date    6:00   72.71 .757
     [XIMP=.57:TIMP=.64]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
 004:0009---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  * DESIGN STANDHYD    05:C-205    2.22      .423 No_date    6:00   81.18 .846
     [XIMP=.70:TIMP=.80]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
 004:0010---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    ADD HYD            01:C-201    1.96      .331 No_date    6:00   72.71  n/a
                 +  02:C-202       3.07      .512 No_date    6:00   72.71  n/a
                 +  03:C-203       1.90      .220 No_date    6:00   53.69  n/a
                 +  04:C-204       5.20      .865 No_date    6:00   72.71  n/a
                 +  05:C-205       2.22      .423 No_date    6:00   81.18  n/a
     [DT= 5.00]  SUM=  06:C-2     14.35     2.352 No_date    6:00   71.50  n/a
 004:0011---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    06:C-2     14.35     2.352 No_date    6:00   71.50  n/a
      Major System /  07:C2maj     1.03     1.088 No_date    6:00   71.50  n/a
      Minor System \  08:C2min    13.32     1.220 No_date    5:35   71.50  n/a
     {MjSysSto=.7180E+03, TotOvfVol=.7364E+03, N-Ovf=    1, TotDurOvf=    0.hrs
 004:0012---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  * DESIGN STANDHYD    01:C-101    3.16      .562 No_date    6:00   78.22 .815
     [XIMP=.70:TIMP=.70]
     [SLP= .60:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
 004:0013---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    01:C-101    3.16      .562 No_date    6:00   78.22  n/a
      Major System /  02:C101ma     .34      .287 No_date    6:00   78.22  n/a
```

