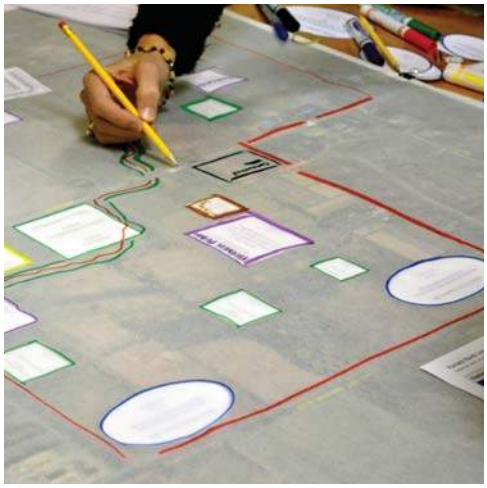
KANATA NORTH
COMMUNITY DESIGN PLAN

ENVIRONMENTAL MANAGEMENT PLAN

SUPPORTING REPORTS



FINAL DRAFT
JUNE 28, 2016

Ottawa

NOVATECH
Engineers, Planners & Landscape Architects

KANATA NORTH COMMUNITY DESIGN PLAN

ENVIRONMENTAL MANAGEMENT PLAN

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WITH THE ASSISTANCE OF:

GEOTECHNICAL
PATERSON GROUP INC

HYDROGEOLOGY
PATERSON GROUP INC

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MUNCASTER ENVIRONMENTAL PLANNING INC.
DST
BOWFIN ENVIRONMENTAL
MCKINLEY ENVIRONMENTAL SOLUTIONS

FLUVIAL GEOMORPHOLOGY
MATRIX SOLUTIONS AND PARISH GEOMORPHIC

ARCHAEOLOGY
PATERSON GROUP INC.

INTEGRATED ENVIRONMENTAL ASSESSMENT
MORRISON HERSHFIELD GROUP INC.

JUNE/28/2016

NOVATECH FILE NO. 112117
REPORT NO. R-2016-017

TABLE OF CONTENTS – VOLUME 3

Appendix J: Kanata North Urban Expansion Area Community Design Plan
Environmental Management Plan Existing Conditions Report:
Storm Drainage, Hydrology & Floodplain Mapping
(Novatech – February 2016)

Appendix K: Existing Conditions Natural Environment Features
Kanata North Urban Expansion Area
(Muncaster Environmental Planning Inc. – January 2016)

Appendix L: Consolidated Preliminary Geotechnical Investigation
Kanata North Urban Expansion Area Community Design Plan
(Patterson Group – October 7, 2013)

Appendix M: Geotechnical Investigation Future Development Lands
936 March Road **REPORT EXCERPT – Slope Stability Sections
Kanata North Urban Expansion Area
(Patterson Group – June 13, 2013)

Appendix N: Hydrogeological Existing Conditions Report
Kanata North Urban Expansion Area
(Patterson Group – May 18,, 2016)

Appendix O: Kanata North Urban Expansion Area
Fluvial Geomorphic Assessment
(Parish Aquatic Services – March 2016)

Appendix P: Kanata North Urban Expansion Area
Headwater Drainage Features Geomorphic Assessment
(Parish Aquatic Services – March 2016)

Appendix Q: Kanata North Headwaters Report
(Bowfin Environmental Consulting & Muncaster Environmental Planning Inc. – September 2015)

Appendix R: Sensitive Groundwater Assessment: Discharge and Recharge Area Evaluation Woodlot S20
(Patterson Group – October 24, 2014)

Appendix S: South March Highlands Blanding's Turtle Conservation Needs Assessment
(Dillon Consulting Limited – January 31, 2013)

Appendix T: South March Highlands Blanding's Turtle Compensation Plan
(DST Consulting Engineers – June 2015)

Appendix U: Kanata North Community Design Plan
Blanding's Turtle Compensation Plan – Offsite Compensation Concept (Memo)
(DST Consulting Engineers – November 12, 2015)

Appendix V: Kanata North Community Design Plan
Water Budget Analysis
(Novatech – May 2016)

Appendix J

Kanata North Urban Expansion Area Community Design Plan Environmental Management Plan Existing Conditions Report: Storm Drainage, Hydrology & Floodplain Mapping

(Novatech – February 2016)

Kanata North Urban Expansion Area

COMMUNITY DESIGN PLAN

ENVIRONMENTAL MANAGEMENT PLAN - EXISTING CONDITIONS REPORT

Storm Drainage Hydrology, Floodplain Mapping

FEBRUARY 29, 2016

NOVATECH
Engineers, Planners & Landscape Architects

KANATA NORTH CDP

ENVIRONMENTAL MANAGEMENT PLAN
EXISTING CONDITIONS

Storm Drainage, Hydrology & Floodplain Mapping

City of Ottawa

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February 29, 2016

Novatech File: 112117
Ref: 2016-023

TABLE OF CONTENTS

EXECUTIVE SUMMARY **1**

Introduction **2**

Section 1.0 Existing Conditions **2**

1.1 Climate & Physiography 2

1.1.1 Surficial Soil Conditions *3*
1.1.2 Land Use & Ownership *3*

1.2 Watercourses / Drainage Features 3

1.2.1 Shirley's Brook Tributary 1 ..... *4*
1.2.2 Shirley's Brook Northwest Branch – Tributary 2 ..... *4*
1.2.3 Shirley's Brook Northwest Branch – Tributary 3 ..... *4*
1.2.4 Shirley's Brook Northwest Branch – Tributary 4 ..... *4*
1.2.5 Shirley's Brook Main Branch *5*
1.2.6 Headwater Drainage Features *5*
1.2.7 Inventory of Structures/ Crossings *5*

Section 2.0 Hydrology **6**

2.1 Previous Studies 6

2.2 Discussions with MVCA 7

Section 3.0 Flow Monitoring – Northwest Branch Tributaries **8**

Section 4.0 Hydrologic Modeling **15**

4.1 Model Parameters 15

4.2 Model Results 17

4.3 Hydrologic Modeling (KNUEA Only) 17

Section 5.0 Floodplain Evaluation (HEC-RAS) **19**

5.1 Model Results 19

Section 6.0 Next Steps **21**

Section 7.0 Reliance Clause **22**

Section 8.0 References **23**

LIST OF FIGURES

Figure 1.1 Key Plan & Study Area
Figure 2.1 Location of Watercourses
Figure 2.2 Hydraulic Structure Locations
Figure 4.1 Flow Monitoring Locations
Figure 6.1 Existing Floodplain

LIST OF TABLES

Table 2.1: Inventory of Hydraulic Structures
Table 3.1: Shirley's Brook Northwest Branch – Summary of Peak Flows from Previous Studies
Table 4.1: 2014 Streamflow Monitoring Results (Shirley's Brook Northwest Branch)
Table 5.1: Standard Initial Abstraction (I_a) Values
Table 5.2: Shirley's Brook Northwest Branch Pre-Development Peak Flows (m^3/s)
Table 5.3: KNUEA Peak Flows to Tributary 2 and Tributary 3 (m^3/s)
Table 6.1: Peak Flows provided in the HEC-RAS Model for the Northwest Branch
Table 6.2: Water Level Elevations within the Northwest Branch

APPENDICES

Appendix A Hydrologic Modeling (SWMHYMO)
Appendix B Floodplain Mapping (HEC-RAS)
Appendix C Drawings

EXECUTIVE SUMMARY

This report has been prepared in accordance with the scope of work for the Kanata North Urban Expansion Area *(KNUEA)* CDP and documents the existing storm drainage and hydrology for the study area. The site is located in the Shirley's Brook Subwatershed, which is within the jurisdiction of the Mississippi Valley Conservation Authority (MVCA).

The naming convention used to describe the Northwest Branch of Shirley's Brook is consistent with the *Shirley's Brook & Watts Creek Phase 2 –SWM Study Draft Report (AECOM, March 2013)*. The Northwest Branch of Shirley's Brook is comprised of two main tributaries *(Tributary 2 & 3)* that flow through the KNUEA before joining the main branch of Shirley's Brook to the South at Maxwell Bridge Road. A portion of the KNUEA lands west of March Road is within the drainage area of *Tributary 1,* which is located just north of the study area and flows northeast to join with the main branch of Shirley's Brook at March Valley Road.

The tributaries outlined have relatively low flow rates, which is representative of the largely undeveloped nature of their respective drainage areas. The *Shirley's Brook and Watts Creek Subwatershed Study (Dillon Consulting, September 1999)* indicates that predominant sources of baseflow for the Northwest Branch tributaries appear to be groundwater discharge, and/or the slow release of surface water temporarily detained in the numerous wetland areas upstream from the KNUEA.

Modeling completed for previous hydrologic studies provide a very large range of predicted design flows for the Northwest Branch of Shirley's Brook. The current regulatory flood mapping for Shirley's Brook is based on "Target (Future) Flow" conditions as listed in the Kanata North EMP (CH2MHill, 2011). The bridges and culverts crossing Shirley's Brook downstream of the KNUEA lands (and the associated regulatory flood limits) have been designed and evaluated based on substantially higher design flow rates than reported in the 2013 AECOM study.

A hydraulic analysis (HEC-RAS) of the Northwest Branch Tributaries using modeled peak flows from the 2013 AECOM study indicates that the bankfull capacity of the existing channels is generally higher than the modeled 100-year peak flows. This indicates that the peak flows may be underestimated, as bankfull flow conditions are typically associated with more frequent storm events (generally a 2-year event). Additional flow monitoring of the Northwest Tributary Watercourses has been completed to supplement the information from previous studies and calibrate the existing conditions model.

The selection of appropriate design flows for developing the SWM criteria will have a significant impact on several aspects of the design, including the extent of the 100-year floodplain and the size of the proposed SWM facilities. Post-development flow targets should be established based on an evaluation of erosion potential, water quality, flood risk, and other factors relating to the function and health of the stream corridors to ensure no adverse impacts to Shirley's Brook.

Introduction

The purpose of this report is to provide an overview of the existing storm drainage features and hydrologic conditions within the limits of the Kanata North Urban Expansion Area, with the intent of utilizing this information to develop a stormwater management strategy for the subject lands. This report has been prepared for and funded by the Kanata North Land Owners Group (KNLOG), which is comprised of five separate landowners within the study area.

The Sponsoring Landowners in the CDP Area include:

- Metcalfe Realty Company Ltd.;
- Brigil (3223701 Canada Inc.);
- Valecraft (8409706 Canada Inc.);
- Junic/Multivesco (7089121 Canada Inc.), and
- JG Rivard Ltd.

Information herein was prepared in accordance with the approved Terms of Reference (ToR) Documents for the Environmental Management Plan (EMP) component of the Community Design Plan (CDP) and was prepared to satisfy Phase 1 of the Class Environmental Assessment (EA) process.

The Urban Expansion Area (180 ha) is located at the north end of Kanata in the West Urban Community and is shown in **Figure 1.1**.

Section 1.0 Existing Conditions

1.1 Climate & Physiography

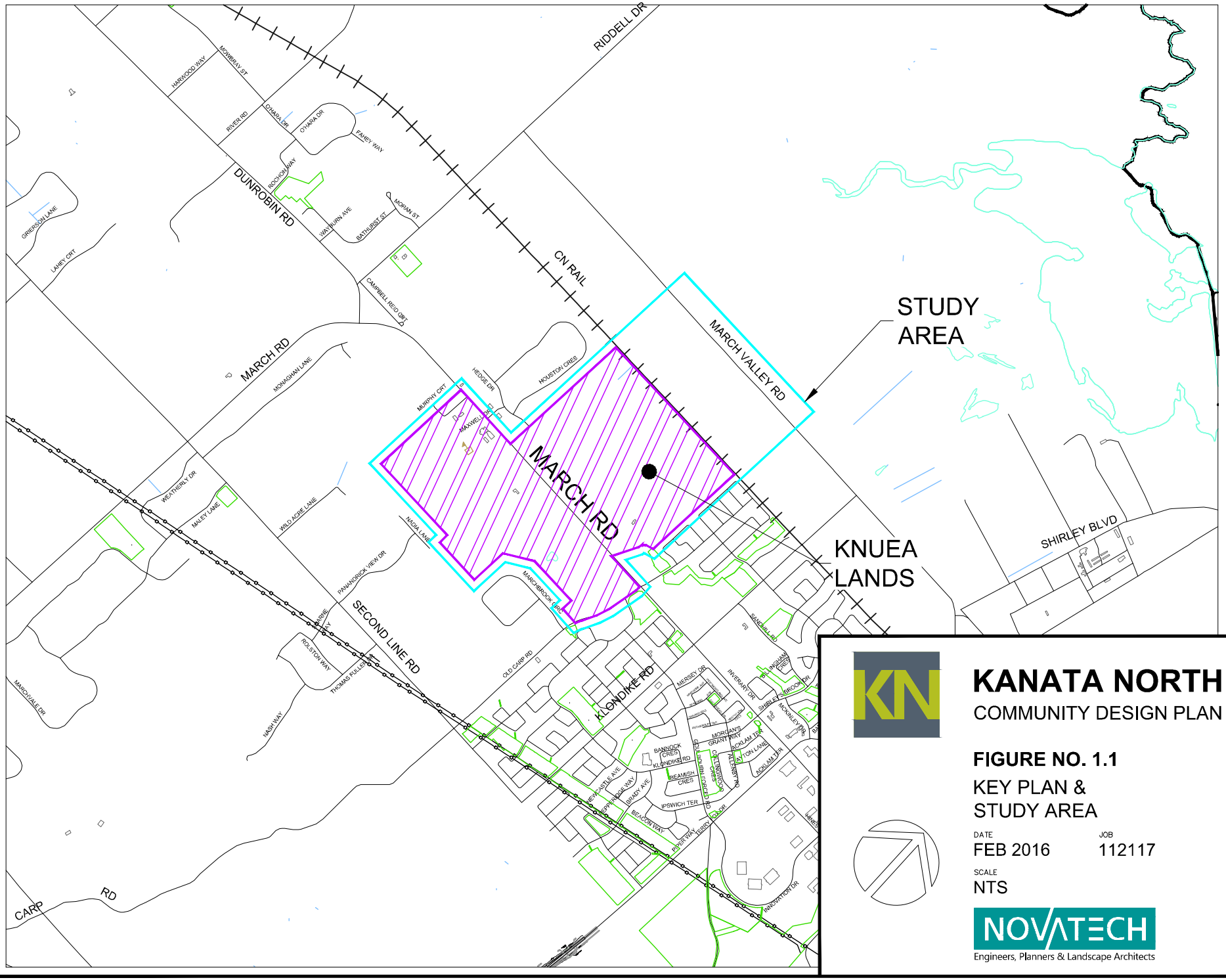
Warm summers, relatively cold winters, a moderate growing season, and usually reliable rainfall characterize the local climate. Average annual precipitation (rain + snow) in the City of Ottawa is 944 mm/yr.

The KNUEA is located within the Shirley's Brook subwatershed, which covers a total area of approximately 3,043 ha (30.43 km^2).

The naming convention used to describe the watercourses within the Study Area is consistent with the *Shirley's Brook & Watts Creek Phase 2 –SWM Study Draft Report (AECOM, March 2013)* and the *Kanata North Urban Expansion Study Geomorphic Assessment* (Parish, October 2013).

There are two main tributaries flowing through the study area, which together comprise the northwest branch of Shirley's Brook *(Tributaries 2 and 3)*. The two northwest branch tributaries flow to their confluence upstream of Maxwell Bridge Road, and then merge with the main branch of Shirley's Brook downstream of Maxwell Bridge Road.

There is another watercourse located just north of the study area *(Tributary 1)*, which flows into the main branch of Shirley's Brook at March Valley Road. The main branch of Shirley's Brook bypasses the study area. It flows through the Kanata North Business Park to Briarbrook, through the adjacent Brookside Subdivision, then runs parallel to March Valley Road and empties into Shirley's Bay.



KANATA NORTH
COMMUNITY DESIGN PLAN

FIGURE NO. 1.1

KEY PLAN & STUDY AREA

DATE FEB 2016

JOB 112117

SCALE NTS

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M:\2012\112117\CAD\Design_EMP\MEMO (CS)\Figure 1.1 Key Plan.dwg, 1.1 Ex.KP, Feb 23, 2016 - 10:34am, kbanks

SHT8x11.DWG - 216mmx279mm

1.1.1 Surficial Soil Conditions

Soil conditions used in the existing conditions hydrologic analysis have been taken from the following reports:

- Shirley's Brook & Watts Creek Phase 2 –Stormwater Management Study Draft Report (AECOM, March 2013)
- Consolidated Preliminary Geotechnical Investigation Kanata North Urban Expansion Area Community Design Plan (Patterson Group, October 7, 2013)
- Kanata North Urban Expansion Study Fluvial Geomorphic Assessment (Parish Geomorphic, February 2016)

The surficial soils in the subject area generally consist of silty clay and glacial till, which is generally consistent with marine deposits associated with the Champlain Sea. Silty sand with trace clay was found in several test pits, but is only present in isolated pockets throughout the site. Based on the borehole and test pit program carried out by Paterson Group, the overburden thickness across the site generally ranges from 0m thick to greater than 10m thick. Bedrock is present just beneath the topsoil and glaciofluvial soil veneer in the southwest corner of the KNUEA and trends downward moving towards the northern portion of the site. In the western quadrant of the KNUEA, there are weathered outcroppings of bedrock, and both Tributary 2 and Tributary 3 contain long expanses of exposed, competent bedrock.

In the review published by OGS mapping, the presence of a large alluvial soils deposit running roughly parallel to March Road is noted. Alluvial soils are loose, unconsolidated deposits which have been previously eroded and reshaped in some form by water and deposited in a non-marine setting. These soil deposits can transmit overburden groundwater significant lateral distances via gravity flow in short durations. In this particular area, the alluvial deposits are generally underlain by a stiff silty clay, with a small section in the vicinity of the existing woodlot was noted to be underlain by shallow bedrock.

1.1.2 Land Use & Ownership

Land use within the proposed development boundary is predominantly agricultural, consisting of a mixture of cultivation, pasture, and specialty crops. There are a number of deciduous hedgerows between agricultural open fields, and a woodlot, identified in the Shirley's Brook Subwatershed Study (Dillon, 1999) as Woodlot S20, between the railway line and March Road in the east portion of the study area.

1.2 Watercourses / Drainage Features

Storm runoff from the agricultural lands in this area is captured by ditches around the perimeter of the fields, which convey storm runoff to Shirley's Brook and its main tributaries.

The bed materials forming the two main tributaries are comprised mainly of cohesive clays and silts. The channel banks are comprised of fine grained silt and sand mixed with clay and are susceptible to erosion. South of Marchbrook Circle, Tributary 3 flows along the bedrock surface.

In undeveloped areas, the tributary channels have not been significantly altered and tend to have a pool-glide-riffle morphology. Many of the channels that constitute the Shirley's Brook drainage network have been altered to accommodate rural development and agricultural activities.

Refer to **Figure 2.1** for the location of the following watercourses and drainage features.

HILLSVIEW ESTATES SUBDIVISION

TRIBUTARY 1

F

TRIBUTARY 2

POND 2

E

D WEST

D EAST

C WEST

C EAST

FORMER CN RAILWAY CORRIDOR (± 30m)

MARCH VALLEY ROAD

SHIRLEY'S BROOK

H

B WEST

B EAST

I

A

B WEST

MARCH ROAD

TRIBUTARY 2

POND 1

MARCHBROOK CIRCLE

TRIBUTARY 3

TRIBUTARY 4 (G)

MORGAN'S GRANT SWMF

MORGAN'S GRANT SUBDIVISION

BROOKSIDE SUBDIVISION

MAXWELL BRIDGE ROAD

LEGEND

- KNUEA
- DRAINAGE CHANNEL
- A — DRAINAGE FEATURE ID

KANATA NORTH

COMMUNITY DESIGN PLAN

FIGURE NO. 2.1

WATERCOURSES

DATE FEB 2016

JOB 112117

SCALE 1:7500

0 37.5m 75m 150m

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M:\2012\112117\CAD\Design_EMPMEMO (CS)\Figure 3.1 Watercourses.dwg, FIG-2.1-ExCond, Feb 23, 2016 - 10:39am, bthurber

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1.2.1 Shirley's Brook Tributary 1

Tributary 1 is located outside of the KNUEA. The watercourse flows east along the northern boundary of the KNUEA development area, crossing March Road and passing through the rearyards of lots on Houston Crescent before entering the Main Branch of Shirley's Brook at March Valley Road. Under existing conditions, approximately 18 hectares of the KNUEA development area drains north toward Tributary 1.

1.2.2 Shirley's Brook Northwest Branch – Tributary 2

The northern tributary comprising the northwest branch of Shirley's Brook (Tributary 2) flows east through the KNUEA development area. This watercourse has a drainage area of approximately 372 hectares upstream of the KNUEA lands and serves as the drainage outlet for approximately 46 hectares of the KNUEA lands west of March Road and approximately 22 hectares east of March Road.

A gabion basket structure has been installed in the watercourse near the existing farm house at 1035 March Road, creating a small pond upstream of the structure.

Tributary 2 crosses March Road through a 1.2m x 1.85m concrete box culvert *(Hydraulic Structure ID S-2)*, then flows southeast through the KNUEA lands toward Maxwell Bridge Road.

1.2.3 Shirley's Brook Northwest Branch – Tributary 3

The southern tributary comprising the northwest branch of Shirley's Brook (Tributary 3) flows east through the southwest corner of the KNUEA development area towards March Road. This watercourse has a drainage area of approximately 258 ha upstream of the KNUEA lands and serves as the drainage outlet for approximately 27 hectares of the KNUEA lands east of March Road.

A concrete weir has been installed on Tributary 3 just south of Marchbrook Circle to forms a small pond upstream of the structure. There is a second, larger pond located downstream of the weir. Outflows from this larger pond are not controlled by an outlet structure.

Tributary 3 crosses March Road through a pair of circular CSP culverts with diameters of approximately 1650mm *(Hydraulic Structure ID S-6).* Tributaries 2 and 3 merge to form the northwest branch of Shirley's Brook just before entering the Main Branch of Shirley's Brook upstream of the Maxwell Bridge Road culvert crossing *(2.1m x 7.0m CSP Arch Culvert, Structure ID S-9).*

1.2.4 Shirley's Brook Northwest Branch – Tributary 4

Shirley's Brook Northwest Branch Tributary 4 runs through the southwestern quadrant of the KNUEA parallel to Old Carp Road. West of March Road, this channel serves as the outlet for a portion of the Marchbrook Circle subdivision, as well as the existing agricultural lands in the southwest quadrant of the KNUEA. East of March Road, Tributary 4 serves as the outlet from the Morgan's Grant SWM Facility.

Tributary 4 has a drainage area of approximately 17 ha upstream of the KNUEA and serves as the drainage outlet for approximately 11 hectares of the KNUEA west of March Road.

1.2.5 Shirley's Brook Main Branch

The main branch of Shirley's Brook flows is located to the south of the KNUEA and flows northeast through the Brookside Subdivision to March Valley Road. The watercourse then turns northwest, flowing parallel to March Valley Road towards to the confluence with Tributary 1 before entering Shirley's Bay and the Ottawa River. Runoff from approximately 90 hectares of the KNUEA lands is conveyed to the Main Branch of Shirley's Brook through drainage ditches that flow under the existing rail line through multiple culverts and outlet to the Main Branch of Shirley's Brook at March Valley Road. Shirley's Brook has a total watershed area of approximately 3,043 hectares upstream of Shirley's Bay.

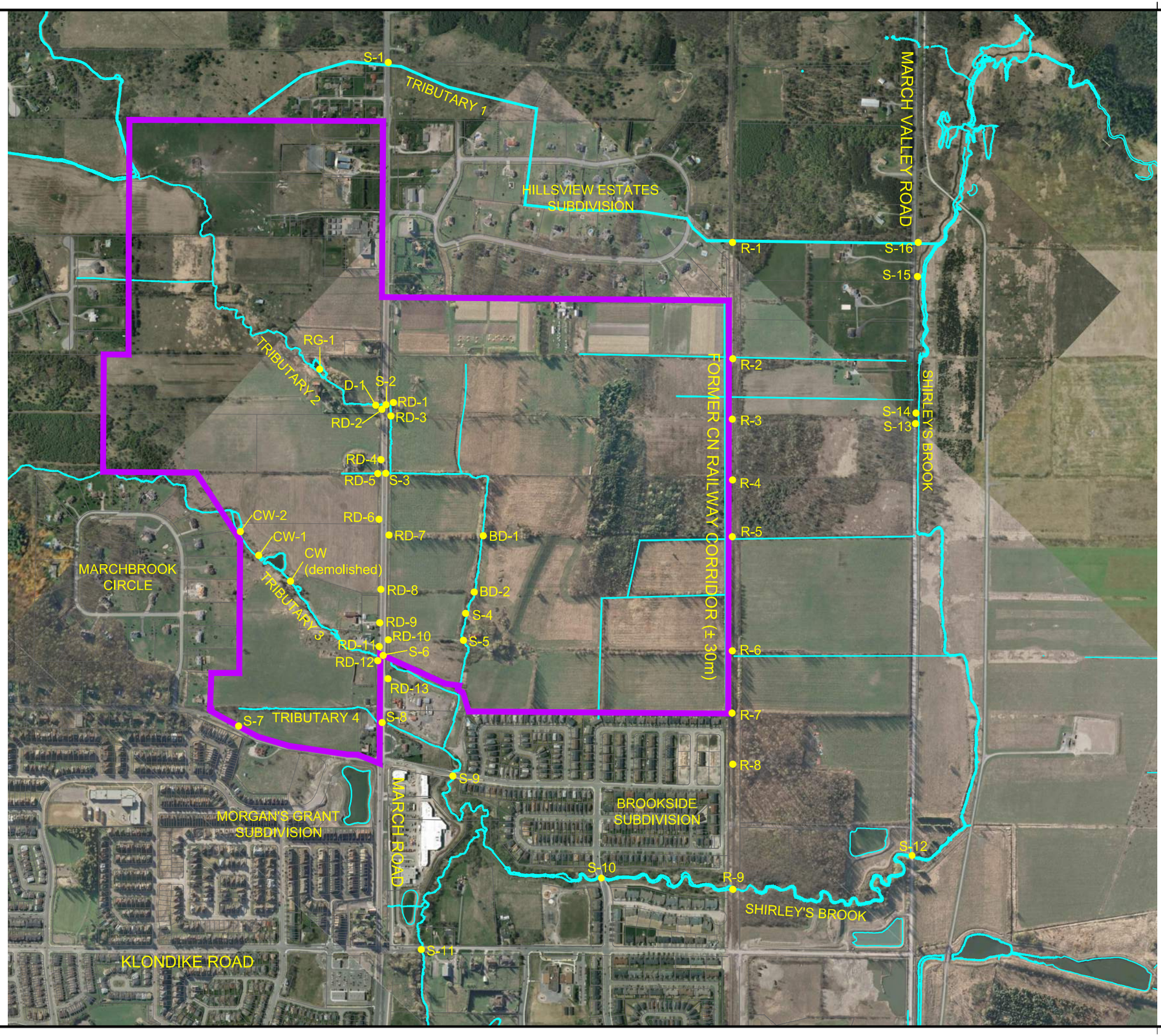
1.2.6 Headwater Drainage Features

On both the west and east sides of March Road are a series of channels and ditches which have been dug for agricultural purposes and to convey overland flow more efficiently.

Runoff from approximately 90ha of the KNUEA east of March Road is conveyed to the Main Branch of Shirley's Brook through a series of these headwater drainage ditches that outlet to Shirley's Brook at March Valley Road.

1.2.7 Inventory of Structures/ Crossings

A detailed inventory of all hydraulic structures and crossings within the limits of the development area has been created based on field reconnaissance, survey data, and information compiled from previous reports. The inventory of hydraulic structures (structure type, elevations, dimensions, length, condition, etc.) is provided as **Table 2.1**, following this page. The locations of all structures are identified on **Figure 2.2**.



LEGEND

STUDY AREA

DRAINAGE CHANNEL

NOTE: SEE ACCOMPANYING TABLE "KNUEA HYDRAULIC STRUCTURES TABLE" FOR DESCRIPTIONS OF EACH STRUCTURE.

