RICHCRAFT GROUP OF COMPANIES

RICHCRAFT TERRACE FLATS, CRT LANDS (BLOCK 344)

STORMWATER MANAGEMENT REPORT

JULY 07, 2021

COPY

RICHCRAFT TERRACE FLATS, CRT LANDS (BLOCK 344)

STORMWATER MANAGEMENT REPORT

RICHCRAFT GROUP OF COMPANIES

COPY

PROJECT NO.: 211-01221-00
DATE: JULY 2021
VERSION: 01

WSP
201-1224 GARDINERS ROAD
KINGSTON, ON
CANADA K7P 0G2

T: +1 613 634-7373
F: +1 613 634-3523
WSP.COM

SIGNATURES

PREPARED BY

Daniel Searle, P.Eng.
Municipal Engineer

REVIEWED BY

Steve Davidson, P.Eng., OLS (Ret.), MBA
Manager, Municipal Engineering – Kingston & Cornwall

This report was prepared by WSP for the account of RICHCRAFT GROUP OF COMPANIES, in accordance with the professional services agreement. The disclosure of any information contained in this report is the sole responsibility of the intended recipient. The material in it reflects WSP's best judgement in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. WSP accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report. This limitations statement is considered part of this report.

The original of the technology-based document sent herewith has been authenticated and will be retained by WSP for a minimum of ten years. Since the file transmitted is now out of WSP's control and its integrity can no longer be ensured, no guarantee may be given with regards to any modifications made to this document.

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

1 INTRODUCTION

1.1 SCOPE

WSP has been retained to provide civil engineering consulting services to support the Site Plan Approval application for greenfield development at 620 Bobolink Ridge, also known as Block 344 of the Phase 1 CRT Lands. This stormwater management (SWM) report examines the potential water quality and quantity impacts of the proposed development and details SWM measures to be provided to address these impacts in accordance with the City of Ottawa Sewer Design Guidelines (2012) and associated Technical Bulletins, Pre-application consultation meeting minutes, and the City of Ottawa Servicing Study Guidelines for Development Applications (2009). Refer to Servicing Report – Appendix B for completed City Servicing Report Checklist.

1.2 SITE LOCATION

The site of the proposed development is located within the City of Ottawa, within the Stittsville Ward, as shown in Figure 1. The site is approximately 1.6 ha and is bounded by Bobolink Ridge (to the north), Embankment Street (to the west), Robert Grant Avenue (to the east), and Cope Drive (to the south).

Figure 1: Project Location (Image Source: GeoOttawa)

1.3 OBJECTIVES

The objectives of this SWM plan are noted below:

- Determine the site-specific stormwater management requirements for the proposed development, as indicated by associated Provincial, Municipal, and Conservation Authority regulations and guidelines, pre-consultation with the City of Ottawa, and IBI Group's (IBI) report titled " Design Brief - CRT Lands Phase 1 - Fernbank Community" dated July 2017 (referred herein as CRT Phase 1 Servicing Report). Refer to Servicing Report – Appendix G for a copy of the CRT Phase 1 Servicing Report.
- In collaboration with the design team and the Developer, develop a strategy to address the SWM criteria on-site. Complete calculations and analyses necessary to determine the required size of the SWM features and demonstrate compliance with the design criteria.
- Prepare a SWM report documenting the above tasks in a manner suitable for review by the City's development review department.
- Address review comments by the City to refine and finalize the SWM report.

1.4 DESIGN CRITERIA

Based on applicable design guidelines and standards, pre-application consultation with the City (Servicing Report - Appendix B), and the CRT Phase 1 Servicing Report, the SWM design criteria for the development have been summarized below:

- Stormwater runoff from all storm events up to and including the 5-year storm (i.e. minor storm) will be captured and conveyed to the Embankment Street storm sewer system; where it ultimately outlet to the CRT Lands Phase 1 – Pond 5.
- Stormwater runoff in excess of the 5-year event and up to the 100-year storm (i.e. major storms), will be attenuated on-site with no overland flow to Embankment Street. During major storm attenuation, stormwater discharge to the Embankment Street storm sewer system shall be restricted to the site's post-development 5-year runoff flow rate. Additionally, up to 39 l/s of major storm flow (corresponding to a 3-hour 100-year Chicago storm event) is permitted to shed onto the Robert Grant Ave./ Cope Dr. Right-of-Ways, as prescribed in the CRT Phase 1 Servicing Report.
- Ponding shall occur in parking lots under the 2-year design storm event.
- 100-year ponding depths in parking lots and laneways shall not exceed 0.35m.
- All stormwater storage provided on-site must be above the Hydraulic Grade Line (HGL) of the receiving storm sewer.
- Maintain 300mm of freeboard between the underside of footing elevations and the 100-year HGL.
- The HGL in the storm sewer must remain below the underside of building footing during the stress test event (100-year + 20%).
- Ponding under the 100 -year + 20% event shall not reach any building envelop, nor breach the lowest building opening.
- Maintain at least 15 cm 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.
- Quality control for stormwater is not required if the site's post-development imperviousness is equal or less than 86% (or runoff coefficient of 0.8), assumed by IBI's the sizing of the subdivision's SWM system. Otherwise, quality control on-site will be required.

2 PRE-DEVELOPMENT CONDITIONS

2.1 EXISTING LAND-USE AND DRAINAGE PATTERNS

The project site is approximately 1.6 ha in area and is currently greenfield. Once water sheet flows off the site it is captured via surface inlets and routed eastward along Cope Drive via storm sewers (600-2400 mm diameter) to Pond 6 of the Fernbank Crossing Development. Refer to Figure 2 for geographic depiction of pre-development drainage patterns.

Figure 2: Pre-Development Stormwater Drainage Pattern (Image Source: GeoOttawa)

Using PCSWMM 2D hydrologic and hydraulic modelling software (PCSWMM), the 5-year and 100-year pre-development runoff flow rates are estimated to be 130 l/s and 280 l/s, respectively. These flows are based on 3-hour Chicago storm distribution (10-minute timestep) using City rainfall Intensity-Duration-Frequency curves (IDF) and the following site -specific parameter:

- Imperviousness = 5% (C-Factor = 0.15)
- Flow Path Length = 300 m

- Catchment slope = 1.2%

Refer to Appendix A for pre-development catchment map, as well as Appendix C for schematic model map and associated scenario model outputs.

2.2 APPROVED OUTLET & ALLOWABLE DISCHARGE RATES

As the subject property is within the boundary of the CRT Lands – Phase 1 development (designed by IBI Group inc.), a portion of the subdivision's stormwater management/collection system has been allocated to the site. As such, allowable runoff release rates for the site are not derived by a comparison to pre-development flows, but rather complying with the requirements specified in IBI's report.

As documented in CRT Phase 1 Servicing Report, the minor storm sewer system was first sized using the rational method where a runoff coefficient of 0.80 (or 86% imperviousness) was assumed for the subject site, resulting in a 5-year site discharge of 306.1 l/s. Following this sizing exercise, the DDSWMM hydrologic modelling was carried out to estimate single event runoff flows and hydraulic performance of the subdivision's dual-drainage system. The single event design storms used in this analysis for the minor and major system were the 5-year and 100-year 3-hour Chicago storm (10 -minute time step).

The DDSWMM modeling, in conjunction with the introduction of inlet flow control devices (IDCs), set the threshold for permissible stormwater flows entering the subdivision's system (including from the subject site) such that hydraulic grade line (HGL) elevations within the subdivision's minor system do not flood developments. From this exercise, 318 l/s of 5-year stormwater discharge (outletting to the Embankment Street storm sewer) was allocated to the subject site. Under the 100-year event (major design storm event), IBI assumed all flow in excess of 318 l/s (to Embankment Street) and 39 l/s (to Robert Grant Ave./Cope Dr.) was to be attenuated on-site. No major storm flow was assumed to enter the CRT Lands – Phase 1 major storm system (i.e. Embankment Street R.O.W.). The allowance for the release of up to 39 l/s to Robert Grant Ave./Cope Dr. was established jointly between the designers of CRT Lands Phase 1 subdivision (IBI) and the designers of Robert Grant Avenue (Novatech) and published in the aforementioned IBI subdivision servicing report.

Refer to Table 1 for a summary of allowable release rates for the site by outlet, as well as Figure 3 for geographic location of dedicated outlets.

Table 1: Allowable Post-Development Runoff Release Rates (by Outlet and Design Storm Event).

Outlet	5-year*	100-year*
Embankment Street (Minor System)	318 l/s	318 l/s
Embankment Street (Major System)	-	-
Robert Grant Ave. / Cope Dr. (Minor System)	-	-
Robert Grant Ave. / Cope Dr. (Major System)	-	39 l/s

***3-hour Chicago Storms (10 min time steps) generated using City of Ottawa IDF curves.**

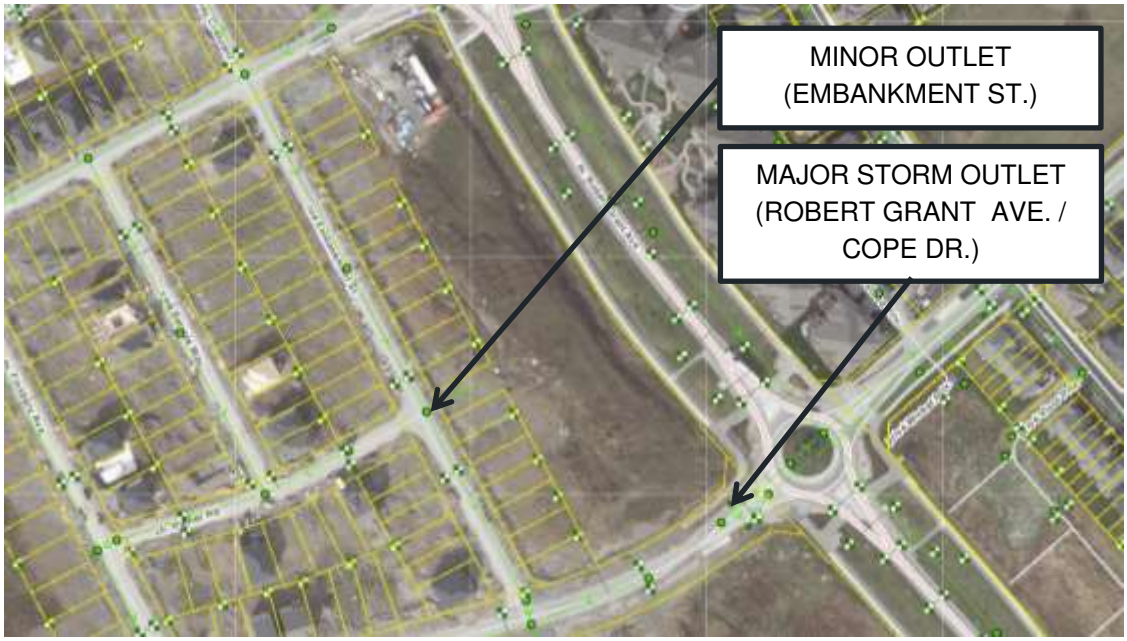


Figure 3: Post-Development Stormwater Outlets.

3 POST-DEVELOPMENT CONDITIONS

The proposed development includes seven (7) new 12-unit townhouses, each with a building area of 412 m^2. In addition, an accessory building with a building area of 154 m^2 with be included for storage and garbage. The site will include both private and communal amenity areas totally 546 m^2 and 980 m^2, respectively. At-grade features also include access laneways, vehicle parking, and asphalt sidewalks. The resulting imperviousness of the site was calculated to be 65% (Runoff coefficient = 0.68).

3.1 PROPOSED MINOR STORM SYSTEM

The proposed minor system constitutes a gravity system comprised of swales, storm sewers, manholes, and catch basins. Stormwater which falls on the site will sheet flow towards to parking lots and laneway areas, where it is directed to catch basins. Catchbasin leads direct the flow to the gravity storm sewer system which routes the flow to the site's minor storm system outlet (located along the southern site access corridor). The outlet is a 750mm storm sewer which drains to the existing 975m storm sewer within Embankment Street, which ultimately drains to the CRT lands Phase 1 Stormwater Management Facility (Pond 5).

The storm sewers (i.e. minor system) were sized using the Rationale method (to establish design flows) and the Manning's equation (for hydraulics), based on the following criteria:

- Design Storm — 1:5 years Return Period (Ottawa IDF Curves)
- Runoff coefficients (C-Factor):
  - Landscaped areas (i.e. Grass) = 0.25
  - Pavement and Concrete Areas = 0.90
  - Roofed Areas = 0.95
- Initial Inlet Time of Concentration = 10 mins.
- Pipe Velocities = 0.80 m/s to 6.0 m/s
- Minimum Pipe Size (Diameter) — 250 mm (Sewers) & 200mm (CB Leads)

Refer to Appendix A for post-development catchment map and Appendix B storm sewer sizing calculation sheet.

3.2 STORMWATER MANAGEMENT

Following the design and sizing of the minor system, hydrodynamic modelling was carried out using PCSWMM software to estimate single event runoff flows and the hydraulic performance of the site's overall stormwater system; including stormwater attenuation complete with the onsite storage areas, and an estimate of the peak hydraulic grade line elevation throughout the entire system.

In addition, the following supplementary checks were completed in order to the comply wit the City of Ottawa design guidelines and associated technical bulletins:

- 2-year Ponding Checks (Refer to Section 3.2.6)
- 100-year HGL to ensure gravity drainage for foundations (Refer to Sections 3.2.4 and 3.2.5)
- 100-year + 20% Stress Test (Refer to Section 3.2.7)

In order to remain consistent with the design of the downstream subdivision system, the single event design storms used in this analysis for the 2-year, 5-year (minor event), 100-year (major event), and 100-year + 20% (stress testing event) were simulated using the 3-hour Chicago storm (10-minute time step) distribution.

3.2.1 BOUNDARY CONDITIONS

Boundary conditions for the stormwater collections where obtained from the CRT Phase 1 Servicing Report. The receiving storm sewer system within Embankment Street is designed for free flow conditions under the 5-year storm event. As such, free flowing condition was assumed within the Embankment Street storm sewer for the purpose of sizing of the minor system within the site and performance assessment simulation of the 5-year Chicago event.

However, under the 100-year event, IBI noted a 100-yr HGL elevation of 105.31m for the receiving storm sewer within Embankment Street. To account for this, our design specifies a fixed tailwater elevation of 105.31m when modelling the 100-year Chicago scenario.

3.2.2 QUANTITY CONTROL & ATTENUATION

As it relates to the minor storm event (5-year), no quantity control is required prior to discharging from the site to the to the storm sewer system on Embankment Street. Post-development 5-year flows (including both the rational and single event modelling methods) yielded peak flows lower than what was specified by IBI to be released from the subject site in the design of the subdivision's stormwater system. Refer to Table 2 for comparison of IBI's specified site post-development flows and WSP's calculated proposed peak flow rates.

Table 2: 5-year Flows (Previously Assumed vs. Proposed)

Outlet	5-year (Rational Method)	5-year (3-hour Chicago)
IBI Design Flows	306 l/s	318 l/s
WSP Modelled Flows	228 l/s	245 l/s

As discussed in Section 1.4 and 2.2, runoff peak flow in excess of the 5 year event (and up to the 100-year event) must be controlled on-site to the release rates defined in Table 1. In order to achieve this, our site design allows for storage within the parking lots, swales and pond storage to achieve the quantity control requirements for the site. Ponding within parking lots has been limited to 350mm in accordance with City of Ottawa Sewer Design Guidelines. In order to control ponding in storage areas, inlet control devices (ICDs) of varying sizes are proposed in dedicated stormwater inlet structures to throttle the flow prior to discharging into the sewer main. Refer to Table 3 for an overview of system quantity control performance as it relates to peak discharge to dedicated outlets, as well as total storage utilized in the system. Refer to Table 4 and *** For parking lot storage zones, maximum depth of ponding is relative to top of grate of primary surface outlet.**

Table 5 for summaries of individual storage cell performance under the 5-year and 100-year storm events, respectively.

It should be noted that discharged from the dry pond (located at the southeast corner of the site) to Robert Grant Ave / Cope Dr.- major system will be controlled through a dedicated outlet structure. A broadcrested weir - with the following characteristics - has been selected as the proposed control structure to ensure proper hydraulic operation and release from the storage facility (refer to Drawing C1.7 located in the Servicing Report - Appendix A for further details):

- Invert Elevation: 105.97m
- Both Width: 0.5m
- Side Slopes: 3H:1V
- Depth (Parallel to Flow Direction): 300mm

Refer to Servicing Report – Appendix A for detailed design drawings (including proposed grading plan) and Appendix C of this report for a model map figure for the purpose of providing geographical context.

Table 3: Proposed Conditions (Controlled) Peak Flows and Total Volume Utilized

Storm Event	Peak Flow Embankment St. Minor System (L/s)	Peak Flow Robert Grant Ave / Cope Dr. Major System (L/s)	Total Storage Utilized (m^3)
5-year	245	-	37
100-year	307	39	173

Table 4: Individual Storage Cell Performance Summary (5-year)

Storage Cell (By Outlet Structure)	Peak Storage (m3)	Max. Depth of Ponding(m)*	Highest Ponding Elevation (m)	Outlet Structure Top of Grate Elevation (m)
CB03	1	-	107.91	108.11
CB04	1	-	107.32	108.00
CB06 & CB07	0	-	107.04	108.16
CB08	5	0.13	108.02	107.89
CB10	1	-	107.27	108.00
CB11	4	0.10	108.13	108.03
CB12	1	-	107.23	108.01
CB13	4	0.10	108.10	108.00
CB14 & CB15	1	-	107.64	107.95
CB16	1	-	107.24	107.86
DCB17	1	-	105.68	106.38
Pond	17	0.16	105.67	105.50

*** For parking lot storage zones, maximum depth of ponding is relative to top of grate of primary surface outlet.**

Table 5: Individual Storage Cell Performance Summary (100-year)

Storage Cell (By Outlet Structure)	Peak Storage (m3)	Max. Depth of Ponding(m)*	Highest Ponding Elevation (m)	Outlet Structure Top of Grate Elevation (m)
CB03	9	0.14	108.25	108.11
CB04	7	0.15	108.15	108.00
CB06 & CB07	3	0.08	108.23	108.16
CB08	27	0.25	108.14	107.89
CB10	5	0.14	108.14	108.00
CB11	20	0.18	108.21	108.03
CB12	3	0.09	108.10	108.01
CB13	17	0.17	108.17	108.00
CB14 & CB15	9	0.14	108.09	107.95
CB16	4	0.12	107.98	107.86
DCB17	1	-	106.07	106.38
Pond	68	0.55	106.05	105.50

*** For parking lot storage zones, maximum depth of ponding is relative to top of grate of primary surface outlet.**

3.2.3 INLET CONTROLS

In order to limit flows into the minor system such that peak flows leaving the site are within allowable limits, ICDs (either stainless steel orifice plates with varying inlet diameters, or a manufactured inlet device such as a Tempest) are proposed throughout the site. ICDs are sized and positioned vertically within PCSWMM model such that maximum ponding depths and release rate to the minor system were optimized. Refer to Table 6 for an inventory of ICDs by host structure, along with peak release and acting head depths for the 2-year and 100-year event. Several ICDs require diameters less than 100mm, as such prefabricated low-flow ICDs (such as a Tempest ICD) with similar drawdown performance will be required to avoid clogging.

Table 6: Inlet Control Device Summary

ICD (By Host Structure)	Diameter * (mm)	Invert Elevation (m)	Peak Cell Release Rate (l/s)*		Acting Head (m)	
			2-Year	100-Year	2-Year	100-Year
CB03	75	105.91	13	19	1.02	2.34
CB04	60	105.80	7	12	0.72	2.35
CB06	25	105.95	3	6	0.58	2.28
CB07	25	105.95	3	6	0.58	2.28
CB08	76	105.69	19	20	2.13	2.45
CB10	60	105.80	7	12	0.74	2.34
CB11	80	105.83	21	22	2.12	2.38
CB12	60	105.81	7	12	0.79	2.29
CB13	75	105.80	18	19	2.11	2.37
CB14	32	105.75	6	9.5	0.95	2.34
CB15	32	105.75	6	9.5	0.95	2.34
CB16	50	105.66	5	9	0.81	2.32
MH409	170	104.81	50	54	0.77	1.24
RYCB02	75	106.18	4	11	0.14	1.15
RYCB04	60	105.85	6	12	0.55	2.66
RYCB09	60	105.69	7	13	0.77	2.93
RYCB18	120	105.39	18	34	0.36	1.17

*** Where ICD diameters are less than 75mm (required minimum per MECP), manufactured low-flow ICDs will be required with equal discharge performance noted active head.**

3.2.4 HGL ANALYSIS & FOUNDATION DRAINAGE (BLOCKS 1 - 4 AND AUXILIARY BUILDING)

In order to ensure gravity drainage for the proposed development's foundation drainage system, minimum underside of footing elevations (USF) elevations for each block are required to be at least 300mm above the 100-year HGL line at the proposed connection location. Refer to Table 7 for a summary of 100-year HGL elevations and foundation drainage details for Blocks 1, 2,3, 4, and the auxiliary building as produced in the PCSWMM hydrodynamic model. Note that foundation drainage for Blocks 5, 6, and 7 will not drain to the site's stormwater connection system, but instead be piped to an alternate existing outlet along Cope Drive with a lower invert and HGL. Refer to the following section for further details.

Table 7:100-year HGL Analysis & Foundation Drainage Summary (Blocks 1- 4 and Auxiliary Building)

Block	100-yr HGL Elevation (m)	Minimum USF Elevation (m)	Proposed USF Elevation (m)	Freeboard (m) *
1	105.81	106.11	107.26	1.45
2	106.05	106.35	106.37	0.32
3	105.51	105.81	106.24	0.73
4	105.37	105.67	106.23	0.86
Auxiliary Bldg.	105.44	105.74	106.53**	0.79

*** Freeboard between 100-yr HGL and Proposed USF elevation.**
****Auxiliary building assumed to possess strip footing foundations at 1.8m below finished ground elevation.**

3.2.5 FOUNDATION DRAINAGE (BLOCKS 5 - 7)

Early in the design process we encountered design challenges while trying to ensure gravity drainage of the foundation systems, in conjunction with the layout and grading of the surrounding lands, all while trying to maintain barrier free connectivity to adjacent streets without the requirement for retaining walls, ramps, etc. In order to

maintain barrier free connectivity and comply with the site's design criteria, the units within the southeasterly Blocks 5,6 and 7 would require sump pump systems, which was not desirable or accepted by the developer.

After the initial grading and drainage review, WSP discovered the potential existence of a storm sewer stub located at the southeast corner of the site (northwest corner of the Cope Drive/Robert Grant Avenue turning circle). The storm stub constitutes part of the Fernbank Crossing develop storm water system, ultimately discharging to Fernbank Development Pond 6 (via Cope Drive). In April 2021, WSP and Richcraft Group of Companies (Richcraft) consulted with Eric Surprenant (City of Ottawa liaison) to confirm the City's willingness to allow for Blocks 5,6, and 7 to drain their foundations to the subject storm sewer stub (via third-pipe system) such that gravity drainage could be provide in combination with the preferred grading strategy for barrier free connectivity to adjacent streets..

The City did not appose the proposed use of new stormwater outlet in this manner; however, the City did indicate that two (2) elements must be confirmed prior to approving the connection, which were:

1. Confirmation that the 100-year HGL (in the receiving system) is at least 300mm below the proposed USF elevation for Blocks 5, 6, and 7;
2. Confirmation that the storm sewer stubs exists.

In order to satisfy the first condition, we completed an analysis to infer the 100-year HGL at the subject connection point based on the 100-year HGL boundary condition used for the design of Phase 3 of the Fernbank Crossing Development (prepared by IBI), as well as as-built storm sewer plan and profile drawings prepared by Novatech. Using the provided 100-year HGL elevation for the intersection of Shinny and Cope Drive, and the cumulative fall of upstream sewers up to the connection point, the 100-year HGL was estimated to be 102.71m. Refer to Table 8 for comparison of the 100-year HGL elevations and proposed foundation details from Blocks 5, 6,and 7.

Table 8: HGL Analysis & Foundation Drainage Summary (Blocks 5, 6, and 7)

Block	100-yr HGL Elevation (m)	Minimum USF Elevation (m)	Proposed USF Elevation (m)	Freeboard (m) *
5 (W)	102.71	103.01	105.89	3.18
5 (E)			105.29	2.58
6			104.58	1.87
7 (E)			104.34	1.63
7 (W)			104.94	2.23

*** Freeboard between 100-yr HGL and Proposed USF elevation.**

To satisfy the second condition, Richcraft retaining a CCTV contractor (Clean Water Works Inc.) to inspect the downstream storm sewer (along Cope Drive). During the inspection – which took place on June 2nd, 2021 - a tee connection to the Cope Drive storm sewer was identified which proves the subject storm stub exists.

Refer to Appendix D for correspondence between the City of Ottawa and WSP, as well as the CCTV inspection report and HGL analysis for the downstream system (Cope Drive sewer). Refer to Appendix E for the Fernbank Crossing (Phase 3) Servicing Report.

3.2.6 2-YEAR PONDING CHECKS

In accordance with City of Ottawa Sewer Design Guidelines (2012) (Technical Bulletin PIEDTB-2016-01), no ponding is permitted in parking lots and laneways during the 2-year design storm event. To complete this check, a 2-year 3-hour Chicago storm event was simulated. Results of this analysis determined that there is no ponding within the parking lot storage cells during the 2-year storm event. This was evident based on the maximum HGL elevations reported in the storage nodes remaining below the proposed top of grate elevations. Refer to Appendix C for the model output for the associated scenario.

3.2.7 100-YEAR + 20% STRESS TEST CHECKS & EMERGENCY SPILLWAYS

In accordance with City of Ottawa Sewer Design Guidelines (2012) - Technical Bulletin PIEDTB-2016-01, the stormwater management shall be stress tested under a 100-year + 20% storm event. The following are the two (2) mandatory checks carried out relative to the stress testing event:

- Depth of ponding remains below the lowest building opening
- HGL in the minor system remains below the USF Elevation

A review was carried out to confirm compliance with the two aforementioned criteria and no violations were identified. Refer to Servicing Report – Appendix A for detailed grading plan which communicates lowest building elevations and peak 100-year + 20% ponding elevations. Refer Table 9 and Appendix C of this report for details related to 100-year + 20% event HGL within the minor system relative to proposed building USF elevations. As previously stated in Section 3.2.5, foundation drains from Blocks 5, 6, and 7 are not connection to the site's minor system and therefore were omitted from this analysis.

Table 9: 100-year +20%HGL Analysis & Foundation Drainage Summary (Blocks 1, 2, 3, and 4)

Block	100-yr+20% HGL Elevation (m)	Proposed USF Elevation (m)	Freeboard (m) *
1	105.83	107.26	1.43
2	106.07	106.37	0.3
3	105.63	106.24	0.61
4	105.38	106.23	0.85
Auxiliary Bldg.	105.52	106.53**	1.01

*** Freeboard between 100-yr+20% HGL and Proposed USF elevation.**
****Auxiliary building assumed to possess strip footing foundations at 1.8m below finished ground elevation.**

In addition to the checks carried out relative to the 100-year + 20% stress testing event, WSP has included provisions for emergency spillways. This was achieved through grading where 150mm vertical clearances between ground elevations (at building envelops) and the site's spill elevation to municipal Right-of-Ways were provided.

3.3 QUALITY CONTROL

As noted in Section 1.4, Quality control for the site's stormwater is not required if the site's post-development imperviousness is equal or less than 86% (or runoff coefficient of 0.8), as specified by IBI's sizing of the subdivision's SWM system. Stormwater from the site will be treated in Pond 5 downstream of the development. The post-development site imperviousness was calculated to be 64% (Runoff coefficient = 0.63); therefore, no on-site quality control is required.

3.4 DIVERSION OF DRAINAGE CATCHMENT AREAS

A diversion of a drainage catchment (when comparing pre-development to post-development) is currently proposed; however, the allocation of stormwater flow to the designated outlets is in accordance with the overall Subdivision design criteria as specified in the CRT Phase 1 Servicing Report.

3.5 WATERCOURSES, MUNICIPAL DRAINS, AND FLOODPLAINS

Stormwater from the proposed development will not be directly discharged to a watercourse. As such, no significant negative impacts are anticipated to downstream receiving watercourses due to proposed quantity and quality control

measures. All stormwater from the site will ultimately be routed to one the two following stormwater management facilities:

- Pond 6 of the CRT Lands – Phase1 development (up to 39 l/s of major overland flow); and
- Pond 5 of the Fernbank Crossing development.

As such, no significant negative impacts are anticipated to downstream receiving watercourses due to proposed quantity and quality control measures.

There are no municipal drains on the site or associated with the drainage from the site.

There are no designated floodplains on the site of this development.

3.6 SETBACKS FROM SIGNIFICANT FEATURES

There are no private sewage disposal systems, watercourses, and/or hazard lands in the vicinity of the subject site. As such, there are no associated set-backs requirements to adhere to.

3.7 FILL CONSTRAINT

There are no known fill constraints applicable to this site related to any floodplain. No fill constraints related to soil conditions are anticipated, as confirmed in the geotechnical report.

4 SEDIMENT AND EROSION CONTROL

4.1 5.1 GENERAL

During construction, existing storm sewer system can be exposed to sediment loadings. A number of construction techniques designed to reduce unnecessary construction sediment loadings will be used, including:

- Filter cloths, which will remain on open surface structures such as manholes and catch basins until these structures are commissioned and put into use;
- Installation of silt fence, where applicable, around the perimeter of the proposed work area;
- The installation of straw bales within existing drainage features surround the site; and
- Bulkhead barriers will be installed in the outlet pipes.

During construction of the services, any trench dewatering using pumps will be fitted with a “filter sock.” Thus, any pumped groundwater will be filtered prior to release to the existing surface runoff. The contractor will inspect and maintain the filter sock as needed including sediment removal and disposal.

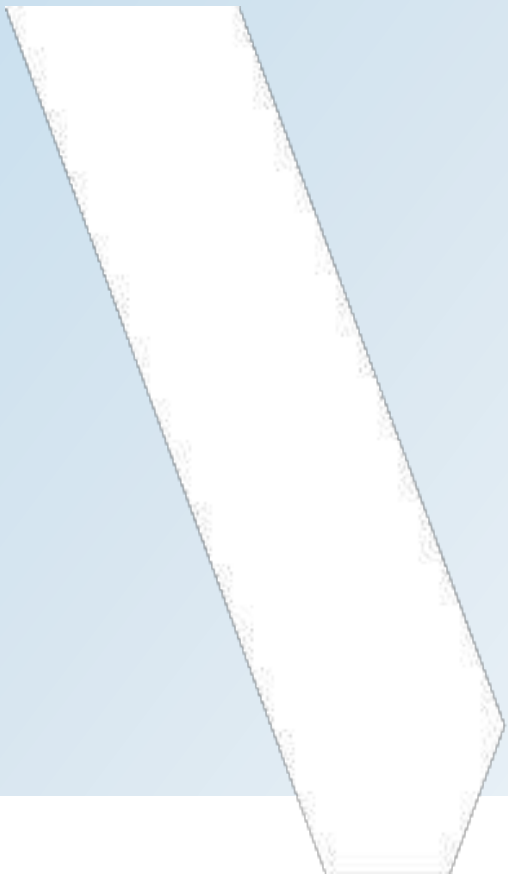
All catch basins, and to a lesser degree, manholes, convey surface water to sewers. Consequently, until the surrounding surface has been completed, these structures will be covered to prevent sediment from entering the minor storm sewer system. These measures will stay in place and be maintained during construction and build-out until it is appropriate to remove them.

During construction of any development both imported and native soils are placed in stockpiles. Mitigative measures and proper management to prevent these materials entering the sewer system are needed. During construction of the deeper watermains and sewers, imported granular bedding materials are temporarily stockpiled on site. These materials are however quickly used up and generally placed before any catch basins are installed. Refer to the Sediment and Erosion Control Plan (drawing C1.8) provided in Servicing Report - Appendix A.

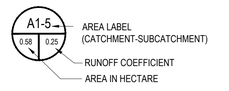
5 CONCLUSIONS

WSP has completed this stormwater management analysis, calculations, and reporting in support of the Site Plan Application for the proposed development at 620 Bobolink Ridge (Block 344). Stormwater management requirements for the site have been determined and associated on-site quantity control infrastructure has been sized. A total of 173 m^3 of storage will be provided (through a combination of parking lot storage, pipe storage, and pond storage) to restrict flow into the minor system during major storm events. Said storge will limit peak flow to dedicated outlets to within allowable limits in accordance with the CRT Lands Phase 1 Servicing Report, as well as comply with all City's SWM criteria.

APPENDIX A – CATCHMENT FIGURES



STORM DRAINAGE BUBBLE



1224 GARDINERS ROAD, SUITE 201
KINGSTON, ONTARIO
CANADA K7P 0G2
PHONE: 613-634-7373
WWW.WSP.COM

CONSULTANT:

M. David Blakely
Architect Inc.
2200 Prince of Wales Dr. - Suite 101
Ottawa, Ontario K2E 6Z9
Phone (613) 226-8811 Fax (613) 226-7942

SEAL:

NORTH

CLIENT:

RICHCRAFT
Group Of Companies

CLIENT REF. #:

PROJECT:

TERRACE FLATS

KEY PLAN:

DISCLAIMER: COPYRIGHT:

ISSUED FOR - REVISION:

IS	RE	DATE	DESCRIPTION
1		2021/06/18	ISSUED FOR CLIENT REVIEW

PROJECT NO: 211-01221-00

DATE: MARCH 2021

ORIGINAL SCALE: 1:500

IF THIS BAR IS NOT 25mm LONG, ADJUST YOUR PLOTTING SCALE.

DESIGNED BY: DS

DRAWN BY: MH

CHECKED BY: SD

25mm

DISCIPLINE: CIVIL

TITLE:

PRE-DEVELOPMENT CATCHMENT MAP

SHEET NUMBER: SWM-SK1-1

SHEET #: 1 OF 2

ISSUE: ISSUED FOR DISTRIBUTION

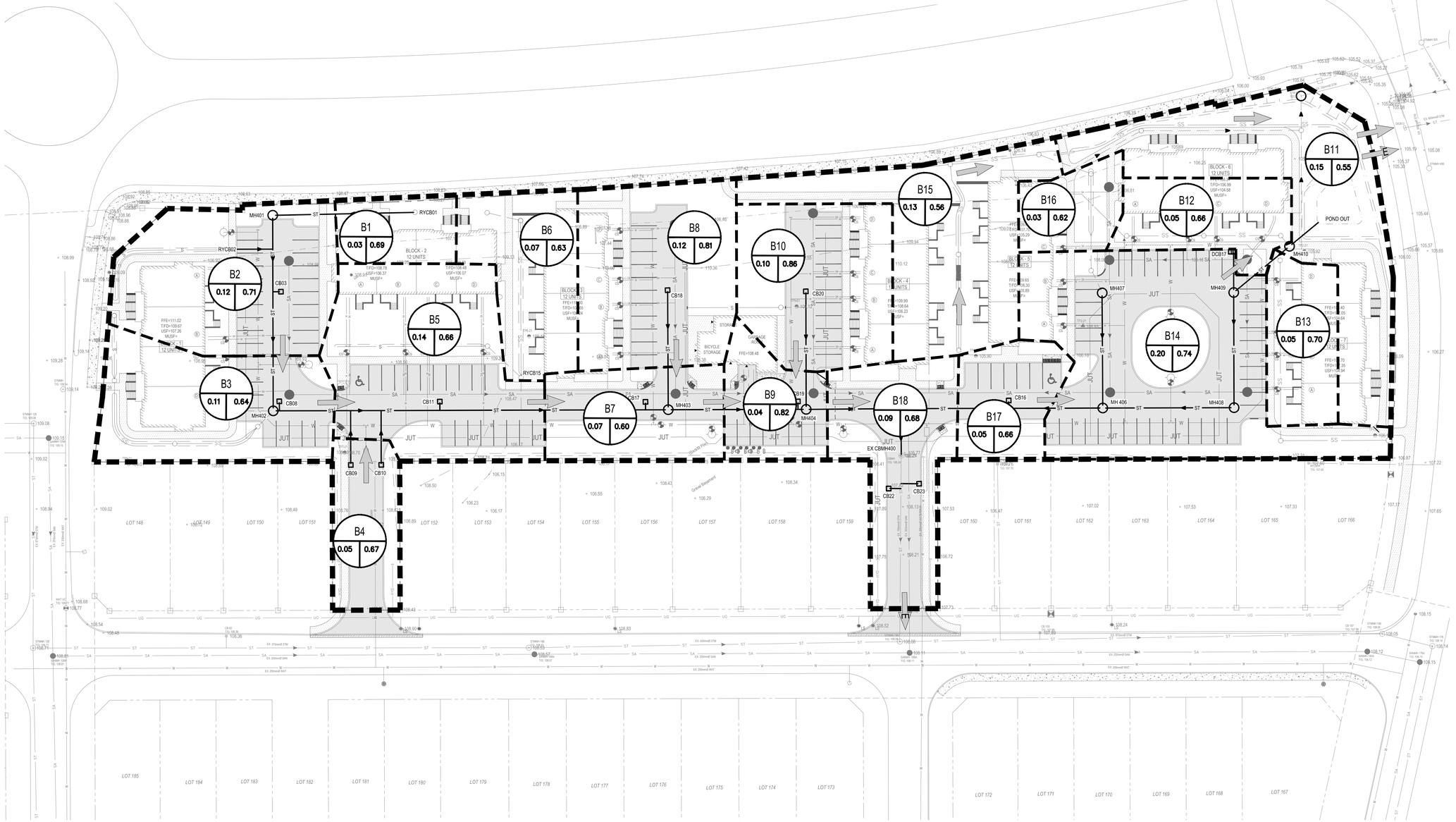
DATE OF: 2020/06/11

REV #: 0

CATCHMENT CHARATERISTICS							
	GRASSED @ C-FACTOR BELOW	GRAVEL @ C-FACTOR BELOW	ASPH/CONC @ C-FACTOR BELOW	ROOFED @ C-FACTOR BELOW			
	0.25	0.65	0.90	0.95			
CATCHMENT ID (B#)	GRASSED AREA (ha)	GRAVEL AREA (ha)	ASPH./CONC AREA (ha)	ROOFED AREA (ha)	TOTAL AREAS (ha)	WEIGHTED C-FACTOR	IMPERVIOUS (%)
1	0.0117	0.0000	0.0015	0.0189	0.0321	0.69	0.64
2	0.0385	0.0000	0.0589	0.0260	0.1234	0.71	0.69
3	0.0437	0.0000	0.0372	0.0250	0.1059	0.64	0.59
4	0.0164	0.0000	0.0299	0.0000	0.0463	0.67	0.65
5	0.0543	0.0000	0.0683	0.0213	0.1439	0.66	0.62
6	0.0318	0.0000	0.0071	0.0322	0.0711	0.63	0.55
7	0.0306	0.0000	0.0346	0.0016	0.0668	0.60	0.54
8	0.0187	0.0000	0.0681	0.0300	0.1168	0.81	0.84
9	0.0061	0.0000	0.0303	0.0081	0.0445	0.82	0.86
10	0.0083	0.0000	0.0641	0.0267	0.0991	0.86	0.92
11	0.0851	0.0000	0.0201	0.0466	0.1518	0.55	0.44
12	0.0216	0.0000	0.0070	0.0250	0.0536	0.66	0.60
13	0.0169	0.0000	0.0050	0.0257	0.0476	0.70	0.64
14	0.0519	0.0000	0.1390	0.0140	0.2049	0.74	0.75
15	0.0699	0.0000	0.0074	0.0489	0.1262	0.56	0.45
16	0.0154	0.0000	0.0065	0.0113	0.0332	0.62	0.54
17	0.0165	0.0000	0.0277	0.0011	0.0453	0.66	0.64
18	0.0309	0.0000	0.0596	0.0018	0.0923	0.68	0.67
TOTAL	0.5683	0.0000	0.6723	0.3642	1.6048	0.68	0.65

STORM DRAINAGE BUBBLE

A1-5 — AREA LABEL (CATCHMENT-SUBCATCHMENT)
0.56 | 0.25 — RUNOFF COEFFICIENT / AREA IN HECTARE
MAJOR FLOW ROUTING
E — EMERGENCY OUTLET



wsp
1224 GARDINERS ROAD, SUITE 201
KINGSTON, ONTARIO
CANADA K7P 0G2
PHONE: 613-634-7373
WWW.WSP.COM

CONSULTANT:
M. David Blakely Architect Inc.
2200 Prince of Wales Dr. - Suite 101
Ottawa, Ontario K2E 6Z9
Phone (613) 226-8811 Fax (613) 226-7942

SEAL:

NORTH

CLIENT:
RICHCRAFT Group Of Companies

CLIENT REF. #:

PROJECT:
TERRACE FLATS

KEY PLAN:

ISSUED FOR - REVISION:

IS	RE	DATE	DESCRIPTION
1		2021/06/18	ISSUED FOR CLIENT REVIEW

PROJECT NO: 211-01221-00	DATE: MARCH 2021
ORIGINAL SCALE: 1:400	IF THIS BAR IS NOT 25mm LONG, ADJUST YOUR PLOTTING SCALE.
DESIGNED BY: DS	25mm
DRAWN BY: MH	
CHECKED BY: SD	

DISCIPLINE: CIVIL

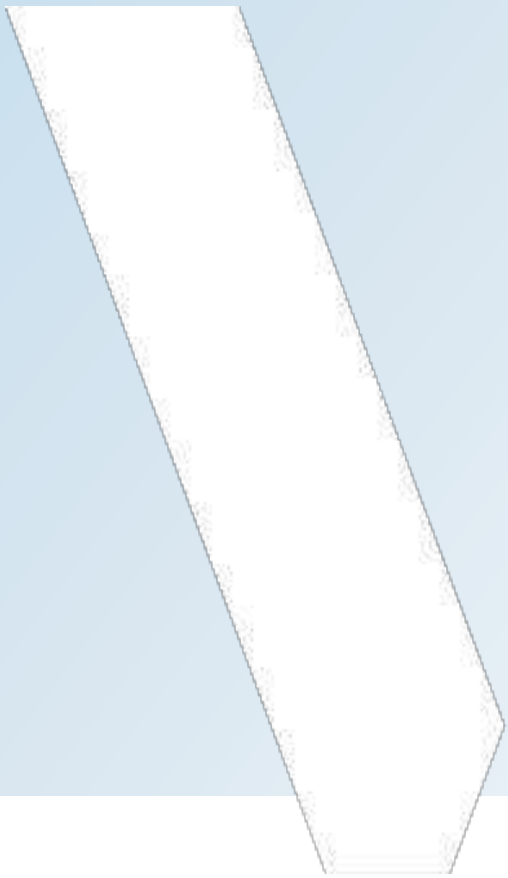
TITLE: POST-DEVELOPMENT CATCHMENT MAP MINOR STORM SYSTEM

SHEET NUMBER: SWM-SK1-2
SHEET #: 2 OF 2

ISSUE: ISSUED FOR DISTRIBUTION
DATE OF: 2020/06/11
REV #: 0

N:\2021\211-01221-00\- Richcraft Terrace Flats Site Plan\Drawings\01. Civil\03. FGS-SKS\00. Sketches\211-01221-00- SWM-SK1-2 (PostDev).dwg Jun 29, 2021-8:48am BY (daniel.seiler)

APPENDIX B –
MINOR SYSTEM SIZING CALCULATIONS



STORM SEWER CAPACITY CALCULATIONS - RICHCRAFT TERRACE FLATS

DATE: JUNE 2021
PROJECT NO. 211-01221-00

PREPARED BY: Daniel Searle, P.Eng.
CHECKED BY: Steve Davidson, P.Eng., OLS (Ret.), MBA

1:5 YR STORM EVENT

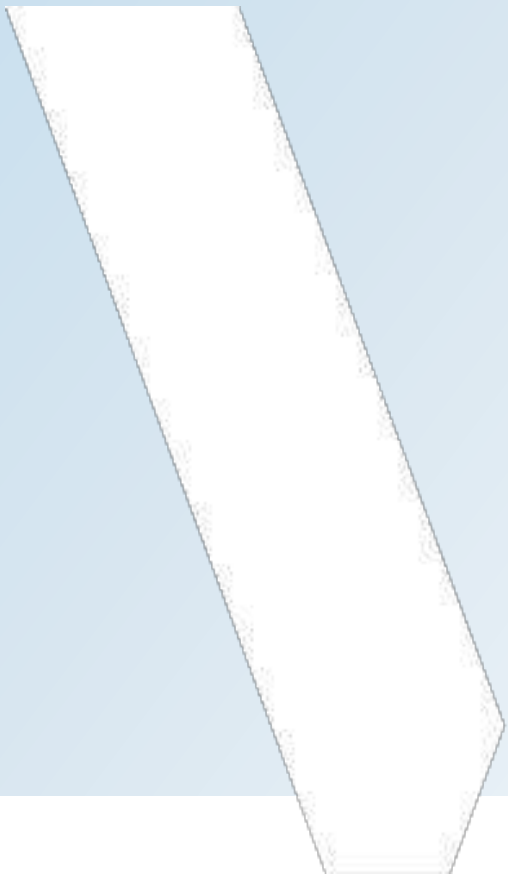
REF. FIGURE: SWM - SK1-2

DRAINAGE AREA			RUNOFF DATA							PIPE DATA					
FROM No.	TO No.	AREA DESCRIPTION	AREA (ha)	RUNOFF COEFFICIENT	AC	Σ AC	Tc (min)	I (mm/hour)	PEAK RUNOFF, Q (L/s)	SIZE (mm)	SLOPE (%)	CAPACITY (L/sec)	Q/Q_{full}	VELOCITY (m/sec)	LENGTH (m)
RYCB01	MH401	B1	0.03	0.69	0.02	0.02	10.00	104.2	6.4	450	0.50%	201.6	0.03	1.27	29.0
MH401	MH402	B2	0.12	0.71	0.09	0.09	10.61	101.1	24.6	450	0.50%	201.6	0.12	1.27	39.0
MH402	MH403	B3,B4,B5, B6	0.37	0.65	0.24	0.33	11.44	97.2	88.1	450	0.50%	201.6	0.44	1.27	80.0
CB11	MH403	B8	0.12	0.81	0.09	0.42	13.13	90.1	105.4	450	0.50%	201.6	0.52	1.27	29.0
MH403	MH404	B7	0.07	0.60	0.04	0.46	13.74	87.9	112.6	450	0.50%	201.6	0.56	1.27	28.0
CB13	MH404	B10	0.10	0.86	0.09	0.55	14.33	85.8	130.2	450	0.50%	201.6	0.65	1.27	24.0
MH404	MH405	B9	0.04	0.82	0.04	0.58	14.84	84.1	136.2	450	0.50%	201.6	0.68	1.27	19.0
POND OUTLET	MH410	B11	0.15	0.55	0.08	0.08	10.00	104.2	24.2	300	3.90%	191.0	0.13	2.70	8.0
MH410	MH409	B12,B13	0.10	0.68	0.07	0.15	10.36	102.3	43.3	600	0.15%	237.8	0.18	0.84	14.6
MH409	MH408	B14	0.20	0.74	0.15	0.30	10.56	101.3	85.6	600	0.15%	237.8	0.36	0.84	23.2
MH408	MH406	-	0.00	0.00	0.00	0.30	10.89	99.7	84.2	600	0.15%	237.8	0.35	0.84	26.4
MH407	MH406	B15,B16	0.16	0.08	0.01	0.32	11.26	98.0	86.1	450	0.25%	142.6	0.60	0.90	23.2
MH406	MH405	B17	0.05	0.66	0.03	0.35	11.61	96.4	92.7	600	0.15%	237.8	0.39	0.84	41.0
MH405	STUB	B18	0.09	0.68	0.06	0.99	15.24	82.8	228.2	750	0.12%	385.7	0.59	0.87	9.5

NOTES:

1. PIPE MANNING'S COEFFICIENT IS "0.013"
2. RAINFALL INTENSITY IN ACCORDANCE WITH CITY OF OTTAWA SEWER DESIGN GUIDELINES.

APPENDIX C –
PCSWMM MODEL MAPS AND OUTPUTS



PRE-DEVELOPMENT - MODEL MAP

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


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


  ****************
  Raingage Summary
  ****************
                                                        Data       Recording
  Name                 Data Source                      Type       Interval
  ------------------------------------------------------------------------
  Richcraft            Chicago_3h_5yr_10min             INTENSITY   10 min.


  ********************
  Subcatchment Summary
  ********************
  Name                        Area     Width    %Imperv    %Slope Rain Gage
Outlet
  ------------------------------------------------------------------------------------
----------------------------
  1                           1.60     53.48      5.00    1.2000 Richcraft
2


  ************
  Node Summary
  ************
                                          Invert      Max.    Ponded    External
  Name                 Type                Elev.     Depth      Area    Inflow
  ------------------------------------------------------------------------------
  2                    OUTFALL             0.00      0.00       0.0


  *********************************************************
  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 ............... CMS
  Process Models:
```

```
    Rainfall/Runoff ........ YES
    RDII ................... NO
    Snowmelt ............... NO
    Groundwater ............ NO
    Flow Routing ........... NO
    Water Quality .......... NO
  Infiltration Method ...... HORTON
  Surcharge Method ......... EXTRAN
  Starting Date ............ 04/21/2021 00:00:00
  Ending Date .............. 04/21/2021 12:00:00
  Antecedent Dry Days ...... 0.0
  Report Time Step ......... 00:01:00
  Wet Time Step ............ 00:05:00
  Dry Time Step ............ 00:05:00


  **************************        Volume         Depth
  Runoff Quantity Continuity     hectare-m            mm
  **************************     ---------       -------
  Total Precipitation ......         0.068        42.498
  Evaporation Loss .........         0.000         0.000
  Infiltration Loss ........         0.008         5.054
  Surface Runoff ...........         0.060        37.507
  Final Storage ............         0.000         0.002
  Continuity Error (%) .....        -0.154


  **************************        Volume        Volume
  Flow Routing Continuity        hectare-m      10^6 ltr
  **************************     ---------     ---------
  Dry Weather Inflow .......         0.000         0.000
  Wet Weather Inflow .......         0.060         0.602
  Groundwater Inflow .......         0.000         0.000
  RDII Inflow ..............         0.000         0.000
  External Inflow ..........         0.000         0.000
  External Outflow .........         0.060         0.602
  Flooding Loss ............         0.000         0.000
  Evaporation Loss .........         0.000         0.000
  Exfiltration Loss ........         0.000         0.000
  Initial Stored Volume ....         0.000         0.000
  Final Stored Volume ......         0.000         0.000
  Continuity Error (%) .....         0.000


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

  ------------------------------------------------------------------------------------
-------------------------------------------
                            Total      Total      Total      Total     Imperv
Perv      Total       Total     Peak  Runoff
                          Precip      Runon       Evap      Infil     Runoff
Runoff     Runoff      Runoff   Runoff   Coeff
  Subcatchment                mm         mm         mm         mm         mm
mm         mm    10^6 ltr      CMS
  ------------------------------------------------------------------------------------
-------------------------------------------
```

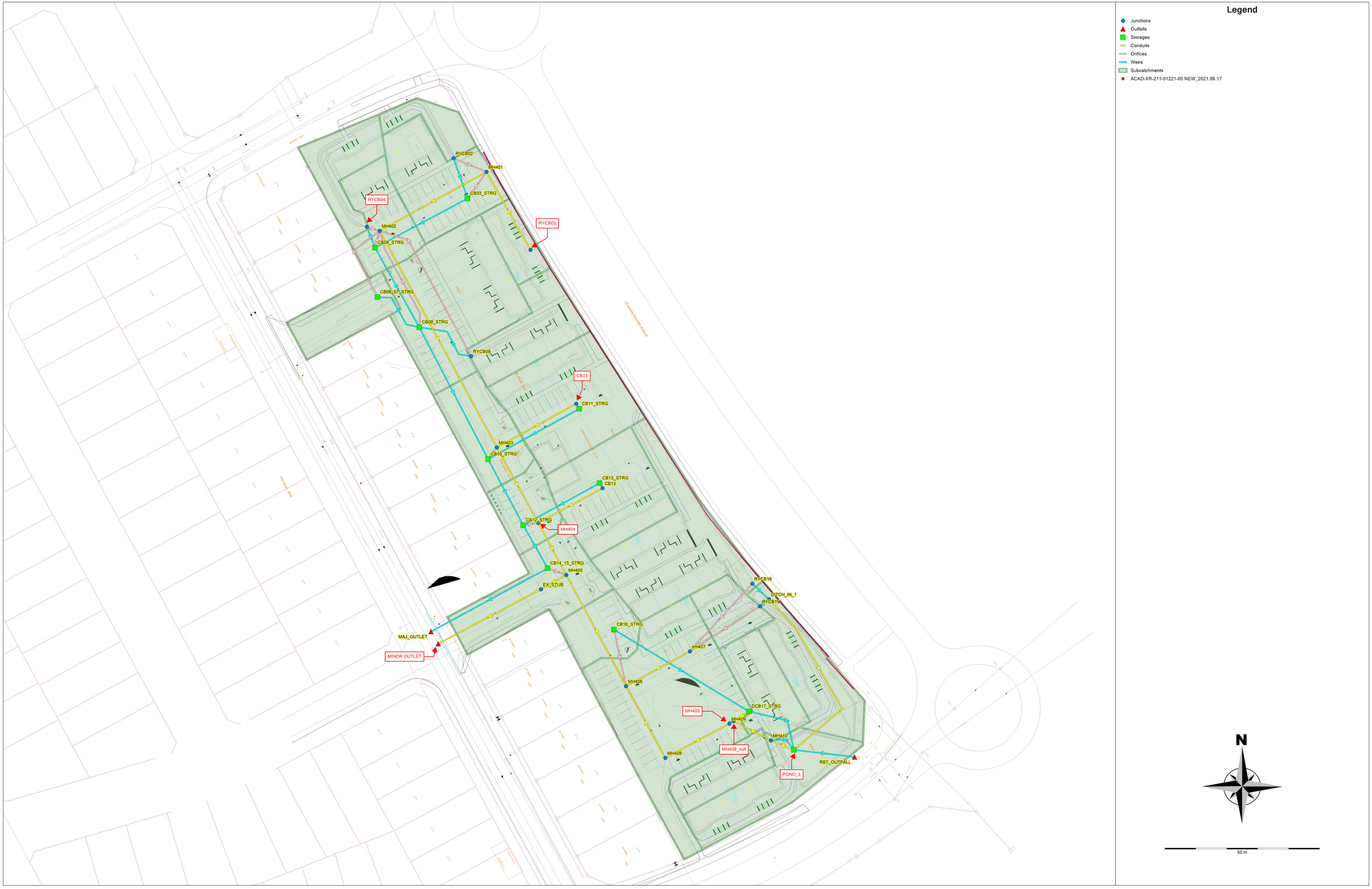
```
  1                          42.50       0.00       0.00       5.05       2.13
35.38      37.51        0.60     0.13   0.883


  Analysis begun on:  Thu Jun 17 23:03:26 2021
  Analysis ended on:  Thu Jun 17 23:03:26 2021
  Total elapsed time: < 1 sec
```

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


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


  ****************
  Raingage Summary
  ****************
                                                    Data       Recording
  Name                 Data Source                  Type       Interval
  ------------------------------------------------------------------------
  Richcraft            Chicago_3h_100yr_10min       INTENSITY   10 min.


  ********************
  Subcatchment Summary
  ********************
  Name                        Area     Width    %Imperv    %Slope Rain Gage
Outlet
  ------------------------------------------------------------------------------------
--------------------------
  1                           1.60     53.48      5.00    1.2000 Richcraft
2


  ************
  Node Summary
  ************
                                          Invert      Max.    Ponded    External
  Name                 Type                Elev.     Depth      Area    Inflow
  ------------------------------------------------------------------------------
  2                    OUTFALL              0.00      0.00       0.0


  *********************************************************
  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 ............... CMS
  Process Models:
```

```
    Rainfall/Runoff ........ YES
    RDII ................... NO
    Snowmelt ............... NO
    Groundwater ............ NO
    Flow Routing ........... NO
    Water Quality .......... NO
  Infiltration Method ...... HORTON
  Surcharge Method ......... EXTRAN
  Starting Date ............ 04/21/2021 00:00:00
  Ending Date .............. 04/21/2021 12:00:00
  Antecedent Dry Days ...... 0.0
  Report Time Step ......... 00:01:00
  Wet Time Step ............ 00:05:00
  Dry Time Step ............ 00:05:00


  **************************        Volume         Depth
  Runoff Quantity Continuity     hectare-m            mm
  **************************     ---------       -------
  Total Precipitation ......         0.114        71.277
  Evaporation Loss .........         0.000         0.000
  Infiltration Loss ........         0.008         5.212
  Surface Runoff ...........         0.106        66.205
  Final Storage ............         0.000         0.002
  Continuity Error (%) .....        -0.199


  **************************        Volume        Volume
  Flow Routing Continuity        hectare-m      10^6 ltr
  **************************     ---------     ---------
  Dry Weather Inflow .......         0.000         0.000
  Wet Weather Inflow .......         0.106         1.062
  Groundwater Inflow .......         0.000         0.000
  RDII Inflow ..............         0.000         0.000
  External Inflow ..........         0.000         0.000
  External Outflow .........         0.106         1.062
  Flooding Loss ............         0.000         0.000
  Evaporation Loss .........         0.000         0.000
  Exfiltration Loss ........         0.000         0.000
  Initial Stored Volume ....         0.000         0.000
  Final Stored Volume ......         0.000         0.000
  Continuity Error (%) .....         0.000


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

  ------------------------------------------------------------------------------------
-------------------------------------------
                             Total      Total      Total      Total     Imperv
Perv      Total       Total     Peak  Runoff
                          Precip      Runon       Evap      Infil     Runoff
Runoff     Runoff      Runoff   Runoff   Coeff
  Subcatchment                mm         mm         mm         mm         mm
mm         mm    10^6 ltr      CMS
  ------------------------------------------------------------------------------------
-------------------------------------------
```

```
  1                          71.28       0.00       0.00       5.21       3.57
62.64      66.21        1.06     0.28   0.929


  Analysis begun on:  Tue Jun 29 08:53:42 2021
  Analysis ended on:  Tue Jun 29 08:53:42 2021
  Total elapsed time: < 1 sec
```

POST-DEVELOPMENT - MODEL MAP



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

  WARNING 02: maximum depth increased for Node MH410
  WARNING 02: maximum depth increased for Node RYCB02
  WARNING 02: maximum depth increased for Node RYCB04
  WARNING 02: maximum depth increased for Node RYCB09
  WARNING 02: maximum depth increased for Node RYCB18
  WARNING 02: maximum depth increased for Node RYCB19

  *************
  Element Count
  *************
  Number of rain gages ...... 1
  Number of subcatchments ... 21
  Number of nodes ........... 36
  Number of links ........... 51
  Number of pollutants ...... 0
  Number of land uses ....... 0


  ****************
  Raingage Summary
  ****************
                                                      Data       Recording
  Name                 Data Source                    Type       Interval
  ------------------------------------------------------------------------
  Richcraft            Chicago_3h_2yr_10min           INTENSITY   10 min.