```
       Minor System \  07:C101mi     2.82     .269 No_date    5:35   78.12  n/a
      {MjSysSto=.1580E+03, TotOvfVol=.2632E+03, N-Ovf=    1, TotDurOvf=    0.hrs
 004:0014---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  *  DESIGN STANDHYD    06:C-103      1.20     .232 No_date    6:00   81.18 .846
      [XIMP=.70:TIMP=.80]
      [SLP=1.00:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
 004:0015---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     DESIGN NASHYD      05:C-102       .90     .129 No_date    6:00   56.52 .589
      [CN= 80.0: N= 3.00]
      [Tp=  .17:DT= 5.00]
 004:0016---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     ADD HYD            05:C-102       .90     .129 No_date    6:00   56.52  n/a
                   +  06:C-103      1.20     .232 No_date    6:00   81.18  n/a
                   +  07:C101mi     2.82     .269 No_date    5:35   78.12  n/a
                   +  08:C2min     13.32    1.220 No_date    5:35   71.50  n/a
                   +  09:C-3min     7.48     .636 No_date    5:45   57.27  n/a
      [DT= 5.00]  SUM=  10:SWMC_I    25.72    2.486 No_date    6:00   68.02  n/a
 004:0017---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     ROUTE RESERVOIR -> 10:SWMC_I    25.72    2.486 No_date    6:00   68.02  n/a
      [RDT= 5.00] out<- 01:SWMC_O    25.72    2.477 No_date    6:10   68.02  n/a
     {MxStoUsed=.7391E+00}
 004:0018---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     SAVE HYD           10:SWMC_I    25.72    2.486 No_date    6:00   68.02  n/a
      fname :M:\2003\103106\DATA\CALCUL~1\SWMHYMO\SMWFC~1\SWMC_IN.004
      remark:Inflow to SWMF C
 004:0002------------------------------------------------------------------------
      FINISH
--------------------------------------------------------------------------------
********************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
 001:0005 DESIGN STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 001:0006 DESIGN STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 001:0007 DESIGN STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 001:0008 DESIGN STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 001:0009 DESIGN STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 001:0012 DESIGN STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 001:0014 DESIGN STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0003 DESIGN STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0005 DESIGN STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0006 DESIGN STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0007 DESIGN STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0008 DESIGN STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0009 DESIGN STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0012 DESIGN STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0014 DESIGN STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 003:0003 DESIGN STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 003:0005 DESIGN STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 003:0006 DESIGN STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 003:0007 DESIGN STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 003:0008 DESIGN STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 003:0009 DESIGN STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 003:0012 DESIGN STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 003:0014 DESIGN STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 004:0003 DESIGN STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 004:0005 DESIGN STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 004:0006 DESIGN STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 004:0007 DESIGN STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 004:0008 DESIGN STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 004:0009 DESIGN STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 004:0012 DESIGN STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 004:0014 DESIGN STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
   Simulation ended on 2006-10-05     at 09:39:07
================================================================================
```

TEMPEST Product Submittal Package R1

<u>Date</u>: November 1, 2019

<u>Customer</u>: Novatech

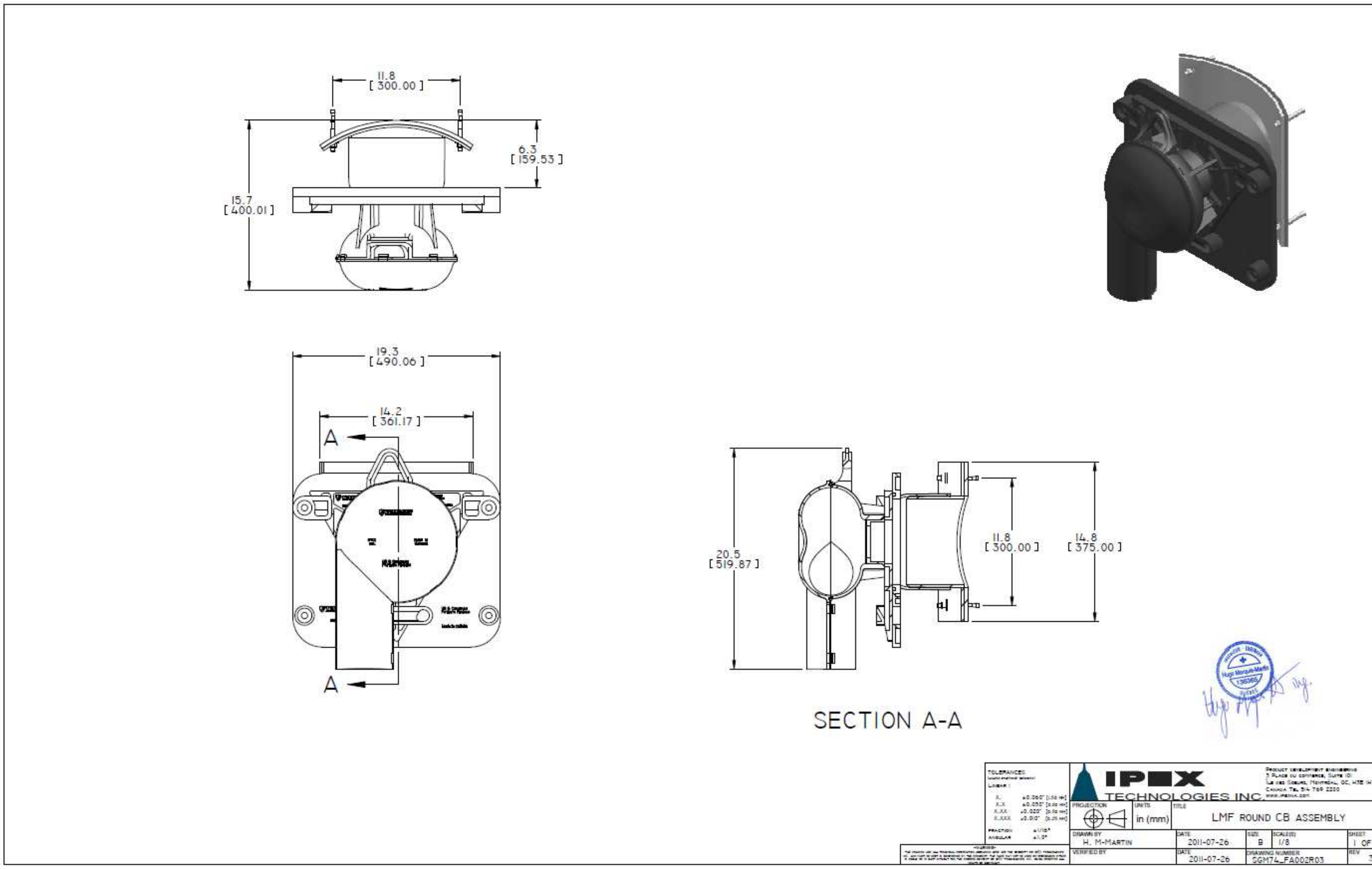
<u>Contact</u>: Conrad Stang

<u>Location</u>: Ottawa

<u>Project Name</u>: Strandherd Drive (Myers)

IPEX

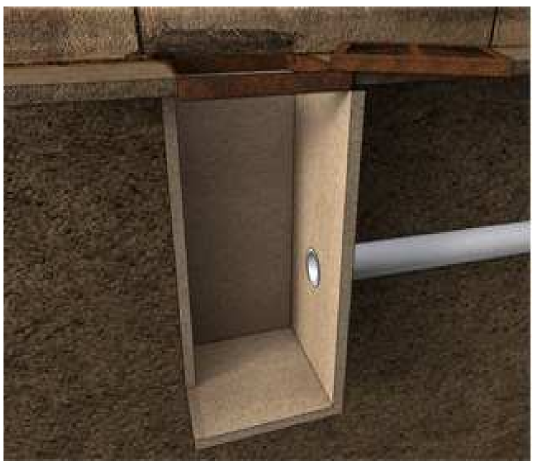
<u>Tempest LMF ICD Rd</u> Shop Drawing

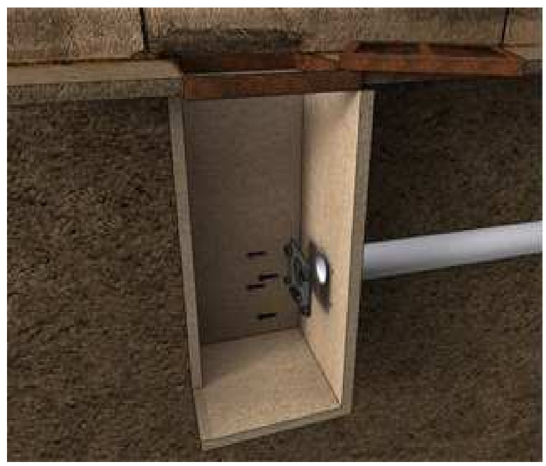


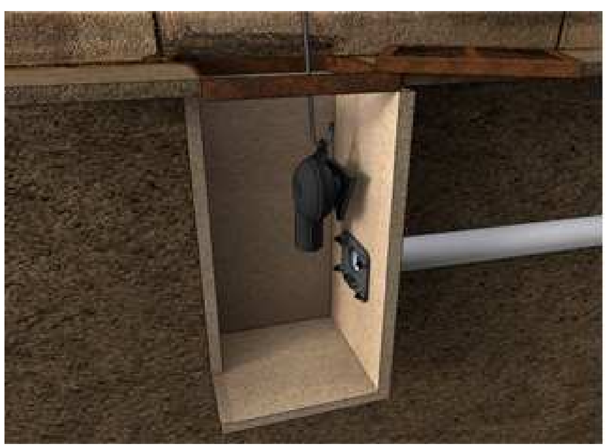
IPEX

<u>**Square CB Installation Notes:**</u>

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 3/8x3-1/2, (4) washers, (4) nuts
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. Put the nuts on the top of the anchors to protect the threads when you will hit the anchors with the hammer. Remove the nuts on the ends of the anchors
5. Install the wall mounting plate on the anchors and screw the nut 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 ground above using a reach bar, lower the device by hooking the end of the reach bar to the handle of the LMF device. Align the triangular plate portion into the mounting wall plate. Push down the device to be sure it has centered in to the wall mounting plate and has created a seal.

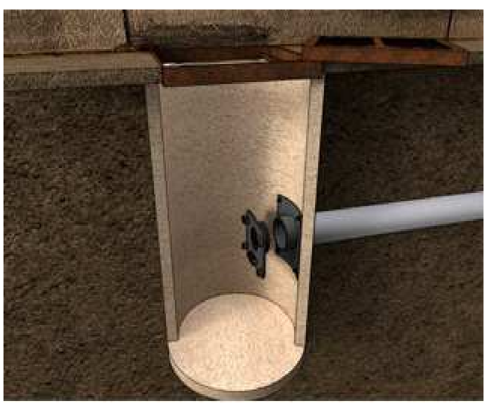






Round CB Installation Notes: (Refer to square install notes above for steps 1 , 3, & 4)

2. Use 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.
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 lb-ft). There should be no gap between the CB spigot wall plate and the catch basin wall.
6. Apply solvent cement on the hub of the universal mounting plate and the spigot of the spigot CB wall plate. 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 into the mounting plate and has created a seal.



CAUTION/WARNING/DISCLAIM:

- Verify that the inlet(s) pipe(s) is not protruding into the catch basin. If it is, cut it back so that the inlet pipe is flush with the catch basin wall.
- Any required cement in the installation must be approved for PVC.
- The solvent cement should not be used below 0°C (32°F) or in a high humidity environment. Please refer to the IPEX solvent cement guide to confirm required curing times or attend the IPEX **Online Solvent Cement Training Course**.
- Call your IPEX representative for more information or if you have any questions about our products.

IPEX TEMPEST Inlet Control Devices 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 where specified. 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 must 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.

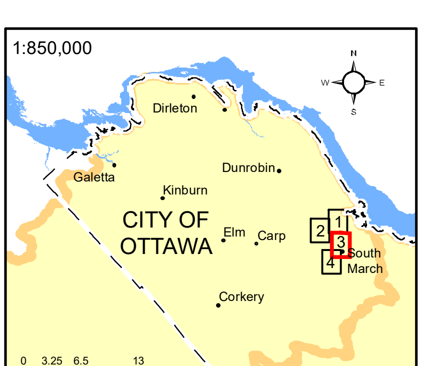
Mississippi Valley Conservation Authority

Shirley's Brook Flood Plain Mapping Study

April 2017
Draft Final September 2017
Final Report November 2017

10970 Hwy 7, Carleton Place, ON K7C 3P1· Tel. (613) 253-0006 · Fax (613) 253-0122 · info@mvc.on.ca

MVCA is a member of Conservation Ontario~Natural Champions



Shirley's Brook Flood Plain Mapping

LEGEND

- Stream
- Cross Sections
- Shirley's Brook Watershed
- Provincially Significant Wetland

Cross Section
3010

1:8,000

Map Projection:
UTM Zone 18 - NAD 83 Datum

Mississippi Valley Conservation Authority

0 250 500 1,000 Meters

Main Branch	Reach 2	4877	12 Hr SCS 2	3.47	72.87	0.54	1.34	0.68
Main Branch	Reach 2	4861	12 Hr SCS 2	3.47	72.56	2.13	1.3	0.64
Main Branch	Reach 2	4851		Culvert				
Main Branch	Reach 2	4841	12 Hr SCS 2	3.47	72.62	1.54	1.3	0.64
Main Branch	Reach 2	4817	12 Hr SCS 2	3.47	72.48	1.18	1.27	0.63
Main Branch	Reach 2	4750	12 Hr SCS 2	3.47	71.96	1.18	1.23	0.54
Main Branch	Reach 2	4653	12 Hr SCS 2	3.47	71.62	0.73	1.1	0.49
Main Branch	Reach 2	4600	12 Hr SCS 2	3.47	71.5	0.8	0.99	0.48
Main Branch	Reach 2	4549	12 Hr SCS 2	3.47	71.16	1.6	0.94	0.46
Main Branch	Reach 2	4509	12 Hr SCS 2	3.47	71.15	0.5	0.85	0.4
Main Branch	Reach 2	4477	12 Hr SCS 2	3.47	71.11	0.66	0.77	0.33
Main Branch	Reach 1	4384	12 Hr SCS 2	6.11	70.65	1.07	23	47.36
Main Branch	Reach 1	4347	12 Hr SCS 2	6.11	70.57	0.8	22.76	47.33
Main Branch	Reach 1	4305	12 Hr SCS 2	6.11	70.5	0.64	22.26	47.28
Main Branch	Reach 1	4254	12 Hr SCS 2	6.11	70.32	1.24	21.98	47.19
Main Branch	Reach 1	4208	12 Hr SCS 2	6.11	70.01	1.72	21.94	47.13
Main Branch	Reach 1	4181	12 Hr SCS 2	6.11	69.46	2.18	21.94	47.12
Main Branch	Reach 1	4056	12 Hr SCS 2	6.11	69.25	0.65	21.44	46.76
Main Branch	Reach 1	4032	12 Hr SCS 2	6.11	69.18	1	21.35	46.6
Main Branch	Reach 1	4013		Culvert				
Main Branch	Reach 1	3987	12 Hr SCS 2	6.11	69.17	1.04	21.35	46.6
Main Branch	Reach 1	3959	12 Hr SCS 2	6.11	69.16	0.53	21.13	46.39
Main Branch	Reach 1	3768	12 Hr SCS 2	6.11	69.01	0.76	19.82	45.3
Main Branch	Reach 1	3643	12 Hr SCS 2	6.11	68.72	1.08	19.06	45.14
Main Branch	Reach 1	3616	12 Hr SCS 2	6.11	68.37	2.12	19.02	45.09
Main Branch	Reach 1	3597		Culvert				
Main Branch	Reach 1	3586	12 Hr SCS 2	6.11	68.15	1.31	19.02	45.09
Main Branch	Reach 1	3562	12 Hr SCS 2	6.24	68.04	1.17	18.98	45.06
Main Branch	Reach 1	3455	12 Hr SCS 2	6.24	67.85	0.61	18.55	44.76
Main Branch	Reach 1	3346	12 Hr SCS 2	6.24	67.68	0.65	18.11	44.31
Main Branch	Reach 1	3246	12 Hr SCS 2	6.24	67.39	0.69	17.97	43.55
Main Branch	Reach 1	3200	12 Hr SCS 2	6.24	67.02		17.95	43.07
Main Branch	Reach 1	3146	12 Hr SCS 2	6.24	66.94	0.02	17.71	41.79
Main Branch	Reach 1	2938	12 Hr SCS 2	6.24	66.91	0.3	14.5	39.6
Main Branch	Reach 1	2830	12 Hr SCS 2	6.24	66.83	0.9	12.47	39.38
Main Branch	Reach 1	2814		Culvert				
Main Branch	Reach 1	2800	12 Hr SCS 2	6.24	66.64	0.67	12.47	39.38
Main Branch	Reach 1	2741	12 Hr SCS 2	7.55	66.59	0.56	12.36	35.63
Main Branch	Reach 1	2673	12 Hr SCS 2	7.55	66.56	0.58	12.23	33.39
Main Branch	Reach 1	2616	12 Hr SCS 2	7.55	66.37	1.52	12.18	30.52
Main Branch	Reach 1	2606		Culvert				
Main Branch	Reach 1	2600	12 Hr SCS 2	7.55	66.32	1.04	12.18	30.52
Main Branch	Reach 1	2582	12 Hr SCS 2	7.55	66.33	0.63	12.17	30.05
Main Branch	Reach 1	2343	12 Hr SCS 2	7.55	65.94	1.48	11.98	23.73
Main Branch	Reach 1	2146	12 Hr SCS 2	7.55	65.66	0.69	11.57	20.05
Main Branch	Reach 1	2026	12 Hr SCS 2	7.55	65.51	1.16	10.83	19.53
Main Branch	Reach 1	1947	12 Hr SCS 2	7.55	65.17	1.55	10.61	19.15

Main Branch	Reach 2	4877	12 Hr SCS 5	5.61	73.14	0.56	2.32	1.08
Main Branch	Reach 2	4861	12 Hr SCS 5	5.61	72.73	2.5	2.27	1.02
Main Branch	Reach 2	4851		Culvert				
Main Branch	Reach 2	4841	12 Hr SCS 5	5.61	72.77	2.03	2.27	1.02
Main Branch	Reach 2	4817	12 Hr SCS 5	5.61	72.6	1.51	2.22	1
Main Branch	Reach 2	4750	12 Hr SCS 5	5.61	72.13	1.23	2.16	0.82
Main Branch	Reach 2	4653	12 Hr SCS 5	5.61	71.79	0.91	1.94	0.7
Main Branch	Reach 2	4600	12 Hr SCS 5	5.61	71.65	0.97	1.76	0.69
Main Branch	Reach 2	4549	12 Hr SCS 5	5.61	71.37	1.47	1.66	0.63
Main Branch	Reach 2	4509	12 Hr SCS 5	5.61	71.34	0.61	1.54	0.53
Main Branch	Reach 2	4477	12 Hr SCS 5	5.61	71.29	0.85	1.41	0.44
Main Branch	Reach 1	4384	12 Hr SCS 5	9.9	70.84	1.05	46.4	82.46
Main Branch	Reach 1	4347	12 Hr SCS 5	9.9	70.78	0.83	45.99	82.41
Main Branch	Reach 1	4305	12 Hr SCS 5	9.9	70.7	0.79	45.26	82.34
Main Branch	Reach 1	4254	12 Hr SCS 5	9.9	70.56	1.18	44.81	82.04
Main Branch	Reach 1	4208	12 Hr SCS 5	9.9	70.21	2.11	44.73	81.83
Main Branch	Reach 1	4181	12 Hr SCS 5	9.9	69.65	2.48	44.72	81.81
Main Branch	Reach 1	4056	12 Hr SCS 5	9.9	69.47	0.63	43.94	81.16
Main Branch	Reach 1	4032	12 Hr SCS 5	9.9	69.37	1.34	43.8	80.9
Main Branch	Reach 1	4013		Culvert				
Main Branch	Reach 1	3987	12 Hr SCS 5	9.9	69.35	1.39	43.8	80.9
Main Branch	Reach 1	3959	12 Hr SCS 5	9.9	69.35	0.62	43.49	80.62
Main Branch	Reach 1	3768	12 Hr SCS 5	9.9	69.19	0.82	41.45	79.06
Main Branch	Reach 1	3643	12 Hr SCS 5	9.9	68.93	1.16	40.1	78.77
Main Branch	Reach 1	3616	12 Hr SCS 5	9.9	68.51	2.52	40	78.67
Main Branch	Reach 1	3597		Culvert				
Main Branch	Reach 1	3586	12 Hr SCS 5	9.9	68.3	1.69	40	78.67
Main Branch	Reach 1	3562	12 Hr SCS 5	10.16	68.18	1.39	39.91	78.6
Main Branch	Reach 1	3455	12 Hr SCS 5	10.16	67.97	0.72	38.89	78.18
Main Branch	Reach 1	3346	12 Hr SCS 5	10.16	67.78	0.79	37.76	77.63
Main Branch	Reach 1	3246	12 Hr SCS 5	10.16	67.48	0.8	37.46	76.46
Main Branch	Reach 1	3200	12 Hr SCS 5	10.16	67.27	0.29	37.42	75.56
Main Branch	Reach 1	3146	12 Hr SCS 5	10.16	67.26	0.09	36.83	72.75
Main Branch	Reach 1	2938	12 Hr SCS 5	10.16	67.25	0.18	29.24	67.47
Main Branch	Reach 1	2830	12 Hr SCS 5	10.16	67.24	0.22	23.1	66.56
Main Branch	Reach 1	2814		Culvert				
Main Branch	Reach 1	2800	12 Hr SCS 5	10.16	66.76	0.98	23.1	66.56
Main Branch	Reach 1	2741	12 Hr SCS 5	12.12	66.73	0.46	22.73	60.2
Main Branch	Reach 1	2673	12 Hr SCS 5	12.12	66.71	0.47	22.31	56.18
Main Branch	Reach 1	2616	12 Hr SCS 5	12.12	66.13	3.16	22.16	52.35
Main Branch	Reach 1	2606		Culvert				
Main Branch	Reach 1	2600	12 Hr SCS 5	12.12	66.4	0.76	22.16	52.35
Main Branch	Reach 1	2582	12 Hr SCS 5	12.12	66.39	0.73	22.14	51.7
Main Branch	Reach 1	2343	12 Hr SCS 5	12.12	66.08	1.11	21.58	39.93
Main Branch	Reach 1	2146	12 Hr SCS 5	12.12	65.78	0.8	20.75	31.23
Main Branch	Reach 1	2026	12 Hr SCS 5	12.12	65.64	1.15	19.35	30.33
Main Branch	Reach 1	1947	12 Hr SCS 5	12.12	65.32	1.71	18.69	29.51

Main Branch	Reach 2	4877	12 Hr SCS 100	12.82	73.96	0.56	5.24	2.28
Main Branch	Reach 2	4861	12 Hr SCS 100	12.82	73.6	2.36	5.04	2.09
Main Branch	Reach 2	4851		Culvert				
Main Branch	Reach 2	4841	12 Hr SCS 100	12.82	73.08	3.36	5.04	2.09
Main Branch	Reach 2	4817	12 Hr SCS 100	12.82	72.8	2.49	4.96	2.05
Main Branch	Reach 2	4750	12 Hr SCS 100	12.82	72.47	1.27	4.85	1.63
Main Branch	Reach 2	4653	12 Hr SCS 100	12.82	72.2	1.15	4.34	1.3
Main Branch	Reach 2	4600	12 Hr SCS 100	12.82	72.06	1.23	3.93	1.27
Main Branch	Reach 2	4549	12 Hr SCS 100	12.82	71.85	1.57	3.68	1.12
Main Branch	Reach 2	4509	12 Hr SCS 100	12.82	71.82	0.87	3.45	0.92
Main Branch	Reach 2	4477	12 Hr SCS 100	12.82	71.75	1.17	3.19	0.75
Main Branch	Reach 1	4384	12 Hr SCS 100	24.2	71.26	1.21	106.66	169.04
Main Branch	Reach 1	4347	12 Hr SCS 100	24.2	71.19	1.13	105.87	168.95
Main Branch	Reach 1	4305	12 Hr SCS 100	24.2	71.05	1.32	104.65	168.82
Main Branch	Reach 1	4254	12 Hr SCS 100	24.2	70.92	1.2	103.84	168.07
Main Branch	Reach 1	4208	12 Hr SCS 100	24.2	70.71	2.05	103.55	167.31
Main Branch	Reach 1	4181	12 Hr SCS 100	24.2	70.3	2.61	103.45	167.07
Main Branch	Reach 1	4056	12 Hr SCS 100	24.2	70.38	0.56	101.41	164.23
Main Branch	Reach 1	4032	12 Hr SCS 100	24.2	70.21	1.8	101.04	163.19
Main Branch	Reach 1	4013		Culvert				
Main Branch	Reach 1	3987	12 Hr SCS 100	24.2	70.12	1.9	101.04	163.19
Main Branch	Reach 1	3959	12 Hr SCS 100	24.2	70.16	0.64	100.26	162.55
Main Branch	Reach 1	3768	12 Hr SCS 100	24.2	70.12	0.47	94.02	156.93
Main Branch	Reach 1	3643	12 Hr SCS 100	24.2	70.1	0.5	87.22	154.87
Main Branch	Reach 1	3616	12 Hr SCS 100	24.2	69.97	1.56	85.93	153.91
Main Branch	Reach 1	3597		Culvert				
Main Branch	Reach 1	3586	12 Hr SCS 100	24.2	68.6	2.93	85.93	153.91
Main Branch	Reach 1	3562	12 Hr SCS 100	25.32	68.47	2.03	85.66	153.71
Main Branch	Reach 1	3455	12 Hr SCS 100	25.32	68.21	0.95	83.14	152.85
Main Branch	Reach 1	3346	12 Hr SCS 100	25.32	67.96	1.11	79.85	151.86
Main Branch	Reach 1	3246	12 Hr SCS 100	25.32	67.69	0.84	78.71	149.16
Main Branch	Reach 1	3200	12 Hr SCS 100	25.32	67.48	0.74	78.47	147.3
Main Branch	Reach 1	3146	12 Hr SCS 100	25.32	67.46	0.19	77.4	143.01
Main Branch	Reach 1	2938	12 Hr SCS 100	25.32	67.44	0.29	66.33	134.94
Main Branch	Reach 1	2830	12 Hr SCS 100	25.32	67.43	0.38	57.8	133.5
Main Branch	Reach 1	2814		Culvert				
Main Branch	Reach 1	2800	12 Hr SCS 100	25.32	66.88	2.19	57.8	133.5
Main Branch	Reach 1	2741	12 Hr SCS 100	28.42	66.81	0.8	57.15	124.61
Main Branch	Reach 1	2673	12 Hr SCS 100	28.42	66.76	0.92	56.5	119.7
Main Branch	Reach 1	2616	12 Hr SCS 100	28.42	66.61	1.43	56.28	113.32
Main Branch	Reach 1	2606		Culvert				
Main Branch	Reach 1	2600	12 Hr SCS 100	28.42	66.57	1.14	56.28	113.32
Main Branch	Reach 1	2582	12 Hr SCS 100	28.42	66.55	0.92	56.1	112.19
Main Branch	Reach 1	2343	12 Hr SCS 100	28.42	66.26	0.92	53.48	88.54
Main Branch	Reach 1	2146	12 Hr SCS 100	28.42	65.99	0.97	51.08	68.47
Main Branch	Reach 1	2026	12 Hr SCS 100	28.42	65.84	1.4	47.82	66.6
Main Branch	Reach 1	1947	12 Hr SCS 100	28.42	65.54	1.8	46.06	64.87

Appendix E

F-1004

EROSION AND SEDIMENT CONTROL PLAN, MONITORING, AND MEASURES

Scope of Work

The work under the applicable items includes the preparation, implementation and monitoring of an Erosion and Sediment Control Plan to prevent sediment-laden runoff resulting from the Contractor's construction operations from entering all sewers and watercourses both within and downstream from the Working Area. The plan shall include management and monitoring of water discharged from dewatering operations. The specification is limited to the management of sediment laden water and the management of contaminants such as hydrocarbons and volatile organic compounds present within groundwater at the site shall be managed as described elsewhere in the contract documents.

General

The Contractor acknowledges that surface erosion and sediment runoff resulting from construction operations has potential to cause a detrimental impact to any downstream watercourse, and that all construction operations that may impact upon water quality shall be carried out in a manner that strictly meets the requirements of all applicable legislation and regulations.

Accordingly, the Contractor shall be responsible for determining and conforming to the requirements of the Ontario Ministry of the Environment (MOE), the Ontario Ministry of Natural Resources, the City of Ottawa, applicable Conservation Authorities and any other Governmental Regulatory Agencies (collectively "Regulatory Agencies") having jurisdiction in the Working Area or over any potentially affected watercourses.

Erosion and Sediment Control Plan

Before commencing the Work, the Contractor shall submit to the Contract Administrator six copies of a detailed Erosion and Sediment Control Plan. The ESC Plan will consist of a written description and detailed drawings indicating the on-site activities and measures to be used to control erosion and sediment movement for each step of the Work. The written description shall be signed by, and the drawings shall bear the stamp and signature of a qualified Professional Engineer licensed in Ontario, herein designated as the Engineer of Record (EOR).

The Contractor acknowledges that the scheduling of the implementation of erosion and sediment controls is the key component for successful sediment control. Accordingly, the ESC Plan will contain a detailed schedule which identifies the following:

- Phasing of the steps for the installation of all control measures.
- Inspection, monitoring and maintenance of all control measures during construction.

EROSION AND SEDIMENT CONTROL PLAN, MONITORING, AND MEASURES

- Phasing of the removal and disposal of the control measures.

The Contractor acknowledges that no one measure is likely to be 100% effective for erosion protection and controlling sediment runoff and water discharges from the site. Therefore, where necessary the ESC Plan will implement sequential measures arranged in such a manner so as to mitigate sediment release from construction operations and achieve specific maximum permitted criteria where applicable. Suggested on-site measures may include, but shall not be limited to, the following methods: sediment ponds, filter bags, pump filters, settling tanks, silt fences, straw bales, filter cloths, check dams and/or berms, or other recognized technologies and methods available at the time of construction. Specific measures shall be installed in accordance with the requirements of OPSS 805 where appropriate, or in accordance with manufacturer's recommendations.

Inspection and Monitoring of Mitigation Measures

The Contractor shall be solely responsible for inspecting, monitoring and maintaining the effectiveness of the ESC Plan upon implementation. The Contractor shall submit to the Contract Administrator weekly inspection reports demonstrating the performance of the installed measures, identifying deficiencies and indentifying required maintenance issues. These reports shall be prepared, signed by the EOR and provided to the Contract Administrator within 48 hours of the inspection.

- Maintenance issues are defined as any measure which is not functioning to the satisfaction of the EOR and in the opinion of the EOR may be repaired by the contractor with subsequent re-inspection at the next scheduled EOR site inspection.
- Deficiencies are defined as any measure or lack of measure which has potential to cause an adverse environmental impact at the site given the current/forecasted conditions and schedule of the work.

Maintenance issues which have previously been identified but not adequately corrected shall be considered deficiencies.

Deficiencies shall be immediately corrected. Corrective actions shall be re-inspected and documented by the EOR. Re-inspection reports shall be specific to the deficiency observed and may be written field reports.

EOR monitoring reports submitted shall include:

- The date and time of the inspection and monitoring.
- General description of the mitigating measures being utilized at the site.
- Confirmation as to the effectiveness of the measures inspected.

EROSION AND SEDIMENT CONTROL PLAN, MONITORING, AND MEASURES

- Description of any maintenance issue which requires minor repair, improvement or maintenance.
- Description of any deficiency observed including timeline for correction and re-inspection.
- Deficiency re-inspection reports outstanding for the site.

The Contractor shall notify the Contract Administrator in all situations where a regulatory agency has identified deficiencies in erosion/sediment control measures, quality of runoff or quality of water quality discharged from dewatering operation.

Where in the opinion of the Contract Administrator either the proof of performance submitted is or the measures implemented are considered inadequate, the Contractor shall have the EOR review measures in the presence of the Contract Administrator within 24 hours of being notified in writing.

The Contractor shall monitor all weather forecasts and schedule the Work in order to minimize the risk of sediment-laden water from entering any watercourse or sewer system. The ESC Plan shall contain a Contingency Plan to include the provision of additional labour, equipment or materials to install additional control measures, and detail an emergency response plan in case of an accidental event. As such, the Contractor shall have additional control materials on site at all times which are easily accessible and may be implemented at a moment's notice.

Contractor's Responsibilities

The Contractor shall ensure that all workers, including sub-contractors, in the Working Area are aware of the importance of the erosion and sediment control measures and informed of the consequences of the failure to comply with the requirements of all Regulatory Agencies and the specifications detailed herein.

The Contractor shall periodically, and when requested by the Contract Administrator or EOR, clean out accumulated sediment deposits as required at the sediment control devices, including those deposits that may originate from outside the construction area. Accumulated sediment shall be removed in such a manner that prevents the deposition of this material into any sewer or watercourse and avoids damage to the control measure. The sediment shall be removed from the site at the Contractor's expense and managed in compliance with the requirements for excess earth material, as specified elsewhere in the Contract.

The Contractor shall immediately report to applicable regulatory agencies and the Contract Administrator any accidental discharges of sediment material into either the watercourse or the storm sewer system. Failure to report will be constitute a breach of this specification and the Contractor may also be subject to the penalties imposed by any

EROSION AND SEDIMENT CONTROL PLAN, MONITORING, AND MEASURES

applicable Regulatory Agency. Appropriate response measures, including any repairs to existing control measures or the implementation of additional control measures, shall be carried out by the Contractor without delay.

The sediment control measures shall be removed when, in the opinion of the EOR, the measure(s) is no longer required. No control measure may be permanently removed without prior written authorization from the EOR. All sediment and erosion control measures shall be removed in a manner that avoids the entry of sediment or debris into any sewer or watercourse within or downstream of the Working Area. All accumulated sediment shall be removed from the Working Area at the Contractor's expense and managed in compliance with the requirements for excess earth material, as specified elsewhere in the Contract. Any seeding and mulching, temporary cover, sodding or original turf cover that is disturbed by the removal of the control measures and accumulated sediment, shall be brought to final grade and restored. Payment for the supply and placing of ground cover at these locations shall be made under the applicable items listed elsewhere in the Contract.

Where, in the opinion of either the Contract Administrator or a Regulatory Agency, any of the terms specified herein have either not been complied with or not performed in a suitable manner, the Contract Administrator or Regulatory Agency has the right to immediately withdraw its permission to continue the work but may renew its permission upon being satisfied that the defaults and/or deficiencies in the performance of this specification by the Contractor have been remedied. No compensation will be made to the Contractor for the withdrawal of permission to do the work resulting from non-compliance with the requirements of this specification and the Regulatory Agencies.

In addition to any other remedy and/or penalty provided by law, where there has been default or non-compliance with any of the terms specified herein and the Contractor refuses to perform or rectify same within forty-eight (48) hours of the receipt of the written demand of the Contract Administrator to do so, the Owner is hereby entitled to enter upon the Working Area and either complete the work in conformity with the Contract or have the work done that it considers necessary to complete the Work to its intended condition, whichever, in the Owner's sole opinion, is the most reasonable course of action. The Contractor and the Owner further agree that the costs incurred for any such work shall be retained by the Owner from monies otherwise due to the Contractor.

Monitoring of Water Quality Impacts and Point Source Discharges

The Contractor shall monitor runoff quality and quantity of water discharged from dewatering operations. The work shall include turbidity monitoring of impacts to watercourses (upstream vs downstream conditions), total suspended solids (TSS) monitoring of point sources such as those from dewatering operations. Discharge shall be in accordance with site specific constraints, regulatory requirements and sewer use bylaw

EROSION AND SEDIMENT CONTROL PLAN, MONITORING, AND MEASURES

requirements. Where no specific criteria has otherwise been identified, the contractor shall meet the following discharge objective.

Source	Objective	Monitoring Frequency (min)
Watercourse Impacts	Downstream turbidity not to exceed upstream levels by greater than 25%	Minimum of daily for first three days of operation Minimum of twice weekly on an ongoing basis Daily for situations where the work is being conducted within 20 metres of a watercourse.
Discharge from Dewatering Operations	TSS maximum level of 25 mg/L	Minimum of daily for first three days of operation Minimum of twice weekly on an ongoing basis

Monitoring frequency to increase where scheduled construction operations have potential to impair water quality.

Mitigation and Action by Contractor Where Monitoring Indicates Water Impacts or Discharges Over Criteria or Objectives

Where site specific criteria or objectives are not attained, the Contractor and/or EOR shall immediately notify applicable regulatory agency of the monitoring results and possible impacts to sewers and watercourses. The Contractor shall implement an Action/Mitigation Plan acceptable to the EOR and applicable regulatory agency prior to continuing or resuming construction activities.

Measurement and Basis of Payment

Item – Erosion and Sediment Control Plan and Monitoring

Payment at the Contract price for the item “Erosion and Sediment Control Plan and Monitoring” shall be full compensation for the preparation and monitoring of the Erosion and Sediment Control Plan.

Payment shall be based upon the following schedule:

a) 25% upon satisfactory submission and implementation of the ESC Plan; and,
b) 75% pro-rated into equal payments over the term of the contract.

EROSION AND SEDIMENT CONTROL PLAN, MONITORING, AND MEASURES

This payment schedule may only be modified as agreed upon in writing between the Contractor and the Contract Administrator.

Item – Erosion and Sediment Control Measures

Payment at the Contract price for the item “Erosion and Sediment Control Measures” shall be full compensation for the implementation and maintenance of erosion and sediment control measures required for the site, and shall include all labour, equipment and materials to supply, construct, monitor and maintain all erosion and sediment control measures detailed therein.

Payment shall be based upon the following schedule:

a) 20% upon satisfactory installation of the control measures;
b) 70% pro-rated into equal payments over the term of the contract; and,
c) 10% upon successful completion and removal of the ESC Plan protection measures.

This payment schedule may only be modified as agreed upon in writing between the Contractor and the Contract Administrator.

Warrant: For work which is conducted in close proximity to watercourses or environmentally sensitive areas.

Appendix F

Shirley's Brook SWM Facility 'C' Detailed Design Report

Prepared by Novatech (November 2006)

SHIRLEY'S BROOK
SWM FACILITY 'C'
DETAILED DESIGN REPORT

Prepared By:

NOVATECH ENGINEERING CONSULTANTS LTD.
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario
K2M 1P6

Submitted: May 2006
Revised November 2006

Novatech File: 103106-0
City File No: D07-16-04-0014
Ref: R-2006-105

NOVATECH
ENGINEERING
CONSULTANTS LTD.

November 9, 2006

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

Attention: **Mr. Stuart Moxley**
Infrastructure Approvals Officer

Dear Sir:

Reference: **Shirley's Brook – SWM Facility 'C'**
Detailed Design Report
Our File No.: 103106

Please find enclosed four (4) copies of the detailed design report for Shirley's Brook SWM Facility 'C'. The report has been amended pursuant to City of Ottawa comments. The facility has been designed in accordance with the criteria established in the *Shirley's Brook Floodplain Analysis & Stormwater Management Report* (NECL, November 2006).

Please do not hesitate to contact us if you have any questions or concerns regarding this report.

Yours truly,

NOVATECH ENGINEERING CONSULTANTS LTD.

Michael Petepiece, P.Eng
Project Engineer

TABLE OF CONTENTS

Tables

Figures

Appendices

1.0 INTRODUCTION

SWM Facility 'C' is one of three proposed SWM facilities intended to provide stormwater management for the Klondike Road Lands (refer to Figure 1) and will be located on the south shore of Shirley's Brook on the west side of March Valley Road.

The Klondike Road Lands are identified as collection Area W-2 in the *City of Ottawa Area-Specific Development Charge Background Study for Individual Stormwater Management Ponds and Drainage Systems* (C.N. Watson, June 2004).

SWM Facility 'C' will service a tributary drainage area of approximately 26.2 ha, comprised primarily of low and medium density residential dwellings west of the OCR, and industrial development east of the OCR. The proposed land use plan is shown on Figure 2. The storm drainage area plan is shown on Figure 3.

2.0 KLONDIKE ROAD LANDS TRIBUTARY TO SWMF 'C'

Stormwater management for the Klondike Road Lands has been designed pursuant to the major-minor system concept:

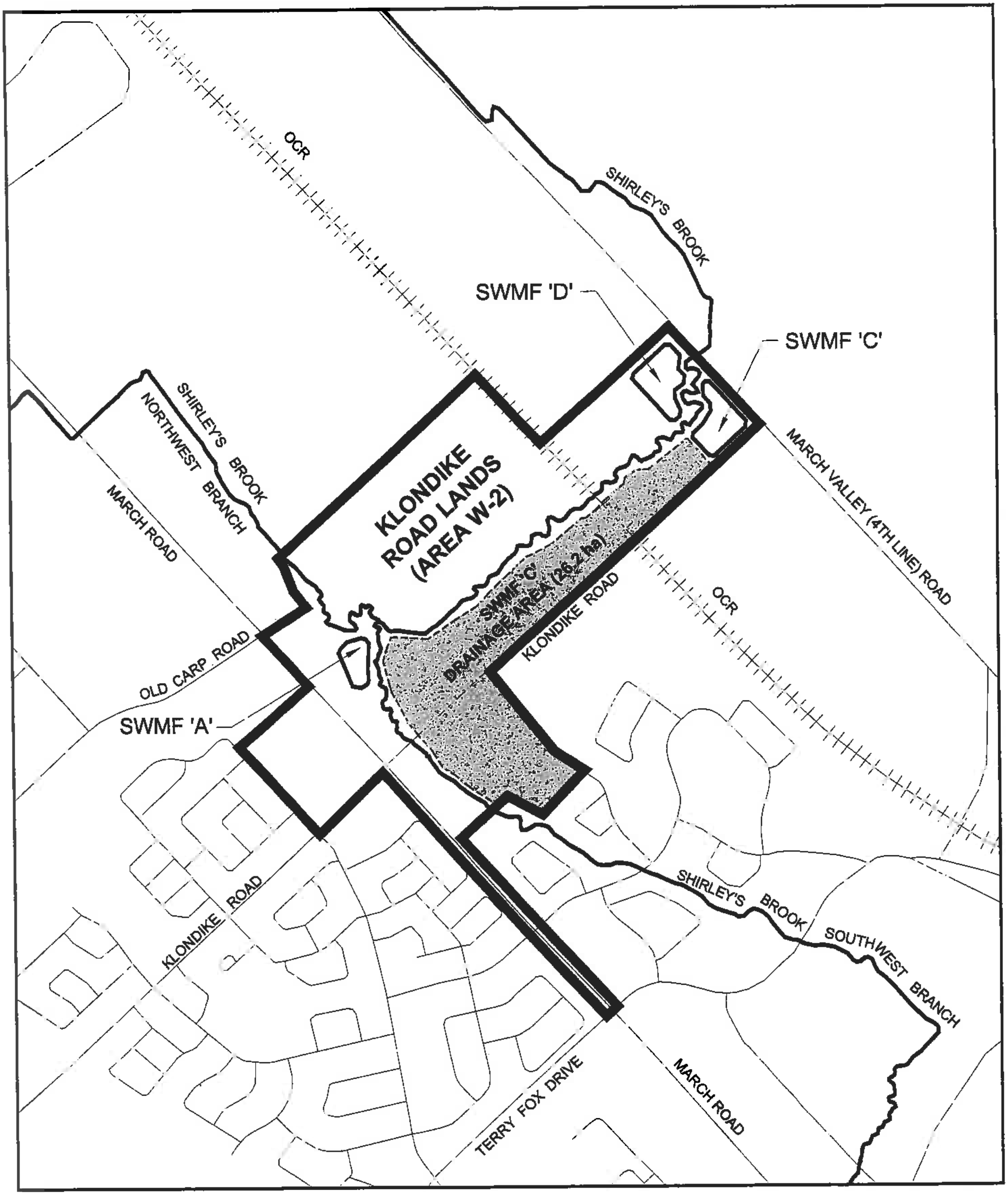
- Storm sewers will capture and convey minor system flows from the upstream drainage area to SWM facility 'C' for quality and quantity control;
- Storage for runoff that that exceeds the capacity of the minor system will be provided in road sags;
- Runoff volumes that exceed the storage provided in road sags will be conveyed overland along defined major system flow routes and outlet directly to Shirley's Brook. The exception is at Klondike Road, where major overland flow east of Area C-103 (refer to Figure 3) will bypass into the inlet channel for the Duck Club Pond.

2.1 Minor System

The Klondike Road storm sewers have been designed with the Rational Method using an initial time of concentration of 20 minutes. This assumes a 15 minute initial time of concentration within the residential development blocks, and 5 minutes of travel time within the upstream storm sewers at a velocity of 1 m/s. Storm design sheets are included in Appendix A. The Storm Drainage Area Plan is provided as Figure 3.

The sewers were sized to permit free flow conveyance of the runoff generated from a 5-year design storm. The design criteria used to determine the size of the storm sewers required to service the proposed development are as follows:

Minimum pipe size	=	300 mm diameter
Minimum velocity	=	0.8 m/s
Maximum velocity	=	3.0 m/s

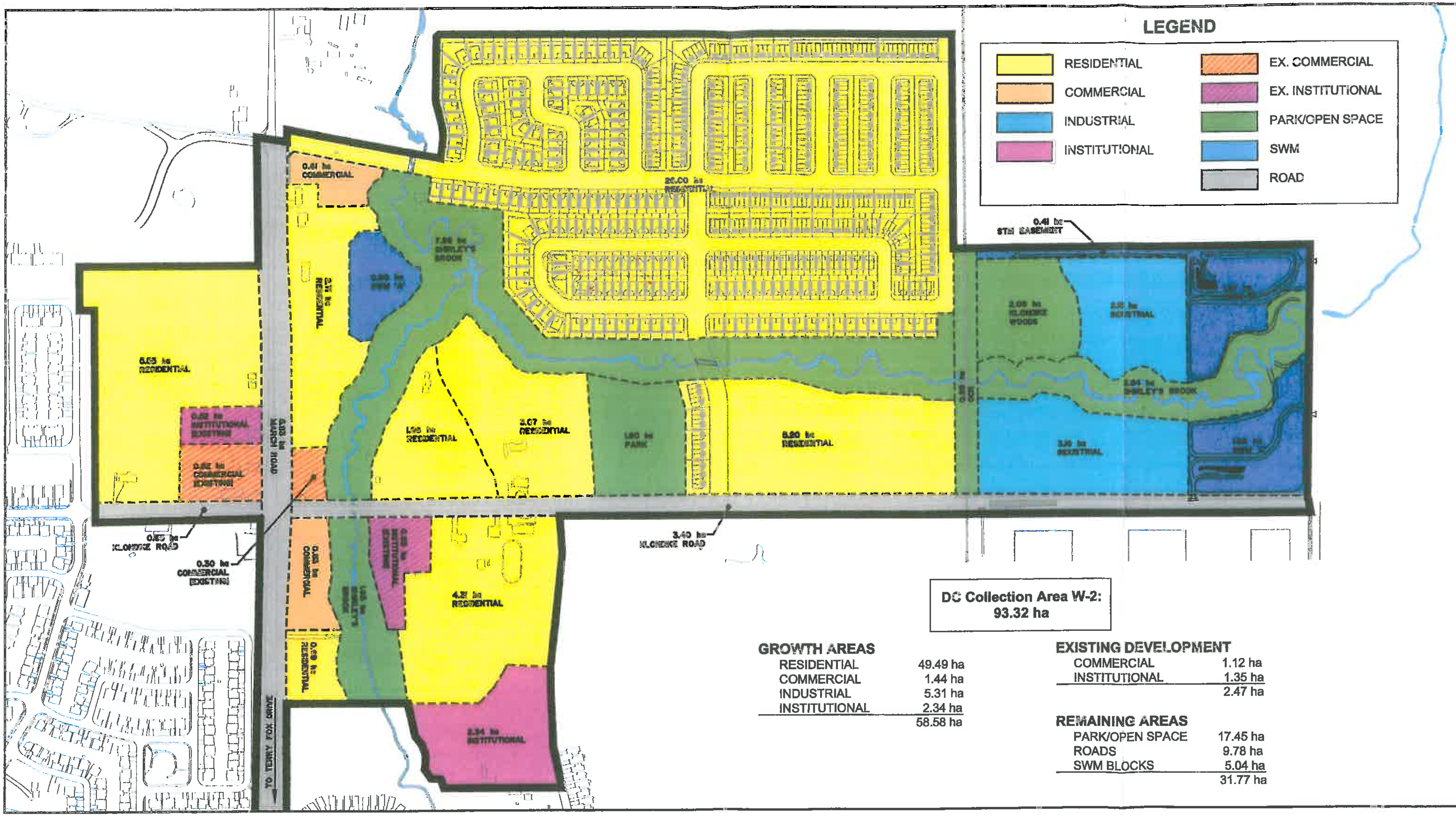


NOVATECH
ENGINEERING CONSULTANTS LTD.
ENGINEERS & PLANNERS
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada
K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Email: novainfo@novatech-eng.com

FIGURE 1
KLONDIKE ROAD LANDS / SWMF 'C'
KEY PLAN

103106 MAY 2006 N.T.S.

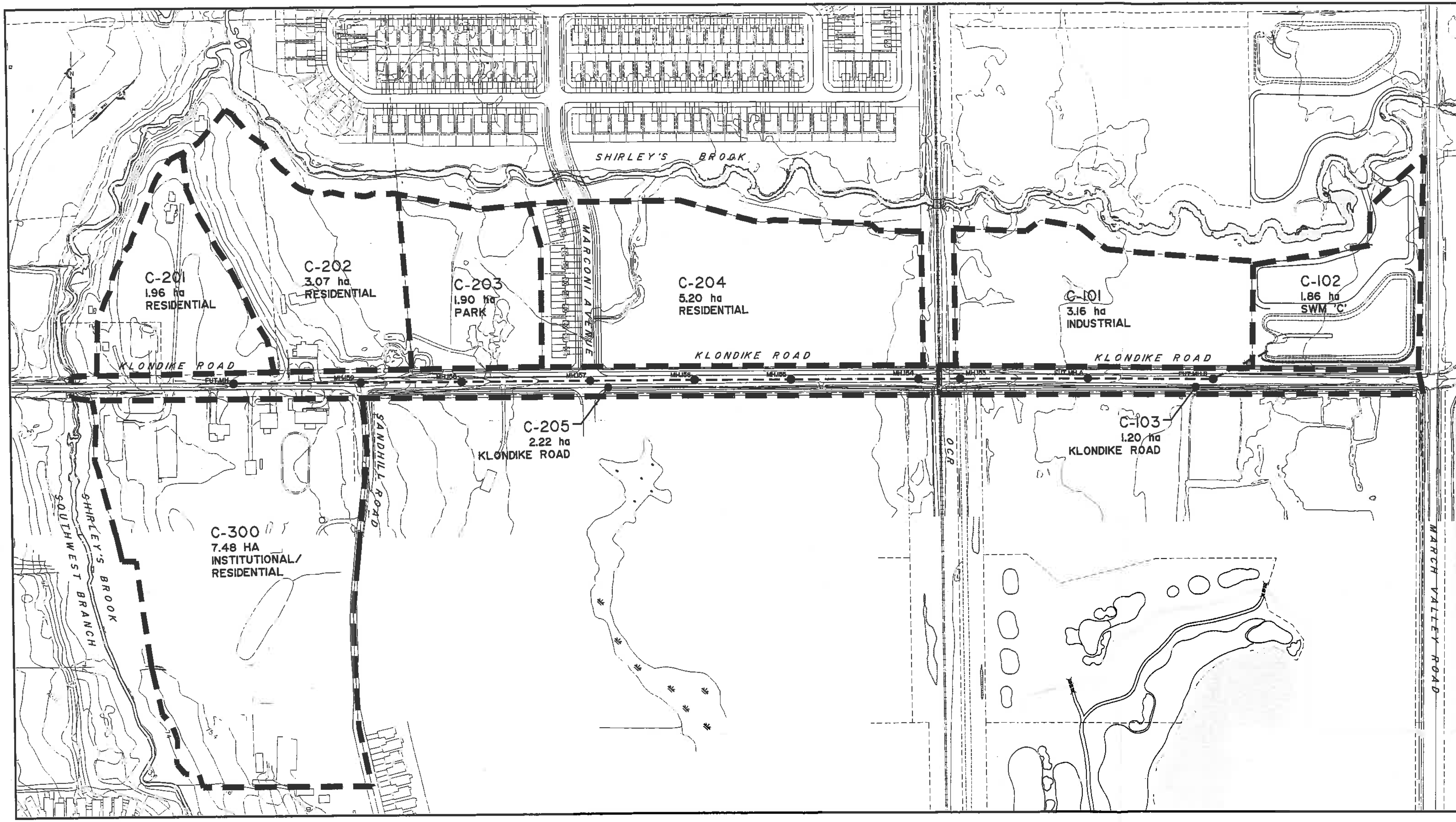
SHT8XII.DWG - 216mmX278mm



NOVATECH ENGINEERING CONSULTANTS LTD.
ENGINEERS & PLANNERS
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada
K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Email: novainfo@novatech-eng.com

FIGURE 2
KLONDIKE ROAD LANDS
LAND USE PLAN (AREA W-2)
103106 APRIL 2006 N.T.S.

SHTIIX17.DWG - 278mmX431mm



NOVATECH
ENGINEERING
CONSULTANTS LTD.
ENGINEERS & PLANNERS
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada
K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Email: novainfo@novatech-eng.com

FIGURE 3
STORM DRAINAGE AREAS
TO SWM FACILITY 'C'
103106 MAY 2006 N.T.S.

SHT11X17.DWG - 278mmX431mm

2.2 Major System

Major system flows will be conveyed overland within the public ROW and outlet into Shirley's Brook. Inlet control devices (ICDs) will be installed in the roadway catch basins to ensure flow into the storm sewer system does not exceed the 5-year runoff rates. Each pair of road catchbasins will be interconnected and will operate as a single inlet. Ponding will be restricted to a maximum depth of 0.30m in the right-of-way.

Major overland flow routes will be designed using open channel principles to ensure that the product of the velocity (m/s) x depth (m) within the right-of-ways does not exceed 0.6.

2.3 Hydraulic Grade Line Analysis

The hydraulic grade line in the Klondike Road storm sewer was calculated for the 1:100 year design event. The HGL elevations will be used in the grading design for the tributary drainage areas to ensure at least 0.30m of freeboard is provided between the design HGL and the underside of footing elevations.