HYDRAULIC STRUCTURE ID

- BD BEAVER DAM
- CW CONCRETE WEIR
- D DRIVEWAY CULVERT
- R RAILWAY CULVERT
- RD ROADWAY CULVERT
- RG ROCK GABIAN BASKET
- S SHIRLEY'S BROOK CULVERT

KANATA NORTH
COMMUNITY DESIGN PLAN

FIGURE NO. 2.2
HYDRAULIC STRUCTURE LOCATIONS

DATE FEB 2016
JOB 112117
SCALE 1:10,000
0 50m 100m 200m

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M:\2012\112117\CADDesign_EMP\Figure 3.7 - Hydraulic Structures.dwg, FIG-2.2 Ex.Cond, Feb 12, 2016 - 10:34am, bhurber

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Hydraulic Structure Table

NECL Structure No. (refer to Figure 3.9)	Dillon Structure No. (refer to Figure 3.9)	Location	Dillon Size (Diameter/HxW)	NECL Size (Diameter/HxW)	Shape	Dillon Material	NECL Material	Length (m)	U/S Invert (m)	D/S Invert (m)	Culvert Condition/Comments
Shirley's Brook											
S-1	S-23	March Road	1.0 x 1.8	-	Box	Concrete		22	-	-	good condition
S-2	S-15	March Road	1.1 x 1.8	1.2 x 1.85	Box	Concrete	Concrete	25	79.24	79.20	good condition
S-3	-	March Road	-	Unknown			Concrete	20	79.11/79.00	79.00/78.99	
S-4	-	Shirley's Brook Main Branch	-	900mm	Circular	Circular	CSP	4.5	76.62	76.59	
S-5	-	Shirley's Brook Main Branch	-	1500mm	Circular	Circular	CSP	6.5	75.40	75.43	
S-6	S-13	March Road	Twin 1650mm	Twin 1500mm	Circular	Steel	CSP	25	77.00/76.95	76.90/76.74	outlet top of culverts partially crushed
S-7	S-12	Old Carp Road	500mm	-	Circular	Steel	-	12	-	-	good condition
S-8	S-11	March Road	1200mm	1200mm	Circular	Steel	Concrete	25	-	-	good condition
S-9	-	Old Carp Road	-	2.1 x 7.0*	Arch	-	CSP*	20	-	-	
S-10	-	Marconi Avenue	-	2.55 x 8.0*	Arch	-	CSP*	20	-	-	
S-11	S-4	Klondike Road	1.45 x 3.1	1.4 X 3.0*	Box	Concrete	Concrete	11	-	-	good condition
S-12	S-1	March Valley Road	2.0 x 2.75	-	Arch	Steel Plate	-	16	-	-	
S-13	-	March Valley Road	-	650mm	Circular	-	CSP	16	63.56	63.77	
S-14	S-27	March Valley Road	600mm	600mm	Circular	Steel	CSP	10	63.84	63.46	
S-15	-	March Valley Road	-	600mm	Circular	-	CSP	15	63.43	63.04	
S-16	S-24	March Valley Road	0.75 x 1.05		Arch	Steel		14			
R-1	S-25	CNR	1050mm	900mm	Circular	Steel	CSP	13	70.46	70.40	good condition
R-2	S-26	CNR	850mm	900mm	Circular	Steel	CSP	12	69.44	69.46	good condition
R-3	S-28	CNR	750mm	-	Circular	Steel	-	-	-	-	good condition
R-4	-	CNR	-	900mm	Circular	-	CSP	11	68.78	68.73	
R-5	S-29	CNR	1500mm	1800mm	Circular	Concrete	Concrete	10	68.69	68.54	good condition
R-6	S-30	CNR	1.0 x 1.2	-	Arch	Steel	-	12	-	-	fair condition
R-7	S-31	CNR	900mm	900mm	Circular	Steel	CSP	12	69.74	69.63	good condition
R-8	S-32	CNR	1400mm	-	Circular	Concrete	-	8	-	-	good condition
R-9	S-2	CNR	Twin 1.45 x 2.8	Twin 1.36 x 2.7*	Box	Concrete	-	6	-	-	good condition
CW-demolished		Shirley's Brook Tributary 3	-		-	-	Concrete				Demolished concrete weir
CW-1	-	Shirley's Brook Tributary 3	-		Rectangular	-	Concrete				Concrete weir - good condition
CW-2		Shirley's Brook Tributary 3	-	55cm x 102cm	Rectangular	-	Concrete	0.57			Concrete weir - good condition
RG-1	-	Shirley's Brook Tributary 2	-		Box	-	-				Gabion Basket Weir
Natural Structures											
BD-1	-	Shirley's Brook	-	Beaver Dam	Natural	-	Wood	-	-	-	build-up slightly obstructing flow
BD-2	-	Shirley's Brook	-	Beaver Dam	Natural	-	Wood	-	-	-	build-up slightly obstructing flow

Kanata North Community Design Plan

Table 2.1: Inventory of Hydraulic Structures

Hydraulic Structure Table											
NECL Structure No. (refer to Figure 3.9)	Dillon Structure No. (refer to Figure 3.9)	Location	Dillon Size (Diameter/HxW)	NECL Size (Diameter/HxW)	Shape	Dillon Material	NECL Material	Length (m)	U/S Invert (m)	D/S Invert (m)	Culvert Condition/Comments
March Road Roadside Ditch Structures											
D-1	-	March Road	-	900mm	Circular	-	CSP	6.5	79.21	79.02	-
RD-1	-	March Road	-	600mm	Circular	-	CSP	12.5	79.86	79.36	-
RD-2	-	March Road	-	650mm	Circular	-	CSP	9	79.56	79.53	-
RD-3	-	March Road	-	Twin 900mm/Single 600mm	Circular	-	CSP	10	79.15	78.96	-
RD-4	-	March Road	-	650mm	Circular	-	CSP	11	79.66	79.55	-
RD-5	-	Shirley's Brook	-	600mm	Circular	-	Concrete	7	80.18	80.15	-
RD-6	-	March Road	-	400mm	Circular	-	CSP	9.5	80.38	80.31	-
RD-7	-	March Road	-	600mm	Circular	-	CSP	9.5	79.53	79.24	-
RD-8	-	March Road	-	300mm	Circular	-	CSP	-	-	-	-
RD-9	-	March Road	-	600mm	Circular	-	CSP	10	79.01	78.85	-
RD-10	-	March Road	-	600mm	Circular	-	CSP	12	78.42	78.19	-
RD-11	-	March Road	-	600mm	Circular	-	CSP	15.5	78.37	78.29	-
RD-12	-	March Road	-	600mm	Circular	-	CSP	15.5	77.77	77.47	-
RD-13	-	March Road	-	600mm	Circular	-	CSP	10.5	77.49	77.49	-

Notes: * Taken from Shirley's Brook & Watts Creek Phase 2 –SWM Study Draft Report (AECOM, March 2013).
Dillon Structures taken from 4. Shirley's Brook and Watts Creek Subwatershed Study (Dillon Consulting, September 1999).

Section 2.0 Hydrology

2.1 Previous Studies

Hydrologic modeling for the Northwest Branch of Shirley's Brook has been completed as part of four previous studies. *The Shirley's Brook Subwatershed Study* (Dillon, 1999) and the *Shirley's Brook and Watts Creek Stormwater Management Study – Phase 2* (AECOM, 2013) use models calibrated to match observed flows recorded during flow monitoring programs.

The *Kanata North EMP* (Ch2MHill, 2001) provides a list of "Target Flow Rates (Future Conditions)" which represent the flows used by MVCA for their current floodplain mapping of Shirley's Brook. These "target" flow rates are higher than the flows listed in the other reports, as they provide some allowance for future development within the watershed, whereas the other reports represent existing conditions for the watercourses comprising the Northwest Branch of Shirley's Brook.

The hydrologic model prepared as part of the *Shirley's Brook Floodplain Analysis and Stormwater Management Report* (Novatech, 2006) was built from a collection of approved subdivision-level models to evaluate the overall impact of upstream development within the Shirley's Brook watershed on flows through the Brookside Subdivision. The peak flows generated by this model were used to evaluate the 100-year floodplain and design the proposed culvert crossings within the Brookside Subdivision. This study did not include any model calibration.

A comparison of the peak flows for the Northwest Branch tributaries from the previous studies is provided in **Table 2.1**.

Table 2.1: Shirley's Brook Northwest Branch – Summary of Peak Flows from Previous Studies

Report Reference	Return Period	Peak Flow (m^3/s)		
		Tributary 2 @ March Road	Tributary 3 @ March Road	Tributary 2 + 3 @ Main Branch
Shirley's Brook Subwatershed Study (Dillon, 1999)	*2-year*	0.25	0.22	0.47
	100-year	1.5	1.3	2.8
*Kanata North EMP** CH2MHill (2001)	*5-year*	3.7	3.2	6.9
	100-year	8.0	7.1	15.1
Shirley's Brook Floodplain Mapping Update (NECL, 2006)	*5-year*	2.4	1.5	3.6
	100-year	6.9	4.7	10.9
Shirley's Brook Phase 2 Subwatershed Study (AECOM, 2013)**	*5-year*	0.45	0.49	0.92
	100-year	1.2	1.4	2.5

* *Flows used in current MVCA regulatory flood mapping.*

2.2 Discussions with MVCA

The findings of the previous hydrologic studies present a very large range of predicted design flows for the Northwest Branch of Shirley's Brook. The current regulatory flood mapping for Shirley's Brook is based on the "Target (Future) Flow" conditions, which represent much higher peak flows than the existing conditions models. The selection of appropriate design flows for use in developing the SWM criteria will have a significant impact on several aspects of the overall stormwater management plan, including the extent of the 100-year floodplain and the size of the proposed SWM facilities.

The 2013 AECOM report represents the most recent hydrologic assessment of the Northwest Branch tributaries of Shirley's Brook, and the hydrologic modeling completed for the KNUEA lands is based on the model parameters used in this study. The AECOM study did not include direct monitoring of flows in the Northwest Tributary watercourses and may not have adequately accounted for the impacts of the existing in-stream structures (concrete weir / gabion basket wall).

The existing peak flows listed in the AECOM report for the Northwest Branch are quite low and would require very large SWM facilities in order to control post-development flows to the modeled pre-development flows. Based on the overall tributary drainage area of approximately 725 ha and a 100-year peak flow rate of 2.5 m^3/s, this corresponds to an allowable release rate of approximately 3 L/s/ha for the 100-year event.

A critical component of the EMP will be the identification of allowable post-development release rates for the KNUEA lands. Flow targets will be based on an evaluation of erosion potential, water quality, flood risk, and other factors relating to the function and health of the stream corridors to ensure no adverse impacts to Shirley's Brook.

Section 3.0 Flow Monitoring – Northwest Branch Tributaries

A streamflow monitoring program for the Northwest Branch of Shirley's Brook was initiated in May 2014, consisting of stream level loggers installed in three locations (refer to **Figure 3.1**).

- Tributary 2 (North Tributary);
- Tributary 3 (North Branch); and
- Downstream of the confluence of the Tributaries 2 & 3.

The monitoring locations were chosen to give an accurate picture of how the streamflow in each of the Tributaries and the Main Branch fluctuate throughout the year, as well as how they react to storm events. The flow monitoring data was used for calibrating the hydrologic model (**Section 5.0**).

Continuous flow monitoring was performed with pressure transducers, which measure air and water pressure to determine water levels within the watercourse. Instantaneous flow monitoring was performed using a Flow Probe to develop a stage-discharge curve to convert measured water level data to flow data based on an adapted version of the *Velocity-Area Procedure for Determining Steam Discharge* (US Environmental Protection Agency, September 1998). Field measurements of instantaneous streamflow were performed on a monthly basis, during both wet and dry periods to gather a range of high/low flow data points for the rating curves.

The continuous monitoring data is shown on **Figures 4.2, 4.3**, and **4.4**. The monthly results of the streamflow monitoring program are summarized in **Table 3.1**.

Table 3.1: 2014 Streamflow Monitoring Results (Shirley's Brook Northwest Branch)

Month	Total Precip. (mm/mo)	Tributary 2 (394 ha)		Tributary 3 (233 ha)		Confluence of Tributaries 2 and 3 (706 ha)	
		Streamflow (L/s)	Baseflow (L/s)	Streamflow (L/s)	Baseflow (L/s)	Streamflow (L/s)	Baseflow (L/s)
Jun.[1]	143.2	45.2	22.5	9.8	22.4	137.8	69.1
Jul.	61.8	8.0	4.1	44.9	2.0	19.2	9.7
Aug.	96.8	3.8	1.9	3.9	0.0	1.9	1.0
Sep.	93.0	8.0	4.0	0.0	0.5	8.6	4.3
Oct.	72.3	15.1	7.5	1.0	2.6	35.8	17.7
Nov.	37.2	36.5	18.1	5.2	2.1	52.7	26.3
Dec.	42.1	61.8	30.8	4.3	6.1	83.4	41.8
Jul-Dec	**403.2**	**22.2**	**11.1**	**4.5**	**2.2**	**33.6**	**16.8**

[1]The storm event in June 2014 is roughly equivalent to a 50-year storm event.

MARCH ROAD

392 ha

MONITORING LOCATION # 1 (CONTINUOUS)

TRIBUTARY 1

TRIBUTARY 2

82 ha

MARCH ROAD

FORMER CN RAILWAY CORRIDOR (± 30m)

MARCH VALLEY ROAD

SHIRLEY'S BROOK

MONITORING LOCATION # 2 (CONTINUOUS)

233 ha

TRIBUTARY 3

29 ha

TRIBUTARY 4

MONITORING LOCATION # 3 (NON-CONTINUOUS)

MONITORING LOCATION # 4 (CONTINUOUS)

SHIRLEY'S BROOK

MONITORING LOCATION # 5 (NON-CONTINUOUS)

KLONDIKE ROAD

LEGEND

- STUDY AREA
- DRAINAGE CHANNEL
- FLOW MONITORING CATCHMENT AREAS

MONITORING LOCATION #1:
TRIBUTARY 2

MONITORING LOCATION #2:
TRIBUTARY 3 U/S OF CONCRETE WEIR

MONITORING LOCATION #3:
OUTLET OF MORGAN'S GRANT SWMF

MONITORING LOCATION #4:
D/S OF TRIBUTARY 2 & 3 CONFLUENCE

MONITORING LOCATION #5:
MAIN BRANCH OF SHIRLEY'S BROOK AT MARCONI AVE.

KANATA NORTH
COMMUNITY DESIGN PLAN

FIGURE NO. 4.1
FLOW MONITORING LOCATIONS

DATE FEB 2016
JOB 112117
SCALE NTS

NOVATECH
Engineers, Planners & Landscape Architects

M:\2012\112117\CAD\Design_EMP\112117-SWM.dwg, Figure 4.1 - Monitoring Loc. ExCond, Feb 12, 2016 - 1:13pm, bthurber

SHT11x17.DWG - 279mmx432mm

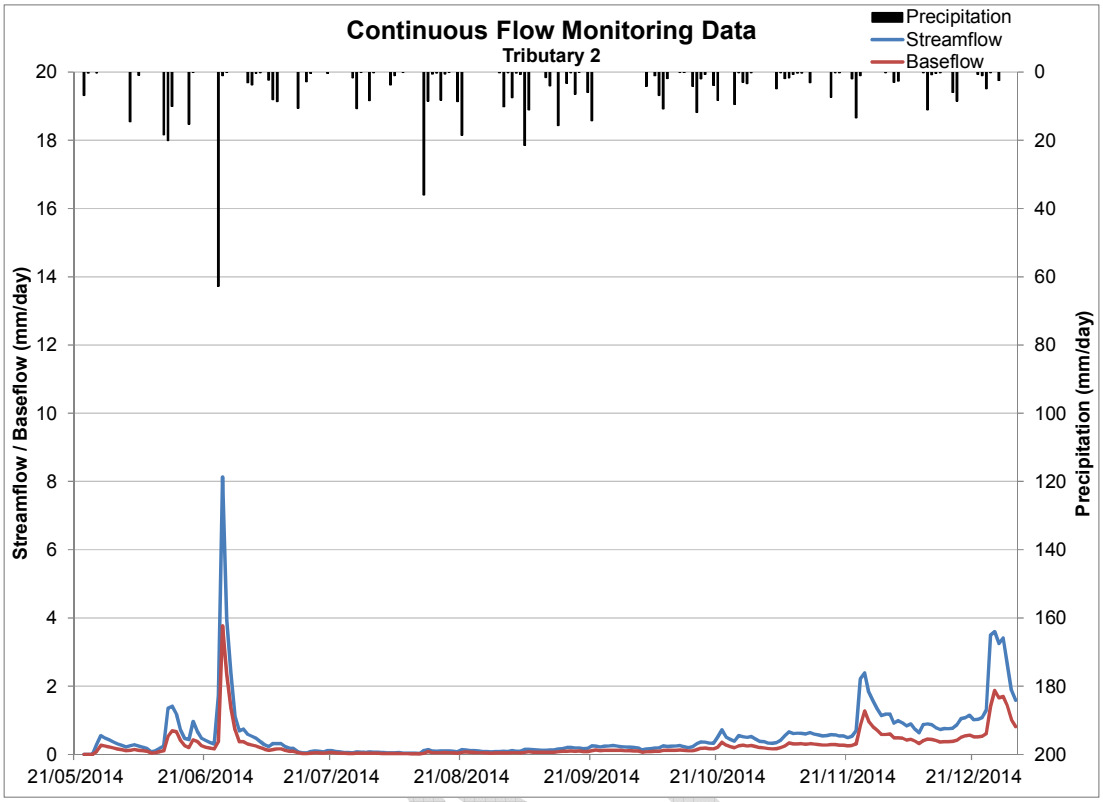


Figure 3.2: Continuous Flow Monitoring Data - Tributary 2

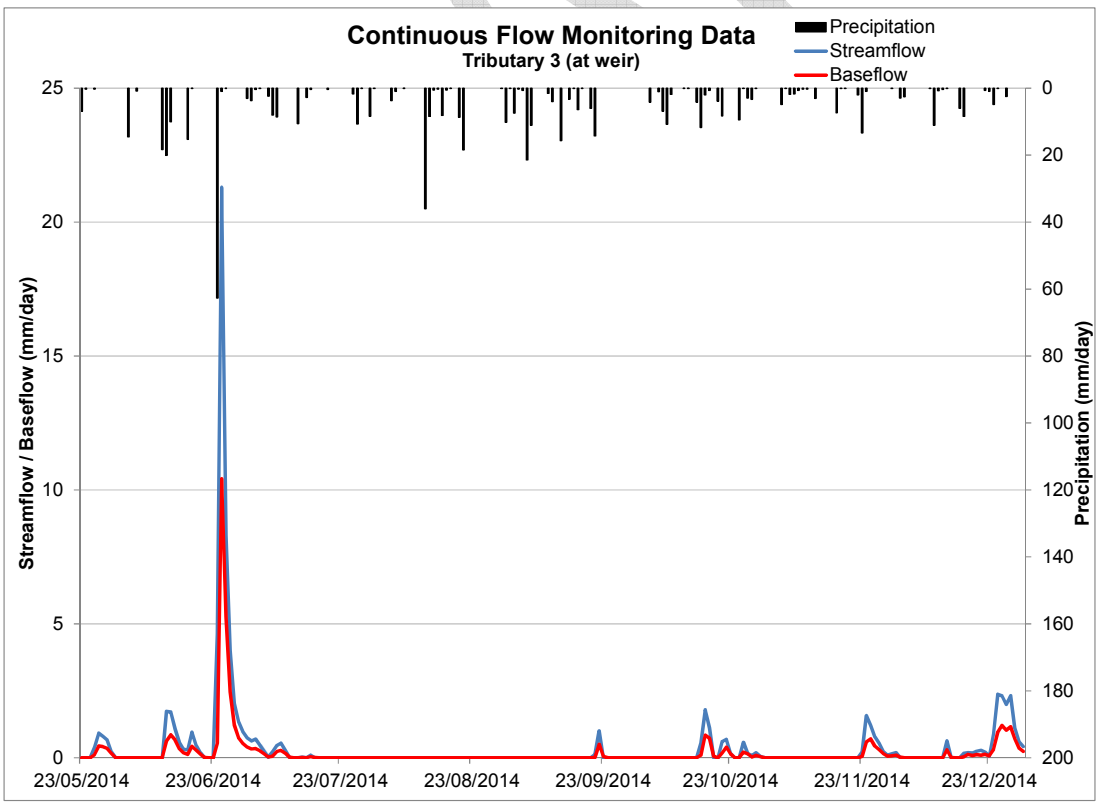


Figure 3.3: Continuous Flow Monitoring Data - Tributary 3

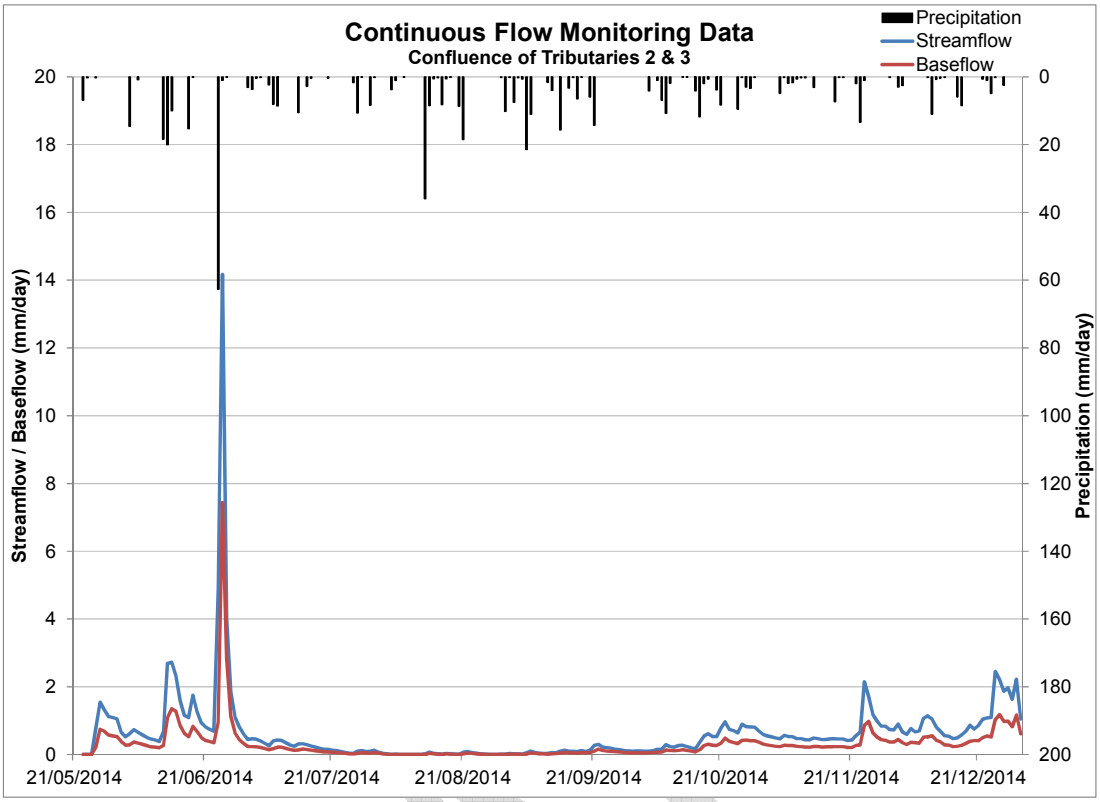


Figure 3.4: Continuous Flow Monitoring Data - Confluence of Tributary 2 & 3

Baseflow

Baseflows in the tributaries comprising the Northwest Branch of Shirley's Brook were observed to vary significantly over the course of the year. Flows during the spring months are relatively high, sustained by the snow and water retained in the wetland areas in the upper portion of the watershed. Over the course of the summer, the baseflows in the Northwest Branch tributaries steadily decrease until the channels are dry, only flowing for short durations following storm events. In the fall, the wetland areas gradually replenish their storage as evapotranspiration rates decrease and the tributaries begin to flow for longer durations following storm events.

These observations are reflected in the following photographs (**Figures 4.5 - 4.10**), taken on April 10 and August 24, 2015.

Figure 3.5: Northwest Branch - Tributary 2 (April 10, 2015)

Figure 3.6: Northwest Branch - Tributary 2 (August 24, 2015)

Figure 3.7: Northwest Branch - Tributary 3 (April 10, 2015)

Figure 3.8: Northwest Branch - Tributary 3 (August 24, 2015)

Figure 3.9: Northwest Branch Confluence (April 10, 2015)

Figure 3.10: Northwest Branch Confluence (August 24, 2015)

Note: There was approximately 22mm of rain between August 20 and August 24. Even so, the Northwest Branch Tributaries were observed to be dry on August 24, 2015.

Streamflow vs. Rainfall

Field observations taken over the course of 2014 and 2015 indicate that the highest annual flows in the Northwest Branch Tributaries typically occur during the spring freshet and significant rainfall events. The spring snowmelt of 2015 was considered to be relatively low in the region, generating lower than average spring runoff responses. However, the observed flow rate on April 10, 2015 was roughly equivalent to the 10-year peak flow for a summer rainfall event.

A comparison of spring versus summer runoff responses in the Northwest Branch of Shirley's Brook is provided below:

- The observed flow rate on April 10, 2015 was approximately 1.2 m^3/s, resulting from approximately 22mm of precipitation over a period of 48 hours.
- The recorded peak flow on June 25, 2014 was approximately 2.8 m^3/s, resulting from a high-intensity storm generating 62.7mm of rainfall over a period of 12 hours.

As shown in **Figures 4.2-4.4**, the streamflow response from summer rain events recedes rather quickly. By contrast, the streamflow response during the spring freshet spring is sustained over a number of days at relatively high flows and depths.

Section 4.0 Hydrologic Modeling

The SWMHYMO hydrologic model has been used to evaluate existing drainage conditions within the Kanata North Urban Expansion Area. The study area has been divided into sub-catchments as shown the Existing Conditions Drainage Area Plan provided as **Drawing 112117-PRE**.

4.1 Model Parameters

Modeling parameters for the lands within the Shirley's Brook watershed have been adapted from the AECOM SWMHYMO model developed for the *Shirley's Brook & Watt's Creek Phase 2 Stormwater Management Study* (Draft, AECOM, March, 2013). This hydrologic model delineates the northwest tributary of Shirley's Brook into three (3) subcatchments. The Novatech model further discretizes these areas into twelve (12) subcatchments, with two (2) areas added (for a total of 14 subcatchment areas) to allow for model refinement based on land use and topographical features. For the Northwest Branch of Shirley's Brook, land use is roughly distributed as follows:

- The headwater areas (west of the hydro corridor) consist primarily of forests and heavily wooded areas. The hydrologic response time from this area is anticipated to be quite slow.
- The mid-reach areas (east of hydro corridor, west of KNUEA) consist primarily of estate residential lots. The drainage infrastructure associated with these developments (roadside ditches and culverts) will have resulted in a considerably faster hydrologic response time as compared to the headwater areas.
- The lower reach of the northwest tributary (KNUEA) consists primarily of agricultural row crops and pasture. These lands have a relatively fast hydrologic response time and generate more runoff than the woodlands and estate lot subdivisions.
- Areas East of March Road and the North West Branch that are tributary to the Main Branch of Shirley's Brook at March Valley Road.

A detailed list of pre-development modeling parameters can be found in **Appendix A**.

Number of Linear Reservoirs (N)

The number of linear reservoirs (N) describes the general shape of the hydrograph. The lower the number, the flatter the hydrograph becomes. The AECOM study used an N value of 1.1 to represent the same area, which provided the baseline for the updated model. One area was given an N value of 3.0 to reflect the existing development that would produce higher peak flows.

Times to Peak

The time to peak (T_p) for each subcatchment area was initially calculated using both the Bransby-Williams method and the SCS Uplands method, consistent with the methodology of the AECOM study. The T_p values calculated using the Bransby-Williams method were ultimately used as they produced results closer to those in the AECOM model than those produce when using the Uplands Method.

Initial Abstraction (I_a)

The initial abstraction (I_a) describes the removal of rainfall from becoming runoff through evapotranspiration, interception, and infiltration. I_a is estimated based on the curve number (in fact, curve numbers were estimated from measurements of abstraction) following the formula:

$$I_a = f(25400/CN - 254)$$

Where *f* is typically expressed as being 0.2 and is recommended as such in the City of Ottawa Sewer Design Guidelines. Initial abstraction values for the subcatchment areas were based on those found in Table 9.2 of *Hydrology of Floods in Canada (1989)* (Watt, W.E. et. Al.). As with SCS Curve Numbers, the subcatchments were given weighted I_a values based on the existing land use. **Table 4.1** outlines the various I_a values based on land use:

Table 4.1: Standard Initial Abstraction (I_a) Values

Cover Type	IA (mm)	Min IA (mm)	Max IA (mm)
Open Water	0	0	0
Road (Asphalt/Concrete)	2.5	1.25	3.75
Gravel/Fill/Quarry	5	-	-
Estate Lot Residential	4	2.5	4
Open/Grass/Natural	8	5	12.5
Field/Crop (Cultivated)	8	5	12.5
Wood/Brush	10	5	15.2

Design Storms

The hydrologic model runs simulations for the following storm events:

4 Hour Chicago Storms:
25mm 4hr Chicago storm
2-year 4hr Chicago storm
5-year 4hr Chicago storm
100-year 4hr Chicago storm

24 Hour SCS Type II Storms:
25mm 24hr SCS Type II storm
2-year 24hr SCS Type II storm
5-year 24hr SCS Type II storm
100-year 24hr SCS Type II storm

12 Hour SCS Type II Storms:
25mm 12hr SCS Type II storm
2-year 12 hour SCS Type II storm
5-year 12 hour SCS Type II storm
100-year 12 hour SCS Type II storm

4.2 Model Results

The pre-development SWMHYMO model of the Shirley's Brook watershed produced the peak flows during the SCS 12-hour storm listed in **Table 4.2**. Flows for all storm events can be found in **Appendix B**.

Table 4.2: Pre-Development Peak Flows (m^3/s)

Storm Distribution ->	SCS 12-Hour			
Return Period ->	**25mm**	**2 year**	**5 year**	**100 year**
Shirley's Brook Northwest Branch				
Tributary 2	0.143	0.522	0.943	2.430
Tributary 3	0.039	0.167	0.316	0.868
Tributary 4	0.014	0.048	0.083	0.204
Confluence of Tributaries 2, 3, & 4	0.196	0.732	1.336	3.488
KNUEA Lands to Main Branch of Shirley's Brook Main at March Valley Road				
Headwater Channels to Shirley's Brook Main Branch (Channels A-D)	0.058	0.220	0.402	1.045

4.3 Hydrologic Modeling (KNUEA Only)

West Side of March Road

The flow rates above (**Table 4.2**) are for the total area of the Shirley's Brook Northwest Branch watershed. To determine the peak flows and preliminary allowable release rates for the lands within the KNUEA boundaries, weighted-area calculations have been completed based on the drainage areas for each of the tributaries. The results of the calculations are outlined in **Table 4.3**.

The flow rates determined for the western drainage areas within the KNUEA will be used as the allowable release rates for the stormwater facilities on the west side of March Road, and will be applied to the stage-storage curves in the post-development hydrologic model.

Table 4.3: KNUEA Peak Flows to Tributary 2 and Tributary 3 (m^3/s)

Storm Event	Tributary 2			Tributary 3		
	Watershed Peak Flows		KNUEA Peak Flows	Watershed Peak Flows		KNUEA Peak Flows
	m^3/s	L/s/ha	L/s for 53 ha	m^3/s	L/s/ha	L/s for 30 ha
25mm 12-hr SCS	0.143	0.3	16.3	0.039	0.2	5.5
2-yr 12-hr SCS	0.522	1.1	59.4	0.167	0.7	23.7
5-yr 12-hr SCS	0.943	2.0	107.3	0.316	1.3	44.9
100-yr 12-hr SCS	2.430	5.2	276.5	0.868	3.7	123.4

As expected, the post-development flows are similar to the results of the 2013 AECOM model. However, there is concern that this model continues to underestimate the design peak flows from larger storm events.

East Side of March Road

As there is not a large upstream drainage area for the land east of March Road, the standard post-to-pre criteria can be used for determining the allowable release rates for any proposed SWM facilities. The flow rates listed in **Table 4.2** for the KNUEA lands on the east side of March Road (approximately 95 ha) will be used as the allowable post-development release rate to Shirley's Brook Main Branch at March Valley Road.

The flow rates determined for the eastern drainage areas within the KNUEA will be used as the allowable release rates for the stormwater facilities on the east side of March Road, and will be applied to the stage-storage curves in the post-development hydrologic model.

Section 5.0 Floodplain Evaluation (HEC-RAS)

A hydraulic model of the Northwest Branch of Shirley's Brook within the limits of the study area *(Tributaries 2 and 3)* was developed using HEC-RAS. The following information was used to prepare the existing conditions HEC-RAS model:

- A ground surface model was generated in Autodesk Civil 3D using detailed survey data compiled by Novatech, supplemented with the 1:1000 and 1:2000 topographic mapping.
- Channel cross-sections were generated from the ground surface model and exported to HEC-RAS. Additional information (bank stations, channel/overbank roughness coefficients, etc.) was added to the HEC-RAS model. Manning's roughness coefficients were estimated based on aerial photography and site visits.
- Details of the hydraulic structures at crossings (culvert type, invert, condition, road elevation, etc.) were input into the HEC-RAS model based on field observations and survey data. Refer to **Section 2.2.7** (Inventory of Structure / Crossings).
- Peak flows generated using the SWMHYMO model (**Table 5.1**) were input into the HEC-RAS model at the beginning of each tributary reach.