  ********************
  Subcatchment Summary
  ********************
  Name                        Area     Width    %Imperv    %Slope Rain Gage
Outlet
  ------------------------------------------------------------------------------
---------------------------
  28                          0.05     15.70     64.00    1.0000 Richcraft
CB06_07_STRG
  B1                          0.03     19.80     63.00    2.0000 Richcraft
RYCB01
  B10                         0.10     50.85     92.00    2.0000 Richcraft
CB13_STRG
  B11_1                       0.07     13.49     44.00    2.0000 Richcraft
DITCH_IN_1
  B11_2                       0.08     12.74     44.00    2.0000 Richcraft
POND_1
  B12                         0.05     16.00     60.00    2.0000 Richcraft
MH410
  B13                         0.04     12.43     64.00    2.0000 Richcraft
MH410
  B14                         0.21     37.73     74.00    3.0000 Richcraft
DCB17_STRG
  B15                         0.13     20.41     44.00    1.0000 Richcraft
RYCB18
  B16                         0.03     16.75     53.00    2.0000 Richcraft
RYCB19
```

B17	0.04	28.40	63.00	2.0000	Richcraft
CB16_STRG					
B18	0.09	29.87	66.00	2.0000	Richcraft
CB14_15_STRG					
B2_1	0.03	9.17	68.00	2.0000	Richcraft
RYCB02					
B2_2	0.09	45.10	68.00	1.0000	Richcraft
CB03_STRG					
B3_1	0.05	9.88	59.00	2.0000	Richcraft
RYCB04					
B3_2	0.06	38.07	59.00	2.0000	Richcraft
CB04_STRG					
B5	0.15	50.87	63.00	2.0000	Richcraft
CB08_STRG					
B6	0.07	14.22	55.00	1.0000	Richcraft
RYCB09					
B7	0.06	27.87	54.00	1.0000	Richcraft
CB10_STRG					
B8	0.12	54.22	84.00	2.0000	Richcraft
CB11_STRG					
B9	0.04	23.17	86.00	2.0000	Richcraft
CB12_STRG					

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
CB11	JUNCTION	105.20	2.89	0.0	
CB13	JUNCTION	105.01	3.02	0.0	
DITCH_IN_1	JUNCTION	106.18	0.67	0.0	
EX_STUB	JUNCTION	104.30	3.65	0.0	
MH401	JUNCTION	105.68	2.97	0.0	
MH402	JUNCTION	105.34	2.68	0.0	
MH403	JUNCTION	104.91	3.12	0.0	
MH404	JUNCTION	104.74	3.30	0.0	
MH405	JUNCTION	104.34	3.66	0.0	
MH406	JUNCTION	104.54	3.43	0.0	
mh407	JUNCTION	104.75	2.60	0.0	
MH408	JUNCTION	104.60	2.53	0.0	
MH409	JUNCTION	104.81	1.79	0.0	
MH409_null	JUNCTION	104.81	1.79	0.0	
MH410	JUNCTION	104.90	1.60	0.0	
RYCB01	JUNCTION	105.98	2.08	0.0	
RYCB02	JUNCTION	106.18	2.50	0.0	
RYCB04	JUNCTION	105.85	2.50	0.0	
RYCB09	JUNCTION	105.69	2.77	0.0	
RYCB18	JUNCTION	105.39	1.31	0.0	
RYCB19	JUNCTION	104.80	2.00	0.0	
14	OUTFALL	104.25	0.75	0.0	
2	OUTFALL	105.38	0.00	0.0	
5	OUTFALL	108.07	0.00	0.0	
CB03_STRG	STORAGE	105.91	4.09	0.0	
CB04_STRG	STORAGE	105.80	4.20	0.0	
CB06_07_STRG	STORAGE	105.95	3.05	0.0	
CB08_STRG	STORAGE	105.69	4.31	0.0	

CB10_STRG	STORAGE	105.80	4.20	0.0
CB11_STRG	STORAGE	105.83	4.17	0.0
CB12_STRG	STORAGE	105.81	4.19	0.0
CB13_STRG	STORAGE	105.80	4.20	0.0
CB14_15_STRG	STORAGE	105.75	2.52	0.0
CB16_STRG	STORAGE	105.66	2.59	0.0
DCB17_STRG	STORAGE	104.57	2.11	0.0
POND_1	STORAGE	105.50	0.75	0.0

****
Link Summary
****

Name	From Node	To Node	Type	Length	% Slope	Roughness
11	POND_1	MH410	CONDUIT	8.0	3.8581	0.0130
13	MH402	MH403	CONDUIT	79.4	0.5036	0.0130
14	RYCB01	MH401	CONDUIT	28.9	0.5193	0.0130
15	mh407	MH406	CONDUIT	23.5	0.2557	0.0130
16	CB11	MH403	CONDUIT	29.2	0.4790	0.0130
17	MH403	MH404	CONDUIT	27.8	0.5042	0.0130
18	MH404	MH405	CONDUIT	19.1	0.5246	0.0130
2	MH401	MH402	CONDUIT	39.3	0.4835	0.0130
2_3	MH408	MH406	CONDUIT	26.4	0.1515	0.0130
3	MH410	MH409_null	CONDUIT	13.6	0.2949	0.0130
39	CB13	MH404	CONDUIT	23.6	0.5095	0.0130
4	MH409	MH408	CONDUIT	23.4	0.1709	0.0130
44	DITCH_IN_1	POND_1	CONDUIT	55.0	0.5091	0.0350
54	DCB17_STRG	MH409_null	CONDUIT	5.8	1.0259	0.0130
7	MH406	MH405	CONDUIT	40.7	0.1474	0.0130
8	MH405	EX_STUB	CONDUIT	9.4	0.1065	0.0130
9	EX_STUB	14	CONDUIT	37.5	0.1334	0.0130
10	CB14_15_STRG	MH405	ORIFICE			
19	RYCB02	MH401	ORIFICE			
21	CB03_STRG	MH401	ORIFICE			
22	RYCB04	MH402	ORIFICE			
24	CB04_STRG	MH402	ORIFICE			
25	CB06_07_STRG	MH402	ORIFICE			
27	RYCB19	mh407	ORIFICE			
28	RYCB18	mh407	ORIFICE			

30	CB10_STRG	MH403	ORIFICE
31	CB11_STRG	CB11	ORIFICE
34	CB12_STRG	MH404	ORIFICE
35	CB13_STRG	CB13	ORIFICE
41	CB16_STRG	MH406	ORIFICE
51	RYCB09	MH402	ORIFICE
52	CB08_STRG	MH402	ORIFICE
53	MH409_null	MH409	ORIFICE
1	CB14_15_STRG	5	WEIR
12	DCB17_STRG	POND_1	WEIR
20	RYCB02	CB03_STRG	WEIR
23	RYCB04	CB04_STRG	WEIR
26	CB06_07_STRG	CB08_STRG	WEIR
29	RYCB09	CB08_STRG	WEIR
32	CB11_STRG	CB10_STRG	WEIR
33	CB08_STRG	CB10_STRG	WEIR
36	CB10_STRG	CB12_STRG	WEIR
37	CB13_STRG	CB12_STRG	WEIR
38	CB12_STRG	CB14_15_STRG	WEIR
40	CB16_STRG	DCB17_STRG	WEIR
42	CB04_STRG	CB08_STRG	WEIR
43	CB03_STRG	CB04_STRG	WEIR
45	RYCB18	DITCH_IN_1	WEIR
46	RYCB19	DITCH_IN_1	WEIR
5	POND_1	2	WEIR
50	MH410	POND_1	WEIR

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
11	CIRCULAR	0.30	0.07	0.07	0.30	1	0.19
13	CIRCULAR	0.45	0.16	0.11	0.45	1	0.20
14	CIRCULAR	0.45	0.16	0.11	0.45	1	0.21
15	CIRCULAR	0.45	0.16	0.11	0.45	1	0.14
16	CIRCULAR	0.45	0.16	0.11	0.45	1	0.20
17	CIRCULAR	0.45	0.16	0.11	0.45	1	0.20
18	CIRCULAR	0.45	0.16	0.11	0.45	1	0.21
2	CIRCULAR	0.45	0.16	0.11	0.45	1	0.20
2_3	CIRCULAR	0.60	0.28	0.15	0.60	1	0.24
3	CIRCULAR	0.60	0.28	0.15	0.60	1	0.33
39	CIRCULAR	0.45	0.16	0.11	0.45	1	0.20

4	CIRCULAR	0.60	0.28	0.15	0.60	1
0.25						
44	TRAPEZOIDAL	0.30	0.36	0.16	2.10	1
0.22						
54	CIRCULAR	0.30	0.07	0.07	0.30	1
0.10						
7	CIRCULAR	0.60	0.28	0.15	0.60	1
0.24						
8	CIRCULAR	0.75	0.44	0.19	0.75	1
0.36						
9	CIRCULAR	0.75	0.44	0.19	0.75	1
0.41						

****
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 ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... HORTON
Flow Routing Method ..... DYNWAVE
Surcharge Method ..... EXTRAN
Starting Date 04/21/2021 00:00:00
Ending Date 04/21/2021 12:00:00
Antecedent Dry Days 0.0
Report Time Step 00:01:00
Wet Time Step 00:05:00
Dry Time Step 00:05:00
Routing Time Step ..... 0.50 sec
Variable Time Step ..... YES
Maximum Trials 8
Number of Threads 4
Head Tolerance ..... 0.001500 m

**********	Volume	Depth
Runoff Quantity Continuity	hectare-m	mm
**********	---------	-------
Total Precipitation	0.051	31.776
Evaporation Loss	0.000	0.000
Infiltration Loss	0.018	11.275
Surface Runoff	0.033	20.619
Final Storage	0.000	0.011

Continuity Error (%) ..... -0.405

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.033	0.331
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.033	0.328
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.001
Continuity Error (%)	0.657	

Time-Step Critical Elements

None

Highest Flow Instability Indexes

All links are stable.

Routing Time Step Summary

Minimum Time Step	:	0.50 sec
Average Time Step	:	0.50 sec
Maximum Time Step	:	0.50 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00
Time Step Frequencies	:	
0.500 - 0.500 sec	:	100.00 %
0.500 - 0.500 sec	:	0.00 %
0.500 - 0.500 sec	:	0.00 %
0.500 - 0.500 sec	:	0.00 %
0.500 - 0.500 sec	:	0.00 %

Subcatchment Runoff Summary

Perv	Total	Total	Total Peak	Total Runoff	Total	Total	Imperv

Subcatchment	Precip mm	Runon mm	Evap mm	Infil mm	Runoff mm	Runoff mm	Runoff 10^6 ltr	Runoff CMS	Runoff Coeff
28	31.78	0.00	0.00	11.42	20.46	0.04	20.50	0.01	0.01	0.645
B1	31.78	0.00	0.00	11.70	19.53	0.12	19.65	0.01	0.00	0.618
B10	31.78	0.00	0.00	2.52	29.36	0.06	29.43	0.03	0.02	0.926
B11_1	31.78	0.00	0.00	17.78	14.06	0.03	14.09	0.01	0.01	0.443
B11_2	31.78	0.00	0.00	17.78	14.07	0.03	14.09	0.01	0.01	0.444
B12	31.78	0.00	0.00	12.68	19.16	0.05	19.20	0.01	0.01	0.604
B13	31.78	0.00	0.00	11.42	20.44	0.05	20.49	0.01	0.01	0.645
B14	31.78	0.00	0.00	8.24	23.67	0.04	23.71	0.05	0.03	0.746
B15	31.78	0.00	0.00	17.78	14.08	0.02	14.10	0.02	0.01	0.444
B16	31.78	0.00	0.00	14.89	16.88	0.08	16.96	0.01	0.00	0.534
B17	31.78	0.00	0.00	11.71	20.06	0.10	20.16	0.01	0.01	0.635
B18	31.78	0.00	0.00	10.78	21.07	0.05	21.12	0.02	0.01	0.665
B2_1	31.78	0.00	0.00	10.14	21.71	0.05	21.76	0.01	0.00	0.685
B2_2	31.78	0.00	0.00	10.14	21.71	0.06	21.76	0.02	0.01	0.685
B3_1	31.78	0.00	0.00	13.01	18.87	0.03	18.90	0.01	0.01	0.595
B3_2	31.78	0.00	0.00	12.98	18.79	0.10	18.89	0.01	0.01	0.594
B5	31.78	0.00	0.00	11.73	20.11	0.05	20.16	0.03	0.02	0.635
B6	31.78	0.00	0.00	14.29	17.60	0.03	17.62	0.01	0.01	0.555
B7	31.78	0.00	0.00	14.59	17.23	0.05	17.28	0.01	0.01	0.544
B8	31.78	0.00	0.00	5.05	26.81	0.06	26.88	0.03	0.02	0.846
B9	31.78	0.00	0.00	4.42	27.43	0.08	27.51	0.01	0.01	0.866

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters

CB11	JUNCTION	0.01	0.10	105.30	0	01:10	0.10
CB13	JUNCTION	0.01	0.09	105.10	0	01:10	0.09
DITCH_IN_1	JUNCTION	0.01	0.08	106.26	0	01:10	0.08
EX_STUB	JUNCTION	0.04	0.33	104.63	0	01:11	0.33
MH401	JUNCTION	0.01	0.10	105.78	0	01:10	0.10
MH402	JUNCTION	0.02	0.18	105.52	0	01:10	0.18
MH403	JUNCTION	0.02	0.21	105.12	0	01:11	0.21
MH404	JUNCTION	0.02	0.24	104.98	0	01:11	0.24
MH405	JUNCTION	0.03	0.33	104.67	0	01:11	0.33
MH406	JUNCTION	0.04	0.22	104.76	0	01:10	0.22
mh407	JUNCTION	0.02	0.11	104.86	0	01:10	0.11
MH408	JUNCTION	0.04	0.20	104.80	0	01:12	0.20
MH409	JUNCTION	0.02	0.19	105.00	0	01:11	0.19
MH409_null	JUNCTION	0.04	0.77	105.58	0	01:10	0.74
MH410	JUNCTION	0.02	0.68	105.58	0	01:10	0.65
RYCB01	JUNCTION	0.00	0.04	106.02	0	01:10	0.04
RYCB02	JUNCTION	0.01	0.14	106.32	0	01:10	0.14
RYCB04	JUNCTION	0.01	0.55	106.40	0	01:10	0.54
RYCB09	JUNCTION	0.02	0.77	106.46	0	01:10	0.77
RYCB18	JUNCTION	0.01	0.20	105.59	0	01:10	0.20
RYCB19	JUNCTION	1.49	1.62	106.42	0	01:10	1.62
14	OUTFALL	0.02	0.27	104.52	0	01:11	0.27
2	OUTFALL	0.00	0.00	105.38	0	00:00	0.00
5	OUTFALL	0.00	0.00	108.07	0	00:00	0.00
CB03_STRG	STORAGE	0.02	1.02	106.93	0	01:10	1.01
CB04_STRG	STORAGE	0.02	0.72	106.52	0	01:10	0.72
CB06_07_STRG	STORAGE	0.02	0.58	106.53	0	01:10	0.58
CB08_STRG	STORAGE	0.05	2.13	107.82	0	01:10	2.12
CB10_STRG	STORAGE	0.02	0.74	106.54	0	01:10	0.74
CB11_STRG	STORAGE	0.05	2.12	107.95	0	01:10	2.11
CB12_STRG	STORAGE	0.02	0.79	106.60	0	01:10	0.79
CB13_STRG	STORAGE	0.05	2.11	107.91	0	01:10	2.10
CB14_15_STRG	STORAGE	0.02	0.95	106.70	0	01:10	0.95
CB16_STRG	STORAGE	0.02	0.81	106.47	0	01:11	0.81
DCB17_STRG	STORAGE	0.60	1.02	105.59	0	01:10	0.99
POND_1	STORAGE	0.01	0.06	105.56	0	01:11	0.06

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min		Lateral Inflow Volume 10^6 ltr	Total Inflow 10^6 ltr	Flow Balance Error Percent
CB11	JUNCTION	0.000	0.021	0	01:10	0	0.0335	-0.001
CB13	JUNCTION	0.000	0.018	0	01:10	0	0.0299	0.032

DITCH_IN_1	JUNCTION	0.007	0.007	0	01:10	0.0105	0.0105
0.006							
EX_STUB	JUNCTION	0.000	0.198	0	01:11	0	0.328
0.001							
MH401	JUNCTION	0.000	0.021	0	01:10	0	0.0315
-0.003							
MH402	JUNCTION	0.000	0.065	0	01:10	0	0.104
0.534							
MH403	JUNCTION	0.000	0.093	0	01:10	0	0.148
-0.412							
MH404	JUNCTION	0.000	0.118	0	01:11	0	0.19
-0.007							
MH405	JUNCTION	0.000	0.199	0	01:11	0	0.329
0.010							
MH406	JUNCTION	0.000	0.070	0	01:10	0	0.12
0.065							
mh407	JUNCTION	0.000	0.016	0	01:10	0	0.0219
0.050							
MH408	JUNCTION	0.000	0.049	0	01:11	0	0.0896
0.053							
MH409	JUNCTION	0.000	0.050	0	01:10	0	0.0896
-0.016							
MH409_null	JUNCTION	0.000	0.050	0	01:10	0	0.0896
-0.033							
MH410	JUNCTION	0.013	0.028	0	01:11	0.0191	0.0412
0.026							
RYCB01	JUNCTION	0.004	0.004	0	01:10	0.00584	0.00584
0.001							
RYCB02	JUNCTION	0.004	0.004	0	01:10	0.00599	0.00599
0.001							
RYCB04	JUNCTION	0.006	0.006	0	01:10	0.00934	0.00934
0.000							
RYCB09	JUNCTION	0.008	0.008	0	01:10	0.0115	0.0115
0.000							
RYCB18	JUNCTION	0.012	0.012	0	01:10	0.0181	0.0181
0.000							
RYCB19	JUNCTION	0.004	0.004	0	01:10	0.00568	0.00568
48.971							
14	OUTFALL	0.000	0.199	0	01:11	0	0.328
0.000							
2	OUTFALL	0.000	0.000	0	00:00	0	0
0.000 ltr							
5	OUTFALL	0.000	0.000	0	00:00	0	0
0.000 ltr							
CB03_STRG	STORAGE	0.013	0.013	0	01:10	0.0196	0.0196
0.000							
CB04_STRG	STORAGE	0.007	0.007	0	01:10	0.0108	0.0108
0.000							
CB06_07_STRG	STORAGE	0.006	0.006	0	01:10	0.00965	0.00965
0.000							
CB08_STRG	STORAGE	0.021	0.021	0	01:10	0.0308	0.0308
0.000							
CB10_STRG	STORAGE	0.007	0.007	0	01:10	0.0111	0.0111
0.000							
CB11_STRG	STORAGE	0.023	0.023	0	01:10	0.0335	0.0335
0.000							
CB12_STRG	STORAGE	0.008	0.008	0	01:10	0.0115	0.0115
0.000							
CB13_STRG	STORAGE	0.020	0.020	0	01:10	0.0299	0.0299
0.000							

```
  CB14_15_STRG          STORAGE      0.013     0.013     0  01:10      0.0189
0.0189       0.000
  CB16_STRG             STORAGE      0.006     0.006     0  01:10     0.00859
0.00859       0.000
  DCB17_STRG            STORAGE      0.033     0.033     0  01:10      0.0492
0.0492       0.525
  POND_1                STORAGE      0.008     0.018     0  01:09      0.0117
0.0222      -0.035


  **********************
  Node Surcharge Summary
  **********************

  Surcharging occurs when water rises above the top of the highest conduit.
  -------------------------------------------------------------------------
                                           Max. Height   Min. Depth
                                  Hours    Above Crown    Below Rim
  Node                  Type    Surcharged     Meters       Meters
  -------------------------------------------------------------------------
  MH409_null            JUNCTION      0.10        0.121        1.019


  **********************
  Node Flooding Summary
  **********************

  No nodes were flooded.


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

  ------------------------------------------------------------------------------
-----------------
                         Average     Avg  Evap Exfil       Maximum     Max    Time
of Max    Maximum
                          Volume    Pcnt  Pcnt  Pcnt        Volume    Pcnt
Occurrence    Outflow
  Storage Unit           1000 m3    Full  Loss  Loss       1000 m3    Full    days
hr:min        CMS
  ------------------------------------------------------------------------------
-----------------
  CB03_STRG                0.000       0     0     0         0.000       0       0
01:10      0.013
  CB04_STRG                0.000       0     0     0         0.000       0       0
01:10      0.007
  CB06_07_STRG             0.000       0     0     0         0.000       0       0
01:10      0.006
  CB08_STRG                0.000       0     0     0         0.001       0       0
01:10      0.019
  CB10_STRG                0.000       0     0     0         0.000       0       0
01:10      0.007
  CB11_STRG                0.000       0     0     0         0.001       0       0
01:10      0.021
  CB12_STRG                0.000       0     0     0         0.000       0       0
01:10      0.007
```

CB13_STRG	0.000	0	0	0	0.001	0	0	01:10 0.018
CB14_15_STRG	0.000	0	0	0	0.000	1	0	01:10 0.012
CB16_STRG	0.000	0	0	0	0.000	1	0	01:11 0.005
DCB17_STRG	0.000	5	0	0	0.001	8	0	01:10 0.036
POND_1	0.001	0	0	0	0.005	5	0	01:11 0.017

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
14	54.27	0.014	0.199	0.328
2	0.00	0.000	0.000	0.000
5	0.00	0.000	0.000	0.000
System	18.09	0.014	0.199	0.328

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
11	CONDUIT	0.017	0 01:11	1.41	0.09	0.60
13	CONDUIT	0.065	0 01:10	1.10	0.32	0.40
14	CONDUIT	0.004	0 01:10	0.53	0.02	0.10
15	CONDUIT	0.016	0 01:10	0.67	0.11	0.21
16	CONDUIT	0.021	0 01:11	0.82	0.11	0.22
17	CONDUIT	0.093	0 01:11	1.25	0.46	0.47
18	CONDUIT	0.118	0 01:11	1.36	0.57	0.53
2	CONDUIT	0.021	0 01:10	0.81	0.10	0.22
2_3	CONDUIT	0.049	0 01:12	0.68	0.21	0.31
3	CONDUIT	0.027	0 01:12	0.35	0.08	1.00
39	CONDUIT	0.018	0 01:11	0.79	0.09	0.20
4	CONDUIT	0.049	0 01:11	0.77	0.19	0.28
44	CONDUIT	0.006	0 01:11	0.25	0.03	0.18
54	CONDUIT	0.036	0 01:09	1.21	0.36	1.00
7	CONDUIT	0.069	0 01:10	0.88	0.29	0.33
8	CONDUIT	0.198	0 01:11	1.15	0.55	0.41
9	CONDUIT	0.199	0 01:11	1.22	0.49	0.40
10	ORIFICE	0.012	0 01:10			1.00
19	ORIFICE	0.004	0 01:10			1.00
21	ORIFICE	0.013	0 01:10			1.00

22	ORIFICE	0.006	0	01:10	1.00
24	ORIFICE	0.007	0	01:10	1.00
25	ORIFICE	0.006	0	01:10	1.00
27	ORIFICE	0.004	0	01:10	
28	ORIFICE	0.012	0	01:10	1.00
30	ORIFICE	0.007	0	01:10	1.00
31	ORIFICE	0.021	0	01:10	1.00
34	ORIFICE	0.007	0	01:10	1.00
35	ORIFICE	0.018	0	01:10	1.00
41	ORIFICE	0.005	0	01:11	1.00
51	ORIFICE	0.007	0	01:10	1.00
52	ORIFICE	0.019	0	01:10	1.00
53	ORIFICE	0.050	0	01:10	1.00
1	WEIR	0.000	0	00:00	0.00
12	WEIR	0.000	0	00:00	0.00
20	WEIR	0.000	0	00:00	0.00
23	WEIR	0.000	0	00:00	0.00
26	WEIR	0.000	0	00:00	0.00
29	WEIR	0.000	0	00:00	0.00
32	WEIR	0.000	0	00:00	0.00
33	WEIR	0.000	0	00:00	0.00
36	WEIR	0.000	0	00:00	0.00
37	WEIR	0.000	0	00:00	0.00
38	WEIR	0.000	0	00:00	0.00
40	WEIR	0.000	0	00:00	0.00
42	WEIR	0.000	0	00:00	0.00
43	WEIR	0.000	0	00:00	0.00
45	WEIR	0.000	0	00:00	0.00
46	WEIR	0.000	0	00:00	0.00
5	WEIR	0.000	0	00:00	0.00
50	WEIR	0.000	0	00:00	0.00

****
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
11	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.01	0.00
13	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.01	0.00
14	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
15	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
16	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00
17	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.00	0.00

18	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
0.00									
2	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
0.00									
2_3	1.00	0.02	0.00	0.00	0.13	0.00	0.00	0.86	0.00
0.00									
3	1.00	0.00	0.00	0.00	0.12	0.00	0.00	0.88	0.05
0.00									
39	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
0.00									
4	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
0.00									
44	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
0.00									
54	1.00	0.03	0.00	0.00	0.02	0.00	0.00	0.95	0.00
0.00									
7	1.00	0.01	0.00	0.00	0.01	0.00	0.00	0.98	0.00
0.00									
8	1.00	0.00	0.00	0.00	0.12	0.00	0.00	0.88	0.00
0.00									
9	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
0.00									

****
Conduit Surcharge Summary
****

Conduit	Hours Full: Both Ends	Hours Full: Upstream	Hours Full: Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
11	0.01	0.01	0.09	0.01	0.01
3	0.09	0.09	0.10	0.01	0.01
54	0.10	0.10	0.12	0.01	0.01

Analysis begun on: Mon Jul 5 14:45:22 2021
Analysis ended on: Mon Jul 5 14:45:34 2021
Total elapsed time: 00:00:12

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

  WARNING 02: maximum depth increased for Node MH410
  WARNING 02: maximum depth increased for Node RYCB02
  WARNING 02: maximum depth increased for Node RYCB04
  WARNING 02: maximum depth increased for Node RYCB09
  WARNING 02: maximum depth increased for Node RYCB18
  WARNING 02: maximum depth increased for Node RYCB19

  *************
  Element Count
  *************
  Number of rain gages ...... 1
  Number of subcatchments ... 21
  Number of nodes ........... 36
  Number of links ........... 51
  Number of pollutants ...... 0
  Number of land uses ....... 0


  ****************
  Raingage Summary
  ****************
                                                      Data       Recording
  Name                 Data Source                    Type       Interval
  ----------------------------------------------------------------------
  Richcraft            Chicago_3h_5yr_10min           INTENSITY   10 min.


  ********************
  Subcatchment Summary
  ********************
  Name                         Area     Width    %Imperv    %Slope Rain Gage
Outlet
  ----------------------------------------------------------------------------------
--------------------------
  28                           0.05     15.70     64.00    1.0000 Richcraft
CB06_07_STRG
  B1                           0.03     19.80     63.00    2.0000 Richcraft
RYCB01
  B10                          0.10     50.85     92.00    2.0000 Richcraft
CB13_STRG
  B11_1                        0.07     13.49     44.00    2.0000 Richcraft
DITCH_IN_1
  B11_2                        0.08     12.74     44.00    2.0000 Richcraft
POND_1
  B12                          0.05     16.00     60.00    2.0000 Richcraft
MH410
  B13                          0.04     12.43     64.00    2.0000 Richcraft
MH410
  B14                          0.21     37.73     74.00    3.0000 Richcraft
DCB17_STRG
  B15                          0.13     20.41     44.00    1.0000 Richcraft
RYCB18
  B16                          0.03     16.75     53.00    2.0000 Richcraft
RYCB19
```

B17	0.04	28.40	63.00	2.0000	Richcraft
CB16_STRG					
B18	0.09	29.87	66.00	2.0000	Richcraft
CB14_15_STRG					
B2_1	0.03	9.17	68.00	2.0000	Richcraft
RYCB02					
B2_2	0.09	45.10	68.00	1.0000	Richcraft
CB03_STRG					
B3_1	0.05	9.88	59.00	2.0000	Richcraft
RYCB04					
B3_2	0.06	38.07	59.00	2.0000	Richcraft
CB04_STRG					
B5	0.15	50.87	63.00	2.0000	Richcraft
CB08_STRG					
B6	0.07	14.22	55.00	1.0000	Richcraft
RYCB09					
B7	0.06	27.87	54.00	1.0000	Richcraft
CB10_STRG					
B8	0.12	54.22	84.00	2.0000	Richcraft
CB11_STRG					
B9	0.04	23.17	86.00	2.0000	Richcraft
CB12_STRG					

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
CB11	JUNCTION	105.20	2.89	0.0	
CB13	JUNCTION	105.01	3.02	0.0	
DITCH_IN_1	JUNCTION	106.18	0.67	0.0	
EX_STUB	JUNCTION	104.30	3.65	0.0	
MH401	JUNCTION	105.68	2.97	0.0	
MH402	JUNCTION	105.34	2.68	0.0	
MH403	JUNCTION	104.91	3.12	0.0	
MH404	JUNCTION	104.74	3.30	0.0	
MH405	JUNCTION	104.34	3.66	0.0	
MH406	JUNCTION	104.54	3.43	0.0	
mh407	JUNCTION	104.75	2.60	0.0	
MH408	JUNCTION	104.60	2.53	0.0	
MH409	JUNCTION	104.81	1.79	0.0	
MH409_null	JUNCTION	104.81	1.79	0.0	
MH410	JUNCTION	104.90	1.60	0.0	
RYCB01	JUNCTION	105.98	2.08	0.0	
RYCB02	JUNCTION	106.18	2.50	0.0	
RYCB04	JUNCTION	105.85	2.50	0.0	
RYCB09	JUNCTION	105.69	2.77	0.0	
RYCB18	JUNCTION	105.39	1.31	0.0	
RYCB19	JUNCTION	104.80	2.00	0.0	
14	OUTFALL	104.25	0.75	0.0	
2	OUTFALL	105.38	0.00	0.0	
5	OUTFALL	108.07	0.00	0.0	
CB03_STRG	STORAGE	105.91	4.09	0.0	
CB04_STRG	STORAGE	105.80	4.20	0.0	
CB06_07_STRG	STORAGE	105.95	3.05	0.0	
CB08_STRG	STORAGE	105.69	4.31	0.0	

CB10_STRG	STORAGE	105.80	4.20	0.0
CB11_STRG	STORAGE	105.83	4.17	0.0
CB12_STRG	STORAGE	105.81	4.19	0.0
CB13_STRG	STORAGE	105.80	4.20	0.0
CB14_15_STRG	STORAGE	105.75	2.52	0.0
CB16_STRG	STORAGE	105.66	2.59	0.0
DCB17_STRG	STORAGE	104.57	2.11	0.0
POND_1	STORAGE	105.50	0.75	0.0

****
Link Summary
****

Name	From Node	To Node	Type	Length	% Slope	Roughness
11	POND_1	MH410	CONDUIT	8.0	3.8581	0.0130
13	MH402	MH403	CONDUIT	79.4	0.5036	0.0130
14	RYCB01	MH401	CONDUIT	28.9	0.5193	0.0130
15	mh407	MH406	CONDUIT	23.5	0.2557	0.0130
16	CB11	MH403	CONDUIT	29.2	0.4790	0.0130
17	MH403	MH404	CONDUIT	27.8	0.5042	0.0130
18	MH404	MH405	CONDUIT	19.1	0.5246	0.0130
2	MH401	MH402	CONDUIT	39.3	0.4835	0.0130
2_3	MH408	MH406	CONDUIT	26.4	0.1515	0.0130
3	MH410	MH409_null	CONDUIT	13.6	0.2949	0.0130
39	CB13	MH404	CONDUIT	23.6	0.5095	0.0130
4	MH409	MH408	CONDUIT	23.4	0.1709	0.0130
44	DITCH_IN_1	POND_1	CONDUIT	55.0	0.5091	0.0350
54	DCB17_STRG	MH409_null	CONDUIT	5.8	1.0259	0.0130
7	MH406	MH405	CONDUIT	40.7	0.1474	0.0130
8	MH405	EX_STUB	CONDUIT	9.4	0.1065	0.0130
9	EX_STUB	14	CONDUIT	37.5	0.1334	0.0130
10	CB14_15_STRG	MH405	ORIFICE			
19	RYCB02	MH401	ORIFICE			
21	CB03_STRG	MH401	ORIFICE			
22	RYCB04	MH402	ORIFICE			
24	CB04_STRG	MH402	ORIFICE			
25	CB06_07_STRG	MH402	ORIFICE			
27	RYCB19	mh407	ORIFICE			
28	RYCB18	mh407	ORIFICE			

30	CB10_STRG	MH403	ORIFICE
31	CB11_STRG	CB11	ORIFICE
34	CB12_STRG	MH404	ORIFICE
35	CB13_STRG	CB13	ORIFICE
41	CB16_STRG	MH406	ORIFICE
51	RYCB09	MH402	ORIFICE
52	CB08_STRG	MH402	ORIFICE
53	MH409_null	MH409	ORIFICE
1	CB14_15_STRG	5	WEIR
12	DCB17_STRG	POND_1	WEIR
20	RYCB02	CB03_STRG	WEIR
23	RYCB04	CB04_STRG	WEIR
26	CB06_07_STRG	CB08_STRG	WEIR
29	RYCB09	CB08_STRG	WEIR
32	CB11_STRG	CB10_STRG	WEIR
33	CB08_STRG	CB10_STRG	WEIR
36	CB10_STRG	CB12_STRG	WEIR
37	CB13_STRG	CB12_STRG	WEIR
38	CB12_STRG	CB14_15_STRG	WEIR
40	CB16_STRG	DCB17_STRG	WEIR
42	CB04_STRG	CB08_STRG	WEIR
43	CB03_STRG	CB04_STRG	WEIR
45	RYCB18	DITCH_IN_1	WEIR
46	RYCB19	DITCH_IN_1	WEIR
5	POND_1	2	WEIR
50	MH410	POND_1	WEIR

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
11	CIRCULAR	0.30	0.07	0.07	0.30	1	0.19
13	CIRCULAR	0.45	0.16	0.11	0.45	1	0.20
14	CIRCULAR	0.45	0.16	0.11	0.45	1	0.21
15	CIRCULAR	0.45	0.16	0.11	0.45	1	0.14
16	CIRCULAR	0.45	0.16	0.11	0.45	1	0.20
17	CIRCULAR	0.45	0.16	0.11	0.45	1	0.20
18	CIRCULAR	0.45	0.16	0.11	0.45	1	0.21
2	CIRCULAR	0.45	0.16	0.11	0.45	1	0.20
2_3	CIRCULAR	0.60	0.28	0.15	0.60	1	0.24
3	CIRCULAR	0.60	0.28	0.15	0.60	1	0.33
39	CIRCULAR	0.45	0.16	0.11	0.45	1	0.20

4	CIRCULAR	0.60	0.28	0.15	0.60	1
0.25						
44	TRAPEZOIDAL	0.30	0.36	0.16	2.10	1
0.22						
54	CIRCULAR	0.30	0.07	0.07	0.30	1
0.10						
7	CIRCULAR	0.60	0.28	0.15	0.60	1
0.24						
8	CIRCULAR	0.75	0.44	0.19	0.75	1
0.36						
9	CIRCULAR	0.75	0.44	0.19	0.75	1
0.41						

****
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 ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... HORTON
Flow Routing Method ..... DYNWAVE
Surcharge Method ..... EXTRAN
Starting Date 04/21/2021 00:00:00
Ending Date 04/21/2021 12:00:00
Antecedent Dry Days 0.0
Report Time Step 00:01:00
Wet Time Step 00:05:00
Dry Time Step 00:05:00
Routing Time Step ..... 0.50 sec
Variable Time Step ..... YES
Maximum Trials 8
Number of Threads 4
Head Tolerance ..... 0.001500 m

**********	Volume	Depth
Runoff Quantity Continuity	hectare-m	mm
**********	---------	-------
Total Precipitation	0.068	42.498
Evaporation Loss	0.000	0.000
Infiltration Loss	0.022	13.451
Surface Runoff	0.047	29.255
Final Storage	0.000	0.011

Continuity Error (%) ..... -0.515

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.047	0.470
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.047	0.467
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.000	0.001
Continuity Error (%)	0.494	

Time-Step Critical Elements

None

Highest Flow Instability Indexes

All links are stable.

Routing Time Step Summary

Minimum Time Step	:	0.50 sec
Average Time Step	:	0.50 sec
Maximum Time Step	:	0.50 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00
Time Step Frequencies	:	
0.500 - 0.500 sec	:	100.00 %
0.500 - 0.500 sec	:	0.00 %
0.500 - 0.500 sec	:	0.00 %
0.500 - 0.500 sec	:	0.00 %
0.500 - 0.500 sec	:	0.00 %

Subcatchment Runoff Summary

Perv	Total	Total	Total Peak	Total Runoff	Total	Total	Imperv

Subcatchment	Precip mm	Runon mm	Evap mm	Infil mm	Runoff mm	Runoff mm	Runoff 10^6 ltr	Runoff CMS	Runoff Coeff
28	42.50	0.00	0.00	13.58	27.34	1.81	29.15	0.01	0.686
B1	42.50	0.00	0.00	13.49	26.28	2.41	28.69	0.01	0.675
B10	42.50	0.00	0.00	2.88	39.24	0.57	39.81	0.04	0.937
B11_1	42.50	0.00	0.00	21.68	18.79	2.20	20.99	0.02	0.494
B11_2	42.50	0.00	0.00	21.82	18.80	2.04	20.85	0.02	0.491
B12	42.50	0.00	0.00	15.01	25.60	2.10	27.70	0.01	0.652
B13	42.50	0.00	0.00	13.49	27.32	1.91	29.23	0.01	0.688
B14	42.50	0.00	0.00	9.72	31.64	1.41	33.05	0.07	0.778
B15	42.50	0.00	0.00	22.09	18.83	1.76	20.58	0.03	0.484
B16	42.50	0.00	0.00	17.46	22.57	2.68	25.25	0.01	0.594
B17	42.50	0.00	0.00	13.57	26.82	2.35	29.17	0.01	0.686
B18	42.50	0.00	0.00	12.66	28.16	1.90	30.06	0.03	0.707
B2_1	42.50	0.00	0.00	11.90	29.02	1.82	30.83	0.01	0.726
B2_2	42.50	0.00	0.00	11.88	29.01	1.84	30.85	0.03	0.726
B3_1	42.50	0.00	0.00	15.63	25.22	1.88	27.09	0.01	0.637
B3_2	42.50	0.00	0.00	15.06	25.11	2.55	27.67	0.02	0.651
B5	42.50	0.00	0.00	13.81	26.88	2.03	28.90	0.04	0.680
B6	42.50	0.00	0.00	17.38	23.52	1.80	25.33	0.02	0.596
B7	42.50	0.00	0.00	17.34	23.03	2.33	25.36	0.02	0.597
B8	42.50	0.00	0.00	5.82	35.84	1.07	36.91	0.05	0.869
B9	42.50	0.00	0.00	5.07	36.66	0.97	37.63	0.02	0.886

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters

CB11	JUNCTION	0.01	0.10	105.30	0	01:12	0.10
CB13	JUNCTION	0.01	0.09	105.10	0	01:12	0.09
DITCH_IN_1	JUNCTION	0.01	0.09	106.27	0	01:11	0.09
EX_STUB	JUNCTION	0.04	0.36	104.66	0	01:11	0.36
MH401	JUNCTION	0.01	0.12	105.80	0	01:10	0.12
MH402	JUNCTION	0.02	0.20	105.54	0	01:11	0.20
MH403	JUNCTION	0.02	0.25	105.16	0	01:11	0.25
MH404	JUNCTION	0.02	0.27	105.01	0	01:12	0.27
MH405	JUNCTION	0.04	0.36	104.70	0	01:11	0.36
MH406	JUNCTION	0.04	0.25	104.79	0	01:11	0.25
mh407	JUNCTION	0.02	0.13	104.88	0	01:10	0.13
MH408	JUNCTION	0.05	0.22	104.82	0	01:11	0.22
MH409	JUNCTION	0.03	0.20	105.01	0	01:14	0.20
MH409_null	JUNCTION	0.05	0.87	105.68	0	01:19	0.86
MH410	JUNCTION	0.04	0.77	105.67	0	01:19	0.77
RYCB01	JUNCTION	0.00	0.06	106.04	0	01:10	0.06
RYCB02	JUNCTION	0.01	0.26	106.44	0	01:10	0.26
RYCB04	JUNCTION	0.02	1.03	106.88	0	01:11	1.03
RYCB09	JUNCTION	0.03	1.42	107.11	0	01:11	1.42
RYCB18	JUNCTION	0.01	0.36	105.75	0	01:10	0.36
RYCB19	JUNCTION	1.50	1.63	106.43	0	01:10	1.63
14	OUTFALL	0.03	0.30	104.55	0	01:11	0.30
2	OUTFALL	0.00	0.00	105.38	0	00:00	0.00
5	OUTFALL	0.00	0.00	108.07	0	00:00	0.00
CB03_STRG	STORAGE	0.04	2.00	107.91	0	01:10	2.00
CB04_STRG	STORAGE	0.03	1.52	107.32	0	01:11	1.51
CB06_07_STRG	STORAGE	0.03	1.09	107.04	0	01:11	1.09
CB08_STRG	STORAGE	0.08	2.33	108.02	0	01:12	2.33
CB10_STRG	STORAGE	0.03	1.47	107.27	0	01:11	1.46
CB11_STRG	STORAGE	0.07	2.30	108.13	0	01:12	2.30
CB12_STRG	STORAGE	0.03	1.42	107.23	0	01:11	1.42
CB13_STRG	STORAGE	0.07	2.30	108.10	0	01:12	2.30
CB14_15_STRG	STORAGE	0.04	1.89	107.64	0	01:10	1.88
CB16_STRG	STORAGE	0.04	1.58	107.24	0	01:11	1.58
DCB17_STRG	STORAGE	0.61	1.11	105.68	0	01:19	1.10
POND_1	STORAGE	0.01	0.17	105.67	0	01:13	0.17

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days hr:min		Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
CB11	JUNCTION	0.000	0.022	0	01:12	0	0.046	-0.001
CB13	JUNCTION	0.000	0.019	0	01:12	0	0.0405	-0.003

DITCH_IN_1	JUNCTION	0.011	0.011	0	01:10	0.0156	0.0156
0.003							
EX_STUB	JUNCTION	0.000	0.245	0	01:11	0	0.467
0.001							
MH401	JUNCTION	0.000	0.030	0	01:10	0	0.0448
-0.003							
MH402	JUNCTION	0.000	0.086	0	01:11	0	0.148
0.283							
MH403	JUNCTION	0.000	0.117	0	01:11	0	0.21
-0.242							
MH404	JUNCTION	0.000	0.146	0	01:11	0	0.267
0.026							
MH405	JUNCTION	0.000	0.244	0	01:11	0	0.467
0.027							
MH406	JUNCTION	0.000	0.083	0	01:10	0	0.173
0.039							
mh407	JUNCTION	0.000	0.024	0	01:10	0	0.0331
0.161							
MH408	JUNCTION	0.000	0.053	0	01:14	0	0.128
0.030							
MH409	JUNCTION	0.000	0.053	0	01:19	0	0.128
-0.012							
MH409_null	JUNCTION	0.000	0.053	0	01:19	0	0.128
-0.042							
MH410	JUNCTION	0.020	0.058	0	01:20	0.0273	0.0647
0.017							
RYCB01	JUNCTION	0.007	0.007	0	01:10	0.00852	0.00852
-0.001							
RYCB02	JUNCTION	0.006	0.006	0	01:10	0.00848	0.00848
0.000							
RYCB04	JUNCTION	0.009	0.009	0	01:10	0.0134	0.0134
0.000							
RYCB09	JUNCTION	0.011	0.011	0	01:10	0.0166	0.0166
0.000							
RYCB18	JUNCTION	0.018	0.018	0	01:10	0.0265	0.0265
0.000							
RYCB19	JUNCTION	0.007	0.007	0	01:10	0.00846	0.00846
28.339							
14	OUTFALL	0.000	0.245	0	01:11	0	0.467
0.000							
2	OUTFALL	0.000	0.000	0	00:00	0	0
0.000 ltr							
5	OUTFALL	0.000	0.000	0	00:00	0	0
0.000 ltr							
CB03_STRG	STORAGE	0.020	0.020	0	01:10	0.0278	0.0278
0.000							
CB04_STRG	STORAGE	0.012	0.012	0	01:10	0.0158	0.0158
0.000							
CB06_07_STRG	STORAGE	0.010	0.010	0	01:10	0.0137	0.0137
0.000							
CB08_STRG	STORAGE	0.032	0.032	0	01:10	0.0441	0.0441
0.001							
CB10_STRG	STORAGE	0.012	0.012	0	01:10	0.0163	0.0163
0.000							
CB11_STRG	STORAGE	0.033	0.033	0	01:10	0.046	0.046
-0.000							
CB12_STRG	STORAGE	0.011	0.011	0	01:10	0.0157	0.0157
0.000							
CB13_STRG	STORAGE	0.029	0.029	0	01:10	0.0405	0.0405
-0.001							

```
  CB14_15_STRG          STORAGE      0.020    0.020     0  01:10      0.0269
0.0269       0.000
  CB16_STRG             STORAGE      0.010    0.010     0  01:10      0.0124
0.0124       0.000
  DCB17_STRG            STORAGE      0.049    0.049     0  01:10      0.0686
0.0686       0.389
  POND_1                STORAGE      0.012    0.036     0  01:10      0.0173
0.0375      -0.019


  **********************
  Node Surcharge Summary
  **********************

  Surcharging occurs when water rises above the top of the highest conduit.
  -------------------------------------------------------------------------
                                           Max. Height   Min. Depth
                                 Hours     Above Crown    Below Rim
  Node                 Type    Surcharged      Meters       Meters
  -------------------------------------------------------------------------
  MH409_null           JUNCTION      0.30         0.215        0.925


  **********************
  Node Flooding Summary
  **********************

  No nodes were flooded.


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

  ------------------------------------------------------------------------------
-----------------
                         Average     Avg  Evap Exfil       Maximum     Max    Time
of Max    Maximum
                          Volume    Pcnt  Pcnt  Pcnt        Volume    Pcnt
Occurrence    Outflow
  Storage Unit           1000 m3    Full  Loss  Loss       1000 m3    Full    days
hr:min        CMS
  ------------------------------------------------------------------------------
-----------------
  CB03_STRG                0.000       0     0     0         0.001       0       0
01:10      0.018
  CB04_STRG                0.000       0     0     0         0.001       0       0
01:11      0.010
  CB06_07_STRG             0.000       0     0     0         0.000       0       0
01:11      0.008
  CB08_STRG                0.000       0     0     0         0.005       0       0
01:12      0.020
  CB10_STRG                0.000       0     0     0         0.001       0       0
01:11      0.010
  CB11_STRG                0.000       0     0     0         0.004       1       0
01:12      0.022
  CB12_STRG                0.000       0     0     0         0.001       0       0
01:11      0.010
```

CB13_STRG	0.000	0	0	0	0.004	1	0
01:12	0.019						
CB14_15_STRG	0.000	0	0	0	0.001	1	0
01:10	0.017						
CB16_STRG	0.000	0	0	0	0.001	1	0
01:11	0.007						
DCB17_STRG	0.000	5	0	0	0.001	9	0
01:19	0.048						
POND_1	0.001	1	0	0	0.016	16	0
01:13	0.052						

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
14	54.73	0.020	0.245	0.467
2	0.00	0.000	0.000	0.000
5	0.00	0.000	0.000	0.000
System	18.24	0.020	0.245	0.467

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
11	CONDUIT	0.052	0 01:20	1.48	0.27	0.78
13	CONDUIT	0.086	0 01:11	1.18	0.42	0.47
14	CONDUIT	0.007	0 01:10	0.60	0.03	0.12
15	CONDUIT	0.024	0 01:10	0.76	0.17	0.25
16	CONDUIT	0.022	0 01:12	0.82	0.11	0.22
17	CONDUIT	0.117	0 01:11	1.32	0.58	0.54
18	CONDUIT	0.146	0 01:12	1.46	0.71	0.60
2	CONDUIT	0.030	0 01:10	0.91	0.15	0.26
2_3	CONDUIT	0.053	0 01:15	0.73	0.22	0.34
3	CONDUIT	0.046	0 01:20	0.35	0.14	1.00
39	CONDUIT	0.019	0 01:12	0.80	0.09	0.24
4	CONDUIT	0.053	0 01:14	0.78	0.21	0.29
44	CONDUIT	0.009	0 01:11	0.28	0.04	0.22
54	CONDUIT	0.048	0 01:10	1.23	0.49	1.00
7	CONDUIT	0.082	0 01:11	0.89	0.35	0.38
8	CONDUIT	0.245	0 01:11	1.22	0.67	0.46
9	CONDUIT	0.245	0 01:11	1.30	0.60	0.44
10	ORIFICE	0.017	0 01:10			1.00
19	ORIFICE	0.006	0 01:10			1.00
21	ORIFICE	0.018	0 01:10			1.00

22	ORIFICE	0.008	0	01:11	1.00
24	ORIFICE	0.010	0	01:11	1.00
25	ORIFICE	0.008	0	01:11	1.00
27	ORIFICE	0.007	0	01:10	
28	ORIFICE	0.018	0	01:10	1.00
30	ORIFICE	0.010	0	01:11	1.00
31	ORIFICE	0.022	0	01:12	1.00
34	ORIFICE	0.010	0	01:11	1.00
35	ORIFICE	0.019	0	01:12	1.00
41	ORIFICE	0.007	0	01:11	1.00
51	ORIFICE	0.010	0	01:11	1.00
52	ORIFICE	0.020	0	01:12	1.00
53	ORIFICE	0.053	0	01:19	1.00
1	WEIR	0.000	0	00:00	0.00
12	WEIR	0.000	0	00:00	0.00
20	WEIR	0.000	0	00:00	0.00
23	WEIR	0.000	0	00:00	0.00
26	WEIR	0.000	0	00:00	0.00
29	WEIR	0.000	0	00:00	0.00
32	WEIR	0.000	0	00:00	0.00
33	WEIR	0.000	0	00:00	0.00
36	WEIR	0.000	0	00:00	0.00
37	WEIR	0.000	0	00:00	0.00
38	WEIR	0.000	0	00:00	0.00
40	WEIR	0.000	0	00:00	0.00
42	WEIR	0.000	0	00:00	0.00
43	WEIR	0.000	0	00:00	0.00
45	WEIR	0.000	0	00:00	0.00
46	WEIR	0.000	0	00:00	0.00
5	WEIR	0.000	0	00:00	0.00
50	WEIR	0.000	0	00:00	0.00

****
Flow Classification Summary
****

	Adjusted	---------- Fraction of Time in Flow Class -------							
	/Actual		Up	Down	Sub	Sup	Up	Down	Norm Inlet
Conduit	Length	Dry	Dry	Dry	Crit	Crit	Crit	Crit	Ltd Ctrl
11	1.00	0.00	0.00	0.00	0.03	0.00	0.00	0.97	0.01 0.00
13	1.00	0.00	0.00	0.00	0.03	0.00	0.00	0.97	0.02 0.00
14	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00 0.00
15	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00 0.00
16	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00 0.00
17	1.00	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.00 0.00

18	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
0.00									
2	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
0.00									
2_3	1.00	0.02	0.00	0.00	0.17	0.00	0.00	0.82	0.00
0.00									
3	1.00	0.00	0.00	0.00	0.16	0.00	0.00	0.84	0.06
0.00									
39	1.00	0.00	0.00	0.00	0.01	0.00	0.00	0.98	0.01
0.00									
4	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
0.00									
44	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
0.00									
54	1.00	0.02	0.00	0.00	0.03	0.00	0.00	0.94	0.00
0.00									
7	1.00	0.01	0.00	0.00	0.02	0.00	0.00	0.97	0.00
0.00									
8	1.00	0.00	0.00	0.00	0.15	0.00	0.00	0.85	0.00
0.00									
9	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
0.00									

****
Conduit Surcharge Summary
****

Conduit	Hours Full: Both Ends	Hours Full: Upstream	Hours Full: Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
11	0.01	0.01	0.30	0.01	0.01
3	0.30	0.30	0.30	0.01	0.01
54	0.30	0.30	0.32	0.01	0.01

Analysis begun on: Mon Jul 5 14:55:07 2021
Analysis ended on: Mon Jul 5 14:55:14 2021
Total elapsed time: 00:00:07

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

  WARNING 02: maximum depth increased for Node MH410
  WARNING 02: maximum depth increased for Node RYCB02
  WARNING 02: maximum depth increased for Node RYCB04
  WARNING 02: maximum depth increased for Node RYCB09
  WARNING 02: maximum depth increased for Node RYCB18
  WARNING 02: maximum depth increased for Node RYCB19

  *************
  Element Count
  *************
  Number of rain gages ...... 1
  Number of subcatchments ... 21
  Number of nodes ........... 36
  Number of links ........... 51
  Number of pollutants ...... 0
  Number of land uses ....... 0


  ****************
  Raingage Summary
  ****************
                                                    Data       Recording
  Name                 Data Source                  Type       Interval
  ------------------------------------------------------------------------
  Richcraft            Chicago_3h_100yr_10min       INTENSITY   10 min.


  ********************
  Subcatchment Summary
  ********************
  Name                        Area     Width    %Imperv    %Slope Rain Gage
Outlet
  ------------------------------------------------------------------------------
---------------------------
  28                          0.05     15.70     64.00    1.0000 Richcraft
CB06_07_STRG
  B1                          0.03     19.80     63.00    2.0000 Richcraft
RYCB01
  B10                         0.10     50.85     92.00    2.0000 Richcraft
CB13_STRG
  B11_1                       0.07     13.49     44.00    2.0000 Richcraft
DITCH_IN_1
  B11_2                       0.08     12.74     44.00    2.0000 Richcraft
POND_1
  B12                         0.05     16.00     60.00    2.0000 Richcraft
MH410
  B13                         0.04     12.43     64.00    2.0000 Richcraft
MH410
  B14                         0.21     37.73     74.00    3.0000 Richcraft
DCB17_STRG
  B15                         0.13     20.41     44.00    1.0000 Richcraft
RYCB18
  B16                         0.03     16.75     53.00    2.0000 Richcraft
RYCB19
```

B17	0.04	28.40	63.00	2.0000	Richcraft
CB16_STRG					
B18	0.09	29.87	66.00	2.0000	Richcraft
CB14_15_STRG					
B2_1	0.03	9.17	68.00	2.0000	Richcraft
RYCB02					
B2_2	0.09	45.10	68.00	1.0000	Richcraft
CB03_STRG					
B3_1	0.05	9.88	59.00	2.0000	Richcraft
RYCB04					
B3_2	0.06	38.07	59.00	2.0000	Richcraft
CB04_STRG					
B5	0.15	50.87	63.00	2.0000	Richcraft
CB08_STRG					
B6	0.07	14.22	55.00	1.0000	Richcraft
RYCB09					
B7	0.06	27.87	54.00	1.0000	Richcraft
CB10_STRG					
B8	0.12	54.22	84.00	2.0000	Richcraft
CB11_STRG					
B9	0.04	23.17	86.00	2.0000	Richcraft
CB12_STRG					

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
CB11	JUNCTION	105.20	2.89	0.0	
CB13	JUNCTION	105.01	3.02	0.0	
DITCH_IN_1	JUNCTION	106.18	0.67	0.0	
EX_STUB	JUNCTION	104.30	3.65	0.0	
MH401	JUNCTION	105.68	2.97	0.0	
MH402	JUNCTION	105.34	2.68	0.0	
MH403	JUNCTION	104.91	3.12	0.0	
MH404	JUNCTION	104.74	3.30	0.0	
MH405	JUNCTION	104.34	3.66	0.0	
MH406	JUNCTION	104.54	3.43	0.0	
mh407	JUNCTION	104.75	2.60	0.0	
MH408	JUNCTION	104.60	2.53	0.0	
MH409	JUNCTION	104.81	1.79	0.0	
MH409_null	JUNCTION	104.81	1.79	0.0	
MH410	JUNCTION	104.90	1.60	0.0	
RYCB01	JUNCTION	105.98	2.08	0.0	
RYCB02	JUNCTION	106.18	2.50	0.0	
RYCB04	JUNCTION	105.85	2.50	0.0	
RYCB09	JUNCTION	105.69	2.77	0.0	
RYCB18	JUNCTION	105.39	1.31	0.0	
RYCB19	JUNCTION	104.80	2.00	0.0	
14	OUTFALL	104.25	0.75	0.0	
2	OUTFALL	105.38	0.00	0.0	
5	OUTFALL	108.07	0.00	0.0	
CB03_STRG	STORAGE	105.91	4.09	0.0	
CB04_STRG	STORAGE	105.80	4.20	0.0	
CB06_07_STRG	STORAGE	105.95	3.05	0.0	
CB08_STRG	STORAGE	105.69	4.31	0.0	

CB10_STRG	STORAGE	105.80	4.20	0.0
CB11_STRG	STORAGE	105.83	4.17	0.0
CB12_STRG	STORAGE	105.81	4.19	0.0
CB13_STRG	STORAGE	105.80	4.20	0.0
CB14_15_STRG	STORAGE	105.75	2.52	0.0
CB16_STRG	STORAGE	105.66	2.59	0.0
DCB17_STRG	STORAGE	104.57	2.11	0.0
POND_1	STORAGE	105.50	0.75	0.0

****
Link Summary
****

Name	From Node	To Node	Type	Length	% Slope	Roughness
11	POND_1	MH410	CONDUIT	8.0	3.8581	0.0130
13	MH402	MH403	CONDUIT	79.4	0.5036	0.0130
14	RYCB01	MH401	CONDUIT	28.9	0.5193	0.0130
15	mh407	MH406	CONDUIT	23.5	0.2557	0.0130
16	CB11	MH403	CONDUIT	29.2	0.4790	0.0130
17	MH403	MH404	CONDUIT	27.8	0.5042	0.0130
18	MH404	MH405	CONDUIT	19.1	0.5246	0.0130
2	MH401	MH402	CONDUIT	39.3	0.4835	0.0130
2_3	MH408	MH406	CONDUIT	26.4	0.1515	0.0130
3	MH410	MH409_null	CONDUIT	13.6	0.2949	0.0130
39	CB13	MH404	CONDUIT	23.6	0.5095	0.0130
4	MH409	MH408	CONDUIT	23.4	0.1709	0.0130
44	DITCH_IN_1	POND_1	CONDUIT	55.0	0.5091	0.0350
54	DCB17_STRG	MH409_null	CONDUIT	5.8	1.0259	0.0130
7	MH406	MH405	CONDUIT	40.7	0.1474	0.0130
8	MH405	EX_STUB	CONDUIT	9.4	0.1065	0.0130
9	EX_STUB	14	CONDUIT	37.5	0.1334	0.0130
10	CB14_15_STRG	MH405	ORIFICE			
19	RYCB02	MH401	ORIFICE			
21	CB03_STRG	MH401	ORIFICE			
22	RYCB04	MH402	ORIFICE			
24	CB04_STRG	MH402	ORIFICE			
25	CB06_07_STRG	MH402	ORIFICE			
27	RYCB19	mh407	ORIFICE			
28	RYCB18	mh407	ORIFICE			

30	CB10_STRG	MH403	ORIFICE
31	CB11_STRG	CB11	ORIFICE
34	CB12_STRG	MH404	ORIFICE
35	CB13_STRG	CB13	ORIFICE
41	CB16_STRG	MH406	ORIFICE
51	RYCB09	MH402	ORIFICE
52	CB08_STRG	MH402	ORIFICE
53	MH409_null	MH409	ORIFICE
1	CB14_15_STRG	5	WEIR
12	DCB17_STRG	POND_1	WEIR
20	RYCB02	CB03_STRG	WEIR
23	RYCB04	CB04_STRG	WEIR
26	CB06_07_STRG	CB08_STRG	WEIR
29	RYCB09	CB08_STRG	WEIR
32	CB11_STRG	CB10_STRG	WEIR
33	CB08_STRG	CB10_STRG	WEIR
36	CB10_STRG	CB12_STRG	WEIR
37	CB13_STRG	CB12_STRG	WEIR
38	CB12_STRG	CB14_15_STRG	WEIR
40	CB16_STRG	DCB17_STRG	WEIR
42	CB04_STRG	CB08_STRG	WEIR
43	CB03_STRG	CB04_STRG	WEIR
45	RYCB18	DITCH_IN_1	WEIR
46	RYCB19	DITCH_IN_1	WEIR
5	POND_1	2	WEIR
50	MH410	POND_1	WEIR

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
11	CIRCULAR	0.30	0.07	0.07	0.30	1	0.19
13	CIRCULAR	0.45	0.16	0.11	0.45	1	0.20
14	CIRCULAR	0.45	0.16	0.11	0.45	1	0.21
15	CIRCULAR	0.45	0.16	0.11	0.45	1	0.14
16	CIRCULAR	0.45	0.16	0.11	0.45	1	0.20
17	CIRCULAR	0.45	0.16	0.11	0.45	1	0.20
18	CIRCULAR	0.45	0.16	0.11	0.45	1	0.21
2	CIRCULAR	0.45	0.16	0.11	0.45	1	0.20
2_3	CIRCULAR	0.60	0.28	0.15	0.60	1	0.24
3	CIRCULAR	0.60	0.28	0.15	0.60	1	0.33
39	CIRCULAR	0.45	0.16	0.11	0.45	1	0.20

4	CIRCULAR	0.60	0.28	0.15	0.60	1
0.25						
44	TRAPEZOIDAL	0.30	0.36	0.16	2.10	1
0.22						
54	CIRCULAR	0.30	0.07	0.07	0.30	1
0.10						
7	CIRCULAR	0.60	0.28	0.15	0.60	1
0.24						
8	CIRCULAR	0.75	0.44	0.19	0.75	1
0.36						
9	CIRCULAR	0.75	0.44	0.19	0.75	1
0.41						

****
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 ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... HORTON
Flow Routing Method ..... DYNWAVE
Surcharge Method ..... EXTRAN
Starting Date 04/21/2021 00:00:00
Ending Date 04/21/2021 12:00:00
Antecedent Dry Days 0.0
Report Time Step 00:01:00
Wet Time Step 00:05:00
Dry Time Step 00:05:00
Routing Time Step ..... 0.50 sec
Variable Time Step ..... YES
Maximum Trials 8
Number of Threads 4
Head Tolerance ..... 0.001500 m

**********	Volume	Depth
Runoff Quantity Continuity	hectare-m	mm
**********	---------	-------
Total Precipitation	0.114	71.277
Evaporation Loss	0.000	0.000
Infiltration Loss	0.026	16.149
Surface Runoff	0.090	55.746
Final Storage	0.000	0.011

Continuity Error (%) ..... -0.881

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.090	0.895
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.083	0.827
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.001	0.008
Final Stored Volume	0.007	0.071
Continuity Error (%)	0.661	

Highest Continuity Errors

Node DITCH_IN_1 (4.46%)
Node MH406 (3.71%)
Node MH408 (3.22%)
Node mh407 (2.90%)
Node MH403 (2.09%)

Time-Step Critical Elements

None

Highest Flow Instability Indexes

Link 53 (17)

Routing Time Step Summary

Minimum Time Step	:	0.50 sec
Average Time Step	:	0.50 sec
Maximum Time Step	:	0.50 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00
Time Step Frequencies	:	
0.500 - 0.500 sec	:	100.00 %
0.500 - 0.500 sec	:	0.00 %
0.500 - 0.500 sec	:	0.00 %
0.500 - 0.500 sec	:	0.00 %
0.500 - 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 10^6 ltr	Total Peak Runoff CMS	Runoff Coeff
28	71.28	0.00	0.00	16.23	45.80	9.86	55.66	0.03	0.02	0.781
B1	71.28	0.00	0.00	16.17	44.44	11.08	55.51	0.02	0.01	0.779
B10	71.28	0.00	0.00	3.50	65.74	2.53	68.27	0.07	0.05	0.958
B11_1	71.28	0.00	0.00	25.98	31.47	14.32	45.79	0.03	0.02	0.642
B11_2	71.28	0.00	0.00	26.23	31.49	14.02	45.52	0.04	0.03	0.639
B12	71.28	0.00	0.00	17.95	42.89	11.09	53.98	0.03	0.02	0.757
B13	71.28	0.00	0.00	16.14	45.76	10.02	55.78	0.02	0.02	0.783
B14	71.28	0.00	0.00	11.63	53.00	7.28	60.28	0.13	0.09	0.846
B15	71.28	0.00	0.00	26.77	31.54	13.41	44.94	0.06	0.04	0.631
B16	71.28	0.00	0.00	20.92	37.83	13.37	51.20	0.02	0.01	0.718
B17	71.28	0.00	0.00	16.33	44.96	10.91	55.87	0.02	0.02	0.784
B18	71.28	0.00	0.00	15.16	47.17	9.61	56.79	0.05	0.04	0.797
B2_1	71.28	0.00	0.00	14.25	48.61	9.09	57.70	0.02	0.01	0.809
B2_2	71.28	0.00	0.00	14.24	48.60	9.13	57.73	0.05	0.04	0.810
B3_1	71.28	0.00	0.00	18.67	42.24	10.94	53.18	0.03	0.02	0.746
B3_2	71.28	0.00	0.00	18.12	42.10	12.01	54.11	0.03	0.03	0.759
B5	71.28	0.00	0.00	16.53	45.02	10.40	55.42	0.08	0.07	0.778
B6	71.28	0.00	0.00	20.83	39.41	11.57	50.98	0.03	0.02	0.715
B7	71.28	0.00	0.00	20.72	38.58	12.62	51.21	0.03	0.03	0.718
B8	71.28	0.00	0.00	7.03	60.03	4.85	64.88	0.08	0.06	0.910
B9	71.28	0.00	0.00	6.14	61.43	4.34	65.76	0.03	0.02	0.923

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
CB11	JUNCTION	0.11	0.30	105.50	0 01:11	0.30
CB13	JUNCTION	0.29	0.42	105.43	0 01:11	0.42
DITCH_IN_1	JUNCTION	0.01	0.14	106.32	0 01:10	0.14
EX_STUB	JUNCTION	0.97	1.04	105.34	0 01:10	1.04
MH401	JUNCTION	0.01	0.14	105.82	0 01:10	0.14
MH402	JUNCTION	0.03	0.26	105.60	0 01:11	0.26
MH403	JUNCTION	0.38	0.59	105.50	0 01:11	0.59
MH404	JUNCTION	0.54	0.68	105.42	0 01:11	0.68
MH405	JUNCTION	0.93	1.01	105.35	0 01:10	1.01
MH406	JUNCTION	0.74	0.82	105.36	0 01:10	0.82
mh407	JUNCTION	0.53	0.62	105.37	0 01:10	0.62
MH408	JUNCTION	0.68	0.77	105.37	0 01:10	0.77
MH409	JUNCTION	0.47	0.56	105.37	0 01:10	0.56
MH409_null	JUNCTION	0.52	1.24	106.05	0 01:15	1.24
MH410	JUNCTION	0.44	1.15	106.05	0 01:13	1.15
RYCB01	JUNCTION	0.01	0.08	106.06	0 01:10	0.08
RYCB02	JUNCTION	0.02	0.85	107.03	0 01:10	0.84
RYCB04	JUNCTION	0.07	2.36	108.21	0 01:10	2.36
RYCB09	JUNCTION	0.09	2.63	108.32	0 01:10	2.63
RYCB18	JUNCTION	0.03	1.17	106.56	0 01:10	1.17
RYCB19	JUNCTION	1.52	1.65	106.45	0 01:10	1.65
14	OUTFALL	1.06	1.06	105.31	0 00:00	1.06
2	OUTFALL	0.00	0.00	105.38	0 00:00	0.00
5	OUTFALL	0.00	0.00	108.07	0 00:00	0.00
CB03_STRG	STORAGE	0.11	2.34	108.25	0 01:13	2.34
CB04_STRG	STORAGE	0.10	2.35	108.15	0 01:13	2.35
CB06_07_STRG	STORAGE	0.07	2.28	108.23	0 01:13	2.28
CB08_STRG	STORAGE	0.20	2.45	108.14	0 01:19	2.45
CB10_STRG	STORAGE	0.10	2.34	108.14	0 01:14	2.34
CB11_STRG	STORAGE	0.16	2.38	108.21	0 01:14	2.38
CB12_STRG	STORAGE	0.08	2.29	108.10	0 01:12	2.29
CB13_STRG	STORAGE	0.15	2.37	108.17	0 01:14	2.37
CB14_15_STRG	STORAGE	0.10	2.34	108.09	0 01:13	2.34
CB16_STRG	STORAGE	0.11	2.32	107.98	0 01:14	2.32
DCB17_STRG	STORAGE	0.78	1.50	106.07	0 01:11	1.50
POND_1	STORAGE	0.03	0.55	106.05	0 01:14	0.55

****
Node Inflow Summary
****

Node	Type	Maximum Lateral	Maximum Total	Time of Max Occurrence days hr:min	Lateral Inflow	Total Inflow	Flow Balance

Node	Type	Inflow CMS	Inflow CMS	Occurrence days	Occurrence hr:min	Volume 10^6 ltr	Volume 10^6 ltr	Error Percent
CB11	JUNCTION	0.000	0.022	0	01:14	0	0.0811	0.738
CB13	JUNCTION	0.000	0.019	0	01:14	0	0.0696	2.079
DITCH_IN_1	JUNCTION	0.025	0.029	0	01:10	0.034	0.0344	4.668
EX_STUB	JUNCTION	0.000	0.307	0	01:10	0	0.817	1.332
MH401	JUNCTION	0.000	0.044	0	01:10	0	0.0844	-0.003
MH402	JUNCTION	0.000	0.114	0	01:10	0	0.286	0.079
MH403	JUNCTION	0.000	0.148	0	01:11	0	0.399	2.133
MH404	JUNCTION	0.000	0.180	0	01:12	0	0.487	1.238
MH405	JUNCTION	0.000	0.307	0	01:10	0	0.835	1.150
MH406	JUNCTION	0.000	0.110	0	01:10	0	0.318	3.856
mh407	JUNCTION	0.000	0.049	0	01:10	0	0.0733	2.987
MH408	JUNCTION	0.000	0.055	0	01:15	0	0.222	3.322
MH409	JUNCTION	0.000	0.054	0	01:15	0	0.224	1.774
MH409_null	JUNCTION	0.000	0.093	0	01:10	0	0.247	0.895
MH410	JUNCTION	0.041	0.082	0	01:10	0.0528	0.168	0.921
RYCB01	JUNCTION	0.014	0.014	0	01:10	0.0165	0.0165	-0.005
RYCB02	JUNCTION	0.012	0.012	0	01:10	0.0159	0.0159	0.000
RYCB04	JUNCTION	0.020	0.020	0	01:10	0.0263	0.0263	0.000
RYCB09	JUNCTION	0.024	0.024	0	01:10	0.0333	0.0333	0.000
RYCB18	JUNCTION	0.038	0.038	0	01:10	0.0578	0.0578	0.000
RYCB19	JUNCTION	0.014	0.014	0	01:10	0.0172	0.0172	12.222
14	OUTFALL	0.000	0.307	0	01:10	0	0.806	0.000
2	OUTFALL	0.000	0.039	0	01:14	0	0.0206	0.000
5	OUTFALL	0.000	0.000	0	00:00	0	0	0.000 ltr
CB03_STRG	STORAGE	0.041	0.041	0	01:10	0.0521	0.0521	0.001
CB04_STRG	STORAGE	0.026	0.033	0	01:10	0.0309	0.0322	0.000
CB06_07_STRG	STORAGE	0.020	0.020	0	01:10	0.0262	0.0262	0.000

```
  CB08_STRG            STORAGE      0.067    0.078     0  01:10      0.0846
0.0874       0.001
  CB10_STRG            STORAGE      0.026    0.026     0  01:10      0.0328
0.0328       0.000
  CB11_STRG            STORAGE      0.060    0.060     0  01:10      0.0809
0.0809       0.001
  CB12_STRG            STORAGE      0.020    0.020     0  01:10      0.0274
0.0274      -0.000
  CB13_STRG            STORAGE      0.050    0.050     0  01:10      0.0694
0.0694       0.001
  CB14_15_STRG         STORAGE      0.040    0.040     0  01:10      0.0509
0.0509       0.000
  CB16_STRG            STORAGE      0.020    0.020     0  01:10      0.0238
0.0238       0.001
  DCB17_STRG           STORAGE      0.094    0.094     0  01:10       0.125
0.125        0.273
  POND_1               STORAGE      0.026    0.129     0  01:10      0.0377
0.115       -0.825


  **********************
  Node Surcharge Summary
  **********************

  Surcharging occurs when water rises above the top of the highest conduit.
  -------------------------------------------------------------------------
                                          Max. Height   Min. Depth
                                Hours     Above Crown    Below Rim
  Node                 Type   Surcharged       Meters       Meters
  -------------------------------------------------------------------------
  EX_STUB              JUNCTION     11.26         0.259        2.611
  MH404                JUNCTION      0.56         0.085        2.615
  MH405                JUNCTION     11.26         0.260        2.650
  MH406                JUNCTION     11.21         0.183        2.607
  MH409_null           JUNCTION      1.11         0.589        0.551


  **********************
  Node Flooding Summary
  **********************

  No nodes were flooded.