The HGL elevations were calculated under steady-state conditions using the Darcy-Weisbach equation to calculate friction losses in the pipe network for a specified flow rate. Minor losses were accounted for at pipe bends using the Sewer Bend Loss Coefficients Design Chart from the City of Ottawa Sewer Design Guidelines. Additionally, entrance and exit structure losses were accounted for at each manhole. The detailed spreadsheet calculations are provided in Appendix A.

Under ultimate development conditions, the HGL in the Klondike Road Storm sewer was calculated starting from an HGL elevation of 67.57 at the inlet headwall to SWMF 'C'. Under interim development conditions, the HGL was calculated starting from an HGL elevation of 67.57 at the outlet headwall to the temporary drainage ditch just downstream of the OCR rail line. The starting HGL elevations were determined using the EPA SWMM hydraulic model. Additional details on the hydraulic modeling of the SWM facility is provided in Section 5.0.

3.0 HYDROLOGIC MODELING

The SWMHYMO hydrologic model was used to generate runoff hydrographs for the drainage areas tributary to SWM Facility 'C', and then separate the runoff hydrographs into major and minor system flows.

- Inflows to the minor system have been modeled at a maximum capture rate of 85 L/s/ha;
- On-site major system storage has been estimated at 50 m^3/ha;
- Major system flows that exceed the on-site storage will be conveyed overland to Shirley's Brook;
- Minor system flows will be conveyed by the Klondike Road storm sewer to SWMF 'C'.

3.1 Subcatchment Data

The modeling parameters used in the SWMHYMO analysis are representative of the proposed development within that subcatchment. Subcatchment areas are shown on Figure 3. SWMHYMO modeling data is provided in Appendix B.

3.2 Design Storms

The performance of the major and minor systems was modeled for the 25mm event, the 1:5 year event and the 1:100 year event using a 3-hour Chicago distribution.

The 3-hour Chicago distribution was used for the subdivision analysis, as short duration/high-intensity storms tend to produce higher peak flows from urban areas and are generally the critical events with regard to the design of the stormwater conveyance system.

The IDF parameters used to generate the design storms were taken from the City of Ottawa Sewer Design Guidelines.

3.3 Methodology

The SWMHYMO model was used to calculate the runoff, major and minor system flows, and major system storage for each subcatchment identified on the SWMHYMO Schematic (103106-SWM). The methodology used in the analysis is summarized below.

1. SWMHYMO calculates a total runoff hydrograph for a given subcatchment.
2. Is peak flow greater than inlet capacity?
   a. If yes, then calculate major system hydrograph (go to step 3).
   b. If no, then all flow is captured by minor system.
3. Does major system hydrograph volume exceed available storage volume?
   a. If yes, then calculate overland flow to next downstream subcatchment.
   b. If no, then all flow eventually enters minor system at inlet.
4. Add subcatchment minor system hydrograph (from Step 2b or Step 3b) to total minor system flow.
5. Calculate local runoff hydrograph for downstream subcatchment.
6. Add overland flow hydrographs from upstream catchments (from Step 3a - if any) to local runoff hydrograph.
7. Go to step 1.

3.4 Results – Hydrology

The results of the hydrologic analysis are summarized in Table 3.4-1. The minor system hydrographs generated using SWMHYMO were used in the hydraulic analysis of the pond. Additional details on the hydraulic analysis of SWM Facility 'C' are provided in Section 5.0.

Table 3.4-1

Return Period	Minor System Peak Flow (m^3/s)	
	Interim Development Conditions (23.0 ha)	Ultimate Development Conditions (26.2 ha)
25 mm	1.56	1.90
1:5 year	2.01	2.42
1:100 year	2.17	2.57

4.0 SWM FACILITY 'C' - DESIGN

SWM Facility 'C' has been sized to provide water quality and erosion control for a tributary drainage area of 26.2 ha. Hydrologic modeling of Shirley's Brook has demonstrated that quantity control is not required for storms greater than the 1:5 year event, as major system flows from the development areas will precede the peak flow in Shirley's Brook and will not increase peak flows within Shirley's Brook.

Refer to the *Shirley's Brook Floodplain Analysis & Stormwater Management Report* (NECL, November 2006) for additional details on the hydrologic analysis of Shirley's Brook.

4.1 Design Criteria

The criteria used in the design of SWM Facility 'C' are as follows:

- The SWM Facility will have a permanent pool and extended detention storage sized to provide a *Normal* level of water quality control for the upstream drainage area, as recommended in the *Shirleys Brook and Watts Creek Subwatershed Study*;
- Provide erosion control storage to limit outflows from the pond to a release rate of between 8-14 L/s/ha for the 1:5 year event, as per the Target Flow Rates listed in Table 4 of the *Kanata North EMP*;
- The forebay will have maximum side slopes of 3:1 (H:V), with a 1.0 m wide safety bench at the normal water level;
- The main cell of the SWM facility will have side slopes of 6:1 (H:V) below the normal water level;
- The active storage portions of the main cell will have maximum side slopes of 4:1;
- The sediment forebay will be sized to provide sufficient storage for 10 years of sediment accumulation;
- The dry pond will provide a net increase in both riparian and total floodplain storage in the reach of Shirley's Brook between the OCR and March Valley Road for all design events (2yr-100yr) to compensate for infilling of the pre-development floodplain through this reach; and
- The pond outlet will be subject to a range of tailwater conditions in Shirley's Brook and must be designed to operate effectively under backwater or submerged conditions for the full range of design events (up to the 1:100 year event).

4.2 Service Road

Access to SWM Facility 'C' will be provided by a 4.0 m wide service road constructed of 150mm of granular 'A' overtop of 300mm of granular 'B' and covered with a minimum of 10cm of seeded topsoil with accesses from March Valley Road and Klondike Road.

4.3 Inlet Structure

The inlet to SWM facility 'C' has been designed for both interim and ultimate development conditions. Until such time as Klondike Road is urbanized from the OCR to March Valley Road, the Klondike Road storm sewer will outlet to an open channel running parallel to Klondike Road, which will convey flows from the upstream drainage area to SWM Facility 'C'.

Once Klondike Road is urbanized from the OCR crossing to March Valley Road, the Klondike Road storm sewer will be extended to SWM Facility 'C' and the open channel along Klondike Road will be abandoned.

4.3.1 Permanent SWM Inlet

The permanent inlet to the SWM facility will be a 1350 mm storm pipe connecting the Klondike Road storm sewer to a flow splitter manhole (STM MH 3). This manhole will have two inlets to the SWM facility set at different elevations:

- The first inlet will be an 825 mm pipe that will convey flows from frequent storms (up to the 25 mm event) to the sediment forebay.
- The second inlet will be a 750 mm pipe set 825 mm above the invert of the forebay inlet. This inlet will allow high flows to bypass the sediment forebay and discharge directly to the main cell of SWM Facility 'C'.

Inlet from Klondike Road Storm Sewer:	40m - 1350 mm STM @ 0.13%	
	U/S INV	= 66.06
Inlet to Forebay:	15.8m - 825mm STM @ 1.6%	
	U/S INV	= 66.00
	D/S INV	= 65.75
Bypass to Main Cell:	8.3m – 750mm STM @ 5.0%	
	U/S INV	= 66.83
	D/S INV	= 66.41

The peak inflow to the SWM facility for the 100-year storm event will be 2.57 m^3/s. The peak inflow to the SWM facility for the 25mm storm event will be 1.90 m^3/s, which represents approximately 74% of the 100-year inflow to SWM facility.

The forebay inlet has been sized to convey the 25mm peak flow to the forebay, and the bypass to the main cell has been sized to convey the balance of the 100-year peak flow (2.57 - 1.90 = 0.670 m^3/s). The required sizes and elevations of the SWM facility inlets have been determined using the EPA SWMM hydraulic model, as the design head on the structures will vary continuously as water levels in the wet pond and in Shirley's Brook rise and fall. Refer to Section 5.0 for additional details on the hydraulic analysis. Inflow & Pipe Capacity output graphs from EPA SWMM are provided in Appendix B for the 25mm and 100yr events.

4.3.2 Temporary SWM Inlet

Under interim conditions, lands downstream of the OCR will be undeveloped and will sheet drain overland directly to Shirley's Brook. A 240 m open channel running parallel to Klondike Road will convey minor system flows from the drainage area upstream of the OCR to SWM Facility 'C'. A temporary headwall will be installed at the downstream end of the open channel and will be connected to a 1350 mm pipe leading to the flow splitter manhole. Details for the temporary SWM inlet are shown on Drawing 103106-SWM-C2.

4.4 Sediment Forebay

The sediment forebay has been sized using design guidelines provided in the *MOE SWM Planning and Design Manual* (March 2003). A submerged berm set 0.3 m below the normal water level will separate the forebay from the main cell of the pond. The forebay will have a length of 72 m. The outlet from the forebay will consist of a submerged rock check dam.

The upstream drainage area to the SWM Facility (26.2 ha) has an average imperviousness of 52%. For a *Normal* level of protection (70% long-term TSS removal), the required permanent pool volume is approximately 1,830 m^3. SWM Facility 'C' will have a permanent pool volume of approximately 4,500 m^3, and will consequently provide a sediment removal efficiency of more than 80% (refer to design calculations in Appendix B).

Annual sediment loading to the SWM facility from the upstream drainage area has been estimated at approximately 44.1 m^3/yr (see design calculations in Appendix B). If the SWM facility provides a long-term TSS removal rate of 80%, then sediment accumulation can be estimated at 0.80 x 44.1 = 35.3 m^3/yr.

The forebay has been designed to allow for a minimum of 10 years of sediment accumulation. At a sediment loading rate of 35.3 m^3/yr, this corresponds to a sediment volume of 353 m^3 over a period of 10 years. The forebay in SWMF 'C' provides a storage volume of approximately 360 m^3 at a depth of 0.55 m, and has a total volume of approximately 530 m^3 at the top of the submerged berm between the forebay and the main cell.

4.5 SWM Outlet

Outflows from SWMF 'C' will be conveyed by a 450 mm reverse slope pipe to the outlet structure which has been designed to provide both extended detention and erosion control for the tributary drainage area. Refer to Drawings 103106-SWM-C1 and 103106-SWM-C2 for details of the outlet structure.

4.5.1 Extended Detention

Extended detention will be provided for the first 0.40 m of active storage to allow for settling of suspended sediment in the pond. The extended detention volume will be released over a period of 24 hours through a 180 mm orifice with an invert elevation set at the normal water level of 66.05m. The orifice will be inserted into a 250 mm storm pipe embedded in a concrete weir built into the base of the outlet structure. Flows that exceed the extended detention storage volume will spill over the weir crest at an elevation of 66.45, bypassing the extended detention orifice and outflows will instead be regulated by the erosion control outlet.

4.5.2 Erosion Control

The main outlet from the control structure will be a 600 mm pipe equipped with a sluice gate. Under normal operating conditions the sluice gate will be opened to a height of 300 mm (50% open) and will act as an orifice to provide erosion control during storm events that exceed the maximum extended detention storage in the facility. The sluice gate will allow for easy adjustment of the size of the outlet opening and can be closed completely during maintenance of the pond to prevent any backwater from Shirley's Brook from entering the facility.

4.5.3 Overflow Spillway

SWM Facility 'C' has been sized to provide sufficient storage to meet extended detention and erosion control criteria for storms up to the 1:5 year event. Runoff from larger storm events will exceed the maximum storage provided in the facility and the excess runoff will bypass the primary outlet structure and be conveyed by the overflow spillway to the adjacent dry pond. The overflow spillway will be 40 m wide broad crested weir with a crest elevation of 67.25. The spillway has been sized to allow the conveyance of the 100-year peak flow from the SWM facility to Shirley's Brook at a minimal head. Refer to Appendix B for design calculations.

4.6 SWM Facility 'C' Wet Pond

The stage-storage curve for the wet pond component of SWM Facility 'C' is provided in Table 4.6-1. Calculations are provided in Appendix B.

Table 4.6-1 SWM Facility 'C' – Wet Pond Stage-Storage Curve

Component	Elevation (m)	Volume				Release Rate * (L/s)
		Forebay (m^3)	Main Cell (m^3)	Total Volume (m^3)	Active Volume (m^3)	
Pond Bottom	65.00	0	0	0	0	-
	65.55	360	1,580	1,940	0	-
Top of Forebay Berm	65.75	530	2,320	2,850	0	-
Normal Water Level	66.05	-	3,570	4,370	0	-
	66.25	-	5,430	5,430	1,060	23
Extended Detention	66.45	-	6,270	6,270	1,900	39
	66.75	-	8,380	8,380	4,010	275
	67.00	-	10,000	10,000	5,630	378
Erosion Control (1:5 year)	67.25	-	11,720	11,720	7,350	425
	67.50	-	13,540	13,540	9,170	468

* The release rates listed in Table 4.6-1 represent free outlet conditions. The SWM facility has been modeled using EPA SWMM to account for high tailwater conditions in Shirley's Brook at the SWM facility outlet. Refer to Section 5.0 for additional details.

4.7 SWM Facility 'C' Dry Pond

Floodplain storage lost due to infilling of the floodplain between the OCR culvert and March Valley Road will be fully compensated for within two proposed dry ponds (dry ponds 'C' and 'D') upstream of March Valley Road. These dry ponds have been designed to provide a net increase in both riparian storage and total floodplain storage in this reach above existing conditions for all storm events (2-100 year).

The stage-storage curve for the dry pond component of SWM Facility 'C' is provided in Table 4.7-1. Refer to the *Shirley's Brook Floodplain Analysis & Stormwater Management Report* (NECL, November 2006) for details on the calculation of storage requirements for the proposed dry ponds. The dry ponds are not intended to provide any form of quantity control and will have an unrestricted outlet back into Shirley's Brook.

Table 4.7-1 SWM Facility 'C' – Dry Pond Stage-Storage Curve

Component	Elevation (m)	Stage Volume (m^3)	Total Volume (m^3)
Dry Pond Outlet @ Shirley's Brook	65.75	0	0
	66.00	80	80
	66.25	1,110	1,190
	66.50	1,690	2,880
	66.75	1,790	4,670
	67.00	1,900	6,570
	67.25	2,020	8,590

5.0 SWM FACILITY 'C' – HYDRAULIC MODELING

The normal water level in SWM Facility 'C' (NWL=66.05) will be approximately 0.20m above the normal water level in Shirley's Brook (NWL=65.85±) at the SWM facility outlet. However, Shirley's Brook is subject to periodic flooding during the spring freshet and moderate storm events. Consequently, the outlet from SWM facility 'C' will be periodically submerged and will need to operate effectively under a range of tailwater conditions.

5.1 Methodology

The EPA SWMM model was used to perform a dynamic hydraulic analysis of SWM Facility 'C' to confirm the size of the pond and the configuration of the inlet and outlet structures. Inflow hydrographs from the tributary drainage areas (generated using SWMHYMO) were routed through the facility with outflows dependant on varying water surface elevations in Shirley's Brook at the outlet.

5.1.1 Shirley's Brook Water Levels

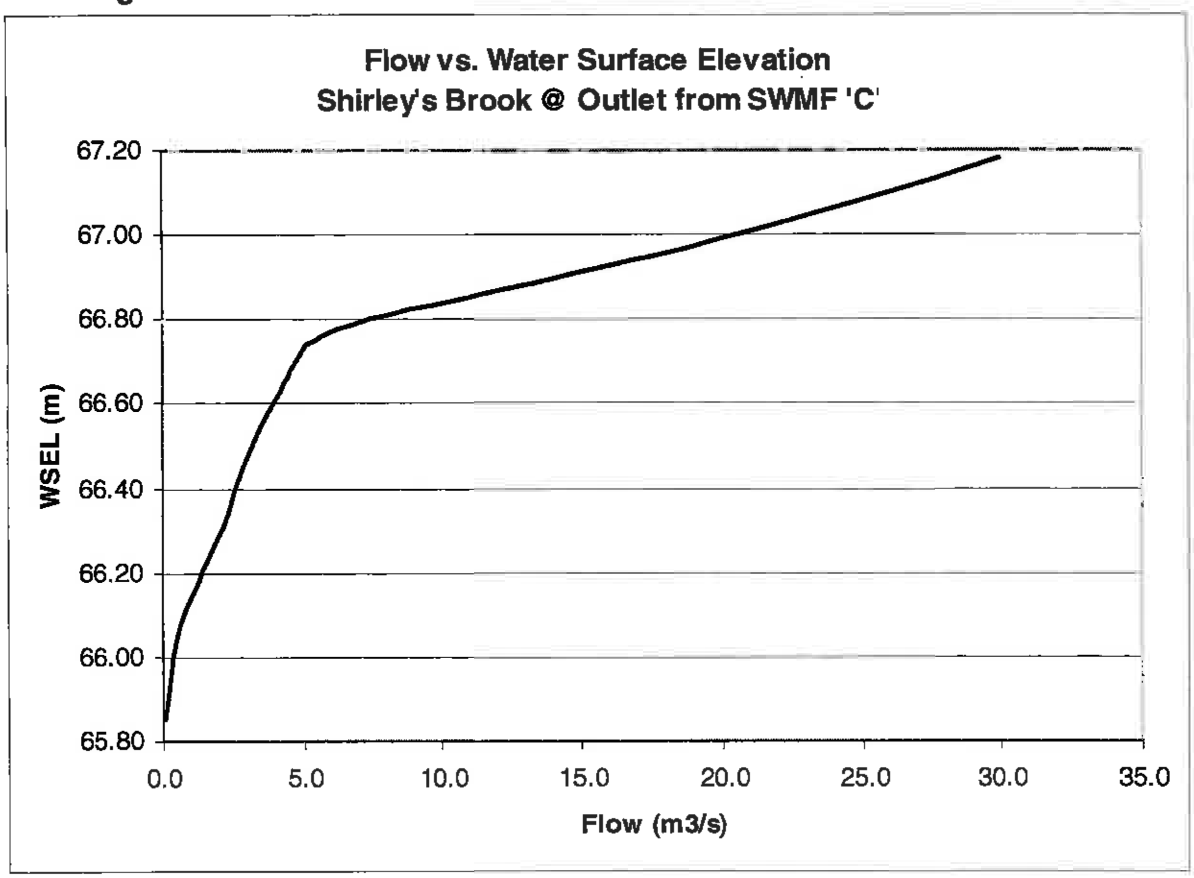
Through discussions with the City of Ottawa, MVCA, MNR and DFO, the HEC-RAS model used to establish flood elevations in Shirley's Brook has been updated and modified to reflect post-development conditions in Shirley's Brook between March Road and March Valley Road. Modifications to the model include floodplain infilling, additional culvert crossings and channel improvements.

The design flows used in the original HEC-RAS model were developed by A.J. Robinson in 1988 using the OTTHYMO hydrologic model. The OTTHYMO model has been imported into SWMHYMO and updated to include any additional existing development since the completion of the original model, as well as all known future development in the upstream drainage area.

The updated HEC-RAS model of Shirley's Brook was used to establish a relationship between flow and water surface elevation in Shirley's Brook at the outlet from the SWM facility (refer to Figure 4).

Further details on the hydrologic and hydraulic analysis of Shirley's Brook are provided in the *Shirley's Brook Floodplain Analysis & Stormwater Management Report* (NECL, November 2006).

Figure 4



5.1.2 SWM Facility 'C'

The flow vs. water surface elevation relationship shown by Figure 4 was used to establish a time series of flood levels at the outlet from SWM Facility 'C' for the 25mm, 1:5 year, and 1:100 year storm events.

The stage-storage curve and the inlet and outlet structures for SWM Facility 'C' were input into the EPA SWMM model.

Inflow hydrographs from the tributary drainage areas were input into the EPA SWMM model and routed through the facility for the 25mm, 1:5 year, and 1:100 year design events.

Separate models were created to represent both interim development conditions and ultimate development conditions:

- Under interim conditions, the inlet to the SWM facility will be from the open channel along Klondike Road. The inflow hydrographs do not include contributions from Area C-101 (KRP Industrial lands), which will be undeveloped and will sheet drain directly to Shirley's Brook.
- Under ultimate development conditions, the inlet to the SWM facility will be a 1350 mm pipe from the Klondike Road storm sewer.

5.2 Results

Once setup was complete, the EPA SWMM model was run to determine the outflows, maximum storage volumes and maximum water surface elevations in the SWM facility for each of the design events. Simulation results are summarized in Table 5.2-1 and illustrated graphically by Figure 5 through 10. Model input and output files are provided in Appendix B.

Table 5.2-1 EPA SWMM Modeling Results – SWM Facility 'C'

Storm Event	Peak Inflow (m^3/s)	Peak Outflow (m^3/s)	Max Storage (m^3)	Max WSEL (m)
Interim Conditions				
25mm	1.56	0.200	3,213	66.62
5yr-3hr Chicago	2.01	0.290	5,426	66.97
100yr-3hr Chicago	2.17	0.420	7,394	67.26
Ultimate Development Conditions				
25mm	1.90	0.240	3,584	66.68
5yr-3hr Chicago	2.42	0.330	5,727	67.02
100yr-3hr Chicago	2.57	1.890	7,692	67.30

The EPA SWMM model results indicate that SWM Facility 'C' will meet the design criteria identified in Section 5.1 for both interim and ultimate development conditions:

- SWM Facility 'C' will provide in excess of 24 hours of extended detention for the 25mm storm event;
- Outflows from SWM Facility 'C' will meet the erosion control target of 8-14 L/s/ha from the Kanata North EMP for the 1:5 year storm event.

Figure 5

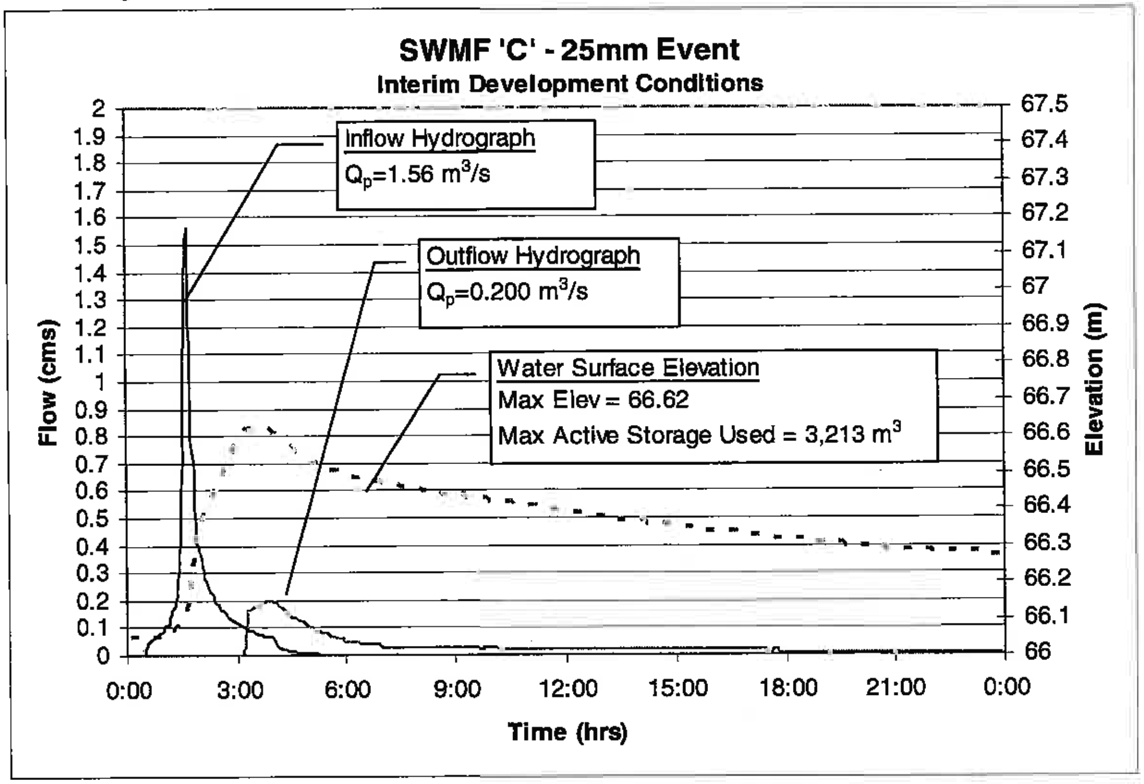


Figure 6

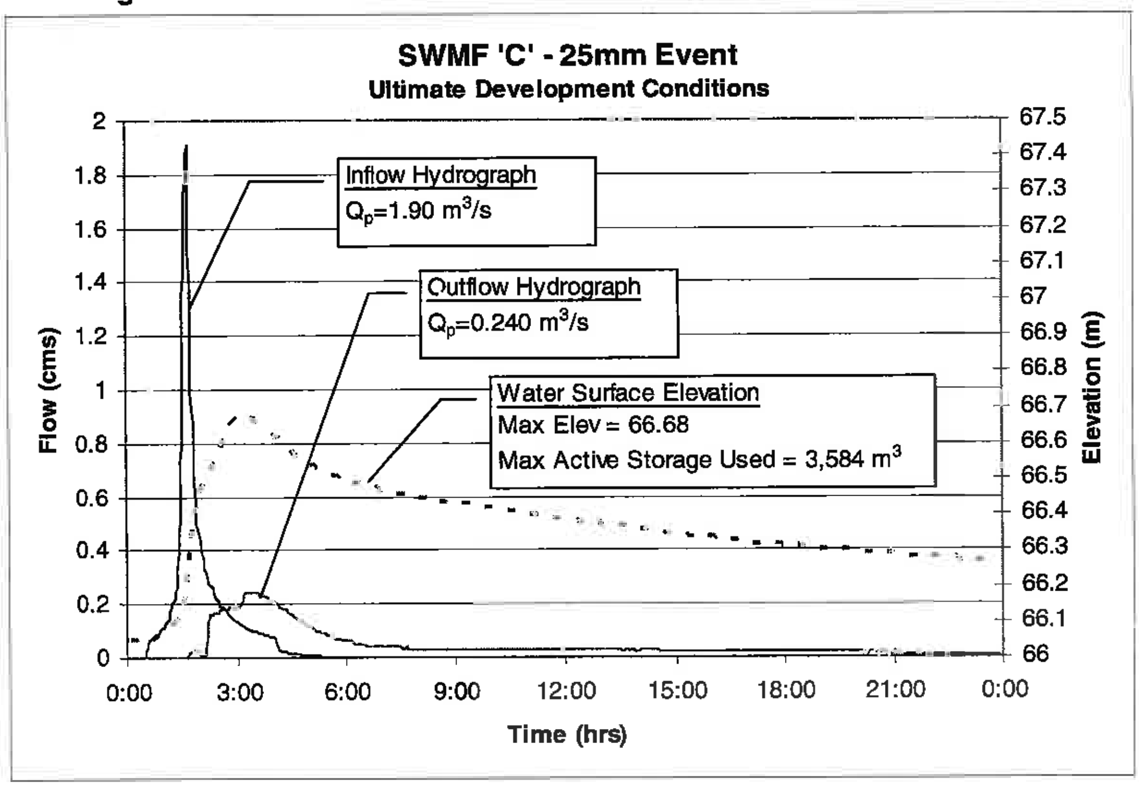


Figure 7

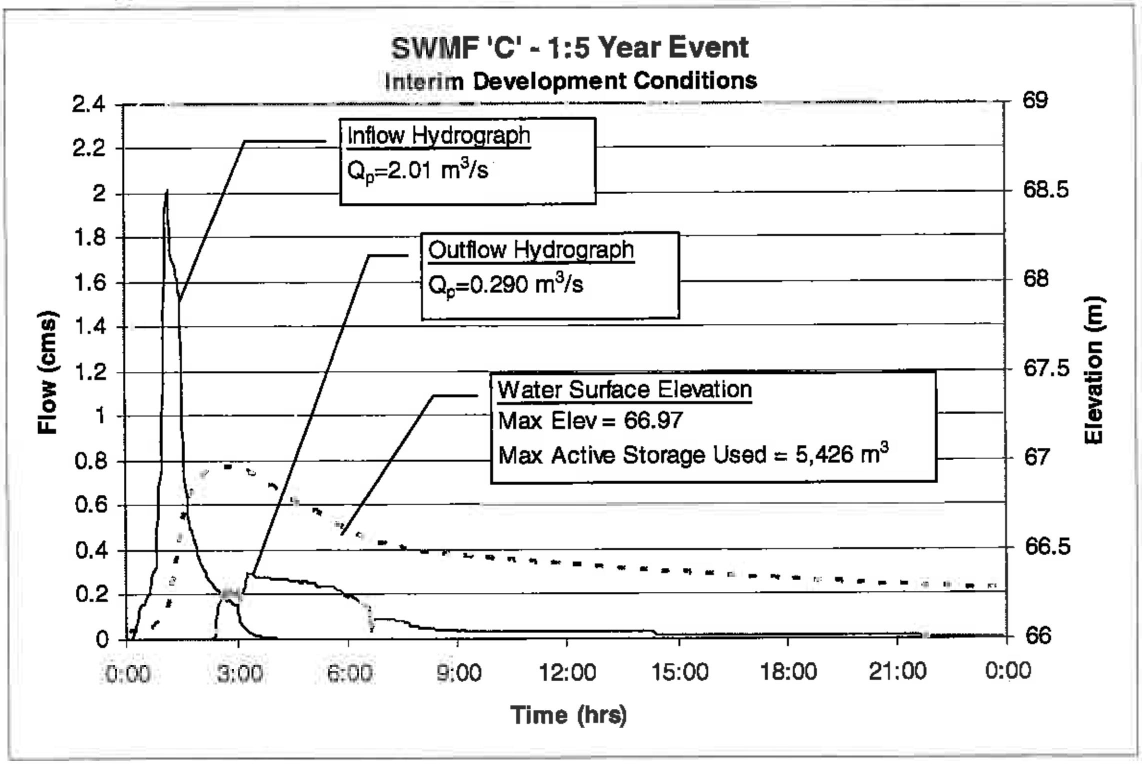


Figure 8

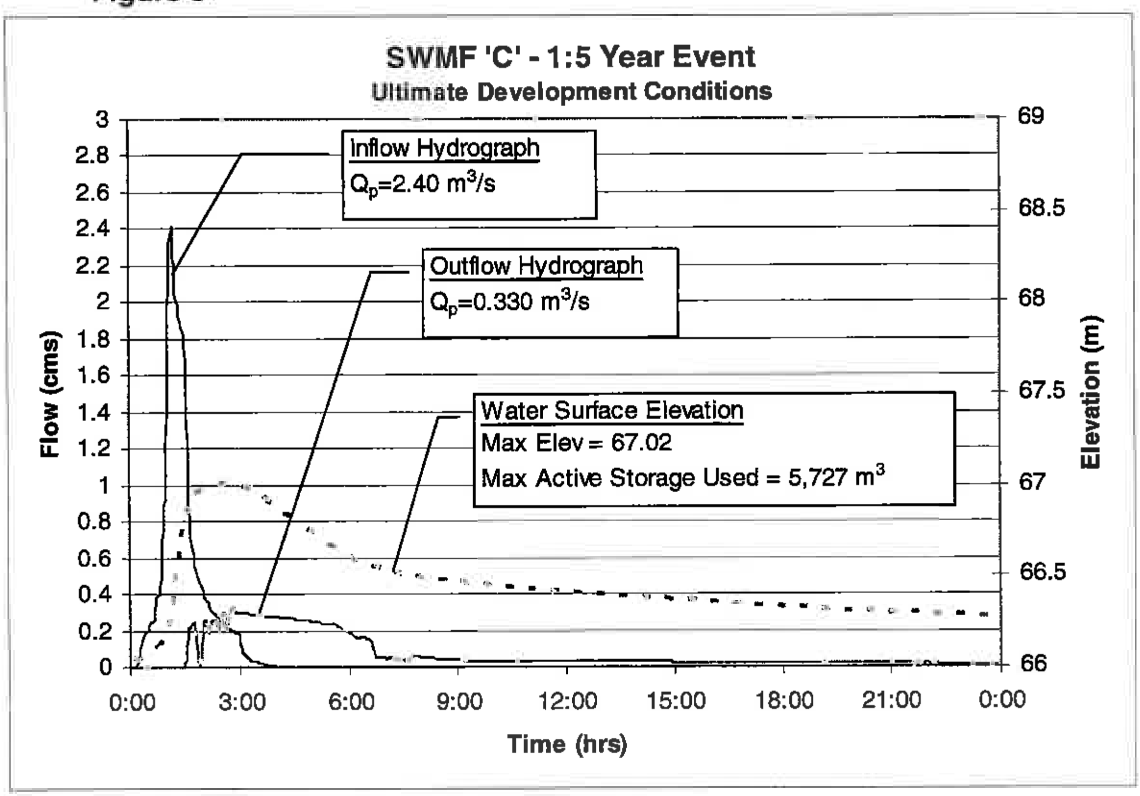


Figure 9

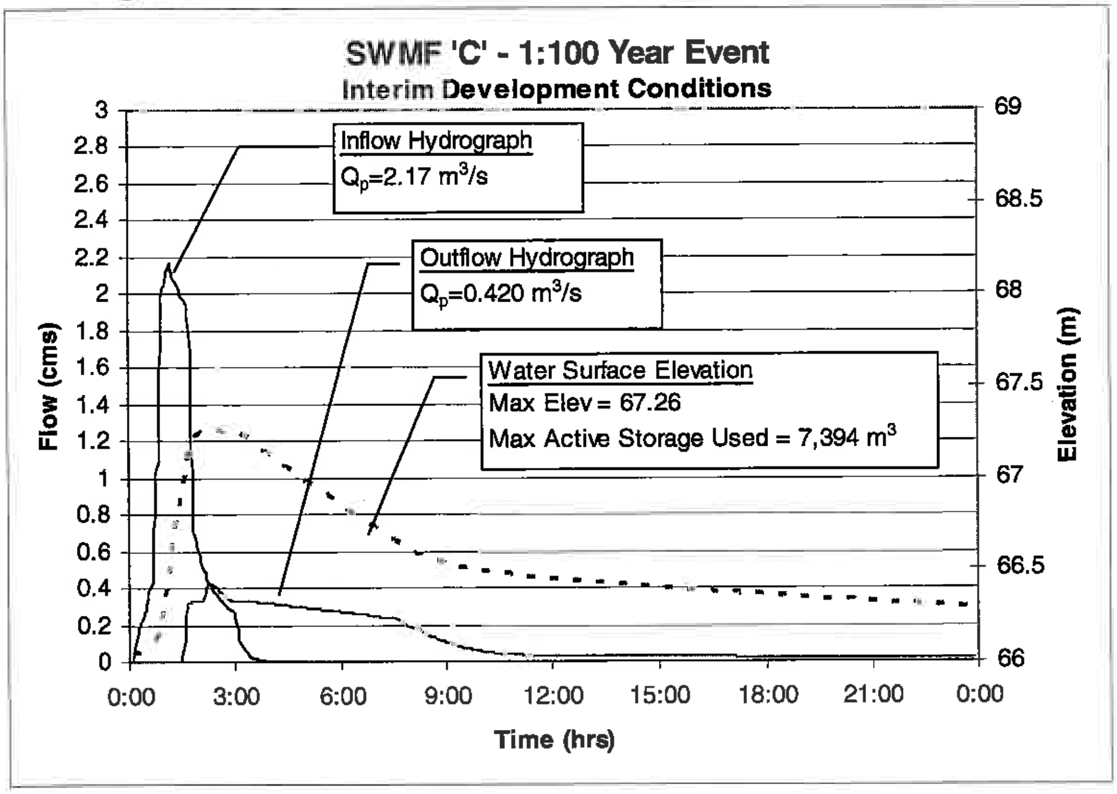
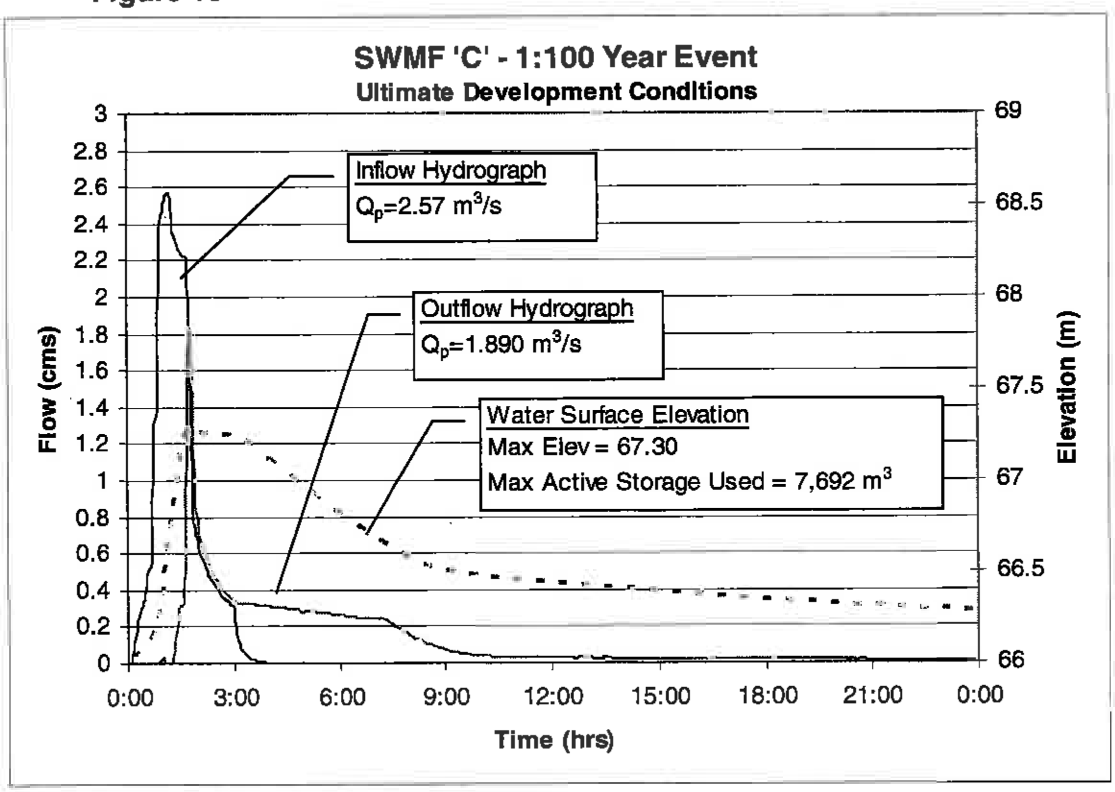


Figure 10



7.0 CONCLUSIONS

The results of the hydrologic and hydraulic modeling indicate that SWM Facility 'C' will meet all applicable stormwater management criteria for the subject lands.

- The storm sewers tributary to SWM facility 'C' will be designed to restrict minor system inflows to 85 L/s/ha.
    - Major system storage will be provided in roadway sags and parking lot areas.
    - The major overland system will be designed to ensure that major system flows are contained within the municipal ROW.
- SWM Facility 'C' will provide an *Enhanced* level of water quality control (80% long-term TSS removal) for a tributary drainage area of 26.2 ha through extended detention of the first 1,900 m^3 of runoff over a period of 24 hours.
- SWM Facility 'C' will have a maximum release rate of 293 L/s during the 1:5 year storm event under ultimate development conditions, which corresponds to a release rate of 11.2 L/s/ha and meets the erosion control target of 8-14 L/s/ha identified in the Kanata North EMP.
- Flows that exceed the maximum storage available in SWM Facility 'C' will spill over into the adjacent dry pond via a 40 m wide overflow spillway with a crest elevation of 67.25.
- The top of bank elevation for SWM Facility 'C' has been established at 67.75, which represents a freeboard of 0.45 m above the 1:100 year ponding elevation of 67.30 under ultimate development conditions.

NOVATECH ENGINEERING CONSULTANTS LTD
Prepared by:

LICENSED PROFESSIONAL ENGINEER
M.J. PETEPIECE
100079354
PROVINCE OF ONTARIO

Michael Petepiece, P. Eng
Project Engineer

APPENDIX A

Klondike Road Storm Sewer: Design Sheets

Storm Sewer Design Sheet	(5-Year Event) – Interim Conditions
HGL Design Sheet	(100-Year Event) – Interim Conditions
Storm Sewer Design Sheet	(5-Year Event) – Ultimate Conditions
HGL Design Sheet	(100-Year Event) – Ultimate Conditions

SWM FACILITY 'C' - KLONDIKE ROAD
STORM SEWER DESIGN SHEET (5-YEAR EVENT - ULTIMATE CONDITION)

The spreadsheet uses the Rational Method to calculate theoretical 5-year event storm sewer flows (see peak flow column).
The Ultimate Condition accounts for the entire drainage areas flowing through the completed storm sewer network.

LOCATION					Area (ha)							FLOW					SEWER DATA									
Street	Catchment	Dev't	From Node	To Node	R= 0.30	R= 0.40	R= 0.45	R= 0.50	R= 0.60	R= 0.65	R= 0.70	Indiv 2.78 AC	Accum 2.78 AC	Time of Conc.	Rainfall Intensity	Peak Flow Q (l/s)	Dia. (m) Actual	Dia. (mm) Nominal	Type	Slope (%)	Length (m)	Capacity (l/s)	Velocity (m/s)	Time of Flow (min)	Ratio Q/Q full
KLONDIKE ROAD																									
	C-201	MDR	-	FUT. MH				1.96				2.72	2.72	20.00	70.25	191.4	0.610	600	CONC	0.14		239.5	0.82	0.00	80%
			FUT. MH	MH 159						0.34		0.61	3.34	20.00	70.25	234.6	0.610	600	CONC	1.87	120.0	875.4	3.00	0.67	27%
	C202/C300	MDR	MH 159	MH 158			4.48	3.13		0.14		10.21	13.55	20.67	68.82	932.3	0.838	825	CONC	0.64	94.0	1,197.4	2.17	0.72	78%
	C203	PRK	MH 158	MH 157	1.88					0.38		2.25	15.80	21.39	67.34	1,064.1	0.838	825	CONC	0.75	120.0	1,296.2	2.35	0.85	82%
MARCONI AVENUE																									
	C204a	MDR	MH 162	MH 161					0.19			0.32	0.32	20.00	70.25	22.3	0.305	300	CONC	0.50	24.6	71.3	0.98	0.42	31%
			MH 161	MH 160					0.06			0.10	0.42	20.42	69.34	28.9	0.305	300	CONC	0.50	23.9	71.3	0.98	0.41	41%
			MH 160	MH 157					0.62			1.03	1.45	20.83	68.49	99.4	0.457	450	CONC	0.25	120.0	148.6	0.91	2.21	67%
				Area C204a					0.87																
KLONDIKE ROAD																									
			MH 157	MH 156						0.52		0.94	18.19	23.04	64.22	1,168.3	1.219	1200	CONC	0.13	97.0	1,465.9	1.26	1.29	80%
			MH 156	MH 155						0.31		0.56	18.75	24.32	62.00	1,162.6	1.219	1200	CONC	0.13	91.3	1,465.9	1.26	1.21	79%
			MH 155	MH 154	0.30					0.59		1.32	20.07	25.54	60.05	1,205.2	1.219	1200	CONC	0.13	117.0	1,465.9	1.26	1.55	82%
	C204b	MDR	MH 154	MH 153					4.15			6.92	26.99	27.09	57.75	1,558.8	1.219	1200	CONC	0.20	39.9	1,818.2	1.56	0.43	86%
			MH 153	FUT.MH A						0.21		0.38	27.37	27.52	57.15	1,564.3	1.372	1350	CONC	0.13	108.4	2,006.9	1.36	1.33	78%
	C101a	IND	FUT.MH A	FUT.MH B						0.45	3.19	7.02	34.39	28.85	55.37	1,904.2	1.372	1350	CONC	0.13	117.0	2,006.9	1.36	1.44	95%
			FUT.MH B	FUT.MH C								0.00	34.39	30.28	53.59	1,842.9	1.372	1350	CONC	0.13	51.0	2,006.9	1.36	0.63	92%
			FUT.MH C	OUTLET								0.00	34.39	30.91	52.85	1,817.5	1.372	1350	CONC	0.14	7.3	2,082.7	1.41	0.09	87%

Definitions:
Q=2.78 AIR, where
Q=Peak Flow in Litres per Second (l/s)
A=Area in hectares (ha)
I=Rainfall Intensity (mm/hr)
R=Runoff Coefficient

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min Pipe Velocity =0.80 m/s
3) Tc=15 min (subdivision)

Design: MAB
Check: JGR
Date: June 28, 2006

PROJECT: Brookside Subdivision

CLIENT: Klondike Developments

File Ref: 103106-0 | Dwg. Reference:

STORM SEWER DESIGN SHEET (5-YEAR EVENT - INTERIM CONDITION)

The spreadsheet uses the Rational Method to calculate theoretical 5-year event storm sewer flows (see peak flow column).
Interim Condition - Prior to complete construction of Klondike Road, flows will be diverted to Pond 'C' via temporary swale.

LOCATION					Area (ha)							FLOW					SEWER DATA								
Street	Catchment	Dev't	From Node	To Node	R= 0.30	R= 0.40	R= 0.45	R= 0.50	R= 0.60	R= 0.65	R= 0.70	Indiv 2.78 AC	Accum 2.78 AC	Time of Conc.	Rainfall Intensity	Peak Flow Q (l/s)	Dia. (m) Actual	Dia. (mm) Nominal	Type	Slope (%)	Length (m)	Capacity (l/s)	Velocity (m/s)	Time of Flow (min)	Ratio Q/Q full
KLONDIKE ROAD																									
	C-201	MDR	-	FUT. MH				1.96				2.72	2.72	20.00	70.25	191.4	0.610	600	CONC	0.14		239.5	0.82	0.00	80%
			FUT. MH	MH 159						0.23		0.42	3.14	20.00	70.25	220.6	0.610	600	CONC	1.87	120.0	675.4	3.00	0.67	25%
	C202/C300	MDR	MH 159	MH 158			4.48	3.13		0.24		10.39	13.53	20.67	68.82	931.1	0.838	825	CONC	0.64	94.0	1,197.4	2.17	0.72	78%
	C203	PRK	MH 158	MH 157	1.88					0.39		2.27	15.80	21.39	67.34	1,064.1	0.838	825	CONC	0.75	120.0	1,296.2	2.35	0.85	82%
MARCONI AVENUE																									
	C204a	MDR	MH 162	MH 161					0.19			0.32	0.32	20.00	70.25	22.3	0.305	300	CONC	0.50	24.6	71.3	0.98	0.42	31%
			MH 161	MH 160					0.06			0.10	0.42	20.42	69.34	28.3	0.305	300	CONC	0.50	23.9	71.3	0.98	0.41	41%
			MH 160	MH 157					0.62			1.03	1.45	20.83	68.49	98.4	0.457	450	CONC	0.25	120.0	148.6	0.91	2.21	67%
KLONDIKE ROAD																									
			MH 157	MH 156						0.52		0.94	16.19	23.04	64.22	1,168.3	1.219	1200	CONC	0.13	97.0	1,465.9	1.26	1.29	80%
			MH 156	MH 155						0.31		0.56	18.75	24.32	62.00	1,162.6	1.219	1200	CONC	0.13	91.3	1,465.9	1.26	1.21	79%
			MH 155	MH 154	0.30					0.59		1.32	20.07	25.54	60.05	1,205.2	1.219	1200	CONC	0.13	117.0	1,465.9	1.26	1.55	82%
	C204b	MDR	MH 154	MH 153					4.15			6.92	26.99	27.09	57.75	1,558.8	1.219	1200	CONC	0.20	39.9	1,818.2	1.56	0.43	86%
	(see note 4)		MH 153	HEADWALL								0.00	26.99	27.52	57.15	1,542.6	1.372	1350	CONC	0.20	32.2	2,489.3	1.68	0.32	62%

Definitions:
Q=2.78 AIR, where
Q=Peak Flow in Litres per Second (l/s)
A=Area in hectares (ha)
I=Rainfall Intensity (mm/hr)
R=Runoff Coefficient

Notes:
1) Ottawa Rainfall-Intensity Curve
2) Min Pipe Velocity =0.80 m/s
3) Tc=15 min (subdivision)
4) Industrial zone (C-101a) area not included

Design: MAB
Check: JGR
Date: April 17, 2006

PROJECT: Brookside Subdivision
CLIENT: Klondike Developments
File Ref: 103106-0
Dwg. Reference:

SWM FACILITY 'C' - KLONDIKE ROAD
STORM SEWER: HYDRAULIC GRADE LINE ANALYSIS (100-YEAR EVENT - ULTIMATE CONDITION)

This spreadsheet uses the Darcy-Weisbach equation to calculate hydraulic losses through a pipe network with a specified flow rate. Minor losses are accounted for including both pipe bend losses and structure losses.

The spreadsheet returns the upstream hydraulic grade line if surcharged, or the pipe obvert if free flow conditions exist. The slope of the HGL is calculated and the minimum USF elevations can be established +0.30m above the HGL.

The theoretical 100-year event storm sewer peak flows will be controlled to the actual 5-year flow rates using various roadway inlet controls within CBs. Additional flows will be directed using overland flow routes.

The Ultimate Condition accounts for the entire drainage areas flowing through the completed storm sewer network.

LOCATION	MANHOLE		INVERT ELEVATION		GROUND ELEVATION	COVER	PIPE PARAMETERS			TOTAL FLOW	Q_{cap}	Q_{in}/Q_{cap}	COMPUTATIONAL COLUMNS					HEAD LOSS	SURCHARGE	HGL			SLOPE	MIN. USF ELEVATION
	Upstream	Downstream	U/S (m)	D/S (m)	Upstream (m)	Upstream (m)	Dia (mm)	Length (m)	'n'	(m^3/s)	(m^3/s)		Pipe Area (m^2)	L/D	Friction Factor (f)	Velocity V (m/s)	$V^2/2g$	HL (m)	Upstream (m)	U/S (m)	D/S (m)	SLOPE (%)	(%)	Upstream (m)
KLONDIKE ROAD																				67.57	<- OUTLET TO POND			
	FUT.MH C	OUTLET	65.93	65.90	67.95	0.670	1350	12.30	0.013	1.827	2.750	0.66	1.478	9	0.01905	1.24	0.08	0.05	0.34	67.62	67.57	0.43	0.24	67.92
	FUT.MH B	FUT.MH C	66.02	65.93	68.55	1.180	1350	42.30	0.013	1.843	2.568	0.72	1.478	31	0.01905	1.25	0.08	0.09	0.34	67.71	67.62	0.21	0.21	68.01
	FUT.MH A	FUT.MH B	66.24	66.05	68.87	1.280	1350	117.00	0.013	1.898	2.244	0.85	1.478	87	0.01905	1.28	0.08	0.16	0.28	67.87	67.71	0.13	0.16	68.17
	MH 153	FUT.MH A	66.40	66.24	70.01	2.260	1350	120.00	0.013	1.564	2.033	0.77	1.478	89	0.01905	1.06	0.06	0.11	0.23	67.98	67.87	0.10	0.13	68.28
	MH 154	MH 153	66.63	66.55	70.18	2.350	1200	39.90	0.013	1.559	1.821	0.86	1.167	33	0.01981	1.34	0.09	0.08	0.23	68.06	67.98	0.20	0.20	68.36
	MH 155	MH 154	66.78	66.63	70.12	2.140	1200	117.00	0.013	1.205	1.456	0.83	1.167	98	0.01981	1.03	0.05	0.12	0.20	68.18	68.06	0.10	0.13	68.48
	MH 156	MH 155	66.90	66.78	70.39	2.290	1200	91.30	0.013	1.163	1.475	0.79	1.167	76	0.01981	1.00	0.05	0.09	0.16	68.26	68.18	0.09	0.13	68.56
	MH 157	MH 156	67.03	66.90	70.29	2.060	1200	97.00	0.013	1.168	1.489	0.78	1.167	81	0.01981	1.00	0.05	0.09	0.12	68.35	68.26	0.09	0.13	68.65
MARCONI AVENUE																								
	MH 160	MH 157	68.08	67.78	70.64	2.110	450	120.00	0.013	0.099	0.149	0.67	0.164	267	0.02747	0.60	0.02	0.17	0.00	68.53	68.35	0.15	0.25	68.83
	MH 161	MH 160	68.35	68.23	70.87	2.220	300	23.90	0.013	0.029	0.071	0.41	0.073	80	0.03145	0.40	0.01	0.02	0.00	68.65	68.53	0.50	0.50	68.95
	MH 162	MH 161	68.50	68.38	71.50	2.700	300	24.60	0.013	0.022	0.070	0.31	0.073	82	0.03145	0.30	0.00	0.01	0.00	68.90	68.68	0.49	0.49	69.10
KLONDIKE ROAD																								
	MH 158	MH 157	68.30	67.40	71.78	2.655	825	120.00	0.013	1.064	1.297	0.82	0.552	145	0.02245	1.93	0.19	0.66	0.00	69.13	68.35	0.64	0.75	69.43
	MH 159	MH 158	68.90	68.30	74.79	5.065	825	94.00	0.013	0.931	1.196	0.78	0.552	114	0.02245	1.69	0.15	0.40	0.00	69.78	69.13	0.64	0.64	70.03
TER LEVEL at Outlet = 67.39m																								

DESIGN PARAMETERS

DOWNSTREAM WATER LEVEL at Outlet = 67.57m (EPA SWMM MAX HGL)
RETURN FREQUENCY = 100 YEARS CONTROLLED TO 5 YEARS
MINIMUM VELOCITY= 0.80 m/s
MANNING'S n= 0.013
MIN. HGL CLEARANCE = 0.30m

HGL=Major + Minor Losses
Major Loss= Pipe Friction (Darcy-Weisbach)
Minor Loss= Head loss correction for flow through MH, changes in pipe size, and pipe bends
Friction Factor= 8g/c^2, where c=(1/n)*(D/4)^1/6

Designed: MAB
Checked: JGR
Dwg. Reference:

PROJECT: Brookside Subdivision
CLIENT: Regional Group
Date: June 28, 2006

SWM FACILITY 'C' - KLONDIKE ROAD

STORM SEWER: HYDRAULIC GRADE LINE ANALYSIS (100-YEAR EVENT - INTERIM CONDITION)

This spreadsheet uses the Darcy-Weisbach equation to calculate hydraulic losses through a pipe network with a specified flow rate. Minor losses are accounted for including both pipe bend losses and structure losses.

The spreadsheet returns the upstream hydraulic grade line if surcharged, or the pipe obvert if free flow conditions exist. The slope of the HGL is calculated and the minimum USF elevations can be established +0.30m above the HGL.

The theoretical 100-year event storm sewer peak flows will be controlled to the actual 5-year flow rates using various roadway inlet controls within CBs. Additional flows will be directed using overland flow routes.

Interim Condition - Prior to complete construction of Klondike Road, flows will be diverted to Pond 'C' via temporary swale.

LOCATION	MANHOLE		INVERT ELEVATION		GROUND ELEVATION	COVER	PIPE PARAMETERS			TOTAL FLOW	Q_{cap}	Q_{in}/Q_{cap}	COMPUTATIONAL COLUMNS					HEAD LOSS	SURCHARGE	HGL			SLOPE	MIN. USF ELEVATION
	Upstream	Downstream	U/S (m)	D/S (m)	Upstream (m)	Upstream (m)	Dia (mm)	Length (m)	'n'	(m^3/s)	(m^3/s)		Pipe Area (m^2)	L/D	Friction Factor (f)	Velocity V (m/s)	$V^2/2g$	HL (m)	Upstream (m)	U/S (m)	D/S (m)	SLOPE (%)	(%)	Upstream (m)
KLONDIKE ROAD																				67.57	<- OUTLET TO SWALE			
	MH 153	HEADWALL	66.40	66.33	70.01	2.260	1350	32.20	0.013	1.543	2.596	0.59	1.478	24	0.01905	1.04	0.06	0.10	0.00	67.75	67.68	0.22	0.22	68.05
	MH 154	MH 153	66.63	66.55	70.18	2.350	1200	39.90	0.013	1.559	1.821	0.86	1.167	33	0.01981	1.34	0.09	0.08	0.00	67.83	67.75	0.20	0.20	68.13
	MH 155	MH 154	66.78	66.63	70.12	2.140	1200	117.00	0.013	1.205	1.456	0.83	1.167	98	0.01981	1.03	0.05	0.12	0.00	67.96	67.83	0.13	0.13	68.28
	MH 156	MH 155	66.90	66.78	70.39	2.290	1200	91.30	0.013	1.163	1.475	0.79	1.167	76	0.01981	1.00	0.05	0.09	0.00	68.10	67.98	0.13	0.13	68.40
	MH 157	MH 156	67.03	66.90	70.29	2.060	1200	97.00	0.013	1.168	1.489	0.78	1.167	81	0.01981	1.00	0.05	0.09	0.00	68.23	68.10	0.13	0.13	68.53
MARCONI AVENUE																								
	MH 160	MH 157	68.08	67.78	70.64	2.110	450	120.00	0.013	0.099	0.149	0.67	0.164	267	0.02747	0.60	0.02	0.17	0.00	68.53	68.23	0.25	0.25	68.83
	MH 161	MH 160	68.35	68.23	70.87	2.220	300	23.90	0.013	0.029	0.071	0.41	0.073	80	0.03145	0.40	0.01	0.02	0.00	68.65	68.53	0.50	0.50	68.95
	MH 162	MH 161	68.50	68.38	71.50	2.700	300	24.60	0.013	0.022	0.070	0.31	0.073	82	0.03145	0.30	0.00	0.01	0.00	68.80	68.68	0.49	0.49	69.10
KLONDIKE ROAD																								
	MH 158	MH 157	68.30	67.40	71.78	2.655	825	120.00	0.013	1.064	1.297	0.82	0.552	145	0.02245	1.93	0.19	0.66	0.00	69.13	68.23	0.75	0.75	69.43
	MH 159	MH 158	68.90	68.30	74.79	5.065	825	94.00	0.013	0.931	1.196	0.78	0.552	114	0.02245	1.69	0.15	0.40	0.00	69.73	69.13	0.64	0.64	70.03

DESIGN PARAMETERS

RETURN FREQUENCY = 100 YEARS CONTROLLED TO 5 YEARS
MINIMUM VELOCITY= 0.80 m/s
DOWNSTREAM WATER LEVEL at Outlet = 67.57m (EPA SWMM MAX HGL)
MIN. HGL CLEARANCE : 0.30m

HGL=Major + Minor Losses
Major Loss= Pipe Friction (Darcy-Weisbach)
Minor Loss= Head loss correction for flow through MH, changes in pipe size, and pipe bends
Friction Factor= 8g/c^2, where c=(1/n)*(D/4)^1/6

Designed: MAB
Checked: JGR
Dwg. Reference:

PROJECT: Brookside Subdivision
CLIENT: Regional Group
Date: August 4, 2006

APPENDIX B

SWM Facility 'C': Design Calculations & Modeling Files

SWMHYMO Modeling Parameters
SWMHYMO Input Files
Summary Output Files

SWM Facility Inlet & Outlet Calculations
SWM Facility Stage-Storage Curves
Forebay Design Calculations
EPA SWMM Model Schematics
EPA SWMM Model Output
EPA SWMM Flow Splitter Model Output (25mm / 100 yr)

Drainage Area Klondike & Adjacent Lands (Post-Development)	Subarea ID	Drainage Area (ha)	HYD	XIMP	TIMP	Slope (%) (perv / imp	Length (m) perv / imp	IA (mm) perv / imp)	CN	TP (hrs)
March Road (40m ROW + road widening)	A-MR1	5.83	STANDHY	0.70	0.80	0.4			65	
Commercial / Residential	A-400	3.62	STANDHY	0.58	0.68	1.0			65	
SWMF A		0.90								
Commercial / Residential	A-500	1.52	STANDHY	0.58	0.68	1.0			65	
Lands to SWMF 'C'										
Future Development (Mixed)	C-300	7.48	STANDHY	0.30	0.37	1.0			65	
Medium Density Residential	C-201	1.96	STANDHY	0.57	0.64	1.5			65	
Medium Density Residential	C-202	3.07	STANDHY	0.57	0.64	1.0			65	
Park	C-203	1.90	STANDHY	0.24	0.30	1.0			65	
Medium Density Residential	C-204	5.20	STANDHY	0.57	0.64	1.0			65	
Klondike Road R.O.W. U/S OCR	C-205	2.22	STANDHY	0.70	0.80	1.0			65	
Industrial	C-101	3.16	STANDHY	0.70	0.70	0.6			65	
SWMF 'C'	C-102	0.90	NASHYD						80	0.17
Klondike Road R.O.W. D/S OCR	C-103	1.20	STANDHY	0.70	0.80	1.0			65	
Low Density Residential	D-101	6.70	STANDHY	0.30	0.37	1.0			65	
Medium Density Residential	D-102	7.70	STANDHY	0.57	0.65	1.0			65	
Low/Med Density Residential	D-201	9.64	STANDHY	0.40	0.50	1.0			65	
Klondike Woods	D-301	2.09	NASHYD						55	0.17
Industrial	D-302	2.15	STANDHY	0.70	0.70	0.6			65	
SWMF 'D' & Inlet Channel	D-303	1.40	NASHYD						80	0.17
Shirley's Brook U/S of Klondike Rd	S-100	1.65								
Shirley's Brook U/S of Marconi Ave	S-101	8.40	NASHYD						80	0.17
Shirley's Brook U/S of OCR	S-102	3.49								
Shirley's Brook U/S of March Valley Road	S-200	5.67	NASHYD						80	0.17

Area to SWMF 'C': **27.1 ha**
26.2 ha (not including SWMF 'C' - used in water quality calculations)