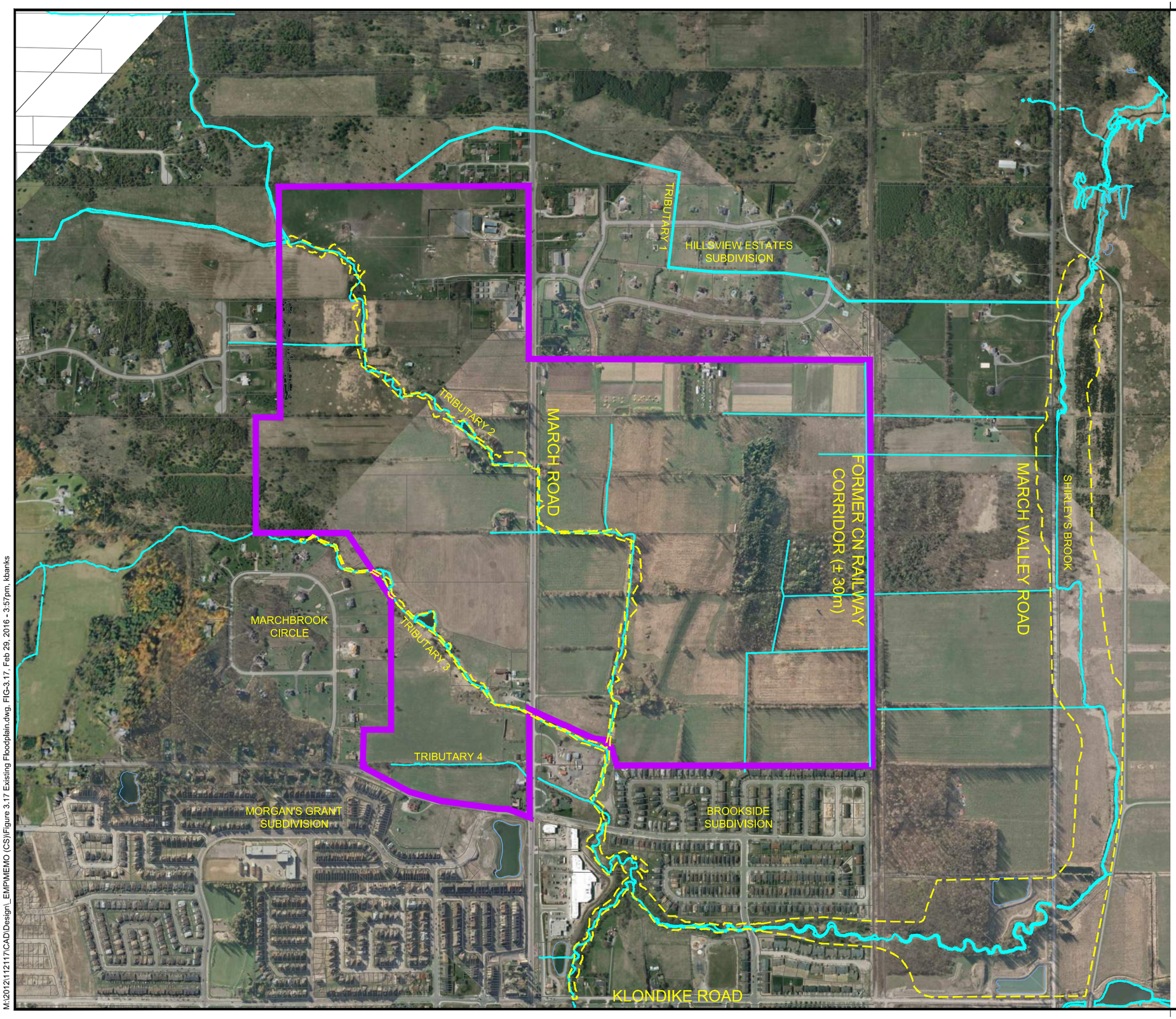
Table 5.1: Peak Flows provided in the HEC-RAS Model for the Northwest Branch

Reach	River Station	$Q_{100\text{-year}*}$	$Q_{5\text{-year}*}$	$Q_{2\text{-year}*}$
Tributary 3	4112.66	0.848	0.308	0.162
	3271.49	0.986	0.366	0.195
	3005.60	1.010	0.375	0.200
Tributary 2	2310.70	1.897	0.722	0.396
	1293.80	2.136	0.821	0.453
	266.29	2.430	0.943	0.522
Northwest Branch *(Confluence of Tributaries 2 & 3)*	206.99	3.438	1.315	0.721
	30.31	3.631	1.394	0.766

*12-hour SCS storm distribution

5.1 Model Results

The HEC-RAS model was run using peak flows associated with the 100-yr storm event. The resulting flood elevations were used to delineate the 100-year floodplain based on the ground surface model as shown on **Figure 6.1**. The water level elevations at various locations for the 2-year, 5-year and 100-year events are shown in **Table 5.2**. The HEC-RAS model schematic, output results and profiles are provided in **Appendix B**.



LEGEND

- KNUEA
- DRAINAGE CHANNEL
- EXISTING FLOODPLAIN

KANATA NORTH
COMMUNITY DESIGN PLAN

FIGURE NO. 6.1
EXISTING FLOODPLAIN LIMITS

DATE FEB 2016
JOB 112117
SCALE 1:10,000
0 50 100m 200m

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Engineers, Planners & Landscape Architects

M:\2012\112117\CAD\Design_EMPMEMO (CS)\Figure 3.17 Existing Floodplain.dwg, FIG-3.17, Feb 29, 2016 - 3:57pm, kbanks

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Table 5.2: Water Level Elevations within the Northwest Branch

Tributary	River Station	2-year WL Elev. (m)	5-year WL Elev. (m)	100-year WL Elev. (m)
Tributary 2	2310.70	89.03	89.05	89.10
	1920.64	86.00	86.11	86.25
	1589.43	83.35	83.39	83.43
	1293.80*	79.89	80.12	80.51
	1245.94**	79.58	79.75	80.13
	808.91	77.91	77.94	78.02
	514.32	76.67	76.76	76.92
	266.29	74.83	74.93	75.14
Tributary 3	4112.66	89.34	89.37	89.45
	3673.90	81.34	81.36	81.43
	3271.49*	77.81	77.89	78.00
	3158.50**	76.66	76.72	76.87
	3005.60	74.54	74.63	74.84
Northwest Branch (Confluence of Tributaries 2 & 3)	206.99	74.41	74.47	74.60
	0.86	71.92	72.02	72.23

*Cross-Section Upstream March Road
**Cross-Section Downstream March Road

Tributary 2

Tributary 2 of the Northwest Branch of Shirley's Brook is located on the Northern part of the subject site and has ample capacity to convey the 100-yr peak flow throughout the subject site to the culvert crossing March Road *(Hydraulic Structure S-2)*. Results from the HEC-RAS model indicate that, apart from some flooding of the adjacent agricultural lands immediately upstream of March Road, the 100-yr water elevations throughout the tributary are largely contained within the banks of the channel.

Tributary 3

Tributary 3 of the North Branch of Shirley's Brook has ample capacity to convey the 100-yr peak flow throughout the subject site to March Road *(Hydraulic Structure S-6)* and beyond to the confluence with Tributary 2. Results from the HEC-RAS model indicate that the 100-yr water elevations throughout the branch are maintained within the banks of the channel.

Section 6.0 Next Steps

The hydrologic and hydraulic assessment has been used to generate runoff hydrographs representative of existing conditions within the study area. The results of the existing conditions analysis will be used to identify development constraints and opportunities for the subject lands, and options for stormwater management servicing will be developed. The existing conditions model will be subject to refinement based on the results of the supplemental flow monitoring program and discussions with City and MVCA staff.

As part of the Environmental Management Plan, stormwater management criteria will be developed for the KNUEA lands. The development of SWM criteria will take the recommendations of previous reports into consideration, but will ultimately be determined through consultation with the MVCA, City, and other regulatory agencies. SWM criteria will include, but not be limited to, the following:

- The required level of water quality control for Shirley's Brook will be determined, and achieved through a proposed combination of stormwater management facilities and lot-level conveyance controls.
- Peak flow control criteria will be developed to ensure no adverse impacts on flood elevations and velocities in Shirley's Brook downstream of the proposed development.
- Water Balance criteria will be developed to ensure that groundwater recharge rates are maintained.
- Erosion control requirements will be developed based on recommendations from the fluvial geomorphology assessment.
- Stream setbacks will be determined based on the findings and recommendations of the existing conditions reports.
- The stormwater management criteria will need to adhere to all applicable policies and guidelines of the Mississippi Valley Conservation Authority and other regulatory agencies.

An existing conditions water balance will be provided once the detailed hydrogeological and geotechnical analysis has been finalized. The existing conditions water balance will be based on the approach presented in the Ministry of the Environment - Stormwater Management and Planning Manual (2003), by taking into account a combination of various land uses and soil types within each pre-development catchment area.

The hydrologic analysis will be refined and calibrated based on the results of the flow monitoring program currently underway for the Northwest Branch Tributaries. The final results of the hydrologic analysis will be used in conjunction with the detailed fluvial geomorphological, natural environment, hydrogeological, and archaeological assessments to establish set meander belt widths, setbacks, and erosion control SWM criteria for the proposed development.

Section 7.0 Reliance Clause

This report has been prepared by Novatech, on behalf of the Kanata North Landowner's Group and in support of the Kanata North Community Design Plan. It is hereby acknowledged that Metcalfe Realty Company Limited, J.G Rivard Limited and 8409706 Canada Inc. (Valecraft Homes), 3223701 Canada Inc. and 7089121 Canada Inc. (Junic/Multivesco) can rely upon and utilize this report for the purpose of obtaining approval of the community design plan and for their own use to seek development approval.

It is further acknowledged that future confirmed participating landowners within the Kanata North Landowner's Group, can rely upon and utilize this report for the purpose of obtaining approval of the community design plan and for their own use to seek development approval.

Section 8.0 References

The following reports were reviewed with regard to storm drainage and stormwater management for the Kanata North Urban Expansion. These reports provided background information that was used in the establishment of stormwater management (SWM) design criteria, as well as input parameters and design storms used in the stormwater management modeling.

1. Existing Conditions Natural Environment Features Kanata North Urban Expansion Area (Muncaster Environmental Planning Inc., January 2016)
2. Consolidated Preliminary Geotechnical Investigation Kanata North Urban Expansion Area Community Design Plan (Patterson Group, October 7, 2013)
3. Hydrogeological Existing Conditions Report Kanata North Urban Expansion Area (Patterson Group, January 27, 2016)
4. *Shirley's Brook & Watts Creek Phase 2 –Stormwater Management Study Draft Report* (AECOM, March 2013).
5. *Shirley's Brook Floodplain Analysis & Stormwater Management Report –Klondike Road Development Lands* (Novatech, May 2006).
6. *Kanata North Environmental/Stormwater Management Plan – Final Draft Report* (CH2MHILL, January 2001).
7. *Shirley's Brook and Watts Creek Subwatershed Study* (Dillon Consulting, September 1999).

NOVATECH

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Appendix A: Hydrologic Modelling Files (SWMHYMO)

SWMHYMO MODEL PARAMETERS

- KNUEA Lands: Existing Condition Model Parameters

SWMHYMO MODEL FILES

- Existing Conditions Input File: KN-PRE.dat
- Existing Conditions Output File: KN-PRE.sum

Kanata North Community Design Plan
Pre-Development SWMHYMO Model Parameters

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Time to Peak Calculations Tc=0.605*(L/((S^0.2)(A^0.1)))
(Bransby-Williams Method)

Drainage Area ID	Area (m2)	Area (ha)	Area (km2)	Length of Channel (m)	Length of Channel (km)	Slope of Channel (m/m)	Tc (hours)
201	1,151,423	115.14	1.151	749	0.75	0.020	0.98
202	2,636,363	263.64	2.636	1065	1.07	0.010	1.47
203	467,369	46.74	0.467	1025	1.03	0.010	1.68
204	293,893	29.39	0.294	552	0.55	0.010	0.95
205	108,387	10.84	0.108	322	0.32	0.020	0.53
301	864,268	86.43	0.864	1047	1.05	0.017	1.45
302	806,913	80.69	0.807	1470	1.47	0.015	2.11
303	651,627	65.16	0.652	971	0.97	0.010	1.54
304	187,795	18.78	0.188	580	0.58	0.010	1.04
305	26,094	2.61	0.026	100	0.10	0.010	0.22
401	167,797	16.78	0.168	941	0.94	0.012	1.66
402	108,910	10.89	0.109	450	0.45	0.010	0.85
403	23,734	2.37	0.024	150	0.15	0.027	0.27
501	626,486	62.65	0.626	450	0.45	0.023	0.60
502	518,434	51.84	0.518	458	0.46	0.010	0.75

SCS Curve Numbers (AMC II, HSG 'B/C')

Area ID	Land Use 1	Area	CN	IA (mm)	Land Use 2	Area	CN	IA (mm)	Land Use 3	Area	CN	IA (mm)	Weighted CN	Weighted IA (mm)
201	Woods (good)	65%	63	12.5	Woods (fair)	25%	67	10.0	Open Space (good)	10%	68	8.0	65	11.4
202	Woods (good)	20%	63	12.5	Estate Residential	35%	70	4.0	50% pasture & 50% Row Crops (good)	45%	73	8.5	70	7.7
203	Cultivated Row Crops (Straight/Contour) (good)	70%	80	7.0	Pasture (good)	20%	65	9.0	Open Space (good)	10%	68	9.0	76	7.6
204	Cultivated Row Crops (Straight/Contour) (good)	70%	80	7.0	Pasture (good)	20%	65	9.0	Open Space (good)	10%	68	9.0	76	7.6
205	Industrial Districts (School/ Church area)	50%	88	4.0	Open Space (good)	50%	68	8.0	-	-	-	-	78	6.0
301	Woods (good)	95%	63	12.5	Open Space (good)	5%	68	8.0	-	-	-	-	63	
302	Woods (good)	60%	63	12.5	Estate Residential	5%	70	4.0	Pasture (good)	35%	65	9.0	64	10.9
303	Woods (good)	37%	63	12.5	Estate Residential	25%	70	4.0	50% pasture & 50% Row Crops (good)	38%	73	8.5	69	8.9
304	Cultivated Row Crops (Straight/Contour) (good)	78%	80	7.0	Estate Residential	5%	70	4.0	Open Space (good)	17%	68	8.0	77	7.0
305	Estate/ Rural Residential	45%	70	4.0	Open Space (fair)	50%	74	6.5	Woods (fair)	5%	67	10.0	72	5.6
401	Woods (good)	22%	63	12.5	Estate Residential	50%	70	4.0	Open Space (good)	28%	68	8.0	68	7.0
402	Cultivated Row Crops (Straight/Contour) (good)	85%	80	7.0	Estate Residential	10%	70	4.0	Open Space (good)	5%	68	8.0	78	6.8
403	Estate/ Rural Residential	90%	70	4.0	Open Space (fair)	10%	74	6.5	-	-	-	-	70	4.3
501	Woods (good)	20%	63	12.5	Pasture (good)	20%	65	9.0	Cultivated Row Crops (Straight/Contour) (good)	60%	80	7.0	74	8.5
502	Woods (good)	30%	63	12.5	Pasture (good)	45%	65	9.0	Cultivated Row Crops (Straight/Contour) (good)	25%	80	7.0	68	9.6

SCS Curve Numbers and Initial Abstration Values

Landuse	Condition	CN (HSG 'B')	CN (HSG 'C')	AVG. CN (HSG 'B/C')	IA (mm)
Woods	Poor	66	77	72	7.0
	Fair	60	73	67	10.0
	Good	55	70	63	12.5
Estate Residential (2 acre avg. lot size)	12% Impervious	65	77	71	4.0
Open Space (lawns, parks, etc.)	Grass Cover < 50% (Poor)	79	86	83	5.0
	Grass Cover 50% to 75% (Fair)	69	79	74	6.5
	Grass Cover > 75% (Good)	61	74	68	8.0
Agriculture (pasture, grassland or range)	Poor	67	77	72	5.0
	Fair	69	79	74	7.0
	Good	58	72	65	9.0
Agriculture (Cultivated Row Crops - Straight)	Poor	81	88	85	5.0
	Good	78	85	82	7.0
Agriculture (Cultivated Row Crops - Contoured)	Poor	79	84	82	5.0
	Good	75	82	79	7.0
Agriculture (Cultivated Row Crops - Avg. Straight / Contoured)	Poor	80	86	83	5.0
	Good	77	84	80	7.0

Inial Abstraction

Cover Type	IA (mm)	Min IA (mm)	Max IA (mm)
Open Water	0	0	0
Road (Asphalt/Concrete)	2.5	1.25	3.75
Gravel/Fill/Quarry	5	-	-
Estate Lot Residential	4	2.5	4
Open/Grass/Natural	8	5	12.5
Field/Crop (Cultivated)	8	5	12.5
Wood/Brush	10	5	15.2

SWMHYMO INPUT FILE (Pre-Development, Event-based) – KN-PRE.dat

```
2     Metric units
*#*************************************************************************
*#  Project Name: [Kanata North]    Project Number: [112117]
*#  Date        : 16-09-2015
*#  Modeller    : [Kallie Auld]
*#  Company     : NOVATECH ENGINEERING CONSULTANTS LTD
*#  License #   :  5320763
*#*************************************************************************
*Shirleys Brook - Pre-Development Model
*Model parameters based on original AECOM model
*See "20150911 - Shirley's Brook Modeling Parameters.xlsx"
*#*************************************************************************
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[1]
                    C25mm-4.stm
*%-----------------|-------------------------------------------------------|
READ STORM          STORM_FILENAME=["STORM.001"]
*%=================|=======================================================|
************************PEAK FLOW FOR TRIBUTARY 2*****************************|
*%=================|=======================================================|
CALIB NASHYD        ID=[1], NHYD=["201"], DT=[5]min, AREA=[115.14](ha),
                    DWF=[0](cms), CN/C=[65], IA=[11.4](mm),
                    N=[1.1], TP=[0.98]hrs,
                    END=-1
*%-----------------|-------------------------------------------------------|
ROUTE CHANNEL       IDout=[2], NHYD=["211"], IDin=[1],
                    RDT=[5](min),
                    CHLGTH=[557.6](m),  CHSLOPE=[0.89](%),
                                        FPSLOPE=[0.89](%),
                    SECNUM=[2096],       NSEG=[3]
                    ( SEGROUGH, SEGDIST (m))=[0.35,30.79 -0.040,51.78 0.35,96.66] NSEG times
                    ( DISTANCE (m), ELEVATION (m))=[   0    , 87.99 ]
                                                  [        11.43     , 86.90 ]
                                                  [        30.79     , 86.74 ]
                                                  [        34.09     , 86.37 ]
                                                  [        35.26     , 86.12 ]
                                                  [        39.56     , 86.12 ]
                                                  [        45.35     , 86.52 ]
                                                  [        51.78     , 86.75 ]
                                                  [        63.33     , 86.96 ]
                                                  [        65.76     , 86.99 ]
                                                  [        76.04     , 87.55 ]
                                                  [        96.66     , 87.99 ]
*%-----------------|-------------------------------------------------------|
CALIB NASHYD        ID=[3], NHYD=["202"], DT=[5]min, AREA=[263.64](ha),
                    DWF=[0](cms), CN/C=[70], IA=[7.7](mm),
                    N=[1.1], TP=[1.47]hrs,
                    END=-1
*%-----------------|-------------------------------------------------------|
ADD HYD             IDsum=[1], NHYD=["200a"], IDs to add=[2,3]
*%-----------------|-------------------------------------------------------|
ROUTE CHANNEL       IDout=[2], NHYD=["212"], IDin=[1],
                    RDT=[5](min),
                    CHLGTH=[255.4](m),  CHSLOPE=[0.88](%),
                                        FPSLOPE=[0.88](%),
                    SECNUM=[1538],       NSEG=[3]
                    ( SEGROUGH, SEGDIST (m))=[0.35,17.84 -0.035,25.92 0.35,65.1] NSEG times
                    ( DISTANCE (m), ELEVATION (m))=[   0    ,  82.05 ]
                                                  [        11.78     , 81.45 ]
                                                  [        15.00  , 81.32 ]
                                                  [        17.21     , 80.82 ]
                                                  [        17.84     , 80.58 ]
                                                  [        19.57     , 79.94 ]
                                                  [        20.79     , 80.14 ]
                                                  [        22.02     , 80.27 ]
                                                  [        25.92     , 80.55 ]
                                                  [        39.31     , 80.79 ]
                                                  [        43.55     , 80.84 ]
                                                  [        48.04     , 80.82 ]
                                                  [        50.86     , 80.85 ]
                                                  [        65.10     , 81.47 ]
*%-----------------|-------------------------------------------------------|
ROUTE CHANNEL       IDout=[1], NHYD=["213"], IDin=[2],
                    RDT=[5](min),
                    CHLGTH=[437.0](m),  CHSLOPE=[0.5](%),
                                        FPSLOPE=[0.5](%),
                    SECNUM=[1283],       NSEG=[3]
                    ( SEGROUGH, SEGDIST (m))=[0.35,36.15 -0.035,50.18 0.35,75.27] NSEG times
                    ( DISTANCE (m), ELEVATION (m))=[   0    , 78.59 ]
                                                  [        10.33     , 78.65 ]
                                                  [        29.43     , 78.60 ]
                                                  [        36.15     , 78.43 ]
                                                  [        37.26     , 78.27 ]
                                                  [        41.19     , 78.00 ]
                                                  [        45.62     , 78.00 ]
                                                  [        50.18     , 78.42 ]
                                                  [        51.67     , 78.43 ]
                                                  [        60.03     , 78.37 ]
                                                  [        60.89     , 78.34 ]
                                                  [        75.27     , 78.42 ]
*%-----------------|-------------------------------------------------------|
CALIB NASHYD        ID=[2], NHYD=["203"], DT=[5]min, AREA=[46.74](ha),
                    DWF=[0](cms), CN/C=[76], IA=[7.6](mm),
                    N=[1.1], TP=[1.68]hrs,
                    END=-1
*%-----------------|-------------------------------------------------------|
ADD HYD             IDsum=[3], NHYD=["200b"], IDs to add=[1,2]
*%-----------------|-------------------------------------------------------|
ROUTE CHANNEL       IDout=[1], NHYD=["214"], IDin=[3],
                    RDT=[5](min),
                    CHLGTH=[542.6](m),  CHSLOPE=[0.52](%),
                                        FPSLOPE=[0.52](%),
                    SECNUM=[0808],       NSEG=[3]
                    ( SEGROUGH, SEGDIST (m))=[0.35,19.56 -0.035,32.26 0.35,49.77] NSEG times
                    ( DISTANCE (m), ELEVATION (m))=[   0    , 77.40 ]
                                                  [         9.26     , 77.00 ]
                                                  [        12.15     , 77.00 ]
                                                  [        13.67     , 76.75 ]
                                                  [        19.56     , 76.75 ]
                                                  [        22.86     , 76.51 ]
                                                  [        26.14     , 76.00 ]
                                                  [        29.07     , 76.00 ]
                                                  [        32.26     , 76.75 ]
                                                  [        33.60     , 76.98 ]
                                                  [        44.31     , 77.50 ]
                                                  [        49.77     , 77.74 ]
*%-----------------|-------------------------------------------------------|
CALIB NASHYD        ID=[2], NHYD=["204"], DT=[5]min, AREA=[29.39](ha),
                    DWF=[0](cms), CN/C=[76], IA=[7.6](mm),
                    N=[1.1], TP=[0.95]hrs,
                    END=-1
*%-----------------|-------------------------------------------------------|
CALIB NASHYD        ID=[3], NHYD=["205"], DT=[5]min, AREA=[10.89](ha),
                    DWF=[0](cms),  CN/C=[78], IA=[6](mm),
                    N=[3.0], TP=[0.53]hrs,
```

```
                  END=-1
*%-----------------|-------------------------------------------------------------|
ADD HYD           IDsum=[10], NHYD=["200"], IDs to add=[1,2,3]
*%-----------------|-------------------------------------------------------------|
*PRINT HYD         ID=[10],   # OF PCYCLES=[1]
*%-----------------|-------------------------------------------------------------|
*%=================|=============================================================|
**********************PEAK FLOW FOR TRIBUTARY 3***************************|
*%=================|=============================================================|
CALIB NASHYD      ID=[1], NHYD=["301"], DT=[5]min, AREA=[86.43](ha),
                  DWF=[0](cms), CN/C=[63], IA=[12.3](mm),
                  N=[1.1], TP=[1.45]hrs,
                  END=-1
*%-----------------|-------------------------------------------------------------|
CALIB NASHYD      ID=[2], NHYD=["302"], DT=[5]min, AREA=[80.69](ha),
                  DWF=[0](cms), CN/C=[64], IA=[10.9](mm),
                  N=[1.1], TP=[2.11]hrs,
                  END=-1
*%-----------------|-------------------------------------------------------------|
ADD HYD           IDsum=[3], NHYD=["300a"], IDs to add=[1,2]
*%-----------------|-------------------------------------------------------------|
ROUTE CHANNEL     IDout=[1], NHYD=["310"], IDin=[3],
                  RDT=[5](min),
                  CHLGTH=[448.8](m),  CHSLOPE=[1.62](%),
                                      FPSLOPE=[1.62](%),
                  SECNUM=[4122],       NSEG=[3]
                  ( SEGROUGH, SEGDIST (m))=[0.35,36.85 -0.04,57.43 0.35,98.10] NSEG times
                  ( DISTANCE (m), ELEVATION (m))=[   0    , 85.97 ]
                                                [        29.14     , 86.03 ]
                                                [        35.73     , 85.88 ]
                                                [        36.85     , 85.69 ]
                                                [        39.63     , 85.47 ]
                                                [        43.19     , 85.31 ]
                                                [        47.24     , 84.78 ]
                                                [        50.54     , 84.78 ]
                                                [        54.28     , 84.94 ]
                                                [        57.43     , 85.70 ]
                                                [        65.07     , 85.80 ]
                                                [        67.25     , 85.80 ]
                                                [        70.81     , 85.80 ]
                                                [        98.10     , 86.10 ]
*%-----------------|-------------------------------------------------------------|
CALIB NASHYD      ID=[2], NHYD=["303"], DT=[5]min, AREA=[65.16](ha),
                  DWF=[0](cms), CN/C=[69], IA=[8.9](mm),
                  N=[1.1], TP=[1.54]hrs,
                  END=-1
*%-----------------|-------------------------------------------------------------|
ADD HYD           IDsum=[3], NHYD=["300b"], IDs to add=[1,2]
*%-----------------|-------------------------------------------------------------|
ROUTE CHANNEL     IDout=[1], NHYD=["312"], IDin=[3],
                  RDT=[5](min),
                  CHLGTH=[423.0](m),  CHSLOPE=[1.17](%),
                                      FPSLOPE=[1.17](%),
                  SECNUM=[3673],       NSEG=[3]
                  ( SEGROUGH, SEGDIST (m))=[0.35,43.21 -0.035,60.18 0.35,88.46] NSEG times
                  ( DISTANCE (m), ELEVATION (m))=[   0    , 81.92 ]
                                                [        24.54     , 81.13 ]
                                                [        30.36     , 81.05 ]
                                                [        43.21     , 80.25 ]
                                                [        50.74     , 79.70 ]
                                                [        56.30     , 79.70 ]
                                                [        60.18     , 80.25 ]
                                                [        73.61     , 80.39 ]
                                                [        88.46     , 80.79 ]
*%-----------------|-------------------------------------------------------------|
CALIB NASHYD      ID=[2], NHYD=["304"], DT=[5]min, AREA=[18.78](ha),
                  DWF=[0](cms), CN/C=[77], IA=[7.0](mm),
                  N=[1.1], TP=[1.04]hrs,
                  END=-1
*%-----------------|-------------------------------------------------------------|
ADD HYD           IDsum=[3], NHYD=["300c"], IDs to add=[1,2]
*%-----------------|-------------------------------------------------------------|
ROUTE CHANNEL     IDout=[1], NHYD=["313"], IDin=[3],
                  RDT=[5](min),
                  CHLGTH=[219.4](m),  CHSLOPE=[1.28](%),
                                      FPSLOPE=[1.28](%),
                  SECNUM=[3250],       NSEG=[3]
                  ( SEGROUGH, SEGDIST (m))=[0.35,20.91 -0.035,30.21 0.35,49.15] NSEG times
                  ( DISTANCE (m), ELEVATION (m))=[   0    , 77.74 ]
                                                [         9.02     , 77.11 ]
                                                [        20.91     , 76.04 ]
                                                [        24.36     , 75.70 ]
                                                [        24.7      , 75.59 ]
                                                [        26.13     , 75.58 ]
                                                [        26.44     , 75.76 ]
                                                [        30.21     , 76.02 ]
                                                [        34.47     , 76.58 ]
                                                [        35.79     , 76.66 ]
                                                [        40.79     , 76.69 ]
                                                [        45.14     , 76.99 ]
                                                [        46.86     , 77.73 ]
                                                [        49.15     , 78.01 ]
*%-----------------|-------------------------------------------------------------|
CALIB NASHYD      ID=[2], NHYD=["305"], DT=[5]min, AREA=[2.61](ha),
                  DWF=[0](cms), CN/C=[72], IA=[5.6](mm),
                  N=[1.1], TP=[0.22]hrs,
                  END=-1
*%-----------------|-------------------------------------------------------------|
ADD HYD           IDsum=[9], NHYD=["300"], IDs to add=[1,2]
*%-----------------|-------------------------------------------------------------|
*PRINT HYD         ID=[9],   # OF PCYCLES=[1]
*%-----------------|-------------------------------------------------------------|
*=============================================================================|
**********************PEAK FLOW FOR TRIBUTARY 4***************************|
*=============================================================================|
*%-----------------|-------------------------------------------------------------|
CALIB NASHYD      ID=[1], NHYD=["401"], DT=[5]min, AREA=[16.78](ha),
                  DWF=[0](cms), CN/C=[68], IA=[7.0](mm),
                  N=[1.1], TP=[1.66]hrs,
                  END=-1
*%-----------------|-------------------------------------------------------------|
CALIB NASHYD      ID=[2], NHYD=["402"], DT=[5]min, AREA=[10.89](ha),
                  DWF=[0](cms), CN/C=[78], IA=[6.8](mm),
                  N=[1.1], TP=[0.85]hrs,
                  END=-1
*%-----------------|-------------------------------------------------------------|
CALIB NASHYD      ID=[3], NHYD=["403"], DT=[5]min, AREA=[2.37](ha),
                  DWF=[0](cms), CN/C=[70], IA=[4.3](mm),
                  N=[1.1], TP=[0.27]hrs,
                  END=-1
*%-----------------|-------------------------------------------------------------|
ADD HYD           IDsum=[8], NHYD=["400"], IDs to add=[1,2,3]
*%-----------------|-------------------------------------------------------------|
*PRINT HYD         ID=[8],   # OF PCYCLES=[1]
```

```
*%-----------------|-------------------------------------------------------------|
*=============================================================================|
************************PEAK FLOW AT CONFLUENCE*****************************|
*=============================================================================|
ADD HYD             IDsum=[1], NHYD=["CONFL"], IDs to add=[10,9]
*%-----------------|-------------------------------------------------------------|
ADD HYD             IDsum=[7], NHYD=["CONFL"], IDs to add=[10,9,8]
*%-----------------|-------------------------------------------------------------|
*PRINT HYD           ID=[7],   # OF PCYCLES=[1]
*%-----------------|-------------------------------------------------------------|
*%=================|=============================================================|
*********************PEAK FLOW FROM EAST SIDE OF MARCH ROAD*******************|
*%=================|=============================================================|
CALIB NASHYD        ID=[1], NHYD=["501"], DT=[5]min, AREA=[62.65](ha),
                    DWF=[0](cms), CN/C=[74], IA=[8.5](mm),
                    N=[1.1], TP=[0.60]hrs,
                    END=-1
*%-----------------|-------------------------------------------------------------|
CALIB NASHYD        ID=[2], NHYD=["502"], DT=[5]min, AREA=[51.84](ha),
                    DWF=[0](cms), CN/C=[68], IA=[9.6](mm),
                    N=[1.1], TP=[0.75]hrs,
                    END=-1
*%-----------------|-------------------------------------------------------------|
ADD HYD             IDsum=[6], NHYD=["500"], IDs to add=[1,2]
*%-----------------|-------------------------------------------------------------|
*PRINT HYD           ID=[6],   # OF PCYCLES=[1]
*%-----------------|-------------------------------------------------------------|
*=============================================================================|
************************TOTAL PEAK FLOW FOR KNUEA**************************|
*=============================================================================|
ADD HYD             IDsum=[5], NHYD=["TOTAL"], IDs to add=[7,6]
*%-----------------|-------------------------------------------------------------|
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[2]
                    C2-4.stm
*%-----------------|-------------------------------------------------------------|
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[3]
                    C5-4.stm
*%-----------------|-------------------------------------------------------------|
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[4]
                    C100-4.stm
*%-----------------|-------------------------------------------------------------|
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[5]
                    S12-25mm.stm
*%-----------------|-------------------------------------------------------------|
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[6]
                    S2-12.stm
*%-----------------|-------------------------------------------------------------|
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[7]
                    S5-12.stm
*%-----------------|-------------------------------------------------------------|
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[8]
                    S100-12.stm
*%-----------------|-------------------------------------------------------------|
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[9]
                    S24-25mm.stm
*%-----------------|-------------------------------------------------------------|
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[10]
                    S2-24.stm
*%-----------------|-------------------------------------------------------------|
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[11]
                    S5-24.stm
*%-----------------|-------------------------------------------------------------|
START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[12]
                    S100-24.stm
*%-----------------|-------------------------------------------------------------|
FINISH
```