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

  ------------------------------------------------------------------------------------
-----------------
                         Average     Avg  Evap Exfil       Maximum     Max    Time
of Max    Maximum
                          Volume    Pcnt  Pcnt  Pcnt        Volume    Pcnt
Occurrence    Outflow
  Storage Unit           1000 m3    Full  Loss  Loss       1000 m3    Full    days
hr:min        CMS
  ------------------------------------------------------------------------------------
-----------------
```

CB03_STRG	0.000	0	0	0	0.009	1	0
01:13	0.019						
CB04_STRG	0.000	0	0	0	0.007	1	0
01:13	0.012						
CB06_07_STRG	0.000	0	0	0	0.003	2	0
01:13	0.012						
CB08_STRG	0.001	0	0	0	0.027	3	0
01:19	0.020						
CB10_STRG	0.000	0	0	0	0.005	1	0
01:14	0.012						
CB11_STRG	0.001	0	0	0	0.020	3	0
01:14	0.022						
CB12_STRG	0.000	0	0	0	0.003	1	0
01:12	0.012						
CB13_STRG	0.001	0	0	0	0.017	2	0
01:14	0.019						
CB14_15_STRG	0.000	0	0	0	0.009	16	0
01:13	0.019						
CB16_STRG	0.000	0	0	0	0.004	9	0
01:14	0.009						
DCB17_STRG	0.001	6	0	0	0.001	12	0
01:11	0.093						
POND_1	0.004	4	0	0	0.068	65	0
01:14	0.046						

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
14	40.69	0.046	0.307	0.806
2	2.52	0.019	0.039	0.021
5	0.00	0.000	0.000	0.000
System	14.40	0.065	0.336	0.827

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
11	CONDUIT	0.080	0 01:10	1.18	0.42	1.00
13	CONDUIT	0.114	0 01:11	0.84	0.56	0.79
14	CONDUIT	0.014	0 01:10	0.73	0.07	0.17
15	CONDUIT	0.049	0 01:10	0.31	0.34	1.00
16	CONDUIT	0.024	0 01:15	0.52	0.12	0.82
17	CONDUIT	0.148	0 01:12	0.93	0.73	1.00
18	CONDUIT	0.180	0 01:12	1.13	0.87	1.00

2	CONDUIT	0.044	0	01:10	1.01	0.22	0.32
2_3	CONDUIT	0.055	0	01:14	0.33	0.23	1.00
3	CONDUIT	0.041	0	01:06	0.33	0.12	1.00
39	CONDUIT	0.020	0	01:15	0.46	0.10	0.96
4	CONDUIT	0.055	0	01:15	0.39	0.22	0.96
44	CONDUIT	0.030	0	01:11	0.38	0.14	0.42
54	CONDUIT	0.093	0	01:10	1.32	0.95	1.00
7	CONDUIT	0.110	0	01:10	0.39	0.47	1.00
8	CONDUIT	0.307	0	01:10	0.70	0.85	1.00
9	CONDUIT	0.307	0	01:10	0.70	0.76	1.00
10	ORIFICE	0.019	0	01:13			1.00
19	ORIFICE	0.011	0	01:10			1.00
21	ORIFICE	0.019	0	01:13			1.00
22	ORIFICE	0.012	0	01:10			1.00
24	ORIFICE	0.012	0	01:13			1.00
25	ORIFICE	0.012	0	01:13			1.00
27	ORIFICE	0.014	0	01:10			
28	ORIFICE	0.034	0	01:10			1.00
30	ORIFICE	0.012	0	01:14			1.00
31	ORIFICE	0.022	0	01:14			1.00
34	ORIFICE	0.012	0	01:12			1.00
35	ORIFICE	0.019	0	01:14			1.00
41	ORIFICE	0.009	0	01:14			1.00
51	ORIFICE	0.013	0	01:10			1.00
52	ORIFICE	0.020	0	01:19			1.00
53	ORIFICE	0.054	0	01:15			1.00
1	WEIR	0.000	0	00:00			0.00
12	WEIR	0.000	0	00:00			0.00
20	WEIR	0.000	0	00:00			0.00
23	WEIR	0.007	0	01:10			0.05
26	WEIR	0.000	0	00:00			0.00
29	WEIR	0.011	0	01:10			0.07
32	WEIR	0.000	0	00:00			0.00
33	WEIR	0.000	0	00:00			0.00
36	WEIR	0.000	0	00:00			0.00
37	WEIR	0.000	0	00:00			0.00
38	WEIR	0.000	0	00:00			0.00
40	WEIR	0.000	0	00:00			0.00
42	WEIR	0.000	0	00:00			0.00
43	WEIR	0.000	0	00:00			0.00
45	WEIR	0.004	0	01:10			0.04
46	WEIR	0.000	0	00:00			0.00
5	WEIR	0.039	0	01:14			0.27
50	WEIR	0.000	0	00:00			0.00

****
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

11	1.00	0.00	0.00	0.00	0.93	0.00	0.00	0.07	0.85
0.00									
13	1.00	0.00	0.00	0.00	0.94	0.00	0.00	0.06	0.93
0.00									
14	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
0.00									
15	1.00	0.00	0.00	0.00	0.97	0.00	0.00	0.03	0.00
0.00									
16	1.00	0.00	0.00	0.00	0.94	0.00	0.00	0.06	0.01
0.00									
17	1.00	0.00	0.00	0.00	0.96	0.00	0.00	0.04	0.01
0.00									
18	1.00	0.00	0.00	0.00	0.97	0.00	0.00	0.03	0.01
0.00									
2	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
0.00									
2_3	1.00	0.01	0.00	0.00	0.98	0.00	0.00	0.01	0.00
0.00									
3	1.00	0.00	0.00	0.00	0.98	0.00	0.00	0.02	0.02
0.00									
39	1.00	0.00	0.00	0.00	0.95	0.00	0.00	0.05	0.01
0.00									
4	1.00	0.00	0.00	0.00	0.96	0.00	0.00	0.04	0.00
0.00									
44	1.00	0.00	0.00	0.00	0.03	0.00	0.00	0.97	0.03
0.00									
54	1.00	0.02	0.00	0.00	0.93	0.00	0.00	0.05	0.00
0.00									
7	1.00	0.01	0.00	0.00	0.98	0.00	0.00	0.01	0.00
0.00									
8	1.00	0.00	0.00	0.00	0.99	0.00	0.00	0.01	0.00
0.00									
9	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
0.00									

****
Conduit Surcharge Summary
****

	Hours Full			Hours Above Full	Hours Capacity
Conduit	Both Ends	Upstream	Dnstream	Normal Flow	Limited
11	0.62	0.62	1.09	0.01	0.01
13	0.01	0.01	0.47	0.01	0.01
15	11.19	11.19	11.22	0.01	0.01
17	0.55	0.55	11.19	0.01	0.01
18	11.20	11.20	11.26	0.01	0.01
2_3	11.19	11.19	11.21	0.01	0.01
3	1.08	1.08	1.11	0.01	0.01
39	0.01	0.01	0.56	0.01	0.01
54	1.10	1.10	1.16	0.01	0.01
7	11.22	11.22	11.26	0.01	0.01
8	11.26	11.26	11.26	0.01	0.10
9	11.29	11.29	12.00	0.01	0.01

```
Analysis begun on:  Mon Jul  5 14:54:40 2021
Analysis ended on:  Mon Jul  5 14:54:46 2021
Total elapsed time: 00:00:06
```

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

  WARNING 02: maximum depth increased for Node MH410
  WARNING 02: maximum depth increased for Node RYCB02
  WARNING 02: maximum depth increased for Node RYCB04
  WARNING 02: maximum depth increased for Node RYCB09
  WARNING 02: maximum depth increased for Node RYCB18
  WARNING 02: maximum depth increased for Node RYCB19

  *************
  Element Count
  *************
  Number of rain gages ...... 1
  Number of subcatchments ... 21
  Number of nodes ........... 36
  Number of links ........... 51
  Number of pollutants ...... 0
  Number of land uses ....... 0


  ****************
  Raingage Summary
  ****************
                                                    Data       Recording
  Name                 Data Source                  Type       Interval
  ------------------------------------------------------------------------
  Richcraft            Chicago_3h_500yr_10minTS     INTENSITY   10 min.


  ********************
  Subcatchment Summary
  ********************
  Name                        Area     Width    %Imperv    %Slope Rain Gage
Outlet
  ------------------------------------------------------------------------------------
--------------------------
  28                          0.05     15.70     64.00    1.0000 Richcraft
CB06_07_STRG
  B1                          0.03     19.80     63.00    2.0000 Richcraft
RYCB01
  B10                         0.10     50.85     92.00    2.0000 Richcraft
CB13_STRG
  B11_1                       0.07     13.49     44.00    2.0000 Richcraft
DITCH_IN_1
  B11_2                       0.08     12.74     44.00    2.0000 Richcraft
POND_1
  B12                         0.05     16.00     60.00    2.0000 Richcraft
MH410
  B13                         0.04     12.43     64.00    2.0000 Richcraft
MH410
  B14                         0.21     37.73     74.00    3.0000 Richcraft
DCB17_STRG
  B15                         0.13     20.41     44.00    1.0000 Richcraft
RYCB18
  B16                         0.03     16.75     53.00    2.0000 Richcraft
RYCB19
```

B17	0.04	28.40	63.00	2.0000	Richcraft
CB16_STRG					
B18	0.09	29.87	66.00	2.0000	Richcraft
CB14_15_STRG					
B2_1	0.03	9.17	68.00	2.0000	Richcraft
RYCB02					
B2_2	0.09	45.10	68.00	1.0000	Richcraft
CB03_STRG					
B3_1	0.05	9.88	59.00	2.0000	Richcraft
RYCB04					
B3_2	0.06	38.07	59.00	2.0000	Richcraft
CB04_STRG					
B5	0.15	50.87	63.00	2.0000	Richcraft
CB08_STRG					
B6	0.07	14.22	55.00	1.0000	Richcraft
RYCB09					
B7	0.06	27.87	54.00	1.0000	Richcraft
CB10_STRG					
B8	0.12	54.22	84.00	2.0000	Richcraft
CB11_STRG					
B9	0.04	23.17	86.00	2.0000	Richcraft
CB12_STRG					

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
CB11	JUNCTION	105.20	2.89	0.0	
CB13	JUNCTION	105.01	3.02	0.0	
DITCH_IN_1	JUNCTION	106.18	0.67	0.0	
EX_STUB	JUNCTION	104.30	3.65	0.0	
MH401	JUNCTION	105.68	2.97	0.0	
MH402	JUNCTION	105.34	2.68	0.0	
MH403	JUNCTION	104.91	3.12	0.0	
MH404	JUNCTION	104.74	3.30	0.0	
MH405	JUNCTION	104.34	3.66	0.0	
MH406	JUNCTION	104.54	3.43	0.0	
mh407	JUNCTION	104.75	2.60	0.0	
MH408	JUNCTION	104.60	2.53	0.0	
MH409	JUNCTION	104.81	1.79	0.0	
MH409_null	JUNCTION	104.81	1.79	0.0	
MH410	JUNCTION	104.90	1.60	0.0	
RYCB01	JUNCTION	105.98	2.08	0.0	
RYCB02	JUNCTION	106.18	2.50	0.0	
RYCB04	JUNCTION	105.85	2.50	0.0	
RYCB09	JUNCTION	105.69	2.77	0.0	
RYCB18	JUNCTION	105.39	1.31	0.0	
RYCB19	JUNCTION	104.80	2.00	0.0	
14	OUTFALL	104.25	0.75	0.0	
2	OUTFALL	105.38	0.00	0.0	
5	OUTFALL	108.07	0.00	0.0	
CB03_STRG	STORAGE	105.91	4.09	0.0	
CB04_STRG	STORAGE	105.80	4.20	0.0	
CB06_07_STRG	STORAGE	105.95	3.05	0.0	
CB08_STRG	STORAGE	105.69	4.31	0.0	

CB10_STRG	STORAGE	105.80	4.20	0.0
CB11_STRG	STORAGE	105.83	4.17	0.0
CB12_STRG	STORAGE	105.81	4.19	0.0
CB13_STRG	STORAGE	105.80	4.20	0.0
CB14_15_STRG	STORAGE	105.75	2.52	0.0
CB16_STRG	STORAGE	105.66	2.59	0.0
DCB17_STRG	STORAGE	104.57	2.11	0.0
POND_1	STORAGE	105.50	0.75	0.0

****
Link Summary
****

Name	From Node	To Node	Type	Length	% Slope	Roughness
11	POND_1	MH410	CONDUIT	8.0	3.8581	0.0130
13	MH402	MH403	CONDUIT	79.4	0.5036	0.0130
14	RYCB01	MH401	CONDUIT	28.9	0.5193	0.0130
15	mh407	MH406	CONDUIT	23.5	0.2557	0.0130
16	CB11	MH403	CONDUIT	29.2	0.4790	0.0130
17	MH403	MH404	CONDUIT	27.8	0.5042	0.0130
18	MH404	MH405	CONDUIT	19.1	0.5246	0.0130
2	MH401	MH402	CONDUIT	39.3	0.4835	0.0130
2_3	MH408	MH406	CONDUIT	26.4	0.1515	0.0130
3	MH410	MH409_null	CONDUIT	13.6	0.2949	0.0130
39	CB13	MH404	CONDUIT	23.6	0.5095	0.0130
4	MH409	MH408	CONDUIT	23.4	0.1709	0.0130
44	DITCH_IN_1	POND_1	CONDUIT	55.0	0.5091	0.0350
54	DCB17_STRG	MH409_null	CONDUIT	5.8	1.0259	0.0130
7	MH406	MH405	CONDUIT	40.7	0.1474	0.0130
8	MH405	EX_STUB	CONDUIT	9.4	0.1065	0.0130
9	EX_STUB	14	CONDUIT	37.5	0.1334	0.0130
10	CB14_15_STRG	MH405	ORIFICE			
19	RYCB02	MH401	ORIFICE			
21	CB03_STRG	MH401	ORIFICE			
22	RYCB04	MH402	ORIFICE			
24	CB04_STRG	MH402	ORIFICE			
25	CB06_07_STRG	MH402	ORIFICE			
27	RYCB19	mh407	ORIFICE			
28	RYCB18	mh407	ORIFICE			

30	CB10_STRG	MH403	ORIFICE
31	CB11_STRG	CB11	ORIFICE
34	CB12_STRG	MH404	ORIFICE
35	CB13_STRG	CB13	ORIFICE
41	CB16_STRG	MH406	ORIFICE
51	RYCB09	MH402	ORIFICE
52	CB08_STRG	MH402	ORIFICE
53	MH409_null	MH409	ORIFICE
1	CB14_15_STRG	5	WEIR
12	DCB17_STRG	POND_1	WEIR
20	RYCB02	CB03_STRG	WEIR
23	RYCB04	CB04_STRG	WEIR
26	CB06_07_STRG	CB08_STRG	WEIR
29	RYCB09	CB08_STRG	WEIR
32	CB11_STRG	CB10_STRG	WEIR
33	CB08_STRG	CB10_STRG	WEIR
36	CB10_STRG	CB12_STRG	WEIR
37	CB13_STRG	CB12_STRG	WEIR
38	CB12_STRG	CB14_15_STRG	WEIR
40	CB16_STRG	DCB17_STRG	WEIR
42	CB04_STRG	CB08_STRG	WEIR
43	CB03_STRG	CB04_STRG	WEIR
45	RYCB18	DITCH_IN_1	WEIR
46	RYCB19	DITCH_IN_1	WEIR
5	POND_1	2	WEIR
50	MH410	POND_1	WEIR

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
11	CIRCULAR	0.30	0.07	0.07	0.30	1	0.19
13	CIRCULAR	0.45	0.16	0.11	0.45	1	0.20
14	CIRCULAR	0.45	0.16	0.11	0.45	1	0.21
15	CIRCULAR	0.45	0.16	0.11	0.45	1	0.14
16	CIRCULAR	0.45	0.16	0.11	0.45	1	0.20
17	CIRCULAR	0.45	0.16	0.11	0.45	1	0.20
18	CIRCULAR	0.45	0.16	0.11	0.45	1	0.21
2	CIRCULAR	0.45	0.16	0.11	0.45	1	0.20
2_3	CIRCULAR	0.60	0.28	0.15	0.60	1	0.24
3	CIRCULAR	0.60	0.28	0.15	0.60	1	0.33
39	CIRCULAR	0.45	0.16	0.11	0.45	1	0.20

4	CIRCULAR	0.60	0.28	0.15	0.60	1
0.25						
44	TRAPEZOIDAL	0.30	0.36	0.16	2.10	1
0.22						
54	CIRCULAR	0.30	0.07	0.07	0.30	1
0.10						
7	CIRCULAR	0.60	0.28	0.15	0.60	1
0.24						
8	CIRCULAR	0.75	0.44	0.19	0.75	1
0.36						
9	CIRCULAR	0.75	0.44	0.19	0.75	1
0.41						

****
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 ..... CMS
Process Models:
  Rainfall/Runoff ..... YES
  RDII ..... NO
  Snowmelt ..... NO
  Groundwater ..... NO
  Flow Routing ..... YES
  Ponding Allowed ..... NO
  Water Quality ..... NO
Infiltration Method ..... HORTON
Flow Routing Method ..... DYNWAVE
Surcharge Method ..... EXTRAN
Starting Date 04/21/2021 00:00:00
Ending Date 04/21/2021 12:00:00
Antecedent Dry Days 0.0
Report Time Step 00:01:00
Wet Time Step 00:05:00
Dry Time Step 00:05:00
Routing Time Step ..... 0.50 sec
Variable Time Step ..... YES
Maximum Trials 8
Number of Threads 4
Head Tolerance ..... 0.001500 m

**********	Volume	Depth
Runoff Quantity Continuity	hectare-m	mm
**********	---------	-------
Total Precipitation	0.137	85.525
Evaporation Loss	0.000	0.000
Infiltration Loss	0.027	16.937
Surface Runoff	0.111	69.306
Final Storage	0.000	0.011

Continuity Error (%) ..... -0.851

Flow Routing Continuity	Volume hectare-m	Volume 10^6 ltr
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.111	1.113
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.000	0.000
External Outflow	0.104	1.045
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.001	0.008
Final Stored Volume	0.007	0.071
Continuity Error (%)	0.507	

Highest Continuity Errors

Node DITCH_IN_1 (3.71%)
Node MH406 (3.22%)
Node MH408 (2.86%)
Node mh407 (2.35%)
Node CB13 (1.76%)

Time-Step Critical Elements

None

Highest Flow Instability Indexes

Link 53 (17)

Routing Time Step Summary

Minimum Time Step	:	0.50 sec
Average Time Step	:	0.50 sec
Maximum Time Step	:	0.50 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.00
Time Step Frequencies	:	
0.500 - 0.500 sec	:	100.00 %
0.500 - 0.500 sec	:	0.00 %
0.500 - 0.500 sec	:	0.00 %
0.500 - 0.500 sec	:	0.00 %
0.500 - 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 CMS	Runoff Coeff
28	85.53	0.00	0.00	17.02	54.93	14.32	69.24	0.03	0.03	0.810
B1	85.52	0.00	0.00	16.99	53.41	15.61	69.02	0.02	0.02	0.807
B10	85.53	0.00	0.00	3.69	78.86	3.40	82.25	0.08	0.06	0.962
B11_1	85.53	0.00	0.00	27.18	37.75	21.24	58.99	0.04	0.03	0.690
B11_2	85.53	0.00	0.00	27.41	37.77	20.94	58.71	0.05	0.03	0.686
B12	85.52	0.00	0.00	18.85	51.44	16.04	67.47	0.04	0.03	0.789
B13	85.53	0.00	0.00	16.95	54.89	14.47	69.36	0.03	0.02	0.811
B14	85.53	0.00	0.00	12.22	63.56	10.49	74.05	0.15	0.12	0.866
B15	85.53	0.00	0.00	27.95	37.82	20.30	58.12	0.07	0.05	0.680
B16	85.52	0.00	0.00	21.99	45.38	19.17	64.55	0.02	0.02	0.755
B17	85.53	0.00	0.00	17.19	53.94	15.42	69.36	0.03	0.02	0.811
B18	85.53	0.00	0.00	15.93	56.58	13.81	70.39	0.06	0.05	0.823
B2_1	85.53	0.00	0.00	14.98	58.30	13.04	71.34	0.02	0.02	0.834
B2_2	85.52	0.00	0.00	14.97	58.29	13.07	71.37	0.06	0.05	0.834
B3_1	85.53	0.00	0.00	19.57	50.65	16.02	66.67	0.03	0.03	0.780
B3_2	85.53	0.00	0.00	19.07	50.51	17.03	67.54	0.04	0.03	0.790
B5	85.53	0.00	0.00	17.37	54.00	14.97	68.97	0.11	0.08	0.806
B6	85.53	0.00	0.00	21.79	47.26	17.14	64.39	0.04	0.03	0.753
B7	85.52	0.00	0.00	21.74	46.28	18.31	64.59	0.04	0.03	0.755
B8	85.52	0.00	0.00	7.41	72.01	6.75	78.76	0.10	0.07	0.921
B9	85.53	0.00	0.00	6.47	73.68	5.94	79.62	0.03	0.02	0.931

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
CB11	JUNCTION	0.11	0.32	105.52	0 01:11	0.32
CB13	JUNCTION	0.29	0.43	105.44	0 01:11	0.42
DITCH_IN_1	JUNCTION	0.01	0.17	106.35	0 01:09	0.17
EX_STUB	JUNCTION	0.98	1.04	105.34	0 01:10	1.04
MH401	JUNCTION	0.02	0.15	105.83	0 01:10	0.15
MH402	JUNCTION	0.03	0.29	105.63	0 01:11	0.29
MH403	JUNCTION	0.39	0.61	105.52	0 01:11	0.61
MH404	JUNCTION	0.55	0.69	105.43	0 01:11	0.69
MH405	JUNCTION	0.94	1.01	105.35	0 01:10	1.01
MH406	JUNCTION	0.74	0.83	105.37	0 01:10	0.83
mh407	JUNCTION	0.54	0.63	105.38	0 01:10	0.63
MH408	JUNCTION	0.68	0.77	105.37	0 01:10	0.77
MH409	JUNCTION	0.48	0.57	105.38	0 01:10	0.57
MH409_null	JUNCTION	0.53	1.36	106.17	0 01:10	1.36
MH410	JUNCTION	0.45	1.27	106.17	0 01:10	1.27
RYCB01	JUNCTION	0.01	0.09	106.07	0 01:10	0.09
RYCB02	JUNCTION	0.03	1.24	107.42	0 01:10	1.24
RYCB04	JUNCTION	0.08	2.36	108.21	0 01:10	2.36
RYCB09	JUNCTION	0.11	2.63	108.32	0 01:10	2.63
RYCB18	JUNCTION	0.04	1.17	106.56	0 01:10	1.17
RYCB19	JUNCTION	1.52	1.66	106.46	0 01:10	1.66
14	OUTFALL	1.06	1.06	105.31	0 00:00	1.06
2	OUTFALL	0.00	0.00	105.38	0 00:00	0.00
5	OUTFALL	0.00	0.00	108.07	0 00:00	0.00
CB03_STRG	STORAGE	0.14	2.36	108.27	0 01:14	2.36
CB04_STRG	STORAGE	0.15	2.39	108.19	0 01:14	2.39
CB06_07_STRG	STORAGE	0.09	2.30	108.25	0 01:10	2.30
CB08_STRG	STORAGE	0.28	2.49	108.18	0 01:21	2.49
CB10_STRG	STORAGE	0.15	2.39	108.19	0 01:14	2.39
CB11_STRG	STORAGE	0.18	2.39	108.22	0 01:13	2.39
CB12_STRG	STORAGE	0.12	2.32	108.13	0 01:14	2.32
CB13_STRG	STORAGE	0.18	2.39	108.19	0 01:13	2.39
CB14_15_STRG	STORAGE	0.15	2.38	108.13	0 01:18	2.38
CB16_STRG	STORAGE	0.13	2.35	108.01	0 01:12	2.35
DCB17_STRG	STORAGE	0.79	1.69	106.26	0 01:10	1.68
POND_1	STORAGE	0.04	0.63	106.13	0 01:13	0.63

****
Node Inflow Summary
****

Node	Type	Maximum Lateral	Maximum Total	Time of Max Occurrence days hr:min	Lateral Inflow	Total Inflow	Flow Balance

Node	Type	Inflow CMS	Inflow CMS	Occurrence days	Occurrence hr:min	Volume 10^6 ltr	Volume 10^6 ltr	Error Percent
CB11	JUNCTION	0.000	0.022	0	01:13	0	0.0917	0.639
CB13	JUNCTION	0.000	0.020	0	01:13	0	0.0805	1.790
DITCH_IN_1	JUNCTION	0.032	0.048	0	01:10	0.0438	0.0481	3.851
EX_STUB	JUNCTION	0.000	0.323	0	01:10	0	0.995	1.091
MH401	JUNCTION	0.000	0.050	0	01:10	0	0.104	-0.003
MH402	JUNCTION	0.000	0.120	0	01:10	0	0.356	0.078
MH403	JUNCTION	0.000	0.154	0	01:11	0	0.49	1.724
MH404	JUNCTION	0.000	0.186	0	01:11	0	0.598	1.005
MH405	JUNCTION	0.000	0.323	0	01:10	0	1.01	0.945
MH406	JUNCTION	0.000	0.120	0	01:10	0	0.367	3.326
mh407	JUNCTION	0.000	0.053	0	01:10	0	0.0904	2.410
MH408	JUNCTION	0.000	0.059	0	01:10	0	0.249	2.943
MH409	JUNCTION	0.000	0.058	0	01:10	0	0.251	1.585
MH409_null	JUNCTION	0.000	0.115	0	01:10	0	0.286	0.772
MH410	JUNCTION	0.052	0.109	0	01:10	0.0658	0.196	0.796
RYCB01	JUNCTION	0.017	0.017	0	01:10	0.0205	0.0205	-0.005
RYCB02	JUNCTION	0.015	0.015	0	01:10	0.0196	0.0196	0.000
RYCB04	JUNCTION	0.025	0.025	0	01:10	0.0329	0.0329	0.000
RYCB09	JUNCTION	0.031	0.031	0	01:10	0.0421	0.0421	0.000
RYCB18	JUNCTION	0.050	0.050	0	01:10	0.0747	0.0747	0.000
RYCB19	JUNCTION	0.018	0.018	0	01:10	0.0216	0.0216	9.454
14	OUTFALL	0.000	0.323	0	01:10	0	0.983	0.000
2	OUTFALL	0.000	0.102	0	01:13	0	0.061	0.000
5	OUTFALL	0.000	0.001	0	01:18	0	0.000245	0.000
CB03_STRG	STORAGE	0.051	0.051	0	01:10	0.0644	0.0644	0.002
CB04_STRG	STORAGE	0.032	0.045	0	01:10	0.0386	0.0432	0.000
CB06_07_STRG	STORAGE	0.025	0.025	0	01:10	0.0326	0.0326	0.002

```
  CB08_STRG             STORAGE      0.083    0.109     0  01:10       0.105
0.114       0.001
  CB10_STRG             STORAGE      0.033    0.041     0  01:12      0.0414
0.048       0.001
  CB11_STRG             STORAGE      0.073    0.073     0  01:10      0.0982
0.0982      0.001
  CB12_STRG             STORAGE      0.024    0.035     0  01:13      0.0332
0.0417      0.084
  CB13_STRG             STORAGE      0.060    0.060     0  01:10      0.0837
0.0837      0.001
  CB14_15_STRG          STORAGE      0.050    0.050     0  01:10      0.0631
0.0683     -0.051
  CB16_STRG             STORAGE      0.024    0.024     0  01:10      0.0295
0.0295      0.001
  DCB17_STRG            STORAGE      0.116    0.116     0  01:10       0.154
0.155       0.220
  POND_1                STORAGE      0.035    0.194     0  01:09      0.0486
0.158      -0.929


  **********************
  Node Surcharge Summary
  **********************

  Surcharging occurs when water rises above the top of the highest conduit.
  -------------------------------------------------------------------------
                                          Max. Height   Min. Depth
                                Hours     Above Crown    Below Rim
  Node                  Type  Surcharged       Meters       Meters
  -------------------------------------------------------------------------
  EX_STUB               JUNCTION      11.34        0.262        2.608
  MH403                 JUNCTION       0.06        0.006        2.514
  MH404                 JUNCTION       0.74        0.094        2.606
  MH405                 JUNCTION      11.33        0.264        2.646
  MH406                 JUNCTION      11.27        0.190        2.600
  MH408                 JUNCTION       0.03        0.003        1.757
  MH409_null            JUNCTION       1.23        0.713        0.427


  **********************
  Node Flooding Summary
  **********************

  No nodes were flooded.


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

  ------------------------------------------------------------------------------
-----------------
                         Average     Avg  Evap Exfil       Maximum     Max    Time
of Max    Maximum
                          Volume    Pcnt  Pcnt  Pcnt        Volume    Pcnt
Occurrence    Outflow
  Storage Unit           1000 m3    Full  Loss  Loss       1000 m3    Full    days
hr:min        CMS
```

CB03_STRG	0.000	0	0	0	0.015	2	0	01:14	0.023
CB04_STRG	0.000	0	0	0	0.013	2	0	01:14	0.013
CB06_07_STRG	0.000	0	0	0	0.004	2	0	01:10	0.023
CB08_STRG	0.003	0	0	0	0.045	5	0	01:21	0.020
CB10_STRG	0.000	0	0	0	0.012	3	0	01:14	0.028
CB11_STRG	0.001	0	0	0	0.025	4	0	01:13	0.041
CB12_STRG	0.000	0	0	0	0.007	1	0	01:14	0.031
CB13_STRG	0.001	0	0	0	0.022	3	0	01:13	0.030
CB14_15_STRG	0.001	1	0	0	0.019	34	0	01:18	0.023
CB16_STRG	0.000	0	0	0	0.007	14	0	01:12	0.014
DCB17_STRG	0.001	7	0	0	0.001	14	0	01:10	0.115
POND_1	0.004	4	0	0	0.080	77	0	01:13	0.102

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
14	41.06	0.055	0.323	0.983
2	3.39	0.042	0.102	0.061
5	0.68	0.001	0.001	0.000
System	15.04	0.098	0.420	1.045

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
11	CONDUIT	0.107	0 01:10	1.52	0.56	1.00
13	CONDUIT	0.120	0 01:11	0.86	0.59	0.82
14	CONDUIT	0.017	0 01:10	0.78	0.08	0.19
15	CONDUIT	0.052	0 01:10	0.33	0.36	1.00
16	CONDUIT	0.023	0 01:17	0.50	0.12	0.85

17	CONDUIT	0.155	0	01:11	0.97	0.76	1.00
18	CONDUIT	0.186	0	01:11	1.17	0.90	1.00
2	CONDUIT	0.050	0	01:10	1.04	0.25	0.34
2_3	CONDUIT	0.059	0	01:10	0.35	0.25	1.00
3	CONDUIT	0.058	0	01:05	0.33	0.17	1.00
39	CONDUIT	0.020	0	01:14	0.46	0.10	0.97
4	CONDUIT	0.059	0	01:10	0.40	0.23	0.97
44	CONDUIT	0.054	0	01:09	0.43	0.24	0.59
54	CONDUIT	0.115	0	01:10	1.63	1.18	1.00
7	CONDUIT	0.120	0	01:10	0.42	0.51	1.00
8	CONDUIT	0.323	0	01:10	0.73	0.89	1.00
9	CONDUIT	0.323	0	01:10	0.73	0.80	1.00
10	ORIFICE	0.019	0	01:18			1.00
19	ORIFICE	0.014	0	01:10			1.00
21	ORIFICE	0.019	0	01:14			1.00
22	ORIFICE	0.012	0	01:10			1.00
24	ORIFICE	0.013	0	01:14			1.00
25	ORIFICE	0.012	0	01:10			1.00
27	ORIFICE	0.018	0	01:10			
28	ORIFICE	0.034	0	01:10			1.00
30	ORIFICE	0.013	0	01:14			1.00
31	ORIFICE	0.022	0	01:13			1.00
34	ORIFICE	0.012	0	01:14			1.00
35	ORIFICE	0.020	0	01:13			1.00
41	ORIFICE	0.009	0	01:12			1.00
51	ORIFICE	0.013	0	01:10			1.00
52	ORIFICE	0.020	0	01:21			1.00
53	ORIFICE	0.058	0	01:10			1.00
1	WEIR	0.001	0	01:18			0.02
12	WEIR	0.000	0	00:00			0.00
20	WEIR	0.000	0	00:00			0.00
23	WEIR	0.013	0	01:10			0.08
26	WEIR	0.011	0	01:10			0.07
29	WEIR	0.018	0	01:10			0.10
32	WEIR	0.019	0	01:13			0.10
33	WEIR	0.000	0	00:00			0.00
36	WEIR	0.016	0	01:14			0.09
37	WEIR	0.011	0	01:13			0.07
38	WEIR	0.018	0	01:14			0.10
40	WEIR	0.006	0	01:12			0.04
42	WEIR	0.000	0	00:00			0.00
43	WEIR	0.003	0	01:14			0.03
45	WEIR	0.016	0	01:10			0.09
46	WEIR	0.000	0	00:00			0.00
5	WEIR	0.102	0	01:13			0.52
50	WEIR	0.000	0	00:00			0.00

****
Flow Classification Summary
****

	Adjusted	---------- Fraction of Time in Flow Class -------						
	/Actual	Up	Down	Sub	Sup	Up	Down	Norm
Inlet								

Conduit	Length	Dry	Dry	Dry	Crit	Crit	Crit	Crit	Ltd Ctrl
11	1.00	0.00	0.00	0.00	0.94	0.00	0.00	0.06	0.84 0.00
13	1.00	0.00	0.00	0.00	0.95	0.00	0.00	0.05	0.93 0.00
14	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00 0.00
15	1.00	0.00	0.00	0.00	0.97	0.00	0.00	0.02	0.00 0.00
16	1.00	0.00	0.00	0.00	0.94	0.00	0.00	0.06	0.01 0.00
17	1.00	0.00	0.00	0.00	0.96	0.00	0.00	0.04	0.01 0.00
18	1.00	0.00	0.00	0.00	0.97	0.00	0.00	0.03	0.01 0.00
2	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00 0.00
2_3	1.00	0.01	0.00	0.00	0.98	0.00	0.00	0.01	0.00 0.00
3	1.00	0.00	0.00	0.00	0.98	0.00	0.00	0.02	0.02 0.00
39	1.00	0.00	0.00	0.00	0.96	0.00	0.00	0.04	0.01 0.00
4	1.00	0.00	0.00	0.00	0.97	0.00	0.00	0.03	0.00 0.00
44	1.00	0.00	0.00	0.00	0.04	0.00	0.00	0.96	0.04 0.00
54	1.00	0.01	0.00	0.00	0.94	0.00	0.00	0.05	0.00 0.00
7	1.00	0.00	0.00	0.00	0.98	0.00	0.00	0.01	0.00 0.00
8	1.00	0.00	0.00	0.00	0.99	0.00	0.00	0.01	0.00 0.00
9	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00 0.00

****
Conduit Surcharge Summary
****

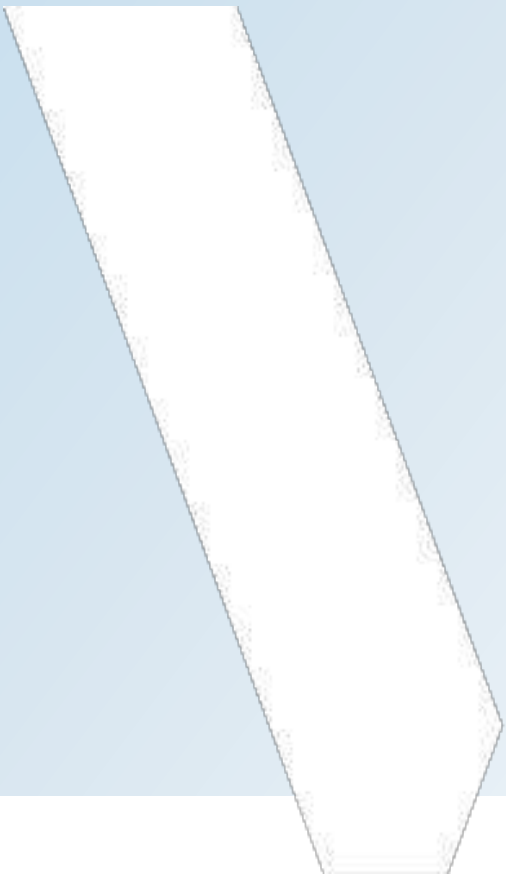
Conduit	Hours Full: Both Ends	Hours Full: Upstream	Hours Full: Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
11	0.72	0.72	1.21	0.01	0.01
13	0.01	0.01	0.63	0.01	0.01
15	11.26	11.26	11.29	0.01	0.01
16	0.01	0.01	0.06	0.01	0.01
17	0.73	0.73	11.25	0.01	0.01
18	11.27	11.27	11.33	0.01	0.01
2_3	11.25	11.25	11.27	0.01	0.01
3	1.20	1.20	1.23	0.01	0.01
39	0.01	0.01	0.74	0.01	0.01
4	0.01	0.01	0.03	0.01	0.01

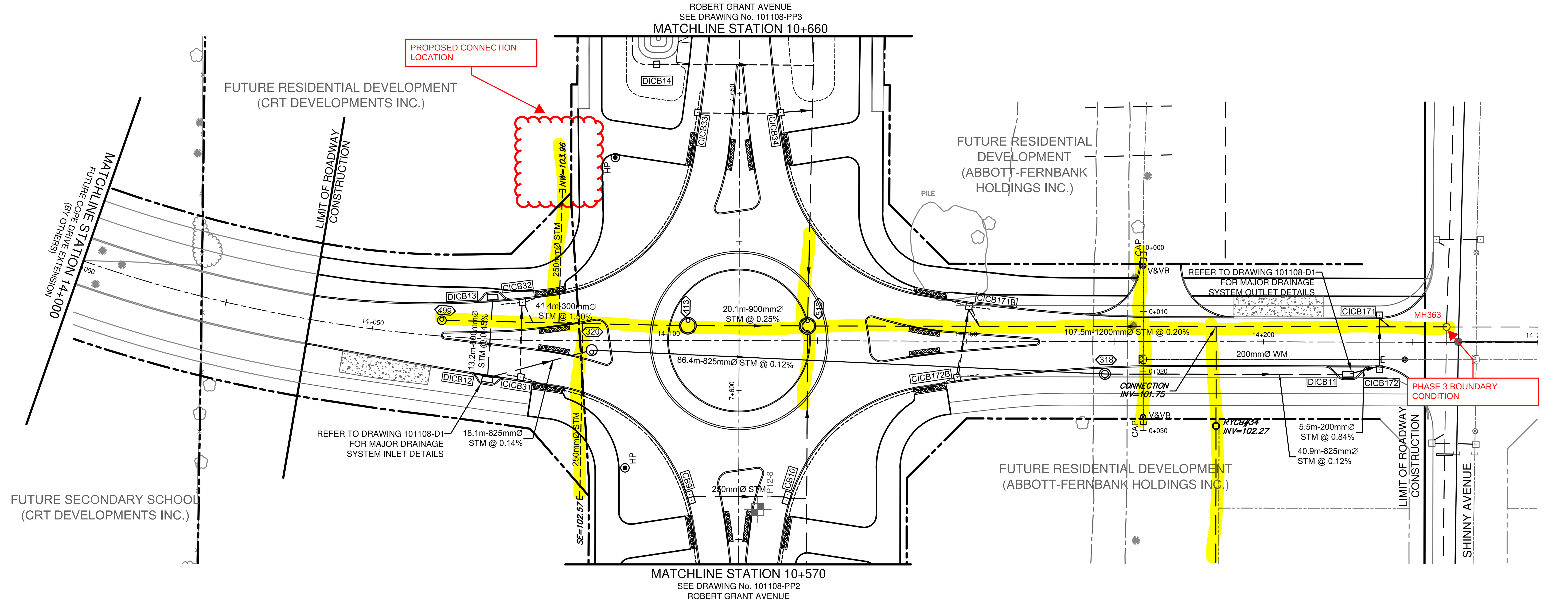
54	1.22	1.22	1.27	0.11	0.11
7	11.29	11.29	11.33	0.01	0.01
8	11.33	11.33	11.34	0.01	0.16
9	11.36	11.36	12.00	0.01	0.01

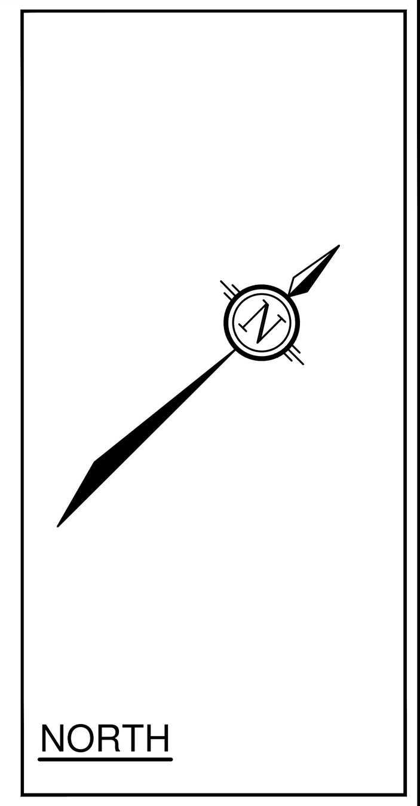
Analysis begun on: Mon Jul 5 14:45:22 2021
Analysis ended on: Mon Jul 5 14:45:33 2021
Total elapsed time: 00:00:11

APPENDIX D –

ROBERT GRANT AVE. / COPE DR. HGL ANALYSIS





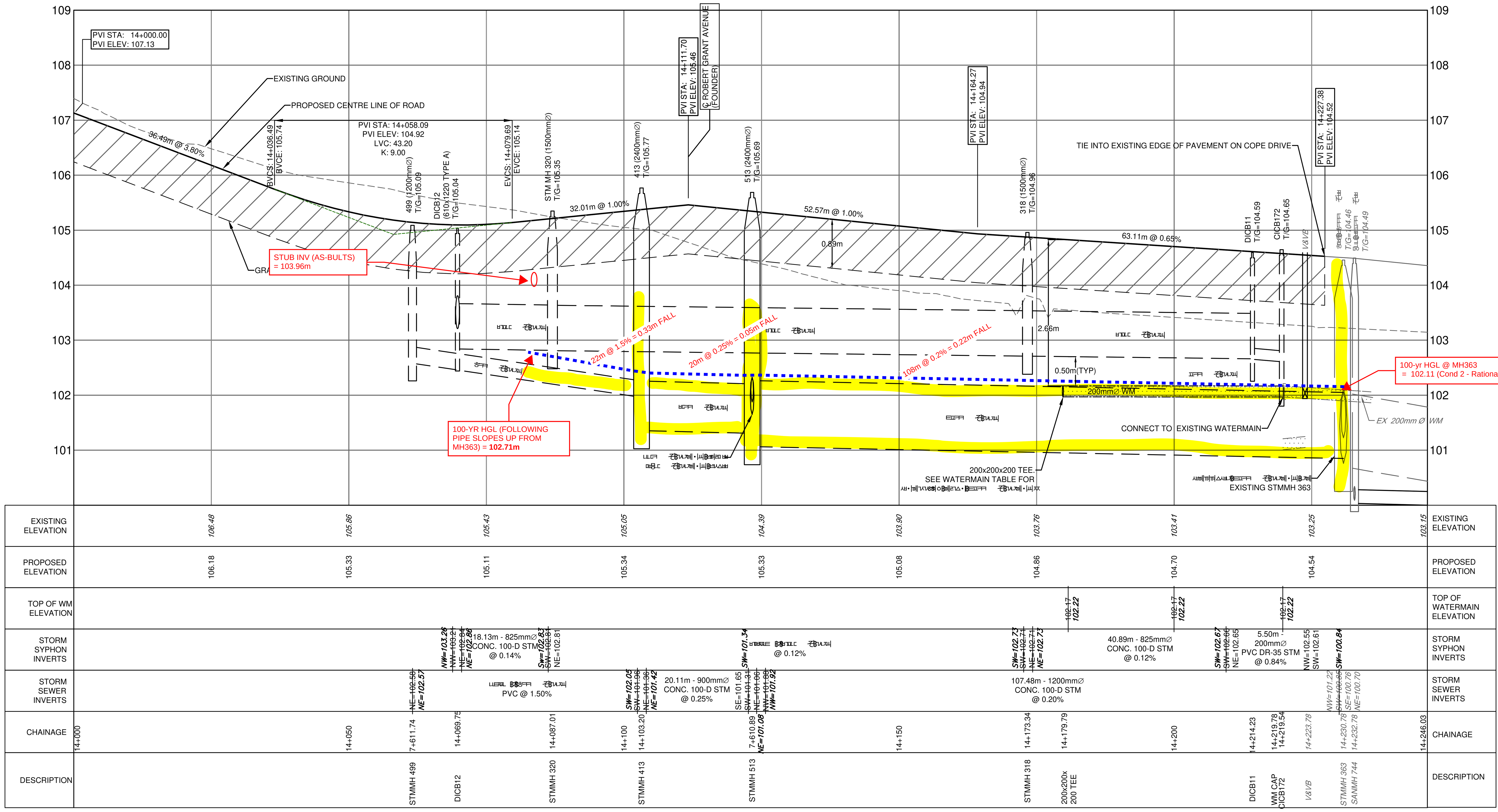


COPE DRIVE WATERMAIN CROSSING TABLE

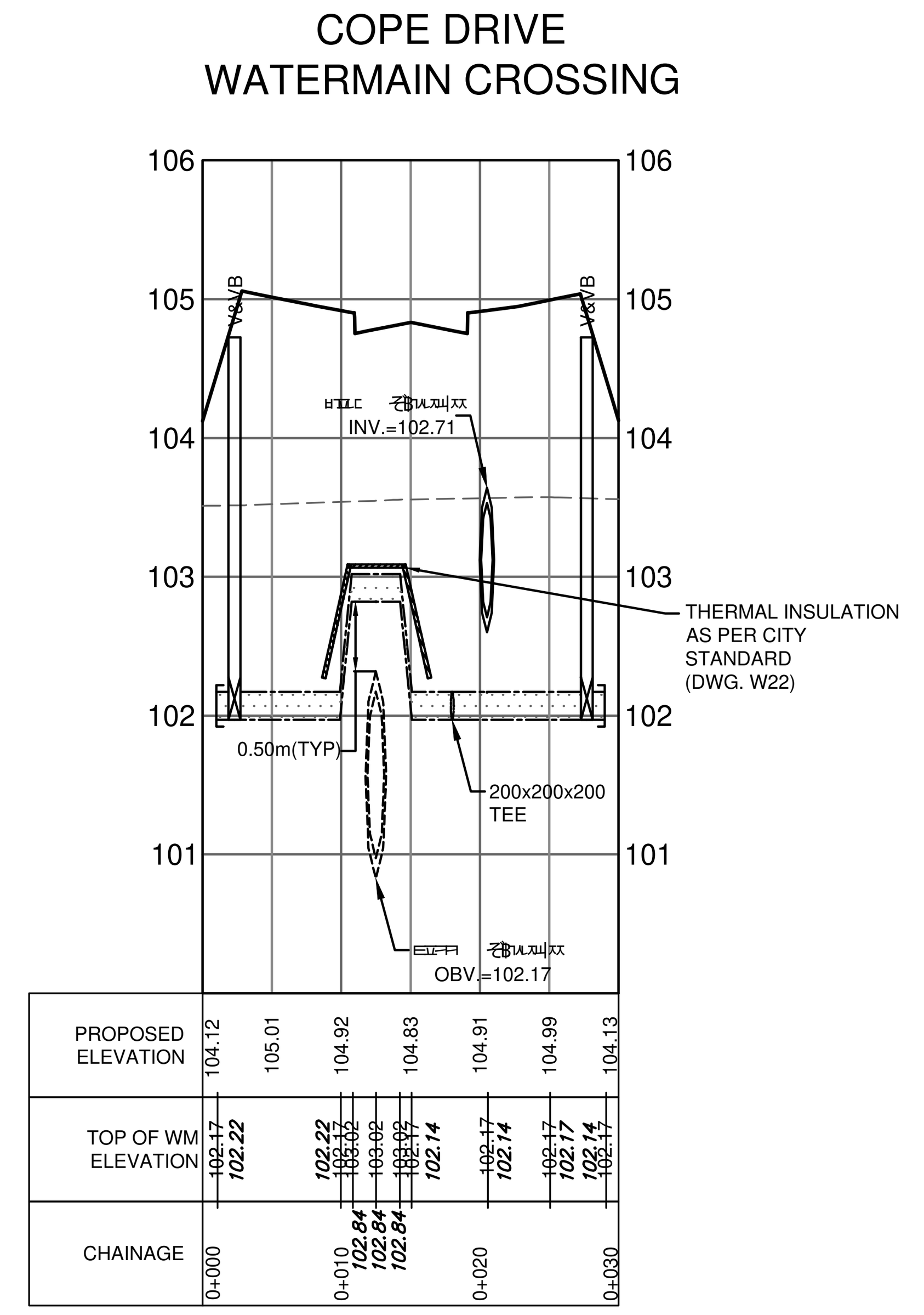
STATION	SURFACE ELEVATION	T/WM ELEVATION	DESCRIPTION
0+001.00	103.89	~~102.17~~ 102.22	CAP
0+002.30	104.31	~~102.17~~ 102.22	VALVE & VALVE BOX
0+009.90	104.72	~~102.17~~ 102.22	[illegible] (INSULATED)
0+0010.75	104.74	~~103.02~~ 102.84	[illegible] (INSULATED)
0+012.50	104.78	~~103.02~~ 102.84	[illegible]
0+014.24	104.81	~~103.02~~ 102.84	[illegible] (INSULATED)
0+015.09	104.83	~~102.17~~ 102.14	[illegible] (INSULATED)
0+017.40	104.78	~~102.17~~ 102.14	[illegible]
0+020.47	104.93	~~102.17~~ 102.14	200x200x200 TEE
0+027.70	104.33	~~102.17~~ 102.14	VALVE & VALVE BOX
0+029.00	103.68	~~102.17~~ 102.14	CAP

NOTE: BARREL TO BARREL SEPARATION SHALL BE 500mm MINIMUM AS PER CITY OF OTTAWA DETAILS W25, AND W25.2.

COPE DRIVE



COPE DRIVE WATERMAIN CROSSING



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.