```
2     Metric units
*#*****************************************************************************
*#  Project Name: [Shirley's Brook - SWMF C]            Project Number: [103106]
*#  Date         : 05-28-2006
*#  Modeller     : [M.Petepiece]
*#  Company      : NOVATECH ENGINEERING CONSULTANTS LTD
*#  License #    :  5320763
*#
*# Post-Development Conditions to SWM Facility 'C'
*# Interim conditions - Klondike Road not urbanized east of OCR
*#                    - KRP Industrial lands not developed - sheet drain
*#                      directly to Shirley's Brook.
*#*****************************************************************************
START             TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[1]
                  C25mm-3.stm
*
READ STORM        STORM_FILENAME=["storm.001"]
*==============================================================================
*
*                          KLONDIKE ROAD SUBDIVISION
*                           LANDS TO SWM FACILITY C
*                             INTERIM CONDITIONS
*
*==============================================================================
* Klondike Area C-300
* (Institutional/Residential)
*   7.48 ha x 85 L/s/ha = 636 L/s
*   7.48 ha @ 50 m3/ha  = 374 m3
* ------------------------------
DESIGN STANDHYD   ID=[1], NHYD=["C-300"], DT=[5]min, AREA=[7.48](ha),
                  XIMP=[0.30], TIMP=[0.37], DWF=[0](cms), LOSS=[2], CN=[65],
                  SLOPE=[1.0](%), END=-1
*
COMPUTE DUALHYD   IDin=[1], CINLET=[0.636](cms), NINLET=[1],
                  MAJID=[2], MajNHYD=["C-3maj"],
                  MINID=[9], MinNHYD=["C-3min"],
                  TMJSTO=[374](cu-m)
*
*%-----------------|----------------------------------------------------------|
* Klondike Area C-201
* medium density residential)
* ------------------------------
DESIGN STANDHYD   ID=[1], NHYD=["C-201"], DT=[5]min, AREA=[1.96](ha),
                  XIMP=[0.57], TIMP=[0.64], DWF=[0](cms), LOSS=[2], CN=[65],
                  SLOPE=[1.5](%), END=-1
*
* Klondike Area C-202
* (medium density residential)
* ------------------------------
DESIGN STANDHYD   ID=[2], NHYD=["C-202"], DT=[5]min, AREA=[3.07](ha),
                  XIMP=[0.57], TIMP=[0.64], DWF=[0](cms), LOSS=[2], CN=[65],
                  SLOPE=[1.0](%), END=-1
*
* Klondike Area C-203
* (park)
* ------------------------------
DESIGN STANDHYD   ID=[3], NHYD=["C-203"], DT=[5]min, AREA=[1.90](ha),
                  XIMP=[0.24], TIMP=[0.30], DWF=[0](cms), LOSS=[2], CN=[65],
                  SLOPE=[1.0](%), END=-1
*
* Klondike Area C-204
* (medium density residential)
* ------------------------------
DESIGN STANDHYD   ID=[4], NHYD=["C-204"], DT=[5]min, AREA=[5.20](ha),
                  XIMP=[0.57], TIMP=[0.64], DWF=[0](cms), LOSS=[2], CN=[65],
                  SLOPE=[1.0](%), END=-1
*
* Klondike Area C-205
* (Klondike Road U/S of OCR)
* ------------------------------
DESIGN STANDHYD   ID=[5], NHYD=["C-205"], DT=[5]min, AREA=[2.22](ha),
                  XIMP=[0.70], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[65],
                  SLOPE=[1.0](%), END=-1
*
* Klondike Area C-2 (ALL)
* ------------------------------
ADD HYD           IDsum=[6], NHYD=["C-2"], IDs to add=[1,2,3,4,5]
*
* Minor System Capture for Area C-2:
*  14.35 ha @ 85 L/s/ha = 1220 L/s
*  14.35 ha @ 50 m3/ha  =  718 m3
* ----------------------------------------
COMPUTE DUALHYD   IDin=[6], CINLET=[1.220](cms), NINLET=[1],
                  MAJID=[7], MajNHYD=["C2maj"],
                  MINID=[8], MinNHYD=["C2min"],
                  TMJSTO=[718](cu-m)
*%-----------------|----------------------------------------------------------|
* Klondike Area C-103 (Klondike Road D/S of OCR - rural)
* ------------------------------
DESIGN STANDHYD   ID=[6], NHYD=["C-103"], DT=[5]min, AREA=[1.20](ha),
                  XIMP=[0.30], TIMP=[0.40], DWF=[0](cms), LOSS=[2], CN=[65],
                  SLOPE=[1.0](%), END=-1
*%-----------------|----------------------------------------------------------|
* Klondike Area C-102 (SWMF C)
* ------------------------------
DESIGN NASHYD     ID=[5], NHYD=["C-102"], DT=[5]min, AREA=[0.90](ha),
                  DWF=[0](cms), CN/C=[80], TP=[0.17]hrs,
                  RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
*%-----------------|----------------------------------------------------------|
*
ADD HYD           IDsum=[10], NHYD=["C_IN_T"], IDs to add=[5,6,8,9]
*
*
* SWMF C
* ----------------------------------------------------
* Drainage Area :       26.2 ha (not incl. SWMF C)
* Extended Detention: Q=  29 L/s max
* Erosion Control:    Q= 262 L/s (10 L/s/ha)
* >5yr Storm:         Qin=Qout
* ----------------------------------------------------
ROUTE RESERVOIR   IDout=[1],   NHYD=["C_OUT_T"],  IDin=[10],
                  RDT=[5](min),
                        TABLE of ( OUTFLOW-STORAGE ) values
                                   (cms) - (ha-m)
                                 [ 0.000 , 0.0000 ]
                                 [ 0.020 , 0.1030 ]
                                 [ 0.029 , 0.1860 ]
                                 [ 0.060 , 0.3910 ]
                                 [ 0.100 , 0.4200 ]
                                 [ 0.160 , 0.5460 ]
                                 [ 0.262 , 0.7090 ]
                                 [ 3.000 , 0.7430 ]
                                 [   -1  ,   -1   ]  (max twenty pts)
*%-----------------|----------------------------------------------------------|
SAVE HYD          ID=[10],   # OF PCYCLES=[1],  ICASEsh=[-1]
                  HYD_FILENAME=["C_IN_T"]
                  HYD_COMMENT=["Inflow to SWMF C - interim"]
*%-----------------|----------------------------------------------------------|
START             TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[2]
                  C5-3.stm
*
START             TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[3]
                  C100-3.stm
*
START             TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[4]
                  S100-12.stm
*
FINISH
```