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

 SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999  =========
 S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
 SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9 Ver. 4.02
     S   W W   M   M  H   H    Y    M   M  O   O       9999   9999 July 1999
 SSSSS   W W   M   M  H   H    Y    M   M   OOO           9      9 =========
                                                      9   9  9   9 # 5320763
      StormWater Management HYdrologic Model           999    999  =========

 ********************************************************************************
 ************************** SWMHYMO-99 Ver/4.02 *********************************
 *******  A single event and continuous hydrologic simulation model  ********
 *******     based on the principles of HYMO and its successors      ********
 *******                  OTTHYMO-83 and OTTHYMO-89.                 ********
 ********************************************************************************
 ******* Distributed by:  J.F. Sabourin and Associates Inc.          ********
 *******                   Ottawa,  Ontario: (613) 727-5199          ********
 *******                   Gatineau, Quebec: (819) 243-6858          ********
 *******                   E-Mail: swmhymo@jfsa.com                  ********
 ********************************************************************************

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

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

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

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

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

 ********************   S U M M A R Y   O U T P U T   ********************
 ********************************************************************************
 *       DATE: 2015-12-10     TIME: 09:39:38     RUN COUNTER: 002086       *
 ********************************************************************************
 * Input   filename: M:\2012\112117\DATA\CALCUL~1\SWMHYMO\EXISTI~1\KN-PRE.d*
 * Output  filename: M:\2012\112117\DATA\CALCUL~1\SWMHYMO\EXISTI~1\KN-PRE.o*
 * Summary filename: M:\2012\112117\DATA\CALCUL~1\SWMHYMO\EXISTI~1\KN-PRE.s*
 * User comments:                                                         *
 * 1:_____________________________________________________________________*
 * 2:_____________________________________________________________________*
 * 3:_____________________________________________________________________*
 ********************************************************************************


#*******************************************************************************
#  Project Name: [Kanata North]    Project Number: [112117]
#  Date        : 16-09-2015
#  Modeller    : [Kallie Auld]
#  Company     : NOVATECH ENGINEERING CONSULTANTS LTD
#  License #   :  5320763
#*******************************************************************************
#*******************************************************************************
 RUN:COMMAND#
 001:0001--------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   1 ]
 001:0002--------------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  = City of Ottawa:  25mm-4hr Chicago (10 minute time step)
      [SDT=10.00:SDUR=   4.00:PTOT=  25.00]
 001:0003---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:201      115.14     .030 No_date    4:00    1.23 .049
      [CN= 65.0: N= 1.10]
      [Tp=  .98:DT= 5.00]
 001:0004---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 01:201      115.14     .030 No_date    4:00    1.23  n/a
      [RDT= 5.00] out<- 02:211      115.14     .029 No_date    4:40    1.23  n/a
      [L/S/n=  558./ .890/.040]
      {Vmax=  .423:Dmax=  .014}
 001:0005---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       03:202      263.64     .090 No_date    4:10    2.37 .095
      [CN= 70.0: N= 1.10]
      [Tp= 1.47:DT= 5.00]
 001:0006---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            02:211      115.14     .029 No_date    4:40    1.23  n/a
                      +  03:202      263.64     .090 No_date    4:10    2.37  n/a
      [DT= 5.00]  SUM=  01:200a     378.78     .118 No_date    4:25    2.02  n/a
 001:0007---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 01:200a     378.78     .118 No_date    4:25    2.02  n/a
      [RDT= 5.00] out<- 02:212      378.78     .118 No_date    4:30    2.02  n/a
      [L/S/n=  255./ .880/.035]
      {Vmax=  .567:Dmax=  .211}
 001:0008---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 02:212      378.78     .118 No_date    4:30    2.02  n/a
      [RDT= 5.00] out<- 01:213      378.78     .117 No_date    4:55    2.02  n/a
      [L/S/n=  437./ .500/.035]
      {Vmax=  .306:Dmax=  .070}
 001:0009---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:203       46.74     .018 No_date    4:15    3.10 .124
      [CN= 76.0: N= 1.10]
      [Tp= 1.68:DT= 5.00]
 001:0010---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:213      378.78     .117 No_date    4:55    2.02  n/a
                      +  02:203       46.74     .018 No_date    4:15    3.10  n/a
      [DT= 5.00]  SUM=  03:200b     425.52     .136 No_date    4:55    2.14  n/a
 001:0011---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 03:200b     425.52     .136 No_date    4:55    2.14  n/a
      [RDT= 5.00] out<- 01:214      425.52     .135 No_date    5:20    2.14  n/a
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```
     [L/S/n=  543./ .520/.035]
     {Vmax=  .367:Dmax=  .094}
001:0012--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:204       29.39     .020 No_date    4:00    3.10 .124
     [CN= 76.0: N= 1.10]
     [Tp=  .95:DT= 5.00]
001:0013--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       03:205       10.89     .073 No_date    2:20    3.98 .159
     [CN= 78.0: N= 3.00]
     [Tp=  .53:DT= 5.00]
001:0014--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:214      425.52     .135 No_date    5:20    2.14  n/a
                   +   02:204       29.39     .020 No_date    4:00    3.10  n/a
                   +   03:205       10.89     .073 No_date    2:20    3.98  n/a
     [DT= 5.00]  SUM=  10:200      465.80     .160 No_date    4:20    2.25  n/a
001:0015--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:301       86.43     .013 No_date    4:15    1.00 .040
     [CN= 63.0: N= 1.10]
     [Tp= 1.45:DT= 5.00]
001:0016--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:302       80.69     .010 No_date    4:40    1.27 .051
     [CN= 64.0: N= 1.10]
     [Tp= 2.11:DT= 5.00]
001:0017--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:301       86.43     .013 No_date    4:15    1.00  n/a
                   +   02:302       80.69     .010 No_date    4:40    1.27  n/a
     [DT= 5.00]  SUM=  03:300a     167.12     .023 No_date    4:25    1.13  n/a
001:0018--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:300a     167.12     .023 No_date    4:25    1.13  n/a
     [RDT= 5.00] out<- 01:310      167.12     .023 No_date    4:55    1.13  n/a
     [L/S/n=  449./1.620/.040]
     {Vmax=  .430:Dmax=  .013}
001:0019--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:303       65.16     .018 No_date    4:10    1.99 .080
     [CN= 69.0: N= 1.10]
     [Tp= 1.54:DT= 5.00]
001:0020--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:310      167.12     .023 No_date    4:55    1.13  n/a
                   +   02:303       65.16     .018 No_date    4:10    1.99  n/a
     [DT= 5.00]  SUM=  03:300b     232.28     .040 No_date    4:45    1.37  n/a
001:0021--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:300b     232.28     .040 No_date    4:45    1.37  n/a
     [RDT= 5.00] out<- 01:312      232.28     .040 No_date    5:05    1.37  n/a
     [L/S/n=  423./1.170/.035]
     {Vmax=  .421:Dmax=  .016}
001:0022--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:304       18.78     .013 No_date    4:00    3.45 .138
     [CN= 77.0: N= 1.10]
     [Tp= 1.04:DT= 5.00]
001:0023--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:312      232.28     .040 No_date    5:05    1.37  n/a
                   +   02:304       18.78     .013 No_date    4:00    3.45  n/a
     [DT= 5.00]  SUM=  03:300c     251.06     .053 No_date    4:55    1.52  n/a
001:0024--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:300c     251.06     .053 No_date    4:55    1.52  n/a
     [RDT= 5.00] out<- 01:313      251.06     .053 No_date    5:00    1.52  n/a
     [L/S/n=  219./1.280/.035]
     {Vmax=  .645:Dmax=  .051}
001:0025--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:305        2.61     .005 No_date    2:45    3.18 .127
     [CN= 72.0: N= 1.10]
     [Tp=  .22:DT= 5.00]
001:0026--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:313      251.06     .053 No_date    5:00    1.52  n/a
                   +   02:305        2.61     .005 No_date    2:45    3.18  n/a
     [DT= 5.00]  SUM=  09:300      253.67     .056 No_date    4:45    1.54  n/a
001:0027--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:401       16.78     .005 No_date    4:15    2.35 .094
     [CN= 68.0: N= 1.10]
     [Tp= 1.66:DT= 5.00]
001:0028--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:402       10.89     .010 No_date    4:00    3.69 .147
     [CN= 78.0: N= 1.10]
     [Tp=  .85:DT= 5.00]
001:0029--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       03:403        2.37     .004 No_date    2:50    3.31 .132
     [CN= 70.0: N= 1.10]
     [Tp=  .27:DT= 5.00]
001:0030--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:401       16.78     .005 No_date    4:15    2.35  n/a
                   +   02:402       10.89     .010 No_date    4:00    3.69  n/a
                   +   03:403        2.37     .004 No_date    2:50    3.31  n/a
     [DT= 5.00]  SUM=  08:400       30.04     .019 No_date    4:00    2.91  n/a
001:0031--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            10:200      465.80     .160 No_date    4:20    2.25  n/a
                   +   09:300      253.67     .056 No_date    4:45    1.54  n/a
     [DT= 5.00]  SUM=  01:CONFL    719.47     .216 No_date    4:25    2.00  n/a
001:0032--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            10:200      465.80     .160 No_date    4:20    2.25  n/a
                   +   09:300      253.67     .056 No_date    4:45    1.54  n/a
                   +   08:400       30.04     .019 No_date    4:00    2.91  n/a
     [DT= 5.00]  SUM=  07:CONFL    749.51     .234 No_date    4:25    2.03  n/a
001:0033--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:501       62.65     .051 No_date    4:00    2.57 .103
     [CN= 74.0: N= 1.10]
     [Tp=  .60:DT= 5.00]
001:0034--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:502       51.84     .024 No_date    4:00    1.76 .070
     [CN= 68.0: N= 1.10]
     [Tp=  .75:DT= 5.00]
001:0035--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:501       62.65     .051 No_date    4:00    2.57  n/a
                   +   02:502       51.84     .024 No_date    4:00    1.76  n/a
     [DT= 5.00]  SUM=  06:500      114.49     .076 No_date    4:00    2.20  n/a
001:0036--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            07:CONFL    749.51     .234 No_date    4:25    2.03  n/a
                   +   06:500      114.49     .076 No_date    4:00    2.20  n/a
     [DT= 5.00]  SUM=  05:TOTAL    864.00     .308 No_date    4:15    2.06  n/a
  ** END OF RUN :   1

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




 RUN:COMMAND#
 002:0001-------------------------------------------------------------------------
    START
     [TZERO =    .00 hrs on        0]
     [METOUT=   2    (1=imperial, 2=metric output)]
     [NSTORM=   1 ]
     [NRUN  =   2 ]
#*******************************************************************************
```

```
#  Project Name: [Kanata North]    Project Number: [112117]
#  Date        : 16-09-2015
#  Modeller    : [Kallie Auld]
#  Company     : NOVATECH ENGINEERING CONSULTANTS LTD
#  License #   :  5320763
#*******************************************************************************
#*******************************************************************************
 002:0002-------------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  = City of Ottawa:  2yr-4hr Chicago (10 minute time step)
      [SDT=10.00:SDUR=   4.00:PTOT=  33.89]
 002:0003--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:201      115.14     .076 No_date    4:00    3.18 .094
      [CN= 65.0: N= 1.10]
      [Tp=  .98:DT= 5.00]
 002:0004--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 01:201      115.14     .076 No_date    4:00    3.18  n/a
      [RDT= 5.00] out<- 02:211      115.14     .075 No_date    4:30    3.18  n/a
      [L/S/n=  558./ .890/.040]
      {Vmax=  .423:Dmax=  .035}
 002:0005--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       03:202      263.64     .192 No_date    4:05    5.08 .150
      [CN= 70.0: N= 1.10]
      [Tp= 1.47:DT= 5.00]
 002:0006--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            02:211      115.14     .075 No_date    4:30    3.18  n/a
                      +  03:202      263.64     .192 No_date    4:05    5.08  n/a
      [DT= 5.00]  SUM=  01:200a     378.78     .266 No_date    4:20    4.50  n/a
 002:0007--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 01:200a     378.78     .266 No_date    4:20    4.50  n/a
      [RDT= 5.00] out<- 02:212      378.78     .266 No_date    4:25    4.50  n/a
      [L/S/n=  255./ .880/.035]
      {Vmax=  .684:Dmax=  .287}
 002:0008--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 02:212      378.78     .266 No_date    4:25    4.50  n/a
      [RDT= 5.00] out<- 01:213      378.78     .264 No_date    4:45    4.50  n/a
      [L/S/n=  437./ .500/.035]
      {Vmax=  .400:Dmax=  .111}
 002:0009--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:203       46.74     .038 No_date    4:10    6.49 .192
      [CN= 76.0: N= 1.10]
      [Tp= 1.68:DT= 5.00]
 002:0010--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:213      378.78     .264 No_date    4:45    4.50  n/a
                      +  02:203       46.74     .038 No_date    4:10    6.49  n/a
      [DT= 5.00]  SUM=  03:200b     425.52     .302 No_date    4:40    4.72  n/a
 002:0011--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 03:200b     425.52     .302 No_date    4:40    4.72  n/a
      [RDT= 5.00] out<- 01:214      425.52     .301 No_date    5:00    4.72  n/a
      [L/S/n=  543./ .520/.035]
      {Vmax=  .507:Dmax=  .153}
 002:0012--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:204       29.39     .041 No_date    4:00    6.49 .192
      [CN= 76.0: N= 1.10]
      [Tp=  .95:DT= 5.00]
 002:0013--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       03:205       10.89     .141 No_date    2:10    7.82 .231
      [CN= 78.0: N= 3.00]
      [Tp=  .53:DT= 5.00]
 002:0014--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:214      425.52     .301 No_date    5:00    4.72  n/a
                      +  02:204       29.39     .041 No_date    4:00    6.49  n/a
                      +  03:205       10.89     .141 No_date    2:10    7.82  n/a
      [DT= 5.00]  SUM=  10:200      465.80     .360 No_date    4:15    4.90  n/a
 002:0015--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:301       86.43     .034 No_date    4:10    2.73 .081
      [CN= 63.0: N= 1.10]
      [Tp= 1.45:DT= 5.00]
 002:0016--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:302       80.69     .026 No_date    4:35    3.19 .094
      [CN= 64.0: N= 1.10]
      [Tp= 2.11:DT= 5.00]
 002:0017--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:301       86.43     .034 No_date    4:10    2.73  n/a
                      +  02:302       80.69     .026 No_date    4:35    3.19  n/a
      [DT= 5.00]  SUM=  03:300a     167.12     .060 No_date    4:15    2.95  n/a
 002:0018--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 03:300a     167.12     .060 No_date    4:15    2.95  n/a
      [RDT= 5.00] out<- 01:310      167.12     .060 No_date    4:50    2.95  n/a
      [L/S/n=  449./1.620/.040]
      {Vmax=  .430:Dmax=  .033}
 002:0019--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:303       65.16     .040 No_date    4:10    4.49 .132
      [CN= 69.0: N= 1.10]
      [Tp= 1.54:DT= 5.00]
 002:0020--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:310      167.12     .060 No_date    4:50    2.95  n/a
                      +  02:303       65.16     .040 No_date    4:10    4.49  n/a
      [DT= 5.00]  SUM=  03:300b     232.28     .100 No_date    4:40    3.38  n/a
 002:0021--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 03:300b     232.28     .100 No_date    4:40    3.38  n/a
      [RDT= 5.00] out<- 01:312      232.28     .099 No_date    5:00    3.38  n/a
      [L/S/n=  423./1.170/.035]
      {Vmax=  .421:Dmax=  .039}
 002:0022--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:304       18.78     .026 No_date    4:00    7.04 .208
      [CN= 77.0: N= 1.10]
      [Tp= 1.04:DT= 5.00]
 002:0023--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:312      232.28     .099 No_date    5:00    3.38  n/a
                      +  02:304       18.78     .026 No_date    4:00    7.04  n/a
      [DT= 5.00]  SUM=  03:300c     251.06     .124 No_date    4:50    3.66  n/a
 002:0024--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 03:300c     251.06     .124 No_date    4:50    3.66  n/a
      [RDT= 5.00] out<- 01:313      251.06     .124 No_date    4:55    3.66  n/a
      [L/S/n=  219./1.280/.035]
      {Vmax=  .651:Dmax=  .115}
 002:0025--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:305        2.61     .011 No_date    2:35    6.30 .186
      [CN= 72.0: N= 1.10]
      [Tp=  .22:DT= 5.00]
 002:0026--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:313      251.06     .124 No_date    4:55    3.66  n/a
                      +  02:305        2.61     .011 No_date    2:35    6.30  n/a
      [DT= 5.00]  SUM=  09:300      253.67     .131 No_date    4:40    3.68  n/a
 002:0027--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:401       16.78     .011 No_date    4:10    4.94 .146
      [CN= 68.0: N= 1.10]
      [Tp= 1.66:DT= 5.00]
 002:0028--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:402       10.89     .019 No_date    4:00    7.44 .219
      [CN= 78.0: N= 1.10]
      [Tp=  .85:DT= 5.00]
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```
 002:0029---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       03:403        2.37     .008 No_date    2:50    6.33 .187
      [CN= 70.0: N= 1.10]
      [Tp=  .27:DT= 5.00]
 002:0030---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:401       16.78     .011 No_date    4:10    4.94  n/a
                    +   02:402       10.89     .019 No_date    4:00    7.44  n/a
                    +   03:403        2.37     .008 No_date    2:50    6.33  n/a
      [DT= 5.00]  SUM=  08:400       30.04     .037 No_date    4:00    5.95  n/a
 002:0031---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            10:200      465.80     .360 No_date    4:15    4.90  n/a
                    +   09:300      253.67     .131 No_date    4:40    3.68  n/a
      [DT= 5.00]  SUM=  01:CONFL    719.47     .489 No_date    4:20    4.47  n/a
 002:0032---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            10:200      465.80     .360 No_date    4:15    4.90  n/a
                    +   09:300      253.67     .131 No_date    4:40    3.68  n/a
                    +   08:400       30.04     .037 No_date    4:00    5.95  n/a
      [DT= 5.00]  SUM=  07:CONFL    749.51     .525 No_date    4:15    4.53  n/a
 002:0033---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:501       62.65     .111 No_date    4:00    5.63 .166
      [CN= 74.0: N= 1.10]
      [Tp=  .60:DT= 5.00]
 002:0034---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:502       51.84     .056 No_date    4:00    4.10 .121
      [CN= 68.0: N= 1.10]
      [Tp=  .75:DT= 5.00]
 002:0035---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:501       62.65     .111 No_date    4:00    5.63  n/a
                    +   02:502       51.84     .056 No_date    4:00    4.10  n/a
      [DT= 5.00]  SUM=  06:500      114.49     .167 No_date    4:00    4.94  n/a
 002:0036---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            07:CONFL    749.51     .525 No_date    4:15    4.53  n/a
                    +   06:500      114.49     .167 No_date    4:00    4.94  n/a
      [DT= 5.00]  SUM=  05:TOTAL    864.00     .689 No_date    4:10    4.59  n/a
   ** END OF RUN :   2

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




 RUN:COMMAND#
 003:0001---------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   3 ]
#*******************************************************************************
#  Project Name: [Kanata North]    Project Number: [112117]
#  Date        : 16-09-2015
#  Modeller    : [Kallie Auld]
#  Company     : NOVATECH ENGINEERING CONSULTANTS LTD
#  License #   :  5320763
#*******************************************************************************
#*******************************************************************************
 003:0002---------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  = City of Ottawa:  5yr-4hr Chicago (10 minute time step)
      [SDT=10.00:SDUR=   4.00:PTOT=  45.18]
```

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003:0003---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:201      115.14     .161 No_date    4:00    6.69 .148
     [CN= 65.0: N= 1.10]
     [Tp=  .98:DT= 5.00]
003:0004---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 01:201      115.14     .161 No_date    4:00    6.69  n/a
     [RDT= 5.00] out<- 02:211      115.14     .158 No_date    4:30    6.69  n/a
     [L/S/n=  558./ .890/.040]
     {Vmax=  .423:Dmax=  .074}
003:0005---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       03:202      263.64     .363 No_date    4:05    9.60 .212
     [CN= 70.0: N= 1.10]
     [Tp= 1.47:DT= 5.00]
003:0006---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            02:211      115.14     .158 No_date    4:30    6.69  n/a
                   +   03:202      263.64     .363 No_date    4:05    9.60  n/a
     [DT= 5.00]  SUM=  01:200a     378.78     .520 No_date    4:20    8.71  n/a
003:0007---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 01:200a     378.78     .520 No_date    4:20    8.71  n/a
     [RDT= 5.00] out<- 02:212      378.78     .519 No_date    4:25    8.71  n/a
     [L/S/n=  255./ .880/.035]
     {Vmax=  .785:Dmax=  .369}
003:0008---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 02:212      378.78     .519 No_date    4:25    8.71  n/a
     [RDT= 5.00] out<- 01:213      378.78     .518 No_date    4:35    8.71  n/a
     [L/S/n=  437./ .500/.035]
     {Vmax=  .497:Dmax=  .161}
003:0009---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:203       46.74     .071 No_date    4:10   11.99 .265
     [CN= 76.0: N= 1.10]
     [Tp= 1.68:DT= 5.00]
003:0010---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:213      378.78     .518 No_date    4:35    8.71  n/a
                   +   02:203       46.74     .071 No_date    4:10   11.99  n/a
     [DT= 5.00]  SUM=  03:200b     425.52     .588 No_date    4:35    9.07  n/a
003:0011---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:200b     425.52     .588 No_date    4:35    9.07  n/a
     [RDT= 5.00] out<- 01:214      425.52     .587 No_date    4:50    9.07  n/a
     [L/S/n=  543./ .520/.035]
     {Vmax=  .630:Dmax=  .222}
003:0012---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:204       29.39     .076 No_date    4:00   11.99 .265
     [CN= 76.0: N= 1.10]
     [Tp=  .95:DT= 5.00]
003:0013---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       03:205       10.89     .270 No_date    2:15   13.85 .307
     [CN= 78.0: N= 3.00]
     [Tp=  .53:DT= 5.00]
003:0014---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:214      425.52     .587 No_date    4:50    9.07  n/a
                   +   02:204       29.39     .076 No_date    4:00   11.99  n/a
                   +   03:205       10.89     .270 No_date    2:15   13.85  n/a
     [DT= 5.00]  SUM=  10:200      465.80     .700 No_date    4:10    9.37  n/a
003:0015---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:301       86.43     .075 No_date    4:05    5.94 .131
     [CN= 63.0: N= 1.10]
     [Tp= 1.45:DT= 5.00]
003:0016---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:302       80.69     .054 No_date    4:30    6.63 .147
     [CN= 64.0: N= 1.10]
     [Tp= 2.11:DT= 5.00]
003:0017---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
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    ADD HYD            01:301       86.43     .075 No_date    4:05    5.94  n/a
                   +  02:302       80.69     .054 No_date    4:30    6.63  n/a
     [DT= 5.00]  SUM=  03:300a     167.12     .129 No_date    4:15    6.27  n/a
003:0018--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:300a     167.12     .129 No_date    4:15    6.27  n/a
     [RDT= 5.00] out<- 01:310      167.12     .128 No_date    4:45    6.27  n/a
     [L/S/n=  449./1.620/.040]
     {Vmax=  .439:Dmax=  .065}
003:0019--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:303       65.16     .078 No_date    4:05    8.75 .194
     [CN= 69.0: N= 1.10]
     [Tp= 1.54:DT= 5.00]
003:0020--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:310      167.12     .128 No_date    4:45    6.27  n/a
                   +  02:303       65.16     .078 No_date    4:05    8.75  n/a
     [DT= 5.00]  SUM=  03:300b     232.28     .206 No_date    4:35    6.97  n/a
003:0021--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:300b     232.28     .206 No_date    4:35    6.97  n/a
     [RDT= 5.00] out<- 01:312      232.28     .205 No_date    4:50    6.97  n/a
     [L/S/n=  423./1.170/.035]
     {Vmax=  .451:Dmax=  .066}
003:0022--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:304       18.78     .047 No_date    4:00   12.78 .283
     [CN= 77.0: N= 1.10]
     [Tp= 1.04:DT= 5.00]
003:0023--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:312      232.28     .205 No_date    4:50    6.97  n/a
                   +  02:304       18.78     .047 No_date    4:00   12.78  n/a
     [DT= 5.00]  SUM=  03:300c     251.06     .251 No_date    4:40    7.40  n/a
003:0024--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:300c     251.06     .251 No_date    4:40    7.40  n/a
     [RDT= 5.00] out<- 01:313      251.06     .251 No_date    4:45    7.40  n/a
     [L/S/n=  219./1.280/.035]
     {Vmax=  .720:Dmax=  .169}
003:0025--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:305        2.61     .020 No_date    2:35   11.32 .251
     [CN= 72.0: N= 1.10]
     [Tp=  .22:DT= 5.00]
003:0026--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:313      251.06     .251 No_date    4:45    7.40  n/a
                   +  02:305        2.61     .020 No_date    2:35   11.32  n/a
     [DT= 5.00]  SUM=  09:300      253.67     .264 No_date    4:30    7.44  n/a
003:0027--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:401       16.78     .020 No_date    4:10    9.24 .205
     [CN= 68.0: N= 1.10]
     [Tp= 1.66:DT= 5.00]
003:0028--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:402       10.89     .034 No_date    4:00   13.39 .296
     [CN= 78.0: N= 1.10]
     [Tp=  .85:DT= 5.00]
003:0029--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       03:403        2.37     .015 No_date    2:45   11.16 .247
     [CN= 70.0: N= 1.10]
     [Tp=  .27:DT= 5.00]
003:0030--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:401       16.78     .020 No_date    4:10    9.24  n/a
                   +  02:402       10.89     .034 No_date    4:00   13.39  n/a
                   +  03:403        2.37     .015 No_date    2:45   11.16  n/a
     [DT= 5.00]  SUM=  08:400       30.04     .068 No_date    4:00   10.90  n/a
003:0031--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            10:200      465.80     .700 No_date    4:10    9.37  n/a
                   +  09:300      253.67     .264 No_date    4:30    7.44  n/a
     [DT= 5.00]  SUM=  01:CONFL    719.47     .961 No_date    4:15    8.69  n/a
003:0032--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            10:200      465.80     .700 No_date    4:10    9.37  n/a
                   +  09:300      253.67     .264 No_date    4:30    7.44  n/a
                   +  08:400       30.04     .068 No_date    4:00   10.90  n/a
     [DT= 5.00]  SUM=  07:CONFL    749.51    1.028 No_date    4:15    8.78  n/a
003:0033--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:501       62.65     .211 No_date    4:00   10.68 .236
     [CN= 74.0: N= 1.10]
     [Tp=  .60:DT= 5.00]
003:0034--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:502       51.84     .112 No_date    4:00    8.16 .181
     [CN= 68.0: N= 1.10]
     [Tp=  .75:DT= 5.00]
003:0035--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:501       62.65     .211 No_date    4:00   10.68  n/a
                   +  02:502       51.84     .112 No_date    4:00    8.16  n/a
     [DT= 5.00]  SUM=  06:500      114.49     .323 No_date    4:00    9.54  n/a
003:0036--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            07:CONFL    749.51    1.028 No_date    4:15    8.78  n/a
                   +  06:500      114.49     .323 No_date    4:00    9.54  n/a
     [DT= 5.00]  SUM=  05:TOTAL    864.00    1.345 No_date    4:10    8.88  n/a
  ** END OF RUN :   3

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




 RUN:COMMAND#
 004:0001--------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   4 ]
#*******************************************************************************
#  Project Name: [Kanata North]    Project Number: [112117]
#  Date        : 16-09-2015
#  Modeller    : [Kallie Auld]
#  Company     : NOVATECH ENGINEERING CONSULTANTS LTD
#  License #   :  5320763
#*******************************************************************************
#*******************************************************************************
 004:0002--------------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  = City of Ottawa:  100yr-4hr Chicago (10 minute time step)
      [SDT=10.00:SDUR=   4.00:PTOT=  76.02]
 004:0003--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:201      115.14     .497 No_date    4:00   20.74 .273
      [CN= 65.0: N= 1.10]
      [Tp=  .98:DT= 5.00]
 004:0004--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 01:201      115.14     .497 No_date    4:00   20.74  n/a
      [RDT= 5.00] out<- 02:211      115.14     .494 No_date    4:10   20.74  n/a
      [L/S/n=  558./ .890/.040]
      {Vmax=  .535:Dmax=  .145}
 004:0005--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       03:202      263.64     .996 No_date    4:00   26.35 .347
      [CN= 70.0: N= 1.10]
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     [Tp= 1.47:DT= 5.00]
004:0006---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            02:211      115.14     .494 No_date    4:10   20.74  n/a
                     +  03:202      263.64     .996 No_date    4:00   26.35  n/a
     [DT= 5.00]  SUM=  01:200a     378.78    1.489 No_date    4:05   24.64  n/a
004:0007---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 01:200a     378.78    1.489 No_date    4:05   24.64  n/a
     [RDT= 5.00] out<- 02:212      378.78    1.489 No_date    4:10   24.64  n/a
     [L/S/n=  255./ .880/.035]
     {Vmax=  .983:Dmax=  .530}
004:0008---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 02:212      378.78    1.489 No_date    4:10   24.64  n/a
     [RDT= 5.00] out<- 01:213      378.78    1.485 No_date    4:20   24.64  n/a
     [L/S/n=  437./ .500/.035]
     {Vmax=  .673:Dmax=  .277}
004:0009---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:203       46.74     .186 No_date    4:05   31.50 .414
     [CN= 76.0: N= 1.10]
     [Tp= 1.68:DT= 5.00]
004:0010---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:213      378.78    1.485 No_date    4:20   24.64  n/a
                     +  02:203       46.74     .186 No_date    4:05   31.50  n/a
     [DT= 5.00]  SUM=  03:200b     425.52    1.671 No_date    4:20   25.39  n/a
004:0011---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:200b     425.52    1.671 No_date    4:20   25.39  n/a
     [RDT= 5.00] out<- 01:214      425.52    1.669 No_date    4:35   25.39  n/a
     [L/S/n=  543./ .520/.035]
     {Vmax=  .859:Dmax=  .386}
004:0012---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:204       29.39     .198 No_date    4:00   31.50 .414
     [CN= 76.0: N= 1.10]
     [Tp=  .95:DT= 5.00]
004:0013---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       03:205       10.89     .710 No_date    2:15   34.61 .455
     [CN= 78.0: N= 3.00]
     [Tp=  .53:DT= 5.00]
004:0014---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:214      425.52    1.669 No_date    4:35   25.39  n/a
                     +  02:204       29.39     .198 No_date    4:00   31.50  n/a
                     +  03:205       10.89     .710 No_date    2:15   34.61  n/a
     [DT= 5.00]  SUM=  10:200      465.80    1.967 No_date    4:10   26.00  n/a
004:0015---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:301       86.43     .239 No_date    4:05   19.07 .251
     [CN= 63.0: N= 1.10]
     [Tp= 1.45:DT= 5.00]
004:0016---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:302       80.69     .167 No_date    4:25   20.39 .268
     [CN= 64.0: N= 1.10]
     [Tp= 2.11:DT= 5.00]
004:0017---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:301       86.43     .239 No_date    4:05   19.07  n/a
                     +  02:302       80.69     .167 No_date    4:25   20.39  n/a
     [DT= 5.00]  SUM=  03:300a     167.12     .406 No_date    4:10   19.71  n/a
004:0018---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:300a     167.12     .406 No_date    4:10   19.71  n/a
     [RDT= 5.00] out<- 01:310      167.12     .405 No_date    4:25   19.71  n/a
     [L/S/n=  449./1.620/.040]
     {Vmax=  .636:Dmax=  .122}
004:0019---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:303       65.16     .222 No_date    4:05   24.86 .327
     [CN= 69.0: N= 1.10]
     [Tp= 1.54:DT= 5.00]
004:0020---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:310      167.12     .405 No_date    4:25   19.71  n/a
                     +  02:303       65.16     .222 No_date    4:05   24.86  n/a
     [DT= 5.00]  SUM=  03:300b     232.28     .627 No_date    4:15   21.15  n/a
004:0021---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:300b     232.28     .627 No_date    4:15   21.15  n/a
     [RDT= 5.00] out<- 01:312      232.28     .627 No_date    4:35   21.15  n/a
     [L/S/n=  423./1.170/.035]
     {Vmax=  .683:Dmax=  .127}
004:0022---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:304       18.78     .122 No_date    4:00   32.88 .433
     [CN= 77.0: N= 1.10]
     [Tp= 1.04:DT= 5.00]
004:0023---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:312      232.28     .627 No_date    4:35   21.15  n/a
                     +  02:304       18.78     .122 No_date    4:00   32.88  n/a
     [DT= 5.00]  SUM=  03:300c     251.06     .746 No_date    4:20   22.03  n/a
004:0024---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:300c     251.06     .746 No_date    4:20   22.03  n/a
     [RDT= 5.00] out<- 01:313      251.06     .746 No_date    4:30   22.03  n/a
     [L/S/n=  219./1.280/.035]
     {Vmax=  .886:Dmax=  .290}
004:0025---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:305        2.61     .053 No_date    2:30   29.31 .386
     [CN= 72.0: N= 1.10]
     [Tp=  .22:DT= 5.00]
004:0026---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:313      251.06     .746 No_date    4:30   22.03  n/a
                     +  02:305        2.61     .053 No_date    2:30   29.31  n/a
     [DT= 5.00]  SUM=  09:300      253.67     .782 No_date    4:15   22.11  n/a
004:0027---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:401       16.78     .054 No_date    4:05   25.27 .332
     [CN= 68.0: N= 1.10]
     [Tp= 1.66:DT= 5.00]
004:0028---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:402       10.89     .087 No_date    4:00   34.02 .447
     [CN= 78.0: N= 1.10]
     [Tp=  .85:DT= 5.00]
004:0029---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       03:403        2.37     .040 No_date    2:40   28.49 .375
     [CN= 70.0: N= 1.10]
     [Tp=  .27:DT= 5.00]
004:0030---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:401       16.78     .054 No_date    4:05   25.27  n/a
                     +  02:402       10.89     .087 No_date    4:00   34.02  n/a
                     +  03:403        2.37     .040 No_date    2:40   28.49  n/a
     [DT= 5.00]  SUM=  08:400       30.04     .175 No_date    4:00   28.69  n/a
004:0031---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            10:200      465.80    1.967 No_date    4:10   26.00  n/a
                     +  09:300      253.67     .782 No_date    4:15   22.11  n/a
     [DT= 5.00]  SUM=  01:CONFL     719.47    2.748 No_date    4:10   24.62  n/a
004:0032---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            10:200      465.80    1.967 No_date    4:10   26.00  n/a
                     +  09:300      253.67     .782 No_date    4:15   22.11  n/a
                     +  08:400       30.04     .175 No_date    4:00   28.69  n/a
     [DT= 5.00]  SUM=  07:CONFL     749.51    2.921 No_date    4:10   24.79  n/a
004:0033---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:501       62.65     .570 No_date    3:50   29.08 .383
     [CN= 74.0: N= 1.10]
     [Tp=  .60:DT= 5.00]
004:0034---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:502       51.84     .322 No_date    4:00   23.73 .312
```