AS-BUILT

No.	REVISION	DATE	BY
14.	ISSUED FOR AS-BUILT	JAN 26/18	ERD
13.	ISSUED WITH COMMENCE WORK NOTICE	OCT 13/15	ERD
12.	RE-ISSUED TO CONTRACTOR FOR INFORMATION ONLY	JUN 12/15	ERD
11.	RE-ISSUED FOR FRONT-ENDING AGREEMENT	NOV 4/14	ERD
10.	REVISED AS PER FRONT-ENDING AGREEMENT COMMENTS	MAR 12/14	ERD
9.	ISSUED WITH FRONT-ENDING AGREEMENT	DEC 6/13	ERD

No.	REVISION	DATE	BY
8.	ISSUED WITH MOE APPLICATION	NOV 21/13	ERD
7.	ISSUED FOR CITY OF OTTAWA APPROVAL	NOV 8/13	ERD
6.	ISSUED TO CONTRACTOR FOR INFORMATION ONLY	NOV 5/13	ERD
5.	ISSUED WITH REVISED STORMWATER SERVICING BRIEF	OCT 30/13	ERD
4.	ISSUED FOR ADDENDUM 3.0	SEPT 5/13	ERD
3.	ISSUED FOR ADDENDUM 2.0	SEPT 3/13	ERD
2.	ISSUED FOR TENDER	AUG 16/13	ERD
1.	ISSUED FOR CITY OF OTTAWA REVIEW	AUG 16/13	ERD

SCALE
1:500 HORIZONTAL
1:50 VERTICAL

DESIGN SML
CHECKED ERD
DRAWN JPB
CHECKED SML
APPROVED ERD

FOR REVIEW ONLY

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

CITY OF OTTAWA - FERNBANK COMMUNITY
Robert Grant Avenue (Founder)

PLAN AND PROFILE
COPE DRIVE
14+000 TO 14+246

PROJECT No. 101108-07
REV REV # 14
DRAWING No. 101108-PP6

Ottawa (Head Office)
1800 Bantree Street
Ottawa, Ontario K1B 5L6
☎ 613.745.2444
613.745.9994

Montreal
2700 Sabourin Street
St-Laurent, Quebec H4S 1M2
☎ 514.738.2666
514.738.9762

www.cwwcanada.com
1.866.695.0155

CLEAN WATER WORKS INC.
INTEGRATED SEWER SOLUTIONS

RICHCRAFT™ Group of Companies

COPER DR - ROBERT GRANT

Ottawa, Ontario

SEWER CCTV INSPECTION REPORT

Report ID
103980ST1

Sewer Use
Storm

Completion Date
June 02, 2021

Inspected Length
25.6 meters

THE WAY IS CLEAR™

Table of contents

1. Index of pipes

1 item

Inspected length : 25.60
Total length : 41.40

Pipe	Start/End	Direction	Road	Date	Inspected	Total	Page
499 413	413 --> 499	Against flow	Cope Dr.	02/06/2021 2:19 PM	25.6	41.4	5

2. Structural rating

1 item

0 - No Defects (1 of 1 items)

Score	Quick	Index	Pipe	Start/End	Direction	Road	Page
0	0000	0	499 413	413 --> 499	Against flow	Cope Dr.	5

3. O&M rating

1 item

3 - Moderate defect grade (1 of 1 items)

Score	Quick	Index	Structural	Pipe	Start/End	Direction	Road	Page
3	3100	3	0	499 413	413 --> 499	Against flow	Cope Dr.	5

4. Pipe summary and condition details

Pipe identification

Pipe:	499 413	**Direction of inspection:**	413 --> 499
Direction of flow:	499 --> 413	**Direction:**	Against flow

Pipe location

			UPSTREAM	DOWNSTREAM
Road:	Cope Dr.	**Easting (X):**		
Crossroad:		**Northing (Y):**		
Drainage Area:		**Elevation (Z):**		
City:	Ottawa			
Location:		**GPS Accuracy:**		
Owner:	Unknown	**Corrdinate System:**		
Road segment:		**Vertical Datum:**		

Pipe characteristics

Sewer Use:	Stormwater	**Inspected length:**	25.6
Height:	300	**Total length:**	41.4
Width:		**Rim/Inv.:**	
Shape:	Circular	**Grade/Inv.:**	
Material:	Polyvinyl Chloride	**Rim/Grade:**	
Lining:		**Rim/Inv.:**	
Joint length:	4	**Grade/Inv.:**	
Year laid:		**Rim/Grade:**	
Year renewed:		**Sewer category:**	

Additional details

Date:	02/06/2021 2:19 PM	**Location details:**	
Project Number:		**Surveyed by:**	Derek Jessup
Customer:	Richcraft Homes	**Certificate #:**	U06180703002192
PO number:		**Pre-Cleaning:**	No Pre-Cleaning
Work order:		**Date cleaned:**	
Purpose:		**Unit of measurement:**	Metric
Weather:	Dry	**Media label:**	
Flow control:	Not Controlled	**Sheet #:**	

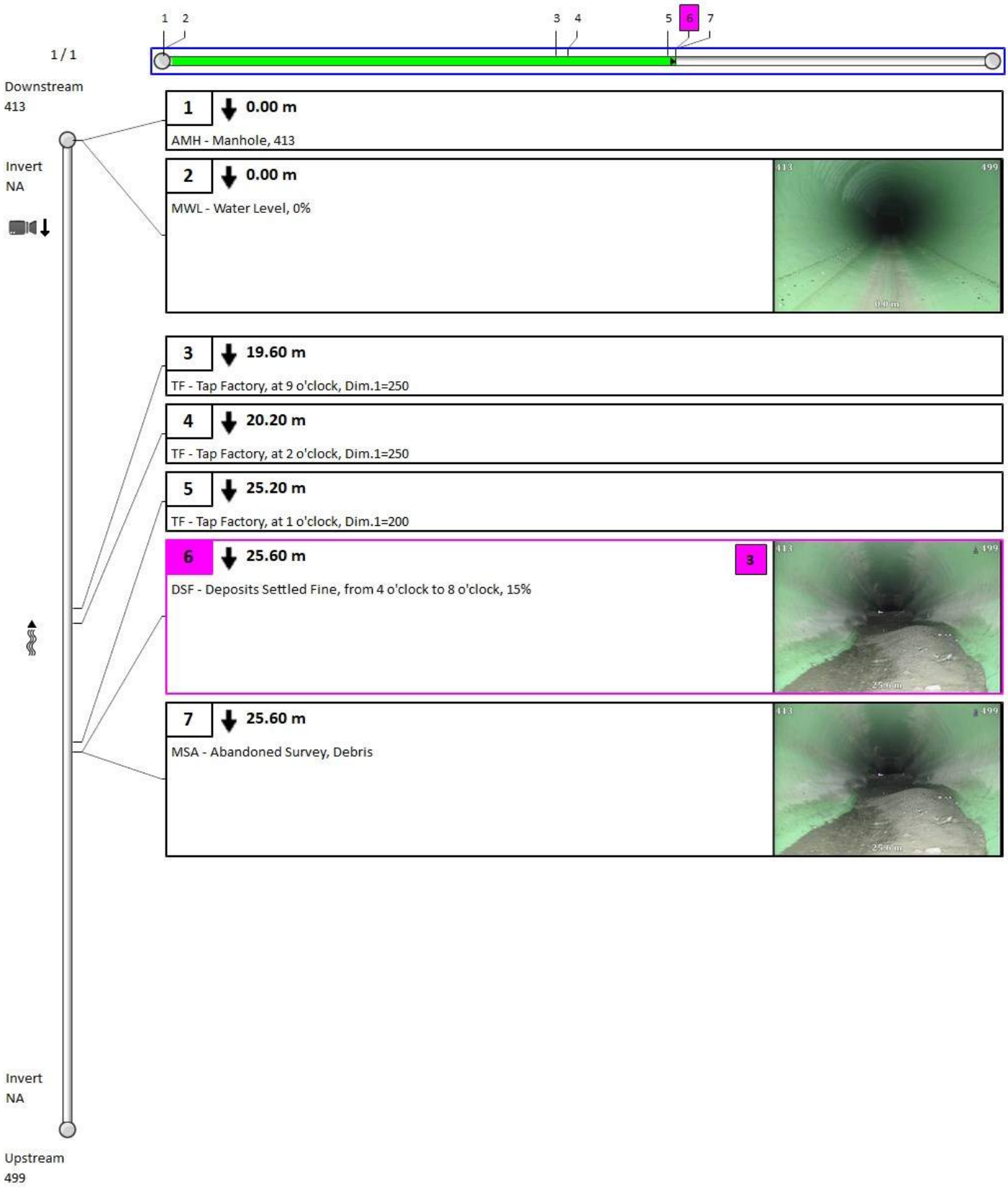
Structural rating		O&M rating		Overall rating	
Peak:	0	**Peak:**	3	**Peak:**	3
Quick rating:	0000	**Quick rating:**	3100	**Quick rating:**	3100
Score:	0	**Score:**	3	**Score:**	3
Index:	0	**Index:**	3	**Index:**	3

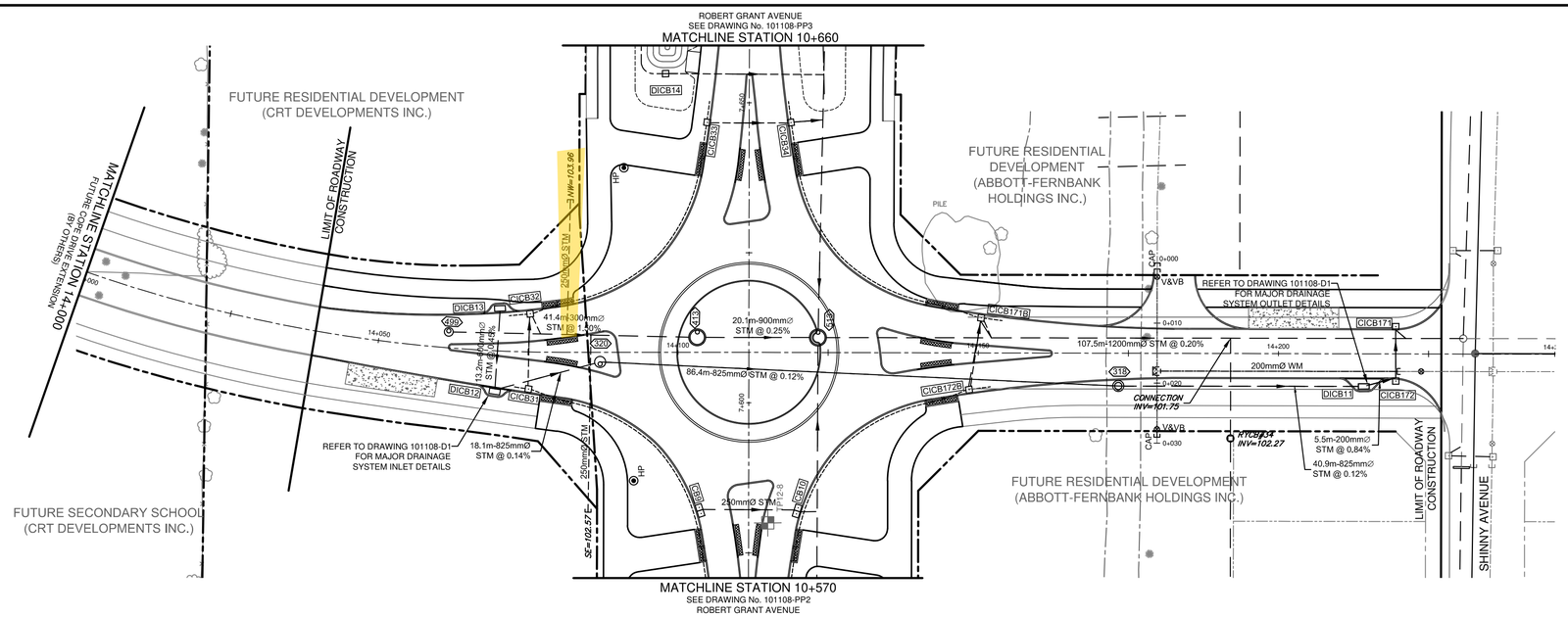
Additional information

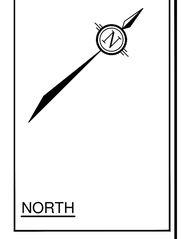
Other information

REPORT ID:	103980ST1	**Information 6:**	
Information 2:		**Information 7:**	
Information 3:		**Information 8:**	
Information 4:		**Information 9:**	
Information 5:		**Information 10:**	

4. Pipe summary and condition details



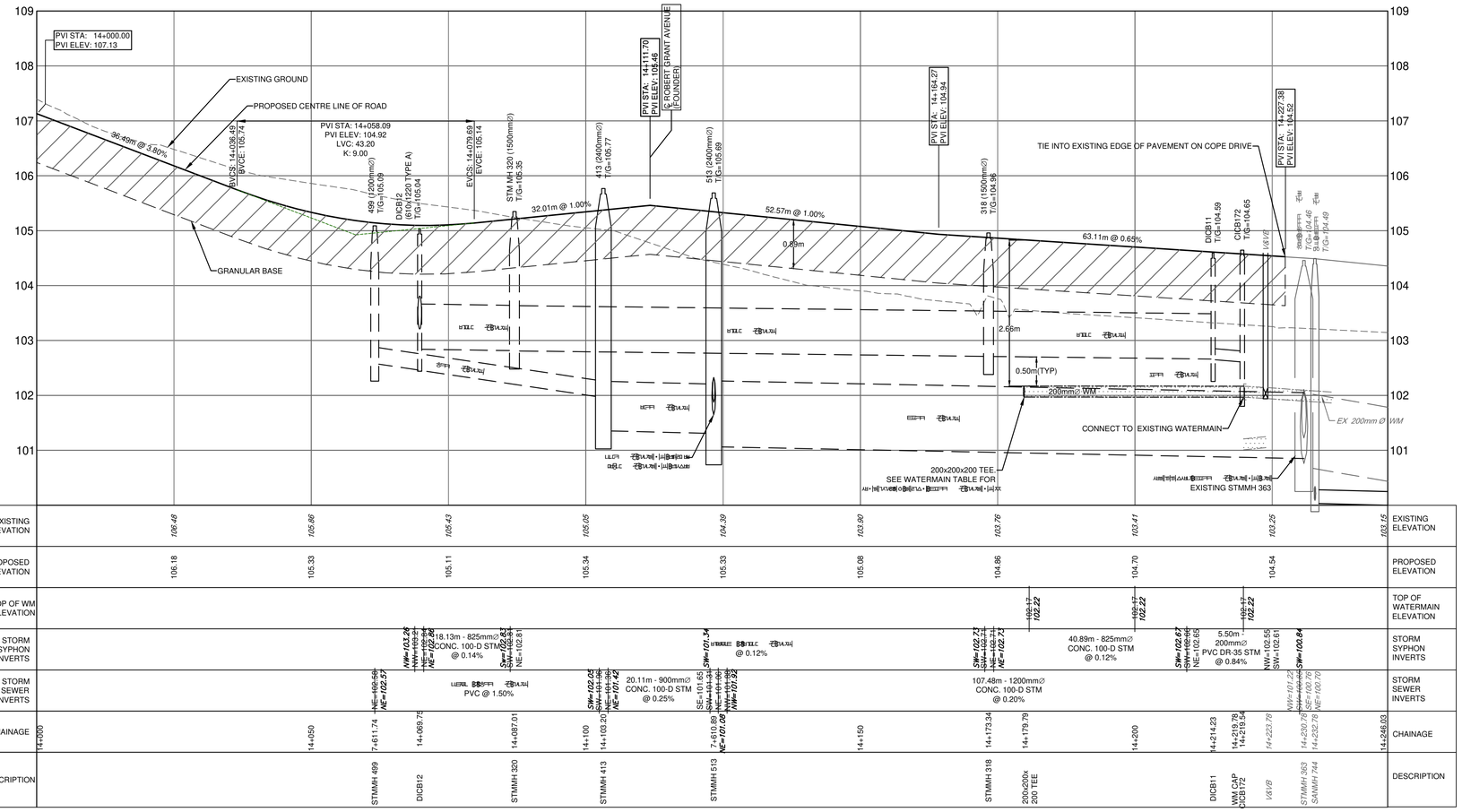




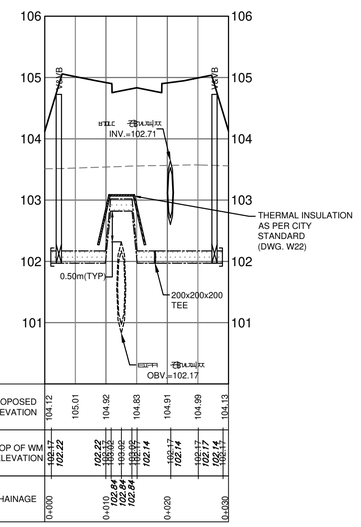
COPE DRIVE WATERMAIN CROSSING TABLE			
STATION	SURFACE ELEVATION	T/WM ELEVATION	DESCRIPTION
0+001.00	103.89	~~102.17~~ 102.22	CAP
0+002.30	104.31	~~102.17~~ 102.22	VALVE & VALVE BOX
0+009.90	104.72	~~102.17~~ 102.22	[illegible] *(INSULATED)*
0+0010.75	104.74	~~102.92~~ 102.84	[illegible] *(INSULATED)*
0+012.50	104.78	~~102.92~~ 102.84	[illegible]
0+014.24	104.81	~~102.92~~ 102.84	[illegible] *(INSULATED)*
0+015.09	104.83	~~102.17~~ 102.14	[illegible] *(INSULATED)*
0+017.40	104.78	~~102.17~~ 102.14	[illegible]
0+020.47	104.93	~~102.17~~ 102.14	200x200x200 TEE
0+027.70	104.33	~~102.17~~ 102.14	VALVE & VALVE BOX
0+029.00	103.68	~~102.17~~ 102.14	CAP

NOTE: BARREL TO BARREL SEPARATION SHALL BE 500mm MINIMUM AS PER CITY OF OTTAWA DETAILS W25, AND W25.2.

COPE DRIVE



COPE DRIVE WATERMAIN CROSSING



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.

AS-BUILT

No.	REVISION	DATE	BY
14.	ISSUED FOR AS-BUILT	JAN 26/18	ERD
13.	ISSUED WITH COMMENCE WORK NOTICE	OCT 13/15	ERD
12.	RE-ISSUED TO CONTRACTOR FOR INFORMATION ONLY	JUN 12/15	ERD
11.	RE-ISSUED FOR FRONT-ENDING AGREEMENT	NOV 4/14	ERD
10.	REVISED AS PER FRONT-ENDING AGREEMENT COMMENTS	MAR 12/14	ERD
9.	ISSUED WITH FRONT-ENDING AGREEMENT	DEC 6/13	ERD
8.	ISSUED WITH MOE APPLICATION	NOV 21/13	ERD
7.	ISSUED FOR CITY OF OTTAWA APPROVAL	NOV 8/13	ERD
6.	ISSUED TO CONTRACTOR FOR INFORMATION ONLY	NOV 5/13	ERD
5.	ISSUED WITH REVISED STORMWATER SERVICING BRIEF	OCT 30/13	ERD
4.	ISSUED FOR ADDENDUM 3.0	SEPT 5/13	ERD
3.	ISSUED FOR ADDENDUM 2.0	SEPT 3/13	ERD
2.	ISSUED FOR TENDER	AUG 16/13	ERD
1.	ISSUED FOR CITY OF OTTAWA REVIEW	AUG 16/13	ERD

SCALE
1:500
0 5 10 15 20
HORIZONTAL
1:50
0 0.5 1.0 1.5 2.0
VERTICAL

DESIGN SML
CHECKED ERD
DRAWN JPB
CHECKED SML
APPROVED ERD

FOR REVIEW ONLY

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

CITY OF OTTAWA - FERNBANK COMMUNITY
Robert Grant Avenue (Founder)

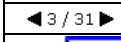
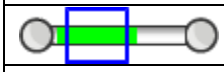
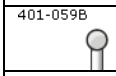
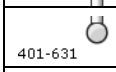
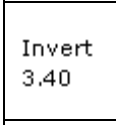
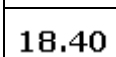
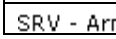
PLAN AND PROFILE
COPE DRIVE
14+000 TO 14+246

PROJECT No. 101108-07
REV REV # 14
DRAWING No. 101108-PP6

M:\2008\101810\NS-Arterial\CAD\Design\Asbuilts\As-builts to City\101810-NSA-Design(AS-BUILT).dwg, PP-06, Jan 05, 2018 - 8:44am, pennell

PLANAT.DWG - 841mmx594mm

Vision Report© Legend

	The numbers sequentially indicate each observation that was picked up throughout the inspection period. This will allow you to sift through the pages and view the accompanying description and photos in each section. Note that when a pipe section contains too many observations, Vision© Report must hide secondary observations in order to optimize the display.*
	A number with neither a square nor circle indicates a general observation.
	A circled number indicates a structural anomaly. The color of the circle indicates the severity of the anomaly on a scale of 1 to 5, 5 being the most severe: green=1, blue=2, magenta=3, orange=4 and red=5.
	A number in a square indicates an operation and maintenance anomaly. The color of the square indicates the severity of the anomaly on a scale of 1 to 5, 5 being the most severe: green=1, blue=2, magenta=3, orange=4 and red=5.
	Indicates the current page number of the inspection report.
	The blue square indicates a section of the pipe; this section is covered in detail on the current page of the report.
	The green line indicates the inspected part of the pipe. The remaining white line indicates the uninspected part of the pipe.
	Indicates the hold points on the camera during an inspection.
	Indicates the hold points on the camera during the reverse inspection.
	Indicates that a reverse inspection was carried out, however the camera did not reach the initial inspection hold point. (the hold point of the initial inspection)
	Indicates that a reverse inspection was carried out and that it has joined (has arrived at) the initial inspection hold point.
	Identifies the start manhole number. Note that this manhole is not necessarily the upstream manhole of the pipe.
	Identifies the end manhole number. Note that this manhole is not necessarily the downstream manhole of the pipe.
	A downward arrow indicates that the inspection was carried out in the direction of the current, whereas an upward arrow indicates an inspection against the current. Note that the manhole located on the upper left of the page is always the start manhole, but not necessarily the upstream manhole of the pipe.
	This camera followed by a downward arrow is located on the upper left of the vertical pipe; it indicates that an inspection was done from this manhole.
	When the second camera appears on the bottom left page it means that a reverse inspection was carried out. Information about the reverse inspection is included in the report, thereby combining both inspections.
	The measurement shown under the word <Invert> indicates the measurements between the frame and the pipe captured during the inspection. This measurement is available at the top left for the start manhole and the bottom left for the end manhole. If the invert was not measured during the inspection, an <NA> mark will be displayed.
	The downward bold arrow to the right of the observation number indicates that this observation was captured during the initial inspection.
	The blank arrow pointing upwards and located to the right of the observation number indicates that this observation was taken during the reverse inspection period, thereby confirming that this report combined both inspections.
	Located to the right of the observation number is a number identifying the observation distance in relation to the start of the pipe.
	A full description of the observation code according to the protocol used.

*Any hidden observations are readily accessible from the database as well as in other CTSpec report templates.

** CTSpec inc. reserves the right to modify, eliminate or add to the product features described in this pamphlet without notice.

Searle, Daniel

From: Searle, Daniel
Sent: Thursday, May 27, 2021 12:25 PM
To: Surprenant, Eric
Cc: Davidson, Steve; Alexander Orakwue
Subject: 620 Bobolink Ridge - Request for Meeting re: Storm/Drainage Discussion #2 - Follow Up

Hi Eric,

Thank you again for meeting with us today.

Based on our discussion, it is our understanding that the City does not store/maintain the existing SWM model associated with the Fernbank Pond 6 catchment. Instead, what the City may possess is a smaller excerpts of the model prepared for individual development applications. We understand you will be following up with the associated City technical reviewers today to see if any copies of the model are available for use by WSP.

In the event the City does not possess copies of the applicable model(s), you had suggested we reach out to Novatech to request a copy, or similarly, Novatech provide a memo communicated the 100-yr HGL at the subject connection point. As a third option, you had indicated that WSP could use 100-yr HGL values (for the Cope Drive trunk sewer) from previous development servicing/SWM reports and infer a HGL upstream to our connection point. Provided there is technical backing to the approach, WSP understands this approach is acceptable to the City.

On another note, you had also confirmed that the City is not aware of the intended use for the stub (for the foreseeable future) and that the City no concern with the proposed connection from this perspective.

As was communicated, the project has been on hold for nearly two weeks as the current grading approach is directly contingent on the acceptable use of this storm connection. We appreciate your commitment to providing us with a follow-up email by end of day today confirmed whether a model is available for WSP's use.

Please advise if I have misrepresented your comments/position in any way.

Thanks,

Dan Searle, P.Eng.
Municipal Engineer

T+ 1 613-935-0538

M+ 1 613-618-4825

1345 Rosemount Avenue
Cornwall, Ontario
K6J 3E5 Canada

www.wsp.ca

Searle, Daniel

From: Surprenant, Eric <Eric.Surprenant@ottawa.ca>
Sent: Thursday, May 06, 2021 9:50 AM
To: Davidson, Steve
Cc: Alexander Orakwue; De Santi, Nadia; Searle, Daniel
Subject: Re: 620 Bobolink Ridge - Request for Meeting re: Storm/Drainage Discussion
Attachments: Robert Grant & Cope.pdf

Hello Steve,

Sorry for the delay, I was trying to locate the Pond 6 design brief, however this pre-dates the electronic files and so you may need to reach out to our records department or designers associated with Pond 6. The other item I was trying to follow up on was the purpose of the storm stub since currently this is the interim Robert Grant cross-section and at some point, the roundabout may transition to a fully signalised intersection when the Middle BRT lanes are implemented and so I was and am still trying to confirm that this wasn't intended for future CBs. I will confirm further on that front and in the meantime have attached the as-built drawing we were looking at during the pre-consult.
Thanks

Eric Surprenant, CET
Sr, Project Manager, Infrastructure Projects, West
Planning, Infrastructure & Economic Development
613 580-2424 ext.: 27794

Please take note that due to current COVID situation, I am working remotely and Phone communication and messaging may not be reliable at this time. Preferred method of communications will be e-mails during this period. If your preference is telephone communication, please indicate this via e-mail and provide a contact telephone number.
Absence alert:

I apologize for any inconvenience.

From: Davidson, Steve <Steve.P.Davidson@wsp.com>
Sent: May 4, 2021 13:13
To: Surprenant, Eric <Eric.Surprenant@ottawa.ca>
Cc: Alexander Orakwue <AOrakwue@richcraft.com>; De Santi, Nadia <nadia.de-santi@wsp.com>; Searle, Daniel <Daniel.Searle@wsp.com>
Subject: RE: 620 Bobolink Ridge - Request for Meeting re: Storm/Drainage Discussion

Hi Eric,

I'm just checking in to see if you have an update on our request below? Let me know.

Thanks,
SD

Steve Davidson, P.Eng., OLS (Ret.), MBA
Manager, Municipal Engineering – Kingston & Cornwall

1224 Gardiners Road, Suite 201
Kingston, Ontario
K7P 0G2 Canada
T+ 1 613-634-7373
T+ 1 613-856-0307 (Direct)

steve.p.davidson@wsp.com | wsp.com

From: Davidson, Steve
Sent: April-29-21 11:37 AM
To: Eric.surprenant@ottawa.ca
Cc: Alexander Orakwue <AOrakwue@richcraft.com>; De Santi, Nadia <Nadia.De-Santi@wsp.com>; Searle, Daniel <Daniel.Searle@wsp.com>
Subject: RE: 620 Bobolink Ridge - Request for Meeting re: Storm/Drainage Discussion

Hi Eric,

Thank you again for the call today, we appreciate your time.

As discussed, please provide any available documentation (incl. As-built DWGs, reports, etc.) related to the SWM works along Cope Drive/Robert Grant Ave, specifically those which related to the 250mm storm services which appears to be stubbed in the SE corner of our site (Block 344 - 620 Bobolink Ridge).

Based on our call, it is our understanding that the City would consider allowing our development to have a secondary storm connection (aside from the dedicated service off Embankment Street) for the sole purpose of providing gravity drainage to a few of the townhome foundation drainage systems. Based the grading differential across the site (from Embankment Street to the intersection of Robert Grant/Cope), these few Townhome foundations currently possess an USF elevation below the site's 100-yr + 300mm HGL. As mentioned, WSP is more then willing to complete an analysis/memo outlining the proposal, which would include a review of the receiving systems HGL as to ensure proper functionality.

If you have any questions or concerns please do not hesitate to reach out.

Regards,
SD

Steve Davidson, P.Eng., OLS (Ret.), MBA
Manager, Municipal Engineering – Kingston & Cornwall

1224 Gardiners Road, Suite 201
Kingston, Ontario
K7P 0G2 Canada
T+ 1 613-634-7373
T+ 1 613-856-0307 (Direct)

steve.p.davidson@wsp.com | wsp.com

-----Original Appointment-----
From: Davidson, Steve
Sent: April-28-21 11:49 AM
To: Davidson, Steve; Eric.surprenant@ottawa.ca; Alexander Orakwue; De Santi, Nadia; Searle, Daniel
Subject: 620 Bobolink Ridge - Request for Meeting re: Storm/Drainage Discussion
When: April-29-21 9:00 AM-10:00 AM (UTC-05:00) Eastern Time (US & Canada).
Where: Microsoft Teams Meeting

The purpose of this meeting is to review some grading/drainage constraints, and we'd like to review a few possible options to see if the City of Ottawa would be in agreeance with our design approach.

If this time doesn't work for anyone, 2-3pm also works for WSP and the City of Ottawa so please let me know if this should be rescheduled to the afternoon.

Regards,
SD

Steve Davidson, P.Eng., OLS (Ret.), MBA
Manager, Municipal Engineering – Kingston & Cornwall

1224 Gardiners Road, Suite 201
Kingston, Ontario
K7P 0G2 Canada
T+ 1 613-634-7373
T+ 1 613-856-0307 (Direct)

steve.p.davidson@wsp.com | wsp.com

Microsoft Teams meeting

Join on your computer or mobile app
Click here to join the meeting

Learn More | Meeting options

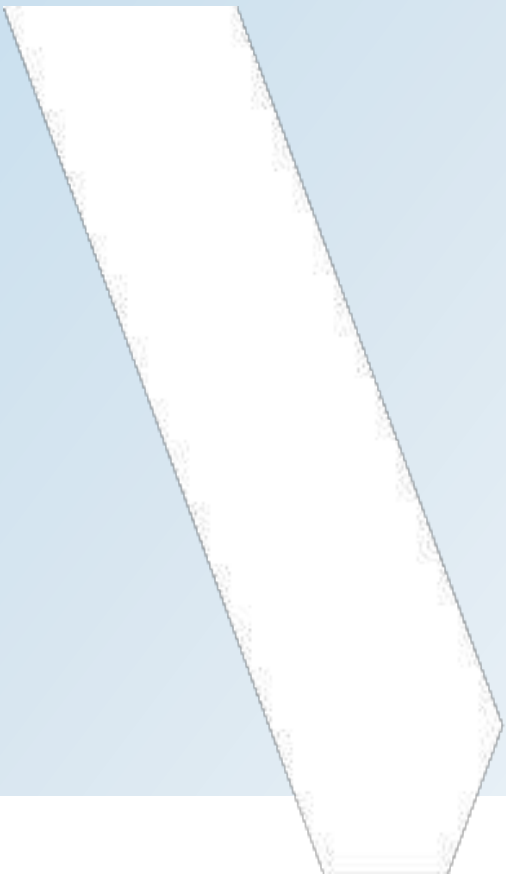
-LAEmHhHzdJzBlTWfa4Hgs7pbKI

'

'

APPENDIX E –

FERNBANK CROSSING – PHASE 3 SERVICING REPORT



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
- Recreation & Parks Planning
- Environmental Restoration
- Sustainable Design

Abbott-Fernbank Holdings Inc.
Fernbank Crossing – Phase 3

Stormwater Management Report

ABBOTT-FERNBANK HOLDINGS INC.
FERNBANK CROSSING

STORMWATER MANAGEMENT REPORT
(PHASE 3)

Prepared By:

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

March 10, 2015
Revised July 13, 2015

Novatech File: 108180-15
Ref: R-2015-051

July 13, 2015

City of Ottawa
Infrastructure Services and Community Sustainability
110 Laurier Avenue West
Ottawa, ON K1P 1J1

Attention: **Ms. Lily Xu**

Dear Ms. Xu

Reference: **Stormwater Management Report – Phase 3**
Abbott-Fernbank Holdings Inc. - Fernbank Crossing
Our File No.: 108180-15

Please find enclosed one (1) copy of the Stormwater Management Report for Phase 3 of the Abbott-Fernbank Holdings Inc. lands within the Fernbank Community – Fernbank Crossing. This report outlines the detailed storm drainage and stormwater management strategy for Phase 3 of the Fernbank Crossing development. The stormwater management design has been developed based on the requirements of the City of Ottawa and Rideau Valley Conservation Authority.

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

Sincerely,

NOVATECH

Michael Petepiece, P.Eng.
Project Manager

cc: Mr. Josh Kardish, Regional Group of Companies (1 copy)
Mr. Eric Surprenant, City of Ottawa (3 copies)

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

Appendices

1.0 INTRODUCTION

1.1 Background

Novatech has been retained to prepare a detailed stormwater management report for the proposed Phase 3 development of the Abbott-Fernbank Lands (hereafter referred to as Fernbank Crossing). The subject site is located within the new Fernbank Community on the North side of Fernbank Road and west of Terry Fox Drive as shown in **Figure 1**. The lands will be developed as a low to medium density residential subdivision.

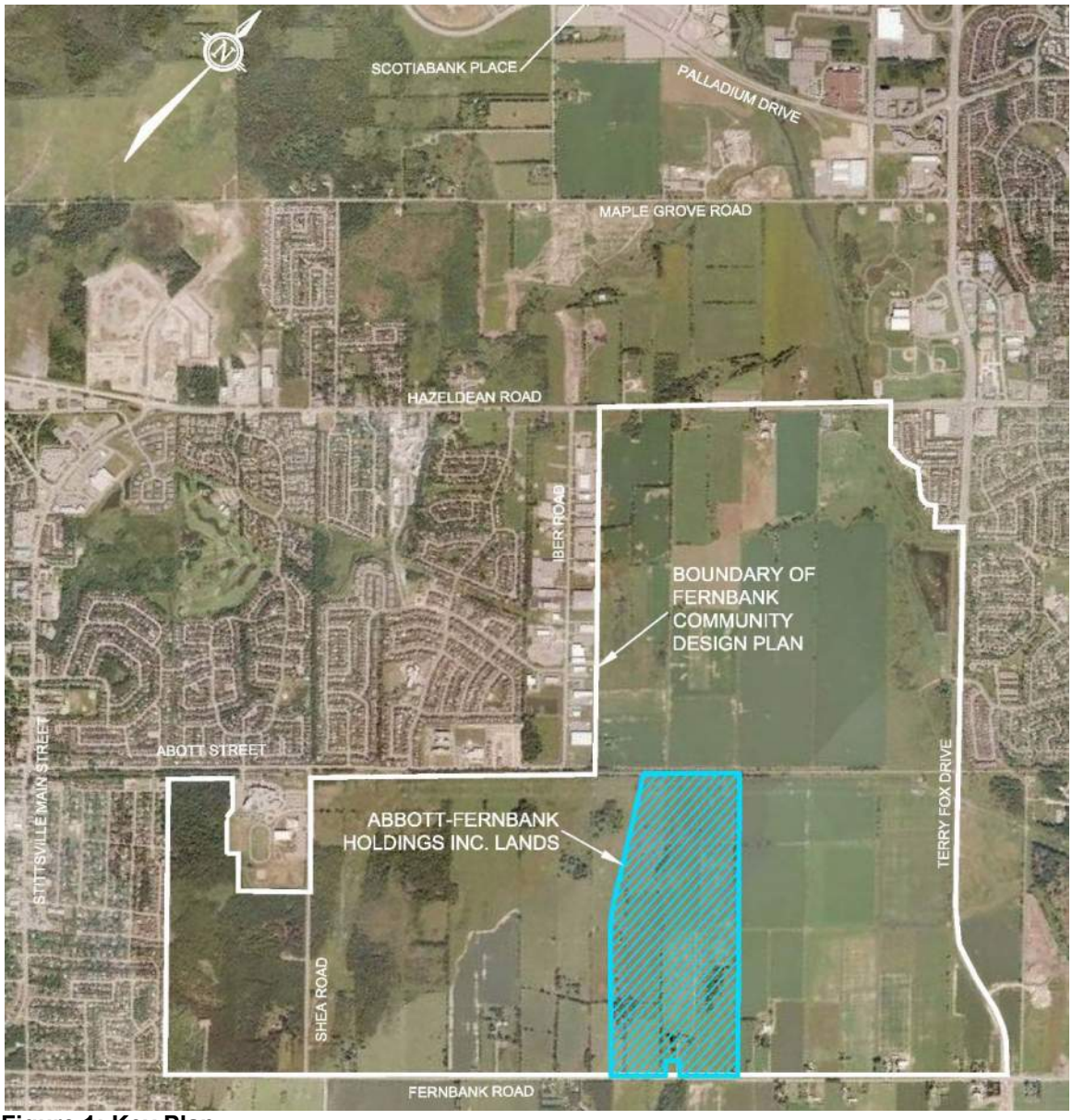


Figure 1: Key Plan

1.2 Land Use

1.2.1 Fernbank Crossing

The Fernbank Crossing subdivision (67.30 ha) will be comprised primarily of low and medium density residential dwellings with a total of 506 singles, 244 towns and 76 stacked units proposed. Medium density residential (6.81ha) and a Community Core Area (7.11ha) are proposed adjacent a new Arterial Road that is to be constructed along the west property line and the hydro corridor. The Community Core is comprised of Mixed-Use land and a Village Green which is a public green space. Two schools (4.95ha) will front onto a Major Collector road which divides the site (North/South). A Park n' Ride facility (1.95ha), and a Paramedic Post (0.71ha) are proposed along Fernbank Road. A Transit Station (1.02ha), Hydro Corridor (3.37ha), a SWM facility (0.93ha) and a Park (1.00ha) make up the remainder of the site. The proposed land use plan is shown in **Figure 2**.

Stormwater Management Draft Conditions are provided in **Appendix A**. The Draft Plan of Subdivision is located in **Appendix D**.

1.2.2 Adjacent Lands

The proposed subdivision will be bordered by future residential lands to the west (CRT Developments Inc.), a hydro corridor and the Trans-Canada Trail to the north, future residential lands to the east (Monarch-Cardel), and agricultural land to the south.

There is ongoing coordination with the both the landowner to the east (Monarch-Cardel) and the landowner to the west (CRT Developments Inc.). The proposed storm drainage system has been designed to accommodate runoff from the adjacent development areas, as well as future phases within the Fernbank Crossing development. The only external area draining to the site is the Phase 5 area which has been included in the modelling.

1.3 Additional Reports

This Stormwater Management Report provides information on the considerations and approach by which Novatech has designed and evaluated the proposed storm drainage system for the Phase 3 lands, and builds upon the recently completed works for the Fernbank Community Design Plan**[**1**]** prepared by Walker, Nott, Dragicevic Associates Limited, the Fernbank Master Servicing Study**[**2**]** prepared by Novatech, and the Fernbank Environmental Management Plan also prepared by Novatech**[**3**]**.

This report should be read in conjunction with the following:

- *Geotechnical Investigation, Fernbank Crossing Residential Subdivision Phase 3 and 4, Ottawa, Ontario* prepared by Houle Chevrier Engineering, dated December 2014 (Ref #14-482).

- *Servicing Design Brief (Phase 3) – Abbott-Fernbank Holdings Inc. Fernbank Crossing* prepared by Novatech Engineering Consultants Ltd., dated June 23, 2015 (R-2014-177).

Figure 2: Conceptual Land Use Plan

1.4 Phasing

The Fernbank Crossing subdivision is being developed in phases as shown in Figure 3. This report includes details of the proposed storm drainage and stormwater management design for Phase 3 which includes 128 single family lots, 68 townhomes, 2 medium-density residential blocks, and a park. A conceptual stormwater analysis for all future phases was modeled to evaluate the storm runoff (major and minor system) onto Cope Drive and will be re-evaluated during detailed design of all future phases.

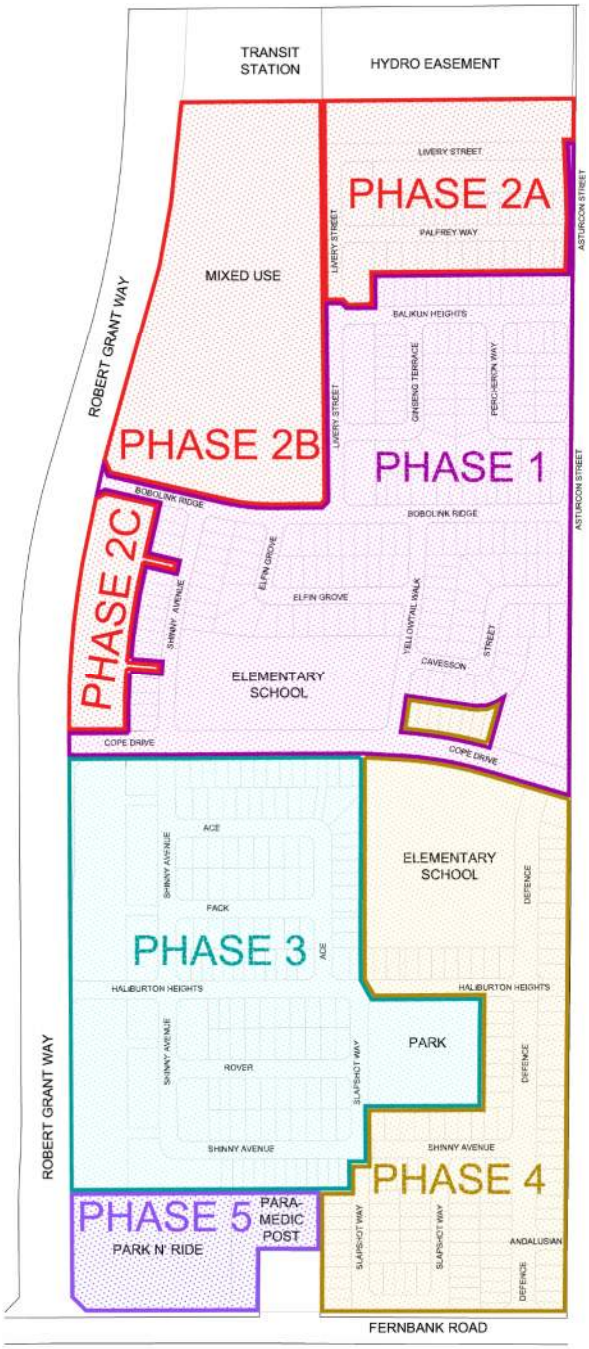


Figure 3: Phasing Plan

2.0 STORMWATER MANAGEMENT CRITERIA

The stormwater management criteria for the proposed development were developed as part of the Fernbank Environmental Management Plan **[**3**]** and are based on the recommendations of the Jock River Reach 2 Subwatershed Study and input from Rideau Valley Conservation Authority.

In additional to the SWM criteria outlined in the Fernbank EMP, the proposed stormwater management strategy will need to adhere to all applicable policies and guidelines of the Rideau Valley Conservation Authority, the City of Ottawa, the Ministry of the Environment, and other approvals agencies.

2.1 Quality Control / Quantity Control / Fish Habitat (Pond 6)

- Fernbank Pond 6 has been designed to control post-development peak flows in the Monahan Drain to pre-development levels and ensure no adverse impacts on the function of the Monahan Drain Constructed Wetlands SWM Facility.
- Fernbank Pond 6 has been designed to provide an *Enhanced* level of water quality protection (80% long term TSS removal), as required for lands tributary to the Monahan Drain (Jock River Subwatershed).
- Fernbank Pond 6 will provide temperature mitigation measures to ensure that the temperature of discharged stormwater does not exceed the target values established as part of the Fernbank EMP:
    - Maximum Discharge Temperature = 25ºC
    - Preferred Discharge Temperature = 22ºC

2.2 Storm Drainage / Conveyance

- Storm sewers are to be designed to convey the 1:5 year post-development peak flow for the proposed development (1:10 year for arterial roads).
- Overland flows are to be confined within the right-of-ways and/or defined drainage easements for all storms up to and including the 1:100 year event.
- ICD flow rates are to be calculated for each drainage area to ensure that the following stormwater management (SWM) objectives are satisfied:
    - Surface water accumulation at street low points, during a 5 year event, shall follow Section 8.3.8.2 of the City of Ottawa Sewer Design Guidelines.
    - Major system storage in backyards is not to be included / accounted for in design computations.
    - Maximum flow depths and elevations on streets shall not exceed 300 mm and shall be confined to the road right-of-way as well as not be within 300 mm (vertical) to the nearest building opening.
        - The maximum flow depth on streets (both public and private and on parking lots) under either static or dynamic conditions shall be 300 mm.
    - The product of the 100 year flow depth (m) on street and flow velocity (m/s) shall not exceed 0.6.
    - The 100 year hydraulic grade line within the storm sewers shall not be within 30 cm (vertical) to adjacent building underside of footing.

2.3 Erosion and Sediment Control

- A qualified inspector should conduct daily visits during construction to ensure that the contractor is working in accord with the design drawings and that mitigation measures are being implemented as specified.
- Silt fencing is to be installed along the upland edge of all fish habitat corridors.
- Straw bale check dams are to be installed at the outlets to roadside ditches.
- Filter fabric is to be placed under all catch basins and storm manhole covers.
- After complete build-out, all sewers are to be inspected and cleaned and all sediment and construction fencing is to be removed.

3.0 EXISTING CONDITIONS

3.1 Topography

The site generally slopes to the northeast at approximately 0.50%. Steeper grades of up to 6.0% are found near the high points along the west and south property boundaries. There is a total elevation differential of approximately 3.75 metres across the site, from a maximum elevation of approximately 106.00 metres in the southwest corner to a minimum elevation of approximately 102.25 metres in the northeast corner.

3.2 Subsurface Conditions

Geotechnical investigations were carried out by Houle Chevrier Engineering **[**4**] [**5**]**, and bedrock was encountered between 0.25 and 6.4 metres below the existing ground surface. The area of shallow bedrock is limited to the western boundary of the site, with the shallowest bedrock located in the northwest corner.

3.3 Drainage Outlet

The Fernbank Crossing development is located at the headwaters of the Monahan Drain Subwatershed (part of the Jock River Watershed). **Figure 4** shows the location of the Abbott Fernbank Lands and the existing watershed boundaries.

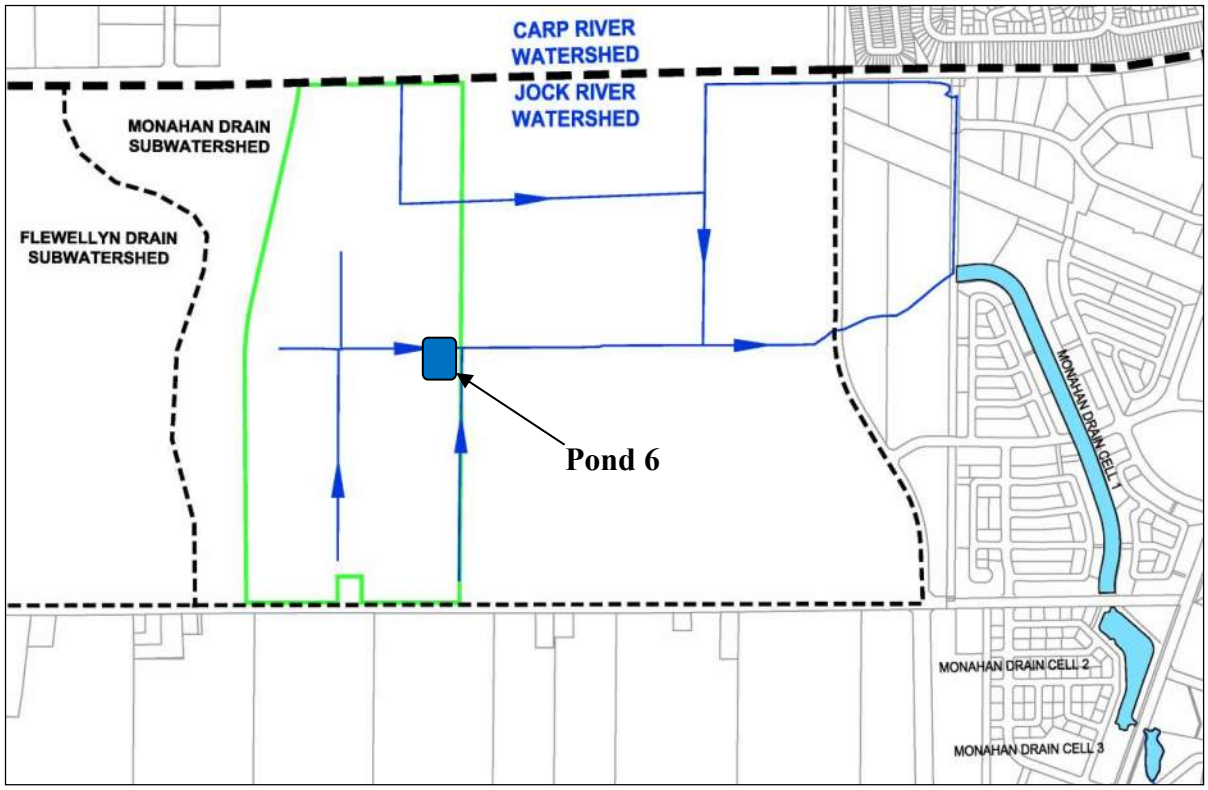


Figure 4: Existing Watershed Boundaries

The Monahan Drain is a municipal drain flowing eastwards towards Terry Fox Drive, with several lateral branches on the north and south sides that connect with the main branch. As specified in the Fernbank Environmental Management Plan, the Monahan Drain upstream of Terry Fox Drive has been classified as an intermittent watercourse that provides indirect habitat supporting tolerant warm/cool water fish communities.

The Monahan Drain has been abandoned upstream of Pond 6, along with the various branch drains within the limits of the Fernbank Community. The branch drains will be filled in as new development within the Fernbank Community proceeds. The main branch between Terry Fox Drive and Pond 6 will be lowered and enhanced using natural channel design techniques to mitigate against the loss of habitat associated with abandoning the various branch drains.

A minimum 40m wide riparian corridor has been designated for the section of the drain to be retained downstream of Pond 6 to protect aquatic habitat and stream function.

4.0 PROPOSED DEVELOPMENT

4.1 Grading Design

The proposed grading for the Abbott Fernbank Lands will closely follow the Grading Plan contained in the Fernbank Master Servicing Study **[3]**. Grade raise constraints are shown in Geotechnical Report **[5]** and are limited to the northeast corner of the site (described as Area 2) where the depth of fill material in the vicinity of structures and in garages should be limited to at most 2.0 metres.

Existing elevations will be met along Fernbank Road, Founder Avenue and Cope Drive. Grading will be coordinated with the proposed development to the east and west. A detailed grading plan can be found in the Phase 3 Servicing Design Brief dated December 12, 2014.

The proposed grading will not impede existing major system flow paths. Interim solutions have been proposed based on the area to be constructed as part of Phase 3. Further details are provided in the Phase 3 Servicing Design Brief.

4.2 Storm Sewer Design (Minor System)

The storm sewer system proposed to service Fernbank Crossing is divided into two main trunks with a north and a south inlet to Pond 6. The design of the trunk sewer outlets to Pond 6 are being coordinated with the City and the adjacent landowners. The overall layout of the proposed storm sewer network is shown on **Figure 5**.

The proposed storm sewers have been designed using the Rational Method to convey peak flows associated with a 5-year return period. The storm sewer design sheets are provided in **Appendix B**. The corresponding Storm Drainage Area Plan (Drawing 108180-15-STM) is provided in **Appendix D**. The design criteria used in sizing the storm sewers are summarized in **Table 4.1** and **Table 4.2**.

Table 4.1: Storm Sewer Design Parameters

Parameter	Design Criteria
Local and Collector Roads	5 Year Return Period
Arterial Roads	10 Year Return Period
Storm Sewer Design	Rational Method/Modeling
IDF Rainfall Data	Ottawa Sewer Design Guidelines
Initial Time of Concentration (T_c)	15 minutes (rear yards) / 10 minutes (roads)
Minimum Velocity	0.8 m/s
Maximum Velocity	3.0 m/s
Minimum Diameter	250 mm

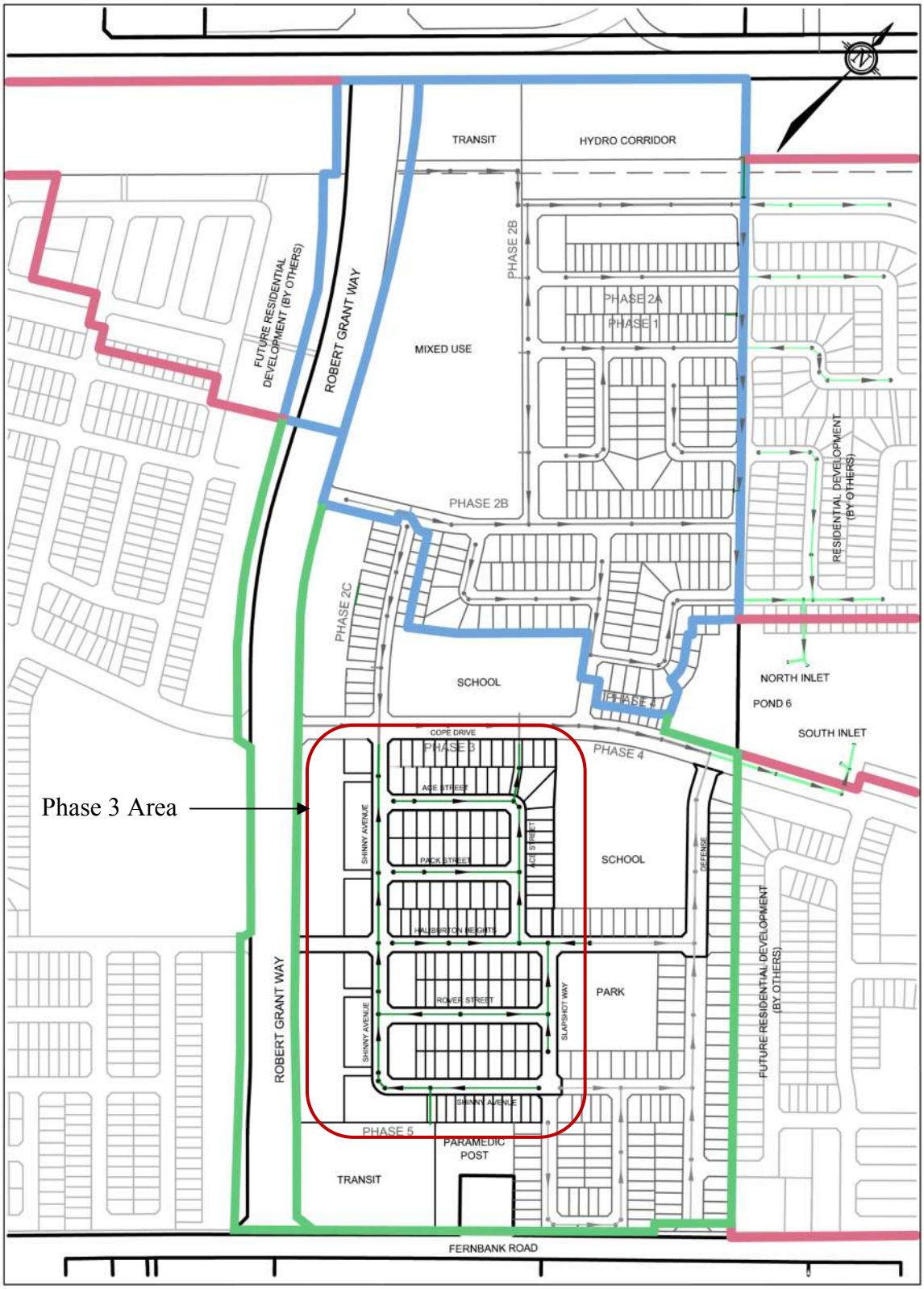


Figure 5: Storm Sewer Network

Table 4.2: Runoff Coefficients

Land Use	Runoff Coefficient
Mixed Use	0.80
Park N' Ride/Paramedic Post	0.80
Arterial Roads	0.90
Schools	0.60
Parks	0.40
Hydro Corridor	0.20
Low Density Front Yards	0.65
Low Density Rear Yards	0.55
Medium Density Front Yards	0.70
Medium Density Rear Yards	0.60

4.2.1 Inlet Control Devices

Inlet control devices (ICDs) will be installed in road and rear yard catch basins as required to limit inflows to the minor system during large (> 1:5 year) storm events. Catch basin leads will typically be interconnected with a single ICD controlling inflow to the storm sewer.

Inlet control devices are proposed at storm sewer inlets as required to ensure inflows to the storm sewer system are regulated to the 5-year peak flow (10-year peak flow for arterial roads and Transitway). ICDs shall be CB lead plug/insertion type and will correspond to the sizes listed in Section 13.1.19 of the Ottawa Sewer Materials Specifications **[7]**.

4.3 Overland Flow Path (Major System)

The rights-of-way have been designed to convey major system overland flow to Pond 6. The road profiles have been graded to ensure that the 100-year peak overland flows are confined within the right-of-way at a maximum flow depth of 0.30 m (static ponding + cascading flow). The major system has been designed to ensure that the product of velocity x depth does not exceed 0.60 during the 100-year event.

4.4 Infiltration Best Management Practices

The Fernbank EMP recommends lot level and infiltration best management practices (BMPs) to mitigate against the potential reduction in infiltration resulting from development. Phase 3 of the Fernbank Crossing subdivision will consist primarily of residential lots. Proposed BMPs for groundwater infiltration include:

- Pipes connecting rear yard CBs will be perforated pipes to promote infiltration of runoff from rear yard areas (as per City of Ottawa Standard Detail S29).
- Roof leaders will be directed to rear yard areas.

By implementing infiltration BMPs as part of the storm drainage design, the impacts of development on the hydrologic cycle can be considerably reduced. Infiltration of clean runoff will have additional benefits for stormwater management. By reducing the volume of "clean" water conveyed to the SWM facility, the end-of-pipe storage requirements can be reduced. The EMP specifies a post-development infiltration target of 110mm of annual rainfall for the site. A water

balance was performed which has been included in Appendix B. The water balance indicates the post-development annual infiltration will be 114mm, which exceeds the minimum recommended by the EMP.

5.0 HYDROLOGIC & HYDRAULIC MODELING

The performance of the proposed storm drainage system for Phase 3 of the Fernbank Crossing subdivision was evaluated using the *Autodesk Storm and Sanitary Analysis* (SSA) hydrologic/hydraulic model. This includes confirmation of the minor system sizing and determination of the 100-year HGL.

5.1 Model Capabilities

The following excerpts are taken from *Autodesk Storm and Sanitary Analysis 2012 – Technical Capabilities and Functionalities* (Autodesk, Inc. 2011) and provide an overview of the hydrologic and hydraulic modeling capabilities of the software.

Hydrologic Modeling Capabilities

Autodesk Storm and Sanitary Analysis accounts for various hydrologic processes that produce runoff from urban areas, including:

- *Time-varying rainfall*
- *Evaporation of standing surface water*
- *Snow accumulation and melting*
- *Rainfall interception from depression storage*
- *Infiltration of rainfall into unsaturated soil layers*
- *Percolation of infiltrated water into groundwater layers*
- *Interflow between groundwater and the drainage system*
- *Nonlinear reservoir routing of overland flow*

Spatial variability in all of these processes is achieved by dividing a study area into a collection of smaller, homogeneous subcatchment areas, each containing its own fraction of pervious and impervious sub-areas. Overland flow can be routed between sub-areas, between subcatchments, or between entry points of a drainage system.

Hydraulic Modeling Capabilities

Autodesk Storm and Sanitary Analysis contains a flexible set of hydraulic modeling capabilities used to help route runoff and external inflows through the drainage system network of pipes, channels, storage/treatment units, and diversion structures. The software can simultaneously simulate dual drainage networks (stormwater sewer network and city streets as separate but connected conveyance pathways) and inlet capacity. It can quickly determine the amount of stormwater flow that is intercepted by the stormwater network inlets and the amount of stormwater flow that bypasses and is then routed further downstream to other inlets. Hydraulic network modeling is performed by the Kinematic Wave or Hydrodynamic (in other words, Saint Venant equation) routing methods.

5.2 Design Storms

The hydrologic analysis was completed using the following synthetic design storms and historical storms. The IDF parameters used to generate the design storms were taken from the Ottawa Design Guidelines - Sewer (October 2012).

3 Hour Chicago Storms:
100-year 3hr Chicago storm

4 Hour Chicago Storms:
5-year 4hr Chicago storm
100-year 4hr Chicago storm

12 Hour SCS Type II Storms:
5-year 12 hour SCS Type II storm
100-year 12 hour SCS Type II storm

24 Hour SCS Type II Storms:
100-year 24 hour SCS Type II storm

Historical Storms:
July 1st, 1979 storm
August, 1988 storm
August, 1996 storm

The 4-hour Chicago distribution generates the highest peak flows for both the minor and major systems and was determined to be the critical storm distribution for the design of the storm drainage system.

The proposed drainage system has also been stress tested using a 4-hour Chicago design storm that has a 20% higher intensity and total volume compared to the 100-year event.

Model results from all storm distributions are provided on the enclosed CD.

5.3 Model Development

The 'Autodesk Storm and Sanitary Analysis' *(SSA)* model has been developed to account for both minor and major system flows *(dual drainage),* including the routing of flows through the storm sewer network *(minor system),* and overland along the road network *(major system).* The results of the analysis were used to:

- Ensure no ponding in the rights-of-way following a 5-year event;
- Calculate the storm sewer hydraulic grade line for the 100-year storm event;
- Evaluate overland flow depths and ponding volumes in the right-of-way during the 100-year event; and
- Determine the total major and minor system runoff from the site to Pond 6.

The SSA program uses 'conveyance links' to model all minor and major systems during analysis. The conveyance links allow you to input the appropriate road cross sections in the

open channel option so during the analysis the major system is modelled correctly. The conveyance links are connected to 'junctions' and 'storm inlets' which represent the gutter grades at selected points, catch basins in sags *(low points)* and overtopping points *(high points)*. The major system *(road network)* corresponds to the grading plan of the proposed site. The junctions, inlets and conveyance links are used to determine the flows, velocities and ponding depths at specific points on the road. The road networks on the plan and profile drawings are used to create the major system model using all slopes and grades for the site.

The SSA model is capable of accounting for both static and dynamic storage within the right-of-ways, including the overland flow across all high points and capture/bypass curves for inlets on continuous grade. The 100-year flow depths computed by the model represent the total (static + dynamic) ponding depths at low points for areas in road sags, or the gutter flow depth where the inlets are on a continuous grade.

5.3.1 Storm Drainage Area Plan

The Fernbank Crossing subdivision has been divided into subcatchments based on the drainage areas tributary to each inlet of the proposed storm sewer system. The catchment areas are shown on the Storm Drainage Area Plans provided as Drawings 108180-15-STM in **Appendix D**.

5.3.2 Subcatchment Model Parameters

The hydrologic parameters for each subcatchment were developed based on the Land Use Plan (Figure 2) and the Storm Drainage Area Plan specified above. An overview of the modeling parameters is provided in **Table 5.1**. Supporting calculations are provided in **Appendix B**.

Table 5.1: Hydrologic Modeling Parameters

Area ID	Catchment Area (ha)	Runoff Coefficient (C)	Percent Impervious (%)	Equivalent Width (m)	Average Slope (%)
109b	0.46	0.55	50	100.00	0.50%
624	1.18	0.80	86	53.00	0.50%
625	0.17	0.65	64	18.00	0.50%
627	1.01	0.80	86	53.00	0.50%
628	0.06	0.55	50	16.00	0.50%
629	0.16	0.55	50	40.00	0.50%
630	0.11	0.55	50	30.00	0.50%
632	1.08	0.80	86	88.00	0.50%
633	1.84	0.80	86	120.00	0.50%
634	0.14	0.60	57	28.00	0.50%
638	0.07	0.60	57	25.00	0.50%
639	0.13	0.60	57	40.00	0.50%
641	0.39	0.70	71	50.00	0.50%
642	0.42	0.65	64	48.00	0.50%

Area ID	Catchment Area (ha)	Runoff Coefficient (C)	Percent Impervious (%)	Equivalent Width (m)	Average Slope (%)
643	0.46	0.65	64	48.00	0.50%
663	0.51	0.55	50	100.00	0.50%
664	0.45	0.65	64	48.00	0.50%
666	0.35	0.65	64	48.00	0.50%
667	0.35	0.70	71	50.00	0.50%
668	0.50	0.55	50	100.00	0.50%
670	0.70	0.65	64	48.00	0.50%
671	0.22	0.65	64	38.00	0.50%
672	0.42	0.55	50	100.00	0.50%
673	0.28	0.65	64	38.00	0.50%
674	0.30	0.65	64	38.00	0.50%
675	0.35	0.65	64	48.00	0.50%
704	0.22	0.65	64	22.00	0.50%
708	0.15	0.65	64	25.00	0.50%
713	0.08	0.55	50	40.00	0.50%
716	0.18	0.55	50	40.00	0.50%
717	0.31	0.65	64	48.00	0.50%
718	0.43	0.55	50	100.00	0.50%
719	0.21	0.65	64	38.00	0.50%
720	0.35	0.65	64	48.00	0.50%
721	0.47	0.65	64	48.00	0.50%
722	0.21	0.55	50	40.00	0.50%
723	0.31	0.65	64	38.00	0.50%
730	0.10	0.60	57	25.00	0.50%
739	0.20	0.55	50	40.00	0.50%
700	0.22	0.65	64	25.00	0.50%
TOTAL	15.6	0.68	68	-	-

Infiltration

Infiltration losses for all catchment areas was modeled using Horton's infiltration equation, which defines the infiltration capacity of the soil over the duration of a precipitation event using a decay function that ranges from an initial maximum infiltration rate to a minimum rate as the storm progresses. The default values for the City of Ottawa **[6]** were used for all catchments.