```
==========================================================================
SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    888  ========
S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  8   8  ========
SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  8   8  Ver. 4.0
    S   W W   M   M  H   H    Y    M   M  O   O       9999   888   Sept 1998
SSSSS   W W   M   M  H   H    Y    M   M   OOO           9  8   8  ========
                                                         9  8   8  # 5320763
    StormWater Management HYdrologic Model            999    888   ========

***************************************************************************
************************ SWMHYMO-98 Ver/4.0 *******************************
*******  A single event and continuous hydrologic simulation model  *******
*******       based on the principles of HYMO and its successors     *******
*******                OTTHYMO-83 and OTTHYMO-89.                    *******
***************************************************************************
******* Distributed by:  J.F. Sabourin and Associates Inc.           *******
*******                  Ottawa, Ontario: (613) 727-5199             *******
*******                  Gatineau, Quebec: (819) 243-6858            *******
*******                  E-Mail: swmhymo@jfsa.Com                    *******
***************************************************************************

+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++++++ Licensed user: NOVATECH ENGINEERING CONSULTANTS LTD         +++++++
+++++++                Nepean                 SERIAL#:5320763       +++++++
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

***************************************************************************
*******            ++++++ PROGRAM ARRAY DIMENSIONS ++++++            *******
*******            Maximum value for ID numbers  :    10             *******
*******            Max. number of rainfall points:  15000            *******
*******            Max. number of flow points    :  15000            *******
***************************************************************************

*** DESCRIPTION SUMMARY TABLE HEADERS (units depend on METOUT in START) ***
***------------------------------------------------------------------------***
***     ID:  Hydrograph IDentification numbers, (1-10).                  ***
***  NHYD:  Hydrograph reference numbers, (6 digits or characters).      ***
***  AREA:  Drainage area associated with hydrograph, (ac.) or (ha.).    ***
*** QPEAK:  Peak flow of simulated hydrograph, (ft^3/s) or (m^3/s).      ***
*** TpeakDate_hh:mm is the date and time of the peak flow.               ***
***  R.V.:  Runoff Volume of simulated hydrograph, (in) or (mm).         ***
***  R.C.:  Runoff Coefficient of simulated hydrograph, (ratio).         ***
***     *:  see WARNING or NOTE message printed at end of run.           ***
***    **:  see  ERROR  message printed at end of run.                   ***
***************************************************************************
***************************************************************************

:::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::

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

********************    S U M M A R Y   O U T P U T    ********************
***************************************************************************
*     DATE: 2003-11-09       TIME: 15:15:29      RUN COUNTER: 000480       *
***************************************************************************
* Input   filename: M:\2003\103106\DATA\CALCUL~1\SWMHYMO\SMWFC~1\SWM_C1.da*
* Output  filename: M:\2003\103106\DATA\CALCUL~1\SWMHYMO\SMWFC~1\SWM_C1.ou*
* Summary filename: M:\2003\103106\DATA\CALCUL~1\SWMHYMO\SMWFC~1\SWM_C1.su*
* User comments:                                                          *
* 1:______________________________________________________________________*
* 2:______________________________________________________________________*
* 3:______________________________________________________________________*
***************************************************************************


#**************************************************************************
# Project Name: [Shirley's Brook - SWMF C]              Project Number: [103106]
# Date        : 05-28-2006
# Modeller    : [M.Petepiece]
# Company     : NOVATECH ENGINEERING CONSULTANTS LTD
# License #   : 5320763
#
# Post-Development Conditions to SWM Facility 'C'
# Interim conditions - Klondike Road not urbanized east of OCR
#                    - KRP Industrial lands not developed - sheet drain
#                      directly to Shirley's Brook.
#**************************************************************************
RUN:COMMAND#
001:0001------------------------------------------------------------------
   START
    [TZERO =      .00 hrs on        0]
    [METOUT=    2     (1=imperial, 2=metric output)]
    [NSTORM=    1 ]
    [NRUN  =    1 ]
001:0002------------------------------------------------------------------
   READ STORM
     Filename = storm.001
     Comment  = City of Ottawa:  25mm-3hr Chicago (10 minute time step)
    [SDT=10.00:SDUR=    3.00:PTOT=   25.00]
001:0003---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
   DESIGN STANDHYD       01:C-300       7.48     .343 No_date     1:10      9.93 .397
    [XIMP=.30:TIMP=.37]
    [SLP=1.00:DT= 5.00]
    [LOSS= 2 :CN= 65.0]
001:0004---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
   COMPUTE DUALHYD       01:C-300       7.48     .343 No_date     1:10      9.93  n/a
      Major System /     02:C-3maj       .00     .000 No_date     0:00       .00  n/a
      Minor System \     09:C-3min      7.48     .343 No_date     1:10      9.93  n/a
    {MjSysSto=.0000E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=      0.hrs
001:0005---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 * DESIGN STANDHYD       01:C-201       1.96     .185 No_date     1:10     15.55 .622
    [XIMP=.57:TIMP=.64]
    [SLP=1.50:DT= 5.00]
    [LOSS= 2 :CN= 65.0]
001:0006---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 * DESIGN STANDHYD       02:C-202       3.07     .280 No_date     1:10     15.55 .622
    [XIMP=.57:TIMP=.64]
    [SLP=1.00:DT= 5.00]
    [LOSS= 2 :CN= 65.0]
001:0007---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 * DESIGN STANDHYD       03:C-203       1.90     .075 No_date     1:10      8.64 .346
    [XIMP=.24:TIMP=.30]
    [SLP=1.00:DT= 5.00]
    [LOSS= 2 :CN= 65.0]
001:0008---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 * DESIGN STANDHYD       04:C-204       5.20     .460 No_date     1:10     15.55 .622
    [XIMP=.57:TIMP=.64]
    [SLP=1.00:DT= 5.00]
    [LOSS= 2 :CN= 65.0]
001:0009---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 * DESIGN STANDHYD       05:C-205       2.22     .252 No_date     1:10     18.44 .738
    [XIMP=.70:TIMP=.80]
    [SLP=1.00:DT= 5.00]
    [LOSS= 2 :CN= 65.0]
001:0010---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
   ADD HYD               01:C-201       1.96     .185 No_date     1:10     15.55  n/a
                       + 02:C-202       3.07     .280 No_date     1:10     15.55  n/a
                       + 03:C-203       1.90     .075 No_date     1:10      8.64  n/a
                       + 04:C-204       5.20     .460 No_date     1:10     15.55  n/a
                       + 05:C-205       2.22     .252 No_date     1:10     18.44  n/a
    [DT= 5.00]  SUM=     06:C-2        14.35    1.252 No_date     1:10     15.08  n/a
001:0011---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
   COMPUTE DUALHYD       06:C-2        14.35    1.252 No_date     1:10     15.08  n/a
      Major System /     07:C2maj        .00     .000 No_date     0:00       .00  n/a
      Minor System \     08:C2min      14.35    1.220 No_date     1:10     15.02  n/a
    {MjSysSto=.9866E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=      0.hrs
001:0012---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 * DESIGN STANDHYD       06:C-103       1.20     .060 No_date     1:10     10.05 .402
    [XIMP=.30:TIMP=.40]
    [SLP=1.00:DT= 5.00]
    [LOSS= 2 :CN= 65.0]
001:0013---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
   DESIGN NASHYD         05:C-102        .90     .022 No_date     1:20      6.35 .254
    [CN= 80.0: N= 3.00]
    [Tp=   .17:DT= 5.00]
001:0014---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
   ADD HYD               05:C-102        .90     .022 No_date     1:20      6.35  n/a
                       + 05:C-103       1.20     .060 No_date     1:10     10.05  n/a
                       + 08:C2min      14.35    1.220 No_date     1:10     15.02  n/a
                       + 09:C-3min      7.48     .343 No_date     1:10      9.93  n/a
    [DT= 5.00]  SUM=     10:C_IN_T     23.93    1.640 No_date     1:10     12.85  n/a
001:0015---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
   ROUTE RESERVOIR ->    10:C_IN_T     23.93    1.640 No_date     1:10     12.85  n/a
    [RDT= 5.00] out<-    01:C_OUT_     23.93     .042 No_date     3:05     12.55  n/a
    {MxStoUsed=.2732E+00}
001:0016---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
   SAVE HYD              10:C_IN_T     23.93    1.640 No_date     1:10     12.85  n/a
     fname :M:\2003\103106\DATA\CALCUL~1\SWMHYMO\SMWFC-1\C_IN_T.001
     remark:Inflow to SWMF C - interim
 ** END OF RUN :    1

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



RUN:COMMAND#
002:0001------------------------------------------------------------------
   START
    [TZERO =      .00 hrs on        0]
    [METOUT=    2     (1=imperial, 2=metric output)]
    [NSTORM=    1 ]
    [NRUN  =    2 ]
#**************************************************************************
# Project Name: [Shirley's Brook - SWMF C]              Project Number: [103106]
# Date        : 05-28-2006
# Modeller    : [M.Petepiece]
# Company     : NOVATECH ENGINEERING CONSULTANTS LTD
# License #   : 5320763
#
# Post-Development Conditions to SWM Facility 'C'
# Interim conditions - Klondike Road not urbanized east of OCR
#                    - KRP Industrial lands not developed - sheet drain
#                      directly to Shirley's Brook.
#**************************************************************************
002:0002------------------------------------------------------------------
   READ STORM
     Filename = storm.001
     Comment  = City of Ottawa:  5yr-3hr Chicago (10 minute time step)
    [SDT=10.00:SDUR=    3.00:PTOT=   42.51]
002:0003---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 * DESIGN STANDHYD       01:C-300       7.48     .658 No_date     1:10     19.73 .464
    [XIMP=.30:TIMP=.37]
    [SLP=1.00:DT= 5.00]
    [LOSS= 2 :CN= 65.0]
002:0004---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
   COMPUTE DUALHYD       01:C-300       7.48     .658 No_date     1:10     19.73  n/a
      Major System /     02:C-3maj       .00     .000 No_date     0:00       .00  n/a
      Minor System \     09:C-3min      7.48     .636 No_date     1:10     19.55  n/a
    {MjSysSto=.8347E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=      0.hrs
002:0005---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 * DESIGN STANDHYD       01:C-201       1.96     .334 No_date     1:10     28.47 .670
    [XIMP=.57:TIMP=.64]
    [SLP=1.50:DT= 5.00]
    [LOSS= 2 :CN= 65.0]
002:0006---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 * DESIGN STANDHYD       02:C-202       3.07     .506 No_date     1:10     28.47 .670
    [XIMP=.57:TIMP=.64]
    [SLP=1.00:DT= 5.00]
    [LOSS= 2 :CN= 65.0]
002:0007---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 * DESIGN STANDHYD       03:C-203       1.90     .144 No_date     1:10     17.70 .416
    [XIMP=.24:TIMP=.30]
    [SLP=1.00:DT= 5.00]
    [LOSS= 2 :CN= 65.0]
002:0008---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 * DESIGN STANDHYD       04:C-204       5.20     .841 No_date     1:10     28.47 .670
    [XIMP=.57:TIMP=.64]
    [SLP=1.00:DT= 5.00]
    [LOSS= 2 :CN= 65.0]
002:0009---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 * DESIGN STANDHYD       05:C-205       2.22     .455 No_date     1:10     33.09 .778
    [XIMP=.70:TIMP=.80]
    [SLP=1.00:DT= 5.00]
    [LOSS= 2 :CN= 65.0]
002:0010---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
   ADD HYD               01:C-201       1.96     .334 No_date     1:10     28.47  n/a
                       + 02:C-202       3.07     .506 No_date     1:10     28.47  n/a
                       + 03:C-203       1.90     .144 No_date     1:10     17.70  n/a
                       + 04:C-204       5.20     .841 No_date     1:10     28.47  n/a
                       + 05:C-205       2.22     .455 No_date     1:10     33.09  n/a
    [DT= 5.00]  SUM=     06:C-2        14.35    2.280 No_date     1:10     27.76  n/a
002:0011---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
   COMPUTE DUALHYD       06:C-2        14.35    2.280 No_date     1:10     27.76  n/a
      Major System /     07:C2maj        .00     .000 No_date     0:00       .00  n/a
      Minor System \     08:C2min      14.35    1.220 No_date     1:05     27.83  n/a
```

```
      {MjSysSto=.4700E+03, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
 002:0012---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  *  DESIGN STANDHYD     06:C-103        1.20      .112 No_date    1:10   20.02 .471
      [XIMP=.30:TIMP=.40]
      [SLP=1.00:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
 002:0013---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     DESIGN NASHYD       05:C-102         .90      .057 No_date    1:15   16.09 .379
      [CN= 80.0: N= 3.00]
      [Tp=  .17:DT= 5.00]
 002:0014---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     ADD HYD             05:C-102         .90      .057 No_date    1:15   16.09  n/a
                       + 06:C-103        1.20      .112 No_date    1:10   20.02  n/a
                       + 08:C2min       14.35     1.220 No_date    1:05   27.83  n/a
                       + 09:C-3min       7.48      .636 No_date    1:10   19.65  n/a
      [DT= 5.00]  SUM= 10:C_IN_T        23.93     2.014 No_date    1:10   24.44  n/a
 002:0015---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     ROUTE RESERVOIR -> 10:C_IN_T       23.93     2.014 No_date    1:10   24.44  n/a
      [RDT= 5.00] out<- 01:C_OUT_       23.93      .138 No_date    3:00   24.44  n/a
     {MxStoUsed=.4996E+00}
 002:0016---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     SAVE HYD            10:C_IN_T      23.93     2.014 No_date    1:10   24.44  n/a
      fname :M:\2003\103106\DATA\CALCUL~1\SWMHYMO\SMWFC~1\C_IN_T.002
      remark:Inflow to SWMF C - interim
  ** END OF RUN :    2