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      [CN= 68.0: N= 1.10]
      [Tp=  .75:DT= 5.00]
 004:0035--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:501       62.65     .570 No_date    3:50   29.08  n/a
                      +  02:502       51.84     .322 No_date    4:00   23.73  n/a
      [DT= 5.00]  SUM=  06:500      114.49     .892 No_date    4:00   26.66  n/a
 004:0036--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            07:CONFL     749.51    2.921 No_date    4:10   24.79  n/a
                      +  06:500      114.49     .892 No_date    4:00   26.66  n/a
      [DT= 5.00]  SUM=  05:TOTAL    864.00    3.807 No_date    4:00   25.03  n/a
   ** END OF RUN :   4

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




 RUN:COMMAND#
 005:0001--------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   5 ]
#*******************************************************************************
#  Project Name: [Kanata North]    Project Number: [112117]
#  Date        : 16-09-2015
#  Modeller    : [Kallie Auld]
#  Company     : NOVATECH ENGINEERING CONSULTANTS LTD
#  License #   :  5320763
#*******************************************************************************
#*******************************************************************************
 005:0002--------------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  = City of Ottawa: 25mm-12hr SCS (30 minute time step)
      [SDT=30.00:SDUR=  12.00:PTOT=  25.00]
 005:0003--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:201      115.14     .025 No_date   12:00    1.23 .049
      [CN= 65.0: N= 1.10]
      [Tp=  .98:DT= 5.00]
 005:0004--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 01:201      115.14     .025 No_date   12:00    1.23  n/a
      [RDT= 5.00] out<- 02:211      115.14     .025 No_date   12:05    1.23  n/a
      [L/S/n=  558./ .890/.040]
      {Vmax=  .423:Dmax=  .012}
 005:0005--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       03:202      263.64     .081 No_date   12:00    2.37 .095
      [CN= 70.0: N= 1.10]
      [Tp= 1.47:DT= 5.00]
 005:0006--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            02:211      115.14     .025 No_date   12:05    1.23  n/a
                      +  03:202      263.64     .081 No_date   12:00    2.37  n/a
      [DT= 5.00]  SUM=  01:200a     378.78     .106 No_date   12:00    2.03  n/a
 005:0007--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 01:200a     378.78     .106 No_date   12:00    2.03  n/a
      [RDT= 5.00] out<- 02:212      378.78     .106 No_date   12:05    2.03  n/a
      [L/S/n=  255./ .880/.035]
      {Vmax=  .548:Dmax=  .201}
 005:0008--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 02:212      378.78     .106 No_date   12:05    2.03  n/a
      [RDT= 5.00] out<- 01:213      378.78     .106 No_date   12:15    2.03  n/a
      [L/S/n=  437./ .500/.035]
      {Vmax=  .299:Dmax=  .066}
 005:0009--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:203       46.74     .017 No_date   12:00    3.10 .124
      [CN= 76.0: N= 1.10]
      [Tp= 1.68:DT= 5.00]
 005:0010--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:213      378.78     .106 No_date   12:15    2.03  n/a
                      +  02:203       46.74     .017 No_date   12:00    3.10  n/a
      [DT= 5.00]  SUM=  03:200b     425.52     .123 No_date   12:15    2.14  n/a
 005:0011--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 03:200b     425.52     .123 No_date   12:15    2.14  n/a
      [RDT= 5.00] out<- 01:214      425.52     .122 No_date   12:30    2.14  n/a
      [L/S/n=  543./ .520/.035]
      {Vmax=  .356:Dmax=  .089}
 005:0012--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:204       29.39     .016 No_date   11:00    3.10 .124
      [CN= 76.0: N= 1.10]
      [Tp=  .95:DT= 5.00]
 005:0013--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       03:205       10.89     .052 No_date    6:35    3.98 .159
      [CN= 78.0: N= 3.00]
      [Tp=  .53:DT= 5.00]
 005:0014--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:214      425.52     .122 No_date   12:30    2.14  n/a
                      +  02:204       29.39     .016 No_date   11:00    3.10  n/a
                      +  03:205       10.89     .052 No_date    6:35    3.98  n/a
      [DT= 5.00]  SUM=  10:200      465.80     .143 No_date   12:05    2.25  n/a
 005:0015--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:301       86.43     .012 No_date   12:00    1.00 .040
      [CN= 63.0: N= 1.10]
      [Tp= 1.45:DT= 5.00]
 005:0016--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:302       80.69     .010 No_date   12:00    1.27 .051
      [CN= 64.0: N= 1.10]
      [Tp= 2.11:DT= 5.00]
 005:0017--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:301       86.43     .012 No_date   12:00    1.00  n/a
                      +  02:302       80.69     .010 No_date   12:00    1.27  n/a
      [DT= 5.00]  SUM=  03:300a     167.12     .021 No_date   12:00    1.13  n/a
 005:0018--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 03:300a     167.12     .021 No_date   12:00    1.13  n/a
      [RDT= 5.00] out<- 01:310      167.12     .021 No_date   12:20    1.13  n/a
      [L/S/n=  449./1.620/.040]
      {Vmax=  .430:Dmax=  .012}
 005:0019--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:303       65.16     .016 No_date   12:00    1.99 .080
      [CN= 69.0: N= 1.10]
      [Tp= 1.54:DT= 5.00]
 005:0020--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:310      167.12     .021 No_date   12:20    1.13  n/a
                      +  02:303       65.16     .016 No_date   12:00    1.99  n/a
      [DT= 5.00]  SUM=  03:300b     232.28     .038 No_date   12:10    1.37  n/a
 005:0021--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 03:300b     232.28     .038 No_date   12:10    1.37  n/a
      [RDT= 5.00] out<- 01:312      232.28     .037 No_date   12:25    1.37  n/a
      [L/S/n=  423./1.170/.035]
      {Vmax=  .421:Dmax=  .015}
 005:0022--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:304       18.78     .011 No_date   11:00    3.45 .138
      [CN= 77.0: N= 1.10]
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     [Tp= 1.04:DT= 5.00]
005:0023--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:312      232.28     .037 No_date   12:25    1.37  n/a
                   +  02:304       18.78     .011 No_date   11:00    3.45  n/a
     [DT= 5.00]  SUM=  03:300c     251.06     .048 No_date   12:15    1.52  n/a
005:0024--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:300c     251.06     .048 No_date   12:15    1.52  n/a
     [RDT= 5.00] out<- 01:313      251.06     .048 No_date   12:20    1.52  n/a
     [L/S/n=  219./1.280/.035]
     {Vmax=  .645:Dmax=  .046}
005:0025--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:305        2.61     .004 No_date    7:00    3.18 .127
     [CN= 72.0: N= 1.10]
     [Tp=  .22:DT= 5.00]
005:0026--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:313      251.06     .048 No_date   12:20    1.52  n/a
                   +  02:305        2.61     .004 No_date    7:00    3.18  n/a
     [DT= 5.00]  SUM=  09:300      253.67     .050 No_date   12:10    1.54  n/a
005:0027--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:401       16.78     .005 No_date   12:00    2.36 .094
     [CN= 68.0: N= 1.10]
     [Tp= 1.66:DT= 5.00]
005:0028--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:402       10.89     .008 No_date   10:30    3.69 .147
     [CN= 78.0: N= 1.10]
     [Tp=  .85:DT= 5.00]
005:0029--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       03:403        2.37     .003 No_date    7:00    3.31 .132
     [CN= 70.0: N= 1.10]
     [Tp=  .27:DT= 5.00]
005:0030--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:401       16.78     .005 No_date   12:00    2.36  n/a
                   +  02:402       10.89     .008 No_date   10:30    3.69  n/a
                   +  03:403        2.37     .003 No_date    7:00    3.31  n/a
     [DT= 5.00]  SUM=  08:400       30.04     .014 No_date    9:30    2.91  n/a
005:0031--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            10:200      465.80     .143 No_date   12:05    2.25  n/a
                   +  09:300      253.67     .050 No_date   12:10    1.54  n/a
     [DT= 5.00]  SUM=  01:CONFL    719.47     .193 No_date   12:05    2.00  n/a
005:0032--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            10:200      465.80     .143 No_date   12:05    2.25  n/a
                   +  09:300      253.67     .050 No_date   12:10    1.54  n/a
                   +  08:400       30.04     .014 No_date    9:30    2.91  n/a
     [DT= 5.00]  SUM=  07:CONFL    749.51     .207 No_date   12:00    2.03  n/a
005:0033--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:501       62.65     .039 No_date    9:30    2.57 .103
     [CN= 74.0: N= 1.10]
     [Tp=  .60:DT= 5.00]
005:0034--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:502       51.84     .019 No_date   10:40    1.76 .070
     [CN= 68.0: N= 1.10]
     [Tp=  .75:DT= 5.00]
005:0035--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:501       62.65     .039 No_date    9:30    2.57  n/a
                   +  02:502       51.84     .019 No_date   10:40    1.76  n/a
     [DT= 5.00]  SUM=  06:500      114.49     .058 No_date   10:30    2.20  n/a
005:0036--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            07:CONFL    749.51     .207 No_date   12:00    2.03  n/a
                   +  06:500      114.49     .058 No_date   10:30    2.20  n/a
     [DT= 5.00]  SUM=  05:TOTAL    864.00     .262 No_date   12:00    2.06  n/a
 ** END OF RUN :   5
```

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



 RUN:COMMAND#
 006:0001--------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   6 ]
#*******************************************************************************
#  Project Name: [Kanata North]    Project Number: [112117]
#  Date        : 16-09-2015
#  Modeller    : [Kallie Auld]
#  Company     : NOVATECH ENGINEERING CONSULTANTS LTD
#  License #   :  5320763
#*******************************************************************************
#*******************************************************************************
 006:0002--------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  = City of Ottawa:  2yr-12hr SCS Type II (30 min time step)
      [SDT=30.00:SDUR=  12.00:PTOT=  42.34]
 006:0003--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:201      115.14     .114 No_date   10:55    5.71 .135
      [CN= 65.0: N= 1.10]
      [Tp=  .98:DT= 5.00]
 006:0004--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 01:201      115.14     .114 No_date   10:55    5.71  n/a
      [RDT= 5.00] out<- 02:211      115.14     .114 No_date   11:20    5.71  n/a
      [L/S/n=  558./ .890/.040]
      {Vmax=  .423:Dmax=  .052}
 006:0005--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       03:202      263.64     .283 No_date   12:00    8.36 .197
      [CN= 70.0: N= 1.10]
      [Tp= 1.47:DT= 5.00]
 006:0006--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            02:211      115.14     .114 No_date   11:20    5.71  n/a
                    +  03:202      263.64     .283 No_date   12:00    8.36  n/a
      [DT= 5.00]  SUM=  01:200a     378.78     .396 No_date   12:00    7.55  n/a
 006:0007--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 01:200a     378.78     .396 No_date   12:00    7.55  n/a
      [RDT= 5.00] out<- 02:212      378.78     .397 No_date   12:00    7.55  n/a
      [L/S/n=  255./ .880/.035]
      {Vmax=  .743:Dmax=  .332}
 006:0008--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 02:212      378.78     .397 No_date   12:00    7.55  n/a
      [RDT= 5.00] out<- 01:213      378.78     .396 No_date   12:05    7.55  n/a
      [L/S/n=  437./ .500/.035]
      {Vmax=  .455:Dmax=  .139}
 006:0009--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:203       46.74     .057 No_date   12:00   10.50 .248
      [CN= 76.0: N= 1.10]
      [Tp= 1.68:DT= 5.00]
 006:0010--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:213      378.78     .396 No_date   12:05    7.55  n/a
                    +  02:203       46.74     .057 No_date   12:00   10.50  n/a
      [DT= 5.00]  SUM=  03:200b     425.52     .453 No_date   12:00    7.88  n/a
 006:0011--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
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    ROUTE CHANNEL   -> 03:200b     425.52     .453 No_date   12:00    7.88  n/a
     [RDT= 5.00] out<- 01:214      425.52     .452 No_date   12:05    7.88  n/a
     [L/S/n=  543./ .520/.035]
     {Vmax=  .580:Dmax=  .192}
006:0012--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:204       29.39     .055 No_date   10:30   10.50 .248
     [CN= 76.0: N= 1.10]
     [Tp=  .95:DT= 5.00]
006:0013--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       03:205       10.89     .176 No_date    6:30   12.23 .289
     [CN= 78.0: N= 3.00]
     [Tp=  .53:DT= 5.00]
006:0014--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:214      425.52     .452 No_date   12:05    7.88  n/a
                     +  02:204       29.39     .055 No_date   10:30   10.50  n/a
                     +  03:205       10.89     .176 No_date    6:30   12.23  n/a
     [DT= 5.00]  SUM=  10:200      465.80     .522 No_date   11:25    8.14  n/a
006:0015--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:301       86.43     .057 No_date   12:00    5.03 .119
     [CN= 63.0: N= 1.10]
     [Tp= 1.45:DT= 5.00]
006:0016--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:302       80.69     .044 No_date   12:00    5.67 .134
     [CN= 64.0: N= 1.10]
     [Tp= 2.11:DT= 5.00]
006:0017--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:301       86.43     .057 No_date   12:00    5.03  n/a
                     +  02:302       80.69     .044 No_date   12:00    5.67  n/a
     [DT= 5.00]  SUM=  03:300a     167.12     .101 No_date   12:00    5.34  n/a
006:0018--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:300a     167.12     .101 No_date   12:00    5.34  n/a
     [RDT= 5.00] out<- 01:310      167.12     .101 No_date   12:10    5.34  n/a
     [L/S/n=  449./1.620/.040]
     {Vmax=  .430:Dmax=  .056}
006:0019--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:303       65.16     .061 No_date   12:00    7.58 .179
     [CN= 69.0: N= 1.10]
     [Tp= 1.54:DT= 5.00]
006:0020--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:310      167.12     .101 No_date   12:10    5.34  n/a
                     +  02:303       65.16     .061 No_date   12:00    7.58  n/a
     [DT= 5.00]  SUM=  03:300b     232.28     .162 No_date   12:00    5.97  n/a
006:0021--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:300b     232.28     .162 No_date   12:00    5.97  n/a
     [RDT= 5.00] out<- 01:312      232.28     .161 No_date   12:15    5.97  n/a
     [L/S/n=  423./1.170/.035]
     {Vmax=  .430:Dmax=  .058}
006:0022--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:304       18.78     .035 No_date   10:30   11.23 .265
     [CN= 77.0: N= 1.10]
     [Tp= 1.04:DT= 5.00]
006:0023--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:312      232.28     .161 No_date   12:15    5.97  n/a
                     +  02:304       18.78     .035 No_date   10:30   11.23  n/a
     [DT= 5.00]  SUM=  03:300c     251.06     .195 No_date   12:05    6.36  n/a
006:0024--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:300c     251.06     .195 No_date   12:05    6.36  n/a
     [RDT= 5.00] out<- 01:313      251.06     .195 No_date   12:10    6.36  n/a
     [L/S/n=  219./1.280/.035]
     {Vmax=  .688:Dmax=  .145}
006:0025--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:305        2.61     .013 No_date    6:45    9.96 .235
     [CN= 72.0: N= 1.10]
     [Tp=  .22:DT= 5.00]
006:0026--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:313      251.06     .195 No_date   12:10    6.36  n/a
                     +  02:305        2.61     .013 No_date    6:45    9.96  n/a
     [DT= 5.00]  SUM=  09:300      253.67     .200 No_date   12:00    6.40  n/a
006:0027--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:401       16.78     .016 No_date   12:00    8.06 .190
     [CN= 68.0: N= 1.10]
     [Tp= 1.66:DT= 5.00]
006:0028--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:402       10.89     .025 No_date    9:25   11.78 .278
     [CN= 78.0: N= 1.10]
     [Tp=  .85:DT= 5.00]
006:0029--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       03:403        2.37     .011 No_date    7:00    9.85 .233
     [CN= 70.0: N= 1.10]
     [Tp=  .27:DT= 5.00]
006:0030--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:401       16.78     .016 No_date   12:00    8.06  n/a
                     +  02:402       10.89     .025 No_date    9:25   11.78  n/a
                     +  03:403        2.37     .011 No_date    7:00    9.85  n/a
     [DT= 5.00]  SUM=  08:400       30.04     .048 No_date    9:00    9.55  n/a
006:0031--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            10:200      465.80     .522 No_date   11:25    8.14  n/a
                     +  09:300      253.67     .200 No_date   12:00    6.40  n/a
     [DT= 5.00]  SUM=  01:CONFL     719.47     .721 No_date   12:00    7.53  n/a
006:0032--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            10:200      465.80     .522 No_date   11:25    8.14  n/a
                     +  09:300      253.67     .200 No_date   12:00    6.40  n/a
                     +  08:400       30.04     .048 No_date    9:00    9.55  n/a
     [DT= 5.00]  SUM=  07:CONFL     749.51     .766 No_date   11:25    7.61  n/a
006:0033--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:501       62.65     .144 No_date    9:00    9.30 .220
     [CN= 74.0: N= 1.10]
     [Tp=  .60:DT= 5.00]
006:0034--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:502       51.84     .076 No_date    9:30    7.04 .166
     [CN= 68.0: N= 1.10]
     [Tp=  .75:DT= 5.00]
006:0035--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:501       62.65     .144 No_date    9:00    9.30  n/a
                     +  02:502       51.84     .076 No_date    9:30    7.04  n/a
     [DT= 5.00]  SUM=  06:500      114.49     .220 No_date    9:00    8.28  n/a
006:0036--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            07:CONFL     749.51     .766 No_date   11:25    7.61  n/a
                     +  06:500      114.49     .220 No_date    9:00    8.28  n/a
     [DT= 5.00]  SUM=  05:TOTAL    864.00     .973 No_date   10:55    7.70  n/a
 ** END OF RUN :   6

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



 RUN:COMMAND#
 007:0001--------------------------------------------------------------------
    START
     [TZERO =    .00 hrs on        0]
     [METOUT=   2    (1=imperial, 2=metric output)]
     [NSTORM=   1 ]
```

```
      [NRUN  =   7 ]
#*******************************************************************************
#  Project Name: [Kanata North]    Project Number: [112117]
#  Date        : 16-09-2015
#  Modeller    : [Kallie Auld]
#  Company     : NOVATECH ENGINEERING CONSULTANTS LTD
#  License #   :  5320763
#*******************************************************************************
#*******************************************************************************
 007:0002-------------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  = City of Ottawa:  5yr-12hr SCS Type II (30 min time step)
      [SDT=30.00:SDUR=  12.00:PTOT=  56.18]
 007:0003--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:201      115.14     .221 No_date   10:30   11.05 .197
      [CN= 65.0: N= 1.10]
      [Tp=  .98:DT= 5.00]
 007:0004--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 01:201      115.14     .221 No_date   10:30   11.05  n/a
      [RDT= 5.00] out<- 02:211      115.14     .220 No_date   10:55   11.05  n/a
      [L/S/n=  558./ .890/.040]
      {Vmax=  .431:Dmax=  .094}
 007:0005--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       03:202      263.64     .504 No_date   12:00   14.94 .266
      [CN= 70.0: N= 1.10]
      [Tp= 1.47:DT= 5.00]
 007:0006--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            02:211      115.14     .220 No_date   10:55   11.05  n/a
                      + 03:202      263.64     .504 No_date   12:00   14.94  n/a
      [DT= 5.00]  SUM=  01:200a     378.78     .722 No_date   11:15   13.75  n/a
 007:0007--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 01:200a     378.78     .722 No_date   11:15   13.75  n/a
      [RDT= 5.00] out<- 02:212      378.78     .722 No_date   11:20   13.75  n/a
      [L/S/n=  255./ .880/.035]
      {Vmax=  .836:Dmax=  .413}
 007:0008--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 02:212      378.78     .722 No_date   11:20   13.75  n/a
      [RDT= 5.00] out<- 01:213      378.78     .722 No_date   11:35   13.75  n/a
      [L/S/n=  437./ .500/.035]
      {Vmax=  .548:Dmax=  .192}
 007:0009--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:203       46.74     .099 No_date   12:00   18.32 .326
      [CN= 76.0: N= 1.10]
      [Tp= 1.68:DT= 5.00]
 007:0010--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:213      378.78     .722 No_date   11:35   13.75  n/a
                      + 02:203       46.74     .099 No_date   12:00   18.32  n/a
      [DT= 5.00]  SUM=  03:200b     425.52     .821 No_date   11:40   14.26  n/a
 007:0011--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 03:200b     425.52     .821 No_date   11:40   14.26  n/a
      [RDT= 5.00] out<- 01:214      425.52     .821 No_date   11:50   14.26  n/a
      [L/S/n=  543./ .520/.035]
      {Vmax=  .701:Dmax=  .267}
 007:0012--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:204       29.39     .096 No_date    9:30   18.32 .326
      [CN= 76.0: N= 1.10]
      [Tp=  .95:DT= 5.00]
 007:0013--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       03:205       10.89     .304 No_date    6:30   20.67 .368
      [CN= 78.0: N= 3.00]
      [Tp=  .53:DT= 5.00]
 007:0014--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:214      425.52     .821 No_date   11:50   14.26  n/a
                      + 02:204       29.39     .096 No_date    9:30   18.32  n/a
                      + 03:205       10.89     .304 No_date    6:30   20.67  n/a
      [DT= 5.00]  SUM=  10:200      465.80     .943 No_date   10:55   14.66  n/a
 007:0015--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:301       86.43     .112 No_date   12:00    9.97 .178
      [CN= 63.0: N= 1.10]
      [Tp= 1.45:DT= 5.00]
 007:0016--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:302       80.69     .085 No_date   12:00   10.90 .194
      [CN= 64.0: N= 1.10]
      [Tp= 2.11:DT= 5.00]
 007:0017--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:301       86.43     .112 No_date   12:00    9.97  n/a
                      + 02:302       80.69     .085 No_date   12:00   10.90  n/a
      [DT= 5.00]  SUM=  03:300a     167.12     .197 No_date   12:00   10.42  n/a
 007:0018--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 03:300a     167.12     .197 No_date   12:00   10.42  n/a
      [RDT= 5.00] out<- 01:310      167.12     .196 No_date   12:05   10.42  n/a
      [L/S/n=  449./1.620/.040]
      {Vmax=  .475:Dmax=  .079}
 007:0019--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:303       65.16     .112 No_date   12:00   13.85 .247
      [CN= 69.0: N= 1.10]
      [Tp= 1.54:DT= 5.00]
 007:0020--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:310      167.12     .196 No_date   12:05   10.42  n/a
                      + 02:303       65.16     .112 No_date   12:00   13.85  n/a
      [DT= 5.00]  SUM=  03:300b     232.28     .308 No_date   12:00   11.38  n/a
 007:0021--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 03:300b     232.28     .308 No_date   12:00   11.38  n/a
      [RDT= 5.00] out<- 01:312      232.28     .308 No_date   12:05   11.38  n/a
      [L/S/n=  423./1.170/.035]
      {Vmax=  .508:Dmax=  .083}
 007:0022--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:304       18.78     .060 No_date   10:30   19.34 .344
      [CN= 77.0: N= 1.10]
      [Tp= 1.04:DT= 5.00]
 007:0023--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:312      232.28     .308 No_date   12:05   11.38  n/a
                      + 02:304       18.78     .060 No_date   10:30   19.34  n/a
      [DT= 5.00]  SUM=  03:300c     251.06     .366 No_date   12:00   11.98  n/a
 007:0024--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 03:300c     251.06     .366 No_date   12:00   11.98  n/a
      [RDT= 5.00] out<- 01:313      251.06     .366 No_date   12:00   11.98  n/a
      [L/S/n=  219./1.280/.035]
      {Vmax=  .798:Dmax=  .218}
 007:0025--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:305        2.61     .024 No_date    6:35   17.13 .305
      [CN= 72.0: N= 1.10]
      [Tp=  .22:DT= 5.00]
 007:0026--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:313      251.06     .366 No_date   12:00   11.98  n/a
                      + 02:305        2.61     .024 No_date    6:35   17.13  n/a
      [DT= 5.00]  SUM=  09:300      253.67     .375 No_date   12:00   12.03  n/a
 007:0027--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:401       16.78     .028 No_date   12:00   14.34 .255
      [CN= 68.0: N= 1.10]
      [Tp= 1.66:DT= 5.00]
 007:0028--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:402       10.89     .043 No_date    9:00   20.15 .359
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      [CN= 78.0: N= 1.10]
      [Tp=  .85:DT= 5.00]
 007:0029--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       03:403        2.37     .018 No_date    7:00   16.74 .298
      [CN= 70.0: N= 1.10]
      [Tp=  .27:DT= 5.00]
 007:0030--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:401       16.78     .028 No_date   12:00   14.34  n/a
                    +   02:402       10.89     .043 No_date    9:00   20.15  n/a
                    +   03:403        2.37     .018 No_date    7:00   16.74  n/a
      [DT= 5.00]  SUM=  08:400       30.04     .083 No_date    9:00   16.63  n/a
 007:0031--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            10:200      465.80     .943 No_date   10:55   14.66  n/a
                    +   09:300      253.67     .375 No_date   12:00   12.03  n/a
      [DT= 5.00]  SUM=  01:CONFL    719.47    1.315 No_date   10:55   13.73  n/a
 007:0032--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            10:200      465.80     .943 No_date   10:55   14.66  n/a
                    +   09:300      253.67     .375 No_date   12:00   12.03  n/a
                    +   08:400       30.04     .083 No_date    9:00   16.63  n/a
      [DT= 5.00]  SUM=  07:CONFL    749.51    1.394 No_date   10:55   13.85  n/a
 007:0033--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:501       62.65     .259 No_date    9:00   16.60 .296
      [CN= 74.0: N= 1.10]
      [Tp=  .60:DT= 5.00]
 007:0034--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:502       51.84     .143 No_date    9:00   13.06 .233
      [CN= 68.0: N= 1.10]
      [Tp=  .75:DT= 5.00]
 007:0035--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:501       62.65     .259 No_date    9:00   16.60  n/a
                    +   02:502       51.84     .143 No_date    9:00   13.06  n/a
      [DT= 5.00]  SUM=  06:500      114.49     .402 No_date    9:00   15.00  n/a
 007:0036--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            07:CONFL    749.51    1.394 No_date   10:55   13.85  n/a
                    +   06:500      114.49     .402 No_date    9:00   15.00  n/a
      [DT= 5.00]  SUM=  05:TOTAL    864.00    1.771 No_date   10:50   14.00  n/a
  ** END OF RUN :   7

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




 RUN:COMMAND#
 008:0001--------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   8 ]
#*******************************************************************************
#  Project Name: [Kanata North]    Project Number: [112117]
#  Date        : 16-09-2015
#  Modeller    : [Kallie Auld]
#  Company     : NOVATECH ENGINEERING CONSULTANTS LTD
#  License #   :  5320763
#*******************************************************************************
#*******************************************************************************
 008:0002--------------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  = City of Ottawa:  100yr-12hr SCS Type II (10 min time step)
      [SDT=10.00:SDUR=  12.00:PTOT=  93.91]
008:0003--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:201      115.14     .620 No_date    9:30   31.04 .331
     [CN= 65.0: N= 1.10]
     [Tp=  .98:DT= 5.00]
008:0004--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 01:201      115.14     .620 No_date    9:30   31.04  n/a
     [RDT= 5.00] out<- 02:211      115.14     .620 No_date    9:35   31.04  n/a
     [L/S/n=  558./ .890/.040]
     {Vmax=  .600:Dmax=  .168}
008:0005--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       03:202      263.64    1.280 No_date   11:00   38.10 .406
     [CN= 70.0: N= 1.10]
     [Tp= 1.47:DT= 5.00]
008:0006--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            02:211      115.14     .620 No_date    9:35   31.04  n/a
                   +   03:202      263.64    1.280 No_date   11:00   38.10  n/a
     [DT= 5.00]  SUM=  01:200a     378.78    1.897 No_date   10:40   35.95  n/a
008:0007--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 01:200a     378.78    1.897 No_date   10:40   35.95  n/a
     [RDT= 5.00] out<- 02:212      378.78    1.897 No_date   10:45   35.95  n/a
     [L/S/n=  255./ .880/.035]
     {Vmax= 1.034:Dmax=  .572}
008:0008--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 02:212      378.78    1.897 No_date   10:45   35.95  n/a
     [RDT= 5.00] out<- 01:213      378.78    1.897 No_date   10:55   35.95  n/a
     [L/S/n=  437./ .500/.035]
     {Vmax=  .726:Dmax=  .311}
008:0009--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:203       46.74     .240 No_date   11:40   44.73 .476
     [CN= 76.0: N= 1.10]
     [Tp= 1.68:DT= 5.00]
008:0010--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:213      378.78    1.897 No_date   10:55   35.95  n/a
                   +   02:203       46.74     .240 No_date   11:40   44.73  n/a
     [DT= 5.00]  SUM=  03:200b     425.52    2.136 No_date   11:00   36.92  n/a
008:0011--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:200b     425.52    2.136 No_date   11:00   36.92  n/a
     [RDT= 5.00] out<- 01:214      425.52    2.135 No_date   11:05   36.92  n/a
     [L/S/n=  543./ .520/.035]
     {Vmax=  .920:Dmax=  .437}
008:0012--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:204       29.39     .236 No_date    9:05   44.73 .476
     [CN= 76.0: N= 1.10]
     [Tp=  .95:DT= 5.00]
008:0013--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       03:205       10.89     .739 No_date    6:25   48.43 .516
     [CN= 78.0: N= 3.00]
     [Tp=  .53:DT= 5.00]
008:0014--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:214      425.52    2.135 No_date   11:05   36.92  n/a
                   +   02:204       29.39     .236 No_date    9:05   44.73  n/a
                   +   03:205       10.89     .739 No_date    6:25   48.43  n/a
     [DT= 5.00]  SUM=  10:200      465.80    2.430 No_date   10:45   37.68  n/a
008:0015--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:301       86.43     .322 No_date   11:35   28.86 .307
     [CN= 63.0: N= 1.10]
     [Tp= 1.45:DT= 5.00]
008:0016--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:302       80.69     .236 No_date   12:00   30.50 .325
     [CN= 64.0: N= 1.10]
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     [Tp= 2.11:DT= 5.00]
008:0017--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:301       86.43     .322 No_date   11:35   28.86  n/a
                   +  02:302       80.69     .236 No_date   12:00   30.50  n/a
     [DT= 5.00]  SUM=  03:300a     167.12     .557 No_date   12:00   29.65  n/a
008:0018--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:300a     167.12     .557 No_date   12:00   29.65  n/a
     [RDT= 5.00] out<- 01:310      167.12     .557 No_date   12:05   29.65  n/a
     [L/S/n=  449./1.620/.040]
     {Vmax=  .682:Dmax=  .140}
008:0019--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:303       65.16     .291 No_date   11:20   36.29 .386
     [CN= 69.0: N= 1.10]
     [Tp= 1.54:DT= 5.00]
008:0020--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:310      167.12     .557 No_date   12:05   29.65  n/a
                   +  02:303       65.16     .291 No_date   11:20   36.29  n/a
     [DT= 5.00]  SUM=  03:300b     232.28     .848 No_date   12:00   31.51  n/a
008:0021--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:300b     232.28     .848 No_date   12:00   31.51  n/a
     [RDT= 5.00] out<- 01:312      232.28     .847 No_date   12:05   31.51  n/a
     [L/S/n=  423./1.170/.035]
     {Vmax=  .758:Dmax=  .152}
008:0022--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:304       18.78     .146 No_date    9:20   46.40 .494
     [CN= 77.0: N= 1.10]
     [Tp= 1.04:DT= 5.00]
008:0023--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:312      232.28     .847 No_date   12:05   31.51  n/a
                   +  02:304       18.78     .146 No_date    9:20   46.40  n/a
     [DT= 5.00]  SUM=  03:300c     251.06     .986 No_date   11:05   32.63  n/a
008:0024--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:300c     251.06     .986 No_date   11:05   32.63  n/a
     [RDT= 5.00] out<- 01:313      251.06     .986 No_date   11:40   32.63  n/a
     [L/S/n=  219./1.280/.035]
     {Vmax=  .945:Dmax=  .333}
008:0025--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:305        2.61     .060 No_date    6:30   41.68 .444
     [CN= 72.0: N= 1.10]
     [Tp=  .22:DT= 5.00]
008:0026--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:313      251.06     .986 No_date   11:40   32.63  n/a
                   +  02:305        2.61     .060 No_date    6:30   41.68  n/a
     [DT= 5.00]  SUM=  09:300      253.67    1.010 No_date   11:10   32.72  n/a
008:0027--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:401       16.78     .071 No_date   12:00   36.59 .390
     [CN= 68.0: N= 1.10]
     [Tp= 1.66:DT= 5.00]
008:0028--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:402       10.89     .102 No_date    9:00   47.79 .509
     [CN= 78.0: N= 1.10]
     [Tp=  .85:DT= 5.00]
008:0029--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       03:403        2.37     .045 No_date    6:45   40.46 .431
     [CN= 70.0: N= 1.10]
     [Tp=  .27:DT= 5.00]
008:0030--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:401       16.78     .071 No_date   12:00   36.59  n/a
                   +  02:402       10.89     .102 No_date    9:00   47.79  n/a
                   +  03:403        2.37     .045 No_date    6:45   40.46  n/a
     [DT= 5.00]  SUM=  08:400       30.04     .204 No_date    9:00   40.95  n/a
008:0031--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            10:200      465.80    2.430 No_date   10:45   37.68  n/a
                   +  09:300      253.67    1.010 No_date   11:10   32.72  n/a
     [DT= 5.00]  SUM=  01:CONFL    719.47    3.438 No_date   10:50   35.93  n/a
008:0032--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            10:200      465.80    2.430 No_date   10:45   37.68  n/a
                   +  09:300      253.67    1.010 No_date   11:10   32.72  n/a
                   +  08:400       30.04     .204 No_date    9:00   40.95  n/a
     [DT= 5.00]  SUM=  07:CONFL    749.51    3.631 No_date   10:45   36.13  n/a
008:0033--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:501       62.65     .665 No_date    8:00   41.76 .445
     [CN= 74.0: N= 1.10]
     [Tp=  .60:DT= 5.00]
008:0034--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:502       51.84     .387 No_date    9:00   34.87 .371
     [CN= 68.0: N= 1.10]
     [Tp=  .75:DT= 5.00]
008:0035--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:501       62.65     .665 No_date    8:00   41.76  n/a
                   +  02:502       51.84     .387 No_date    9:00   34.87  n/a
     [DT= 5.00]  SUM=  06:500      114.49    1.045 No_date    8:20   38.64  n/a
008:0036--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            07:CONFL    749.51    3.631 No_date   10:45   36.13  n/a
                   +  06:500      114.49    1.045 No_date    8:20   38.64  n/a
     [DT= 5.00]  SUM=  05:TOTAL    864.00    4.630 No_date    9:25   36.46  n/a
  ** END OF RUN :   8

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