Horton's Equation:
$f(t) = f_c + (f_o - f_c)e^{-k(t)}$

Initial infiltration rate: f_o = 76.2 mm/hr
Final infiltration rate: f_c = 13.2 mm/hr
Decay Coefficient: k = 4.14/hr

Depression Storage

The default values for depression storage in the City of Ottawa **[6]** were used for all catchments. Residential rooftops were assumed to provide no depression storage.

- Depression Storage (pervious areas): 4.67 mm
- Depression Storage (impervious areas): 1.57 mm

Impervious Values

Impervious (TIMP) values for each subcatchment area were calculated based on the proposed land use plan (Figure 2) and correspond to the Runoff Coefficients used in the Rational Method calculations using the equation:

$$C = 0.90(\%\ IMP) + 0.20(1 - \%\ IMP)$$

To check that the impervious values used in the design are appropriate, the impervious value for a typical lot was calculated for each land use and compared to the values used in the design. The results of this analysis indicate that the Runoff Coefficients and impervious values used in the stormwater management design are slightly higher than the calculated values and therefore represent a slightly conservative design. Supporting calculations are provided in **Appendix B**.

5.3.3 Minor System

Inflows to the storm sewer were modeled based on the characteristics of each inlet.

- For areas where catch basins are located at low points *(represented as junctions),* inflows to the storm sewer are based on the ICD specified for the inlet and the maximum depth of ponding. Storage volumes within the right-of-way are based on the grading design.
- For areas where catch basins are located on a continuous grade *(represented as inlets),* the capture rate is based on the type of grate, the geometry of the road, and the approach flow. Rating curves for approach flow vs. capture rate were input into the model using the appropriate tables from the *Ottawa Design Guidelines – Sewer*:
    - Design Chart 4.04: Gutter Flow Rate for Barrier Curb with Gutter.
    - Design Chart 4.06: Gutter Flow Rate for Mountable Curb with Gutter.
    - Design Chart 4.14: Inlet Capacity for Barrier Curb.
    - Design Chart 4.15: Inlet Capacity for Mountable Curb.
    - Appendix 7-A. Type S22 Curb Inlet Catch Basin with Cross Fall fixed at 3%

5.3.4 Major System

The proposed road network was input into the 'Storm and Sanitary Analysis' model to calculate the total inflow into the storm sewers (minor system), and to calculate the overland flows and flow depths within the right-of-ways (major system).

The roads are represented in the model as open channels. Model input includes:

- Right-of-way cross-sections;
- Length and slope of the road between each high and low point;
- The location of all storm inlets and whether the inlets are in a sag or on-grade.

The elevations used to define the road network are based on the gutter elevations, as opposed to the centerline of road elevations shown on the Grading Plans.

5.3.5 Assumptions for Off-Site / Future Development

The 'Storm and Sanitary Analysis' model developed for Phase 3 of the Fernbank Crossing subdivision has to account for inflows from all future phases, as well as inflows from adjacent development. Where detailed information does not exist, the following assumptions were made in developing the model:

- Inflows from all future development have been accounted for based on the 5-year peak flow (10-year peak flow for arterial roads)

- The maximum release rate for the paramedic station and park and ride facility was established as 150L/s/ha as per the community design plan.

5.3.6 Modeling Files / Schematic

The 'Storm and Sanitary Analysis' modeling files and model schematics are provided in **Appendix C**. Digital copies of the modeling files and model output for all storm events are provided on the enclosed CD.

5.4 Results of Hydrologic Analysis

The 'Autodesk Storm and Sanitary Analysis' hydrologic/hydraulic model was used to evaluate the performance of the proposed storm drainage system for the Phase 3 lands tributary to the South Inlet of Pond 6 and specifically to determine the 100-year hydraulic grade line.

5.4.1 Minor System

The proposed inlet control devices (ICDs) have been sized to allow the capture of the approximate 5-year peak flow at each inlet to the storm sewer. As a result, there will be effectively no ponding within the right-of-ways at the end of the 5-year event. The selection of ICDs takes into account the overland flow that bypasses catch basins on-grade by providing additional capacity at the downstream inlets. The list of ICD sizes and a comparison of storm sewer design sheet peak flow results from modeling peak flow results is provided in **Table 5.2** and **Table 5.3** respectively.

Table 5.2: Inlet Control Device Sizes and Design Flows

Area ID	Structure	ICD Orifice Diameter (mm)	5-year Peak Runoff Rate (L/s)	5-year Inlet Capture Rate (L/s)	100-year Peak Runoff Rate (L/s)	100-year Inlet Capture Rate (L/s)	Excess Runoff Stored and Bypassed (L/s)
109b	RYCBMH-2	152	51	50	128	59	69
625	CB-119	127	30	29	54	35	19
628	RYCB-34	83	7	7	18	18	0
629	RYCB-33	108	19	19	46	37	9
630	RYCB-32	83	13	13	31	18	13
634	RYCB-39	94	18	18	43	25	18
638	RYCB-31	94	12	12	25	25	0
639	RYCB-30	83	21	20	45	22	23
641	CB-129	200 Lead	78	78	141	100	41
642	CB-132	178	75	74	136	78	58
643	CB-134	178	82	81	148	85	63
663	RYCBMH-4	152	52	52	136	62	74
664	CB-125	178	81	81	147	88	59
666	CB-123	178	63	63	115	79	36
667	CB-121	200 Lead	71	71	128	101	27
668	RYCBMH-3	152	52	52	134	64	70
670	CB-97	200 Lead	120	102	218	107	111
671	CB-96	200 Lead	40	40	74	74	0
672	RYCB-24	152	49	48	120	65	55
673	CB-117	152	51	51	93	59	34
674	CB-115	152	54	54	98	58	40
675	CB-93	152	63	63	115	66	49
704	CB-101	108	39	18	71	22	49
708	CB-111	108	27	22	50	22	28
713	E-34	83	13	13	31	18	13
716	RYCB-28	108	20	19	50	35	15
717	CB-91	200 Lead	57	57	104	74	30
718	RYCB-25	127	49	47	121	51	70
719	CB-90	152	38	38	70	48	22
720	CB-87	152	64	64	115	66	49
721	CB-85	200 Lead	85	84	153	97	56
722	RYCBMH-17	127	21	21	55	51	4
723	CB-113	178	55	55	101	85	16
730	RYCB-38	83	15	14	32	16	16
739	RYCB-21	94	21	21	54	27	27
700	CB-127	152	40	40	72	55	17

The Rational Method design sheets (**Appendix B**) were used to calculate the required storm sewer sizes based on capturing the peak flow at each inlet to the storm sewer for a 5-year design return period.

Two sets of storm sewer design sheets are included in **Appendix B**:

- The 'Standard' Rational Method design sheets represent the expected 5-year peak flow in the storm sewers.
- The 'Fixed Tc' Rational Method design sheets represent the expected 100-year peak flow in the storm sewers based on the following assumptions and were used to determine the boundary conditions for the SSA model:
    - Each inlet is restricted to the 5-year peak flow using ICDs;
    - During the 100-year event, each inlet will contribute their maximum design flow (i.e. 5-year peak flow) simultaneously, which is often the case when ICDs operate at or near their maximum rate for a sustained period of time (i.e. duration of ponding).

5.4.2 Major System

During the 100-year event, the available static storage within road sags will be utilized and overland flow will occur as described in **Table 5.4**. Storm runoff that exceeds the available static storage will be conveyed overland within the right-of-ways and/or defined drainage easements to Pond 6. The major system network was evaluated using the 'Autodesk Storm and Sanitary Analysis' model to ensure that the flow depths and velocities conform to City standards.

The results of the 100-year modeling indicate that the overland flow depths on all streets will be less than 0.30m, the product of depth x velocity will be less than 0.60, and major system flows will be confined to the rights-of-way with no encroachment onto private property. The model results for points of maximum overland flow on the site are summarized in **Table 5.3**. Depths recorded in this table reflect depths along the model conduits (i.e. the roadways) and not the depths at the sags.

Table 5.3 also provides the model results for a 20% increase in the 100-year design event. The results of this stress testing indicate that the overland flow depths for the proposed site will be less than or equal to 0.30m. Based on these results, the proposed storm drainage system will not experience any severe flooding even with a 20% increase to the 100-year event. **Table 5.4** describes the ponding depths at roadway sags and the spill flows.

Table 5.3: Maximum Overland Flow Results

Location	Max Static Depth	Chicago 100-year 4 hour				Chicago 100-year 4 hour (+20%)			
		Peak Flow	Velocity	Total Depth (static + dynamic)	Velocity x Depth	Peak Flow	Velocity	Total Depth	Velocity x Depth
		(m^3/s)	(m/s)	(m)	(m^2/s)	(m^3/s)	(m/s)	(m)	(m^2/s)
Catch Basins at Low Points									
Ace Street									
CB 85/86	0.30	0.00	0.00	0.19	0.00	0.02	0.16	0.35	0.06
CB 89/90	0.18	0.01	0.20	0.20	0.04	0.09	0.09	0.24	0.02
CB 95/96	0.14	0.00	0.00	0.08	0.00	0.03	0.05	0.18	0.01
Pack Street									
CB 91/92	0.17	0.00	0.00	0.16	0.00	0.04	0.05	0.23	0.01
Shinny Avenue									
CB 115/116	0.18	0.15	0.46	0.26	0.12	0.17	0.47	0.29	0.14
CB 117/118	0.22	0.00	0.00	0.17	0.00	0.15	0.14	0.30	0.04
CB 121/122	0.16	0.06	0.18	0.22	0.04	0.30	0.28	0.27	0.08
CB 129/130	0.13	0.04	0.27	0.18	0.05	0.06	0.28	0.21	0.06
CB 131/132	0.24	0.00	0.00	0.21	0.00	0.01	0.17	0.26	0.04
CB 133/134	0.24	0.00	0.00	0.15	0.00	0.00	0.00	0.20	0.00
Haliburton Heights									
CB 97/98	0.20	0.00	0.00	0.17	0.00	0.01	0.25	0.22	0.06
Slapshot Way									
CB 101/102	0.13	0.11	0.41	0.20	0.08	0.26	0.40	0.23	0.09
CB 127/128	0.08	0.04	0.45	0.13	0.06	0.11	0.55	0.16	0.09
Rover Street									
CB 123/124	0.18	0.10	0.46	0.24	0.11	0.14	0.43	0.27	0.11
CB 125/126	0.04	0.03	0.10	0.09	0.01	0.12	0.16	0.12	0.02
Catch Basins on Continuous Grade									
Ace Street									
CB 87/88	-	0.04	0.52	0.04	0.02	0.07	0.28	0.05	0.01
Pack Street									
CB 93/94	-	0.04	0.49	0.05	0.02	0.07	0.52	0.06	0.03
High Points with Spill									
Haliburton Heights									
8+350	-	0.11	0.41	0.13	0.05	0.26	0.40	0.15	0.06
Shinny Avenue									
4+345	-	0.15	0.46	0.08	0.04	0.17	0.47	0.11	0.05
4+505	-	0.06	0.18	0.08	0.01	0.30	0.28	0.11	0.03
4+605	-	0.04	0.27	0.05	0.01	0.33	1.30	0.08	0.10
Slapshot Way									
6+095	-	0.04	0.45	0.05	0.02	0.11	0.55	0.08	0.05

Table 5.4: Major System Storage Summary

Structure ID	Top of Grate Elevation (m)	Max Static Ponding Elevation (m)	Max Static Ponding Volume (m^3)	Model Results (5yr Event)		Model Results (100yr Event)		
				Depth Used (m)	Storage Used (m^3)	Depth Used (m)	Storage Used (m^3)	Spill Flow (L/s)
CB 115/116	104.31	104.49	19.28	0.01	0.02	**0.26**	19.28	**146**
CB 117/118	104.48	104.70	35.75	0.00	0.00	0.17	27.63	0
CB 121/122	104.70	104.86	17.86	0.00	0.00	**0.22**	17.86	**62**
CB 129/130	104.88	105.01	6.91	0.00	0.00	**0.18**	6.91	**41**
CB 131/132	104.97	105.21	43.39	0.04	7.23	0.21	37.97	0
CB 133/134	105.07	105.31	47.64	0.01	0.12	0.15	29.77	0
CB 127/128	104.53	104.61	3.02	0.00	0.00	**0.13**	3.02	**37**
CB 125/126	104.39	104.43	2.44	0.00	0.00	**0.09**	2.44	**41**
CB 123/124	104.82	105.00	23.21	0.02	2.58	**0.24**	23.21	**99**
CB 101/102	103.60	103.73	5.58	0.00	0.00	**0.20**	5.58	**109**
CB 97/98	103.74	103.94	25.96	0.03	0.53	0.17	22.07	0
CB 95/96	103.27	103.41	9.42	0.00	0.00	0.08	5.38	0
CB 91/92	103.15	103.32	7.61	0.00	0.00	0.16	7.16	0
CB 89/90	103.14	103.32	15.36	0.00	0.00	**0.20**	15.36	**12**
CB 85/86	103.00	103.30	59.33	0.00	0.00	0.19	37.58	0
RYCBMH-1	103.07	103.30	0	0.00	0	**0.29**	0	**27**
RYCBMH-2	103.16	103.30	0	0.00	0	**0.24**	0	**69**
RYCBMH-3	104.01	104.14	0	0.00	0	**0.23**	0	**68**
RYCBMH-4	104.79	104.87	0	0.00	0	**0.17**	0	**73**
RYCB-21	105.31	105.31	0	0.00	0	**0.07**	0	**26**
RYCB-24	103.26	103.46	0	0.00	0	**0.29**	0	**55**
RYCB-25	103.08	103.28	0	0.00	0	**0.30**	0	**69**
RYCB-30	105.06	105.06	0	0.00	0	**0.05**	0	**22**
RYCB-33	104.48	104.50	0	0.00	0	**0.11**	0	**22**
RYCB-38	105.25	105.35	0	0.00	0	**0.16**	0	**16**
RYCB-39	105.28	105.40	0	0.00	0	**0.17**	0	**18**

5.4.3 Hydraulic Grade Line

Downstream Boundary Condition – Cope Drive Storm Sewer

The proposed Phase 3 development will have a higher imperviousness than originally accounted for in the design of the Cope Drive storm sewer as outlined in the *Fernbank Crossing Phases 1 & 2 SWM report* (Novatech, July 2012). To provide a 5-year level of service for Phase 3, the minor system capture rate has increased and the peak flow entering the existing Cope Drive storm sewer will be higher for both the 5-year and 100-year events - refer to **Section 5.4.4**.

The previously approved Autodesk SSA model for Phases 1 and 2 was updated to reflect the higher flows from Phase 3 and re-evaluate the 100-year HGL in the Cope Drive storm sewer. For the Phase 3 SSA model, the 100-year boundary condition water levels at Cope Drive were established based on the worst-case (highest elevation) condition of:

Condition 1: The pipe obvert where the storm sewer connects to the trunk sewer under Cope Drive;

Condition 2: The HGL in the Cope Drive storm sewer, as calculated using the storm sewer design sheet (fixed 10 minute time of concentration - represents the controlled 100-year minor system flow) – refer to Appendix B; or

Condition 3: The modeled HGL for Cope Drive from the updated SSA model for Phases 1 and 2.

From this evaluation, the boundary elevations at Cope Drive for the Phase 3 model have been established as follows:

MH 363: 102.11m (Condition 2)
MH 341: 100.17m (Condition 3)

HGL Analysis Results – Phase 3

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 elevations. The 100-year HGL is indicated on the Plan and Profile Drawings (submitted separately). The 100-year HGL elevations at each storm manhole with the respected range of underside of footing elevations and obvert of pipes are provided below in **Table 5.5.**

Table 5.5: 100-year HGL Elevations

MH ID	Street	Obvert Elevation (m)	T/G Elevation (m)	HGL Elevation (m)	Sur-charge (m)	Clearance from T/G (m)	Minimum USF (m)
309	Haliburton Heights	101.33	103.86	101.41	0.08	2.45	101.71
343	Ace Street	99.69	103.09	100.63	0.94	2.46	100.93
345	Ace Street	101.76	104.26	101.46	0.00	2.80	101.76
347	Ace Street	100.12	103.46	100.98	0.86	2.48	101.28
349	Pack Street	101.06	104.47	101.26	0.20	3.21	101.56
351	Ace Street	100.37	104.05	101.28	0.91	2.77	101.58
353	Haliburton Heights	101.72	104.86	101.42	0.00	3.44	101.72
357	Slapshot Way	102.50	104.65	102.27	0.00	2.38	102.57
359	Rover Street	102.99	105.24	102.56	0.00	2.68	102.86
373	Shinny Avenue	102.25	104.40	102.24	0.00	2.16	102.54
375	Shinny Avenue	102.44	104.76	102.39	0.00	2.37	102.69
377	Shinny Avenue	102.59	104.98	102.49	0.00	2.49	102.79
379	Shinny Avenue	102.73	104.99	102.62	0.00	2.37	102.92
381	Shinny Avenue	102.79	105.14	102.70	0.00	2.44	103.00
383	Shinny Avenue	102.97	105.23	102.92	0.00	2.31	103.22
385	Shinny Avenue	102.99	105.26	102.98	0.00	2.28	103.28
387	Shinny Avenue	103.10	105.17	103.07	0.00	2.10	103.37

MH ID	Street	Obvert Elevation	T/G Elevation	HGL Elevation	Sur-charge	Clearance from T/G	Minimum USF
		(m)	(m)	(m)	(m)	(m)	(m)
389	Shinny Avenue	103.33	105.46	103.17	0.00	2.29	103.47
391	Maintenance Easement	99.55	103.19	100.40	0.85	2.79	100.70
393	Ace Street	101.59	103.91	101.46	0.00	2.45	101.76
395	Ace Street	99.75	103.18	100.73	0.98	2.45	101.03
397	Pack Street	100.55	103.94	101.57	1.02	2.37	101.87
399	Haliburton Heights	101.17	104.22	101.44	0.27	2.78	101.74
417	Slapshot Way	100.50	103.87	101.40	0.90	2.47	101.70
421	Slapshot Way	102.58	104.86	102.56	0.00	2.30	102.86

5.4.4 Comparison to Previous Studies

While all flow from the site eventually discharges to Pond 6, the infrastructure immediately downstream must also be checked to determine if it has the capacity to convey the proposed conditions flows to the pond. **Table 5.6** summarizes the proposed flows as they compare to previous studies.

Table 5.6: Comparison to Previous Studies

Comparison Location	Proposed Flows (L/s)		Phase 1&2 SWM Report (L/s) [8]	
	Minor System	Major System	Minor System	Major System
MH 363	1563	127	1490	1650
MH 341	1165	95	710	530

While the minor system results are increased at MH 341 compared to what had previously been assumed, the total increase to the minor system is 528L/s. As shown in the fixed time of concentration storm sewer design sheet (included in **Appendix B**), the pipe, even under 100-year conditions, has additional capacity of 148 L/s. As such, we can expect that the downstream sewer will exceed capacity by 380 L/s in the 100-year storm. This additional flow was assessed using the approved Phase 1 and 2 SSA model and determined a small increase in HGL as a result of the additional flow. This increased does not have any adverse effect on the upstream or downstream pipe system and does not change established minimum USF elevations in Phase 1. The increase in HGL did, however, necessitate using the Phase 1 and 2 model HGL as the boundary condition for the Phase 3 model at MH 341.

With respect to flows entering Pond 6, they are being significantly reduced as a result of greater than anticipated storage within the proposed subdivision. Comparing the total runoff volumes between the SSA model and IBI's SWMHYMO model used to design the pond, the SWMHYMO model had a runoff volume of 11,139m^3 and the SSA model has a runoff volume of 11,245m^3, which is an increase of 106m^3, or less than 1%. This small increase is within the tolerance of the model. Consequently, Pond 6 will not be adversely affected by any changes in the design.

In addition to the flows reported in Table 5.6, there is major system overland drainage during the 100-year storm to the future Phase 4 area in the amount of 103 L/s east of Haliburton Heights

and 26 L/s south of Slapshot Way. These flows are much reduced from the existing conditions flows in these areas and as such are not anticipated to cause adverse impacts downstream before Phase 4 is developed. During the Phase 4 development process, these flows will be considered and incorporated during the detail design modelling of that phase.

Overall, during the 100-year storm, the average site release rate through the minor system is 175L/s/ha and the major system release rate is 23L/s/ha. During the 5-year storm, the average site release rate through the minor system is 135 L/s/ha.

6.0 CHANGES FROM FERNBANK COMMUNITY DESIGN PLAN

Changes in the proposed storm sewer system are defined as *minor* on page 83 of the Fernbank Master Servicing Study **[**2**]** and do not require an amendment to the Environmental Assessment since the results do not appreciably change the expected net impacts associated with the project. A full summary of the changes can be found in the Phase 3 Servicing Design Brief.

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). Details are provided on the Erosion and Sediment Control Plan (108180-15-ESC) provided in **Appendix D**.

- All erosion and sediment control measures are to be installed to the satisfaction of the engineer, the municipality and the conservation authority prior to undertaking any site alterations (filling, grading, removal of vegetation, etc.) and remain present during all phases of site preparation and construction.
- A qualified inspector should conduct daily visits during construction to ensure that the contractor is working in accord with the design drawings and that mitigation measures are being implemented as specified.
    - A light duty silt fence barrier is to be installed in the locations shown on the Erosion and Sediment Control Plan.
    - Straw bale barriers are to be installed in drainage ditches that will remain open as part of Phase 1 development.
    - Filter cloth is to be placed above the grates of all catch basins and structures within the construction area.
    - 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

The servicing design generally conforms to the conclusions and recommendations outlined in the Fernbank Master Servicing Study and the Fernbank Environmental Management Plan both of which were approved by Ottawa City Council on June 24, 2009.

The conclusions based on the results of the stormwater management analysis are as follows:

Storm Drainage / Conveyance

- Storm sewers (minor system) have been designed to convey the greater of:
  - The uncontrolled 5-year peak flow, or
  - The controlled 100-year peak flow.
- Inflows to the minor system will be controlled using inlet control devices (ICDs). Where possible, pairs of road catch basins will be interconnected where possible.
- The site has been graded to provide an overland flow route along the road network.
- Overland flows during the 100-year event will not exceed a maximum flow depth of 0.30m within the right-of-way. The product of depth x velocity will be less than 0.6.
- A minimum clearance of 0.30m will be provided between the 100-year hydraulic grade line (HGL) and the designed underside of footing elevations.

Stormwater Management

- Water quality and quantity control for the Fernbank Crossing subdivision will be provided by Fernbank Pond 6 located at the headwaters of the Monahan Drain.
- Pond 6 will control post-development flows to the Monahan Drain to pre-development levels for all storms up to and including the 1:100 year event.
- Pipes connecting rear yard catch basins will be perforated to promote infiltration and reduce the volume of storm runoff to Pond 6.

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

Bryan Orendorff, M.A.Sc., P.Eng.
Water Resources Engineer

Reviewed by

Michael Petepiece, P.Eng.
Project Manager

References

1 "Fernbank Community Design Plan, Walker, Nott, Dragicevic Associates Ltd. [June 24, 2009]

2 "Fernbank Master Servicing Study", Novatech Engineering Consultants Ltd. [June 24, 2009]

3 "Fernbank Environmental Management Plan", Novatech Engineering Consultants Ltd. [June 24, 2009]

4 "Additional Test Pits East Portion of Brookfield Property, Fernbank Community Design, Ottawa, Ontario" Houle Chevrier Engineering Ltd. [Report No. 08-601, December 2008]

5 "Geotechnical Investigation, Fernbank Crossing Residential Subdivision Phase 3 and 4, Ottawa, Ontario" Houle Chevrier Engineering Ltd. [Report No. 14-482, December 2014]

6 "Sewer Design Guidelines", Department of Public Works and Services, City of Ottawa [October 2012]

7 "Standard Tender Documents, Material Specifications and Standard Detail Drawings" City of Ottawa, Department of Infrastructure Services and Community Sustainability [March 31, 2009]

8 "Fernbank Crossing Stormwater Management Report (Phases 1&2)", Novatech Engineering Consultants Ltd. [March 9, 2012]

Appendix A

Draft Conditions (SWM)

Stormwater Management

97. SW1 The Owner shall provide to the General Manager, Planning and Growth Management any and all stormwater reports that may be required by the City for approval prior to the commencement of any works in any phase of the Plan of Subdivision. Such reports shall be in accordance with any watershed or subwatershed studies, conceptual stormwater reports, City or Provincial standards, specifications and guidelines. The reports shall include, but not be limited to, the provision of erosion and sedimentation control measures, implementation or phasing requirements of interim or permanent measures, and all stormwater monitoring and testing requirements. All reports shall be to the satisfaction of the General Manager, Planning and Growth Management. **OTTAWA Planning and CA**

98. SW2 (a) Prior to the commencement of construction of any phase of this Subdivision (roads, utilities, any off site work, etc.) the Owner shall: **OTTAWA Planning**

i. have a Stormwater Management Plan and an Erosion and Sediment Control Plan prepared by a Professional Engineer in accordance with Current Best Management Practices,
ii. have said plans approved by the General Manager, Planning and Growth Management, and
iii. provide certification to the General Manager, Planning and Growth Management through a Professional Engineer that the plans has been implemented.

(b) Any changes made to the Plan shall be submitted to the satisfaction to the City of Ottawa and the Conservation Authority.

(c) The Owner shall implement an inspection and monitoring plan to maintain erosion control measures.

99. SW3 On completion of all stormwater works, the Owner shall provide certification to the General Manager, Planning and Growth Management through a Professional Engineer that all measures have been implemented in conformity with the approved Stormwater Site Management Plan. **OTTAWA Planning**

100. SW4 Prior to the registration, or the making of an application for a Ministry of Environment Certificate of Approval for any stormwater works, whichever event first occurs, the Owner shall prepare a Stormwater Site Management Plan in accordance with a Conceptual Stormwater Site Management Plan (specified by title of plan, date). The Stormwater Site Management Plan shall identify the sequence of its implementation in relation to the construction of the subdivision and shall be to the satisfaction of the General Manager, Planning and Growth Management and the (Specify) Conservation Authority. **OTTAWA Planning and CA**

101. SW5 The Owner shall maintain the stormwater management pond in accordance with the recommendations of the Stormwater Management Plan and to the satisfaction of the General Manager, Planning and Growth Management until such time as the stormwater management pond has been given Final Acceptance and assumed by the City of Ottawa. **OTTAWA Planning**

102. SW6 The Owner shall design and construct, as part of the stormwater management infrastructure, at no cost to the City, a monitoring facility or facilities and vehicular access to the satisfaction of the General Manager, Planning and Growth Management. **OTTAWA Planning**

103. SW7 The Owner agrees that the development of the Subdivision shall be undertaken in such a manner as to prevent any adverse effects, and to protect, enhance or restore any of the existing or natural environment, through the preparation of any storm water management reports, as required by the City. All reports are to be approved by the General Manager, Planning and Growth Management prior to the commencement of any Works. **OTTAWA Planning**

104. SW8 The Owner covenants and agrees that the following clause shall be incorporated into all agreements of purchase and sale for the whole or any part of a lot or block on the Plan of Subdivision, and registered separately against the title: **OTTAWA Legal**

"The Owner acknowledges that some of the rear yards within this subdivision are used for on-site storage of infrequent storm events. Pool installation and/or grading alterations on some of the lots may not be permitted and/or revisions to the approved Subdivision Stormwater Management Plan Report may be required to study the possibility of pool installation on any individual lot. The Owner must obtain approval of the General Manager, Planning and Growth Management of the City of Ottawa prior to undertaking any grading alterations."

105. The Owner shall acknowledge and agree in the subdivision agreement that the agricultural tile drains encountered during construction shall be decommissioned/removed in accordance with the direction provided in the Fernbank Community Design Plan Environmental Management Plan, as approved by Council June 24, 2009. **OTTAWA Planning**

106. The Owner acknowledges and agrees that prior to early servicing and prior to final approval and registration, a detailed stormwater site management plan in accordance with the Fernbank Community Design Plan, Master Servicing Study and Environmental Management Plan, as approved by Council June 24, 2009 shall be prepared and accepted by the City of Ottawa and Rideau Valley Conservation Authority. The final design shall satisfy the requirements for the receiving stream flow quantity and quality as they relate to natural channel design and the protection of fish habitat and maintenance of the existing hydrological characteristics. The final design shall also account for upstream drainage, including areas serviced by agricultural tiles drains in accordance with the Fernbank Community Design Plan, Master Servicing Study and Environmental Management Plan, as approved by Council June 24, 2009 **OTTAWA Planning**

107. Prior to early servicing and final approval and registration, the Owner shall provide an implementation/staging plan that clearly describes the coordination between the construction of the Pond 6 stormwater management facility and its outlet, related stormwater infrastructure and the undertaking of modifications and improvement works to the Monahan Drain as described in Section 11.9, 11.9.1 & 11.9.2 of the Fernbank Community Design Plan Environmental Management Plan, as approved by Council June 24, 2009. **OTTAWA Planning**

108. The Owner acknowledges and agrees that the proposed stormwater Pond identified as Pond 6 and the outlet to the downstream Monahan Drain shall require an application and approval under Ontario Regulation 174/06 under Section 28 of the Conservation Authorities Act "Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulation" prior to undertaking said works. Any applications received in this regard would be assessed within the context of approved policies for the administration of the regulation, including those for the protection of fish habitat. **OTTAWA Planning RVCA**

109. The Owner acknowledges and agrees that the design and construction of the stormwater management facility identified as Pond 6 requires the concurrence and coordination with the adjacent landowner to the west. The Owner shall provide the General Manager, Planning and Growth Management written verification from the abutting owner that there is an agreement with respect to design and construction of Pond 6. **OTTAWA Planning**

110.	Prior to early servicing and final approval and registration, a report documenting the process for undertaking the construction of the stormwater management facility identified as Pond 6 in coordination with the adjacent landowner to the west shall be prepared to the satisfaction of the Rideau Valley Conservation Authority and the City of Ottawa.	**OTTAWA Planning RVCA**
111.	The Owner acknowledges and agrees that the stormwater management facility identified as Pond 6 is constructed and operational prior to the commissioning of the stormsewers within the plan of subdivision.	**OTTAWA Planning**

Appendix B

SWM Calculations & Design Sheets

Typical Storm Sewer Design Sheet
Fixed Tc Storm Sewer Design Sheet
Catch basin Inlet Curves
Typical Lot Impervious Calculations
Water Balance Calculations

Fernbank Crossing (Phase 3)- Storm Sewer Design Sheet (Traditional Rational Method)

LOCATION			AREA											FLOW						Total Peak Flow (Q)	PROPOSED SEWER							
Location	From node	To node	Mixed Use	Park N' Ride Paramedic Post Medium Block	Arterial Road ROW	Schools	Parks	Hydro Corridor	Singles Front Yards	Singles Rear Yard	Towns Front Yard	Towns Rear Yard	Total Area	Weighted Runoff Coefficient	Indivi 2.78 AR	Accum 2.78 AR	Time of Concentration	Rain Intensity (mm/hr) 5yr	Rain Intensity (mm/hr) 10yr	Peak Flow		Pipe	Size	Grade	Length	Capacity	Full Flow Velocity	Time of Flow	Q/Qfull
			0.80	0.80	0.90	0.60	0.40	0.20	0.65	0.55	0.70	0.60	(ha)							(L/s)	(L/s)	Type	(mm)	(%)	(m)	(l/s)	(m/s)	(min.)	(%)
South Outlet																													
643	389	387							0.46				0.46	0.65	0.83	0.83	10.00	104.2		86.6	**86.6**	PVC	450	0.19	123.5	129.6	0.79	2.61	66.8%
													0.00		0.00	0.00	10.00			0.0									
633, 632, 739, 730	387A	387		2.92						0.20		0.10	3.22	0.78	6.97	6.97	10.00	104.2		725.9	**725.9**	CONC	900	0.20	41.5	844.6	1.29	0.54	85.9%
													0.00		0.00	0.00	10.00			0.0									
642	387	385							0.43				0.43	0.65	0.78	8.57	12.61	92.2		790.5	**790.5**	CONC	900	0.20	51.8	844.6	1.29	0.67	93.6%
													0.00		0.00	0.00	12.61			0.0									
	385	383											0.00	0.00	0.00	8.57	13.28	89.6		768.0	**768.0**	CONC	900	0.20	10.9	844.6	1.29	0.14	90.9%
													0.00		0.00	0.00	13.28			0.0									
634	383	419										0.14	0.14	0.60	0.23	8.81	13.42	89.0		784.3	**784.3**	CONC	900	0.25	9.3	944.3	1.44	0.11	83.1%
													0.00		0.00	0.00	13.42			0.0									
641	419	381									0.39		0.39	0.70	0.76	9.57	13.53	88.6		848.1	**848.1**	CONC	900	0.25	66.9	944.3	1.44	0.78	89.8%
													0.00		0.00	0.00	13.53			0.0									
666	359	381							0.35				0.35	0.65	0.63	0.63	10.00	104.2		65.9	**65.9**	PVC	375	0.25	93.3	91.5	0.80	1.94	72.1%
													0.00		0.00	0.00	10.00			0.0									
639	381	379										0.13	0.13	0.60	0.22	10.42	14.30	85.9		894.6	**894.6**	CONC	975	0.24	25.9	1145.4	1.49	0.29	78.1%
													0.00		0.00	0.00	14.30			0.0									
627	379A	379		1.01									1.01	0.80	2.25	2.25	10.00	104.2		234.0	**234.0**	CONC	600	0.25	7.5	320.3	1.10	0.11	73.1%
													0.00		0.00	0.00	10.00			0.0									
667	379	377									0.35		0.35	0.70	0.68	13.34	14.59	84.9		1132.9	**1132.9**	CONC	1050	0.25	55.3	1424.4	1.59	0.58	79.5%
													0.00		0.00	0.00	14.59			0.0									
625, 638, 630	423	377									0.17	0.18	0.35	0.65	0.63	0.63	15.17	83.0		52.4	**52.4**	PVC	300	1.00	40.0	100.9	1.38	0.48	51.9%
													0.00		0.00	0.00	15.17			0.0									
673	377	375									0.28		0.28	0.70	0.54	14.52	15.65	81.5		1183.4	**1183.4**	CONC	1200	0.17	80.1	1677.0	1.44	0.93	70.6%
													0.00		0.00	0.00	15.65			0.0									
674, 629	375	373									0.30	0.16	0.46	0.67	0.85	15.37	16.58	78.8		1210.7	**1210.7**	CONC	1200	0.18	110.5	1725.6	1.48	1.25	70.2%
													0.00		0.00	0.00	16.58			0.0									
624	373A	373		1.18									1.18	0.80	2.62	2.62	10.00	104.2		273.4	**273.4**	CONC	600	0.25	7.5	320.3	1.10	0.11	85.4%
													0.00		0.00	0.00	10.00			0.0									
723, 628	373	363									0.31	0.06	0.37	0.68	0.70	18.70	17.83	75.4		1410.0	**1410.0**	CONC	1350	0.20	58.9	2490.2	1.69	0.58	56.6%
													0.00		0.00	0.00	17.83			0.0									
108	363	361							0.21				0.21	0.65	0.38	6.14	18.96	72.6		445.8	**1723.3**	CONC	1350	1.74	78.6	7344.9	4.97	0.26	23.5%
													0.00		0.00	15.03	18.96		85.0	1277.5									
109a	361	341							0.33				0.33	0.65	0.60	6.73	19.22	72.0		485.0	**1751.5**	CONC	1350	1.74	81.1	7344.9	4.97	0.27	23.8%
													0.00		0.00	15.03	19.22		84.3	1266.6									
708	309	417							0.25				0.25	0.65	0.45	0.45	10.00	104.2		47.1	**47.1**	PVC	300	0.65	47.6	81.3	1.11	0.71	57.9%
													0.00		0.00	0.00	10.00			0.0									
700, 699, 663	421	357							0.18	0.61			0.79	0.57	1.26	1.26	10.00	104.2		131.1	**131.1**	PVC	450	0.35	42.8	176.0	1.07	0.67	74.5%
													0.00		0.00	0.00	10.00			0.0									
664	359	357							0.45				0.45	0.65	0.81	0.81	10.00	104.2		84.7	**84.7**	PVC	375	0.50	99.9	129.3	1.13	1.47	65.5%
													0.00		0.00	0.00	10.00			0.0									
704, 668	357	417							0.22	0.50			0.72	0.58	1.16	3.23	11.47	97.0		313.7	**313.7**	CONC	525	2.39	81.2	693.6	3.10	0.44	45.2%
													0.00		0.00	0.00	11.47			0.0									
	417	351											0.00	0.00	0.00	3.68	11.90	95.1		350.5	**350.5**	CONC	675	0.60	32.8	679.3	1.84	0.30	51.6%
													0.00		0.00	0.00	11.90			0.0									

NOVATECH
Engineers, Planners & Landscape Architects

Fernbank Crossing (Phase 3)- Storm Sewer Design Sheet (Traditional Rational Method)

LOCATION			AREA											FLOW						Total Peak Flow (Q)	PROPOSED SEWER							
Location	From node	To node	Mixed Use	Park N' Ride Paramedic Post Medium Block	Arterial Road ROW	Schools	Parks	Hydro Corridor	Singles Front Yards	Singles Rear Yard	Towns Front Yard	Towns Rear Yard	Total Area	Weighted Runoff Coefficient	Indivi 2.78 AR	Accum 2.78 AR	Time of Concentration	Rain Intensity (mm/hr) 5yr	Rain Intensity (mm/hr) 10yr	Peak Flow		Pipe	Size	Grade	Length	Capacity	Full Flow Velocity	Time of Flow	Q/Qfull
			0.80	0.80	0.90	0.60	0.40	0.20	0.65	0.55	0.70	0.60	(ha)							(L/s)	(L/s)	Type	(mm)	(%)	(m)	(l/s)	(m/s)	(min.)	(%)
	353	399											0.00	0.00	0.00	0.00	10.00			0.0	**0.0**	PVC	300	1.00	64.0	100.9	1.38	0.77	0.0%
													0.00		0.00	0.00	10.00			0.0								
670	399	351							0.70				0.70	0.65	1.26	1.26	10.77	100.3		126.9	**126.9**	PVC	450	1.00	80.5	297.4	1.81	0.74	42.6%
													0.00		0.00	0.00	10.77			0.0								
671, 672	351	347							0.22	0.42			0.64	0.58	1.04	5.99	12.20	93.8		562.1	**562.1**	CONC	750	0.38	81.1	715.9	1.57	0.86	78.5%
													0.00		0.00	0.00	12.20			0.0								
	349	397											0.00	0.00	0.00	0.00	10.00			0.0	**0.0**	PVC	300	1.50	34.8	123.6	1.69	0.34	0.0%
													0.00		0.00	0.00	10.00			0.0								
675,717	397	347							0.66				0.66	0.65	1.19	1.19	10.34	102.4		122.1	**122.1**	PVC	450	0.52	108.5	214.5	1.31	1.38	56.9%
													0.00		0.00	0.00	10.34			0.0								
713, 719, 716, 718	347	395							0.21	0.69			0.90	0.57	1.43	8.62	13.06	90.4		778.9	**778.9**	CONC	900	0.34	74.2	1101.2	1.68	0.74	70.7%
													0.00		0.00	0.00	13.06			0.0								
	395	343											0.00	0.00	0.00	8.62	13.80	87.6		755.2	**755.2**	CONC	900	0.50	9.4	1335.4	2.03	0.08	56.6%
													0.00		0.00	0.00	13.80			0.0								
	345	393											0.00	0.00	0.00	0.00	10.00			0.0	**0.0**	PVC	300	0.65	26.9	81.3	1.11	0.40	0.0%
													0.00		0.00	0.00	10.00			0.0								
720,721	393	343							0.82				0.82	0.65	1.48	1.48	10.40	102.1		151.3	**151.3**	PVC	450	0.60	109.7	230.4	1.40	1.30	65.7%
													0.00		0.00	0.00	10.40			0.0								
	343	391											0.00	0.00	0.00	10.10	13.88	87.4		882.3	**882.3**	CONC	900	0.37	38.3	1148.8	1.75	0.36	76.8%
													0.00		0.00	0.00	13.88			0.0								
109b,722	391	341								0.67			0.67	0.55	1.02	11.12	14.24	86.1		957.6	**957.6**	CONC	900	0.40	48.2	1194.4	1.82	0.44	80.2%
													0.00		0.00	0.00	14.24			0.0								
110	341A	341				2.12							2.12	0.60	3.54	3.54	10.00	104.2		368.4	**368.4**	CONC	675	0.25	12.5	438.5	1.19	0.18	84.0%
													0.00		0.00	0.00	10.00			0.0								
728, 729	341	339							0.28				0.28	0.65	0.51	21.90	19.49	71.4		1563.3	**2818.8**	CONC	1650	0.40	67.8	6013.7	2.72	0.41	46.9%
													0.00		0.00	15.03	19.49		83.5	1255.5								

Q = 2.78 AIR

WHERE : Q = PEAK FLOW IN LITRES PER SECOND (L/s)
A = AREA IN HECTARES (ha)
I = RAINFALL INTENSITY IN MILLIMETERS PER HOUR (mm/hr)
R = WEIGHTED RUNOFF COEFFICIENT

Q = (1/n) A R(2/3)So(1/2)

WHERE :
Q = CAPACITY (L/s)
n = MANNING COEFFICIENT OF ROUGHNESS (0.013)
A = FLOW AREA (m2)

Project: Fernbank Crossing (108180-15)
Designed: LRW
Checked: MAB
Date: July 13 2015

NOVATECH
Engineers, Planners & Landscape Architects

Fernbank Crossing - Storm Sewer Design Sheet (Fixed Tc)

LOCATION			AREA														FLOW								Total Peak Flow (Q) (L/s)	PROPOSED SEWER							
Location	From node	To node	Mixed Use	Park N' Ride Paramedic Post Medium Block	Arterial Road ROW	Schools	Parks	Hydro Corridor	Singles Front Yards	Singles Rear Yard	Towns Front Yard	Towns Rear Yard	Total Area (10 min)	Total Area (15 min)	Weighted Runoff Coefficient	Weighted Runoff Coefficient	2.78 AR	2.78 AR	Rain Intensity (mm/hr)				Peak Flow (10 min)	Peak Flow (15 min)		Pipe	Size	Grade	Length	Capacity	Full Flow Velocity	Time of Flow	Q/Qfull
																			5yr		10yr											
			0.80	0.80	0.90	0.60	0.40	0.20	0.65	0.55	0.70	0.60	(ha)	(ha)	(10 min)	(15 min)	(10 min)	(15 min)	(10 min)	(15 min)	(10 min)	(15 min)	(L/s)	(L/s)		Type	(mm)	(%)	(m)	(l/s)	(m/s)	(min.)	(%)
South Outlet																																	
107	FUT	363		5.15					3.90	1.36			9.05	1.36	0.74	0.55	18.50	2.08	104.19	83.56			1927.66	173.75	**2101.4**	CONC	1350	0.20	58.8	2490.2	1.69	0.58	84.4%
														0.00		0.00	0.00	0.00			122.14	97.85		0.00								
105	391	363							0.22				0.22	0.00	0.65	0.00	0.40	0.00	104.19	83.56			41.42	0.00	**1847.2**	CONC	1050	0.50	120.4	2014.4	2.25	0.89	91.7%
				0.82	5.18								6.00			0.89	14.78	0.00			122.14	97.85	1805.75	0.00								
101	371	369							0.42	0.09			0.42	0.09	0.65	0.55	0.76	0.14	104.19	83.56			79.08	11.50	**90.6**	PVC	375	0.65	53.5	147.5	1.29	0.69	61.4%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
	369	367											0.00	0.00	0.00	0.00	0.00	0.00	104.19	83.56			0.00	0.00	**90.6**	CONC	450	0.20	50.9	133.0	0.81	1.05	68.1%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
102	367	365							0.35	0.18			0.35	0.18	0.65	0.55	0.63	0.28	104.19	83.56			65.90	23.00	**179.5**	CONC	600	0.15	59.8	248.1	0.85	1.17	72.3%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
103	365A	365		1.39									1.39	0.00	0.80	0.00	3.09	0.00	104.19	83.56			322.10	0.00	**322.1**	CONC	600	0.30	8.7	350.8	1.20	0.12	91.8%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
104	365	363							0.18	0.08			0.18	0.08	0.65	0.55	0.33	0.12	104.19	83.56			33.89	10.22	**545.7**	CONC	825	0.15	66.1	580.0	1.05	1.05	94.1%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
108	363	361							0.20				0.20	0.00	0.65	0.00	0.36	0.00	104.19	83.56			37.66	0.00	**4531.9**	CONC	1350	1.74	78.6	7344.9	4.97	0.26	61.7%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
109	361	341							0.34	0.36			0.34	0.36	0.65	0.55	0.61	0.55	104.19	83.56			64.01	45.99	**4641.9**	CONC	1350	1.74	81.1	7344.9	4.97	0.27	63.2%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
111	FUT	341							3.23	1.67			3.23	1.67	0.65	0.55	5.84	2.55	104.19	83.56			608.13	213.36	**821.5**	CONC	825	1.88	86.2	2053.3	3.72	0.39	40.0%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
110	341A	341				2.12							2.12	0.00	0.60	0.00	3.54	0.00	104.19	83.56			368.44	0.00	**368.4**	CONC	675	0.25	12.5	438.5	1.19	0.18	84.0%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
112	341	339							0.18				0.18	0.00	0.65	0.00	0.33	0.00	104.19	83.56			33.89	0.00	**5865.8**	CONC	1650	0.40	67.8	6013.7	2.72	0.41	97.5%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
113	339	337							0.11				0.11	0.00	0.65	0.00	0.20	0.00	104.19	83.56			20.71	0.00	**5886.5**	CONC	1800	0.25	45.2	5995.9	2.28	0.33	98.2%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
114	337	335							0.29				0.29	0.00	0.65	0.00	0.52	0.00	104.19	83.56			54.60	0.00	**5941.1**	CONC	1800	0.25	50.8	5995.9	2.28	0.37	99.1%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
115	335A	335				2.83							2.83	0.00	0.60	0.00	4.72	0.00	104.19	83.56			491.84	0.00	**491.8**	CONC	750	0.25	17.9	580.7	1.27	0.23	84.7%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
116	335	301							0.21				0.21	0.00	0.65	0.00	0.38	0.00	104.19	83.56			39.54	0.00	**6472.4**	CONC	1800	0.30	57.7	6568.2	2.50	0.38	98.5%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
117	FUT	301					1.20		5.13	1.57			5.13	2.77	0.65	0.49	9.27	3.73	104.19	83.56			965.86	312.08	**1277.9**	CONC	975	0.61	54.7	1826.0	2.37	0.38	70.0%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
118	301	**M97**									0.30		0.30	0.00	0.70	0.00	0.00	0.00	104.19	83.56			60.83	0.00	**7811.2**	CONC	1950	0.30	78.3	8131.0	2.64	0.49	96.1%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
119	M97	M98								0.94	0.40		0.40	0.94	0.70	0.55	0.78	1.44	104.19	83.56			81.10	120.09	**8012.4**	CONC	2100	0.20	78.0	8089.5	2.26	0.57	99.0%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
	M98	**M99**											0.00	0.00	0.00	0.00	0.00	0.00	104.19	83.56			0.00	0.00	**8012.4**	CONC	2400	0.15	29.6	10002.3	2.14	0.23	80.1%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								

Q = 2.78 AIR

WHERE : Q = PEAK FLOW IN LITRES PER SECOND (L/s)
A = AREA IN HECTARES (ha)
I = RAINFALL INTENSITY IN MILLIMETERS PER HOUR (mm/hr)
R = WEIGHTED RUNOFF COEFFICIENT

Q = (1/n) A R(2/3)So(1/2)

WHERE : Q = CAPACITY (L/s)
n = MANNING COEFFICIENT OF ROUGHNESS (0.013)
A = FLOW AREA (m2)

Project: Fernbank Crossing (108180-10)
Designed: KJM
Checked: MAB
Date: August 17, 2012

This design sheet is included in support of the downstream boundary conditions for the SSA modelling.

NOVATECH ENGINEERING CONSULTANTS LTD.

Fernbank Crossing - Storm Sewer Design Sheet (Fixed Tc)

LOCATION			AREA														FLOW									PROPOSED SEWER							
Location	From node	To node	Mixed Use	Park N' Ride Paramedic Post Medium Block	Arterial Road ROW	Schools	Parks	Hydro Corridor	Singles Front Yards	Singles Rear Yard	Towns Front Yard	Towns Rear Yard	Total Area (10 min)	Total Area (15 min)	Weighted Runoff Coefficient	Weighted Runoff Coefficient	2.78 AR	2.78 AR	Rain Intensity (mm/hr) 5yr		Rain Intensity (mm/hr) 10yr		Peak Flow (10 min)	Peak Flow (15 min)	Total Peak Flow (Q) (L/s)	Pipe	Size	Grade	Length	Capacity	Full Flow Velocity	Time of Flow	Q/Qfull
			0.80	0.80	0.90	0.60	0.40	0.20	0.65	0.55	0.70	0.60	(ha)	(ha)	(10 min)	(15 min)	(10 min)	(15 min)	(10 min)	(15 min)	(10 min)	(15 min)	(L/s)	(L/s)		Type	(mm)	(%)	(m)	(l/s)	(m/s)	(min.)	(%)
North Outlet																			10.00	15.00	10.00	15.00											
CRT	CRT	287						2.91					0.00	13.95		0.38	0.00	14.54	104.2	83.6			0.0	1215.2	**1215.2**	PVC							
														0.00			0.00	0.00			122.1	97.85		0.0									
1	287	285											0.00	0.00	0.00	0.00	0.00	0.00	104.19	83.56				0.00	**2257.9**	CONC	1200	0.35	76.7	2406.2	2.06	0.62	93.8%
				0.34	3.11								3.45	0.00	0.89	0.00	8.54	0.00	104.19		122.14	97.85	1042.77	0.00								
	285	283											0.00	0.00	0.00	0.00	0.00	0.00	104.19	83.56			0.00	0.00	**2257.9**	CONC	1200	0.35	76.7	2406.2	2.06	0.62	93.8%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
2	283	281		1.11									1.11	0.00	0.80	0.00	2.47	0.00	104.19	83.56			257.22	0.00	**2515.1**	CONC	1350	0.25	41.5	2784.1	1.88	0.37	90.3%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
3	281	275	2.00										2.00	0.00	0.80	0.00	4.45	0.00	104.19	83.56			463.45	0.00	**2978.6**	CONC	1350	0.30	11.0	3049.8	2.06	0.09	97.7%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
4	279	277									0.20		0.20	0.00	0.70	0.00	0.39	0.00	104.19	83.56			40.55	0.00	**40.6**	PVC	250	0.65	69.8	50.0	0.99	1.18	81.1%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
5	277	275									0.14		0.14	0.00	0.70	0.00	0.27	0.00	104.19	83.56			28.39	0.00	**68.9**	PVC	375	0.30	83.0	100.2	0.88	1.57	68.8%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
6	275	273									0.35		0.35	0.00	0.70	0.00	0.68	0.00	104.19	83.56			70.97	0.00	**3118.5**	CONC	1350	0.35	82.8	3294.2	2.23	0.62	94.7%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
7	273	271									0.36		0.36	0.00	0.70	0.00	0.70	0.00	104.19	83.56			72.99	0.00	**3191.5**	CONC	1350	0.35	80.5	3294.2	2.23	0.60	96.9%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
8	271A	271		0.85									0.85	0.00	0.80	0.00	1.89	0.00	104.19	83.56			196.97	0.00	**197.0**	CONC	525	0.25	8.5	224.3	1.00	0.14	87.8%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
9,10	271	**M40**									0.50		0.50	0.00	0.70	0.00	0.97	0.00	104.19	83.56			101.38	0.00	**3489.8**	CONC	1350	0.40	82.6	3521.6	2.38	0.58	99.1%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
11	269A	**M40**						2.91					0.00	2.91	0.00	0.20	0.00	1.62	104.19	83.56			0.00	135.19	**135.2**	CONC	450	0.25	54.5	148.7	0.91	1.00	90.9%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
13	267	265							0.30				0.30	0.00	0.65	0.00	0.54	0.00	104.19	83.56			56.48	0.00	**56.5**	PVC	300	0.65	86.6	81.3	1.11	1.29	69.4%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
14	265	**M41**							0.78	0.40			0.78	0.40	0.65	0.55	1.41	0.61	104.19	83.56			146.86	51.10	**254.4**	CONC	525	0.50	115.4	317.2	1.42	1.35	80.2%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
16	261	259								0.15			0.00	0.15	0.00	0.55	0.00	0.23	104.19	83.56			0.00	19.16	**19.2**	PVC	250	0.65	34.9	50.0	0.99	0.59	38.3%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
	259	257											0.00	0.00	0.00	0.00	0.00	0.00	104.19	83.56			0.00	0.00	**19.2**	PVC	250	0.65	10.4	50.0	0.99	0.18	38.3%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
17	257	253							0.79				0.79	0.00	0.65	0.00	1.43	0.00	104.19	83.56			148.74	0.00	**167.9**	CONC	525	0.30	115.2	245.7	1.10	1.75	68.3%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
18	255	253							0.19	0.15			0.19	0.15	0.65	0.55	0.34	0.23	104.19	83.56			35.77	19.16	**54.9**	PVC	300	0.65	45.3	81.3	1.11	0.68	67.5%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
19	253	251							0.21	0.38			0.21	0.38	0.65	0.55	0.38	0.58	104.19	83.56			39.54	48.55	**310.9**	CONC	600	0.30	80.5	350.8	1.20	1.12	88.6%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
20	251	**M42**							0.61				0.61	0.00	0.65	0.00	1.10	0.00	104.19	83.56			114.85	0.00	**425.8**	CONC	600	0.50	77.2	452.9	1.55	0.83	94.0%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								

This design sheet is included in support of the downstream boundary conditions for the SSA modelling.

NOVATECH ENGINEERING CONSULTANTS LTD.

Fernbank Crossing - Storm Sewer Design Sheet (Fixed Tc)

LOCATION			AREA														FLOW									PROPOSED SEWER							
Location	From node	To node	Mixed Use	Park N' Ride Paramedic Post Medium Block	Arterial Road ROW	Schools	Parks	Hydro Corridor	Singles Front Yards	Singles Rear Yard	Towns Front Yard	Towns Rear Yard	Total Area (10 min)	Total Area (15 min)	Weighted Runoff Coefficient	Weighted Runoff Coefficient	2.78 AR	2.78 AR	Rain Intensity (mm/hr)				Peak Flow (10 min)	Peak Flow (15 min)	Total Peak Flow (Q) (L/s)	Pipe	Size	Grade	Length	Capacity	Full Flow Velocity	Time of Flow	Q/Qfull
																			5yr		10yr											
			0.80	0.80	0.90	0.60	0.40	0.20	0.65	0.55	0.70	0.60	(ha)	(ha)	(10 min)	(15 min)	(10 min)	(15 min)	(10 min)	(15 min)	(10 min)	(15 min)	(L/s)	(L/s)		Type	(mm)	(%)	(m)	(l/s)	(m/s)	(min.)	(%)
21	245	243								0.32			0.00	0.32	0.00	0.55	0.00	0.49	104.19	83.56			0.00	40.88	**40.9**	PVC	250	0.65	66.9	50.0	0.99	1.13	81.7%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
	243	241							0.35				0.35	0.00	0.65	0.00	0.63	0.00	104.19	83.56			65.90	0.00	**106.8**	PVC	375	0.65	12.9	147.5	1.29	0.17	72.4%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
22	241	**M44**							0.30	0.30			0.30	0.30	0.65	0.55	0.54	0.46	104.19	83.56			56.48	38.33	**201.6**	CONC	450	1.00	67.3	297.4	1.81	0.62	67.8%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
24	233A	233	3.32										3.32	0.00	0.80	0.00	7.38	0.00	104.19	83.56			769.33	0.00	**769.3**	CONC	825	0.45	8.5	1004.6	1.82	0.08	76.6%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
25	233	231									0.35		0.35	0.00	0.70	0.00	0.68	0.00	104.19	83.56			70.97	0.00	**840.3**	CONC	825	0.45	114.0	1004.6	1.82	1.04	83.6%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
26	231	229									0.24		0.24	0.00	0.70	0.00	0.47	0.00	104.19	83.56			48.66	0.00	**889.0**	CONC	825	0.50	82.0	1058.9	1.92	0.71	84.0%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
27	237A	237	1.58										1.58	0.00	0.80	0.00	3.51	0.00	104.19	83.56			366.13	0.00	**366.1**	CONC	600	0.50	9.0	452.9	1.55	0.10	80.8%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
28	237	235									0.15		0.15	0.00	0.70	0.00	0.29	0.00	104.19	83.56			30.41	0.00	**396.5**	CONC	600	1.40	49.0	757.9	2.60	0.31	52.3%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
29	235	229							0.37				0.37	0.00	0.65	0.00	0.67	0.00	104.19	83.56			69.66	0.00	**466.2**	CONC	600	1.85	88.1	871.3	2.99	0.49	53.5%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
30	229	227							0.57				0.57	0.00	0.65	0.00	1.03	0.00	104.19	83.56			107.32	0.00	**1462.5**	CONC	975	0.50	117.4	1653.2	2.15	0.91	88.5%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
31	227	**M45**							0.73	0.47			0.73	0.47	0.65	0.55	1.32	0.72	104.19	83.56			137.44	60.05	**1660.0**	CONC	975	0.65	120.0	1884.9	2.45	0.82	88.1%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
	223	221											0.00	0.00	0.00	0.00	0.00	0.00	104.19	83.56			0.00	0.00	**0.0**	PVC	250	0.65	57.1	50.0	0.99	0.96	0.0%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
	221	219											0.00	0.00	0.00	0.00	0.00	0.00	104.19	83.56			0.00	0.00	**0.0**	PVC	250	0.65	8.6	50.0	0.99	0.15	0.0%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
33	219	217							0.41	0.50			0.41	0.50	0.65	0.55	0.74	0.76	104.19	83.56			77.19	63.88	**141.1**	PVC	375	1.00	76.8	182.9	1.60	0.80	77.1%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
34	217	213							0.48				0.48	0.00	0.65	0.00	0.87	0.00	104.19	83.56			90.37	0.00	**231.4**	CONC	450	1.00	71.7	297.4	1.81	0.66	77.8%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
35	215	213								0.41			0.00	0.41	0.00	0.55	0.00	0.63	104.19	83.56			0.00	52.38	**52.4**	PVC	300	0.65	42.6	81.3	1.11	0.64	64.4%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
36	213	211							0.25	0.14			0.25	0.14	0.65	0.55	0.45	0.21	104.19	83.56			47.07	17.89	**348.8**	CONC	600	0.50	64.9	452.9	1.55	0.70	77.0%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
37	211	209							0.25	0.30			0.25	0.30	0.65	0.55	0.45	0.46	104.19	83.56			47.07	38.33	**434.2**	CONC	675	0.30	78.4	480.3	1.30	1.00	90.4%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
	209	207											0.00	0.00	0.00	0.00	0.00	0.00	104.19	83.56			0.00	0.00	**434.2**	CONC	675	0.30	8.7	480.3	1.30	0.11	90.4%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
38	207	205							0.41	0.21			0.41	0.21	0.65	0.55	0.74	0.32	104.19	83.56			77.19	26.83	**538.2**	CONC	675	0.45	65.8	588.3	1.59	0.69	91.5%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
	205	203											0.00	0.00	0.00	0.00	0.00	0.00	104.19	83.56			0.00	0.00	**538.2**	CONC	675	0.45	6.0	588.3	1.59	0.06	91.5%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
	203	**M46**							0.21				0.21	0.00	0.65	0.00	0.38	0.00	104.19	83.56			39.54	0.00	**577.7**	CONC	750	0.25	66.3	580.7	1.27	0.87	99.5%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								

This design sheet is included in support of the downstream boundary conditions for the SSA modelling.

NOVATECH ENGINEERING CONSULTANTS LTD.