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




 RUN:COMMAND#
 003:0001-----------------------------------------------------------------------
     START
      [TZERO =     .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   3 ]
#******************************************************************************
#  Project Name: [Shirley's Brook - SWMF C]             Project Number: [103106]
#  Date         : 05-28-2006
#  Modeller     : [M.Petepiece]
#  Company      : NOVATECH ENGINEERING CONSULTANTS LTD
#  License #    :  5320763
#
# Post-Development Conditions to SWM Facility 'C'
# Interim conditions - Klondike Road not urbanized east of OCR
#                     - KRP Industrial lands not developed - sheet drain
#                       directly to Shirley's Brook.
#******************************************************************************
 003:0002-----------------------------------------------------------------------
     READ STORM
      Filename = storm.001
      Comment  = City of Ottawa:  100yr-3hr Chicago (10 minute time step)
      [SDT=10.00:SDUR=   3.00:PTOT=  71.65]
 003:0003---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  *  DESIGN STANDHYD     01:C-300        7.48     1.313 No_date    1:10   39.14 .546
      [XIMP=.30:TIMP=.37]
      [SLP=1.00:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
 003:0004---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     COMPUTE DUALHYD     01:C-300        7.48     1.313 No_date    1:10   39.14  n/a
        Major System /   02:C-3maj        .12      .086 No_date    1:25   39.12  n/a
        Minor System \   09:C-3min       7.36      .636 No_date    1:05   39.12  n/a
      {MjSysSto=.3740E+03, TotOvfVol=.4518E+02, N-Ovf=    1, TotDurOvf=    0.hrs
 003:0005---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  *  DESIGN STANDHYD     01:C-201        1.96      .628 No_date    1:10   51.90 .724
      [XIMP=.57:TIMP=.64]
      [SLP=1.50:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
 003:0006---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  *  DESIGN STANDHYD     02:C-202        3.07      .925 No_date    1:10   51.90 .724
      [XIMP=.57:TIMP=.64]
      [SLP=1.00:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
 003:0007---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  *  DESIGN STANDHYD     03:C-203        1.90      .292 No_date    1:10   36.12 .504
      [XIMP=.24:TIMP=.30]
      [SLP=1.00:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
 003:0008---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  *  DESIGN STANDHYD     04:C-204        5.20     1.548 No_date    1:10   51.90 .724
      [XIMP=.57:TIMP=.64]
      [SLP=1.00:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
 003:0009---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  *  DESIGN STANDHYD     05:C-205        2.22      .835 No_date    1:10   58.84 .821
      [XIMP=.70:TIMP=.80]
      [SLP=1.00:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
 003:0010---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     ADD HYD             01:C-201        1.95      .628 No_date    1:10   51.90  n/a
                       + 02:C-202        3.07      .925 No_date    1:10   51.90  n/a
                       + 03:C-203        1.90      .292 No_date    1:10   36.12  n/a
                       + 04:C-204        5.20     1.548 No_date    1:10   51.90  n/a
                       + 05:C-205        2.22      .835 No_date    1:10   58.84  n/a
      [DT= 5.00]  SUM= 06:C-2          14.35     4.228 No_date    1:10   50.89  n/a
 003:0011---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     COMPUTE DUALHYD     06:C-2          14.35     4.228 No_date    1:10   50.89  n/a
        Major System /   07:C2maj        2.59     1.933 No_date    1:15   50.89  n/a
        Minor System \   08:C2min       11.76     1.220 No_date    1:05   51.22  n/a
      {MjSysSto=.7180E+03, TotOvfVol=.1317E+04, N-Ovf=    1, TotDurOvf=    0.hrs
 003:0012---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  *  DESIGN STANDHYD     06:C-103        1.20      .247 No_date    1:10   39.73 .554
      [XIMP=.30:TIMP=.40]
      [SLP=1.00:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
 003:0013---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     DESIGN NASHYD       05:C-102         .90      .139 No_date    1:15   36.82 .514
      [CN= 80.0: N= 3.00]
      [Tp=  .17:DT= 5.00]
 003:0014---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     ADD HYD             05:C-102         .90      .139 No_date    1:15   36.82  n/a
                       + 06:C-103        1.20      .247 No_date    1:10   39.73  n/a
                       + 08:C2min       11.76     1.220 No_date    1:05   51.22  n/a
                       + 09:C-3min       7.36      .636 No_date    1:05   39.12  n/a
      [DT= 5.00]  SUM= 10:C_IN_T        21.23     2.215 No_date    1:10   45.76  n/a
 003:0015---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     ROUTE RESERVOIR -> 10:C_IN_T       21.23     2.216 No_date    1:10   45.76  n/a
      [RDT= 5.00] out<- 01:C_OUT_       21.23     1.524 No_date    1:55   45.76  n/a
     {MxStoUsed=.7337E+00}
 003:0016---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     SAVE HYD            10:C_IN_T      21.23     2.216 No_date    1:10   45.76  n/a
      fname :M:\2003\103106\DATA\CALCUL~1\SWMHYMO\SMWFC~1\C_IN_T.003
      remark:Inflow to SWMF C - interim
  ** END OF RUN :    3

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




 RUN:COMMAND#
 004:0001-----------------------------------------------------------------------
     START
      [TZERO =     .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   4 ]
#******************************************************************************
#  Project Name: [Shirley's Brook - SWMF C]             Project Number: [103106]
#  Date         : 05-28-2006
#  Modeller     : [M.Petepiece]
#  Company      : NOVATECH ENGINEERING CONSULTANTS LTD
#  License #    :  5320763
#
# Post-Development Conditions to SWM Facility 'C'
# Interim conditions - Klondike Road not urbanized east of OCR
#                     - KRP Industrial lands not developed - sheet drain
#                       directly to Shirley's Brook.
#******************************************************************************
 004:0002-----------------------------------------------------------------------
     READ STORM
      Filename = storm.001
      Comment  = City of Ottawa:  100yr-12hr SCS Type II (10 min time step)
      [SDT=10.00:SDUR=  12.00:PTOT=  96.00]
 004:0003---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  *  DESIGN STANDHYD     01:C-300        7.48      .922 No_date    6:00   57.36 .598
      [XIMP=.30:TIMP=.37]
      [SLP=1.00:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
 004:0004---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     COMPUTE DUALHYD     01:C-300        7.48      .922 No_date    6:00   57.36  n/a
        Major System /   02:C-3maj        .00      .000 No_date    0:00     .00  n/a
        Minor System \   09:C-3min       7.48      .636 No_date    5:45   57.27  n/a
      {MjSysSto=.2175E+03, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
 004:0005---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  *  DESIGN STANDHYD     01:C-201        1.96      .331 No_date    6:00   72.71 .757
      [XIMP=.57:TIMP=.64]
      [SLP=1.50:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
 004:0006---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  *  DESIGN STANDHYD     02:C-202        3.07      .512 No_date    6:00   72.71 .757
      [XIMP=.57:TIMP=.64]
      [SLP=1.00:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
 004:0007---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  *  DESIGN STANDHYD     03:C-203        1.90      .220 No_date    6:00   53.69 .559
      [XIMP=.24:TIMP=.30]
      [SLP=1.00:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
 004:0008---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  *  DESIGN STANDHYD     04:C-204        5.20      .865 No_date    6:00   72.71 .757
      [XIMP=.57:TIMP=.64]
      [SLP=1.00:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
 004:0009---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  *  DESIGN STANDHYD     05:C-205        2.22      .423 No_date    6:00   81.18 .846
      [XIMP=.70:TIMP=.80]
      [SLP=1.00:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
 004:0010---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     ADD HYD             01:C-201        1.96      .331 No_date    6:00   72.71  n/a
                       + 02:C-202        3.07      .512 No_date    6:00   72.71  n/a
                       + 03:C-203        1.90      .220 No_date    6:00   53.69  n/a
                       + 04:C-204        5.20      .865 No_date    6:00   72.71  n/a
                       + 05:C-205        2.22      .423 No_date    6:00   81.18  n/a
      [DT= 5.00]  SUM= 06:C-2          14.35     2.352 No_date    6:00   71.50  n/a
 004:0011---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     COMPUTE DUALHYD     06:C-2          14.35     2.352 No_date    6:00   71.50  n/a
        Major System /   07:C2maj        1.03     1.088 No_date    6:00   71.50  n/a
        Minor System \   08:C2min       13.32     1.220 No_date    5:35   71.50  n/a
      {MjSysSto=.7180E+03, TotOvfVol=.7364E+03, N-Ovf=    1, TotDurOvf=    0.hrs
 004:0012---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  *  DESIGN STANDHYD     06:C-103        1.20      .154 No_date    6:00   58.19 .606
      [XIMP=.30:TIMP=.40]
      [SLP=1.00:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
 004:0013---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     DESIGN NASHYD       05:C-102         .90      .129 No_date    6:00   56.52 .589
      [CN= 80.0: N= 3.00]
      [Tp=  .17:DT= 5.00]
 004:0014---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     ADD HYD             05:C-102         .90      .129 No_date    6:00   56.52  n/a
                       + 06:C-103        1.20      .154 No_date    6:00   58.19  n/a
                       + 08:C2min       13.32     1.220 No_date    5:35   71.50  n/a
                       + 09:C-3min       7.48      .636 No_date    5:45   57.27  n/a
      [DT= 5.00]  SUM= 10:C_IN_T        22.90     2.139 No_date    6:00   65.57  n/a
 004:0015---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     ROUTE RESERVOIR -> 10:C_IN_T       22.90     2.139 No_date    6:00   65.57  n/a
      [RDT= 5.00] out<- 01:C_OUT_       22.90     2.135 No_date    6:20   65.56  n/a
     {MxStoUsed=.7345E+00}
 004:0016---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     SAVE HYD            10:C_IN_T      22.90     2.139 No_date    6:00   65.57  n/a
      fname :M:\2003\103106\DATA\CALCUL~1\SWMHYMO\SMWFC~1\C_IN_T.004
      remark:Inflow to SWMF C - interim
 004:0002-----------------------------------------------------------------------
      FINISH
-------------------------------------------------------------------------------
*******************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
 001:0005 DESIGN STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 001:0006 DESIGN STANDHYD
```

```
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
001:0007 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
001:0008 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
001:0009 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
001:0012 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
002:0003 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
002:0005 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
002:0006 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
002:0007 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
002:0008 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
002:0009 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
002:0012 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
003:0003 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
003:0005 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
003:0006 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
003:0007 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
003:0008 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
003:0009 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
003:0012 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
004:0003 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
004:0005 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
004:0006 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
004:0007 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
004:0008 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
004:0009 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
004:0012 DESIGN STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
  Simulation ended on 2006-11-09     at 15:15:30
==============================================================================
```