 RUN:COMMAND#
 009:0001--------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =   9 ]
#*******************************************************************************
#  Project Name: [Kanata North]    Project Number: [112117]
#  Date        : 16-09-2015
#  Modeller    : [Kallie Auld]
#  Company     : NOVATECH ENGINEERING CONSULTANTS LTD
#  License #   :  5320763
#*******************************************************************************
#*******************************************************************************
 009:0002--------------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  = City of Ottawa: 25mm-24hr SCS (60 minute time step)
      [SDT=60.00:SDUR=  24.00:PTOT=  25.05]
 009:0003--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:201      115.14     .019 No_date   21:00    1.24 .049
      [CN= 65.0: N= 1.10]
      [Tp=  .98:DT= 5.00]
 009:0004--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 01:201      115.14     .019 No_date   21:00    1.24  n/a
      [RDT= 5.00] out<- 02:211      115.14     .019 No_date   21:20    1.24  n/a
      [L/S/n=  558./ .890/.040]
      {Vmax=  .423:Dmax=  .009}
 009:0005--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
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    CALIB NASHYD       03:202      263.64     .067 No_date   21:00    2.39 .095
     [CN= 70.0: N= 1.10]
     [Tp= 1.47:DT= 5.00]
009:0006--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            02:211      115.14     .019 No_date   21:20    1.24  n/a
                     +  03:202      263.64     .067 No_date   21:00    2.39  n/a
     [DT= 5.00]  SUM=  01:200a     378.78     .086 No_date   21:00    2.04  n/a
009:0007--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 01:200a     378.78     .086 No_date   21:00    2.04  n/a
     [RDT= 5.00] out<- 02:212      378.78     .086 No_date   21:15    2.04  n/a
     [L/S/n=  255./ .880/.035]
     {Vmax=  .519:Dmax=  .184}
009:0008--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 02:212      378.78     .086 No_date   21:15    2.04  n/a
     [RDT= 5.00] out<- 01:213      378.78     .086 No_date   21:25    2.04  n/a
     [L/S/n=  437./ .500/.035]
     {Vmax=  .267:Dmax=  .058}
009:0009--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:203       46.74     .014 No_date   21:05    3.12 .124
     [CN= 76.0: N= 1.10]
     [Tp= 1.68:DT= 5.00]
009:0010--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:213      378.78     .086 No_date   21:25    2.04  n/a
                     +  02:203       46.74     .014 No_date   21:05    3.12  n/a
     [DT= 5.00]  SUM=  03:200b     425.52     .100 No_date   21:25    2.16  n/a
009:0011--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:200b     425.52     .100 No_date   21:25    2.16  n/a
     [RDT= 5.00] out<- 01:214      425.52     .100 No_date   21:50    2.16  n/a
     [L/S/n=  543./ .520/.035]
     {Vmax=  .339:Dmax=  .080}
009:0012--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:204       29.39     .013 No_date   18:00    3.12 .124
     [CN= 76.0: N= 1.10]
     [Tp=  .95:DT= 5.00]
009:0013--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       03:205       10.89     .039 No_date   12:20    4.00 .160
     [CN= 78.0: N= 3.00]
     [Tp=  .53:DT= 5.00]
009:0014--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:214      425.52     .100 No_date   21:50    2.16  n/a
                     +  02:204       29.39     .013 No_date   18:00    3.12  n/a
                     +  03:205       10.89     .039 No_date   12:20    4.00  n/a
     [DT= 5.00]  SUM=  10:200      465.80     .117 No_date   21:10    2.26  n/a
009:0015--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:301       86.43     .010 No_date   24:00    1.00 .040
     [CN= 63.0: N= 1.10]
     [Tp= 1.45:DT= 5.00]
009:0016--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:302       80.69     .009 No_date   24:00    1.28 .051
     [CN= 64.0: N= 1.10]
     [Tp= 2.11:DT= 5.00]
009:0017--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:301       86.43     .010 No_date   24:00    1.00  n/a
                     +  02:302       80.69     .009 No_date   24:00    1.28  n/a
     [DT= 5.00]  SUM=  03:300a     167.12     .018 No_date   24:00    1.13  n/a
009:0018--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:300a     167.12     .018 No_date   24:00    1.13  n/a
     [RDT= 5.00] out<- 01:310      167.12     .018 No_date   24:05    1.13  n/a
     [L/S/n=  449./1.620/.040]
     {Vmax=  .430:Dmax=  .010}
009:0019--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:303       65.16     .014 No_date   21:15    2.00 .080
     [CN= 69.0: N= 1.10]
     [Tp= 1.54:DT= 5.00]
009:0020--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:310      167.12     .018 No_date   24:05    1.13  n/a
                     +  02:303       65.16     .014 No_date   21:15    2.00  n/a
     [DT= 5.00]  SUM=  03:300b     232.28     .032 No_date   23:30    1.38  n/a
009:0021--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:300b     232.28     .032 No_date   23:30    1.38  n/a
     [RDT= 5.00] out<- 01:312      232.28     .032 No_date   23:55    1.38  n/a
     [L/S/n=  423./1.170/.035]
     {Vmax=  .421:Dmax=  .012}
009:0022--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:304       18.78     .009 No_date   18:00    3.47 .138
     [CN= 77.0: N= 1.10]
     [Tp= 1.04:DT= 5.00]
009:0023--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:312      232.28     .032 No_date   23:55    1.38  n/a
                     +  02:304       18.78     .009 No_date   18:00    3.47  n/a
     [DT= 5.00]  SUM=  03:300c     251.06     .040 No_date   22:05    1.53  n/a
009:0024--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:300c     251.06     .040 No_date   22:05    1.53  n/a
     [RDT= 5.00] out<- 01:313      251.06     .040 No_date   22:10    1.53  n/a
     [L/S/n=  219./1.280/.035]
     {Vmax=  .645:Dmax=  .038}
009:0025--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:305        2.61     .003 No_date   13:00    3.20 .128
     [CN= 72.0: N= 1.10]
     [Tp=  .22:DT= 5.00]
009:0026--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:313      251.06     .040 No_date   22:10    1.53  n/a
                     +  02:305        2.61     .003 No_date   13:00    3.20  n/a
     [DT= 5.00]  SUM=  09:300      253.67     .040 No_date   21:55    1.55  n/a
009:0027--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:401       16.78     .004 No_date   21:00    2.37 .095
     [CN= 68.0: N= 1.10]
     [Tp= 1.66:DT= 5.00]
009:0028--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:402       10.89     .006 No_date   16:15    3.70 .148
     [CN= 78.0: N= 1.10]
     [Tp=  .85:DT= 5.00]
009:0029--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       03:403        2.37     .003 No_date   13:00    3.32 .133
     [CN= 70.0: N= 1.10]
     [Tp=  .27:DT= 5.00]
009:0030--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:401       16.78     .004 No_date   21:00    2.37  n/a
                     +  02:402       10.89     .006 No_date   16:15    3.70  n/a
                     +  03:403        2.37     .003 No_date   13:00    3.32  n/a
     [DT= 5.00]  SUM=  08:400       30.04     .012 No_date   16:00    2.93  n/a
009:0031--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            10:200      465.80     .117 No_date   21:10    2.26  n/a
                     +  09:300      253.67     .040 No_date   21:55    1.55  n/a
     [DT= 5.00]  SUM=  01:CONFL    719.47     .157 No_date   21:15    2.01  n/a
009:0032--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            10:200      465.80     .117 No_date   21:10    2.26  n/a
                     +  09:300      253.67     .040 No_date   21:55    1.55  n/a
                     +  08:400       30.04     .012 No_date   16:00    2.93  n/a
     [DT= 5.00]  SUM=  07:CONFL    749.51     .167 No_date   21:10    2.05  n/a
009:0033--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:501       62.65     .030 No_date   16:00    2.59 .103
     [CN= 74.0: N= 1.10]
     [Tp=  .60:DT= 5.00]
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 009:0034---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:502       51.84     .015 No_date   18:00    1.77 .071
      [CN= 68.0: N= 1.10]
      [Tp=  .75:DT= 5.00]
 009:0035---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:501       62.65     .030 No_date   16:00    2.59  n/a
                      +  02:502       51.84     .015 No_date   18:00    1.77  n/a
      [DT= 5.00]  SUM=  06:500      114.49     .045 No_date   16:00    2.22  n/a
 009:0036---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            07:CONFL     749.51     .167 No_date   21:10    2.05  n/a
                      +  06:500      114.49     .045 No_date   16:00    2.22  n/a
      [DT= 5.00]  SUM=  05:TOTAL     864.00     .209 No_date   18:25    2.07  n/a
   ** END OF RUN :   9

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




 RUN:COMMAND#
 010:0001---------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =  10 ]
#*******************************************************************************
#  Project Name: [Kanata North]    Project Number: [112117]
#  Date        : 16-09-2015
#  Modeller    : [Kallie Auld]
#  Company     : NOVATECH ENGINEERING CONSULTANTS LTD
#  License #   :  5320763
#*******************************************************************************
#*******************************************************************************
 010:0002---------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  = City of Ottawa:  2yr-24hr SCS Type II (60 minute time step)
      [SDT=60.00:SDUR=  24.00:PTOT=  48.02]
 010:0003---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:201      115.14     .126 No_date   18:00    7.73 .161
      [CN= 65.0: N= 1.10]
      [Tp=  .98:DT= 5.00]
 010:0004---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 01:201      115.14     .126 No_date   18:00    7.73  n/a
      [RDT= 5.00] out<- 02:211      115.14     .125 No_date   18:05    7.73  n/a
      [L/S/n=  558./ .890/.040]
      {Vmax=  .423:Dmax=  .058}
 010:0005---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       03:202      263.64     .311 No_date   18:00   10.90 .227
      [CN= 70.0: N= 1.10]
      [Tp= 1.47:DT= 5.00]
 010:0006---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            02:211      115.14     .125 No_date   18:05    7.73  n/a
                      +  03:202      263.64     .311 No_date   18:00   10.90  n/a
      [DT= 5.00]  SUM=  01:200a     378.78     .436 No_date   18:05    9.94  n/a
 010:0007---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 01:200a     378.78     .436 No_date   18:05    9.94  n/a
      [RDT= 5.00] out<- 02:212      378.78     .436 No_date   18:10    9.94  n/a
      [L/S/n=  255./ .880/.035]
      {Vmax=  .756:Dmax=  .344}
 010:0008---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 02:212      378.78     .436 No_date   18:10    9.94  n/a
      [RDT= 5.00] out<- 01:213      378.78     .436 No_date   18:25    9.94  n/a
      [L/S/n=  437./ .500/.035]
      {Vmax=  .468:Dmax=  .146}
 010:0009---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:203       46.74     .062 No_date   18:35   13.54 .282
      [CN= 76.0: N= 1.10]
      [Tp= 1.68:DT= 5.00]
 010:0010---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:213      378.78     .436 No_date   18:25    9.94  n/a
                      +  02:203       46.74     .062 No_date   18:35   13.54  n/a
      [DT= 5.00]  SUM=  03:200b     425.52     .498 No_date   18:25   10.33  n/a
 010:0011---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 03:200b     425.52     .498 No_date   18:25   10.33  n/a
      [RDT= 5.00] out<- 01:214      425.52     .498 No_date   18:35   10.33  n/a
      [L/S/n=  543./ .520/.035]
      {Vmax=  .606:Dmax=  .204}
 010:0012---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:204       29.39     .059 No_date   16:00   13.54 .282
      [CN= 76.0: N= 1.10]
      [Tp=  .95:DT= 5.00]
 010:0013---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       03:205       10.89     .170 No_date   12:15   15.53 .324
      [CN= 78.0: N= 3.00]
      [Tp=  .53:DT= 5.00]
 010:0014---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:214      425.52     .498 No_date   18:35   10.33  n/a
                      +  02:204       29.39     .059 No_date   16:00   13.54  n/a
                      +  03:205       10.89     .170 No_date   12:15   15.53  n/a
      [DT= 5.00]  SUM=  10:200      465.80     .573 No_date   18:10   10.66  n/a
 010:0015---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:301       86.43     .064 No_date   19:00    6.90 .144
      [CN= 63.0: N= 1.10]
      [Tp= 1.45:DT= 5.00]
 010:0016---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:302       80.69     .051 No_date   22:00    7.66 .159
      [CN= 64.0: N= 1.10]
      [Tp= 2.11:DT= 5.00]
 010:0017---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:301       86.43     .064 No_date   19:00    6.90  n/a
                      +  02:302       80.69     .051 No_date   22:00    7.66  n/a
      [DT= 5.00]  SUM=  03:300a     167.12     .115 No_date   21:00    7.27  n/a
 010:0018---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 03:300a     167.12     .115 No_date   21:00    7.27  n/a
      [RDT= 5.00] out<- 01:310      167.12     .115 No_date   21:15    7.27  n/a
      [L/S/n=  449./1.620/.040]
      {Vmax=  .432:Dmax=  .062}
 010:0019---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:303       65.16     .068 No_date   18:30    9.99 .208
      [CN= 69.0: N= 1.10]
      [Tp= 1.54:DT= 5.00]
 010:0020---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:310      167.12     .115 No_date   21:15    7.27  n/a
                      +  02:303       65.16     .068 No_date   18:30    9.99  n/a
      [DT= 5.00]  SUM=  03:300b     232.28     .182 No_date   21:00    8.03  n/a
 010:0021---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 03:300b     232.28     .182 No_date   21:00    8.03  n/a
      [RDT= 5.00] out<- 01:312      232.28     .182 No_date   21:10    8.03  n/a
      [L/S/n=  423./1.170/.035]
      {Vmax=  .439:Dmax=  .062}
 010:0022---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
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    CALIB NASHYD       02:304       18.78     .038 No_date   16:00   14.40 .300
     [CN= 77.0: N= 1.10]
     [Tp= 1.04:DT= 5.00]
010:0023--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:312      232.28     .182 No_date   21:10    8.03  n/a
                     +  02:304       18.78     .038 No_date   16:00   14.40  n/a
     [DT= 5.00]  SUM=  03:300c     251.06     .218 No_date   19:00    8.50  n/a
010:0024--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:300c     251.06     .218 No_date   19:00    8.50  n/a
     [RDT= 5.00] out<- 01:313      251.06     .218 No_date   19:05    8.50  n/a
     [L/S/n=  219./1.280/.035]
     {Vmax=  .701:Dmax=  .154}
010:0025--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:305        2.61     .014 No_date   13:00   12.74 .265
     [CN= 72.0: N= 1.10]
     [Tp=  .22:DT= 5.00]
010:0026--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:313      251.06     .218 No_date   19:05    8.50  n/a
                     +  02:305        2.61     .014 No_date   13:00   12.74  n/a
     [DT= 5.00]  SUM=  09:300      253.67     .222 No_date   18:40    8.55  n/a
010:0027--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:401       16.78     .017 No_date   18:50   10.48 .218
     [CN= 68.0: N= 1.10]
     [Tp= 1.66:DT= 5.00]
010:0028--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:402       10.89     .026 No_date   15:10   15.05 .314
     [CN= 78.0: N= 1.10]
     [Tp=  .85:DT= 5.00]
010:0029--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       03:403        2.37     .011 No_date   13:00   12.53 .261
     [CN= 70.0: N= 1.10]
     [Tp=  .27:DT= 5.00]
010:0030--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:401       16.78     .017 No_date   18:50   10.48  n/a
                     +  02:402       10.89     .026 No_date   15:10   15.05  n/a
                     +  03:403        2.37     .011 No_date   13:00   12.53  n/a
     [DT= 5.00]  SUM=  08:400       30.04     .051 No_date   14:15   12.30  n/a
010:0031--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            10:200      465.80     .573 No_date   18:10   10.66  n/a
                     +  09:300      253.67     .222 No_date   18:40    8.55  n/a
     [DT= 5.00]  SUM=  01:CONFL     719.47     .795 No_date   18:10    9.91  n/a
010:0032--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            10:200      465.80     .573 No_date   18:10   10.66  n/a
                     +  09:300      253.67     .222 No_date   18:40    8.55  n/a
                     +  08:400       30.04     .051 No_date   14:15   12.30  n/a
     [DT= 5.00]  SUM=  07:CONFL     749.51     .842 No_date   18:10   10.01  n/a
010:0033--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:501       62.65     .156 No_date   14:00   12.13 .253
     [CN= 74.0: N= 1.10]
     [Tp=  .60:DT= 5.00]
010:0034--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:502       51.84     .083 No_date   15:20    9.35 .195
     [CN= 68.0: N= 1.10]
     [Tp=  .75:DT= 5.00]
010:0035--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:501       62.65     .156 No_date   14:00   12.13  n/a
                     +  02:502       51.84     .083 No_date   15:20    9.35  n/a
     [DT= 5.00]  SUM=  06:500      114.49     .237 No_date   14:25   10.87  n/a
010:0036--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            07:CONFL     749.51     .842 No_date   18:10   10.01  n/a
                     +  06:500      114.49     .237 No_date   14:25   10.87  n/a
     [DT= 5.00]  SUM=  05:TOTAL    864.00    1.057 No_date   18:00   10.12  n/a

  ** END OF RUN :  10

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




 RUN:COMMAND#
 011:0001--------------------------------------------------------------------------
     START
      [TZERO =    .00 hrs on        0]
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =  11 ]
#*******************************************************************************
#  Project Name: [Kanata North]    Project Number: [112117]
#  Date        : 16-09-2015
#  Modeller    : [Kallie Auld]
#  Company     : NOVATECH ENGINEERING CONSULTANTS LTD
#  License #   :  5320763
#*******************************************************************************
#*******************************************************************************
 011:0002--------------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  = City of Ottawa:  5yr-24hr SCS Type II (60 minute time step)
      [SDT=60.00:SDUR=  24.00:PTOT=  61.92]
 011:0003--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:201      115.14     .224 No_date   16:05   13.63 .220
      [CN= 65.0: N= 1.10]
      [Tp=  .98:DT= 5.00]
 011:0004--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 01:201      115.14     .224 No_date   16:05   13.63  n/a
      [RDT= 5.00] out<- 02:211      115.14     .223 No_date   16:40   13.63  n/a
      [L/S/n=  558./ .890/.040]
      {Vmax=  .432:Dmax=  .094}
 011:0005--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       03:202      263.64     .517 No_date   18:00   18.03 .291
      [CN= 70.0: N= 1.10]
      [Tp= 1.47:DT= 5.00]
 011:0006--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            02:211      115.14     .223 No_date   16:40   13.63  n/a
                      +  03:202      263.64     .517 No_date   18:00   18.03  n/a
      [DT= 5.00]  SUM=  01:200a     378.78     .740 No_date   18:00   16.69  n/a
 011:0007--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 01:200a     378.78     .740 No_date   18:00   16.69  n/a
      [RDT= 5.00] out<- 02:212      378.78     .740 No_date   18:05   16.69  n/a
      [L/S/n=  255./ .880/.035]
      {Vmax=  .840:Dmax=  .416}
 011:0008--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 02:212      378.78     .740 No_date   18:05   16.69  n/a
      [RDT= 5.00] out<- 01:213      378.78     .740 No_date   18:15   16.69  n/a
      [L/S/n=  437./ .500/.035]
      {Vmax=  .552:Dmax=  .194}
 011:0009--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:203       46.74     .101 No_date   18:05   21.93 .354
      [CN= 76.0: N= 1.10]
      [Tp= 1.68:DT= 5.00]
 011:0010--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:213      378.78     .740 No_date   18:15   16.69  n/a
                      +  02:203       46.74     .101 No_date   18:05   21.93  n/a
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     [DT= 5.00]  SUM=  03:200b     425.52     .841 No_date   18:15   17.27  n/a
011:0011--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:200b     425.52     .841 No_date   18:15   17.27  n/a
     [RDT= 5.00] out<- 01:214      425.52     .841 No_date   18:20   17.27  n/a
     [L/S/n=  543./ .520/.035]
     {Vmax=  .708:Dmax=  .271}
011:0012--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:204       29.39     .097 No_date   16:00   21.93 .354
     [CN= 76.0: N= 1.10]
     [Tp=  .95:DT= 5.00]
011:0013--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       03:205       10.89     .275 No_date   12:15   24.51 .396
     [CN= 78.0: N= 3.00]
     [Tp=  .53:DT= 5.00]
011:0014--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:214      425.52     .841 No_date   18:20   17.27  n/a
                     +  02:204       29.39     .097 No_date   16:00   21.93  n/a
                     +  03:205       10.89     .275 No_date   12:15   24.51  n/a
     [DT= 5.00]  SUM=  10:200      465.80     .961 No_date   18:10   17.73  n/a
011:0015--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:301       86.43     .116 No_date   18:15   12.39 .200
     [CN= 63.0: N= 1.10]
     [Tp= 1.45:DT= 5.00]
011:0016--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:302       80.69     .090 No_date   21:05   13.42 .217
     [CN= 64.0: N= 1.10]
     [Tp= 2.11:DT= 5.00]
011:0017--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:301       86.43     .116 No_date   18:15   12.39  n/a
                     +  02:302       80.69     .090 No_date   21:05   13.42  n/a
     [DT= 5.00]  SUM=  03:300a     167.12     .205 No_date   19:00   12.89  n/a
011:0018--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:300a     167.12     .205 No_date   19:00   12.89  n/a
     [RDT= 5.00] out<- 01:310      167.12     .205 No_date   19:10   12.89  n/a
     [L/S/n=  449./1.620/.040]
     {Vmax=  .480:Dmax=  .081}
011:0019--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:303       65.16     .115 No_date   18:05   16.82 .272
     [CN= 69.0: N= 1.10]
     [Tp= 1.54:DT= 5.00]
011:0020--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:310      167.12     .205 No_date   19:10   12.89  n/a
                     +  02:303       65.16     .115 No_date   18:05   16.82  n/a
     [DT= 5.00]  SUM=  03:300b     232.28     .319 No_date   19:00   13.99  n/a
011:0021--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:300b     232.28     .319 No_date   19:00   13.99  n/a
     [RDT= 5.00] out<- 01:312      232.28     .319 No_date   19:05   13.99  n/a
     [L/S/n=  423./1.170/.035]
     {Vmax=  .516:Dmax=  .085}
011:0022--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:304       18.78     .061 No_date   16:00   23.06 .372
     [CN= 77.0: N= 1.10]
     [Tp= 1.04:DT= 5.00]
011:0023--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:312      232.28     .319 No_date   19:05   13.99  n/a
                     +  02:304       18.78     .061 No_date   16:00   23.06  n/a
     [DT= 5.00]  SUM=  03:300c     251.06     .377 No_date   18:30   14.67  n/a
011:0024--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE CHANNEL   -> 03:300c     251.06     .377 No_date   18:30   14.67  n/a
     [RDT= 5.00] out<- 01:313      251.06     .377 No_date   18:35   14.67  n/a
     [L/S/n=  219./1.280/.035]
     {Vmax=  .803:Dmax=  .221}
011:0025--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:305        2.61     .023 No_date   13:00   20.45 .330
     [CN= 72.0: N= 1.10]
     [Tp=  .22:DT= 5.00]
011:0026--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:313      251.06     .377 No_date   18:35   14.67  n/a
                     +  02:305        2.61     .023 No_date   13:00   20.45  n/a
     [DT= 5.00]  SUM=  09:300      253.67     .385 No_date   18:20   14.73  n/a
011:0027--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:401       16.78     .029 No_date   18:15   17.29 .279
     [CN= 68.0: N= 1.10]
     [Tp= 1.66:DT= 5.00]
011:0028--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:402       10.89     .043 No_date   15:00   23.97 .387
     [CN= 78.0: N= 1.10]
     [Tp=  .85:DT= 5.00]
011:0029--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       03:403        2.37     .018 No_date   13:00   19.94 .322
     [CN= 70.0: N= 1.10]
     [Tp=  .27:DT= 5.00]
011:0030--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:401       16.78     .029 No_date   18:15   17.29  n/a
                     +  02:402       10.89     .043 No_date   15:00   23.97  n/a
                     +  03:403        2.37     .018 No_date   13:00   19.94  n/a
     [DT= 5.00]  SUM=  08:400       30.04     .084 No_date   14:00   19.92  n/a
011:0031--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            10:200      465.80     .961 No_date   18:10   17.73  n/a
                     +  09:300      253.67     .385 No_date   18:20   14.73  n/a
     [DT= 5.00]  SUM=  01:CONFL    719.47    1.346 No_date   18:10   16.67  n/a
011:0032--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            10:200      465.80     .961 No_date   18:10   17.73  n/a
                     +  09:300      253.67     .385 No_date   18:20   14.73  n/a
                     +  08:400       30.04     .084 No_date   14:00   19.92  n/a
     [DT= 5.00]  SUM=  07:CONFL    749.51    1.423 No_date   18:05   16.80  n/a
011:0033--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:501       62.65     .264 No_date   14:00   20.00 .323
     [CN= 74.0: N= 1.10]
     [Tp=  .60:DT= 5.00]
011:0034--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       02:502       51.84     .144 No_date   15:00   15.93 .257
     [CN= 68.0: N= 1.10]
     [Tp=  .75:DT= 5.00]
011:0035--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            01:501       62.65     .264 No_date   14:00   20.00  n/a
                     +  02:502       51.84     .144 No_date   15:00   15.93  n/a
     [DT= 5.00]  SUM=  06:500      114.49     .407 No_date   14:05   18.16  n/a
011:0036--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD            07:CONFL    749.51    1.423 No_date   18:05   16.80  n/a
                     +  06:500      114.49     .407 No_date   14:05   18.16  n/a
     [DT= 5.00]  SUM=  05:TOTAL    864.00    1.794 No_date   16:15   16.98  n/a
 ** END OF RUN :  11

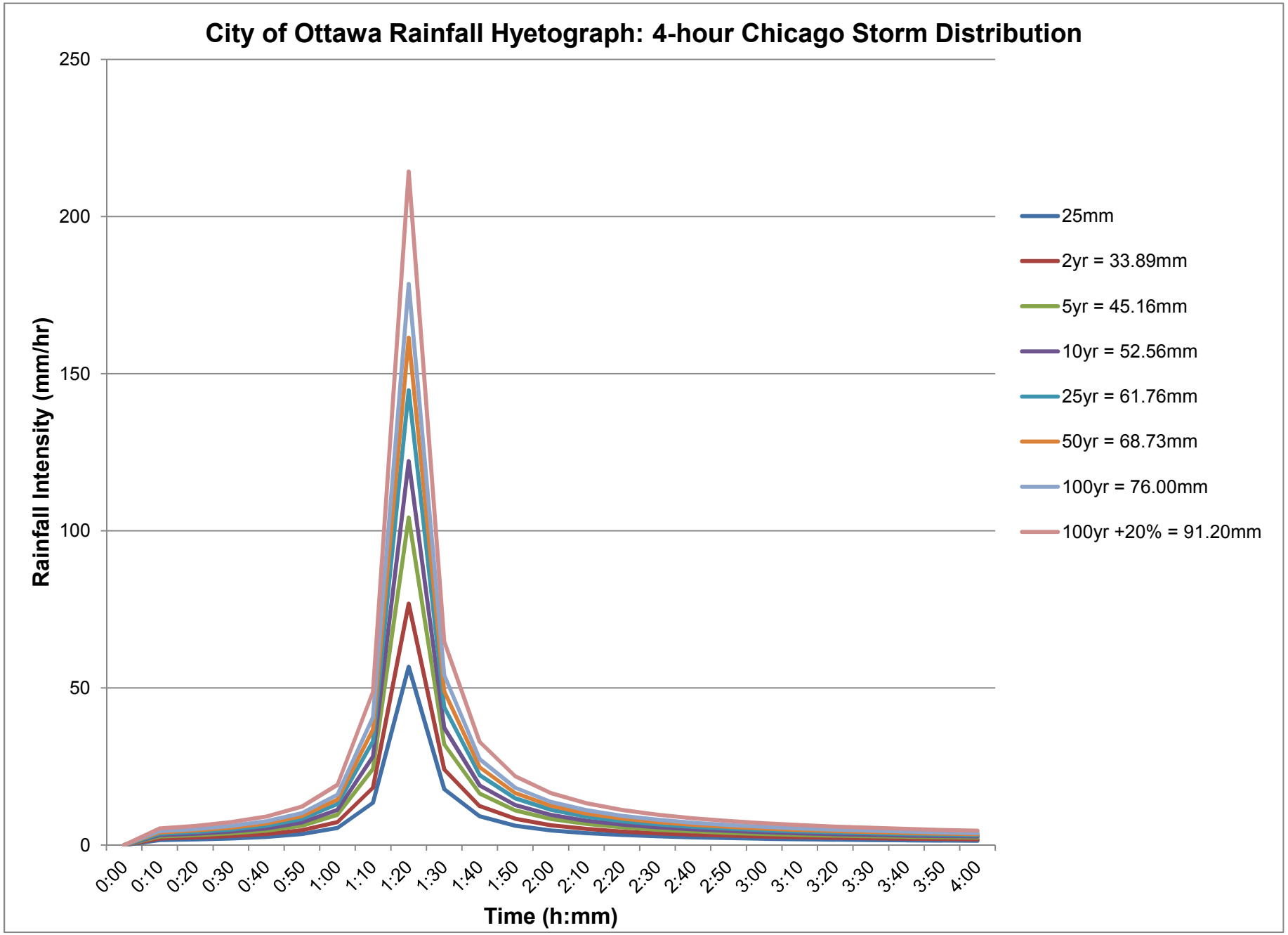
*******************************************************************************

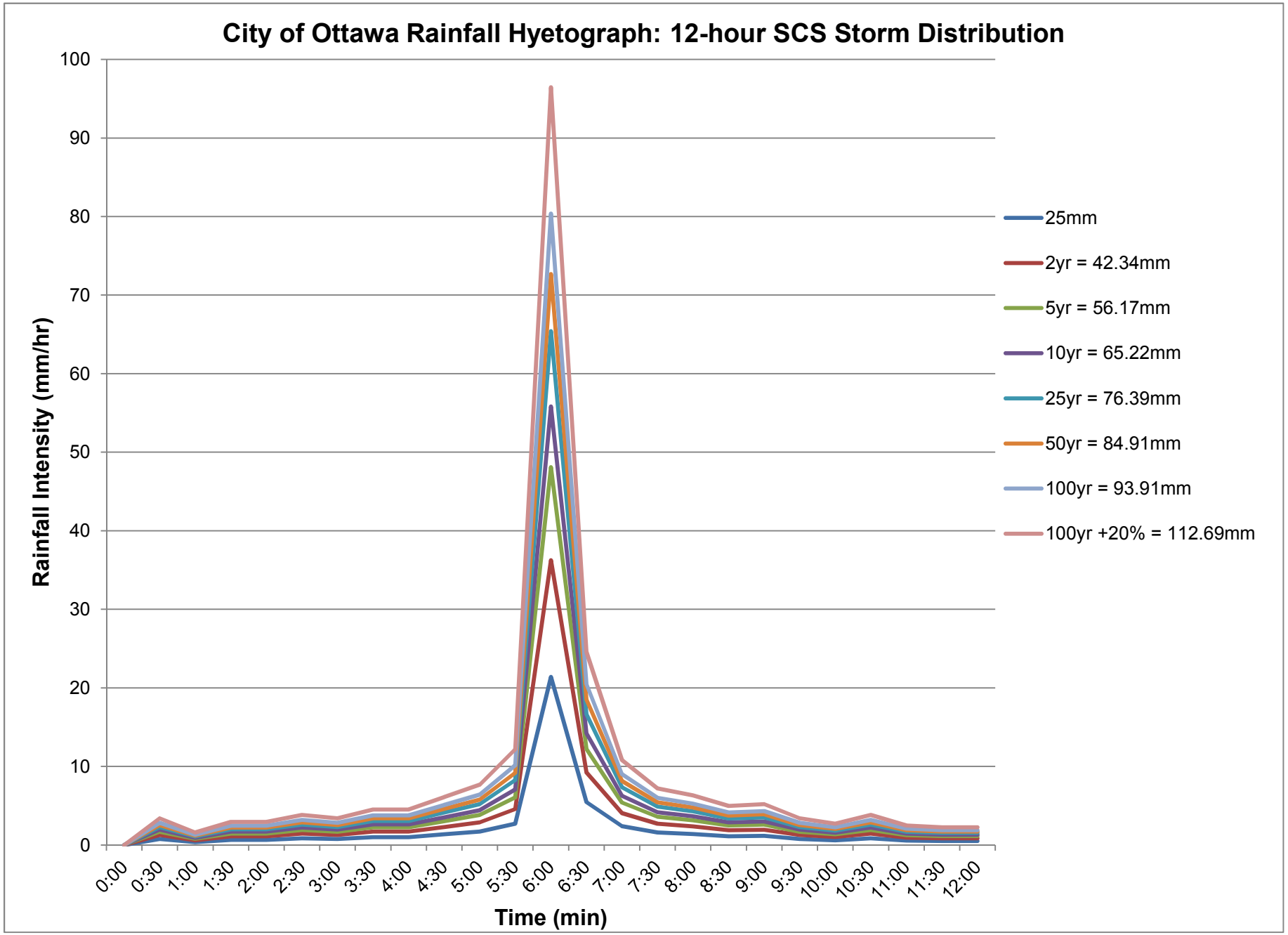


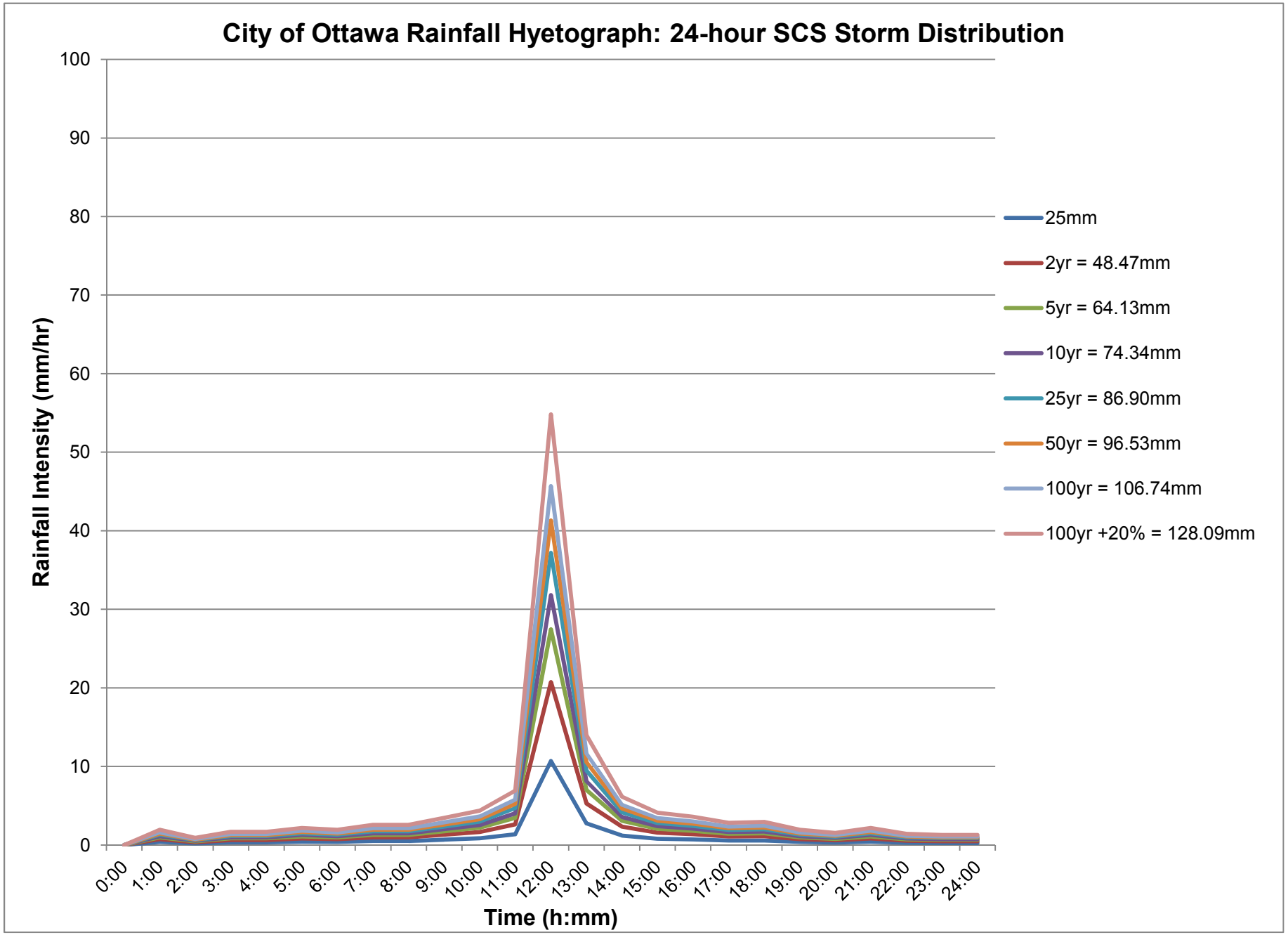

 RUN:COMMAND#
 012:0001--------------------------------------------------------------------
    START
     [TZERO =    .00 hrs on        0]
```

```
      [METOUT=   2    (1=imperial, 2=metric output)]
      [NSTORM=   1 ]
      [NRUN  =  12 ]
#*******************************************************************************
#  Project Name: [Kanata North]    Project Number: [112117]
#  Date        : 16-09-2015
#  Modeller    : [Kallie Auld]
#  Company     : NOVATECH ENGINEERING CONSULTANTS LTD
#  License #   :  5320763
#*******************************************************************************
#*******************************************************************************
 012:0002-------------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  = City of Ottawa:  100yr-24hr SCS Type II (60 minute time step
      [SDT=60.00:SDUR=  24.00:PTOT= 105.74]
 012:0003--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:201      115.14     .652 No_date   16:00   38.51 .364
      [CN= 65.0: N= 1.10]
      [Tp=  .98:DT= 5.00]
 012:0004--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 01:201      115.14     .652 No_date   16:00   38.51  n/a
      [RDT= 5.00] out<- 02:211      115.14     .654 No_date   16:05   38.51  n/a
      [L/S/n=  558./ .890/.040]
      {Vmax=  .619:Dmax=  .174}
 012:0005--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       03:202      263.64    1.348 No_date   18:00   46.46 .439
      [CN= 70.0: N= 1.10]
      [Tp= 1.47:DT= 5.00]
 012:0006--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            02:211      115.14     .654 No_date   16:05   38.51  n/a
                      +  03:202      263.64    1.348 No_date   18:00   46.46  n/a
      [DT= 5.00]  SUM=  01:200a     378.78    1.987 No_date   16:25   44.04  n/a
 012:0007--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 01:200a     378.78    1.987 No_date   16:25   44.04  n/a
      [RDT= 5.00] out<- 02:212      378.78    1.987 No_date   16:30   44.04  n/a
      [L/S/n=  255./ .880/.035]
      {Vmax= 1.046:Dmax=  .581}
 012:0008--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 02:212      378.78    1.987 No_date   16:30   44.04  n/a
      [RDT= 5.00] out<- 01:213      378.78    1.987 No_date   16:40   44.04  n/a
      [L/S/n=  437./ .500/.035]
      {Vmax=  .737:Dmax=  .318}
 012:0009--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:203       46.74     .253 No_date   18:00   54.00 .511
      [CN= 76.0: N= 1.10]
      [Tp= 1.68:DT= 5.00]
 012:0010--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:213      378.78    1.987 No_date   16:40   44.04  n/a
                      +  02:203       46.74     .253 No_date   18:00   54.00  n/a
      [DT= 5.00]  SUM=  03:200b     425.52    2.237 No_date   16:55   45.14  n/a
 012:0011--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 03:200b     425.52    2.237 No_date   16:55   45.14  n/a
      [RDT= 5.00] out<- 01:214      425.52    2.237 No_date   17:00   45.14  n/a
      [L/S/n=  543./ .520/.035]
      {Vmax=  .932:Dmax=  .447}
 012:0012--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:204       29.39     .245 No_date   15:00   54.00 .511
      [CN= 76.0: N= 1.10]
      [Tp=  .95:DT= 5.00]
 012:0013--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       03:205       10.89     .673 No_date   12:15   58.05 .549
      [CN= 78.0: N= 3.00]
      [Tp=  .53:DT= 5.00]
 012:0014--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:214      425.52    2.237 No_date   17:00   45.14  n/a
                      +  02:204       29.39     .245 No_date   15:00   54.00  n/a
                      +  03:205       10.89     .673 No_date   12:15   58.05  n/a
      [DT= 5.00]  SUM=  10:200      465.80    2.546 No_date   16:15   46.00  n/a
 012:0015--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:301       86.43     .343 No_date   18:00   35.99 .340
      [CN= 63.0: N= 1.10]
      [Tp= 1.45:DT= 5.00]
 012:0016--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:302       80.69     .254 No_date   21:00   37.84 .358
      [CN= 64.0: N= 1.10]
      [Tp= 2.11:DT= 5.00]
 012:0017--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:301       86.43     .343 No_date   18:00   35.99  n/a
                      +  02:302       80.69     .254 No_date   21:00   37.84  n/a
      [DT= 5.00]  SUM=  03:300a     167.12     .595 No_date   18:05   36.88  n/a
 012:0018--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 03:300a     167.12     .595 No_date   18:05   36.88  n/a
      [RDT= 5.00] out<- 01:310      167.12     .595 No_date   18:20   36.88  n/a
      [L/S/n=  449./1.620/.040]
      {Vmax=  .694:Dmax=  .145}
 012:0019--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:303       65.16     .308 No_date   18:00   44.45 .420
      [CN= 69.0: N= 1.10]
      [Tp= 1.54:DT= 5.00]
 012:0020--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:310      167.12     .595 No_date   18:20   36.88  n/a
                      +  02:303       65.16     .308 No_date   18:00   44.45  n/a
      [DT= 5.00]  SUM=  03:300b     232.28     .902 No_date   18:10   39.01  n/a
 012:0021--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 03:300b     232.28     .902 No_date   18:10   39.01  n/a
      [RDT= 5.00] out<- 01:312      232.28     .902 No_date   18:15   39.01  n/a
      [L/S/n=  423./1.170/.035]
      {Vmax=  .779:Dmax=  .158}
 012:0022--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:304       18.78     .151 No_date   15:15   55.84 .528
      [CN= 77.0: N= 1.10]
      [Tp= 1.04:DT= 5.00]
 012:0023--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:312      232.28     .902 No_date   18:15   39.01  n/a
                      +  02:304       18.78     .151 No_date   15:15   55.84  n/a
      [DT= 5.00]  SUM=  03:300c     251.06    1.046 No_date   18:05   40.26  n/a
 012:0024--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE CHANNEL   -> 03:300c     251.06    1.046 No_date   18:05   40.26  n/a
      [RDT= 5.00] out<- 01:313      251.06    1.047 No_date   18:10   40.26  n/a
      [L/S/n=  219./1.280/.035]
      {Vmax=  .953:Dmax=  .339}
 012:0025--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:305        2.61     .059 No_date   13:00   50.41 .477
      [CN= 72.0: N= 1.10]
      [Tp=  .22:DT= 5.00]
 012:0026--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:313      251.06    1.047 No_date   18:10   40.26  n/a
                      +  02:305        2.61     .059 No_date   13:00   50.41  n/a
      [DT= 5.00]  SUM=  09:300      253.67    1.066 No_date   18:05   40.37  n/a
 012:0027--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:401       16.78     .075 No_date   18:00   44.67 .422
      [CN= 68.0: N= 1.10]
      [Tp= 1.66:DT= 5.00]
```

```
 012:0028--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:402       10.89     .106 No_date   14:20   57.39 .543
      [CN= 78.0: N= 1.10]
      [Tp=  .85:DT= 5.00]
 012:0029--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       03:403        2.37     .046 No_date   13:00   48.93 .463
      [CN= 70.0: N= 1.10]
      [Tp=  .27:DT= 5.00]
 012:0030--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:401       16.78     .075 No_date   18:00   44.67  n/a
                    +   02:402       10.89     .106 No_date   14:20   57.39  n/a
                    +   03:403        2.37     .046 No_date   13:00   48.93  n/a
      [DT= 5.00]  SUM=  08:400       30.04     .214 No_date   14:00   49.61  n/a
 012:0031--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            10:200      465.80    2.546 No_date   16:15   46.00  n/a
                    +   09:300      253.67    1.066 No_date   18:05   40.37  n/a
      [DT= 5.00]  SUM=  01:CONFL    719.47    3.601 No_date   16:25   44.01  n/a
 012:0032--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            10:200      465.80    2.546 No_date   16:15   46.00  n/a
                    +   09:300      253.67    1.066 No_date   18:05   40.37  n/a
                    +   08:400       30.04     .214 No_date   14:00   49.61  n/a
      [DT= 5.00]  SUM=  07:CONFL    749.51    3.803 No_date   16:15   44.24  n/a
 012:0033--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:501       62.65     .698 No_date   14:00   50.70 .480
      [CN= 74.0: N= 1.10]
      [Tp=  .60:DT= 5.00]
 012:0034--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       02:502       51.84     .404 No_date   14:10   42.86 .405
      [CN= 68.0: N= 1.10]
      [Tp=  .75:DT= 5.00]
 012:0035--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:501       62.65     .698 No_date   14:00   50.70  n/a
                    +   02:502       51.84     .404 No_date   14:10   42.86  n/a
      [DT= 5.00]  SUM=  06:500      114.49    1.102 No_date   14:00   47.15  n/a
 012:0036--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            07:CONFL    749.51    3.803 No_date   16:15   44.24  n/a
                    +   06:500      114.49    1.102 No_date   14:00   47.15  n/a
      [DT= 5.00]  SUM=  05:TOTAL    864.00    4.829 No_date   15:40   44.62  n/a
 012:0002--------------------------------------------------------------------------
      FINISH
-------------------------------------------------------------------------------
*******************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2015-12-10     at 09:40:13
===============================================================================
```