Fernbank Crossing - Storm Sewer Design Sheet (Fixed Tc)

LOCATION			AREA														FLOW									PROPOSED SEWER							
Location	From node	To node	Mixed Use	Park N' Ride Paramedic Post Medium Block	Arterial Road ROW	Schools	Parks	Hydro Corridor	Singles Front Yards	Singles Rear Yard	Towns Front Yard	Towns Rear Yard	Total Area (10 min)	Total Area (15 min)	Weighted Runoff Coefficient	Weighted Runoff Coefficient	2.78 AR	2.78 AR	Rain Intensity (mm/hr) 5yr		Rain Intensity (mm/hr) 10yr		Peak Flow (10 min)	Peak Flow (15 min)	**Total Peak Flow (Q) (L/s)**	Pipe	Size	Grade	Length	Capacity	Full Flow Velocity	Time of Flow	Q/Qfull
			0.80	0.80	0.90	0.60	0.40	0.20	0.65	0.55	0.70	0.60	(ha)	(ha)	(10 min)	(15 min)	(10 min)	(15 min)	(10 min)	(15 min)	(10 min)	(15 min)	(L/s)	(L/s)		Type	(mm)	(%)	(m)	(l/s)	(m/s)	(min.)	(%)
South Outlet																																	
107	FUT	363		5.15					3.90	1.36			9.05	1.36	0.74	0.55	18.50	2.08	104.19	83.56			1927.66	173.75	**2101.4**	CONC	1350	0.20	58.8	2490.2	1.69	0.58	84.4%
														0.00		0.00	0.00	0.00			122.14	97.85		0.00								
105	391	363							0.22				0.22	0.00	0.65	0.00	0.40	0.00	104.19	83.56			41.42	0.00	**1847.2**	CONC	1050	0.50	120.4	2014.4	2.25	0.89	91.7%
				0.82	5.18								6.00			0.89	14.78	0.00			122.14	97.85	1805.75	0.00								
101	371	369							0.42	0.09			0.42	0.09	0.65	0.55	0.76	0.14	104.19	83.56			79.08	11.50	**90.6**	PVC	375	0.65	53.5	147.5	1.29	0.69	61.4%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
	369	367											0.00	0.00	0.00	0.00	0.00	0.00	104.19	83.56			0.00	0.00	**90.6**	CONC	450	0.20	50.9	133.0	0.81	1.05	68.1%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
102	367	365							0.35	0.18			0.35	0.18	0.65	0.55	0.63	0.28	104.19	83.56			65.90	23.00	**179.5**	CONC	600	0.15	59.8	248.1	0.85	1.17	72.3%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
103	365A	365		1.39									1.39	0.00	0.80	0.00	3.09	0.00	104.19	83.56			322.10	0.00	**322.1**	CONC	600	0.30	8.7	350.8	1.20	0.12	91.8%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
104	365	363							0.18	0.08			0.18	0.08	0.65	0.55	0.33	0.12	104.19	83.56			33.89	10.22	**545.7**	CONC	825	0.15	66.1	580.0	1.05	1.05	94.1%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
108	363	361							0.20				0.20	0.00	0.65	0.00	0.36	0.00	104.19	83.56			37.66	0.00	**4531.9**	CONC	1350	1.74	78.6	7344.9	4.97	0.26	61.7%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
109	361	341							0.34	0.36			0.34	0.36	0.65	0.55	0.61	0.55	104.19	83.56			64.01	45.99	**4641.9**	CONC	1350	1.74	81.1	7344.9	4.97	0.27	63.2%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
111	FUT	341							3.23	1.67			3.23	1.67	0.65	0.55	5.84	2.55	104.19	83.56			608.13	213.36	**821.5**	CONC	825	1.88	86.2	2053.3	3.72	0.39	40.0%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
110	341A	341				2.12							2.12	0.00	0.60	0.00	3.54	0.00	104.19	83.56			368.44	0.00	**368.4**	CONC	675	0.25	12.5	438.5	1.19	0.18	84.0%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
112	341	339							0.18				0.18	0.00	0.65	0.00	0.33	0.00	104.19	83.56			33.89	0.00	**5865.8**	CONC	1650	0.40	67.8	6013.7	2.72	0.41	97.5%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
113	339	337							0.11				0.11	0.00	0.65	0.00	0.20	0.00	104.19	83.56			20.71	0.00	**5886.5**	CONC	1800	0.25	45.2	5995.9	2.28	0.33	98.2%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
114	337	335							0.29				0.29	0.00	0.65	0.00	0.52	0.00	104.19	83.56			54.60	0.00	**5941.1**	CONC	1800	0.25	50.8	5995.9	2.28	0.37	99.1%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
115	335A	335				2.83							2.83	0.00	0.60	0.00	4.72	0.00	104.19	83.56			491.84	0.00	**491.8**	CONC	750	0.25	17.9	580.7	1.27	0.23	84.7%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
116	335	301							0.21				0.21	0.00	0.65	0.00	0.38	0.00	104.19	83.56			39.54	0.00	**6472.4**	CONC	1800	0.30	57.7	6568.2	2.50	0.38	98.5%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
117	FUT	301					1.20		5.13	1.57			5.13	2.77	0.65	0.49	9.27	3.73	104.19	83.56			965.86	312.08	**1277.9**	CONC	975	0.61	54.7	1826.0	2.37	0.38	70.0%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
118	301	**M97**									0.30		0.30	0.00	0.70	0.00	0.58	0.00	104.19	83.56			60.83	0.00	**7811.2**	CONC	1950	0.30	78.3	8131.0	2.64	0.49	96.1%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
119	M97	M98								0.94	0.40		0.40	0.94	0.70	0.55	0.78	1.44	104.19	83.56			81.10	120.09	**8012.4**	CONC	2100	0.20	78.0	8089.5	2.26	0.57	99.0%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								
	M98	**M99**											0.00	0.00	0.00	0.00	0.00	0.00	104.19	83.56			0.00	0.00	**8012.4**	CONC	2400	0.15	29.6	10002.3	2.14	0.23	80.1%
														0.00		0.90	0.00	0.00			122.14	97.85		0.00								

Q = 2.78 AIR

WHERE : Q = PEAK FLOW IN LITRES PER SECOND (L/s)
A = AREA IN HECTARES (ha)
I = RAINFALL INTENSITY IN MILLIMETERS PER HOUR (mm/hr)
R = WEIGHTED RUNOFF COEFFICIENT

Q = (1/n) A R(2/3)So(1/2)

WHERE : Q = CAPACITY (L/s)
n = MANNING COEFFICIENT OF ROUGHNESS (0.013)
A = FLOW AREA (m2)

Project: Fernbank Crossing (108180-10)
Designed: KJM
Checked: MAB
Date: August 17, 2012

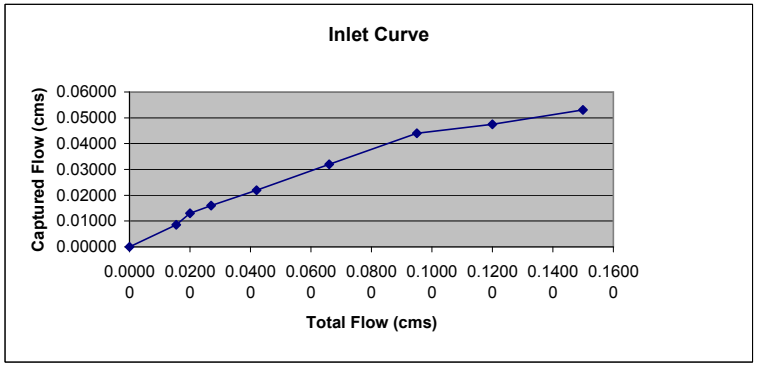
This design sheet is included in support of the downstream boundary conditions for the SSA modelling.

NOVATECH ENGINEERING CONSULTANTS LTD.

Fernbank Crossings
Inlet Curves

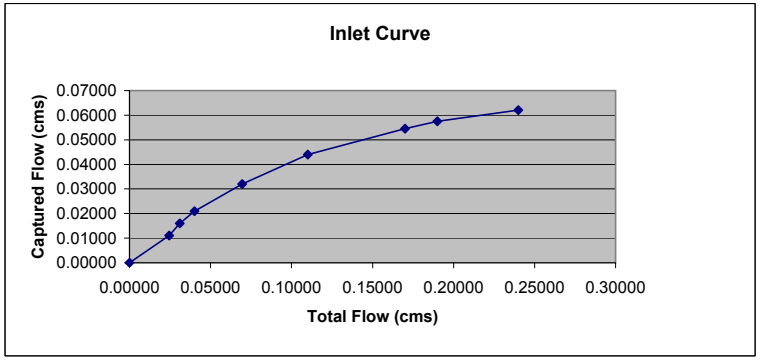
Mountable Curb with Gutter
Gutter Grade= 0.008

Sx=	**0.03**								
T	Qg	Qc		Q	Q	=	QTOTAL		
m	m^3/s	m^3/s		Captured	Bypass		Total		
0.00	0	0	[	0.00000	0.00000	=	0.00000	]
0.50	0.0155	0.0085	[	0.00850	0.00700	=	0.01550	]
0.75	0.02	0.013	[	0.01300	0.00700	=	0.02000	]
1.00	0.027	0.016	[	0.01600	0.01100	=	0.02700	]
1.50	0.042	0.022	[	0.02200	0.02000	=	0.04200	]
2.00	0.066	0.032	[	0.03200	0.03400	=	0.06600	]
2.50	0.095	0.044	[	0.04400	0.05100	=	0.09500	]
2.70	0.12	0.0475	[	0.04750	0.07250	=	0.12000	]
3.00	0.15	0.053	[	0.05300	0.09700	=	0.15000	]



Barrier Curb with Gutter
Gutter Grade= 0.03

Sx=	**0.03**								
T	Qg	Qc		QIDi	QIDii	=	QTOTAL		
m	m^3/s	m^3/s		Captured	Bypass		Total		
0.00	0	0	[	0.00000	0.00000	=	0.00000	]
0.50	0.0245	0.011	[	0.01100	0.01350	=	0.02450	]
0.75	0.031	0.016	[	0.01600	0.01500	=	0.03100	]
1.00	0.04	0.021	[	0.02100	0.01900	=	0.04000	]
1.50	0.0695	0.032	[	0.03200	0.03750	=	0.06950	]
2.00	0.11	0.044	[	0.04400	0.06600	=	0.11000	]
2.50	0.17	0.0545	[	0.05450	0.11550	=	0.17000	]
2.70	0.19	0.0575	[	0.05750	0.13250	=	0.19000	]
3.00	0.24	0.062	[	0.06200	0.17800	=	0.24000	]

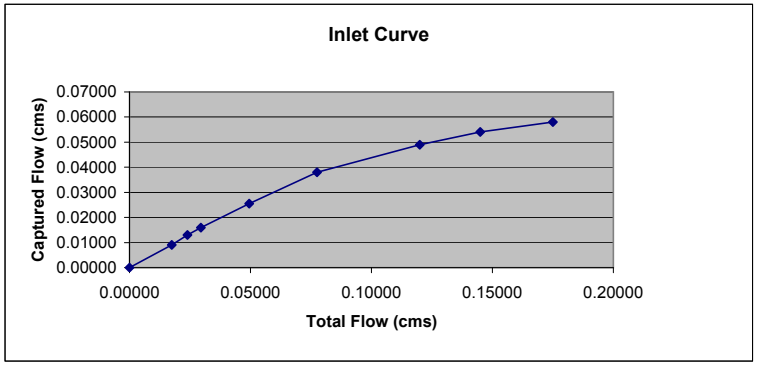


Fernbank Crossings
Inlet Curves

Barrier Curb with Gutter
Gutter Grade= 0.015

Sx=	**0.03**	
T	Qg	Qc
m	m^3/s	m^3/s
0.00	0	0
0.50	0.0175	0.009
0.75	0.024	0.013
1.00	0.0295	0.016
1.50	0.0495	0.0255
2.00	0.0775	0.038
2.50	0.12	0.049
2.70	0.145	0.054
3.00	0.175	0.058

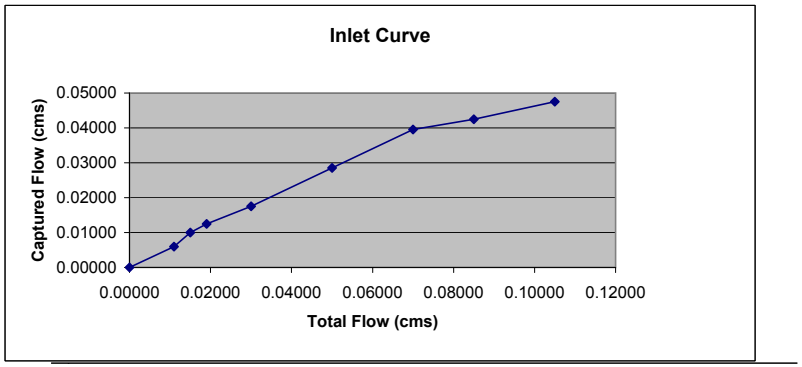
	QIDi	QIDii		QTOTAL	
	Captured	Bypass		Total	
[	0.00000	0.00000	=	0.00000	]
[	0.00900	0.00850	=	0.01750	]
[	0.01300	0.01100	=	0.02400	]
[	0.01600	0.01350	=	0.02950	]
[	0.02550	0.02400	=	0.04950	]
[	0.03800	0.03950	=	0.07750	]
[	0.04900	0.07100	=	0.12000	]
[	0.05400	0.09100	=	0.14500	]
[	0.05800	0.11700	=	0.17500	]

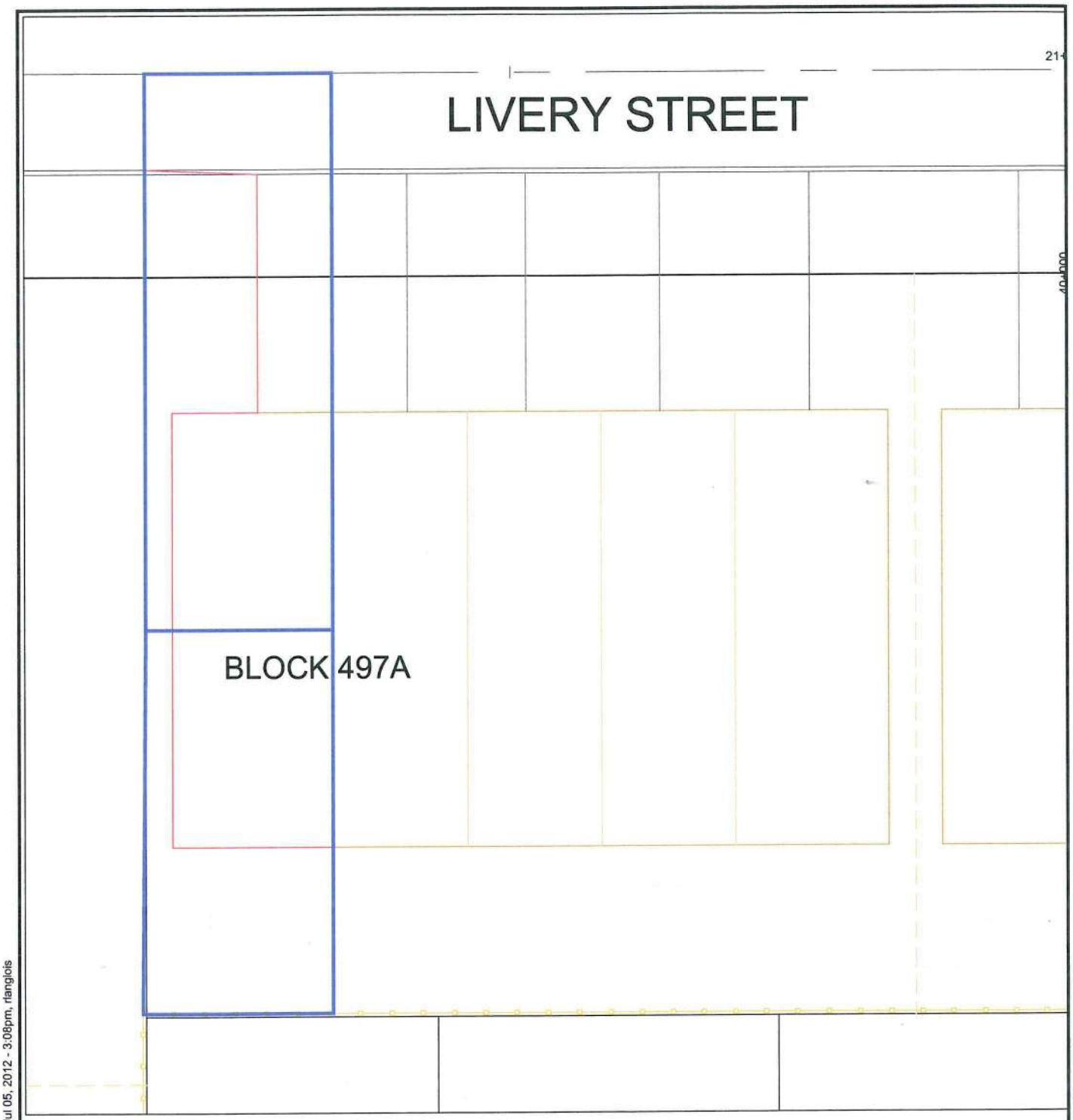


Barrier Curb with Gutter
Gutter Grade= 0.0065

Sx=	**0.03**	
T	Qg	Qc
m	m^3/s	m^3/s
0.00	0	0
0.50	0.011	0.006
0.75	0.015	0.01
1.00	0.019	0.0125
1.50	0.03	0.0175
2.00	0.05	0.0285
2.50	0.07	0.0395
2.70	0.085	0.0425
3.00	0.105	0.0475

	QIDi	QIDii		QTOTAL	
	Captured	Bypass		Total	
[	0.00000	0.00000	=	0.00000	]
[	0.00600	0.00500	=	0.01100	]
[	0.01000	0.00500	=	0.01500	]
[	0.01250	0.00650	=	0.01900	]
[	0.01750	0.01250	=	0.03000	]
[	0.02850	0.02150	=	0.05000	]
[	0.03950	0.03050	=	0.07000	]
[	0.04250	0.04250	=	0.08500	]
[	0.04750	0.05750	=	0.10500	]





FRONTYARD AREA = 207.151 m²
AREA OF IMPERVIOUSNESS = 141.718 m²
TOTAL IMPERVIOUSNESS = 68.4 %

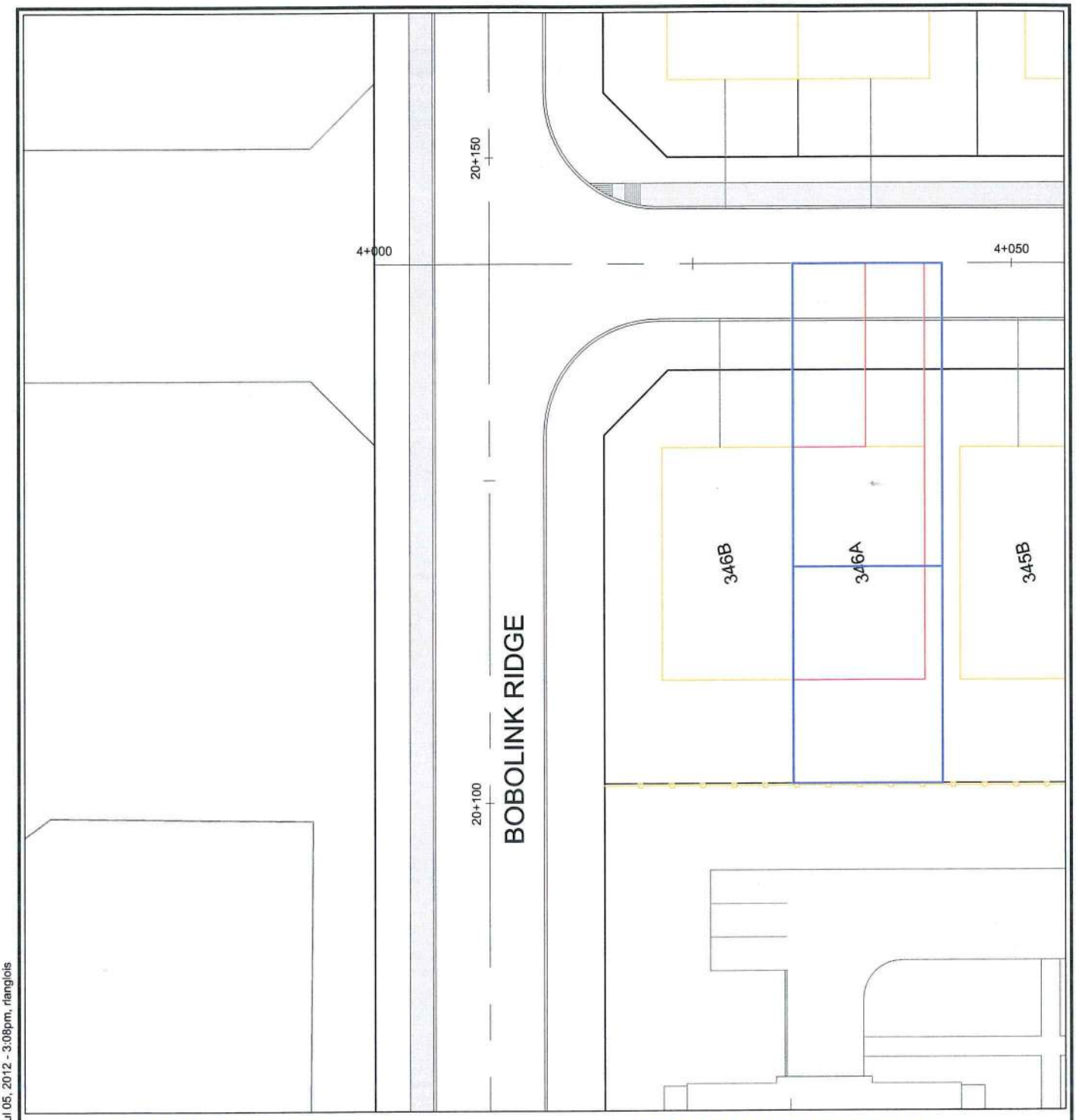
REARYARD AREA = 144.070 m²
AREA OF IMPERVIOUSNESS = 69.418 m²
TOTAL IMPERVIOUSNESS = 48.2 %

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

FERNBANK LANDS

EXAMPLE LOT 1 - TOWNS

JULY 2012	108180	TOWN 1



REARYARD AREA = 196.103 m²
AREA OF IMPERVIOUSNESS = 90.238 m²
TOTAL IMPERVIOUSNESS = 46.0 %

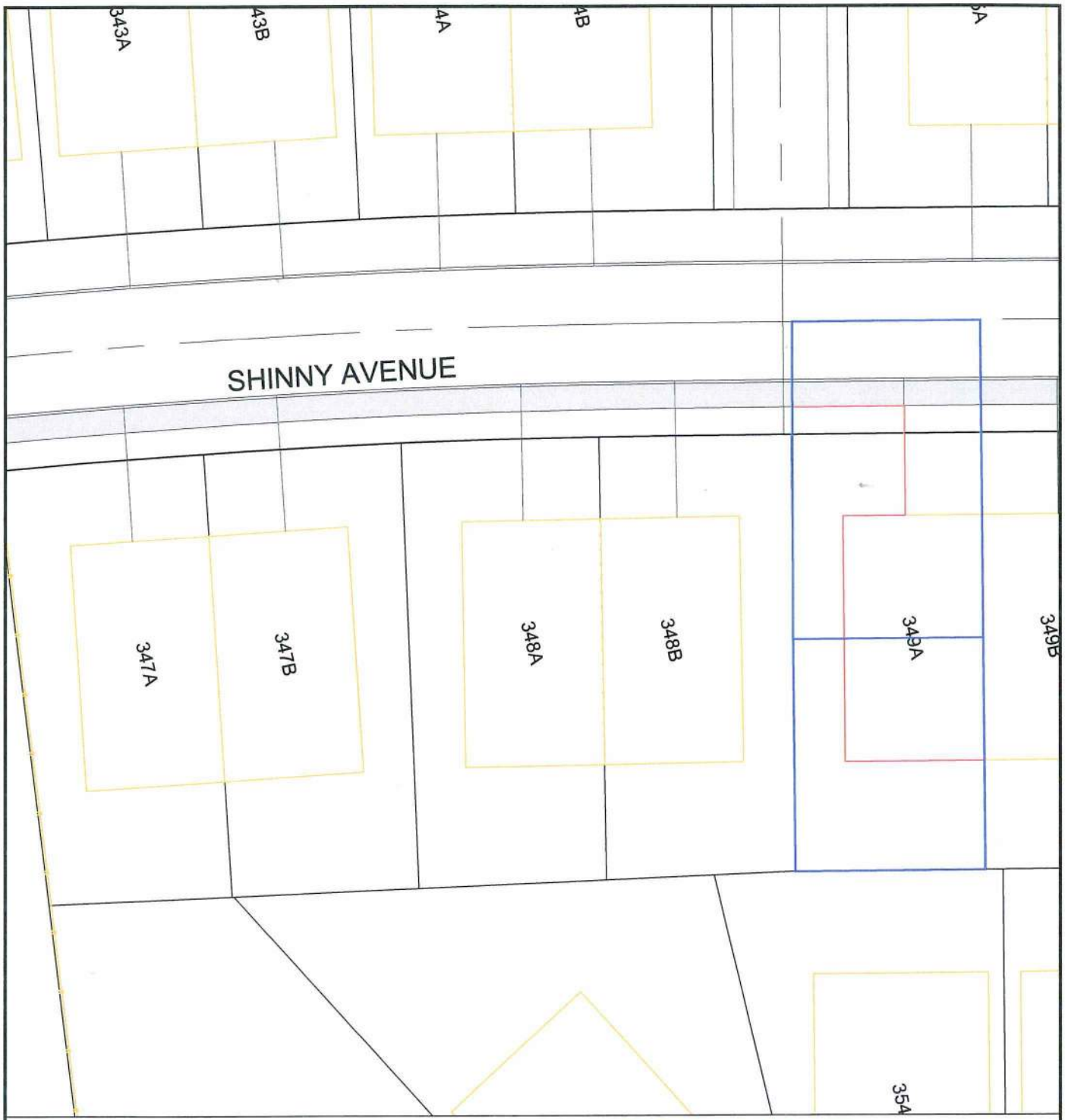
FRONTYARD AREA = 274.822 m²
AREA OF IMPERVIOUSNESS = 160.712 m²
TOTAL IMPERVIOUSNESS = 58.5 %

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

FERNBANK LANDS

EXAMPLE LOT 2 - TOWNS

JULY 2012	108180	TOWN 2



REARYARD AREA = 238.850m²
AREA OF IMPERVIOUSNESS = 92.700 m²
TOTAL IMPERVIOUSNESS = 38.8 %

FRONTYARD AREA = 325.1 m²
AREA OF IMPERVIOUSNESS = 225.272 m²
TOTAL IMPERVIOUSNESS = 69.3 %

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

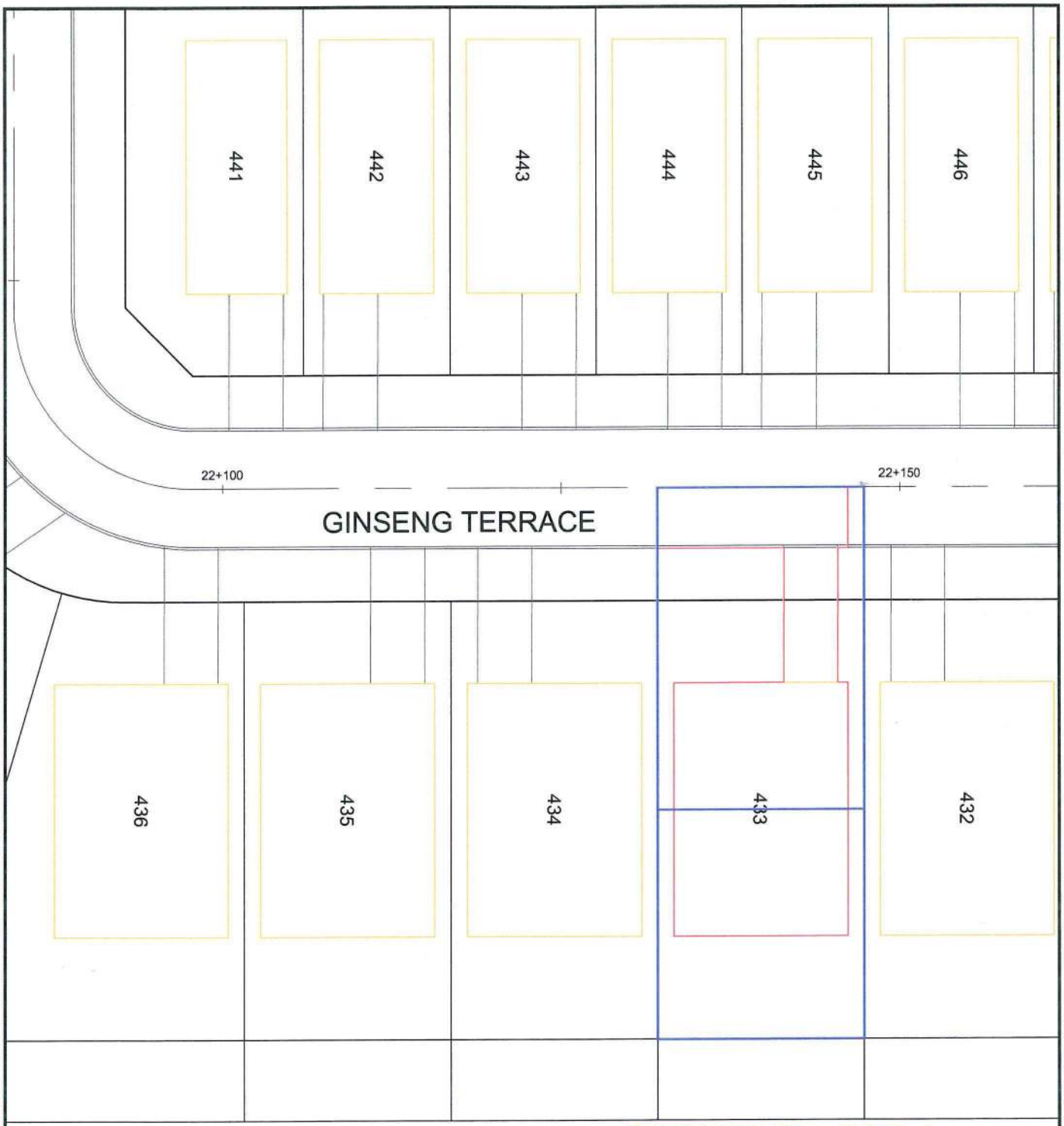
FERNBANK LANDS

EXAMPLE LOT 3 - TOWNS

JULY 2012	108180	TOWN 3

M:\2008\108180\CAD\design\SWM\108180-AVG-TIMP.dwg, Towns3, Jul 05, 2012 - 3:08pm, rlanglois

SHT8X11.DWG - 216mmX278mm



REARYARD AREA = 255.437 m²
AREA OF IMPERVIOUSNESS =118.863 m²
TOTAL IMPERVIOUSNESS = 46.6 %

FRONTYRARD AREA = 358.375 m²
AREA OF IMPERVIOUSNESS = 220.602 m²
TOTAL IMPERVIOUSNESS = 61.6 %

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

FERNBANK LANDS

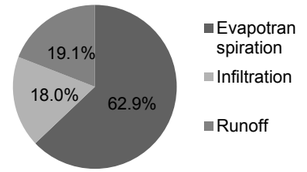
EXAMPLE LOT- SINGLE

JULY 2012	108180	SINGLE

Water Balance Calculations: Stittsville South (Area 6) - Faulkner Drain Upstream Flewellyn Road

Pre-Development

Landuse	Drainage Area % of Watershed	Water Holding Capacity (HSG "C")	Infiltration Factor Classification: Land Cover	Soils (Varied)	Topography (Rolling Land)	Infiltration Factor
Mature Forest	10.0%	400 mm	0.20	0.20	0.20	**0.49**
Pasture/Meadow	85.0%	250 mm	0.10	0.20	0.20	
Urban Lawns	0.0%	125 mm	0.10	0.20	0.20	**Runoff Factor**
Imp. Areas	5.0%	0 mm	0.00	0.00	0.00	**0.52**
Average		**253 mm**	**0.11**	**0.19**	**0.19**	

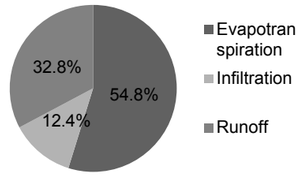


Ottawa CDA (6105976) 1971-2000

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Total Precipitation (mm)	**P**	64	52	65	68	81	91	89	88	87	79	77	74	**914**
Potential Evapotranspiration (mm)	**PE**	0	0	0	0	112	129	140	115	72	43	0	0	**610**
Total Precip. - Potential ET (mm)	P-PE	64	52	65	68	-31	-38	-51	-27	15	36	77	74	
Soil Moisture Storage (mm)	ST	253	253	253	253	224	192	157	141	156	192	253	253	
Change in Soil Moisture Storage (mm)	ΔST	0	0	0	0	-29	-31	-35	-16	15	36	61	0	
Deficit (mm)	D	0	0	0	0	2	7	16	11	0	0	0	0	**35**
Actual Evapotranspiration (mm)	**AE**	0	0	0	0	110	122	124	104	72	43	0	0	**575**
Water Surplus (mm)	**S**	64	52	65	68	0	0	0	0	0	0	16	74	**339**
Annual Infiltration (mm)	**I**													**164**
Annual Runoff (mm)	**R**													**175**

Post-Development

Landuse	% of Watershed	Water Holding Capacity (HSG "B")	Infiltration Factor Classification: Land Cover	Soils (Varied)	Topography (Rolling Land)	Infiltration Factor
Mature Forest	0.0%	400 mm	0.20	0.20	0.20	**0.28**
Pasture/Meadow	0.0%	250 mm	0.10	0.20	0.20	
Urban Lawns	50.0%	75 mm	0.10	0.25	0.20	**Runoff Factor**
Imp. Areas	50.0%	0 mm	0.00	0.00	0.00	**0.73**
Average		**38 mm**	**0.05**	**0.13**	**0.10**	



Ottawa CDA (6105976) 1971-2000

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Total Precipitation (mm)	**P**	64	52	65	68	81	91	89	88	87	79	77	74	**914**
Potential Evapotranspiration (mm)	**PE**	0	0	0	0	112	129	140	115	72	43	0	0	**610**
Total Precip. - Potential Evap. (mm)	P-PE	64	52	65	68	-31	-38	-51	-27	15	36	77	74	
Soil Moisture Storage (mm)	ST	38	38	38	38	16	6	1	1	16	38	38	38	
Change in Soil Moisture Storage (mm)	ΔST	0	0	0	0	-21	-11	-4	-1	15	22	0	0	
Deficit (mm)	D	0	0	0	0	10	27	46	26	0	0	0	0	**109**
Actual Evapotranspiration (mm)	**AE**	0	0	0	0	102	102	93	88	72	43	0	0	**501**
Water Surplus (mm)	**S**	64	52	65	68	0	0	0	0	0	14	77	74	**413**
Annual Infiltration (mm)	**I**													**114**
Annual Runoff (mm)	**R**													**300**

Notes:
1) Uses measured average monthly total precipitation and potential evaporation data (converted to evapotranspiration based on a cover coefficient of 1.0).
2) Actual evapotranspiration and water surplus calculated using the Thornthwaite & Mather (1957) methodology.
3) Runoff and infiltration calculated as per the MOE SWM Planning and Design Manual (2003) methodology.
4) Impervious areas consist of rooftops, roads, and driveways.

Annual Summary

Scenario	Precipitation	Evapotranspiration		Water Surplus		Infiltration		Runoff	
Pre-Development	914 mm	575 mm	62.9%	339 mm	37.1%	164 mm	18.0%	175 mm	19.1%
Post-Development	914 mm	501 mm	54.8%	413 mm	45.2%	114 mm	12.4%	300 mm	32.8%
Difference (Post - Pre)	0 mm	-74 mm	-8.1%	74 mm	8.1%	-51 mm	-5.5%	125 mm	13.7%

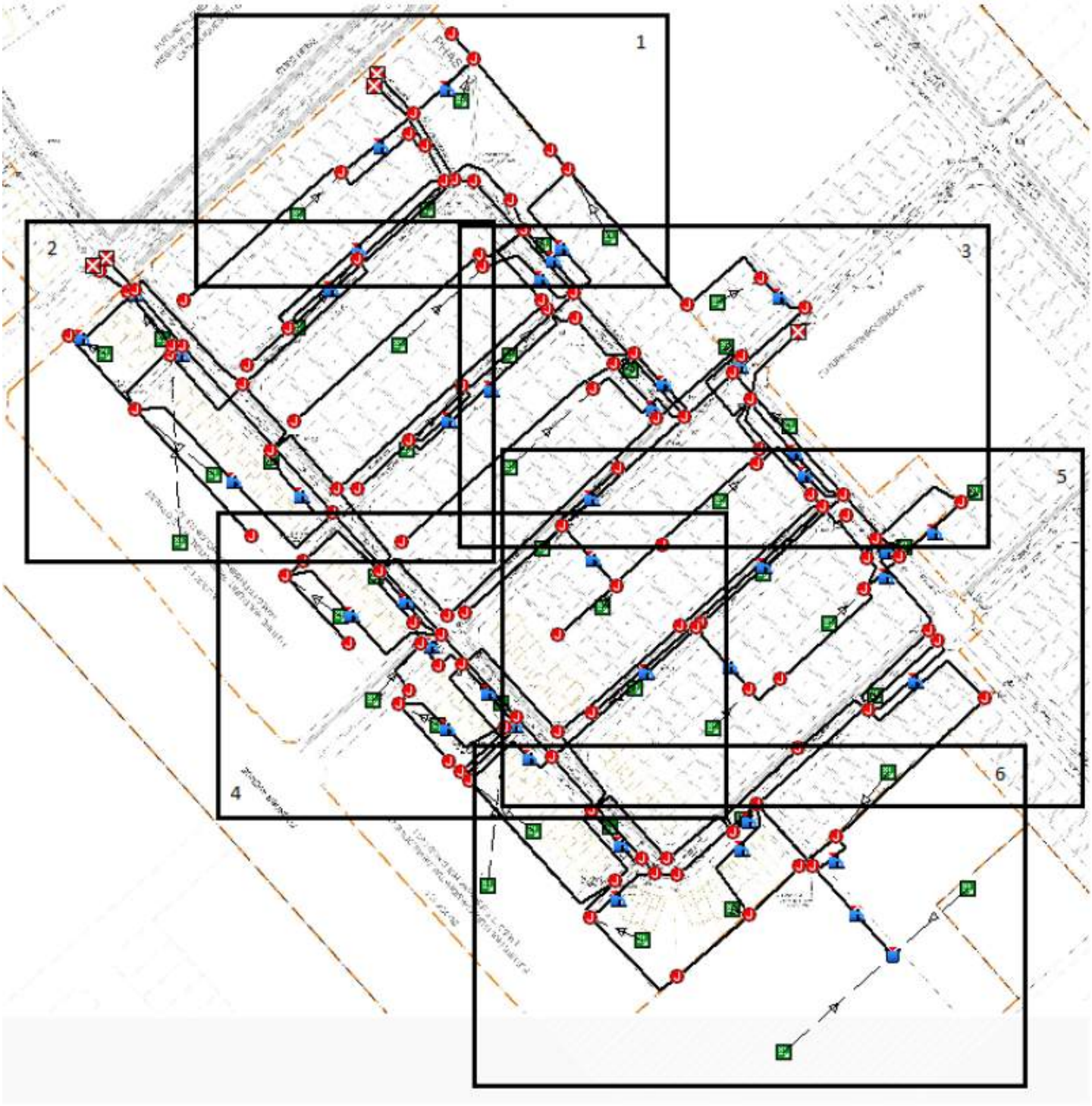
Thornthwaite, C.W., and Mather, J.R. 1957. Instructions and tables for computing potential evapotranspiration and the water balance.
Centerton, N.J., Laboratory of Climatology, Publications in Climatology, v.10, no.3, p.185-311

Appendix C

Autodesk Storm and Sanitary Analysis Model

Schematics:

Model Results:



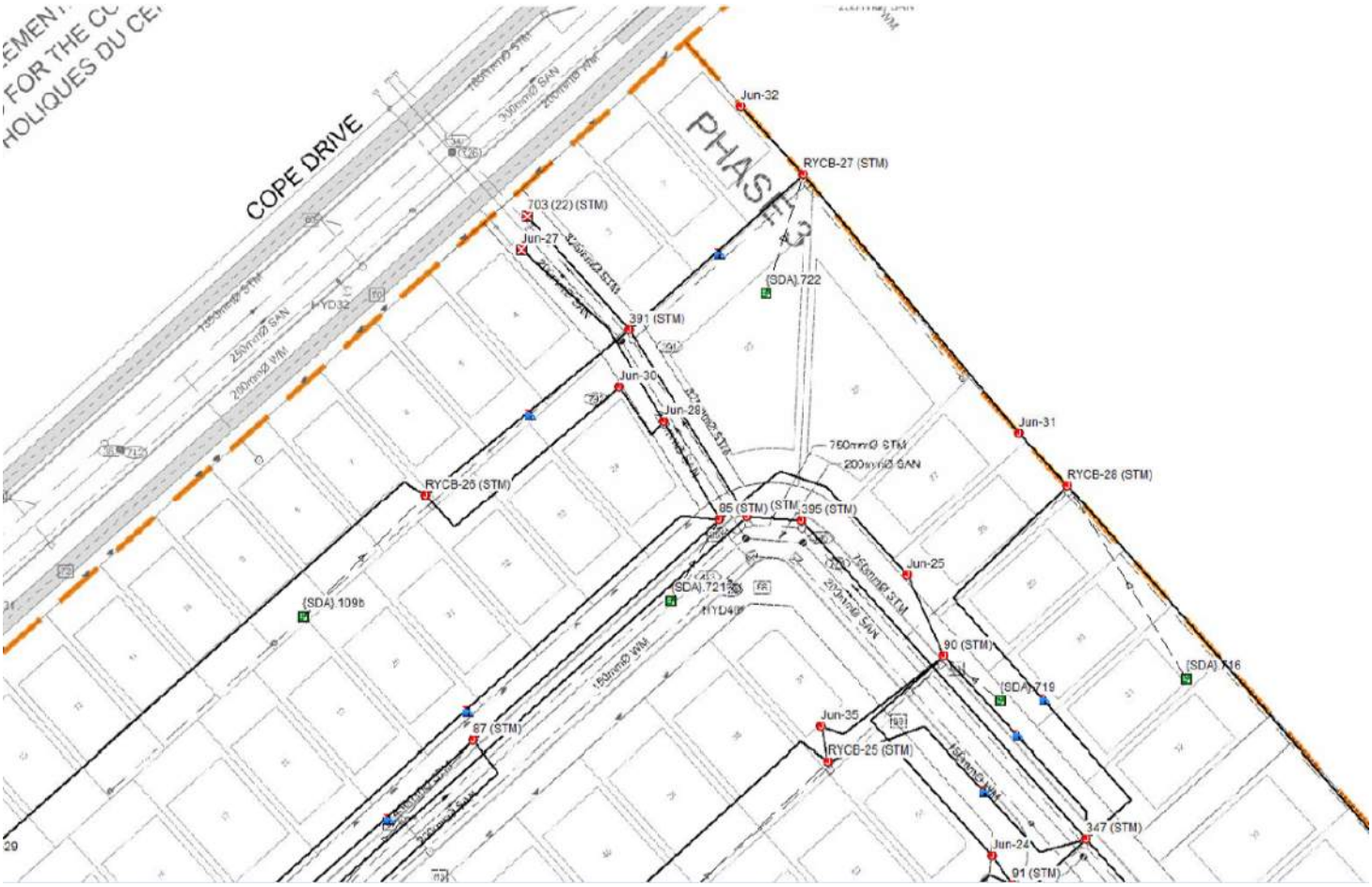
NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6

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

FERNBANK CROSSING PHASE 3

MODEL SCHEMATIC KEY PLAN

DEC 2014	108180	FIGURE C1



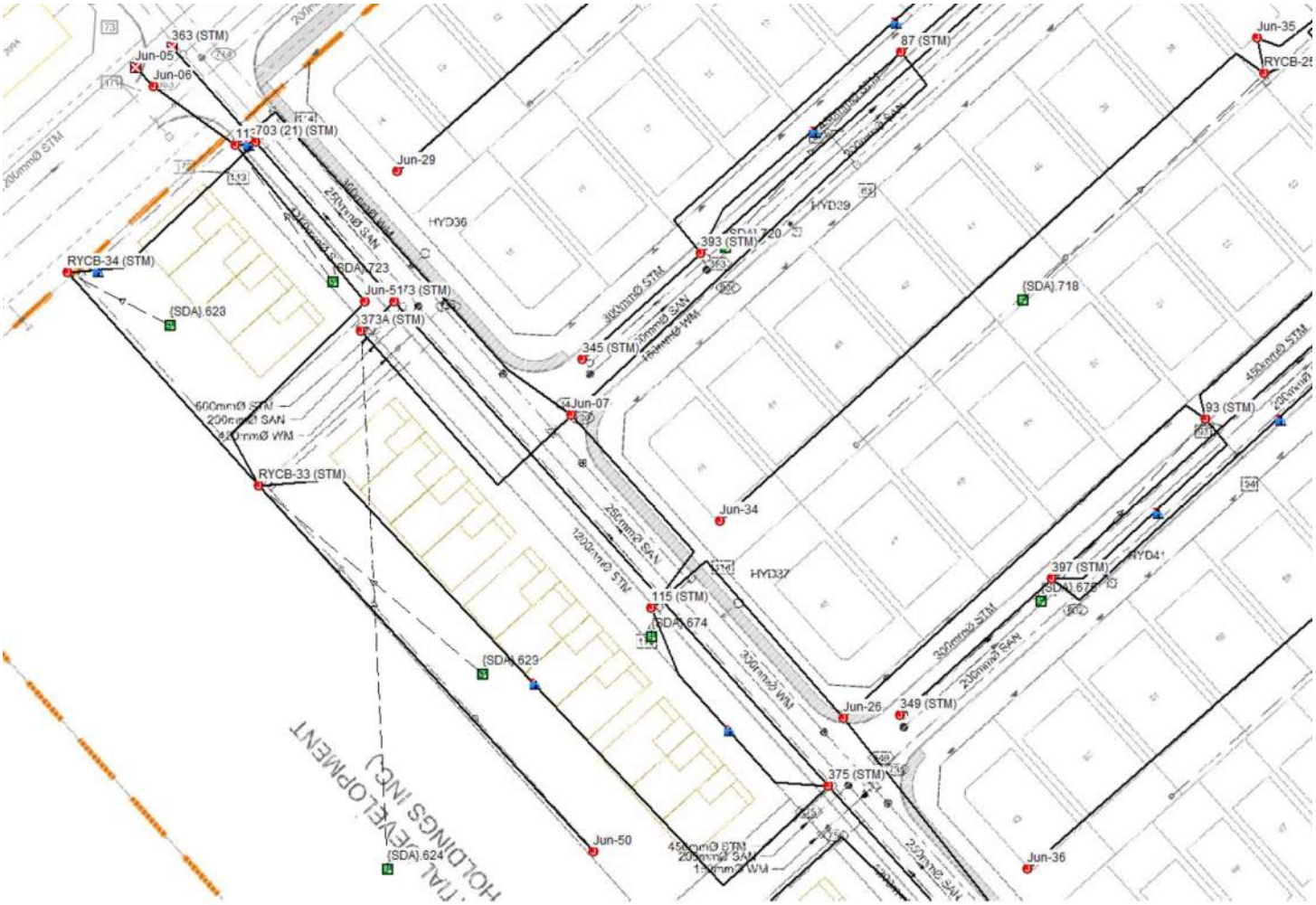
NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6

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

FERNBANK CROSSING PHASE 3

MODEL SCHEMATIC SHEET 1

DEC 2014	108180	FIGURE C2



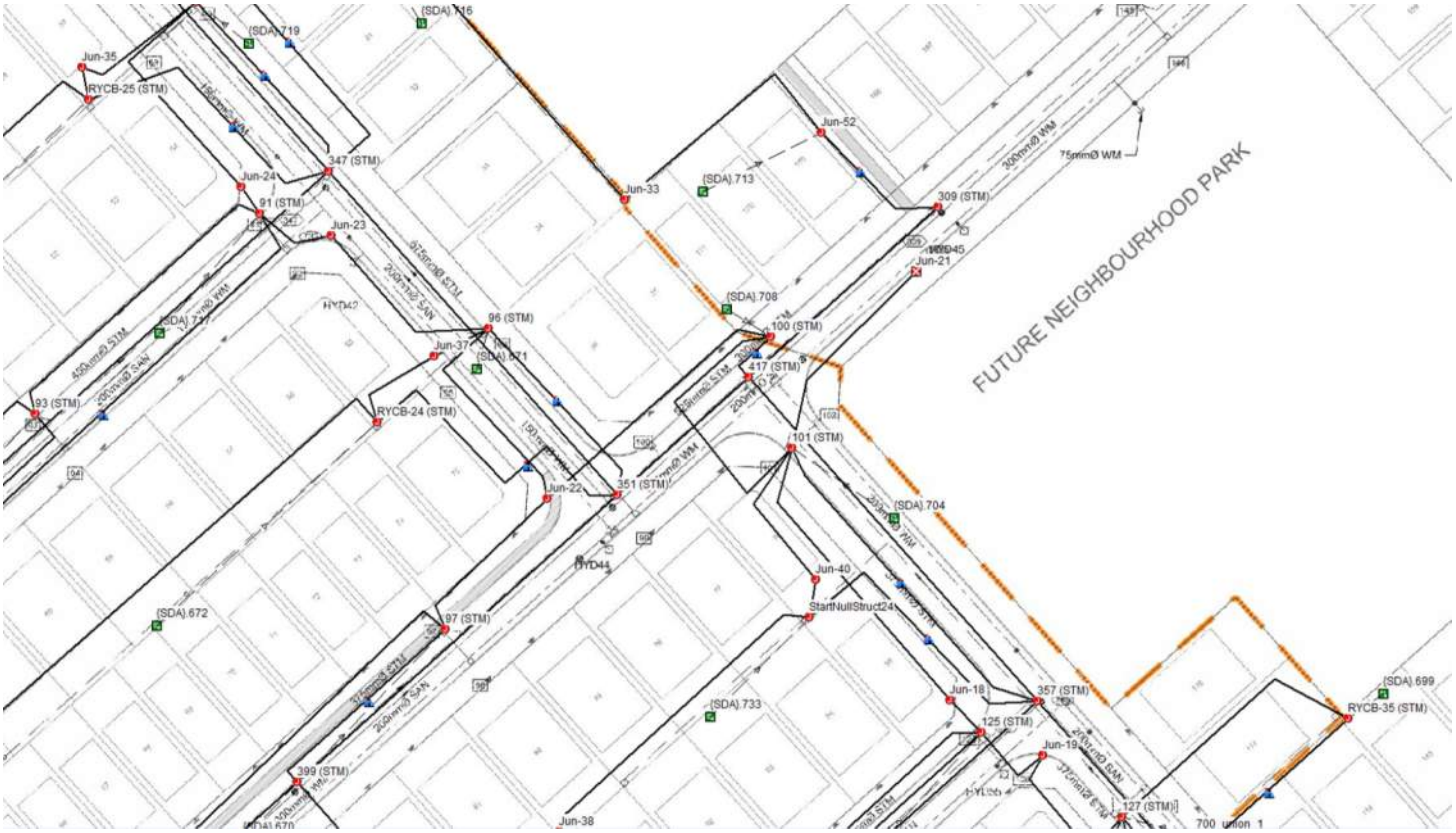
NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6

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

FERNBANK CROSSING PHASE 3

MODEL SCHEMATIC SHEET 2

DEC 2014	108180	FIGURE C3



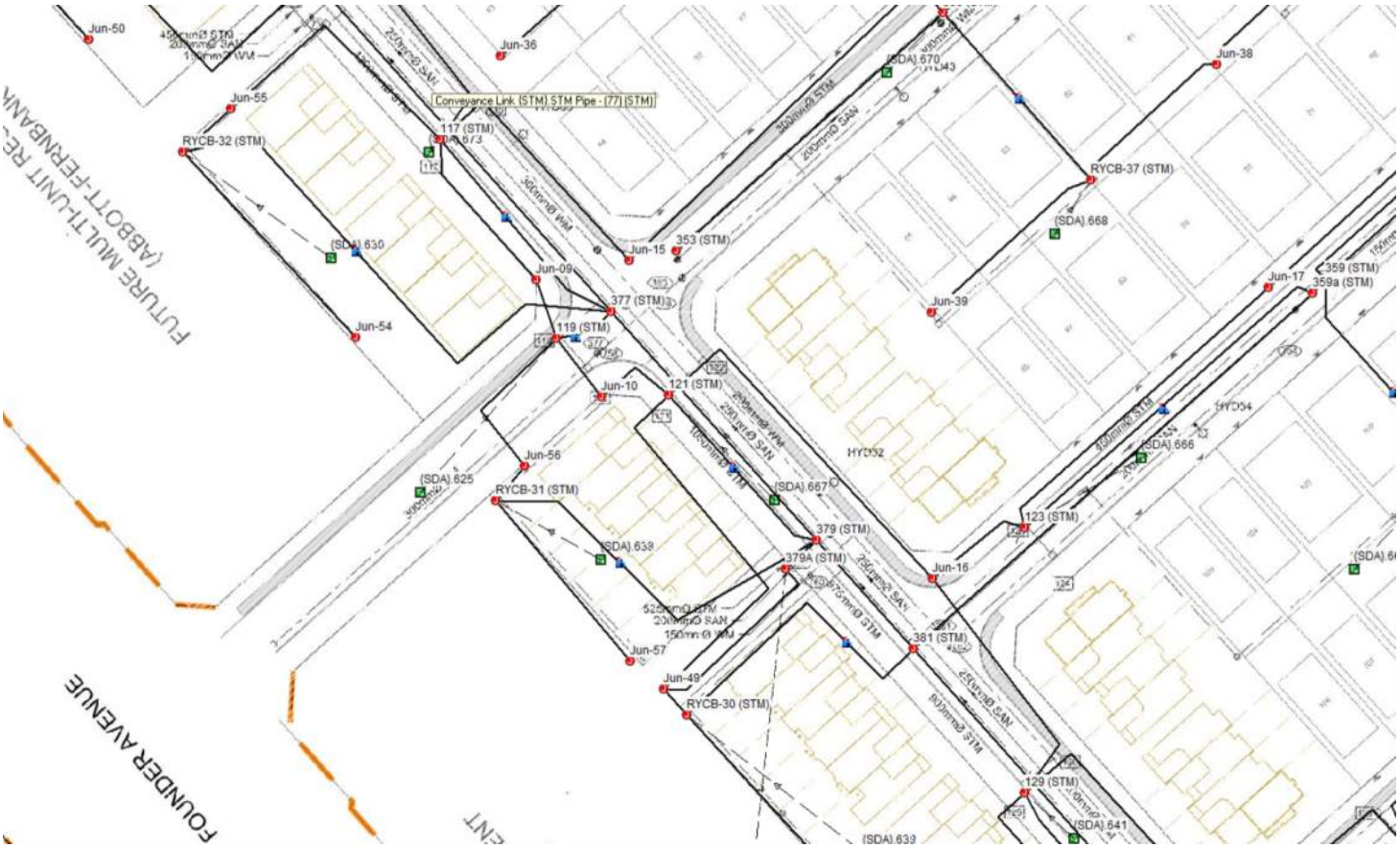
NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6

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

FERNBANK CROSSING PHASE 3

MODEL SCHEMATIC SHEET 3

DEC 2014	108180	FIGURE C4



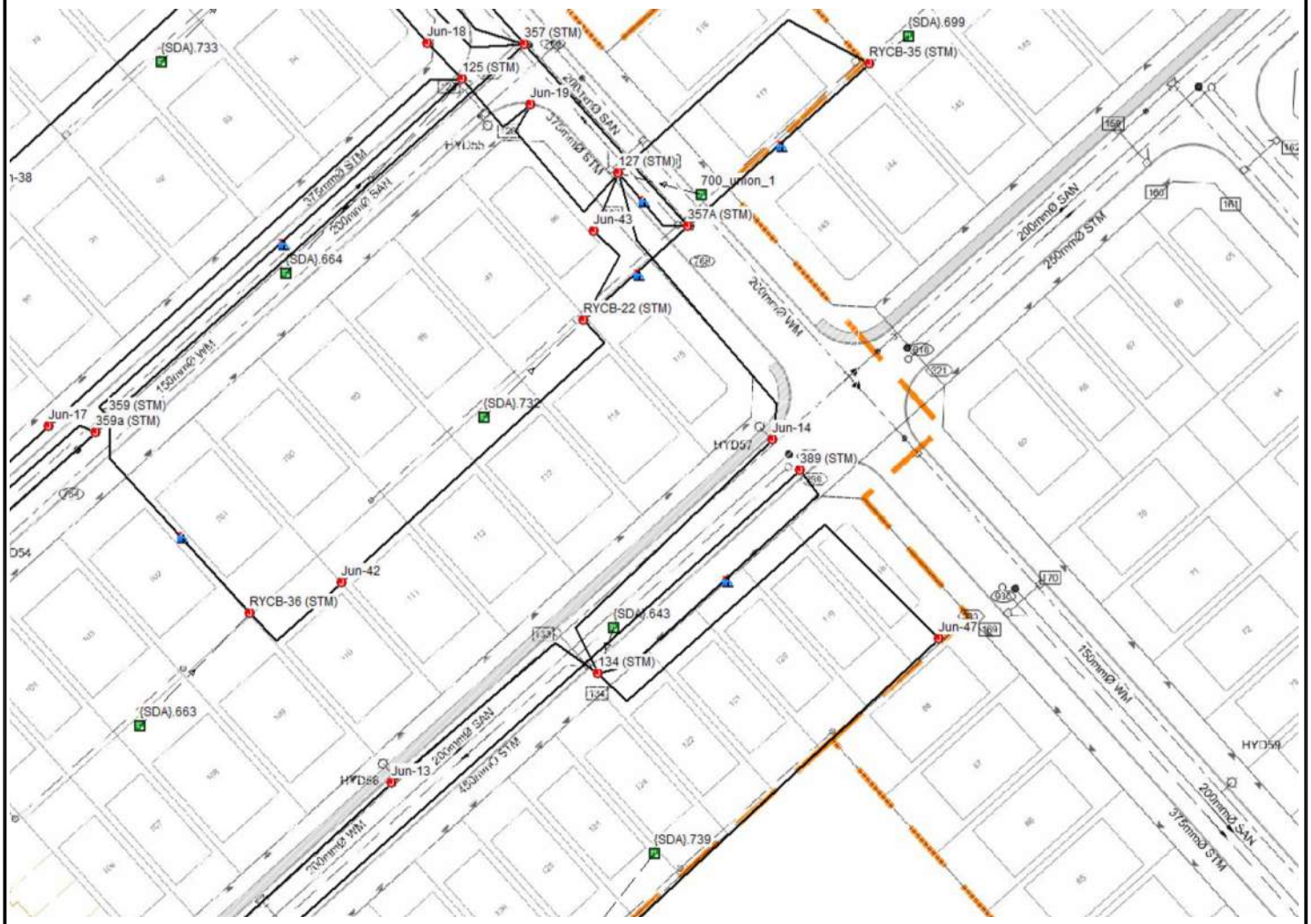
NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6

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

FERNBANK CROSSING PHASE 3

MODEL SCHEMATIC SHEET 4

DEC 2014	108180	FIGURE C5



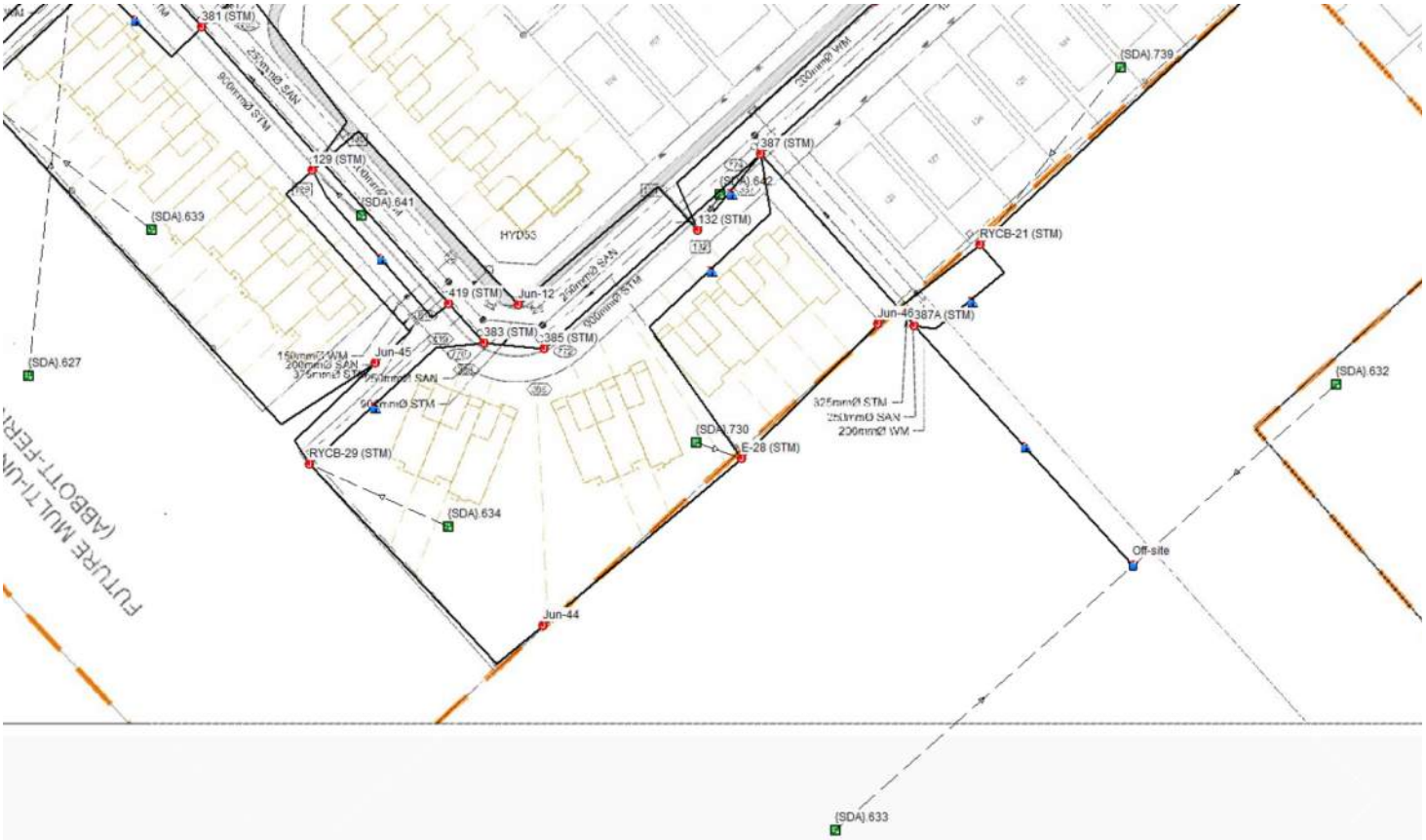
NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6

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

FERNBANK CROSSING PHASE 3

MODEL SCHEMATIC SHEET 5

DEC 2014	108180	FIGURE C6



NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6

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

FERNBANK CROSSING PHASE 3

MODEL SCHEMATIC SHEET 6

DEC 2014	108180	FIGURE C7

Autodesk® Storm and Sanitary Analysis 2013 - Version 7.1.2186 (Build 1)

****
Project Description
****
File Name ..... Phase 3 SSA - 20150708.SPF
Description ..... C:\Users\borendorff.NOVATECH\Desktop\108180-15-STM.dwg

****
Analysis Options
****
Flow Units ..... LPS
Subbasin Hydrograph Method. EPA SWMM
Infiltration Method ..... Horton
Link Routing Method ..... Hydrodynamic
Storage Node Exfiltration.. None
Starting Date NOV-25-2014 00:00:00
Ending Date NOV-25-2014 23:59:00
Antecedent Dry Days 0.0
Report Time Step 00:05:00
Wet Time Step 00:05:00
Dry Time Step 01:00:00
Routing Time Step ..... 5.00 sec

****
Element Count
****
Number of rain gages 1
Number of subbasins 40
Number of nodes 98
Number of links 133
Number of pollutants 0
Number of land uses 0