```
2    Metric units
*#*****************************************************************************
*#  Project Name: [Shirley's Brook - SWMF C]              Project Number: [103106]
*#  Date        : 05-28-2006
*#  Modeller    : [M.Petepiece]
*#  Company     : NOVATECH ENGINEERING CONSULTANTS LTD
*#  License #   :  5320763
*#
*# Post-Development Conditions to SWM Facility 'C'
*#*****************************************************************************
START                 TZERO=[0.0],   METOUT=[2],   NSTORM=[1],   NRUN=[1]
                      C25mm-3.stm
*
READ STORM            STORM_FILENAME=["storm.001"]
*=============================================================================
*
*                              KLONDIKE ROAD SUBDIVISION
*                               LANDS TO SWM FACILITY C
*                                 ULTIMATE CONDITIONS
*
*=============================================================================
* Klondike Area C-300
* (Institutional/Residential)
*   7.48 ha x 85 L/s/ha = 636 L/s
*   7.48 ha @ 50 m3/ha  = 374 m3
* -----------------------------
DESIGN STANDHYD       ID=[1], NHYD=["C-300"], DT=[5]min, AREA=[7.48](ha),
                      XIMP=[0.30], TIMP=[0.37], DWF=[0](cms), LOSS=[2], CN=[65],
                      SLOPE=[1.0](%), END=-1
*
COMPUTE DUALHYD       IDin=[1], CINLET=[0.636](cms), NINLET=[1],
                      MAJID=[2], MajNHYD=["C-3maj"],
                      MINID=[9], MinNHYD=["C-3min"],
                      TMJSTO=[374](cu-m)
*
*%-----------------|----------------------------------------------------------|
* Klondike Area C-201
* medium density residential)
* -----------------------------
DESIGN STANDHYD       ID=[1], NHYD=["C-201"], DT=[5]min, AREA=[1.96](ha),
                      XIMP=[0.57], TIMP=[0.64], DWF=[0](cms), LOSS=[2], CN=[65],
                      SLOPE=[1.5](%), END=-1
*
* Klondike Area C-202
* (medium density residential)
* -----------------------------
DESIGN STANDHYD       ID=[2], NHYD=["C-202"], DT=[5]min, AREA=[3.07](ha),
                      XIMP=[0.57], TIMP=[0.64], DWF=[0](cms), LOSS=[2], CN=[65],
                      SLOPE=[1.0](%), END=-1
*
* Klondike Area C-203
* (park)
* -----------------------------
DESIGN STANDHYD       ID=[3], NHYD=["C-203"], DT=[5]min, AREA=[1.90](ha),
                      XIMP=[0.24], TIMP=[0.30], DWF=[0](cms), LOSS=[2], CN=[65],
                      SLOPE=[1.0](%), END=-1
*
* Klondike Area C-204
* (medium density residential)
* -----------------------------
DESIGN STANDHYD       ID=[4], NHYD=["C-204"], DT=[5]min, AREA=[5.20](ha),
                      XIMP=[0.57], TIMP=[0.64], DWF=[0](cms), LOSS=[2], CN=[65],
                      SLOPE=[1.0](%), END=-1
*
* Klondike Area C-205
* (Klondike Road U/S of CCR)
* -----------------------------
DESIGN STANDHYD       ID=[5], NHYD=["C-205"], DT=[5]min, AREA=[2.22](ha),
                      XIMP=[0.70], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[65],
                      SLOPE=[1.0](%), END=-1
*
* Klondike Area C-2 (ALL)
* -----------------------------
ADD HYD               IDsum=[6], NHYD=["C-2"], IDs to add=[1,2,3,4,5]
*
* Minor System Capture for Area C-2:
*  14.35 ha @ 85 L/s/ha = 1220 L/s
*  14.35 ha @ 50 m3/ha  =  718 m3
* ---------------------------------------
COMPUTE DUALHYD       IDin=[6], CINLET=[1.220](cms), NINLET=[1],
                      MAJID=[7], MajNHYD=["C2maj"],
                      MINID=[8], MinNHYD=["C2min"],
                      TMJSTO=[718](cu-m)
*%-----------------|----------------------------------------------------------|
* Klondike Area C-101
* (Industrial)
* -----------------------
DESIGN STANDHYD       ID=[1], NHYD=["C-101"], DT=[5]min, AREA=[3.16](ha),
                      XIMP=[0.70], TIMP=[0.70], DWF=[0](cms), LOSS=[2], CN=[65],
                      SLOPE=[0.6](%), END=-1
*
* 3.16 ha @ 85 L/s/ha = 269 L/s
* 3.16 ha @ 50 m3/ha  = 158 m3
* -----------------------------
COMPUTE DUALHYD       IDin=[1], CINLET=[0.269](cms), NINLET=[1],
                      MAJID=[2], MajNHYD=["C101ma"],
                      MINID=[7], MinNHYD=["C101mi"],
                      TMJSTO=[158](cu-m)
*%-----------------|----------------------------------------------------------|
* Klondike Area C-103 (Klondike Road D/S of CCR)
* -----------------------------
DESIGN STANDHYD       ID=[6], NHYD=["C-103"], DT=[5]min, AREA=[1.20](ha),
                      XIMP=[0.70], TIMP=[0.80], DWF=[0](cms), LOSS=[2], CN=[65],
                      SLOPE=[1.0](%), END=-1
*%-----------------|----------------------------------------------------------|
* Klondike Area C-102 (SWMF C)
* -----------------------------
DESIGN NASHYD         ID=[5], NHYD=["C-102"], DT=[5]min, AREA=[0.90](ha),
                      DWF=[0](cms), CN/C=[80], TP=[0.17]hrs,
                      RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
*%-----------------|----------------------------------------------------------|
*
ADD HYD               IDsum=[10], NHYD=["SWMC_IN"], IDs to add=[5,6,7,8,9]
*
* -------------------------------------------------
* SWMF C
* -------------------------------------------------
* Drainage Area :       26.2 ha (not incl. SWMF C)
* Extended Detention: Q=  29 L/s max
* Erosion Control:      Q= 262 L/s (10 L/s/ha)
* >5yr Storm:           Qin=Qout
* -------------------------------------------------
ROUTE RESERVOIR       IDout=[1],   NHYD=["SWMC_OUT"],  IDin=[10],
                      RDT=[5](min),
                            TABLE of ( OUTFLOW-STORAGE ) values
                                      (cms) - (ha-m)
                                     [ 0.000 , 0.0000 ]
                                     [ 0.020 , 0.1030 ]
                                     [ 0.029 , 0.1860 ]
                                     [ 0.060 , 0.3910 ]
                                     [ 0.100 , 0.4200 ]
                                     [ 0.160 , 0.5460 ]
                                     [ 0.262 , 0.7090 ]
                                     [ 3.000 , 0.7430 ]
                                     [  -1   ,  -1    ]  (max twenty pts)
*%-----------------|----------------------------------------------------------|
SAVE HYD              ID=[10],   # OF PCYCLES=[1],  ICASEsh=[-1]
                      HYD_FILENAME=["SWMC_IN"]
                      HYD_COMMENT=["Inflow to SWMF C"]
*%-----------------|----------------------------------------------------------|
START                 TZERO=[0.0],   METOUT=[2],   NSTORM=[1],   NRUN=[2]
                      C5-3.stm
*
START                 TZERO=[0.0],   METOUT=[2],   NSTORM=[1],   NRUN=[3]
                      C100-3.stm
*
START                 TZERO=[0.0],   METOUT=[2],   NSTORM=[1],   NRUN=[4]
                      S100-12.stm
*
FINISH
```

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

SSSSS  W   W  M   M  H   H  Y   Y  M   M  OOO        999   888  =========
S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  8   8 =========
SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  8   8 Ver. 4.0
    S  W W    M   M  H   H    Y    M   M  O   O       9999   888  Sept 1998
SSSSS  W W    M   M  H   H    Y    M   M   OOO           9  8   8 =========
                                                     9   9  8   8 # 5320763
     StormWater Management HYdrologic Model            999   888  =========

**************************************************************************
************************* SWMHYMO-98  Ver/4.0 ****************************
*******  A single event and continuous hydrologic simulation model  *******
*******     based on the principles of HYMO and its successors      *******
*******                OTTHYMO-83 and OTTHYMO-89.                   *******
**************************************************************************
******* Distributed by:  J.F. Sabourin and Associates Inc.          *******
*******                  Ottawa, Ontario: (613) 727-5199            *******
*******                  Gatineau, Quebec: (819) 243-6858           *******
*******                  E-Mail: swmhymo@jfsa.Com                   *******
**************************************************************************

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++++++ Licensed user: NOVATECH ENGINEERING CONSULTANTS LTD        +++++++
+++++++                Nepean               SERIAL#:5320763        +++++++
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

**************************************************************************
*******            ++++++ PROGRAM ARRAY DIMENSIONS ++++++           *******
*******            Maximum value for ID numbers    :    10          *******
*******            Max. number of rainfall points:  15000           *******
*******            Max. number of flow points     :  15000          *******
**************************************************************************

*** DESCRIPTION SUMMARY TABLE HEADERS (units depend on METOUT in START) ***
***----------------------------------------------------------------------***
***     ID:  Hydrograph IDentification numbers, (1-10).                  ***
***   NHYD:  Hydrograph reference numbers, (6 digits or characters).     ***
***   AREA:  Drainage area associated with hydrograph, (ac.) or (ha.).   ***
***  QPEAK:  Peak flow of simulated hydrograph, (ft^3/s) or (m^3/s).     ***
***  TpeakDate_hh:mm is the date and time of the peak flow.              ***
***   R.V.:  Runoff Volume of simulated hydrograph, (in) or (mm).        ***
***   R.C.:  Runoff Coefficient of simulated hydrograph, (ratio).        ***
***      *:  see WARNING or NOTE message printed at end of run.          ***
***     **:  see  ERROR  message printed at end of run.                  ***
**************************************************************************
**************************************************************************

::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::

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

********************   S U M M A R Y   O U T P U T   ********************
**************************************************************************
*     DATE: 2006-10-05     TIME: 09:39:06     RUN COUNTER: 000419        *
**************************************************************************
* Input    filename: M:\2003\103106\DATA\CALCUL~1\SWMHYMO\SMWFC~1\SWM_C.dat*
* Output   filename: M:\2003\103106\DATA\CALCUL~1\SWMHYMO\SMWFC~1\SWM_C.out*
* Summary filename: M:\2003\103106\DATA\CALCUL~1\SWMHYMO\SMWFC~1\SWM_C.sum*
* User comments:                                                         *
* 1:_____________________________________________________________________*
* 2:_____________________________________________________________________*
* 3:_____________________________________________________________________*
**************************************************************************

#*************************************************************************
# Project Name: [Shirley's Brook - SWMF C]        Project Number: [103106]
# Date        : 05-28-2006
# Modeller    : [M.Petepiece]
# Company     : NOVATECH ENGINEERING CONSULTANTS LTD
# License #   :  5320763
#
# Post-Development Conditions to SWM Facility 'C'
#*************************************************************************
RUN:COMMAND#
001:0001------------------------------------------------------------------
    START
     [TZERO =    .00 hrs on        0]
     [METOUT=    2    (1=imperial, 2=metric output)]
     [NSTORM=    1 ]
     [NRUN  =    1 ]
001:0002------------------------------------------------------------------
    READ STORM
     Filename = storm.001
     Comment  = City of Ottawa:  25mm storm (Chicago distribution - 10 minut
     [SDT=10.00:SDUR=   4.00:PTOT=  24.98]
001:0003---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    DESIGN STANDHYD    01:C-300      7.48     .319 No_date    1:40     9.92 .397
     [XIMP=.30:TIMP=.37]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
001:0004---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    01:C-300      7.48     .319 No_date    1:40     9.92  n/a
      Major System /   02:C-3maj      .00     .000 No_date    0:00      .00  n/a
      Minor System \   09:C-3min     7.48     .319 No_date    1:40     9.92  n/a
     {MjSysSto=.0000E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
001:0005---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  * DESIGN STANDHYD    01:C-201      1.96     .173 No_date    1:40    15.54 .622
     [XIMP=.57:TIMP=.64]
     [SLP=1.50:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
001:0006---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  * DESIGN STANDHYD    02:C-202      3.07     .261 No_date    1:40    15.54 .622
     [XIMP=.57:TIMP=.64]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
001:0007---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  * DESIGN STANDHYD    03:C-203      1.90     .070 No_date    1:40     8.63 .346
     [XIMP=.24:TIMP=.30]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
001:0008---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  * DESIGN STANDHYD    04:C-204      5.20     .428 No_date    1:40    15.54 .622
     [XIMP=.57:TIMP=.64]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
001:0009---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  * DESIGN STANDHYD    05:C-205      2.22     .235 No_date    1:40    18.43 .738
     [XIMP=.70:TIMP=.80]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
001:0010---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    ADD HYD            01:C-201      1.96     .173 No_date    1:40    15.54  n/a
                     + 02:C-202      3.07     .261 No_date    1:40    15.54  n/a
                     + 03:C-203      1.90     .070 No_date    1:40     3.63  n/a
                     + 04:C-204      5.20     .428 No_date    1:40    15.54  n/a
                     + 05:C-205      2.22     .235 No_date    1:40    18.43  n/a
     [DT= 5.00]  SUM=  06:C-2       14.35    1.166 No_date    1:40    15.07  n/a
001:0011---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    06:C-2       14.35    1.166 No_date    1:40    15.07  n/a
      Major System /   07:C2maj       .00     .000 No_date    0:00      .00  n/a
      Minor System \   08:C2min     14.35    1.166 No_date    1:40    15.07  n/a
     {MjSysSto=.0000E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
001:0012---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  * DESIGN STANDHYD    01:C-101      3.16     .317 No_date    1:40    17.96 .719
     [XIMP=.70:TIMP=.70]
     [SLP= .60:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
001:0013---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    01:C-101      3.16     .317 No_date    1:40    17.96  n/a
      Major System /   02:C101ma      .00     .000 No_date    0:00      .00  n/a
      Minor System \   07:C101mi     3.16     .269 No_date    1:40    17.63  n/a
     {MjSysSto=.8342E+01, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
001:0014---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  * DESIGN STANDHYD    06:C-103      1.20     .130 No_date    1:40    18.43 .738
     [XIMP=.70:TIMP=.80]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
001:0015---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    DESIGN NASHYD      05:C-102       .90     .020 No_date    1:45     6.34 .254
     [CN= 80.0: N= 3.00]
     [Tp=  .17:DT= 5.00]
001:0016---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    ADD HYD            05:C-102       .90     .020 No_date    1:45     6.34  n/a
                     + 06:C-103      1.20     .130 No_date    1:40    18.43  n/a
                     + 07:C101mi     3.16     .269 No_date    1:40    17.63  n/a
                     + 08:C2min     14.35    1.166 No_date    1:40    15.07  n/a
                     + 09:C-3min     7.48     .319 No_date    1:40     9.92  n/a
     [DT= 5.00]  SUM=  10:SWMC_I    27.09    1.900 No_date    1:40    13.81  n/a
001:0017---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    ROUTE RESERVOIR -> 10:SWMC_I    27.09    1.900 No_date    1:40    13.81  n/a
     [RDT= 5.00] out<- 01:SWMC_O    27.05     .050 No_date    4:05    13.81  n/a
     {MxStoUsed=.3270E+00}
001:0018---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    SAVE HYD           10:SWMC_I    27.09    1.900 No_date    1:40    13.81  n/a
      fname :M:\2003\103106\DATA\CALCUL~1\SWMHYMO\SMWFC~1\SWMC_IN.001
      remark:Inflow to SWMF C
 ** END OF RUN :    1

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

RUN:COMMAND#
002:0001------------------------------------------------------------------
    START
     [TZERO =    .00 hrs on        0]
     [METOUT=    2    (1=imperial, 2=metric output)]
     [NSTORM=    1 ]
     [NRUN  =    2 ]
#*************************************************************************
# Project Name: [Shirley's Brook - SWMF C]        Project Number: [103106]
# Date        : 05-28-2006
# Modeller    : [M.Petepiece]
# Company     : NOVATECH ENGINEERING CONSULTANTS LTD
# License #   :  5320763
#
# Post-Development Conditions to SWM Facility 'C'
#*************************************************************************
002:0002------------------------------------------------------------------
    READ STORM
     Filename = storm.001
     Comment  = City of Ottawa:  5yr-3hr Chicago (DT=10 min, TPRAT=0.4, Peak
     [SDT=10.00:SDUR=   3.00:PTOT=  42.50]
002:0003---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  * DESIGN STANDHYD    01:C-300      7.48     .657 No_date    1:10    19.73 .464
     [XIMP=.30:TIMP=.37]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
002:0004---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD    01:C-300      7.48     .657 No_date    1:10    19.73  n/a
      Major System /   02:C-3maj      .00     .000 No_date    0:00      .00  n/a
      Minor System \   09:C-3min     7.48     .636 No_date    1:10    19.65  n/a
     {MjSysSto=.7624E+00, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=    0.hrs
002:0005---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  * DESIGN STANDHYD    01:C-201      1.96     .334 No_date    1:10    28.47 .670
     [XIMP=.57:TIMP=.64]
     [SLP=1.50:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
002:0006---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  * DESIGN STANDHYD    02:C-202      3.07     .505 No_date    1:10    28.47 .670
     [XIMP=.57:TIMP=.64]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
002:0007---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  * DESIGN STANDHYD    03:C-203      1.90     .143 No_date    1:10    17.70 .416
     [XIMP=.24:TIMP=.30]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
002:0008---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  * DESIGN STANDHYD    04:C-204      5.20     .840 No_date    1:10    28.47 .670
     [XIMP=.57:TIMP=.64]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
002:0009---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
  * DESIGN STANDHYD    05:C-205      2.22     .454 No_date    1:10    33.09 .778
     [XIMP=.70:TIMP=.80]
     [SLP=1.00:DT= 5.00]
     [LOSS= 2 :CN= 65.0]
002:0010---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    ADD HYD            01:C-201      1.96     .334 No_date    1:10    28.47  n/a
                     + 02:C-202      3.07     .505 No_date    1:10    28.47  n/a
                     + 03:C-203      1.90     .143 No_date    1:10    17.70  n/a
                     + 04:C-204      5.20     .840 No_date    1:10    28.47  n/a
                     + 05:C-205      2.22     .454 No_date    1:10    33.09  n/a
```

```
       [DT= 5.00]  SUM=  06:C-2        14.35     2.276 No_date     1:10    27.76  n/a
002:0011----------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD     06:C-2        14.35     2.276 No_date     1:10    27.76  n/a
       Major System /   07:C2maj        .00      .000 No_date     0:00      .00  n/a
       Minor System \   08:C2min      14.35     1.220 No_date     1:05    27.79  n/a
      {MjSysSto=.4711E+03, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=     0.hrs
002:0012----------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD     01:C-101       3.16      .614 No_date     1:10    32.03 .754
      [XIMP=.70:TIMP=.70]
      [SLP= .60:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
002:0013----------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD     01:C-101       3.16      .614 No_date     1:10    32.03  n/a
       Major System /   02:C101ma       .05      .047 No_date     1:15    32.03  n/a
       Minor System \   07:C101mi      3.11      .269 No_date     1:05    31.82  n/a
      {MjSysSto=.1580E+03, TotOvfVol=.1685E+02, N-Ovf=    1, TotDurOvf=     0.hrs
002:0014----------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD     06:C-103       1.20      .248 No_date     1:10    33.09 .778
      [XIMP=.70:TIMP=.80]
      [SLP=1.00:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
002:0015----------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    DESIGN NASHYD       05:C-102        .90      .058 No_date     1:15    16.09 .379
      [CN= 80.0: N= 3.00]
      [Tp=  .17:DT= 5.00]
002:0016----------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    ADD HYD             05:C-102        .90      .058 No_date     1:15    16.09  n/a
                    +   06:C-103       1.20      .248 No_date     1:10    33.09  n/a
                    +   07:C101mi      3.11      .269 No_date     1:05    31.82  n/a
                    +   08:C2min      14.35     1.220 No_date     1:05    27.79  n/a
                    +   09:C-3min      7.48      .636 No_date     1:10    19.65  n/a
       [DT= 5.00]  SUM= 10:SWMC_I     27.04     2.419 No_date     1:10    25.84  n/a
002:0017----------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    ROUTE RESERVOIR ->  10:SWMC_I     27.04     2.419 No_date     1:10    25.84  n/a
     [RDT= 5.00] out<-  01:SWMC_O     27.04      .184 No_date     2:55    25.84  n/a
      {MxStoUsed=.5850E+00}
002:0018----------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    SAVE HYD            10:SWMC_I     27.04     2.419 No_date     1:10    25.84  n/a
      fname :M:\2003\103106\DATA\CALCUL~1\SWMHYMO\SMWFC~1\SWMC_IN.002
      remark:Inflow to SWMF C
 ** END OF RUN :    2

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



RUN:COMMAND#
003:0001--------------------------------------------------------------------------
    START
      [TZERO =     .00 hrs on        0]
      [METOUT=    2     (1=imperial, 2=metric output)]
      [NSTORM=    1 ]
      [NRUN  =    3 ]
#*************************************************************************************
#  Project Name: [Shirley's Brook - SWMF C]              Project Number: [103106]
#  Date          : 05-28-2006
#  Modeller      : [M.Petepiece]
#  Company       : NOVATECH ENGINEERING CONSULTANTS LTD
#  License #     :  5320763
#
# Post-Development Conditions to SWM Facility 'C'
#*************************************************************************************
003:0002--------------------------------------------------------------------------
    READ STORM
      Filename = storm.001
      Comment  = City of Ottawa:  100yr-3hr Chicago (10 minute time step - 20
      [SDT=10.00:SDUR=   3.00:PTOT=  71.67]
003:0003----------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD     01:C-300       7.48     1.076 No_date     1:10    39.16 .546
      [XIMP=.30:TIMP=.37]
      [SLP=1.00:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
003:0004----------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD     01:C-300       7.48     1.076 No_date     1:10    39.16  n/a
       Major System /   02:C-3maj       .00      .000 No_date     0:00      .00  n/a
       Minor System \   09:C-3min      7.48      .636 No_date     0:55    39.26  n/a
      {MjSysSto=.3154E+03, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=     0.hrs
003:0005----------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD     01:C-201       1.96      .444 No_date     1:10    51.92 .725
      [XIMP=.57:TIMP=.64]
      [SLP=1.50:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
003:0006----------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD     02:C-202       3.07      .664 No_date     1:10    51.92 .725
      [XIMP=.57:TIMP=.64]
      [SLP=1.00:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
003:0007----------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD     03:C-203       1.90      .247 No_date     1:10    36.14 .504
      [XIMP=.24:TIMP=.30]
      [SLP=1.00:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
003:0008----------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD     04:C-204       5.20     1.121 No_date     1:10    51.92 .725
      [XIMP=.57:TIMP=.64]
      [SLP=1.00:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
003:0009----------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD     05:C-205       2.22      .578 No_date     1:10    58.86 .821
      [XIMP=.70:TIMP=.80]
      [SLP=1.00:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
003:0010----------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    ADD HYD             01:C-201       1.96      .444 No_date     1:10    51.92  n/a
                    +   02:C-202       3.07      .664 No_date     1:10    51.92  n/a
                    +   03:C-203       1.90      .247 No_date     1:10    36.14  n/a
                    +   04:C-204       5.20     1.121 No_date     1:10    51.92  n/a
                    +   05:C-205       2.22      .578 No_date     1:10    58.86  n/a
       [DT= 5.00]  SUM= 06:C-2        14.35     3.053 No_date     1:10    50.91  n/a
003:0011----------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD     06:C-2        14.35     3.053 No_date     1:10    50.91  n/a
       Major System /   07:C2maj       2.28     1.748 No_date     1:10    50.91  n/a
       Minor System \   08:C2min      12.07     1.220 No_date     0:55    51.44  n/a
      {MjSysSto=.7180E+03, TotOvfVol=.1161E+04, N-Ovf=    1, TotDurOvf=     0.hrs
003:0012----------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD     01:C-101       3.16      .755 No_date     1:10    56.74 .792
      [XIMP=.70:TIMP=.70]
```

```
      [SLP= .60:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
003:0013----------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD     01:C-101       3.16      .755 No_date     1:10    56.74  n/a
       Major System /   02:C101ma       .67      .475 No_date     1:10    56.74  n/a
       Minor System \   07:C101mi      2.49      .269 No_date     0:55    57.52  n/a
      {MjSysSto=.1580E+03, TotOvfVol=.3793E+03, N-Ovf=    1, TotDurOvf=     0.hrs
003:0014----------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD     06:C-103       1.20      .313 No_date     1:10    58.86 .821
      [XIMP=.70:TIMP=.80]
      [SLP=1.00:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
003:0015----------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    DESIGN NASHYD       05:C-102        .90      .132 No_date     1:10    36.83 .514
      [CN= 80.0: N= 3.00]
      [Tp=  .17:DT= 5.00]
003:0016----------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    ADD HYD             05:C-102        .90      .132 No_date     1:10    36.83  n/a
                    +   06:C-103       1.20      .313 No_date     1:10    58.86  n/a
                    +   07:C101mi      2.49      .269 No_date     0:55    57.52  n/a
                    +   08:C2min      12.07     1.220 No_date     0:55    51.44  n/a
                    +   09:C-3min      7.48      .636 No_date     0:55    39.26  n/a
       [DT= 5.00]  SUM= 10:SWMC_I     24.14     2.570 No_date     1:10    48.12  n/a
003:0017----------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    ROUTE RESERVOIR ->  10:SWMC_I     24.14     2.570 No_date     1:10    48.12  n/a
     [RDT= 5.00] out<-  01:SWMC_O     24.14     2.313 No_date     1:40    48.12  n/a
      {MxStoUsed=.7360E+00}
003:0018----------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    SAVE HYD            10:SWMC_I     24.14     2.570 No_date     1:10    48.12  n/a
      fname :M:\2003\103106\DATA\CALCUL~1\SWMHYMO\SMWFC~1\SWMC_IN.003
      remark:Inflow to SWMF C
 ** END OF RUN :    3

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



RUN:COMMAND#
004:0001--------------------------------------------------------------------------
    START
      [TZERO =     .00 hrs on        0]
      [METOUT=    2     (1=imperial, 2=metric output)]
      [NSTORM=    1 ]
      [NRUN  =    4 ]
#*************************************************************************************
#  Project Name: [Shirley's Brook - SWMF C]              Project Number: [103106]
#  Date          : 05-28-2006
#  Modeller      : [M.Petepiece]
#  Company       : NOVATECH ENGINEERING CONSULTANTS LTD
#  License #     :  5320763
#
# Post-Development Conditions to SWM Facility 'C'
#*************************************************************************************
004:0002--------------------------------------------------------------------------
    READ STORM
      Filename = storm.001
      Comment  = City of Ottawa:  100yr-12hr SCS Type II (10 min time step)
      [SDT=10.00:SDUR=  12.00:PTOT=  93.00]
004:0003----------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD     01:C-300       7.48      .922 No_date     6:00    57.36 .598
      [XIMP=.30:TIMP=.37]
      [SLP=1.00:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
004:0004----------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD     01:C-300       7.48      .922 No_date     6:00    57.36  n/a
       Major System /   02:C-3maj       .00      .000 No_date     0:00      .00  n/a
       Minor System \   09:C-3min      7.48      .636 No_date     5:45    57.27  n/a
      {MjSysSto=.2175E+03, TotOvfVol=.0000E+00, N-Ovf=    0, TotDurOvf=     0.hrs
004:0005----------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD     01:C-201       1.96      .331 No_date     6:00    72.71 .757
      [XIMP=.57:TIMP=.64]
      [SLP=1.50:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
004:0006----------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD     02:C-202       3.07      .512 No_date     6:00    72.71 .757
      [XIMP=.57:TIMP=.64]
      [SLP=1.00:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
004:0007----------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD     03:C-203       1.90      .220 No_date     6:00    53.69 .559
      [XIMP=.24:TIMP=.30]
      [SLP=1.00:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
004:0008----------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD     04:C-204       5.20      .865 No_date     6:00    72.71 .757
      [XIMP=.57:TIMP=.64]
      [SLP=1.00:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
004:0009----------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD     05:C-205       2.22      .423 No_date     6:00    81.18 .846
      [XIMP=.70:TIMP=.80]
      [SLP=1.00:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
004:0010----------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    ADD HYD             01:C-201       1.96      .331 No_date     6:00    72.71  n/a
                    +   02:C-202       3.07      .512 No_date     6:00    72.71  n/a
                    +   03:C-203       1.90      .220 No_date     6:00    53.69  n/a
                    +   04:C-204       5.20      .865 No_date     6:00    72.71  n/a
                    +   05:C-205       2.22      .423 No_date     6:00    81.18  n/a
       [DT= 5.00]  SUM= 06:C-2        14.35     2.352 No_date     6:00    71.50  n/a
004:0011----------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD     06:C-2        14.35     2.352 No_date     6:00    71.50  n/a
       Major System /   07:C2maj       1.03     1.088 No_date     6:00    71.50  n/a
       Minor System \   08:C2min      13.32     1.220 No_date     5:35    71.50  n/a
      {MjSysSto=.7180E+03, TotOvfVol=.7364E+03, N-Ovf=    1, TotDurOvf=     0.hrs
004:0012----------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD     01:C-101       3.16      .562 No_date     6:00    78.22 .815
      [XIMP=.70:TIMP=.70]
      [SLP= .60:DT= 5.00]
      [LOSS= 2 :CN= 65.0]
004:0013----------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
    COMPUTE DUALHYD     01:C-101       3.16      .562 No_date     6:00    78.22  n/a
       Major System /   02:C101ma       .34      .287 No_date     6:00    78.22  n/a
       Minor System \   07:C101mi      2.82      .269 No_date     5:35    78.12  n/a
      {MjSysSto=.1580E+03, TotOvfVol=.2432E+03, N-Ovf=    1, TotDurOvf=     0.hrs
004:0014----------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
 *  DESIGN STANDHYD     06:C-103       1.20      .232 No_date     6:00    81.18 .846
```

```
       [XIMP=.70:TIMP=.80]
       [SLP=1.00:DT= 5.00]
       [LOSS= 2 :CN= 65.0]
004:0015---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     DESIGN NASHYD      05:C-102       .90      .129 No_date    6:00   56.52 .509
       [CN= 80.0: N= 3.00]
       [Tp=  .17:DT= 5.00]
004:0016---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     ADD HYD            05:C-102       .90      .129 No_date    6:00   56.52  n/a
                     +  06:C-103      1.20      .232 No_date    6:00   81.16  n/a
                     +  07:C101mi     2.82      .269 No_date    5:35   78.12  n/a
                     +  08:C2min     13.32     1.220 No_date    5:35   71.50  n/a
                     +  09:C-3min     7.48      .636 No_date    5:45   57.27  n/a
       [DT= 5.00]  SUM= 10:SWMC_I    25.72     2.486 No_date    6:00   68.02  n/a
004:0017---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     ROUTE RESERVOIR -> 10:SWMC_I    25.72     2.406 No_date    6:00   68.02  n/a
       [RDT= 5.00] out<- 01:SWMC_O   25.72     2.477 No_date    6:10   68.02  n/a
      {MxStoUsed=.7391E+00}
004:0018---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.
     SAVE HYD           10:SWMC_I    25.72     2.486 No_date    6:00   68.02  n/a
       fname :M:\2003\103106\DATA\CALCUL~1\SWMHYMO\SMWFC~1\SWMC_IN.004
       remark:Inflow to SWMF C
004:0002-----------------------------------------------------------------------
       FINISH
-------------------------------------------------------------------------------
*******************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
001:0005 DESIGN STANDHYD
       *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
001:0006 DESIGN STANDHYD
       *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
001:0007 DESIGN STANDHYD
       *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
001:0008 DESIGN STANDHYD
       *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
001:0009 DESIGN STANDHYD
       *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
001:0012 DESIGN STANDHYD
       *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
001:0014 DESIGN STANDHYD
       *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
002:0003 DESIGN STANDHYD
       *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
002:0005 DESIGN STANDHYD
       *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
002:0006 DESIGN STANDHYD
       *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
002:0007 DESIGN STANDHYD
       *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
002:0008 DESIGN STANDHYD
       *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
002:0009 DESIGN STANDHYD
       *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
002:0012 DESIGN STANDHYD
       *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
002:0014 DESIGN STANDHYD
       *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
003:0003 DESIGN STANDHYD
       *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
003:0005 DESIGN STANDHYD
       *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
003:0006 DESIGN STANDHYD
       *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
003:0007 DESIGN STANDHYD
       *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
003:0008 DESIGN STANDHYD
       *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
003:0009 DESIGN STANDHYD
       *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
003:0012 DESIGN STANDHYD
       *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
003:0014 DESIGN STANDHYD
       *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
004:0003 DESIGN STANDHYD
       *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
004:0005 DESIGN STANDHYD
       *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
004:0006 DESIGN STANDHYD
       *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
004:0007 DESIGN STANDHYD
       *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
004:0008 DESIGN STANDHYD
       *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
004:0009 DESIGN STANDHYD
       *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
004:0012 DESIGN STANDHYD
       *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
004:0014 DESIGN STANDHYD
       *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
   Simulation ended on 2006-10-05     at 09:39:07
===============================================================================
```

SWMF 'C' - Outlet Strucutre

Head vs. Discharge Curves (for use in EPA SWMM Model)

Outlet Details						
	EXT.DET		EROSION CONTROL		OVERFLOW SPILLWAY (WEIR)	
Dia	*180 mm*	*Dia*	*600 mm*	*Length*	*40 m*	
Inv	*66.05 m*	*Inv*	*66.05 m*	*Crest Elev*	*67.25*	
C/L Elev	*66.14*	*C/L Elev*	*66.35 m*	*Weir Coeff:*	*1.847*	
Area	*0.025 m^2*					
		Slide Gate Set at Height of 300 mm				
		Area	*0.141 m^2*			

Head vs. Discharge Curves

Elev (m)	EXT.DET Head (m)	EXT.DET Q (m^3/s)	EROSION CONTROL Head (m)	EROSION CONTROL Q (m^3/s)	OVERFLOW SPILLWAY Head (m)	OVERFLOW SPILLWAY Q (m^3/s)
66.05	0.00	0.000	0.00	0.000	0.00	0
66.1	0.05	0.007	0.05	0.000	0.00	0
66.15	0.10	0.012	0.10	0.000	0.00	0
66.2	0.15	0.020	0.15	0.000	0.00	0
66.25	0.20	0.023	0.20	0.000	0.00	0
66.35	0.30	0.032	0.30	0.213	0.00	0
66.45	0.40	0.039	0.40	0.246	0.00	0
66.55	0.50	0.045	0.50	0.275	0.00	0
66.65	0.60	0.050	0.60	0.301	0.00	0
66.75	0.70	0.055	0.70	0.325	0.00	0
66.85	0.80	0.059	0.80	0.347	0.00	0
66.95	0.90	0.063	0.90	0.368	0.00	0
67.05	1.00	0.067	1.00	0.388	0.00	0
67.15	1.10	0.070	1.10	0.407	0.00	0
67.25	1.20	0.074	1.20	0.425	0.00	0
67.3	1.25	0.075	1.25	0.434	0.05	0.83
67.5	1.45	0.081	1.45	0.468	0.25	9.24

SWMF 'C' - Inlet Strucutres

(refer to EPA SWMM output charts in back of Appendix B)

Inlet to Forebay

Dia= 825 mm
Area= 0.535 m2
Invert Elev = 66.00
Slope = 1.6%

Q_{cap} = 1,894 L/s (Manning's)
Q_{25mm} = 1,900 L/s

Forebay Bypass

Dia = 750 mm
Area = 0.442 m2
Invert Elev = 66.83

SWM Facility 'C'
Design Calculations

SWMF 'C' - Water Quality Requirements

Drainage Area	26.2
% Impervious:	**0.52**
Level 2 protection:	
Treatment Volume	110 m^3/ha
Active Storage:	40 m^3/ha
	1,048 m^3
Perm Pool:	70 m^3/ha required
	1,834 m^3 required
	4,370 m^3 provided
	167 m^3/ha provided
Extended Detention:	12.1 L/s average
	29 L/s max (2.4 x avg)
Erosion Control (14 L/s/ha for 5yr storm)	
	367 L/s
Erosion Control (8 L/s/ha for 5yr storm)	
	210 L/s

SWMF 'C' - Dry Pond Stage-Storage

Elevation (m)	Area (m^2)	Stage Volume (m^3)	Total Volume (m^3)
65.75	-	-	-
66.00	640	80	80
66.10	3,800	220	300
66.15	6,360	250	550
66.25	6,500	640	1,190
66.50	6,980	1,690	2,880
66.75	7,360	1,790	4,670
67.00	7,840	1,900	6,570
67.25	8,280	2,020	8,590

SWMF 'C' - Wet Pond Stage-Storage

Elevation (m)	Area		Stage Volume			Total Volume			
	All (m^2)	Forebay (m^2)	All (m^3)	Forebay (m^3)	Main Cell (m^3)	Forebay (m^3)	Main Cell (m^3)	All	Active Volume (m3)
65.00	2,810	520	0	0	0	0	0	0	
65.55	4,250	790	1,940	360	1,580	360	1,580	1,940	
65.75	4,890	940	910	170	740	530	2,320	2,850	
66.05	5,222	880	1,520	270	1,250	800	3,570	4,370	
66.25	5,350		1,060		1,060		5,430	5,430	1,060
66.40	5,790		840		840		6,270	6,270	1,900
66.75	6,250		2,110		2,110		8,380	8,380	4,010
67.00	6,690		1,620		1,620		10,000	10,000	5,630
67.25	7,050		1,720		1,720		11,720	11,720	7,350
67.50	7,470		1,820		1,820		13,540	13,540	9,170

SWMF 'C' - Required Forebay Length

Parameters:

Length to width ratio of forebay, r =	3.0:1
Peak outflow rate during 25 mm storm, Q_p =	0.240 m^3/s (24hr ext. det)
Target particle size =	150 mm
Settling velocity, V_s =	0.0003 m/s

Forebay Settling Length, Dist

$$Dist = \sqrt{\frac{rQ_p}{V_s}}$$

= 49 m

Check Dispersion Length, $Dist_2$

Desired velocity in forebay, V_f =	0.2 m/s
Inlet flowrate, Q =	1.900 m^3/s
Depth in forebay, d =	1.1 m

$$Dist_2 = \frac{8Q}{dV_f}$$

= 72 m

Therefore, the dispersion length of 72 m governs the design.

Provided Length: 72 m

SWMF 'C' - Sediment Loading Estimate

Table 6.3 - MOE SWM Planning & Design Manual

Catchment Imperviousness	Annual Loading (kg/ha)	Wet Density (kg/m³)	Annual Loading (m³/ha)
35%	770	1,230	0.6
55%	2,300	1,230	1.9
70%	3,495	1,230	2.8
85%	4,680	1,230	3.8

Catchment Area:	26.2 ha
% Impervious:	52%
Annual Sediment Loading:	2,071 kg/ha/yr
	1.68 m^3/ha/yr
	44.1 m^3/yr
Sediment Removal Efficiency:	80%
	35.3 m^3/yr

Sediment Accumulation:

10yrs	353 m^3

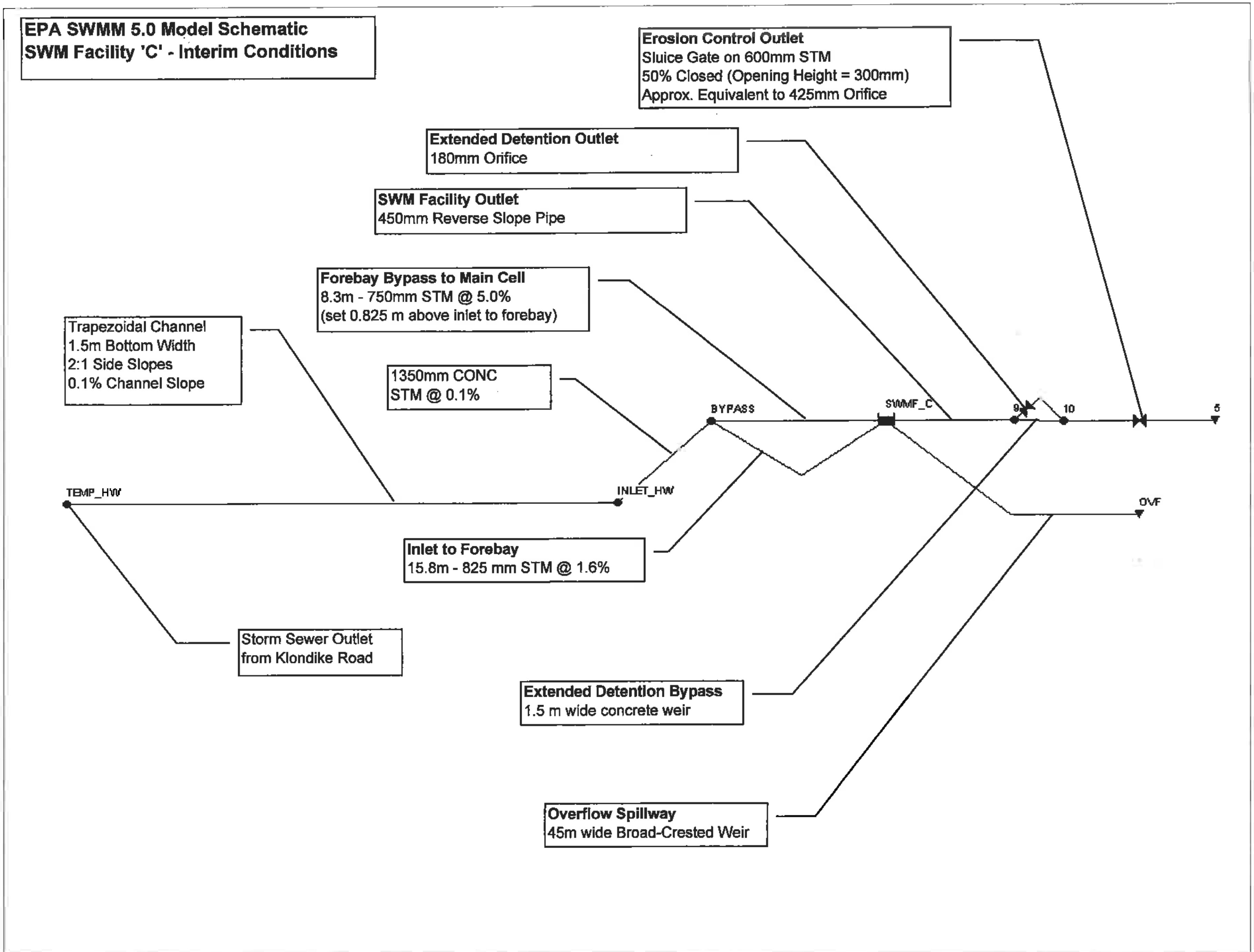
Volume Provided in Forebay: 530 m^3

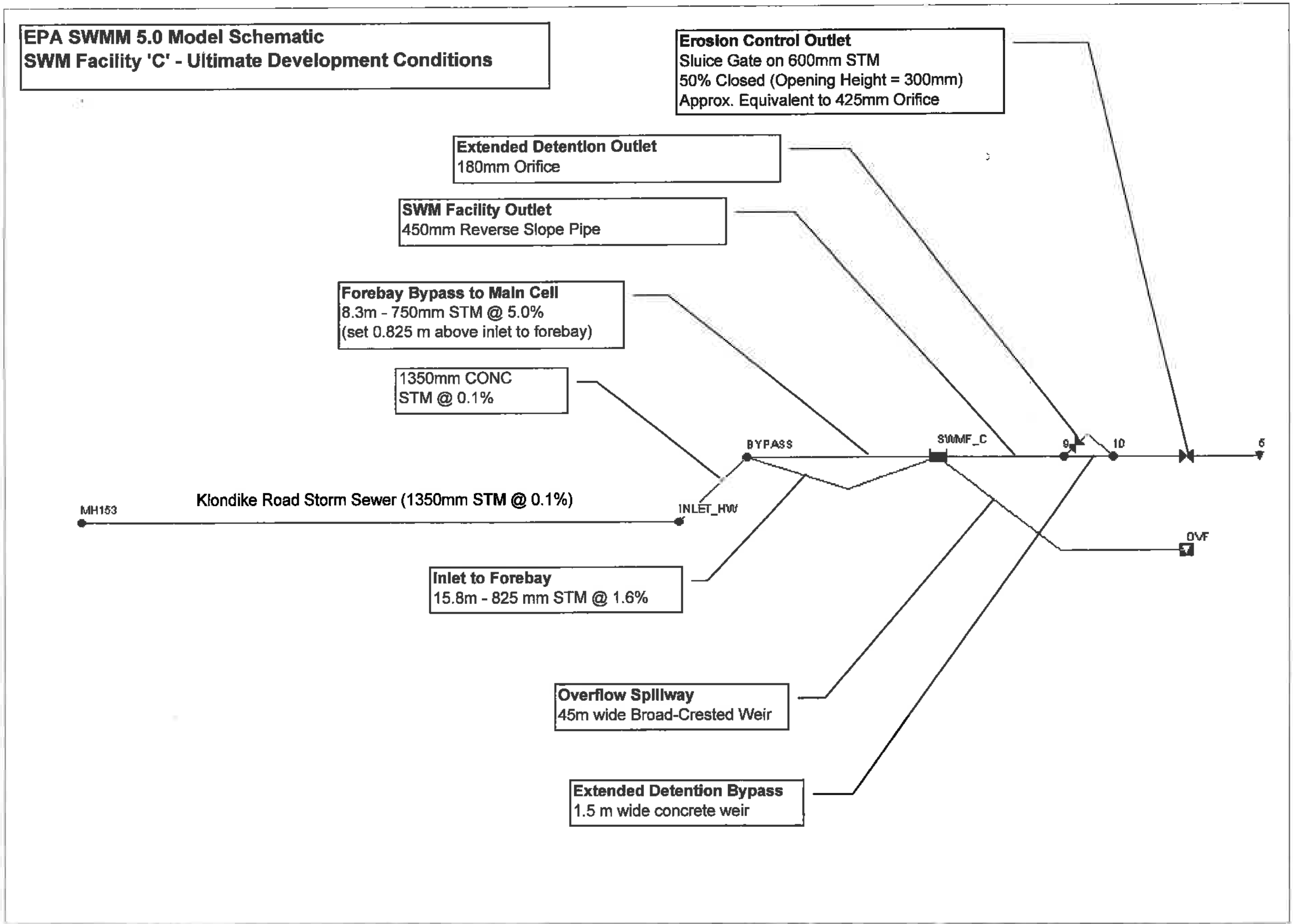
SWMF C

Drainage Area:	26.2 ha
Runoff Coefficient:	0.6
Estimate Influent TSS Level (max):	250 mg/L
(Long-term average):	150 mg/L
Sediment Density:	1,230 kg/m^3
Total Annual Precipitation:	907 mm
Total Annual Rain (Ice Free Period):	686 mm
Total Annual Runoff:	142,580 m^3
Runoff during Ice-free period:	107,839 m^3
Max Annual TSS Loading:	35,645 kg
(total precipitation)	29.0 m^3/yr
Max Annual TSS Loading:	26,960 kg
(precipitation during ice-free period)	21.9 m^3/yr
Average Annual TSS Loading:	21,387 kg
(total precipitation)	17.4 m^3/yr
Average Annual TSS Loading:	16,176 kg
(precipitation during ice-free period)	13.2 m^3/yr