City of Ottawa Rainfall Hyetograph: 4-hour Chicago Storm Distribution
Rainfall Intensity (mm/hr)
250
200
150
100
50
0
0:00
0:10
0:20
0:30
0:40
0:50
1:00
1:10
1:20
1:30
1:40
1:50
2:00
2:10
2:20
2:30
2:40
2:50
3:00
3:10
3:20
3:30
3:40
3:50
4:00
Time (h:mm)
25mm
2yr = 33.89mm
5yr = 45.16mm
10yr = 52.56mm
25yr = 61.76mm
50yr = 68.73mm
100yr = 76.00mm
100yr +20% = 91.20mm


City of Ottawa Rainfall Hyetograph: 12-hour SCS Storm Distribution
Rainfall Intensity (mm/hr)
100
90
80
70
60
50
40
30
20
10
0
0:00
0:30
1:00
1:30
2:00
2:30
3:00
3:30
4:00
4:30
5:00
5:30
6:00
6:30
7:00
7:30
8:00
8:30
9:00
9:30
10:00
10:30
11:00
11:30
12:00
Time (min)
25mm
2yr = 42.34mm
5yr = 56.17mm
10yr = 65.22mm
25yr = 76.39mm
50yr = 84.91mm
100yr = 93.91mm
100yr +20% = 112.69mm


City of Ottawa Rainfall Hyetograph: 24-hour SCS Storm Distribution
Rainfall Intensity (mm/hr)
100
90
80
70
60
50
40
30
20
10
0
0:00
1:00
2:00
3:00
4:00
5:00
6:00
7:00
8:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
22:00
23:00
24:00
Time (h:mm)
25mm
2yr = 48.47mm
5yr = 64.13mm
10yr = 74.34mm
25yr = 86.90mm
50yr = 96.53mm
100yr = 106.74mm
100yr +20% = 128.09mm

Appendix B: HEC-RAS Modelling Files

- Shirley's Brook Existing Conditions: HEC-RAS Schematic
- Shirley's Brook Existing Conditions: HEC-RAS Output Results
- Shirley's Brook Existing Conditions: HEC-RAS Output Profile

M:\2012\112117\CAD\Design_EMPMEMO (CS)\HECRAS Figs.dwg, H-1 ExCond, Feb 27, 2016 - 10:29am, kbanks