****
Raingage Summary
****

Gage ID	Data Source	Data Type	Recording Interval min
Rain Gage-01	C100-4	INTENSITY	10.00

****
Subbasin Summary
****

Subbasin ID	Total Area hectares	Equiv. Width m	Imperv. Area %	Average Slope %	Raingage
{SDA}.109b	0.46	100.00	50.00	0.5000	Rain Gage-01
{SDA}.624	1.18	53.00	86.00	0.5000	Rain Gage-01
{SDA}.625	0.17	18.00	64.00	0.5000	Rain Gage-01
{SDA}.627	1.01	53.00	86.00	0.5000	Rain Gage-01
{SDA}.628	0.06	16.00	50.00	0.5000	Rain Gage-01
{SDA}.629	0.16	40.00	50.00	0.5000	Rain Gage-01
{SDA}.630	0.11	30.00	50.00	0.5000	Rain Gage-01
{SDA}.632	1.08	88.00	86.00	0.5000	Rain Gage-01
{SDA}.633	1.84	120.00	86.00	0.5000	Rain Gage-01
{SDA}.634	0.14	28.00	57.00	0.5000	Rain Gage-01
{SDA}.638	0.07	25.00	57.00	0.5000	Rain Gage-01
{SDA}.639	0.13	40.00	57.00	0.5000	Rain Gage-01
{SDA}.641	0.39	50.00	71.00	0.5000	Rain Gage-01
{SDA}.642	0.42	48.00	64.00	0.5000	Rain Gage-01

{SDA}.643	0.46	48.00	64.00	0.5000	Rain Gage-01
{SDA}.663	0.51	100.00	50.00	0.5000	Rain Gage-01
{SDA}.664	0.45	48.00	64.00	0.5000	Rain Gage-01
{SDA}.666	0.35	48.00	64.00	0.5000	Rain Gage-01
{SDA}.667	0.35	50.00	71.00	0.5000	Rain Gage-01
{SDA}.668	0.50	100.00	50.00	0.5000	Rain Gage-01
{SDA}.670	0.70	48.00	64.00	0.5000	Rain Gage-01
{SDA}.671	0.22	38.00	64.00	0.5000	Rain Gage-01
{SDA}.672	0.42	100.00	50.00	0.5000	Rain Gage-01
{SDA}.673	0.28	38.00	64.00	0.5000	Rain Gage-01
{SDA}.674	0.30	38.00	64.00	0.5000	Rain Gage-01
{SDA}.675	0.35	48.00	64.00	0.5000	Rain Gage-01
{SDA}.704	0.22	22.00	64.00	0.5000	Rain Gage-01
{SDA}.708	0.15	25.00	64.00	0.5000	Rain Gage-01
{SDA}.713	0.08	40.00	50.00	0.5000	Rain Gage-01
{SDA}.716	0.18	40.00	50.00	0.5000	Rain Gage-01
{SDA}.717	0.31	48.00	64.00	0.5000	Rain Gage-01
{SDA}.718	0.43	100.00	50.00	0.5000	Rain Gage-01
{SDA}.719	0.21	38.00	64.00	0.5000	Rain Gage-01
{SDA}.720	0.35	48.00	64.00	0.5000	Rain Gage-01
{SDA}.721	0.47	48.00	64.00	0.5000	Rain Gage-01
{SDA}.722	0.21	40.00	50.00	0.5000	Rain Gage-01
{SDA}.723	0.31	38.00	64.00	0.5000	Rain Gage-01
{SDA}.730	0.10	25.00	57.00	0.5000	Rain Gage-01
{SDA}.739	0.20	40.00	50.00	0.5000	Rain Gage-01
700_union_1	0.22	25.00	64.00	0.5000	Rain Gage-01

****
Node Summary
****

Node ID	Element Type	Invert Elevation m	Maximum Elev. m	Ponded Area m²	External Inflow
10+053	JUNCTION	103.16	103.46	0.00	
11+001	JUNCTION	104.63	104.93	0.00	
12+001	JUNCTION	104.55	104.85	0.00	
12+185	JUNCTION	103.32	103.62	0.00	
12+228	JUNCTION	103.32	103.62	0.00	
12+254	JUNCTION	103.41	103.71	0.00	
12+309	JUNCTION	103.94	104.24	0.00	
309 (STM)	JUNCTION	100.73	103.86	0.00	
343 (STM)	JUNCTION	98.71	103.09	0.00	
345 (STM)	JUNCTION	101.46	104.26	0.00	
347 (STM)	JUNCTION	99.08	103.46	0.00	
349 (STM)	JUNCTION	100.76	104.47	0.00	
351 (STM)	JUNCTION	99.61	104.05	0.00	
353 (STM)	JUNCTION	101.42	104.86	0.00	
357 (STM)	JUNCTION	101.97	104.65	0.00	
357A (STM)	JUNCTION	102.34	104.86	0.00	
359 (STM)	JUNCTION	102.53	105.24	0.00	
359A (STM)	JUNCTION	102.63	105.24	0.00	
373 (STM)	JUNCTION	100.88	104.40	0.00	
373A (STM)	JUNCTION	101.65	104.85	0.00	
375 (STM)	JUNCTION	101.22	104.76	0.00	
377 (STM)	JUNCTION	101.37	104.98	0.00	
379 (STM)	JUNCTION	101.66	104.99	0.00	
379A (STM)	JUNCTION	102.13	105.60	0.00	
381 (STM)	JUNCTION	101.80	105.14	0.00	
383 (STM)	JUNCTION	102.06	105.23	0.00	
385 (STM)	JUNCTION	102.08	105.26	0.00	
387 (STM)	JUNCTION	102.19	105.17	0.00	
387A (STM)	JUNCTION	102.34	105.19	0.00	
389 (STM)	JUNCTION	102.87	105.46	0.00	
391 (STM)	JUNCTION	98.64	103.19	0.00	
393 (STM)	JUNCTION	101.13	103.91	0.00	
395 (STM)	JUNCTION	98.79	103.18	0.00	
397 (STM)	JUNCTION	100.09	103.94	0.00	
399 (STM)	JUNCTION	100.71	104.22	0.00	

4+345	JUNCTION	104.49	104.79	0.00
4+420	JUNCTION	104.70	105.00	0.00
4+510	JUNCTION	104.74	105.16	0.00
4+568	JUNCTION	105.00	105.31	0.00
4+665	JUNCTION	105.21	105.51	0.00
4+750	JUNCTION	105.31	105.61	0.00
4+828	JUNCTION	105.41	105.71	0.00
417 (STM)	JUNCTION	99.89	103.87	0.00
419 (STM)	JUNCTION	102.04	105.17	0.00
6+088	JUNCTION	104.43	104.73	0.00
6+102	JUNCTION	104.61	104.91	0.00
7+096	JUNCTION	105.19	105.49	0.00
703 (STM)	JUNCTION	100.80	106.80	0.00
8+128	JUNCTION	104.86	105.16	0.00
8+150	JUNCTION	104.77	105.07	0.00
CB101-102 (STM)	JUNCTION	102.90	103.90	0.00
CB111-112	JUNCTION	103.02	104.12	0.00
CB113-114 (STM)	JUNCTION	102.61	104.42	0.00
CB115-116 (STM)	JUNCTION	102.99	104.61	0.00
CB117-118 (STM)	JUNCTION	103.20	104.78	0.00
CB119-120 (STM)	JUNCTION	103.81	105.04	0.00
CB121-122 (STM)	JUNCTION	103.40	105.25	0.00
CB123-124 (STM)	JUNCTION	103.54	105.12	0.00
CB125-126 (STM)	JUNCTION	102.60	104.74	0.00
CB127-128 (STM)	JUNCTION	103.35	104.83	0.00
CB129-130 (STM)	JUNCTION	103.58	105.30	0.00
CB131-132 (STM)	JUNCTION	103.73	105.50	0.00
CB133-134 (STM)	JUNCTION	103.57	105.37	0.00
CB85-86 (STM)	JUNCTION	101.80	103.60	0.00
CB87-88 (STM)	JUNCTION	101.54	103.86	0.00
CB89-90 (STM)	JUNCTION	102.29	103.44	0.00
CB91-92 (STM)	JUNCTION	102.46	103.45	0.00
CB93-94 (STM)	JUNCTION	101.69	103.89	0.00
CB95-96 (STM)	JUNCTION	102.48	103.57	0.00
CB97-98 (STM)	JUNCTION	102.24	104.04	0.00
E-34	JUNCTION	102.52	104.26	0.00
Jun-35	JUNCTION	103.28	103.58	0.00
Jun-37	JUNCTION	103.46	103.76	0.00
Jun-40	JUNCTION	104.14	104.44	0.00
Jun-43	JUNCTION	104.87	105.17	0.00
Jun-51	JUNCTION	104.45	104.75	0.00
RYCB-21 (STM)	JUNCTION	102.98	105.60	0.00
RYCB-22 (STM)	JUNCTION	102.99	104.91	0.00
RYCB-23 (STM)	JUNCTION	102.21	104.31	0.00
RYCB-24 (STM)	JUNCTION	101.36	103.45	0.00
RYCB-25 (STM)	JUNCTION	100.85	103.32	0.00
RYCB-27 (STM)	JUNCTION	101.23	103.70	0.00
RYCB-28 (STM)	JUNCTION	101.16	103.75	0.00
RYCB-30 (STM)	JUNCTION	102.52	105.30	0.00
RYCB-31 (STM)	JUNCTION	102.83	105.86	0.00
RYCB-32 (STM)	JUNCTION	102.84	105.00	0.00
RYCB-33 (STM)	JUNCTION	101.90	104.80	0.00
RYCB-34 (STM)	JUNCTION	102.16	105.27	0.00
RYCB-38 (STM)	JUNCTION	103.92	105.65	0.00
RYCB-39 (STM)	JUNCTION	103.68	105.70	0.00
RYCBMH-2 (STM)	JUNCTION	101.60	103.60	0.00
EX341 (STM)	OUTFALL	98.53	99.44	0.00
EX363 (STM)	OUTFALL	100.40	102.13	0.00
MAJ-Easement	OUTFALL	103.00	103.30	0.00
MAJ-Haliburton	OUTFALL	103.73	104.03	0.00
MAJ-Shinny	OUTFALL	104.12	104.43	0.00
MAJ-Slapshot	OUTFALL	105.10	105.50	0.00
Off-site	STORAGE	102.36	104.79	0.00

****
Link Summary
****

Link	From Node	To Node	Element	Length	Slope	Manning's

ID			Type	m	%	Roughness
{STM}.STM Pipe - (190) (STM)387A (STM)	387 (STM)		CONDUIT	41.5	0.1928	0.0130
{STM}.STM Pipe - (199) (STM)357A (STM)	357 (STM)		CONDUIT	41.1	0.8996	0.0130
{STM}.STM Pipe - (390) (STM)357 (STM)	417 (STM)		CONDUIT	81.2	2.4755	0.0130
{STM}.STM Pipe - (69) (1) (1) (STM)343 (STM)	391 (STM)		CONDUIT	38.3	0.1825	0.0130
{STM}.STM Pipe - (69) (1) (STM)391 (STM)	EX341 (STM)		CONDUIT	26.7	0.4118	0.0130
{STM}.STM Pipe - (70) (1) (STM)347 (STM)	395 (STM)		CONDUIT	74.2	0.3504	0.0130
{STM}.STM Pipe - (70) (STM)395 (STM)	343 (STM)		CONDUIT	9.4	0.5308	0.0130
{STM}.STM Pipe - (71) (STM)351 (STM)	347 (STM)		CONDUIT	81.1	0.3515	0.0130
{STM}.STM Pipe - (72) (1) (STM)309 (STM)	417 (STM)		CONDUIT	47.6	1.9336	0.0130
{STM}.STM Pipe - (72) (STM)417 (STM)	351 (STM)		CONDUIT	32.8	0.6284	0.0130
{STM}.STM Pipe - (75) (2) (1) (STM)373 (STM)	703 (STM)		CONDUIT	35.9	0.2173	0.0130
{STM}.STM Pipe - (75) (STM)703 (STM)	EX363 (STM)		CONDUIT	21.5	0.1860	0.0130
{STM}.STM Pipe - (76) (STM)375 (STM)	373 (STM)		CONDUIT	110.5	0.1756	0.0130
{STM}.STM Pipe - (77) (STM)377 (STM)	375 (STM)		CONDUIT	80.1	0.1847	0.0130
{STM}.STM Pipe - (78) (1) (STM)345 (STM)	393 (STM)		CONDUIT	26.9	0.6510	0.0130
{STM}.STM Pipe - (78) (STM)393 (STM)	343 (STM)		CONDUIT	109.7	0.4996	0.0130
{STM}.STM Pipe - (79) (1) (STM)349 (STM)	397 (STM)		CONDUIT	34.8	1.4939	0.0130
{STM}.STM Pipe - (79) (STM)397 (STM)	347 (STM)		CONDUIT	108.5	0.4978	0.0130
{STM}.STM Pipe - (80) (1) (STM)353 (STM)	399 (STM)		CONDUIT	64.0	0.9999	0.0130
{STM}.STM Pipe - (80) (STM)399 (STM)	351 (STM)		CONDUIT	80.5	1.0005	0.0130
{STM}.STM Pipe - (81) (STM)379 (STM)	377 (STM)		CONDUIT	55.3	0.2530	0.0130
{STM}.STM Pipe - (82) (STM)381 (STM)	379 (STM)		CONDUIT	25.9	0.2434	0.0130
{STM}.STM Pipe - (83) (1) (STM)383 (STM)	419 (STM)		CONDUIT	9.3	0.2583	0.0130
{STM}.STM Pipe - (83) (STM)419 (STM)	381 (STM)		CONDUIT	66.9	0.2495	0.0130
{STM}.STM Pipe - (84) (STM)385 (STM)	383 (STM)		CONDUIT	10.9	0.2016	0.0130
{STM}.STM Pipe - (85) (STM)387 (STM)	385 (STM)		CONDUIT	52.3	0.2006	0.0130
{STM}.STM Pipe - (86) (STM)389 (STM)	387 (STM)		CONDUIT	120.0	0.2000	0.0130
{STM}.STM Pipe - (87) (STM)359A (STM)	381 (STM)		CONDUIT	96.6	0.2381	0.0130
{STM}.STM Pipe - (88) (STM)359 (STM)	357 (STM)		CONDUIT	93.7	0.5339	0.0130
Link-02	359A (STM)	359 (STM)	CONDUIT	2.9	0.0105	0.0130
Link-07	MAJ-Shinny	CB113-114 (STM)	CHANNEL	17.1	0.0583	0.0130
Link-09	4+828	CB133-134 (STM)	CHANNEL	63.0	0.5333	0.0130
Link-10	4+750	CB133-134 (STM)	CHANNEL	39.0	0.6051	0.0130

Link-101	Jun-51	CB113-114 (STM)	CHANNEL	10.0	3.2800
0.0350					
Link-106	RYCB-32 (STM)	RYCB-33 (STM)	CHANNEL	20.0	1.0000
0.0350					
Link-11	4+750	CB131-132 (STM)	CHANNEL	48.0	0.6292
0.0130					
Link-112	RYCB-34 (STM)	RYCB-33 (STM)	CHANNEL	10.0	4.7000
0.0350					
Link-113	379A (STM)	4+568	CHANNEL	25.0	1.2000
0.0130					
Link-114	373A (STM)	4+345	CHANNEL	10.0	0.6000
0.0130					
Link-115	11+001	CB93-94 (STM)	CHANNEL	76.4	1.3609
0.0130					
Link-116	8+150	CB97-98 (STM)	CHANNEL	107.8	0.9579
0.0130					
Link-117	12+001	CB87-88 (STM)	CHANNEL	87.5	1.1314
0.0130					
Link-118	RYCB-39 (STM)	CB129-130 (STM)	CHANNEL	10.0	4.0000
0.0350					
Link-119	RYCB-27 (STM)	10+053	CHANNEL	10.0	2.4000
0.0350					
Link-12	4+665	CB131-132 (STM)	CHANNEL	36.0	0.5611
0.0130					
Link-120	10+053	MAJ-Easement	CHANNEL	26.2	0.6102
0.0350					
Link-13	4+665	CB129-130 (STM)	CHANNEL	45.0	0.7267
0.0130					
Link-14	4+568	CB129-130 (STM)	CHANNEL	42.0	0.3024
0.0130					
Link-16	8+128	CB121-122 (STM)	CHANNEL	17.8	0.9291
0.0130					
Link-17	8+128	CB119-120 (STM)	CHANNEL	7.5	1.6000
0.0130					
Link-18	4+510	CB119-120 (STM)	CHANNEL	8.2	1.4616
0.0130					
Link-19	4+510	CB117-118 (STM)	CHANNEL	45.0	0.5778
0.0130					
Link-22	4+345	CB115-116 (STM)	CHANNEL	20.0	0.9000
0.0130					
Link-23	4+345	CB113-114 (STM)	CHANNEL	74.0	0.4973
0.0130					
Link-25	4+568	CB121-122 (STM)	CHANNEL	52.0	0.5865
0.0130					
Link-26	4+568	CB123-124 (STM)	CHANNEL	25.0	0.7360
0.0130					
Link-30	7+096	CB123-124 (STM)	CHANNEL	61.0	0.6130
0.0130					
Link-31	7+096	CB125-126 (STM)	CHANNEL	91.8	0.8661
0.0130					
Link-32	6+088	CB125-126 (STM)	CHANNEL	8.4	0.4177
0.0130					
Link-33	4+828	CB127-128 (STM)	CHANNEL	50.0	1.7520
0.0130					
Link-34	6+102	CB127-128 (STM)	CHANNEL	10.0	0.7600
0.0130					
Link-35	6+102	CB125-126 (STM)	CHANNEL	14.0	0.5000
0.0130					
Link-38	6+088	CB101-102 (STM)	CHANNEL	59.0	1.4068
0.0130					
Link-40	12+309	CB97-98 (STM)	CHANNEL	36.0	0.5639
0.0130					
Link-44	CB111-112	CB101-102 (STM)	CHANNEL	25.8	0.8544
0.0130					
Link-45	MAJ-Haliburton	CB101-102 (STM)	CHANNEL	12.0	1.0833
0.0130					
Link-47	12+309	CB95-96 (STM)	CHANNEL	33.5	1.9970
0.0130					
Link-48	12+254	CB95-96 (STM)	CHANNEL	20.0	0.7000
0.0130					

Link-49	12+254	CB91-92 (STM)	CHANNEL	14.1	1.8434
0.0130					
Link-51	12+228	CB91-92 (STM)	CHANNEL	11.0	1.5364
0.0130					
Link-52	12+228	CB89-90 (STM)	CHANNEL	32.0	0.5625
0.0130					
Link-53	12+185	CB89-90 (STM)	CHANNEL	13.0	1.3846
0.0130					
Link-54	4+420	CB117-118 (STM)	CHANNEL	27.0	0.8148
0.0130					
Link-55	4+420	CB115-116 (STM)	CHANNEL	60.0	0.6500
0.0130					
Link-57	CB93-94 (STM)	CB91-92 (STM)	CHANNEL	56.6	0.7753
0.0130					
Link-59	CB87-88 (STM)	CB85-86 (STM)	CHANNEL	57.9	0.9751
0.0130					
Link-60	12+185	CB85-86 (STM)	CHANNEL	22.0	1.4773
0.0130					
Link-61	CB85-86 (STM)	10+053	CHANNEL	28.0	0.5000
0.0350					
Link-64	RYCBMH-2 (STM)	10+053	CHANNEL	10.0	1.4000
0.0350					
Link-70	RYCB-28 (STM)	RYCB-27 (STM)	CHANNEL	10.0	0.5000
0.0350					
Link-71	E-34	RYCB-28 (STM)	CHANNEL	50.0	1.0200
0.0350					
Link-72	Jun-35	RYCB-25 (STM)	CHANNEL	9.7	2.6832
0.0350					
Link-74	Jun-35	CB89-90 (STM)	CHANNEL	19.9	0.9839
0.0350					
Link-75	Jun-37	RYCB-24 (STM)	CHANNEL	10.3	3.0039
0.0350					
Link-77	Jun-37	CB95-96 (STM)	CHANNEL	19.4	1.3378
0.0350					
Link-80	Jun-40	RYCB-23 (STM)	CHANNEL	12.6	1.0317
0.0350					
Link-82	Jun-40	CB101-102 (STM)	CHANNEL	19.4	2.7878
0.0350					
Link-85	Jun-43	RYCB-22 (STM)	CHANNEL	15.9	1.6332
0.0350					
Link-86	Jun-43	CB127-128 (STM)	CHANNEL	10.6	3.1758
0.0350					
Link-91	RYCB-38 (STM)	CB131-132 (STM)	CHANNEL	10.0	1.5000
0.0350					
Link-93	RYCB-21 (STM)	MAJ-Slapshot	CHANNEL	10.0	1.0000
0.0350					
Link-96	RYCB-30 (STM)	CB121-122 (STM)	CHANNEL	10.0	0.5000
0.0350					
Link-97	RYCB-31 (STM)	CB121-122 (STM)	CHANNEL	10.0	6.1000
0.0350					
Link-99	RYCB-33 (STM)	Jun-51	CHANNEL	10.0	0.5000
0.0350					

{STM}.CBL109 (STM)	CB113-114 (STM)	703 (STM)	ORIFICE
{STM}.CBL111 (STM)	CB115-116 (STM)	375 (STM)	ORIFICE
{STM}.CBL113 (STM)	CB117-118 (STM)	377 (STM)	ORIFICE
{STM}.CBL115 (STM)	CB119-120 (STM)	377 (STM)	ORIFICE
{STM}.CBL117 (STM)	CB121-122 (STM)	379 (STM)	ORIFICE
{STM}.CBL119 (STM)	CB123-124 (STM)	359A (STM)	ORIFICE
{STM}.CBL123 (STM)	CB127-128 (STM)	357A (STM)	ORIFICE
{STM}.CBL125 (STM)	CB129-130 (STM)	419 (STM)	ORIFICE
{STM}.CBL128 (STM)	CB131-132 (STM)	387 (STM)	ORIFICE
{STM}.CBL130 (STM)	CB133-134 (STM)	389 (STM)	ORIFICE
{STM}.CBL85 (STM)	CB89-90 (STM)	347 (STM)	ORIFICE
{STM}.CBL87 (STM)	CB91-92 (STM)	397 (STM)	ORIFICE
{STM}.CBL91 (STM)	CB95-96 (STM)	351 (STM)	ORIFICE
{STM}.CBL93 (STM)	CB97-98 (STM)	399 (STM)	ORIFICE
{STM}.CBL97 (STM)	CB101-102 (STM)	357 (STM)	ORIFICE
{STM}.STM Pipe - (182) (STM)	373A (STM)	373 (STM)	ORIFICE
{STM}.STM Pipe - (183) (STM)	379A (STM)	379 (STM)	ORIFICE
{STM}.STM Pipe - (389) (STM)	CB87-88 (STM)	393 (STM)	ORIFICE

{STM}.STM Pipe - (391) (STM)	CB85-86 (STM)	393 (STM)	ORIFICE
{STM}.STM Pipe - (392) (STM)	CB93-94 (STM)	397 (STM)	ORIFICE
{STM}.STM Pipe - (393) (STM)	CB125-126 (STM)	359 (STM)	ORIFICE
{STM}.STM Pipe - (397) (STM)	RYCB-21 (STM)	387A (STM)	ORIFICE
{STM}.STM Pipe - (400) (STM)	RYCB-22 (STM)	357A (STM)	ORIFICE
{STM}.STM Pipe - (403) (STM)	RYCB-23 (STM)	357 (STM)	ORIFICE
{STM}.STM Pipe - (406) (STM)	RYCB-24 (STM)	351 (STM)	ORIFICE
{STM}.STM Pipe - (409) (STM)	RYCB-25 (STM)	347 (STM)	ORIFICE
{STM}.STM Pipe - (412) (STM)	RYCBMH-2 (STM)	391 (STM)	ORIFICE
{STM}.STM Pipe - (414) (STM)	RYCB-27 (STM)	391 (STM)	ORIFICE
{STM}.STM Pipe - (417) (STM)	RYCB-28 (STM)	347 (STM)	ORIFICE
{STM}.STM Pipe - (419) (STM)	RYCB-38 (STM)	387A (STM)	ORIFICE
{STM}.STM Pipe - (421) (STM)	RYCB-39 (STM)	383 (STM)	ORIFICE
{STM}.STM Pipe - (425) (STM)	RYCB-30 (STM)	381 (STM)	ORIFICE
{STM}.STM Pipe - (427) (STM)	RYCB-31 (STM)	377 (STM)	ORIFICE
{STM}.STM Pipe - (429) (STM)	RYCB-32 (STM)	377 (STM)	ORIFICE
{STM}.STM Pipe - (433) (STM)	RYCB-33 (STM)	375 (STM)	ORIFICE
{STM}.STM Pipe - (435) (STM)	RYCB-34 (STM)	703 (STM)	ORIFICE
Link-01	Off-site	387A (STM)	ORIFICE
Link-102	E-34	309 (STM)	ORIFICE
O-111	CB111-112	417 (STM)	ORIFICE

****
Cross Section Summary
****

Link ID	Shape	Depth/ Diameter	Width	No. of Barrels	Cross Sectional Area	Full Flow Hydraulic Radius	Design Flow Capacity
		m	m		m²	m	LPS
{STM}.STM Pipe - (190) (STM)	CIRCULAR	0.91	0.91	1	0.66	0.23	828.28
{STM}.STM Pipe - (199) (STM)	CIRCULAR	0.46	0.46	1	0.16	0.11	281.79
{STM}.STM Pipe - (390) (STM)	CIRCULAR	0.53	0.53	1	0.22	0.13	704.54
{STM}.STM Pipe - (69) (1) (1) (STM)	CIRCULAR	0.91	0.91	1	0.66	0.23	806.02
{STM}.STM Pipe - (69) (1) (STM)	CIRCULAR	0.91	0.91	1	0.66	0.23	1210.53
{STM}.STM Pipe - (70) (1) (STM)	CIRCULAR	0.91	0.91	1	0.66	0.23	1116.74
{STM}.STM Pipe - (70) (STM)	CIRCULAR	0.91	0.91	1	0.66	0.23	1374.48
{STM}.STM Pipe - (71) (STM)	CIRCULAR	0.76	0.76	1	0.46	0.19	688.61
{STM}.STM Pipe - (72) (1) (STM)	CIRCULAR	0.30	0.30	1	0.07	0.08	140.53
{STM}.STM Pipe - (72) (STM)	CIRCULAR	0.69	0.69	1	0.37	0.17	695.73
{STM}.STM Pipe - (75) (2) (1) (STM)	CIRCULAR	1.37	1.37	1	1.48	0.34	2597.59
{STM}.STM Pipe - (75) (STM)	CIRCULAR	1.37	1.37	1	1.48	0.34	2403.74
{STM}.STM Pipe - (76) (STM)	CIRCULAR	1.22	1.22	1	1.17	0.30	1703.53
{STM}.STM Pipe - (77) (STM)	CIRCULAR	1.22	1.22	1	1.17	0.30	1747.31
{STM}.STM Pipe - (78) (1) (STM)	CIRCULAR	0.30	0.30	1	0.07	0.08	81.54
{STM}.STM Pipe - (78) (STM)	CIRCULAR	0.46	0.46	1	0.16	0.11	210.00
{STM}.STM Pipe - (79) (1) (STM)	CIRCULAR	0.30	0.30	1			

```
0.07         0.08       123.53
  {STM}.STM Pipe - (79) (STM) CIRCULAR           0.46         0.46             1
0.16         0.11       209.62
  {STM}.STM Pipe - (80) (1) (STM) CIRCULAR           0.30         0.30             1
0.07         0.08       101.06
  {STM}.STM Pipe - (80) (STM) CIRCULAR           0.46         0.46             1
0.16         0.11       297.17
  {STM}.STM Pipe - (81) (STM) CIRCULAR           1.07         1.07             1
0.89         0.27      1433.75
  {STM}.STM Pipe - (82) (STM) CIRCULAR           0.99         0.99             1
0.77         0.25      1154.69
  {STM}.STM Pipe - (83) (1) (STM) CIRCULAR           0.91         0.91             1
0.66         0.23       958.70
  {STM}.STM Pipe - (83) (STM) CIRCULAR           0.91         0.91             1
0.66         0.23       942.25
  {STM}.STM Pipe - (84) (STM) CIRCULAR           0.91         0.91             1
0.66         0.23       847.10
  {STM}.STM Pipe - (85) (STM) CIRCULAR           0.91         0.91             1
0.66         0.23       845.04
  {STM}.STM Pipe - (86) (STM) CIRCULAR           0.46         0.46             1
0.16         0.11       132.87
  {STM}.STM Pipe - (87) (STM) CIRCULAR           0.46         0.46             1
0.16         0.11       144.96
  {STM}.STM Pipe - (88) (STM) CIRCULAR           0.46         0.46             1
0.16         0.11       217.08
  Link-02           CIRCULAR           0.45          0.45              1          0.16
0.11        29.18
  Link-07           IRREGULAR          0.30         18.00              1          2.83
0.17      1599.37
  Link-09           IRREGULAR          0.30         18.00              1          2.83
0.17      4835.64
  Link-10           IRREGULAR          0.30         18.00              1          2.83
0.17      5150.85
  Link-101          IRREGULAR          0.30         10.00              1          1.50
0.15      2182.86
  Link-106          IRREGULAR          0.30         10.00              1          1.50
0.15      1205.28
  Link-11           IRREGULAR          0.30         18.00              1          2.83
0.17      5252.16
  Link-112          IRREGULAR          0.30         10.00              1          1.50
0.15      2612.99
  Link-113          IRREGULAR          0.30         18.00              1          2.83
0.17      7253.46
  Link-114          IRREGULAR          0.30         18.00              1          2.83
0.17      5128.97
  Link-115          IRREGULAR          0.30         18.00              1          2.83
0.17      7724.46
  Link-116          IRREGULAR          0.30         18.00              1          2.83
0.17      6480.60
  Link-117          IRREGULAR          0.30         18.00              1          2.83
0.17      7043.17
  Link-118          IRREGULAR          0.30         10.00              1          1.50
0.15      2410.57
  Link-119          IRREGULAR          0.30         10.00              1          1.50
0.15      1867.22
  Link-12           IRREGULAR          0.30         18.00              1          2.83
0.17      4959.97
  Link-120          IRREGULAR          0.30          7.00              1          0.92
0.16       615.70
  Link-13           IRREGULAR          0.30         18.00              1          2.83
0.17      5644.46
  Link-14           IRREGULAR          0.30         18.00              1          2.83
0.17      3641.10
  Link-16           IRREGULAR          0.30         18.00              1          2.83
0.17      6382.27
  Link-17           IRREGULAR          0.20         20.00              1          2.00
0.10      4181.01
  Link-18           IRREGULAR          0.30         18.00              1          2.83
0.17      8005.23
  Link-19           IRREGULAR          0.30         18.00              1          2.83
```

0.17	5033.10					
Link-22		IRREGULAR	0.30	18.00	1	2.83
0.17	6281.68					
Link-23		IRREGULAR	0.30	18.00	1	2.83
0.17	4669.42					
Link-25		IRREGULAR	0.30	18.00	1	2.83
0.17	5071.11					
Link-26		IRREGULAR	0.30	18.00	1	2.83
0.17	5680.59					
Link-30		IRREGULAR	0.30	18.00	1	2.83
0.17	5184.30					
Link-31		IRREGULAR	0.30	18.00	1	2.83
0.17	6162.27					
Link-32		IRREGULAR	0.30	18.00	1	2.83
0.17	4279.24					
Link-33		IRREGULAR	0.30	18.00	1	2.83
0.17	8764.39					
Link-34		IRREGULAR	0.30	18.00	1	2.83
0.17	5772.47					
Link-35		IRREGULAR	0.20	20.00	1	2.00
0.10	2337.25					
Link-38		IRREGULAR	0.30	18.00	1	2.83
0.17	7853.58					
Link-40		IRREGULAR	0.30	18.00	1	2.83
0.17	4972.23					
Link-44		IRREGULAR	0.30	18.00	1	2.83
0.17	6120.37					
Link-45		IRREGULAR	0.30	18.00	1	2.83
0.17	6891.85					
Link-47		IRREGULAR	0.30	18.00	1	2.83
0.17	9357.20					
Link-48		IRREGULAR	0.30	18.00	1	2.83
0.17	5539.93					
Link-49		IRREGULAR	0.30	18.00	1	2.83
0.17	8990.14					
Link-51		IRREGULAR	0.30	18.00	1	2.83
0.17	8207.33					
Link-52		IRREGULAR	0.30	18.00	1	2.83
0.17	4966.11					
Link-53		IRREGULAR	0.30	18.00	1	2.83
0.17	7791.47					
Link-54		IRREGULAR	0.30	18.00	1	2.83
0.17	5977.01					
Link-55		IRREGULAR	0.30	18.00	1	2.83
0.17	5338.41					
Link-57		IRREGULAR	0.30	18.00	1	2.83
0.17	5830.45					
Link-59		IRREGULAR	0.30	18.00	1	2.83
0.17	6538.68					
Link-60		IRREGULAR	0.30	18.00	1	2.83
0.17	8047.95					
Link-61		IRREGULAR	0.30	7.00	1	0.92
0.16	557.33					
Link-64		IRREGULAR	0.30	10.00	1	1.50
0.15	1426.11					
Link-70		IRREGULAR	0.30	10.00	1	1.50
0.15	852.26					
Link-71		IRREGULAR	0.30	10.00	1	1.50
0.15	1217.28					
Link-72		IRREGULAR	0.30	10.00	1	1.50
0.15	1974.30					
Link-74		IRREGULAR	0.30	10.00	1	1.50
0.15	1195.56					
Link-75		IRREGULAR	0.30	10.00	1	1.50
0.15	2088.96					
Link-77		IRREGULAR	0.30	10.00	1	1.50
0.15	1394.08					
Link-80		IRREGULAR	0.30	10.00	1	1.50
0.15	1224.27					
Link-82		IRREGULAR	0.30	10.00	1	1.50

0.15	2012.43					
Link-85		IRREGULAR	0.30	10.00	1	1.50
0.15	1540.30					
Link-86		IRREGULAR	0.30	10.00	1	1.50
0.15	2147.91					
Link-91		IRREGULAR	0.30	10.00	1	1.50
0.15	1476.16					
Link-93		IRREGULAR	0.30	10.00	1	1.50
0.15	1205.28					
Link-96		IRREGULAR	0.30	10.00	1	1.50
0.15	852.26					
Link-97		IRREGULAR	0.30	10.00	1	1.50
0.15	2976.83					
Link-99		IRREGULAR	0.30	10.00	1	1.50
0.15	852.26					

****
Transect Summary
****

Transect 18m ROW
Area:

0.0005	0.0018	0.0041	0.0073	0.0114
0.0165	0.0224	0.0293	0.0370	0.0457
0.0553	0.0658	0.0773	0.0896	0.1029
0.1171	0.1321	0.1481	0.1651	0.1829
0.2016	0.2211	0.2405	0.2600	0.2795
0.2993	0.3200	0.3413	0.3634	0.3863
0.4099	0.4342	0.4593	0.4852	0.5117
0.5391	0.5671	0.5960	0.6255	0.6558
0.6869	0.7187	0.7513	0.7846	0.8186
0.8534	0.8889	0.9252	0.9622	1.0000

Hrad:

0.0176	0.0351	0.0527	0.0702	0.0878
0.1053	0.1229	0.1405	0.1580	0.1756
0.1931	0.2107	0.2282	0.2458	0.2634
0.2809	0.2985	0.3160	0.3336	0.3511
0.3687	0.3990	0.4334	0.4678	0.5021
0.5361	0.5683	0.5989	0.6277	0.6551
0.6811	0.7058	0.7292	0.7514	0.7726
0.7928	0.8120	0.8304	0.8479	0.8647
0.8808	0.8962	0.9109	0.9251	0.9388
0.9519	0.9646	0.9768	0.9886	1.0000

Width:

0.0240	0.0479	0.0719	0.0959	0.1199
0.1438	0.1678	0.1918	0.2158	0.2397
0.2637	0.2877	0.3117	0.3356	0.3596
0.3836	0.4076	0.4315	0.4555	0.4795
0.5035	0.5098	0.5102	0.5107	0.5111
0.5307	0.5502	0.5698	0.5893	0.6089
0.6284	0.6480	0.6676	0.6871	0.7067
0.7262	0.7458	0.7653	0.7849	0.8044
0.8240	0.8436	0.8631	0.8827	0.9022
0.9218	0.9413	0.9609	0.9804	1.0000

Transect Backyard Swale
Area:

0.0004	0.0016	0.0036	0.0064	0.0100
0.0144	0.0196	0.0256	0.0324	0.0400
0.0484	0.0576	0.0676	0.0784	0.0900
0.1024	0.1156	0.1296	0.1444	0.1600
0.1764	0.1936	0.2116	0.2304	0.2500
0.2704	0.2916	0.3136	0.3364	0.3600
0.3844	0.4096	0.4356	0.4624	0.4900
0.5184	0.5476	0.5776	0.6084	0.6400
0.6724	0.7056	0.7396	0.7744	0.8100
0.8464	0.8836	0.9216	0.9604	1.0000

Hrad:

0.0200	0.0400	0.0600	0.0800	0.1000

0.1200	0.1400	0.1600	0.1800	0.2000
0.2200	0.2400	0.2600	0.2800	0.3000
0.3200	0.3400	0.3600	0.3800	0.4000
0.4200	0.4400	0.4600	0.4800	0.5000
0.5200	0.5400	0.5600	0.5800	0.6000
0.6200	0.6400	0.6600	0.6800	0.7000
0.7200	0.7400	0.7600	0.7800	0.8000
0.8200	0.8400	0.8600	0.8800	0.9000
0.9200	0.9400	0.9600	0.9800	1.0000

Width:

0.0200	0.0400	0.0600	0.0800	0.1000
0.1200	0.1400	0.1600	0.1800	0.2000
0.2200	0.2400	0.2600	0.2800	0.3000
0.3200	0.3400	0.3600	0.3800	0.4000
0.4200	0.4400	0.4600	0.4800	0.5000
0.5200	0.5400	0.5600	0.5800	0.6000
0.6200	0.6400	0.6600	0.6800	0.7000
0.7200	0.7400	0.7600	0.7800	0.8000
0.8200	0.8400	0.8600	0.8800	0.9000
0.9200	0.9400	0.9600	0.9800	1.0000

Transect Outlet Swale

Area:

0.0004	0.0016	0.0035	0.0062	0.0097
0.0140	0.0191	0.0249	0.0315	0.0389
0.0471	0.0560	0.0658	0.0763	0.0876
0.0996	0.1125	0.1261	0.1405	0.1557
0.1716	0.1884	0.2059	0.2242	0.2432
0.2631	0.2837	0.3051	0.3273	0.3503
0.3740	0.3985	0.4238	0.4499	0.4768
0.5044	0.5328	0.5620	0.5920	0.6227
0.6542	0.6866	0.7203	0.7556	0.7924
0.8308	0.8708	0.9123	0.9554	1.0000

Hrad:

0.0183	0.0365	0.0548	0.0730	0.0913
0.1095	0.1278	0.1461	0.1643	0.1826
0.2008	0.2191	0.2373	0.2556	0.2738
0.2921	0.3104	0.3286	0.3469	0.3651
0.3834	0.4016	0.4199	0.4382	0.4564
0.4747	0.4929	0.5112	0.5294	0.5477
0.5660	0.5842	0.6025	0.6207	0.6390
0.6572	0.6755	0.6938	0.7120	0.7303
0.7485	0.7727	0.8072	0.8396	0.8701
0.8989	0.9261	0.9520	0.9765	1.0000

Width:

0.0171	0.0343	0.0514	0.0686	0.0857
0.1029	0.1200	0.1371	0.1543	0.1714
0.1886	0.2057	0.2229	0.2400	0.2571
0.2743	0.2914	0.3086	0.3257	0.3429
0.3600	0.3771	0.3943	0.4114	0.4286
0.4457	0.4629	0.4800	0.4971	0.5143
0.5314	0.5486	0.5657	0.5829	0.6000
0.6171	0.6343	0.6514	0.6686	0.6857
0.7029	0.7257	0.7600	0.7943	0.8286
0.8629	0.8971	0.9314	0.9657	1.0000

Transect ROW Crown

Area:

0.0004	0.0016	0.0036	0.0064	0.0100
0.0144	0.0196	0.0256	0.0324	0.0400
0.0484	0.0576	0.0676	0.0784	0.0900
0.1024	0.1156	0.1296	0.1444	0.1600
0.1764	0.1936	0.2116	0.2304	0.2500
0.2704	0.2916	0.3136	0.3364	0.3600
0.3844	0.4096	0.4356	0.4624	0.4900
0.5184	0.5476	0.5776	0.6084	0.6400
0.6724	0.7056	0.7396	0.7744	0.8100
0.8464	0.8836	0.9216	0.9604	1.0000

Hrad:

0.0200	0.0400	0.0600	0.0800	0.1000

0.1200	0.1400	0.1600	0.1800	0.2000
0.2200	0.2400	0.2600	0.2800	0.3000
0.3200	0.3400	0.3600	0.3800	0.4000
0.4200	0.4400	0.4600	0.4800	0.5000
0.5200	0.5400	0.5600	0.5800	0.6000
0.6200	0.6400	0.6600	0.6800	0.7000
0.7200	0.7400	0.7600	0.7800	0.8000
0.8200	0.8400	0.8600	0.8800	0.9000
0.9200	0.9400	0.9600	0.9800	1.0000

Width:

0.0200	0.0400	0.0600	0.0800	0.1000
0.1200	0.1400	0.1600	0.1800	0.2000
0.2200	0.2400	0.2600	0.2800	0.3000
0.3200	0.3400	0.3600	0.3800	0.4000
0.4200	0.4400	0.4600	0.4800	0.5000
0.5200	0.5400	0.5600	0.5800	0.6000
0.6200	0.6400	0.6600	0.6800	0.7000
0.7200	0.7400	0.7600	0.7800	0.8000
0.8200	0.8400	0.8600	0.8800	0.9000
0.9200	0.9400	0.9600	0.9800	1.0000

Runoff Quantity Continuity	Volume hectare-m	Depth mm
Total Precipitation	1.181	76.023
Evaporation Loss	0.000	0.000
Infiltration Loss	0.269	17.285
Surface Runoff	0.911	58.618
Final Surface Storage	0.010	0.660
Continuity Error (%)	-0.710	

Flow Routing Continuity	Volume hectare-m	Volume Mliters
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.911	9.109
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	0.066	0.662
External Outflow	0.972	9.717
Surface Flooding	0.000	0.000
Evaporation Loss	0.000	0.000
Initial Stored Volume	0.040	0.405
Final Stored Volume	0.045	0.452
Continuity Error (%)	0.070	

****
EPA SWMM Time of Concentration Computations Report
****

Tc = (0.94 * (L^0.6) * (n^0.6)) / ((i^0.4) * (S^0.3))

Where:

Tc = Time of Concentration (min)
L = Flow Length (ft)
n = Manning's Roughness
i = Rainfall Intensity (in/hr)
S = Slope (ft/ft)

Subbasin {SDA}.109b

Flow length (m): 46.40
Pervious Manning's Roughness: 0.25000

Impervious Manning's Roughness:	0.01300
Pervious Rainfall Intensity (mm/hr):	19.00583
Impervious Rainfall Intensity (mm/hr):	19.00583
Slope (%):	0.50000
Computed TOC (minutes):	35.44

Subbasin {SDA}.624

Flow length (m):	222.64
Pervious Manning's Roughness:	0.25000
Impervious Manning's Roughness:	0.01300
Pervious Rainfall Intensity (mm/hr):	19.00583
Impervious Rainfall Intensity (mm/hr):	19.00583
Slope (%):	0.50000
Computed TOC (minutes):	54.42

Subbasin {SDA}.625

Flow length (m):	91.67
Pervious Manning's Roughness:	0.25000
Impervious Manning's Roughness:	0.01300
Pervious Rainfall Intensity (mm/hr):	19.00583
Impervious Rainfall Intensity (mm/hr):	19.00583
Slope (%):	0.50000
Computed TOC (minutes):	46.41

Subbasin {SDA}.627

Flow length (m):	191.32
Pervious Manning's Roughness:	0.25000
Impervious Manning's Roughness:	0.01300
Pervious Rainfall Intensity (mm/hr):	19.00583
Impervious Rainfall Intensity (mm/hr):	19.00583
Slope (%):	0.50000
Computed TOC (minutes):	49.69

Subbasin {SDA}.628

Flow length (m):	38.75
Pervious Manning's Roughness:	0.25000
Impervious Manning's Roughness:	0.01300
Pervious Rainfall Intensity (mm/hr):	19.00583
Impervious Rainfall Intensity (mm/hr):	19.00583
Slope (%):	0.50000
Computed TOC (minutes):	31.81

Subbasin {SDA}.629

Flow length (m):	40.25
Pervious Manning's Roughness:	0.25000
Impervious Manning's Roughness:	0.01300
Pervious Rainfall Intensity (mm/hr):	19.00583
Impervious Rainfall Intensity (mm/hr):	19.00583
Slope (%):	0.50000
Computed TOC (minutes):	32.55

Subbasin {SDA}.630

Flow length (m):	35.00
Pervious Manning's Roughness:	0.25000
Impervious Manning's Roughness:	0.01300
Pervious Rainfall Intensity (mm/hr):	19.00583
Impervious Rainfall Intensity (mm/hr):	19.00583
Slope (%):	0.50000
Computed TOC (minutes):	29.93

Subbasin {SDA}.632

Flow length (m):	122.95
Pervious Manning's Roughness:	0.25000
Impervious Manning's Roughness:	0.01300
Pervious Rainfall Intensity (mm/hr):	19.00583
Impervious Rainfall Intensity (mm/hr):	19.00583
Slope (%):	0.50000
Computed TOC (minutes):	38.11

Subbasin {SDA}.633

Flow length (m):	153.00
Pervious Manning's Roughness:	0.25000
Impervious Manning's Roughness:	0.01300
Pervious Rainfall Intensity (mm/hr):	19.00583
Impervious Rainfall Intensity (mm/hr):	19.00583
Slope (%):	0.50000
Computed TOC (minutes):	43.45

Subbasin {SDA}.634

Flow length (m):	50.00
Pervious Manning's Roughness:	0.25000
Impervious Manning's Roughness:	0.01300
Pervious Rainfall Intensity (mm/hr):	19.00583
Impervious Rainfall Intensity (mm/hr):	19.00583
Slope (%):	0.50000
Computed TOC (minutes):	34.77

Subbasin {SDA}.638

Flow length (m):	27.60
Pervious Manning's Roughness:	0.25000
Impervious Manning's Roughness:	0.01300
Pervious Rainfall Intensity (mm/hr):	19.00583
Impervious Rainfall Intensity (mm/hr):	19.00583
Slope (%):	0.50000
Computed TOC (minutes):	24.34

Subbasin {SDA}.639

Flow length (m):	32.50
Pervious Manning's Roughness:	0.25000
Impervious Manning's Roughness:	0.01300
Pervious Rainfall Intensity (mm/hr):	19.00583
Impervious Rainfall Intensity (mm/hr):	19.00583
Slope (%):	0.50000
Computed TOC (minutes):	26.85

Subbasin {SDA}.641

Flow length (m):	78.00
Pervious Manning's Roughness:	0.25000
Impervious Manning's Roughness:	0.01300
Pervious Rainfall Intensity (mm/hr):	19.00583
Impervious Rainfall Intensity (mm/hr):	19.00583
Slope (%):	0.50000
Computed TOC (minutes):	38.51

Subbasin {SDA}.642

Flow length (m):	86.67
Pervious Manning's Roughness:	0.25000
Impervious Manning's Roughness:	0.01300
Pervious Rainfall Intensity (mm/hr):	19.00583
Impervious Rainfall Intensity (mm/hr):	19.00583
Slope (%):	0.50000
Computed TOC (minutes):	44.87

Subbasin {SDA}.643

Flow length (m):	95.21
Pervious Manning's Roughness:	0.25000
Impervious Manning's Roughness:	0.01300
Pervious Rainfall Intensity (mm/hr):	19.00583
Impervious Rainfall Intensity (mm/hr):	19.00583
Slope (%):	0.50000
Computed TOC (minutes):	47.48

Subbasin {SDA}.663

Flow length (m):	51.00
Pervious Manning's Roughness:	0.25000
Impervious Manning's Roughness:	0.01300
Pervious Rainfall Intensity (mm/hr):	19.00583
Impervious Rainfall Intensity (mm/hr):	19.00583
Slope (%):	0.50000
Computed TOC (minutes):	37.51

Subbasin {SDA}.664

Flow length (m):	94.58
Pervious Manning's Roughness:	0.25000
Impervious Manning's Roughness:	0.01300
Pervious Rainfall Intensity (mm/hr):	19.00583
Impervious Rainfall Intensity (mm/hr):	19.00583
Slope (%):	0.50000
Computed TOC (minutes):	47.29

Subbasin {SDA}.666

Flow length (m):	72.50
Pervious Manning's Roughness:	0.25000
Impervious Manning's Roughness:	0.01300
Pervious Rainfall Intensity (mm/hr):	19.00583
Impervious Rainfall Intensity (mm/hr):	19.00583
Slope (%):	0.50000
Computed TOC (minutes):	40.32

Subbasin {SDA}.667

Flow length (m):	70.20
Pervious Manning's Roughness:	0.25000
Impervious Manning's Roughness:	0.01300
Pervious Rainfall Intensity (mm/hr):	19.00583
Impervious Rainfall Intensity (mm/hr):	19.00583
Slope (%):	0.50000
Computed TOC (minutes):	36.15

Subbasin {SDA}.668

Flow length (m):	50.00
Pervious Manning's Roughness:	0.25000
Impervious Manning's Roughness:	0.01300
Pervious Rainfall Intensity (mm/hr):	19.00583
Impervious Rainfall Intensity (mm/hr):	19.00583
Slope (%):	0.50000
Computed TOC (minutes):	37.07

Subbasin {SDA}.670

Flow length (m):	145.83
Pervious Manning's Roughness:	0.25000
Impervious Manning's Roughness:	0.01300
Pervious Rainfall Intensity (mm/hr):	19.00583
Impervious Rainfall Intensity (mm/hr):	19.00583
Slope (%):	0.50000
Computed TOC (minutes):	61.32

Subbasin {SDA}.671

Flow length (m):	57.89
Pervious Manning's Roughness:	0.25000
Impervious Manning's Roughness:	0.01300
Pervious Rainfall Intensity (mm/hr):	19.00583
Impervious Rainfall Intensity (mm/hr):	19.00583
Slope (%):	0.50000
Computed TOC (minutes):	35.23

Subbasin {SDA}.672

Flow length (m):	42.40
Pervious Manning's Roughness:	0.25000
Impervious Manning's Roughness:	0.01300
Pervious Rainfall Intensity (mm/hr):	19.00583
Impervious Rainfall Intensity (mm/hr):	19.00583
Slope (%):	0.50000
Computed TOC (minutes):	33.58

Subbasin {SDA}.673

Flow length (m):	73.95
Pervious Manning's Roughness:	0.25000
Impervious Manning's Roughness:	0.01300
Pervious Rainfall Intensity (mm/hr):	19.00583
Impervious Rainfall Intensity (mm/hr):	19.00583
Slope (%):	0.50000

Computed TOC (minutes):	40.80

Subbasin {SDA}.674

Flow length (m):	78.16
Pervious Manning's Roughness:	0.25000
Impervious Manning's Roughness:	0.01300
Pervious Rainfall Intensity (mm/hr):	19.00583
Impervious Rainfall Intensity (mm/hr):	19.00583
Slope (%):	0.50000
Computed TOC (minutes):	42.17

Subbasin {SDA}.675

Flow length (m):	72.08
Pervious Manning's Roughness:	0.25000
Impervious Manning's Roughness:	0.01300
Pervious Rainfall Intensity (mm/hr):	19.00583
Impervious Rainfall Intensity (mm/hr):	19.00583
Slope (%):	0.50000
Computed TOC (minutes):	40.18

Subbasin {SDA}.704

Flow length (m):	100.00
Pervious Manning's Roughness:	0.25000
Impervious Manning's Roughness:	0.01300
Pervious Rainfall Intensity (mm/hr):	19.00583
Impervious Rainfall Intensity (mm/hr):	19.00583
Slope (%):	0.50000
Computed TOC (minutes):	48.90

Subbasin {SDA}.708

Flow length (m):	59.60
Pervious Manning's Roughness:	0.25000
Impervious Manning's Roughness:	0.01300
Pervious Rainfall Intensity (mm/hr):	19.00583
Impervious Rainfall Intensity (mm/hr):	19.00583
Slope (%):	0.50000
Computed TOC (minutes):	35.84

Subbasin {SDA}.713

Flow length (m):	20.75
Pervious Manning's Roughness:	0.25000
Impervious Manning's Roughness:	0.01300
Pervious Rainfall Intensity (mm/hr):	19.00583
Impervious Rainfall Intensity (mm/hr):	19.00583
Slope (%):	0.50000
Computed TOC (minutes):	21.87