Target 80% TSS Removal:	
Max:	23.2 m^3/yr
Min:	10.5 m^3/yr

EPA SWMM 5.0 Model Schematic
SWM Facility 'C' - Interim Conditions




EPA SWMM 5.0 Model Schematic
SWM Facility 'C' - Ultimate Development Conditions
Erosion Control Outlet
Sluice Gate on 600mm STM
50% Closed (Opening Height = 300mm)
Approx. Equivalent to 425mm Orifice
Extended Detention Outlet
180mm Orifice
SWM Facility Outlet
450mm Reverse Slope Pipe
Forebay Bypass to Main Cell
8.3m - 750mm STM @ 5.0%
(set 0.825 m above inlet to forebay)
1350mm CONC
STM @ 0.1%
BYPASS
SWMF_C
9
10
5
OVF
MH153
Klondike Road Storm Sewer (1350mm STM @ 0.1%)
INLET_HW
Inlet to Forebay
15.8m - 825 mm STM @ 1.6%
Overflow Spillway
45m wide Broad-Crested Weir
Extended Detention Bypass
1.5 m wide concrete weir

SWM Facility 'C' – 25mm Storm Event
EPA SWMM Model Summary Output (Ultimate Development Conditions)

```
****************
Analysis Options
****************
Flow Units ............... CMS
Flow Routing Method ...... DYNWAVE
Starting Date ............ FEB-16-2006 00:00:00
Ending Date .............. FEB-17-2006 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:05:00
Routing Time Step ........ 3.00 sec

**************************        Volume         Volume
Flow Routing Continuity         hectare-m        Mliters
**************************     ---------      ---------
Dry Weather Inflow .......         0.000          0.000
Wet Weather Inflow .......         0.000          0.000
Groundwater Inflow .......         0.000          0.000
RDII Inflow ..............         0.000          0.000
External Inflow ..........         0.425          4.252
External Outflow .........         0.308          3.077
Surface Flooding .........         0.000          0.000
Evaporation Loss .........         0.000          0.000
Initial Stored Volume ....         0.487          4.874
Final Stored Volume ......         0.606          6.057
Continuity Error (%) .....        -0.078

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

------------------------------------------------------------------------------------------
                                Average  Maximum  Maximum  Time of Max    Total    Total
                                  Depth    Depth      HGL   Occurrence Flooding  Minutes
Node                 Type        Meters   Meters   Meters  days hr:min    ha-mm  Flooded
------------------------------------------------------------------------------------------
MH153                JUNCTION      0.08     1.04    67.42     0  01:40        0        0
BYPASS               JUNCTION      0.39     0.92    66.92     0  01:41        0        0
INLET_HW             JUNCTION      0.35     1.00    67.05     0  01:41        0        0
9                    JUNCTION      0.47     0.83    66.73     0  03:03        0        0
10                   JUNCTION      0.38     0.82    66.72     0  02:50        0        0
5                    OUTFALL       0.18     1.00    66.75     0  02:45        0        0
OVF                  OUTFALL       0.00     0.00    65.75     0  00:00        0        0
SWMF_C               STORAGE       1.48     1.78    66.68     0  03:09        0        0

**********************
Storage Volume Summary
**********************

--------------------------------------------------------------------------------------
                       Average     Avg       Maximum     Max   Time of Max    Maximum
                        Volume    Pcnt        Volume    Pcnt    Occurrence    Outflow
Storage Unit           1000 m3    Full       1000 m3    Full   days hr:min        CMS
--------------------------------------------------------------------------------------
SWMF_C                   6.650      42         8.455      53      0  03:09       0.25

********************
Link Flow Summary
********************

------------------------------------------------------------------------------------------
```

Link	Type	Maximum Flow CMS	Time of Max Occurrence days hr:min	Maximum Velocity m/sec	Length Factor	Max/ Full Flow	Total Minutes Surcharged
10	CONDUIT	0.00	0 00:00	0.00	3.65	0.00	0
20	CONDUIT	1.74	0 01:41	3.71	4.15	0.60	0
21	CONDUIT	1.81	0 01:41	1.67	1.00	0.92	0
22	CONDUIT	0.07	0 01:41	0.55	1.52	0.03	0
25	CONDUIT	1.85	0 01:40	1.63	1.00	0.93	0
26	CONDUIT	0.27	0 02:45	1.69	1.61	0.31	784
27	CONDUIT	0.28	0 02:51	1.36	1.77	0.45	0
1	ORIFICE	0.04	0 02:10				
2	DUMMY	0.27	0 02:45				

****
Flow Classification Summary
****

Conduit	Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Avg. Froude Number	Avg. Flow Change
	--- Fraction of Time in Flow Class ----								
10	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
20	0.00	0.00	0.00	0.98	0.02	0.00	0.00	0.06	0.0000
21	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.05	0.0001
22	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
25	0.00	0.04	0.00	0.96	0.00	0.00	0.00	0.05	0.0001
26	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.12	0.0002
27	0.74	0.00	0.00	0.05	0.00	0.00	0.21	0.15	0.0009

****
Highest Continuity Errors
****
Node INLET_HW (0.73%)
Node BYPASS (0.24%)
Node 10 (-0.13%)
Node SWMF_C (0.04%)

****
Time-Step Critical Elements
****
Link 20 (0.47%)
Node 10 (0.00%)

****
Routing Time Step Summary
****
Minimum Time Step : 2.84 sec
Average Time Step : 3.00 sec
Maximum Time Step : 3.00 sec
Percent in Steady State : 0.00
Average Iterations per Step : 3.10

Analysis begun on: Thu Oct 05 15:07:12 2006
Total elapsed time: 00:00:01

SWM Facility 'C' – 1:5 year Storm Event
EPA SWMM Model Summary Output (Ultimate Development Conditions)

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.0 (Build 5.0.007)
--------------------------------------------------------------

EPA SWMM 5.0 Model - SWM Facility 'C'

****************
Analysis Options
****************
Flow Units ............... CMS
Flow Routing Method ...... DYNWAVE
Starting Date ............ FEB-16-2006 00:00:00
Ending Date .............. FEB-17-2006 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:05:00
Routing Time Step ........ 3.00 sec


**************************        Volume         Volume
Flow Routing Continuity        hectare-m        Mliters
**************************     ---------      ---------
Dry Weather Inflow .......         0.000          0.000
Wet Weather Inflow .......         0.000          0.000
Groundwater Inflow .......         0.000          0.000
RDII Inflow ..............         0.000          0.000
External Inflow ..........         0.725          7.252
External Outflow .........         0.609          6.092
Surface Flooding .........         0.000          0.000
Evaporation Loss .........         0.000          0.000
Initial Stored Volume ....         0.487          4.874
Final Stored Volume ......         0.612          6.117
Continuity Error (%) .....        -0.684


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

----------------------------------------------------------------------------------------------
                                Average  Maximum  Maximum  Time of Max    Total    Total
                                  Depth    Depth      HGL   Occurrence Flooding  Minutes
Node                 Type        Meters   Meters   Meters days hr:min    ha-mm  Flooded
----------------------------------------------------------------------------------------------
MH153                JUNCTION      0.16     1.31    67.69    0  01:10        0        0
BYPASS               JUNCTION      0.48     1.06    67.06    0  01:31        0        0
INLET_HW             JUNCTION      0.44     1.17    67.22    0  01:10        0        0
9                    JUNCTION      0.55     1.39    67.29    0  02:49        0        0
10                   JUNCTION      0.47     1.30    67.20    0  02:49        0        0
5                    OUTFALL       0.44     1.20    66.95    0  02:20        0        0
OVF                  OUTFALL       0.05     1.20    66.95    0  02:20        0        0
SWMF_C               STORAGE       1.57     2.12    67.02    0  02:41        0        0


**********************
Storage Volume Summary
**********************

--------------------------------------------------------------------------------------------
                          Average     Avg     Maximum     Max   Time of Max     Maximum
                           Volume    Pcnt      Volume    Pcnt    Occurrence     Outflow
Storage Unit              1000 m3    Full     1000 m3    Full   days hr:min         CMS
--------------------------------------------------------------------------------------------
SWMF_C                      7.191      45      10.599      66      0  02:41        0.49


********************
```

Link Flow Summary
****

Link	Type	Maximum Flow CMS	Time of Max Occurrence days	hr:min	Maximum Velocity m/sec	Length Factor	Max/ Full Flow	Total Minutes Surcharged
10	CONDUIT	0.00	0	00:00	0.00	3.65	0.00	0
20	CONDUIT	1.94	0	01:10	3.94	4.15	0.66	184
21	CONDUIT	2.40	0	01:10	1.91	1.00	1.21	15
22	CONDUIT	0.53	0	01:31	2.02	1.52	0.22	0
25	CONDUIT	2.40	0	01:10	1.75	1.00	1.21	15
26	CONDUIT	0.30	0	02:54	1.91	1.61	0.35	930
27	CONDUIT	1.52	0	01:38	1.44	1.77	2.50	0
1	ORIFICE	0.05	0	01:38				
2	DUMMY	0.35	0	02:49				

****
Flow Classification Summary
****

Conduit	Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Avg. Froude Number	Avg. Flow Change
	--- Fraction of Time in Flow Class ----								
10	0.96	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
20	0.00	0.00	0.00	0.97	0.03	0.00	0.00	0.07	0.0001
21	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.04	0.0001
22	0.00	0.86	0.00	0.14	0.00	0.00	0.00	0.05	0.0000
25	0.00	0.01	0.00	0.99	0.00	0.00	0.00	0.04	0.0001
26	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.21	0.0003
27	0.63	0.00	0.00	0.18	0.00	0.00	0.18	0.16	0.0078

****
Highest Continuity Errors
****

Node 10 (-1.50%)
Node INLET_HW (0.40%)
Node BYPASS (0.13%)
Node SWMF_C (0.02%)

****
Time-Step Critical Elements
****

Link 27 (3.62%)
Link 20 (0.81%)

****
Routing Time Step Summary
****

```
Minimum Time Step           :     0.50 sec
Average Time Step           :     2.99 sec
Maximum Time Step           :     3.00 sec
Percent in Steady State     :     0.00
Average Iterations per Step :     3.12
```

Analysis begun on: Thu Oct 05 15:04:15 2006

SWM Facility 'C' – 1:100 year Storm Event
EPA SWMM Model Summary Output (Ultimate Development Conditions)

```
EPA STORM WATER MANAGEMENT MODEL - VERSION 5.0 (Build 5.0.007)
--------------------------------------------------------------

EPA SWMM 5.0 Model - SWM Facility 'C'

****************
Analysis Options
****************
Flow Units ............... CMS
Flow Routing Method ...... DYNWAVE
Starting Date ............ FEB-16-2006 00:00:00
Ending Date .............. FEB-17-2006 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:05:00
Routing Time Step ........ 3.00 sec
```

Flow Routing Continuity	hectare-m	Mliters
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.000	0.000
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	1.173	11.734
External Outflow	1.042	10.424
Surface Flooding	0.000	0.000
Evaporation Loss	0.000	0.000
Initial Stored Volume	0.487	4.874
Final Stored Volume	0.618	6.183
Continuity Error (%)	0.007	

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

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Total Flooding ha-mm	Total Minutes Flooded
MH153	JUNCTION	0.26	1.72	68.10	0 01:39	0	0
BYPASS	JUNCTION	0.58	1.57	67.57	0 01:40	0	0
INLET_HW	JUNCTION	0.54	1.62	67.67	0 01:39	0	0
9	JUNCTION	0.48	1.25	67.30	0 01:28	0	0
10	JUNCTION	0.40	1.17	67.22	0 01:29	0	0
5	OUTFALL	0.72	1.52	67.07	0 02:49	0	0
OVF	OUTFALL	0.16	1.27	67.07	0 02:49	0	0
SWMF_C	STORAGE	1.66	2.40	67.30	0 01:44	0	0

```
**********************
Storage Volume Summary
**********************
```

Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CMS
SWMF_C	7.774	49	12.564	79	0 01:44	1.90

```
********************
Link Flow Summary
********************
```

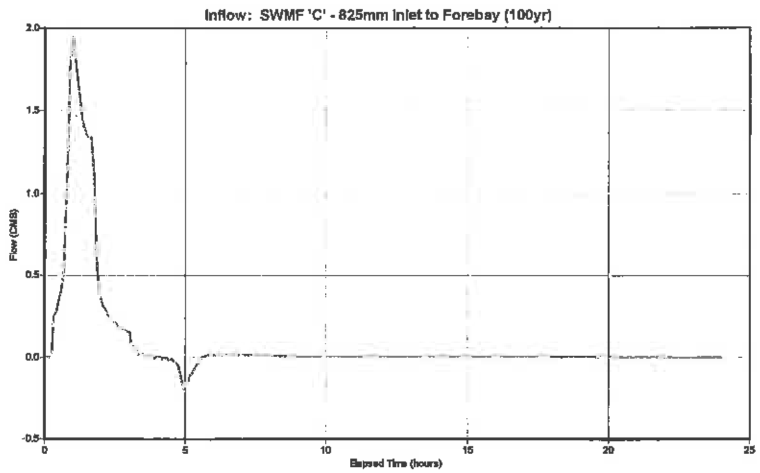
Link	Type	Maximum Flow CMS	Time of Max Occurrence days hr:min		Maximum Velocity m/sec	Length Factor	Max/ Full Flow	Total Minutes Surcharged
10	CONDUIT	1.56	0	01:44	1.33	3.44	0.03	0
20	CONDUIT	1.94	0	00:58	3.88	4.15	0.66	296
21	CONDUIT	2.54	0	01:08	1.94	1.00	1.29	54
22	CONDUIT	0.89	0	01:30	2.44	1.52	0.37	0
25	CONDUIT	2.56	0	01:10	1.81	1.00	1.29	52
26	CONDUIT	0.34	0	01:40	2.15	1.72	0.36	492
27	CONDUIT	0.80	0	01:28	1.26	1.77	1.31	0
1	ORIFICE	0.04	0	01:28				
2	DUMMY	0.35	0	01:29				

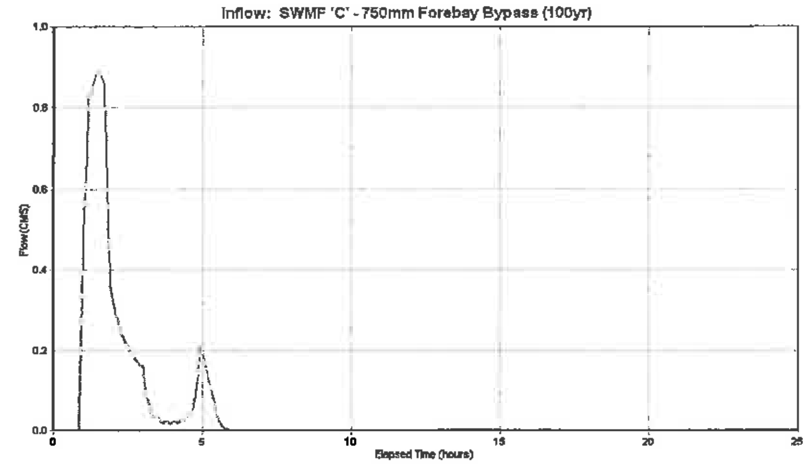
```
***************************
Flow Classification Summary
***************************
```

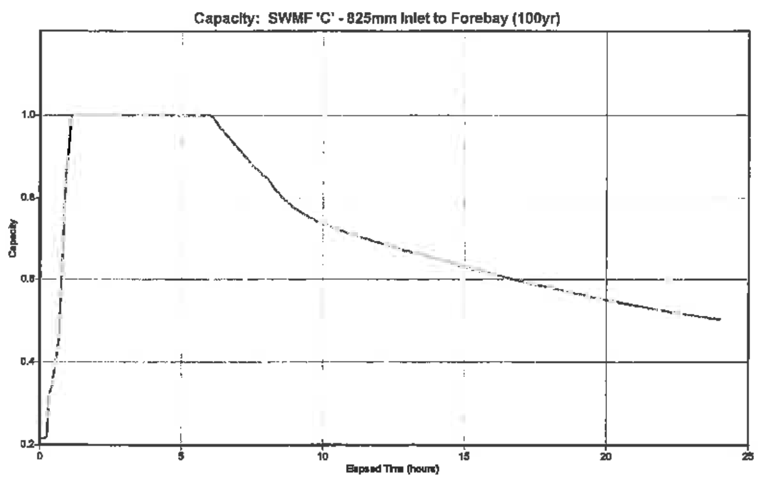
Conduit	--- Fraction of Time in Flow Class ----							Avg.	Avg.
	Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Froude Number	Flow Change
10	0.87	0.06	0.00	0.06	0.01	0.00	0.00	0.03	0.0000
20	0.00	0.00	0.00	0.96	0.04	0.00	0.00	0.08	0.0001
21	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.05	0.0001
22	0.00	0.78	0.00	0.22	0.01	0.00	0.00	0.06	0.0000
25	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.04	0.0001
26	0.00	0.01	0.00	0.92	0.07	0.00	0.00	0.32	0.0001
27	0.55	0.00	0.00	0.27	0.00	0.00	0.18	0.17	0.0043

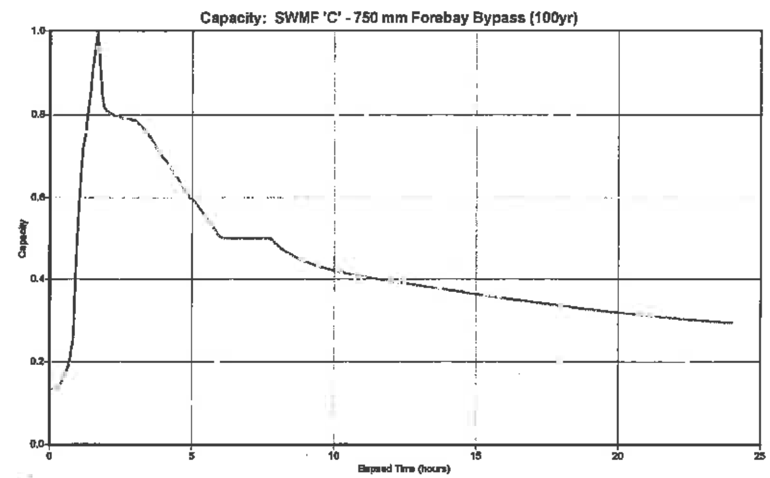
```
*************************
Highest Continuity Errors
*************************
Node INLET_HW (0.20%)
Node BYPASS (0.09%)
Node 10 (0.06%)
Node SWMF_C (0.01%)

***************************
Time-Step Critical Elements
***************************
Link 27 (16.66%)
Link 20 (0.92%)

*************************
Routing Time Step Summary
*************************
Minimum Time Step           :     1.62 sec
Average Time Step           :     2.96 sec
Maximum Time Step           :     3.00 sec
Percent in Steady State     :     0.00
Average Iterations per Step :     2.97

Analysis begun on:  Wed Aug 02 18:12:35 2006
Total elapsed time: 00:00:01
```

EPA SWMM Model Output
SWM Facility 'C' Flow Splitter
(ultimate development conditions)

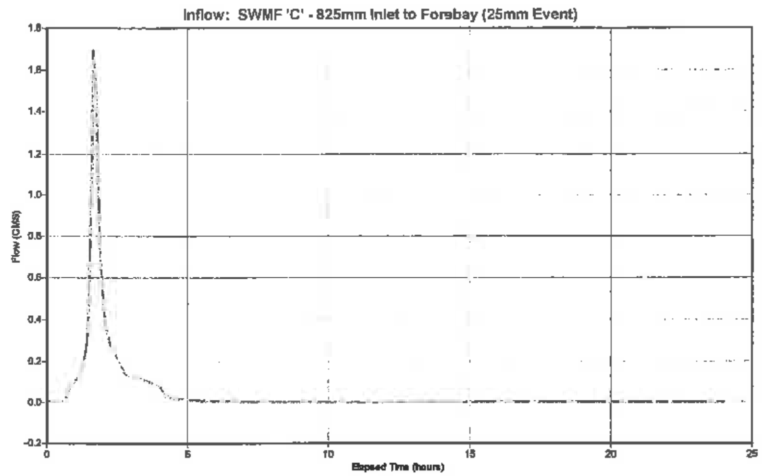


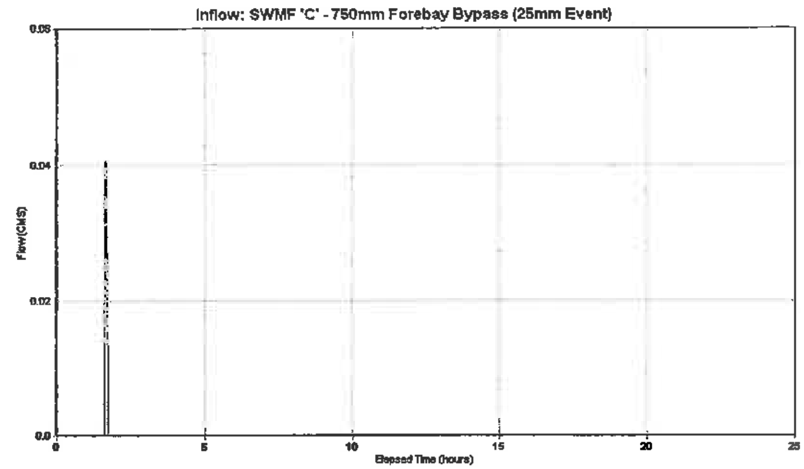


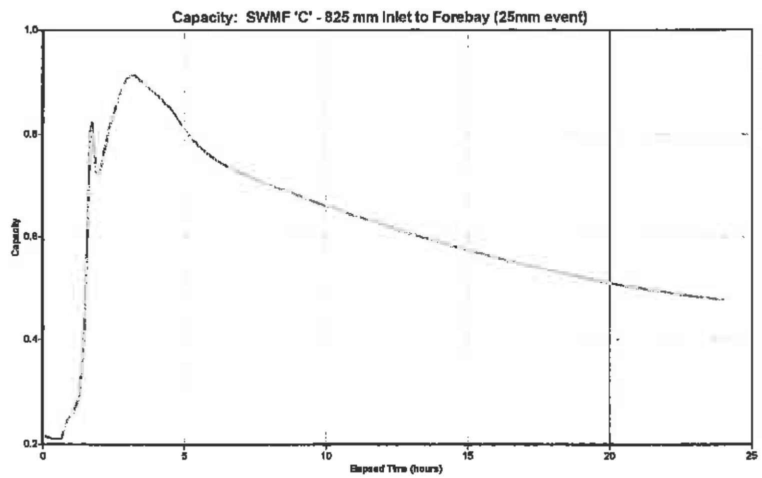


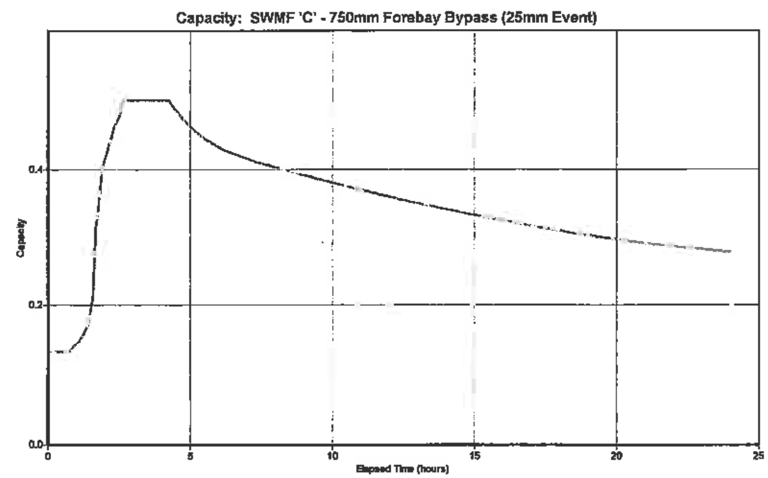


EPA SWMM Model Output
SWM Facility 'C' Flow Splitter
(ultimate development conditions)









APPENDIX C

Plans:

103106-SWM	Overall Plan
103106-SWM-C1	SWM Pond 'C' - Layout
103106-SWM-C2	SWM Pond 'C' - Sections
103106-GR8	SWM Pond 'C' - Temporary Open Channel