Subbasin {SDA}.716

Flow length (m):	45.00
Pervious Manning's Roughness:	0.25000
Impervious Manning's Roughness:	0.01300
Pervious Rainfall Intensity (mm/hr):	19.00583

```
        Impervious Rainfall Intensity (mm/hr):   19.00583
        Slope (%):                                0.50000
        Computed TOC (minutes):                     34.80

---------------------
Subbasin {SDA}.717
---------------------

        Flow length (m):                            65.00
        Pervious Manning's Roughness:             0.25000
        Impervious Manning's Roughness:           0.01300
        Pervious Rainfall Intensity (mm/hr):     19.00583
        Impervious Rainfall Intensity (mm/hr):   19.00583
        Slope (%):                                0.50000
        Computed TOC (minutes):                     37.76

---------------------
Subbasin {SDA}.718
---------------------

        Flow length (m):                            42.60
        Pervious Manning's Roughness:             0.25000
        Impervious Manning's Roughness:           0.01300
        Pervious Rainfall Intensity (mm/hr):     19.00583
        Impervious Rainfall Intensity (mm/hr):   19.00583
        Slope (%):                                0.50000
        Computed TOC (minutes):                     33.67

---------------------
Subbasin {SDA}.719
---------------------

        Flow length (m):                            54.74
        Pervious Manning's Roughness:             0.25000
        Impervious Manning's Roughness:           0.01300
        Pervious Rainfall Intensity (mm/hr):     19.00583
        Impervious Rainfall Intensity (mm/hr):   19.00583
        Slope (%):                                0.50000
        Computed TOC (minutes):                     34.06

---------------------
Subbasin {SDA}.720
---------------------

        Flow length (m):                            72.71
        Pervious Manning's Roughness:             0.25000
        Impervious Manning's Roughness:           0.01300
        Pervious Rainfall Intensity (mm/hr):     19.00583
        Impervious Rainfall Intensity (mm/hr):   19.00583
        Slope (%):                                0.50000
        Computed TOC (minutes):                     40.39

---------------------
Subbasin {SDA}.721
---------------------

        Flow length (m):                            98.75
        Pervious Manning's Roughness:             0.25000
        Impervious Manning's Roughness:           0.01300
        Pervious Rainfall Intensity (mm/hr):     19.00583
        Impervious Rainfall Intensity (mm/hr):   19.00583
        Slope (%):                                0.50000
        Computed TOC (minutes):                     48.53

---------------------
Subbasin {SDA}.722
---------------------

        Flow length (m):                            52.50
        Pervious Manning's Roughness:             0.25000
```

```
        Impervious Manning's Roughness:           0.01300
        Pervious Rainfall Intensity (mm/hr):     19.00583
        Impervious Rainfall Intensity (mm/hr):   19.00583
        Slope (%):                                0.50000
        Computed TOC (minutes):                     38.17

  ---------------------
  Subbasin {SDA}.723
  ---------------------

        Flow length (m):                            80.53
        Pervious Manning's Roughness:             0.25000
        Impervious Manning's Roughness:           0.01300
        Pervious Rainfall Intensity (mm/hr):     19.00583
        Impervious Rainfall Intensity (mm/hr):   19.00583
        Slope (%):                                0.50000
        Computed TOC (minutes):                     42.94

  ---------------------
  Subbasin {SDA}.730
  ---------------------

        Flow length (m):                            40.00
        Pervious Manning's Roughness:             0.25000
        Impervious Manning's Roughness:           0.01300
        Pervious Rainfall Intensity (mm/hr):     19.00583
        Impervious Rainfall Intensity (mm/hr):   19.00583
        Slope (%):                                0.50000
        Computed TOC (minutes):                     30.41

  ---------------------
  Subbasin {SDA}.739
  ---------------------

        Flow length (m):                            50.25
        Pervious Manning's Roughness:             0.25000
        Impervious Manning's Roughness:           0.01300
        Pervious Rainfall Intensity (mm/hr):     19.00583
        Impervious Rainfall Intensity (mm/hr):   19.00583
        Slope (%):                                0.50000
        Computed TOC (minutes):                     37.18

  ----------------------
  Subbasin 700_union_1
  ----------------------

        Flow length (m):                            88.00
        Pervious Manning's Roughness:             0.25000
        Impervious Manning's Roughness:           0.01300
        Pervious Rainfall Intensity (mm/hr):     19.00583
        Impervious Rainfall Intensity (mm/hr):   19.00583
        Slope (%):                                0.50000
        Computed TOC (minutes):                     45.29


  ************************
  Subbasin Runoff Summary
  ************************


-------------------------------------------------------------------------------------------------
------------
  Subbasin             Total      Total      Total      Total      Total       Peak        Runoff
     Time of
  ID                Rainfall      Runon      Evap.     Infil.     Runoff     Runoff   Coefficient
Concentration
                          mm         mm         mm         mm         mm        LPS
days  hh:mm:ss

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

{SDA}.109b	76.02	0.00	0.00	30.69	46.00	128.03	0.605
0 00:35:26							
{SDA}.624	76.02	0.00	0.00	7.12	68.52	439.00	0.901
0 00:54:25							
{SDA}.625	76.02	0.00	0.00	18.38	57.12	53.70	0.751
0 00:46:24							
{SDA}.627	76.02	0.00	0.00	7.03	68.64	389.72	0.903
0 00:49:41							
{SDA}.628	76.02	0.00	0.00	30.44	46.26	18.04	0.609
0 00:31:48							
{SDA}.629	76.02	0.00	0.00	30.49	46.21	46.38	0.608
0 00:32:32							
{SDA}.630	76.02	0.00	0.00	30.31	46.40	31.31	0.610
0 00:29:55							
{SDA}.632	76.02	0.00	0.00	6.83	68.53	446.34	0.901
0 00:38:06							
{SDA}.633	76.02	0.00	0.00	6.93	68.39	734.36	0.900
0 00:43:27							
{SDA}.634	76.02	0.00	0.00	27.35	49.40	42.73	0.650
0 00:34:46							
{SDA}.638	76.02	0.00	0.00	26.84	49.92	25.30	0.657
0 00:24:20							
{SDA}.639	76.02	0.00	0.00	26.95	49.81	44.80	0.655
0 00:26:50							
{SDA}.641	76.02	0.00	0.00	14.40	61.38	141.30	0.807
0 00:38:30							
{SDA}.642	76.02	0.00	0.00	18.30	57.51	135.96	0.756
0 00:44:52							
{SDA}.643	76.02	0.00	0.00	18.44	57.36	148.32	0.754
0 00:47:28							
{SDA}.663	76.02	0.00	0.00	30.84	45.84	136.12	0.603
0 00:37:30							
{SDA}.664	76.02	0.00	0.00	18.43	57.37	147.42	0.755
0 00:47:17							
{SDA}.666	76.02	0.00	0.00	18.05	57.77	115.18	0.760
0 00:40:18							
{SDA}.667	76.02	0.00	0.00	14.30	61.49	128.10	0.809
0 00:36:09							
{SDA}.668	76.02	0.00	0.00	30.80	45.87	134.43	0.603
0 00:37:04							
{SDA}.670	76.02	0.00	0.00	19.16	56.59	218.44	0.744
0 01:01:19							
{SDA}.671	76.02	0.00	0.00	17.78	58.05	73.94	0.764
0 00:35:13							
{SDA}.672	76.02	0.00	0.00	30.56	46.14	120.34	0.607
0 00:33:34							
{SDA}.673	76.02	0.00	0.00	18.08	57.74	92.88	0.759
0 00:40:47							
{SDA}.674	76.02	0.00	0.00	18.15	57.66	97.79	0.758
0 00:42:10							
{SDA}.675	76.02	0.00	0.00	18.05	57.77	114.56	0.760
0 00:40:10							
{SDA}.704	76.02	0.00	0.00	18.52	56.97	71.12	0.749
0 00:48:53							
{SDA}.708	76.02	0.00	0.00	17.81	58.02	49.98	0.763
0 00:35:50							
{SDA}.713	76.02	0.00	0.00	29.83	46.91	30.76	0.617
0 00:21:52							
{SDA}.716	76.02	0.00	0.00	30.64	46.05	50.16	0.606
0 00:34:47							
{SDA}.717	76.02	0.00	0.00	17.92	57.91	104.03	0.762
0 00:37:45							
{SDA}.718	76.02	0.00	0.00	30.56	46.13	120.74	0.607
0 00:33:40							
{SDA}.719	76.02	0.00	0.00	17.72	58.12	70.17	0.764
0 00:34:03							
{SDA}.720	76.02	0.00	0.00	18.06	57.76	115.48	0.760
0 00:40:23							
{SDA}.721	76.02	0.00	0.00	18.50	57.30	153.40	0.754

0 00:48:31							
{SDA}.722	76.02	0.00	0.00	30.89	45.79	55.44	0.602
0 00:38:10							
{SDA}.723	76.02	0.00	0.00	18.20	57.62	100.54	0.758
0 00:42:56							
{SDA}.730	76.02	0.00	0.00	27.12	49.64	32.20	0.653
0 00:30:24							
{SDA}.739	76.02	0.00	0.00	30.81	45.86	53.94	0.603
0 00:37:10							
700_union_1	76.02	0.00	0.00	18.32	57.48	71.82	0.756
0 00:45:17							

****
Node Depth Summary
****

Node ID	Average Depth Attained m	Maximum Depth Attained m	Maximum HGL Attained m	Time of Max Occurrence days	Time of Max Occurrence hh:mm	Total Flooded Volume ha-mm	Total Time Flooded minutes	Retention Time hh:mm:ss
10+053	0.00	0.16	103.32	0	01:56	0	0	0:00:00
11+001	0.00	0.00	104.63	0	00:00	0	0	0:00:00
12+001	0.00	0.00	104.55	0	00:00	0	0	0:00:00
12+185	0.00	0.02	103.34	0	02:00	0	0	0:00:00
12+228	0.00	0.02	103.34	0	02:01	0	0	0:00:00
12+254	0.00	0.00	103.41	0	00:00	0	0	0:00:00
12+309	0.00	0.00	103.94	0	00:00	0	0	0:00:00
309 (STM)	0.31	0.68	101.41	0	01:56	0	0	0:00:00
343 (STM)	1.47	1.92	100.63	0	01:56	0	0	0:00:00
345 (STM)	0.00	0.01	101.46	0	01:55	0	0	0:00:00
347 (STM)	1.11	1.90	100.98	0	01:56	0	0	0:00:00
349 (STM)	0.01	0.50	101.26	0	01:55	0	0	0:00:00
351 (STM)	0.58	1.67	101.28	0	01:56	0	0	0:00:00
353 (STM)	0.00	0.00	101.42	0	01:47	0	0	0:00:00
357 (STM)	0.05	0.30	102.27	0	01:56	0	0	0:00:00
357A (STM)	0.01	0.22	102.56	0	02:08	0	0	0:00:00
359 (STM)	0.02	0.27	102.80	0	01:56	0	0	0:00:00
359A (STM)	0.01	0.17	102.80	0	01:56	0	0	0:00:00
373 (STM)	1.24	1.36	102.24	0	01:56	0	0	0:00:00
373A (STM)	0.52	3.00	104.65	0	01:50	0	0	0:00:00
375 (STM)	0.90	1.17	102.39	0	01:56	0	0	0:00:00
377 (STM)	0.75	1.12	102.49	0	01:56	0	0	0:00:00
379 (STM)	0.46	0.96	102.62	0	01:57	0	0	0:00:00
379A (STM)	0.10	3.26	105.39	0	01:50	0	0	0:00:00
381 (STM)	0.33	0.91	102.70	0	01:58	0	0	0:00:00
383 (STM)	0.09	0.86	102.92	0	01:59	0	0	0:00:00
385 (STM)	0.08	0.90	102.98	0	02:00	0	0	0:00:00
387 (STM)	0.06	0.89	103.07	0	02:00	0	0	0:00:00
387A (STM)	0.06	0.79	103.13	0	02:00	0	0	0:00:00
389 (STM)	0.02	0.30	103.17	0	02:00	0	0	0:00:00
391 (STM)	1.53	1.76	100.40	0	01:56	0	0	0:00:00
393 (STM)	0.02	0.34	101.46	0	01:55	0	0	0:00:00
395 (STM)	1.39	1.94	100.73	0	01:56	0	0	0:00:00
397 (STM)	0.10	1.48	101.57	0	01:43	0	0	0:00:00
399 (STM)	0.02	0.73	101.44	0	01:47	0	0	0:00:00
4+345	0.00	0.08	104.57	0	01:53	0	0	0:00:00
4+420	0.00	0.00	104.70	0	00:00	0	0	0:00:00
4+510	0.00	0.05	104.79	0	01:55	0	0	0:00:00
4+568	0.00	0.07	105.07	0	01:50	0	0	0:00:00
4+665	0.00	0.00	105.21	0	00:00	0	0	0:00:00
4+750	0.00	0.00	105.31	0	00:00	0	0	0:00:00
4+828	0.00	0.00	105.41	0	00:00	0	0	0:00:00
417 (STM)	0.31	1.51	101.40	0	01:56	0	0	0:00:00
419 (STM)	0.11	0.82	102.86	0	01:59	0	0	0:00:00

6+088	0.00	0.04	104.47	0	01:52	0	0	0:00:00
6+102	0.00	0.05	104.66	0	01:57	0	0	0:00:00
7+096	0.00	0.00	105.19	0	00:00	0	0	0:00:00
703 (STM)	1.31	1.37	102.17	0	01:56	0	0	0:00:00
8+128	0.00	0.05	104.91	0	01:55	0	0	0:00:00
8+150	0.00	0.00	104.77	0	00:00	0	0	0:00:00
CB101-102 (STM)	0.18	0.90	103.80	0	01:56	0	0	0:00:00
CB111-112	0.03	0.84	103.86	0	01:50	0	0	0:00:00
CB113-114 (STM)	0.04	1.63	104.24	0	01:54	0	0	0:00:00
CB115-116 (STM)	0.06	1.58	104.57	0	01:54	0	0	0:00:00
CB117-118 (STM)	0.05	1.45	104.65	0	02:01	0	0	0:00:00
CB119-120 (STM)	0.03	1.10	104.91	0	01:54	0	0	0:00:00
CB121-122 (STM)	0.04	1.51	104.91	0	01:54	0	0	0:00:00
CB123-124 (STM)	0.05	1.52	105.06	0	01:56	0	0	0:00:00
CB125-126 (STM)	0.05	1.90	104.49	0	01:51	0	0	0:00:00
CB127-128 (STM)	0.04	1.31	104.66	0	01:57	0	0	0:00:00
CB129-130 (STM)	0.04	1.48	105.06	0	01:54	0	0	0:00:00
CB131-132 (STM)	0.05	1.45	105.18	0	01:56	0	0	0:00:00
CB133-134 (STM)	0.05	1.65	105.22	0	01:54	0	0	0:00:00
CB85-86 (STM)	0.04	1.39	103.19	0	01:54	0	0	0:00:00
CB87-88 (STM)	0.05	2.06	103.60	0	01:50	0	0	0:00:00
CB89-90 (STM)	0.04	1.05	103.34	0	02:00	0	0	0:00:00
CB91-92 (STM)	0.03	0.85	103.31	0	01:54	0	0	0:00:00
CB93-94 (STM)	0.04	1.95	103.64	0	01:50	0	0	0:00:00
CB95-96 (STM)	0.02	0.87	103.35	0	01:58	0	0	0:00:00
CB97-98 (STM)	0.06	1.67	103.91	0	01:57	0	0	0:00:00
E-34	0.03	1.49	104.01	0	01:52	0	0	0:00:00
Jun-35	0.00	0.10	103.38	0	01:55	0	0	0:00:00
Jun-37	0.00	0.09	103.55	0	01:55	0	0	0:00:00
Jun-40	0.00	0.08	104.22	0	01:55	0	0	0:00:00
Jun-43	0.00	0.08	104.95	0	01:55	0	0	0:00:00
Jun-51	0.00	0.05	104.50	0	01:55	0	0	0:00:00
RYCB-21 (STM)	0.35	2.40	105.38	0	01:55	0	0	0:00:00
RYCB-22 (STM)	0.35	1.97	104.96	0	01:55	0	0	0:00:00
RYCB-23 (STM)	0.35	2.03	104.24	0	01:55	0	0	0:00:00
RYCB-24 (STM)	0.43	2.19	103.55	0	01:55	0	0	0:00:00
RYCB-25 (STM)	0.36	2.54	103.39	0	01:55	0	0	0:00:00
RYCB-27 (STM)	0.04	2.23	103.46	0	01:55	0	0	0:00:00
RYCB-28 (STM)	0.34	2.38	103.54	0	01:55	0	0	0:00:00
RYCB-30 (STM)	0.35	2.57	105.09	0	01:51	0	0	0:00:00
RYCB-31 (STM)	0.32	2.07	104.90	0	01:51	0	0	0:00:00
RYCB-32 (STM)	0.33	1.91	104.75	0	01:55	0	0	0:00:00
RYCB-33 (STM)	0.34	2.69	104.59	0	01:55	0	0	0:00:00
RYCB-34 (STM)	0.32	1.83	103.99	0	01:55	0	0	0:00:00
RYCB-38 (STM)	0.33	1.49	105.41	0	01:55	0	0	0:00:00
RYCB-39 (STM)	0.04	1.77	105.45	0	01:55	0	0	0:00:00
RYCBMH-2 (STM)	0.34	1.80	103.40	0	01:55	0	0	0:00:00
EX341 (STM)	1.64	1.64	100.17	0	00:00	0	0	0:00:00
EX363 (STM)	1.71	1.71	102.11	0	00:00	0	0	0:00:00
MAJ-Easement	0.00	0.16	103.16	0	01:56	0	0	0:00:00
MAJ-Haliburton	0.02	0.06	103.79	0	01:56	0	0	0:00:00
MAJ-Shinny	0.00	0.00	104.12	0	00:00	0	0	0:00:00
MAJ-Slapshot	0.00	0.00	105.10	0	00:00	0	0	0:00:00
Off-site	0.12	2.38	104.74	0	02:02	0	0	0:00:00

****
Node Flow Summary
****

Node ID	Element Type	Maximum Lateral Inflow LPS	Peak Inflow LPS	Time of Peak Inflow Occurrence days	Time of Peak Inflow Occurrence hh:mm	Maximum Flooding Overflow LPS	Time of Peak Flooding Occurrence days	Time of Peak Flooding Occurrence hh:mm
10+053	JUNCTION	0.00	116.76	0	01:55	0.00		
11+001	JUNCTION	0.00	0.00	0	00:00	0.00		
12+001	JUNCTION	0.00	0.00	0	00:00	0.00		
12+185	JUNCTION	0.00	16.98	0	01:55	0.00		

12+228	JUNCTION	0.00	17.13	0	01:56	0.00
12+254	JUNCTION	0.00	0.00	0	00:00	0.00
12+309	JUNCTION	0.00	0.00	0	00:00	0.00
309 (STM)	JUNCTION	0.00	19.11	0	01:47	0.00
343 (STM)	JUNCTION	0.00	1056.66	0	01:56	0.00
345 (STM)	JUNCTION	0.00	0.12	0	01:48	0.00
347 (STM)	JUNCTION	0.00	890.41	0	01:56	0.00
349 (STM)	JUNCTION	0.00	21.59	0	01:43	0.00
351 (STM)	JUNCTION	0.00	615.76	0	01:59	0.00
353 (STM)	JUNCTION	0.00	0.22	0	01:47	0.00
357 (STM)	JUNCTION	0.00	328.42	0	01:55	0.00
357A (STM)	JUNCTION	0.00	117.23	0	01:55	0.00
359 (STM)	JUNCTION	0.00	126.09	0	01:44	0.00
359A (STM)	JUNCTION	0.00	80.89	0	01:56	0.00
373 (STM)	JUNCTION	0.00	1465.43	0	01:57	0.00
373A (STM)	JUNCTION	439.00	439.00	0	01:50	0.00
375 (STM)	JUNCTION	0.00	1298.54	0	01:57	0.00
377 (STM)	JUNCTION	0.00	1201.13	0	01:57	0.00
379 (STM)	JUNCTION	0.00	1072.64	0	02:01	0.00
379A (STM)	JUNCTION	389.72	389.72	0	01:50	0.00
381 (STM)	JUNCTION	0.00	830.64	0	02:01	0.00
383 (STM)	JUNCTION	0.00	672.93	0	02:11	0.00
385 (STM)	JUNCTION	0.00	655.59	0	02:11	0.00
387 (STM)	JUNCTION	0.00	639.85	0	02:02	0.00
387A (STM)	JUNCTION	0.00	476.90	0	02:02	0.00
389 (STM)	JUNCTION	0.00	84.54	0	01:54	0.00
391 (STM)	JUNCTION	0.00	1166.12	0	01:56	0.00
393 (STM)	JUNCTION	0.00	166.56	0	01:53	0.00
395 (STM)	JUNCTION	0.00	890.41	0	01:56	0.00
397 (STM)	JUNCTION	0.00	141.46	0	01:54	0.00
399 (STM)	JUNCTION	0.00	106.97	0	01:57	0.00
4+345	JUNCTION	0.00	269.92	0	01:50	0.00
4+420	JUNCTION	0.00	0.00	0	00:00	0.00
4+510	JUNCTION	0.00	55.53	0	01:54	0.00
4+568	JUNCTION	0.00	245.28	0	01:50	0.00
4+665	JUNCTION	0.00	0.00	0	00:00	0.00
4+750	JUNCTION	0.00	0.00	0	00:00	0.00
4+828	JUNCTION	0.00	0.00	0	00:00	0.00
417 (STM)	JUNCTION	0.00	372.97	0	02:04	0.00
419 (STM)	JUNCTION	0.00	767.22	0	02:02	0.00
6+088	JUNCTION	0.00	42.99	0	01:51	0.00
6+102	JUNCTION	0.00	44.16	0	01:56	0.00
7+096	JUNCTION	0.00	0.00	0	00:00	0.00
703 (STM)	JUNCTION	0.00	1565.99	0	01:56	0.00
8+128	JUNCTION	0.00	62.75	0	01:52	0.00
8+150	JUNCTION	0.00	0.00	0	00:00	0.00
CB101-102 (STM)	JUNCTION	71.12	175.33	0	01:51	0.00
CB111-112	JUNCTION	49.98	49.98	0	01:50	0.00
CB113-114 (STM)	JUNCTION	100.54	249.88	0	01:53	0.00
CB115-116 (STM)	JUNCTION	97.79	244.87	0	01:50	0.00
CB117-118 (STM)	JUNCTION	92.88	97.85	0	01:54	0.00
CB119-120 (STM)	JUNCTION	53.70	257.60	0	02:05	0.00
CB121-122 (STM)	JUNCTION	128.10	237.25	0	01:50	0.00
CB123-124 (STM)	JUNCTION	115.18	214.44	0	01:50	0.00
CB125-126 (STM)	JUNCTION	147.42	147.42	0	01:50	0.00
CB127-128 (STM)	JUNCTION	71.82	115.60	0	01:52	0.00
CB129-130 (STM)	JUNCTION	141.30	194.73	0	01:50	0.00
CB131-132 (STM)	JUNCTION	135.96	149.91	0	01:50	0.00
CB133-134 (STM)	JUNCTION	148.32	148.32	0	01:50	0.00
CB85-86 (STM)	JUNCTION	153.40	193.96	0	01:50	0.00
CB87-88 (STM)	JUNCTION	115.48	115.48	0	01:50	0.00
CB89-90 (STM)	JUNCTION	70.17	117.79	0	01:51	0.00
CB91-92 (STM)	JUNCTION	104.03	146.01	0	01:50	0.00
CB93-94 (STM)	JUNCTION	114.56	114.56	0	01:50	0.00
CB95-96 (STM)	JUNCTION	73.94	103.23	0	01:52	0.00
CB97-98 (STM)	JUNCTION	218.44	218.44	0	01:50	0.00
E-34	JUNCTION	30.76	30.76	0	01:50	0.00
Jun-35	JUNCTION	0.00	69.68	0	01:55	0.00
Jun-37	JUNCTION	0.00	55.24	0	01:55	0.00
Jun-40	JUNCTION	0.00	69.90	0	01:55	0.00

Jun-43	JUNCTION	0.00	73.35	0	01:55	0.00
Jun-51	JUNCTION	0.00	21.74	0	01:55	0.00
RYCB-21 (STM)	JUNCTION	53.94	53.94	0	01:55	0.00
RYCB-22 (STM)	JUNCTION	136.12	136.12	0	01:55	0.00
RYCB-23 (STM)	JUNCTION	134.43	134.43	0	01:55	0.00
RYCB-24 (STM)	JUNCTION	120.34	120.34	0	01:55	0.00
RYCB-25 (STM)	JUNCTION	120.74	120.74	0	01:55	0.00
RYCB-27 (STM)	JUNCTION	55.44	78.89	0	01:55	0.00
RYCB-28 (STM)	JUNCTION	50.16	60.04	0	01:55	0.00
RYCB-30 (STM)	JUNCTION	44.80	44.80	0	01:50	0.00
RYCB-31 (STM)	JUNCTION	25.30	25.30	0	01:50	0.00
RYCB-32 (STM)	JUNCTION	31.31	31.31	0	01:55	0.00
RYCB-33 (STM)	JUNCTION	46.38	59.21	0	01:55	0.00
RYCB-34 (STM)	JUNCTION	18.04	18.04	0	01:55	0.00
RYCB-38 (STM)	JUNCTION	32.20	32.20	0	01:55	0.00
RYCB-39 (STM)	JUNCTION	42.73	42.73	0	01:55	0.00
RYCBMH-2 (STM)	JUNCTION	128.03	128.03	0	01:55	0.00
EX341 (STM)	OUTFALL	0.00	1166.13	0	01:56	0.00
EX363 (STM)	OUTFALL	0.00	1566.02	0	01:56	0.00
MAJ-Easement	OUTFALL	0.00	105.29	0	01:56	0.00
MAJ-Haliburton	OUTFALL	0.00	113.37	0	01:56	0.00
MAJ-Shinny	OUTFALL	0.00	128.49	0	01:54	0.00
MAJ-Slapshot	OUTFALL	0.00	26.54	0	01:55	0.00
Off-site	STORAGE	1180.70	1180.70	0	01:50	0.00

****
Storage Node Summary
****

Storage Node ID	Maximum Ponded Volume 1000 m³	Maximum Ponded Volume (%)	Time of Max Ponded Volume days hh:mm	Average Ponded Volume 1000 m³	Average Ponded Volume (%)	Maximum Storage Node Outflow LPS	Maximum Exfiltration Rate cmm	Time of Max. Exfiltration Rate hh:mm:ss	Total Exfiltrated Volume 1000 m³
Off-site	0.438	73	0 02:02	0.010	2	448.44	0.00	0:00:00	0.000

****
Outfall Loading Summary
****

Outfall Node ID	Flow Frequency (%)	Average Flow LPS	Peak Inflow LPS
EX341 (STM)	100.00	46.87	1166.13
EX363 (STM)	79.33	80.10	1566.02
MAJ-Easement	3.39	23.58	105.29
MAJ-Haliburton	99.99	7.70	113.37
MAJ-Shinny	1.62	66.10	128.49
MAJ-Slapshot	1.52	14.26	26.54
System	47.64	238.62	3100.89

****
Link Flow Summary
****

Link ID	Element Type	Time of Peak Flow	Maximum Velocity	Length Factor	Peak Flow during Analysis	Design Flow Capacity	Ratio of Maximum Flow	Ratio of Maximum Flow	Total Reported Time	Condition
		Occurrence days hh:mm	Attained m/sec		LPS	LPS	/Design	Flow	Surcharged minutes	
{STM}.STM Pipe - (190)	(STM) CONDUIT	0 02:14	1.10	1.00	482.39	828.28	0.58	0.88	0	Calculated
{STM}.STM Pipe - (199)	(STM) CONDUIT	0 01:55	1.42	1.00	117.25	281.79	0.42	0.56	0	Calculated
{STM}.STM Pipe - (390)	(STM) CONDUIT	0 02:04	1.81	1.00	332.11	704.54	0.47	0.78	0	Calculated
{STM}.STM Pipe - (69) (1) (1)	(STM) CONDUIT	0 01:56	1.61	1.00	1056.68	806.02	1.31	1.00	1439	SURCHARGED
{STM}.STM Pipe - (69) (1)	(STM) CONDUIT	0 01:56	1.78	1.00	1166.13	1210.53	0.96	1.00	1439	SURCHARGED
{STM}.STM Pipe - (70) (1)	(STM) CONDUIT	0 01:56	1.36	1.00	890.41	1116.74	0.80	1.00	1438	SURCHARGED
{STM}.STM Pipe - (70)	(STM) CONDUIT	0 01:57	1.36	1.00	890.46	1374.48	0.65	1.00	1439	SURCHARGED
{STM}.STM Pipe - (71)	(STM) CONDUIT	0 01:59	1.35	1.00	616.50	688.61	0.90	1.00	40	SURCHARGED
{STM}.STM Pipe - (72) (1)	(STM) CONDUIT	0 02:04	0.41	1.00	26.38	140.53	0.19	1.00	13	SURCHARGED
{STM}.STM Pipe - (72)	(STM) CONDUIT	0 02:04	1.01	1.00	372.63	695.73	0.54	1.00	35	SURCHARGED
{STM}.STM Pipe - (75) (2) (1)	(STM) CONDUIT	0 01:57	0.99	1.00	1465.53	2597.59	0.56	1.00	0	Calculated
{STM}.STM Pipe - (75)	(STM) CONDUIT	0 01:56	1.06	1.00	1566.02	2403.74	0.65	0.99	0	Calculated
{STM}.STM Pipe - (76)	(STM) CONDUIT	0 01:57	1.12	1.00	1298.78	1703.53	0.76	0.97	0	Calculated
{STM}.STM Pipe - (77)	(STM) CONDUIT	0 01:57	1.06	1.00	1201.30	1747.31	0.69	0.94	0	Calculated
{STM}.STM Pipe - (78) (1)	(STM) CONDUIT	0 01:48	0.01	1.00	0.12	81.54	0.00	0.32	0	Calculated
{STM}.STM Pipe - (78)	(STM) CONDUIT	0 01:55	1.40	1.00	166.37	210.00	0.79	0.68	0	Calculated
{STM}.STM Pipe - (79) (1)	(STM) CONDUIT	0 01:43	0.57	1.00	21.59	123.53	0.17	1.00	17	SURCHARGED
{STM}.STM Pipe - (79)	(STM) CONDUIT	0 01:54	0.86	1.00	141.43	209.62	0.67	1.00	29	SURCHARGED
{STM}.STM Pipe - (80) (1)	(STM) CONDUIT	0 01:47	0.01	1.00	0.22	101.06	0.00	0.50	0	Calculated
{STM}.STM Pipe - (80)	(STM) CONDUIT	0 02:12	1.01	1.00	135.97	297.17	0.46	1.00	19	SURCHARGED
{STM}.STM Pipe - (81)	(STM) CONDUIT	0 02:03	1.27	1.00	1073.54	1433.75	0.75	0.90	0	Calculated
{STM}.STM Pipe - (82)	(STM) CONDUIT	0 02:04	1.23	1.00	836.15	1154.69	0.72	0.90	0	Calculated
{STM}.STM Pipe - (83) (1)	(STM) CONDUIT	0 02:10	1.16	1.00	676.78	958.70	0.71	0.92	0	Calculated
{STM}.STM Pipe - (83)	(STM) CONDUIT	0 02:06	1.31	1.00	766.51	942.25	0.81	0.91	0	Calculated
{STM}.STM Pipe - (84)	(STM) CONDUIT	0 02:11	1.06	1.00	657.15	847.10	0.78	0.96	0	Calculated
{STM}.STM Pipe - (85)	(STM) CONDUIT	0 02:11	1.04	1.00	655.59	845.04	0.78	0.98	0	Calculated
{STM}.STM Pipe - (86)	(STM) CONDUIT	0 02:08	0.80	1.00	84.27	132.87	0.63	0.82	0	Calculated
{STM}.STM Pipe - (87)	(STM) CONDUIT	0 01:56	0.77	1.00	43.99					

```
144.96      0.30      0.52           0  Calculated
  {STM}.STM Pipe - (88) (STM) CONDUIT      0  01:57      1.33    1.00      124.75
217.08      0.57      0.56           0  Calculated
  Link-02               CONDUIT      0  02:07      0.97    1.00       48.64       29.18
1.67      0.38            0  > CAPACITY
  Link-07               CHANNEL      0  01:54      0.37    1.00      128.49     1599.37
0.08      0.33            0  Calculated
  Link-09               CHANNEL      0  00:00      0.00    1.00        0.00     4835.64
0.00      0.24            0  Calculated
  Link-10               CHANNEL      0  00:00      0.00    1.00        0.00     5150.85
0.00      0.24            0  Calculated
  Link-101              CHANNEL      0  01:55      0.18    1.00       21.68     2182.86
0.01      0.29            0  Calculated
  Link-106              CHANNEL      0  01:55      0.25    1.00       12.84     1205.28
0.01      0.24            0  Calculated
  Link-11               CHANNEL      0  00:00      0.00    1.00        0.00     5252.16
0.00      0.29            0  Calculated
  Link-112              CHANNEL      0  00:00      0.00    1.00        0.00     2612.99
0.00      0.14            0  Calculated
  Link-113              CHANNEL      0  01:50      1.20    1.00      245.28     7253.46
0.03      0.25            0  Calculated
  Link-114              CHANNEL      0  01:50      1.04    1.00      269.92     5128.97
0.05      0.28            0  Calculated
  Link-115              CHANNEL      0  00:00      0.00    1.00        0.00     7724.46
0.00      0.08            0  Calculated
  Link-116              CHANNEL      0  00:00      0.00    1.00        0.00     6480.60
0.00      0.28            0  Calculated
  Link-117              CHANNEL      0  00:00      0.00    1.00        0.00     7043.17
0.00      0.07            0  Calculated
  Link-118              CHANNEL      0  01:55      0.46    1.00       17.89     2410.57
0.01      0.18            0  Calculated
  Link-119              CHANNEL      0  01:55      0.14    1.00       27.73     1867.22
0.01      0.37            0  Calculated
  Link-12               CHANNEL      0  00:00      0.00    1.00        0.00     4959.97
0.00      0.29            0  Calculated
  Link-120              CHANNEL      0  01:56      0.41    1.00      105.29      615.70
0.17      0.53            0  Calculated
  Link-13               CHANNEL      0  00:00      0.00    1.00        0.00     5644.46
0.00      0.29            0  Calculated
  Link-14               CHANNEL      0  01:50      0.27    1.00       42.23     3641.10
0.01      0.37            0  Calculated
  Link-16               CHANNEL      0  01:52      0.11    1.00       62.75     6382.27
0.01      0.44            0  Calculated
  Link-17               CHANNEL      0  01:55      0.18    1.00       89.71     4181.01
0.02      0.54            0  Calculated
  Link-18               CHANNEL      0  02:05      0.61    1.00      241.66     8005.23
0.03      0.36            0  Calculated
  Link-19               CHANNEL      0  01:55      0.14    1.00       49.35     5033.10
0.01      0.36            0  Calculated
  Link-22               CHANNEL      0  01:50      0.47    1.00      150.01     6281.68
0.02      0.57            0  Calculated
  Link-23               CHANNEL      0  01:53      0.49    1.00      162.91     4669.42
0.03      0.33            0  Calculated
  Link-25               CHANNEL      0  01:50      0.43    1.00       91.45     5071.11
0.02      0.45            0  Calculated
  Link-26               CHANNEL      0  01:50      0.46    1.00      102.45     5680.59
0.02      0.49            0  Calculated
  Link-30               CHANNEL      0  00:00      0.00    1.00        0.00     5184.30
0.00      0.40            0  Calculated
  Link-31               CHANNEL      0  00:00      0.00    1.00        0.00     6162.27
0.00      0.16            0  Calculated
  Link-32               CHANNEL      0  01:51      0.27    1.00       42.99     4279.24
0.01      0.22            0  Calculated
  Link-33               CHANNEL      0  00:00      0.00    1.00        0.00     8764.39
0.00      0.22            0  Calculated
  Link-34               CHANNEL      0  01:56      0.16    1.00       44.16     5772.47
0.01      0.29            0  Calculated
  Link-35               CHANNEL      0  01:57      0.45    1.00       43.82     2337.25
0.02      0.22            0  Calculated
  Link-38               CHANNEL      0  01:52      0.09    1.00       39.54     7853.58
```

0.01	0.40		0	Calculated				
Link-40		CHANNEL	0	00:00	0.00	1.00	0.00	4972.23
0.00	0.28		0	Calculated				
Link-44		CHANNEL	0	01:50	0.16	1.00	27.40	6120.37
0.00	0.38		0	Calculated				
Link-45		CHANNEL	0	01:56	0.41	1.00	113.37	6891.85
0.02	0.44		0	Calculated				
Link-47		CHANNEL	0	00:00	0.00	1.00	0.00	9357.20
0.00	0.14		0	Calculated				
Link-48		CHANNEL	0	00:00	0.00	1.00	0.00	5539.93
0.00	0.14		0	Calculated				
Link-49		CHANNEL	0	00:00	0.00	1.00	0.00	8990.14
0.00	0.27		0	Calculated				
Link-51		CHANNEL	0	02:01	0.23	1.00	10.26	8207.33
0.00	0.29		0	Calculated				
Link-52		CHANNEL	0	01:56	0.05	1.00	17.13	4966.11
0.00	0.38		0	Calculated				
Link-53		CHANNEL	0	01:55	0.05	1.00	16.98	7791.47
0.00	0.38		0	Calculated				
Link-54		CHANNEL	0	00:00	0.00	1.00	0.00	5977.01
0.00	0.29		0	Calculated				
Link-55		CHANNEL	0	00:00	0.00	1.00	0.00	5338.41
0.00	0.44		0	Calculated				
Link-57		CHANNEL	0	01:50	0.27	1.00	42.67	5830.45
0.01	0.33		0	Calculated				
Link-59		CHANNEL	0	01:50	0.57	1.00	41.31	6538.68
0.01	0.38		0	Calculated				
Link-60		CHANNEL	0	02:00	0.19	1.00	10.32	8047.95
0.00	0.33		0	Calculated				
Link-61		CHANNEL	0	01:55	0.18	1.00	20.53	557.33
0.04	0.37		0	Calculated				
Link-64		CHANNEL	0	01:55	2.54	1.00	68.96	1426.11
0.05	0.42		0	Calculated				
Link-70		CHANNEL	0	01:55	0.26	1.00	23.60	852.26
0.03	0.25		0	Calculated				
Link-71		CHANNEL	0	01:52	0.21	1.00	11.08	1217.28
0.01	0.22		0	Calculated				
Link-72		CHANNEL	0	01:55	0.13	1.00	69.68	1974.30
0.04	0.67		0	Calculated				
Link-74		CHANNEL	0	01:55	0.18	1.00	68.99	1195.56
0.06	0.59		0	Calculated				
Link-75		CHANNEL	0	01:55	0.12	1.00	55.24	2088.96
0.03	0.65		0	Calculated				
Link-77		CHANNEL	0	01:55	0.31	1.00	54.61	1394.08
0.04	0.39		0	Calculated				
Link-80		CHANNEL	0	01:55	0.17	1.00	69.90	1224.27
0.06	0.53		0	Calculated				
Link-82		CHANNEL	0	01:55	0.20	1.00	69.24	2012.43
0.03	0.48		0	Calculated				
Link-85		CHANNEL	0	01:55	0.12	1.00	73.35	1540.30
0.05	0.64		0	Calculated				
Link-86		CHANNEL	0	01:55	0.45	1.00	72.70	2147.91
0.03	0.35		0	Calculated				
Link-91		CHANNEL	0	01:55	0.35	1.00	16.36	1476.16
0.01	0.18		0	Calculated				
Link-93		CHANNEL	0	01:55	0.35	1.00	26.54	1205.28
0.02	0.23		0	Calculated				
Link-96		CHANNEL	0	01:51	0.27	1.00	22.29	852.26
0.03	0.23		0	Calculated				
Link-97		CHANNEL	0	00:00	0.00	1.00	0.00	2976.83
0.00	0.00		0	Calculated				
Link-99		CHANNEL	0	01:55	1.13	1.00	21.74	852.26
0.03	0.23		0	Calculated				
{STM}.CBL109 (STM)		ORIFICE	0	01:54			84.04	
1.00								
{STM}.CBL111 (STM)		ORIFICE	0	01:54			60.59	
1.00								
{STM}.CBL113 (STM)		ORIFICE	0	02:01			57.96	
1.00								
{STM}.CBL115 (STM)		ORIFICE	0	01:54			35.09	

1.00						
{STM}.CBL117 (STM)	ORIFICE	0	01:54		101.49	
1.00						
{STM}.CBL119 (STM)	ORIFICE	0	01:56		80.89	
1.00						
{STM}.CBL123 (STM)	ORIFICE	0	01:57		54.90	
1.00						
{STM}.CBL125 (STM)	ORIFICE	0	01:54		100.39	
1.00						
{STM}.CBL128 (STM)	ORIFICE	0	01:56		78.96	
1.00						
{STM}.CBL130 (STM)	ORIFICE	0	01:54		84.54	
1.00						
{STM}.CBL85 (STM)	ORIFICE	0	02:00		48.82	
1.00						
{STM}.CBL87 (STM)	ORIFICE	0	01:54		74.14	
1.00						
{STM}.CBL91 (STM)	ORIFICE	0	01:58		75.23	
1.00						
{STM}.CBL93 (STM)	ORIFICE	0	01:57		106.97	
1.00						
{STM}.CBL97 (STM)	ORIFICE	0	01:56		22.95	
1.00						
{STM}.STM Pipe - (182) (STM)	ORIFICE	0	01:42			169.12
1.00						
{STM}.STM Pipe - (183) (STM)	ORIFICE	0	01:41			148.87
1.00						
{STM}.STM Pipe - (389) (STM)	ORIFICE	0	01:50			69.60
1.00						
{STM}.STM Pipe - (391) (STM)	ORIFICE	0	01:54			97.13
1.00						
{STM}.STM Pipe - (392) (STM)	ORIFICE	0	01:50			67.55
1.00						
{STM}.STM Pipe - (393) (STM)	ORIFICE	0	01:51			88.17
1.00						
{STM}.STM Pipe - (397) (STM)	ORIFICE	0	01:55			27.05
1.00						
{STM}.STM Pipe - (400) (STM)	ORIFICE	0	01:55			62.40
1.00						
{STM}.STM Pipe - (403) (STM)	ORIFICE	0	01:55			63.53
1.00						
{STM}.STM Pipe - (406) (STM)	ORIFICE	0	01:55			64.87
1.00						
{STM}.STM Pipe - (409) (STM)	ORIFICE	0	01:55			50.81
1.00						
{STM}.STM Pipe - (412) (STM)	ORIFICE	0	01:55			58.83
1.00						
{STM}.STM Pipe - (414) (STM)	ORIFICE	0	01:55			50.74
1.00						
{STM}.STM Pipe - (417) (STM)	ORIFICE	0	01:55			35.43
1.00						
{STM}.STM Pipe - (419) (STM)	ORIFICE	0	01:55			15.78
1.00						
{STM}.STM Pipe - (421) (STM)	ORIFICE	0	01:55			24.76
1.00						
{STM}.STM Pipe - (425) (STM)	ORIFICE	0	01:51			21.97
1.00						
{STM}.STM Pipe - (427) (STM)	ORIFICE	0	01:51			24.76
1.00						
{STM}.STM Pipe - (429) (STM)	ORIFICE	0	01:55			18.46
1.00						
{STM}.STM Pipe - (433) (STM)	ORIFICE	0	01:52			37.00
1.00						
{STM}.STM Pipe - (435) (STM)	ORIFICE	0	01:55			17.94
1.00						
Link-01	ORIFICE	0	02:18		448.44	
1.00						
Link-102	ORIFICE	0	01:52		17.72	
1.00						
O-111	ORIFICE	0	01:50		22.08	

1.00

****
Flow Classification Summary
****

Link	--- Fraction of Time in Flow Class ---- Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Avg. Froude Number	Avg. Flow Change
{STM}.STM Pipe - (190) (STM)	0.00	0.00	0.00	0.06	0.00	0.00	0.94	0.45	0.0001
{STM}.STM Pipe - (199) (STM)	0.00	0.02	0.00	0.97	0.01	0.00	0.00	0.12	0.0000
{STM}.STM Pipe - (390) (STM)	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.26	0.0001
{STM}.STM Pipe - (69) (1) (1) (STM)	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.0003
{STM}.STM Pipe - (69) (1) (STM)	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.0002
{STM}.STM Pipe - (70) (1) (STM)	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.0002
{STM}.STM Pipe - (70) (STM)	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.0002
{STM}.STM Pipe - (71) (STM)	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.01	0.0003
{STM}.STM Pipe - (72) (1) (STM)	0.00	0.84	0.00	0.15	0.00	0.00	0.00	0.01	0.0000
{STM}.STM Pipe - (72) (STM)	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.03	0.0002
{STM}.STM Pipe - (75) (2) (1) (STM)	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.01	0.0001
{STM}.STM Pipe - (75) (STM)	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.01	0.0001
{STM}.STM Pipe - (76) (STM)	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.01	0.0001
{STM}.STM Pipe - (77) (STM)	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.02	0.0001
{STM}.STM Pipe - (78) (1) (STM)	0.00	0.00	0.00	0.03	0.00	0.00	0.97	0.00	0.0000
{STM}.STM Pipe - (78) (STM)	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.58	0.0001
{STM}.STM Pipe - (79) (1) (STM)	0.00	0.00	0.00	0.04	0.00	0.00	0.96	0.00	0.0000
{STM}.STM Pipe - (79) (STM)	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.01	0.0002
{STM}.STM Pipe - (80) (1) (STM)	0.88	0.03	0.00	0.04	0.00	0.00	0.06	0.00	0.0000
{STM}.STM Pipe - (80) (STM)	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.03	0.0001
{STM}.STM Pipe - (81) (STM)	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.03	0.0001
{STM}.STM Pipe - (82) (STM)	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.04	0.0001
{STM}.STM Pipe - (83) (1) (STM)	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.12	0.0001
{STM}.STM Pipe - (83) (STM)	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.08	0.0001
{STM}.STM Pipe - (84) (STM)	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.12	0.0001
{STM}.STM Pipe - (85) (STM)	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.17	0.0001
{STM}.STM Pipe - (86) (STM)	0.00	0.00	0.00	0.04	0.00	0.00	0.96	0.34	0.0001
{STM}.STM Pipe - (87) (STM)	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.31	0.0000
{STM}.STM Pipe - (88) (STM)	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.54	0.0001
Link-02	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.23	0.0002
Link-07	0.98	0.00	0.00	0.00	0.00	0.02	0.00	0.01	0.0000
Link-09	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
Link-10	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
Link-101	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.07	0.0000
Link-106	0.99	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.0000
Link-11	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
Link-112	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
Link-113	0.00	0.98	0.00	0.00	0.01	0.00	0.00	0.03	0.0000
Link-114	0.00	0.98	0.00	0.01	0.01	0.00	0.00	0.02	0.0000
Link-115	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
Link-116	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
Link-117	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
Link-118	0.99	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.0000
Link-119	0.00	0.99	0.00	0.01	0.00	0.00	0.00	0.00	0.0000
Link-12	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
Link-120	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.19	0.0000
Link-13	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
Link-14	0.98	0.00	0.00	0.02	0.00	0.00	0.00	0.01	0.0000
Link-16	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.06	0.0000

Link-17	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.13	0.0000
Link-18	0.98	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.0000
Link-19	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.00	0.0000
Link-22	0.00	0.00	0.00	0.03	0.00	0.00	0.97	0.52	0.0000
Link-23	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.36	0.0000
Link-25	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.36	0.0000
Link-26	0.00	0.00	0.00	0.03	0.00	0.00	0.97	0.42	0.0000
Link-30	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
Link-31	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
Link-32	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.24	0.0000
Link-33	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
Link-34	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.09	0.0000
Link-35	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.12	0.0000
Link-38	0.00	0.00	0.00	0.07	0.00	0.00	0.93	0.37	0.0000
Link-40	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
Link-44	0.93	0.05	0.00	0.02	0.00	0.00	0.00	0.00	0.0000
Link-45	0.00	0.00	0.00	0.06	0.00	0.00	0.94	1.11	0.0000
Link-47	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
Link-48	0.99	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
Link-49	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
Link-51	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.25	0.0000
Link-52	0.00	0.00	0.00	0.03	0.00	0.00	0.97	0.12	0.0000
Link-53	0.00	0.00	0.00	0.03	0.00	0.00	0.97	0.12	0.0000
Link-54	0.98	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
Link-55	0.97	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
Link-57	0.98	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.0000
Link-59	0.98	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.0000
Link-60	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.15	0.0000
Link-61	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
Link-64	0.00	0.98	0.00	0.02	0.00	0.00	0.00	0.01	0.0000
Link-70	0.99	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.0000
Link-71	0.99	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.0000
Link-72	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.10	0.0000
Link-74	0.00	0.00	0.00	0.03	0.00	0.00	0.97	0.05	0.0000
Link-75	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.09	0.0000
Link-77	0.00	0.00	0.00	0.01	0.00	0.00	0.99	0.06	0.0000
Link-80	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.06	0.0000
Link-82	0.00	0.00	0.00	0.07	0.00	0.00	0.93	0.09	0.0000
Link-85	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.05	0.0000
Link-86	0.00	0.00	0.00	0.02	0.00	0.00	0.98	0.09	0.0000
Link-91	0.99	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.0000
Link-93	0.98	0.00	0.00	0.00	0.00	0.00	0.02	0.01	0.0000
Link-96	0.99	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.0000
Link-97	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0000
Link-99	0.00	0.99	0.00	0.01	0.00	0.00	0.00	0.00	0.0000

****
Highest Continuity Errors
****
Node 4+568 (-3.17%)
Node CB87-88 (STM) (-1.97%)
Node CB93-94 (STM) (-1.66%)
Node Jun-51 (1.22%)
Node CB91-92 (STM) (1.19%)

****
Highest Flow Instability Indexes
****
Link {STM}.STM Pipe - (182) (STM) (20)
Link Link-01 (15)
Link {STM}.STM Pipe - (75) (2) (1) (STM) (9)
Link {STM}.STM Pipe - (76) (STM) (6)
Link {STM}.STM Pipe - (75) (STM) (3)

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

```
  Minimum Time Step           :     5.00 sec
  Average Time Step           :     5.00 sec
  Maximum Time Step           :     5.00 sec
  Percent in Steady State     :     0.00
  Average Iterations per Step :     7.26
```

```
  WARNING 107 : Initial water surface elevation defined for Junction 379A (STM) is below
junction invert elevation.
                Assumed initial water surface elevation equal to invert elevation.
  WARNING 108 : Surcharge elevation defined for Junction 4+420 is below junction maximum
elevation. Assumed surcharge elevation equal to maximum elevation.
  WARNING 118 : Orifice crest elevation defined for Orifice O-111 is below upstream node
invert elevation.
                Assumed orifice crest elevation equal to upstream node invert elevation.
  WARNING 116 : Conduit inlet invert elevation defined for Conduit
{STM}.STM Pipe - (199) (STM) is below upstream node invert elevation.
                Assumed conduit inlet invert elevation equal to upstream node invert
elevation.
  WARNING 116 : Conduit inlet invert elevation defined for Conduit
{STM}.STM Pipe - (71) (STM) is below upstream node invert elevation.
                Assumed conduit inlet invert elevation equal to upstream node invert
elevation.
  WARNING 116 : Conduit inlet invert elevation defined for Conduit
{STM}.STM Pipe - (72) (STM) is below upstream node invert elevation.
                Assumed conduit inlet invert elevation equal to upstream node invert
elevation.
  WARNING 004 : Minimum elevation drop used for Conduit Link-02.
  WARNING 117 : Conduit outlet invert elevation defined for Conduit Link-113 is below
downstream node invert elevation.
                Assumed conduit outlet invert elevation equal to downstream node invert
elevation.
```

  WARNING 117 : Conduit outlet invert elevation defined for Conduit Link-114 is below downstream node invert elevation.
                Assumed conduit outlet invert elevation equal to downstream node invert elevation.
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node 10+053.
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node 11+001.
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node 12+001.
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node 12+185.
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node 12+228.
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node 12+254.
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node 12+309.
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node 373A (STM).
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node 379A (STM).
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node 4+345.
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node 4+420.
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node 4+510.
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node 4+568.
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node 4+665.
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node 4+750.
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node 4+828.
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node 6+088.
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node 6+102.
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node 7+096.
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node 8+128.
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node 8+150.
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node CB101-102 (STM).
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node CB111-112.
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node CB113-114 (STM).
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node CB115-116 (STM).
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node CB117-118 (STM).
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node CB119-120 (STM).
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node CB121-122 (STM).
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node CB123-124 (STM).
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node CB125-126 (STM).
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node CB127-128 (STM).
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node CB129-130 (STM).
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node CB131-132 (STM).

  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node CB133-134 (STM).
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node CB85-86 (STM).
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node CB87-88 (STM).
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node CB89-90 (STM).
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node CB91-92 (STM).
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node CB93-94 (STM).
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node CB95-96 (STM).
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node CB97-98 (STM).
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node E-34.
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node Jun-35.
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node Jun-37.
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node Jun-40.
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node Jun-43.
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node Jun-51.
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node RYCB-21 (STM).
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node RYCB-22 (STM).
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node RYCB-23 (STM).
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node RYCB-24 (STM).
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node RYCB-25 (STM).
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node RYCB-27 (STM).
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node RYCB-28 (STM).
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node RYCB-30 (STM).
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node RYCB-31 (STM).
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node RYCB-32 (STM).
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node RYCB-33 (STM).
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node RYCB-34 (STM).
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node RYCB-38 (STM).
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node RYCB-39 (STM).
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height dimensions for Node RYCBMH-2 (STM).

  Analysis began on: Tue Jul 14 09:13:37 2015
  Analysis ended on: Tue Jul 14 09:13:43 2015
  Total elapsed time: 00:00:06

Appendix D
Drawings

Draft Plan of Subdivision	*(Annis, O'Sullivan, Vollebekk)*
Storm Drainage Area Plans	*108180-15-STM*
Erosion and Sediment Control Plan	*108180-15-ESC*

CURVE SCHEDULE					
NUM.	LOCATION	RADIUS	ARC	CHORD	BEARING
C1					
C2					

APPROVED UNDER SECTION 51 OF THE PLANNING ACT
BY THE CITY OF OTTAWA.

THIS _____ DAY OF _____, _____

JOHN L. MOSER, GENERAL MANAGER
PLANNING AND GROWTH MANAGEMENT DEPARTMENT
PLANNING AND INFRASTRUCTURE PORTFOLIO
CITY OF OTTAWA

PLAN 4M-

I CERTIFY THAT THIS PLAN
IS REGISTERED IN THE LAND REGISTRY OFFICE
FOR THE LAND TITLES DIVISION OF OTTAWA-CARLETON NO. 4
AT _____ O'CLOCK ON THE _____ DAY OF _____, _____
AND ENTERED IN THE PARCEL REGISTER FOR
PROPERTY IDENTIFIERS _____
_____
AND THE REQUIRED CONSENTS ARE REGISTERED AS
PLAN DOCUMENT NO._____

_____
LAND REGISTRAR

This plan comprises part of the land Identified by PIN's 04450-2059 and 04450-2060.

PLAN OF SUBDIVISION OF

PART OF LOT 28
CONCESSION 10
Geographic Township of Goulbourn
And
PART OF BLOCK 222
REGISTERED PLAN 4M-1503
CITY OF OTTAWA

Surveyed by Annis , O'Sullivan , Vollebekk Ltd.

Scale 1 : 1000

40 30 20 10 0 20 40 Metres

Metric
DISTANCES AND COORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

SURVEYOR'S CERTIFICATE
I CERTIFY THAT :

1. This survey and plan are correct and in accordance with the Surveys Act, the Surveyors Act and the Land Titles Act and the regulations made under them.
2. The Survey was completed on the day of 2015.

_____ _____
Date Edward M. Lancaster
Ontario Land Surveyor

OWNER'S CERTIFICATE
THIS IS TO CERTIFY THAT :

1. Lots 1 to 126, both inclusive, Blocks 127 to 140, both inclusive, the Streets, namely, rue Ace Street, rue Defence Street, plateau Haliburton Heights, rue Pack Street, rue Rover Street, avenue Shinny Avenue and voie Slapshot Way and the Reserves, namely, Blocks 141, 142 and 143 have been laid out in accordance with my instructions.
2. The Streets are dedicated as public highways.

Dated the _____ day
of _____ 2015 _____
Steven Gordon, President
Abbott - Fernbank Holdings Inc.
I have the authority to bind the corporation.

NOTES AND LEGEND

—○—	denotes	Survey Monument Planted.
—■—	"	Survey Monument Found
SIB	"	Standard Iron Bar.
SSIB	"	Short Standard Iron Bar.
CC	"	Cut Cross.
IB	"	Iron Bar.
CLF	"	Chain Link Fence
BF	"	Board Fence
(AOG)	"	Annis, O'Sullivan, Vollebekk Ltd.
(P1)	"	Plan
(P2)	"	Plan

All planted survey monuments are IB's unless otherwise noted.

Distances shown on curved limits are Arc distances unless otherwise noted.

Distances shown on this plan are ground distances and can be converted to grid distances by multiplying by the combined scale factor of 0.999xx.

Bearings are grid bearings, derived from....

Coordinates are derived from Can-Net 3.0 Real Time Network GPS observations on monument A and B, shown hereon, and are referred to the Central Meridian of MTM Zone 9 (76°30' West Longitude) NAD-83 (original).

Coordinate values are to urban accuracy in accordance with O. Reg. 216/10.

. Point A Northing Easting
. Point B Northing Easting

Caution: Coordinates cannot, in themselves, be used to re-establish corners or boundaries shown on this plan.

ANNIS, O'SULLIVAN, VOLLEBEKK LTD.
14 Concourse Gate, Suite 500
Nepean, Ont. K2E 7S6
Phone: (613) 727-0850 / Fax: (613) 727-1079
Email: Nepean@aovltd.com
Ontario Land Surveyors

Job No. I5474-I4 Reg Grp Pt LT 28 C10 00 SUB D3 N

D07-16-09-0034

PLAN #16229

NORTH

KEY PLAN
N.T.S.

LEGEND

- SILT FENCE PER OPSD 219.110
- STRAW BALE FLOW CHECK PER OPSD 219.180
- DEBRIS AND RUBBLE FROM DEMOLISHED STRUCTURE
- CLEARING, GRUBBING & TOPSOIL STRIPPING
- x REMOVALS

EROSION AND SEDIMENT CONTROL NOTES :

1. ALL EROSION AND SEDIMENT CONTROLS ARE TO BE INSTALLED TO THE SATISFACTION OF THE ENGINEER, THE MUNICIPALITY AND THE CONSERVATION AUTHORITY. THEY ARE TO BE APPROPRIATE TO THE SITE CONDITIONS, PRIOR TO UNDERTAKING ANY SITE ALTERATIONS (FILLING, GRADING, REMOVAL OF VEGETATION, ETC.) AND DURING ALL PHASES OF SITE PREPARATION AND CONSTRUCTION. THESE PRACTICES ARE TO BE IMPLEMENTED IN ACCORDANCE WITH THE CURRENT BEST MANAGEMENT PRACTICES FOR EROSION AND SEDIMENT CONTROL AND SHOULD INCLUDE AS A MINIMUM THOSE MEASURES INDICATED ON THE PLAN.
2. TO PREVENT SURFACE EROSION FROM ENTERING THE DITCH OR STORM SYSTEM DURING CONSTRUCTION, FILTER CLOTH WILL BE PLACED UNDER GRATES OF ALL PROPOSED AND EXISTING CATCHBASINS AND STRUCTURES. A LIGHT DUTY SILT FENCE BARRIER WILL ALSO BE INSTALLED IN SELECTED LOCATIONS SHOWN ON THIS PLAN, AND STRAW BALE BARRIERS WILL BE INSTALLED WITHIN THE OUTLET DITCHES. THESE CONTROL MEASURES WILL REMAIN IN PLACE UNTIL VEGETATION HAS BEEN ESTABLISHED AND CONSTRUCTION COMPLETE.
3. THE SEDIMENT CONTROL MEASURES SHALL ONLY BE REMOVED WHEN, IN THE OPINION OF THE ENGINEER, THE MEASURES ARE NO LONGER REQUIRED. NO CONTROL MEASURES MAY BE PERMANENTLY REMOVED WITHOUT PRIOR AUTHORIZATION FROM THE ENGINEER.
4. THE CONTRACTOR SHALL IMMEDIATELY REPORT TO THE ENGINEER ANY ACCIDENTAL DISCHARGES OF SEDIMENT MATERIAL INTO ANY DITCH OR STORM SEWER SYSTEM. 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.
5. THE CONTRACTOR ACKNOWLEDGES THAT FAILURE TO IMPLEMENT EROSION AND SEDIMENT CONTROL MEASURES MAY BE SUBJECT TO PENALTIES IMPOSED BY ANY APPLICABLE REGULATORY AGENCY.
6. THE CONTRACTOR SHALL ENSURE PROPER DUST CONTROL IS PROVIDED WITH THE APPLICATION OF WATER (AND IF REQUIRED, CALCIUM CHLORIDE) DURING DRY PERIODS.

REMOVALS NOTES :

1. ALL HYDRANTS, VALVES AND OTHER APPURTENANCES TO BE REMOVED SHALL BE SALVAGED AND DELIVERED TO CITY OF OTTAWA MAINTENANCE YARD AT CLYDE AVENUE.
2. THE CONTRACTOR SHALL PROTECT ALL SURVEY MONUMENTS.
3. REMOVAL OF ALL ABOVE GROUND TRAFFIC PLANT AND STREETLIGHTING TO BE DONE BY OTHERS. CONTRACTOR SHALL PROTECT AND MAINTAIN EXISTING STREETLIGHTING, HYDRO POLES AND OVERHEAD LINES DURING CONSTRUCTION.
4. ALL BELL AND HYDRO OTTAWA MAINTENANACE HOLE ADJUSTMENTS SHALL BE PERFORMED BY AN APPROVED CONTRACTOR ONLY.
5. ALL TOPSOIL AND ANY SOFT, WET OR DELETERIOUS MATERIAL SHALL BE REMOVED FROM IMPROVED AREAS UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
6. FORESTRY TO BE CONTACTED PRIOR TO ANY SELECTIVE PRUNING OR REMOVALS WITHIN THE AREAS OF TRESS SURROUNDING THE TRANS CANADA TRAIL AND TREES THAT ARE TO REMAIN ARE TO HAVE PROPER TREE PROTECTION FENCING.

REVIEWED BY DEVELOPMENT REVIEW BRANCH
Signed _____
Date _____ 2015
Plan Number 16229

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.

FERNBANK CROSSING
the Heart of the Community

ABBOTT-FERNBANK HOLDINGS INC.

REGIONAL
THE REGIONAL GROUP
Corporate Head Office
111 Zenith Avenue, Unit 17 Floor
Ottawa, Ontario K2C 0P9
Telephone: 613-230-2100
Fax: 613-230-2962

No.	REVISION	DATE	BY
5.	ISSUED FOR MOE	JUL 13/15	MAB
4.	REVISED PER CITY COMENTS	JUN 23/15	MAB
3.	ISSUED FOR APPROVAL	MAY 5/15	MAB
2.	ISSUED FOR APPROVAL	MAR 10/15	MAB
1.	ISSUED FOR APPROVAL	DEC 19/14	MAB

SCALE 1:1500
1:1500
0 15 30 45 60

DESIGN LRW
CHECKED MAB
DRAWN DTD
CHECKED MAB
APPROVED JGR

FOR REVIEW ONLY

REGISTERED PROFESSIONAL ENGINEER J.G. RIDDELL PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER M.A. BISSETT 2015.07.13 PROVINCE OF ONTARIO

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

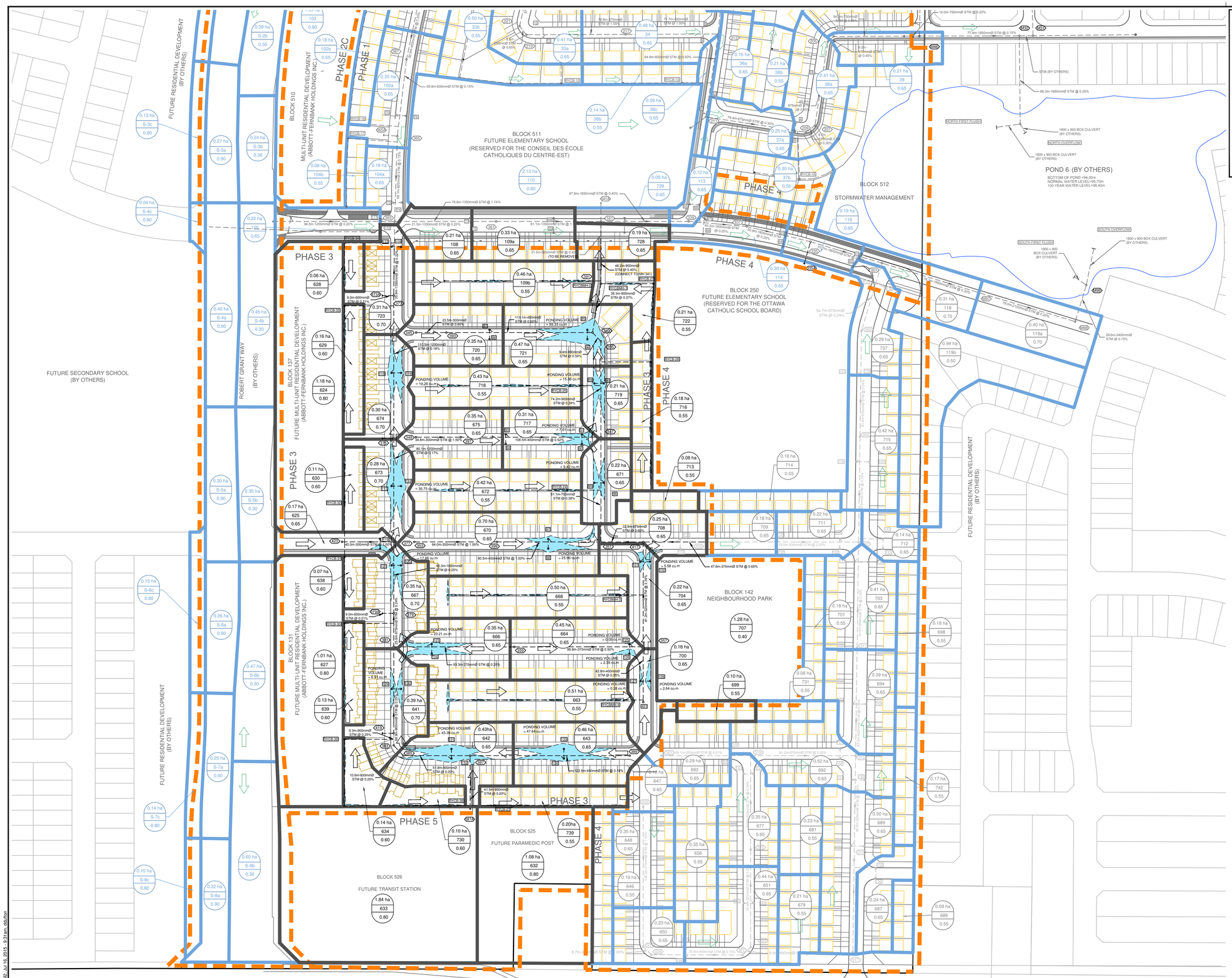
CITY OF OTTAWA
FERNBANK CROSSING

EROSION AND SEDIMENT CONTROL PLAN & REMOVALS

PROJECT No. 108180-15
REV REV # 5
DRAWING No. 108180-15-ESC

M:\2008\108180\Subdivision - Phase 3 (CAD)\Design\108180-15-ESC.dwg ESC - Jul 16, 2015 - 8:43am - dduhon

FILENAME: 108180-15-ESC.dwg



LEGEND

- PHASE 3 AREA (hectares)
- PHASE 3 AREA ID
- PHASE 3 RUN-OFF COEFFICIENT
- FUTURE/EXISTING DRAINAGE AREA (hectares)
- FUTURE/EXISTING AREA ID
- FUTURE/EXISTING RUN-OFF COEFFICIENT
- STORM DRAINAGE AREA BOUNDARY
- EXISTING STORM DRAINAGE AREA BOUNDARY
- PROPOSED STORM MANHOLE & SEWER WITH DIRECTION OF FLOW
- PROPOSED ROAD CATCHBASIN
- MAJOR SYSTEM FLOW ROUTE
- PONDING AREA

STM MANHOLE TABLE (PH3)

MANHOLE ID	OBVERT
309	NE=101.68 SW=100.79
343	NW=99.61 E=99.64 SW=100.93
345	NE=101.75
347	NW=99.98 SE=99.98 SW=99.98
349	NE=101.06
351	NW=100.28 NE=100.28 SW=100.28
353	NE=101.72
357	NW=102.42 SW=102.42 SE=102.42
359	SW=103.00 NE=102.92
373	NW=102.23 SE=102.23 SW=102.23
375	NW=102.43 SE=102.43 SW=102.43
377	NW=102.57 SE=102.57 SW=102.57
379	NW=102.71 SE=102.71 SW=102.71
381	NW=102.77 SE=102.77 NE=102.77
383	NW=102.96 E=102.96
385	W=102.98 NE=102.98
387	SW=103.08 NE=103.08 SE=103.14
389	SW=103.32
391	NW=99.46 SE=99.46
393	NE=101.61 SW=101.61
395	W=99.69 SE=99.72
397	NE=100.54 SW=100.54
399	NE=101.08 SW=101.08
417	SW=100.48 NE=100.48 SE=100.48
419	NW=102.94 SE=102.94 SW=102.94
421	NW=102.57
423	NE=102.97

REVIEWED BY DEVELOPMENT REVIEW BRANCH
Signed _____
Date _____ 2015
Plan Number 16229

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.

FERNBANK · CROSSING · the Heart of the Community

ABBOTT-FERNBANK HOLDINGS INC.
REGIONAL
THE REGIONAL GROUP
Corporate Head Office
111 Commissioners Road West, 1st Floor
Ottawa, Ontario K2C 3P4
Telephone 613-230-2100
Fax: 613-230-2962

No.	REVISION	DATE	BY
5.	ISSUED FOR MOE	JUL 13/15	MAB
4.	REVISED PER CITY COMMENTS	JUN 23/15	MAB
3.	ISSUED FOR APPROVAL	MAY 5/15	MAB
2.	ISSUED FOR APPROVAL	MAR 10/15	MAB
1.	ISSUED FOR APPROVAL	DEC 19/14	MAB

SCALE 1:1250 (1:1250 0 10 20 30 40 50)

DESIGN LRW
CHECKED MAB
DRAWN DTD
CHECKED MAB
APPROVED JGR

FOR REVIEW ONLY

REGISTERED PROFESSIONAL ENGINEER J.G. RIDDELL PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER M.A. BISSETT 2015.07.13 PROVINCE OF ONTARIO

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

CITY OF OTTAWA
FERNBANK CROSSING - PHASE 3

STORM DRAINAGE AREA PLAN

PROJECT No. 108180-15
REV REV # 5
DRAWING No. 108180-15-STM

PLAN #16229

M:\2008\108180\CAD\design\Phase 3 & 4\108180-15-STM.dwg, STM2, Jul 16, 2015 - 9:31am, dtothm

PLAN#1_STM2 - 108180-15-STM.dwg