KANATA NORTH
COMMUNITY DESIGN PLAN

FIGURE NO. H-1
EXISTING CONDITIONS
HEC-RAS MODEL
SCHEMATIC

DATE
FEB 2016

JOB
112117

SCALE
NTS

NOVATECH
Engineers, Planners & Landscape Architects

SHT11x17.DWG - 279mmx432mm

HEC-RAS Plan: Existing Con

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Tributary 3	4112.66	100yr-12hrSCS	0.85	89.22	89.45	89.45	89.51	0.026144	1.10	0.77	6.66	1.03
Tributary 3	4112.66	5yr-12hrSCS	0.31	89.22	89.37	89.37	89.41	0.030389	0.89	0.35	4.54	1.03
Tributary 3	4112.66	2yr-12hrSCS	0.16	89.22	89.34	89.34	89.37	0.022941	0.68	0.24	3.76	0.87
Tributary 3	4103.10*	100yr-12hrSCS	0.85	88.98	89.21	89.22	89.28	0.028576	1.16	0.73	5.98	1.05
Tributary 3	4103.10*	5yr-12hrSCS	0.31	88.98	89.13	89.13	89.17	0.028169	0.89	0.35	4.11	0.98
Tributary 3	4103.10*	2yr-12hrSCS	0.16	88.98	89.09	89.09	89.12	0.035797	0.84	0.19	3.05	1.06
Tributary 3	4093.54*	100yr-12hrSCS	0.85	88.74	88.96	88.96	89.02	0.030616	1.16	0.73	5.77	1.04
Tributary 3	4093.54*	5yr-12hrSCS	0.31	88.74	88.88	88.87	88.92	0.024449	0.82	0.37	4.15	0.88
Tributary 3	4093.54*	2yr-12hrSCS	0.16	88.74	88.75	88.83	90.88	14.312870	6.45	0.03	1.52	16.02
Tributary 3	4083.98*	100yr-12hrSCS	0.85	88.49	88.69	88.70	88.77	0.038012	1.23	0.69	5.57	1.12
Tributary 3	4083.98*	5yr-12hrSCS	0.31	88.49	88.61	88.61	88.66	0.038188	0.96	0.32	3.79	1.06
Tributary 3	4083.98*	2yr-12hrSCS	0.16	88.49	88.57	88.58	88.61	0.052730	0.89	0.18	3.07	1.17
Tributary 3	4074.43	100yr-12hrSCS	0.85	88.25	88.39	88.44	88.54	0.087854	1.66	0.51	4.78	1.62
Tributary 3	4074.43	5yr-12hrSCS	0.31	88.25	88.37		88.40	0.022005	0.76	0.41	4.39	0.79
Tributary 3	4074.43	2yr-12hrSCS	0.16	88.25	88.34	88.33	88.36	0.020958	0.61	0.26	3.79	0.74
Tributary 3	4063.93*	100yr-12hrSCS	0.85	88.07	88.27	88.25	88.32	0.022942	1.02	0.83	5.93	0.87
Tributary 3	4063.93*	5yr-12hrSCS	0.31	88.07	88.19		88.22	0.018133	0.70	0.44	4.64	0.72
Tributary 3	4063.93*	2yr-12hrSCS	0.16	88.07	88.16		88.17	0.019682	0.59	0.27	3.97	0.72
Tributary 3	4053.43*	100yr-12hrSCS	0.85	87.89	88.10		88.14	0.018456	0.93	0.91	6.28	0.78
Tributary 3	4053.43*	5yr-12hrSCS	0.31	87.89	88.01		88.03	0.021126	0.73	0.42	4.72	0.77
Tributary 3	4053.43*	2yr-12hrSCS	0.16	87.89	87.97		87.99	0.020924	0.59	0.27	4.11	0.73
Tributary 3	4042.93*	100yr-12hrSCS	0.85	87.71	87.90		87.95	0.021033	0.97	0.88	6.31	0.83
Tributary 3	4042.93*	5yr-12hrSCS	0.31	87.71	87.83		87.85	0.018832	0.69	0.45	4.94	0.73
Tributary 3	4042.93*	2yr-12hrSCS	0.16	87.71	87.79		87.81	0.019800	0.57	0.28	4.31	0.71
Tributary 3	4032.43*	100yr-12hrSCS	0.85	87.54	87.72		87.77	0.021118	0.96	0.88	6.48	0.83
Tributary 3	4032.43*	5yr-12hrSCS	0.31	87.54	87.64		87.67	0.021710	0.71	0.43	5.05	0.78
Tributary 3	4032.43*	2yr-12hrSCS	0.16	87.54	87.61		87.63	0.020979	0.57	0.28	4.47	0.73
Tributary 3	4021.93*	100yr-12hrSCS	0.85	87.36	87.54		87.58	0.018704	0.91	0.93	6.79	0.78
Tributary 3	4021.93*	5yr-12hrSCS	0.31	87.36	87.46		87.49	0.018202	0.66	0.46	5.32	0.72
Tributary 3	4021.93*	2yr-12hrSCS	0.16	87.36	87.43		87.45	0.017510	0.53	0.30	4.72	0.67
Tributary 3	4011.43*	100yr-12hrSCS	0.85	87.18	87.35	87.33	87.40	0.022564	0.96	0.88	6.80	0.85
Tributary 3	4011.43*	5yr-12hrSCS	0.31	87.18	87.28		87.30	0.023661	0.71	0.43	5.37	0.81
Tributary 3	4011.43*	2yr-12hrSCS	0.16	87.18	87.25		87.26	0.023970	0.58	0.28	4.79	0.77

HEC-RAS Plan: Existing Con (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Tributary 3	4000.94	100yr-12hrSCS	0.85	87.00	87.19	87.15	87.22	0.014115	0.80	1.06	7.48	0.68
Tributary 3	4000.94	5yr-12hrSCS	0.31	87.00	87.11	87.08	87.12	0.016120	0.62	0.50	5.77	0.67
Tributary 3	4000.94	2yr-12hrSCS	0.16	87.00	87.07	87.05	87.09	0.016339	0.50	0.32	5.14	0.64
Tributary 3	3990.29*	100yr-12hrSCS	0.85	86.84	87.04	87.01	87.08	0.013821	0.84	1.01	6.86	0.70
Tributary 3	3990.29*	5yr-12hrSCS	0.31	86.84	86.96	86.94	86.98	0.015391	0.65	0.48	5.15	0.68
Tributary 3	3990.29*	2yr-12hrSCS	0.16	86.84	86.92	86.90	86.93	0.016326	0.54	0.30	4.48	0.67
Tributary 3	3979.64*	100yr-12hrSCS	0.85	86.68	86.90	86.86	86.94	0.014062	0.87	0.97	6.34	0.71
Tributary 3	3979.64*	5yr-12hrSCS	0.31	86.68	86.81	86.78	86.83	0.015565	0.68	0.45	4.55	0.69
Tributary 3	3979.64*	2yr-12hrSCS	0.16	86.68	86.77	86.75	86.78	0.015457	0.56	0.29	3.90	0.66
Tributary 3	3969.00*	100yr-12hrSCS	0.85	86.52	86.77	86.72	86.81	0.013574	0.90	0.95	5.93	0.72
Tributary 3	3969.00*	5yr-12hrSCS	0.31	86.52	86.66	86.63	86.69	0.014332	0.71	0.43	4.02	0.69
Tributary 3	3969.00*	2yr-12hrSCS	0.16	86.52	86.62	86.59	86.64	0.014516	0.60	0.27	3.32	0.66
Tributary 3	3958.35*	100yr-12hrSCS	0.85	86.36	86.64	86.59	86.68	0.013392	0.92	0.92	5.66	0.73
Tributary 3	3958.35*	5yr-12hrSCS	0.31	86.36	86.52	86.49	86.55	0.015057	0.78	0.40	3.46	0.73
Tributary 3	3958.35*	2yr-12hrSCS	0.16	86.36	86.47	86.45	86.49	0.014836	0.65	0.25	2.79	0.70
Tributary 3	3947.71*	100yr-12hrSCS	0.85	86.20	86.52	86.47	86.56	0.012184	0.91	0.93	5.70	0.72
Tributary 3	3947.71*	5yr-12hrSCS	0.31	86.20	86.39	86.36	86.42	0.012835	0.78	0.39	3.12	0.70
Tributary 3	3947.71*	2yr-12hrSCS	0.16	86.20	86.33	86.31	86.36	0.013170	0.69	0.24	2.33	0.69
Tributary 3	3937.06*	100yr-12hrSCS	0.85	86.04	86.40	86.36	86.44	0.012556	0.90	0.94	6.01	0.72
Tributary 3	3937.06*	5yr-12hrSCS	0.31	86.04	86.28	86.23	86.31	0.010178	0.74	0.41	2.98	0.64
Tributary 3	3937.06*	2yr-12hrSCS	0.16	86.04	86.21	86.17	86.24	0.011207	0.68	0.24	2.11	0.64
Tributary 3	3926.42	100yr-12hrSCS	0.85	85.88	86.30	86.25	86.33	0.010856	0.82	1.04	7.08	0.68
Tributary 3	3926.42	5yr-12hrSCS	0.31	85.88	86.19	86.13	86.21	0.010207	0.69	0.45	3.71	0.64
Tributary 3	3926.42	2yr-12hrSCS	0.16	85.88	86.12	86.06	86.14	0.009069	0.65	0.25	2.09	0.60
Tributary 3	3916.75*	100yr-12hrSCS	0.85	85.84	86.20	86.15	86.23	0.009641	0.78	1.08	7.26	0.65
Tributary 3	3916.75*	5yr-12hrSCS	0.31	85.84	86.09	86.04	86.11	0.009932	0.66	0.47	4.14	0.63
Tributary 3	3916.75*	2yr-12hrSCS	0.16	85.84	86.03	85.98	86.05	0.008864	0.60	0.27	2.55	0.58
Tributary 3	3907.08*	100yr-12hrSCS	0.85	85.79	86.14	86.05	86.16	0.005753	0.67	1.27	7.40	0.51
Tributary 3	3907.08*	5yr-12hrSCS	0.31	85.79	86.02	85.96	86.04	0.006657	0.56	0.55	4.74	0.52
Tributary 3	3907.08*	2yr-12hrSCS	0.16	85.79	85.97	85.91	85.98	0.006347	0.48	0.34	3.50	0.49
Tributary 3	3897.42	100yr-12hrSCS	0.85	85.75	86.01	85.99	86.07	0.015202	1.10	0.78	4.85	0.84
Tributary 3	3897.42	5yr-12hrSCS	0.31	85.75	85.91	85.89	85.95	0.013606	0.79	0.39	3.37	0.74

HEC-RAS Plan: Existing Con (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Tributary 3	3897.42	2yr-12hrSCS	0.16	85.75	85.87	85.85	85.89	0.014371	0.67	0.24	2.79	0.72
Tributary 3	3888.47*	100yr-12hrSCS	0.85	85.63	85.88	85.85	85.94	0.016052	1.09	0.78	4.49	0.83
Tributary 3	3888.47*	5yr-12hrSCS	0.31	85.63	85.78	85.76	85.81	0.015314	0.78	0.39	3.61	0.76
Tributary 3	3888.47*	2yr-12hrSCS	0.16	85.63	85.74	85.72	85.76	0.012904	0.60	0.27	3.20	0.66
Tributary 3	3879.53*	100yr-12hrSCS	0.85	85.50	85.74	85.72	85.80	0.015498	1.03	0.83	4.86	0.79
Tributary 3	3879.53*	5yr-12hrSCS	0.31	85.50	85.66	85.63	85.68	0.013744	0.70	0.44	4.21	0.69
Tributary 3	3879.53*	2yr-12hrSCS	0.16	85.50	85.62	85.60	85.63	0.014540	0.58	0.28	3.64	0.68
Tributary 3	3870.59*	100yr-12hrSCS	0.85	85.38	85.61	85.58	85.66	0.015496	0.97	0.88	5.40	0.77
Tributary 3	3870.59*	5yr-12hrSCS	0.31	85.38	85.53	85.50	85.55	0.015720	0.68	0.45	4.79	0.71
Tributary 3	3870.59*	2yr-12hrSCS	0.16	85.38	85.50	85.47	85.51	0.013324	0.53	0.31	4.17	0.63
Tributary 3	3861.65*	100yr-12hrSCS	0.85	85.26	85.50	85.46	85.53	0.011660	0.84	1.01	6.08	0.65
Tributary 3	3861.65*	5yr-12hrSCS	0.31	85.26	85.42	85.38	85.43	0.011458	0.58	0.53	5.48	0.59
Tributary 3	3861.65*	2yr-12hrSCS	0.16	85.26	85.37	85.35	85.39	0.015333	0.52	0.31	4.60	0.65
Tributary 3	3852.71	100yr-12hrSCS	0.85	85.13	85.34	85.33	85.39	0.022376	0.98	0.87	6.46	0.85
Tributary 3	3852.71	5yr-12hrSCS	0.31	85.13	85.28	85.26	85.30	0.017463	0.63	0.49	5.87	0.70
Tributary 3	3852.71	2yr-12hrSCS	0.16	85.13	85.25	85.23	85.26	0.013893	0.48	0.34	5.16	0.60
Tributary 3	3841.15*	100yr-12hrSCS	0.85	84.96	85.13	85.11	85.17	0.023175	0.93	0.91	7.77	0.87
Tributary 3	3841.15*	5yr-12hrSCS	0.31	84.96	85.06	85.06	85.09	0.028216	0.72	0.43	6.18	0.88
Tributary 3	3841.15*	2yr-12hrSCS	0.16	84.96	85.03	85.03	85.05	0.038655	0.66	0.24	5.11	0.97
Tributary 3	3829.60*	100yr-12hrSCS	0.85	84.78	84.93	84.91	84.97	0.020063	0.86	0.99	8.95	0.82
Tributary 3	3829.60*	5yr-12hrSCS	0.31	84.78	84.88	84.86	84.89	0.015009	0.56	0.55	7.48	0.67
Tributary 3	3829.60*	2yr-12hrSCS	0.16	84.78	84.85	84.83	84.86	0.012349	0.43	0.38	6.83	0.58
Tributary 3	3818.05*	100yr-12hrSCS	0.85	84.60	84.73	84.72	84.77	0.021994	0.86	0.98	9.80	0.87
Tributary 3	3818.05*	5yr-12hrSCS	0.31	84.60	84.67	84.67	84.70	0.028893	0.67	0.46	8.14	0.91
Tributary 3	3818.05*	2yr-12hrSCS	0.16	84.60	84.65	84.64	84.67	0.035434	0.58	0.28	7.14	0.94
Tributary 3	3806.50*	100yr-12hrSCS	0.85	84.43	84.54	84.53	84.57	0.019222	0.80	1.06	11.06	0.83
Tributary 3	3806.50*	5yr-12hrSCS	0.31	84.43	84.50	84.48	84.51	0.014145	0.52	0.60	9.71	0.66
Tributary 3	3806.50*	2yr-12hrSCS	0.16	84.43	84.48	84.47	84.49	0.012117	0.39	0.41	9.07	0.58
Tributary 3	3794.95	100yr-12hrSCS	0.85	84.25	84.35	84.35	84.38	0.020636	0.79	1.07	12.73	0.87
Tributary 3	3794.95	5yr-12hrSCS	0.31	84.25	84.30	84.29	84.32	0.032843	0.65	0.47	10.54	0.98
Tributary 3	3794.95	2yr-12hrSCS	0.16	84.25	84.28	84.28	84.30	0.038388	0.54	0.30	9.82	1.00
Tributary 3	3785.62*	100yr-12hrSCS	0.85	83.91	83.99	84.01	84.06	0.061698	1.20	0.71	10.19	1.45

HEC-RAS Plan: Existing Con (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Tributary 3	3785.62*	5yr-12hrSCS	0.31	83.91	83.96	83.96	83.99	0.040029	0.75	0.41	8.78	1.10
Tributary 3	3785.62*	2yr-12hrSCS	0.16	83.91	83.93	83.94	84.01	0.407593	1.25	0.13	7.17	2.98
Tributary 3	3776.29*	100yr-12hrSCS	0.85	83.56	83.65	83.69	83.76	0.096042	1.46	0.58	8.64	1.80
Tributary 3	3776.29*	5yr-12hrSCS	0.31	83.56	83.63	83.63	83.66	0.032212	0.74	0.42	7.68	1.01
Tributary 3	3776.29*	2yr-12hrSCS	0.16	83.56	83.61	83.61	83.63	0.045897	0.68	0.24	6.39	1.13
Tributary 3	3766.96*	100yr-12hrSCS	0.85	83.22	83.37	83.37	83.41	0.028741	0.96	0.88	9.95	1.03
Tributary 3	3766.96*	5yr-12hrSCS	0.31	83.22	83.30	83.31	83.34	0.038471	0.82	0.38	6.72	1.11
Tributary 3	3766.96*	2yr-12hrSCS	0.16	83.22	83.29	83.29	83.31	0.028085	0.61	0.26	5.74	0.91
Tributary 3	3757.64	100yr-12hrSCS	0.85	82.88	83.04	83.05	83.10	0.043308	1.11	0.76	9.47	1.25
Tributary 3	3757.64	5yr-12hrSCS	0.31	82.88	82.99	83.00	83.02	0.032123	0.77	0.40	6.86	1.02
Tributary 3	3757.64	2yr-12hrSCS	0.16	82.88	82.97	82.97	82.99	0.022813	0.58	0.28	5.75	0.83
Tributary 3	3748.27*	100yr-12hrSCS	0.85	82.62	82.75	82.80	82.92	0.176689	1.86	0.46	7.48	2.40
Tributary 3	3748.27*	5yr-12hrSCS	0.31	82.62	82.75	82.75	82.77	0.025434	0.70	0.44	7.36	0.91
Tributary 3	3748.27*	2yr-12hrSCS	0.16	82.62	82.71	82.71	82.74	0.034292	0.67	0.24	5.43	1.01
Tributary 3	3738.91*	100yr-12hrSCS	0.85	82.37	82.54	82.54	82.58	0.028710	0.93	0.91	10.74	1.02
Tributary 3	3738.91*	5yr-12hrSCS	0.31	82.37	82.44	82.48	82.63	0.383480	1.92	0.16	4.48	3.24
Tributary 3	3738.91*	2yr-12hrSCS	0.16	82.37	82.41	82.46	83.01	2.545334	3.42	0.05	2.30	7.61
Tributary 3	3729.54*	100yr-12hrSCS	0.85	82.11	82.27	82.29	82.32	0.030332	0.95	0.89	10.59	1.05
Tributary 3	3729.54*	5yr-12hrSCS	0.31	82.11	82.22	82.22	82.25	0.037249	0.79	0.39	7.22	1.08
Tributary 3	3729.54*	2yr-12hrSCS	0.16	82.11	82.19	82.19	82.22	0.053851	0.76	0.21	5.50	1.23
Tributary 3	3720.18	100yr-12hrSCS	0.85	81.86	82.06	82.01	82.07	0.006557	0.55	1.56	13.59	0.51
Tributary 3	3720.18	5yr-12hrSCS	0.31	81.86	81.89	81.95	82.55	2.742320	3.60	0.09	4.08	7.93
Tributary 3	3720.18	2yr-12hrSCS	0.16	81.86	81.95	81.92	81.96	0.008447	0.39	0.42	7.29	0.52
Tributary 3	3710.92*	100yr-12hrSCS	0.85	81.74	81.97		82.00	0.011014	0.72	1.18	9.65	0.65
Tributary 3	3710.92*	5yr-12hrSCS	0.31	81.74	81.89	81.85	81.91	0.011998	0.59	0.52	6.03	0.64
Tributary 3	3710.92*	2yr-12hrSCS	0.16	81.74	81.85	81.82	81.86	0.010962	0.49	0.33	4.73	0.59
Tributary 3	3701.66*	100yr-12hrSCS	0.85	81.62	81.83		81.87	0.015726	0.92	0.92	6.48	0.78
Tributary 3	3701.66*	5yr-12hrSCS	0.31	81.62	81.73		81.76	0.019247	0.75	0.41	4.54	0.80
Tributary 3	3701.66*	2yr-12hrSCS	0.16	81.62	81.69		81.72	0.023976	0.67	0.24	3.79	0.84
Tributary 3	3692.41*	100yr-12hrSCS	0.85	81.49	81.69	81.65	81.73	0.014385	0.91	0.93	5.95	0.74
Tributary 3	3692.41*	5yr-12hrSCS	0.31	81.49	81.61	81.58	81.63	0.010567	0.59	0.52	5.07	0.59
Tributary 3	3692.41*	2yr-12hrSCS	0.16	81.49	81.58	81.55	81.59	0.008300	0.44	0.37	4.70	0.50

HEC-RAS Plan: Existing Con (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Tributary 3	3683.15*	100yr-12hrSCS	0.85	81.37	81.53		81.58	0.018528	0.96	0.88	6.09	0.80
Tributary 3	3683.15*	5yr-12hrSCS	0.31	81.37	81.45	81.45	81.48	0.025475	0.73	0.42	5.52	0.85
Tributary 3	3683.15*	2yr-12hrSCS	0.16	81.37	81.42	81.42	81.44	0.042113	0.67	0.24	5.29	1.00
Tributary 3	3673.9	100yr-12hrSCS	0.85	81.25	81.43		81.45	0.009515	0.74	1.15	6.87	0.57
Tributary 3	3673.9	5yr-12hrSCS	0.31	81.25	81.36	81.31	81.37	0.005747	0.43	0.72	6.62	0.42
Tributary 3	3673.9	2yr-12hrSCS	0.16	81.25	81.34	81.29	81.34	0.003915	0.30	0.54	6.52	0.33
Tributary 3	3664.25*	100yr-12hrSCS	0.85	81.25	81.40		81.41	0.002184	0.33	2.57	17.05	0.27
Tributary 3	3664.25*	5yr-12hrSCS	0.31	81.25	81.34		81.34	0.001887	0.21	1.45	16.70	0.23
Tributary 3	3664.25*	2yr-12hrSCS	0.16	81.25	81.31		81.31	0.001536	0.16	1.04	16.57	0.20
Tributary 3	3654.60*	100yr-12hrSCS	0.85	81.25	81.39		81.39	0.001106	0.22	3.80	27.27	0.19
Tributary 3	3654.60*	5yr-12hrSCS	0.31	81.25	81.32		81.32	0.001319	0.16	1.95	26.79	0.19
Tributary 3	3654.60*	2yr-12hrSCS	0.16	81.25	81.30		81.30	0.001219	0.12	1.35	26.63	0.17
Tributary 3	3644.95*	100yr-12hrSCS	0.85	81.25	81.38		81.39	0.000695	0.17	4.96	37.51	0.15
Tributary 3	3644.95*	5yr-12hrSCS	0.31	81.25	81.31		81.31	0.001255	0.14	2.25	36.87	0.18
Tributary 3	3644.95*	2yr-12hrSCS	0.16	81.25	81.29		81.29	0.001427	0.11	1.47	36.67	0.18
Tributary 3	3635.31	100yr-12hrSCS	0.85	81.25	81.38		81.38	0.000486	0.14	6.08	47.80	0.12
Tributary 3	3635.31	5yr-12hrSCS	0.31	81.25	81.27		81.28	0.020361	0.29	1.07	46.60	0.61
Tributary 3	3635.31	2yr-12hrSCS	0.16	81.25	81.28		81.28	0.003602	0.13	1.22	46.64	0.26
Tributary 3	3625.37*	100yr-12hrSCS	0.85	81.19	81.38		81.38	0.000232	0.13	6.73	36.70	0.09
Tributary 3	3625.37*	5yr-12hrSCS	0.31	81.19	81.25		81.25	0.001342	0.14	2.14	35.49	0.19
Tributary 3	3625.37*	2yr-12hrSCS	0.16	81.19	81.21		81.21	0.025479	0.27	0.60	35.06	0.66
Tributary 3	3615.43*	100yr-12hrSCS	0.85	81.12	81.37		81.37	0.000189	0.14	6.12	25.78	0.09
Tributary 3	3615.43*	5yr-12hrSCS	0.31	81.12	81.24		81.24	0.000297	0.11	2.85	24.54	0.10
Tributary 3	3615.43*	2yr-12hrSCS	0.16	81.12	81.19		81.19	0.000745	0.11	1.46	24.03	0.14
Tributary 3	3605.49*	100yr-12hrSCS	0.85	81.06	81.37		81.37	0.000299	0.20	4.20	15.34	0.12
Tributary 3	3605.49*	5yr-12hrSCS	0.31	81.06	81.24		81.24	0.000250	0.13	2.31	13.82	0.10
Tributary 3	3605.49*	2yr-12hrSCS	0.16	81.06	81.18		81.18	0.000262	0.11	1.52	13.26	0.10
Tributary 3	3595.55	100yr-12hrSCS	0.85	81.00	81.31		81.36	0.011564	0.98	0.87	4.74	0.73
Tributary 3	3595.55	5yr-12hrSCS	0.31	81.00	81.20		81.23	0.011156	0.73	0.42	3.52	0.67
Tributary 3	3595.55	2yr-12hrSCS	0.16	81.00	81.15		81.17	0.011646	0.63	0.26	2.81	0.66
Tributary 3	3585.28*	100yr-12hrSCS	0.85	80.90	81.21		81.25	0.010230	0.86	0.99	5.80	0.66
Tributary 3	3585.28*	5yr-12hrSCS	0.31	80.90	81.11		81.13	0.009598	0.65	0.47	4.00	0.61
Tributary 3	3585.28*	2yr-12hrSCS	0.16	80.90	81.06		81.07	0.010131	0.57	0.29	3.13	0.60

HEC-RAS Plan: Existing Con (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Tributary 3	3575.02*	100yr-12hrSCS	0.85	80.80	81.11		81.14	0.010736	0.81	1.05	6.45	0.64
Tributary 3	3575.02*	5yr-12hrSCS	0.31	80.80	81.01		81.03	0.010506	0.63	0.49	4.26	0.60
Tributary 3	3575.02*	2yr-12hrSCS	0.16	80.80	80.95		80.97	0.010787	0.55	0.29	3.25	0.58
Tributary 3	3564.75*	100yr-12hrSCS	0.85	80.71	81.03	80.95	81.05	0.007608	0.67	1.26	7.56	0.53
Tributary 3	3564.75*	5yr-12hrSCS	0.31	80.71	80.92		80.93	0.007346	0.53	0.58	4.94	0.49
Tributary 3	3564.75*	2yr-12hrSCS	0.16	80.71	80.85		80.87	0.009972	0.52	0.31	3.34	0.55
Tributary 3	3554.49	100yr-12hrSCS	0.85	80.61	80.84	80.84	80.91	0.031708	1.12	0.76	6.01	1.00
Tributary 3	3554.49	5yr-12hrSCS	0.31	80.61	80.75	80.75	80.80	0.036339	0.99	0.31	3.29	1.02
Tributary 3	3554.49	2yr-12hrSCS	0.16	80.61	80.74	80.71	80.76	0.012261	0.56	0.29	3.20	0.59
Tributary 3	3548.69*	100yr-12hrSCS	0.85	80.55	80.80	80.66	80.81	0.002276	0.40	2.14	11.16	0.29
Tributary 3	3548.69*	5yr-12hrSCS	0.31	80.55	80.64	80.63	80.65	0.014119	0.52	0.59	7.99	0.61
Tributary 3	3548.69*	2yr-12hrSCS	0.16	80.55	80.59	80.59	80.61	0.060397	0.66	0.25	7.00	1.12
Tributary 3	3542.89	100yr-12hrSCS	0.85	80.50	80.80		80.80	0.000362	0.18	4.67	19.79	0.12
Tributary 3	3542.89	5yr-12hrSCS	0.31	80.50	80.63		80.64	0.000741	0.17	1.84	14.99	0.15
Tributary 3	3542.89	2yr-12hrSCS	0.16	80.50	80.57	80.53	80.58	0.001517	0.17	0.98	13.82	0.20
Tributary 3	3534.04	100yr-12hrSCS	0.85	80.25	80.71	80.68	80.78	0.014838	1.21	0.70	3.26	0.83
Tributary 3	3534.04	5yr-12hrSCS	0.31	80.25	80.58		80.62	0.011863	0.89	0.34	2.13	0.71
Tributary 3	3534.04	2yr-12hrSCS	0.16	80.25	80.52		80.54	0.008215	0.68	0.24	1.67	0.58
Tributary 3	3526.39*	100yr-12hrSCS	0.85	80.20	80.56	80.56	80.65	0.022586	1.32	0.64	3.71	1.01
Tributary 3	3526.39*	5yr-12hrSCS	0.31	80.20	80.46	80.46	80.50	0.019218	0.96	0.32	2.66	0.88
Tributary 3	3526.39*	2yr-12hrSCS	0.16	80.20	80.39	80.39	80.44	0.027365	0.95	0.17	1.85	1.00
Tributary 3	3518.74	100yr-12hrSCS	0.85	80.16	80.49	80.41	80.53	0.006849	0.88	0.96	4.11	0.58
Tributary 3	3518.74	5yr-12hrSCS	0.31	80.16	80.27	80.31	80.42	0.156210	1.72	0.18	3.00	2.25
Tributary 3	3518.74	2yr-12hrSCS	0.16	80.16	80.22	80.28	80.73	1.382297	3.17	0.05	1.76	5.94
Tributary 3	3509.46*	100yr-12hrSCS	0.85	80.09	80.43		80.47	0.006580	0.87	0.98	4.20	0.57
Tributary 3	3509.46*	5yr-12hrSCS	0.31	80.09	80.30	80.25	80.32	0.006867	0.63	0.49	3.51	0.54
Tributary 3	3509.46*	2yr-12hrSCS	0.16	80.09	80.25	80.22	80.26	0.007797	0.52	0.31	3.23	0.54
Tributary 3	3500.18*	100yr-12hrSCS	0.85	80.02	80.37		80.41	0.005881	0.83	1.03	4.35	0.54
Tributary 3	3500.18*	5yr-12hrSCS	0.31	80.02	80.24		80.26	0.006095	0.61	0.51	3.56	0.51
Tributary 3	3500.18*	2yr-12hrSCS	0.16	80.02	80.19		80.20	0.006762	0.50	0.32	3.24	0.51
Tributary 3	3490.90*	100yr-12hrSCS	0.85	79.96	80.33		80.36	0.004671	0.75	1.13	4.62	0.49
Tributary 3	3490.90*	5yr-12hrSCS	0.31	79.96	80.20		80.22	0.003866	0.52	0.60	3.74	0.41

HEC-RAS Plan: Existing Con (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Tributary 3	3490.90*	2yr-12hrSCS	0.16	79.96	80.15		80.16	0.003512	0.41	0.40	3.38	0.38
Tributary 3	3481.62*	100yr-12hrSCS	0.85	79.89	80.30		80.32	0.003193	0.65	1.31	5.07	0.41
Tributary 3	3481.62*	5yr-12hrSCS	0.31	79.89	80.18		80.19	0.001903	0.40	0.77	4.14	0.30
Tributary 3	3481.62*	2yr-12hrSCS	0.16	79.89	80.14		80.14	0.001226	0.28	0.57	3.75	0.23
Tributary 3	3472.34*	100yr-12hrSCS	0.85	79.82	80.28		80.30	0.002075	0.53	1.61	6.13	0.33
Tributary 3	3472.34*	5yr-12hrSCS	0.31	79.82	80.18		80.18	0.000890	0.30	1.02	4.80	0.21
Tributary 3	3472.34*	2yr-12hrSCS	0.16	79.82	80.13		80.13	0.000469	0.20	0.81	4.38	0.15
Tributary 3	3463.06*	100yr-12hrSCS	0.85	79.76	80.27		80.28	0.001155	0.40	2.10	7.77	0.25
Tributary 3	3463.06*	5yr-12hrSCS	0.31	79.76	80.17		80.17	0.000444	0.22	1.39	6.12	0.15
Tributary 3	3463.06*	2yr-12hrSCS	0.16	79.76	80.13		80.13	0.000205	0.14	1.13	5.43	0.10
Tributary 3	3453.78*	100yr-12hrSCS	0.85	79.69	80.27		80.27	0.000646	0.30	2.85	10.77	0.18
Tributary 3	3453.78*	5yr-12hrSCS	0.31	79.69	80.17		80.17	0.000204	0.16	1.94	7.96	0.10
Tributary 3	3453.78*	2yr-12hrSCS	0.16	79.69	80.13		80.13	0.000091	0.10	1.62	7.23	0.07
Tributary 3	3444.51	100yr-12hrSCS	0.85	79.62	80.27		80.27	0.000296	0.20	4.25	16.41	0.12
Tributary 3	3444.51	5yr-12hrSCS	0.31	79.62	80.17		80.17	0.000101	0.11	2.85	12.27	0.07
Tributary 3	3444.51	2yr-12hrSCS	0.16	79.62	80.13		80.13	0.000042	0.07	2.36	10.53	0.05
Tributary 3	3435.9*	100yr-12hrSCS	0.85	79.81	80.26		80.27	0.000682	0.27	3.12	14.16	0.18
Tributary 3	3435.9*	5yr-12hrSCS	0.31	79.81	80.17		80.17	0.000280	0.16	1.96	10.36	0.12
Tributary 3	3435.9*	2yr-12hrSCS	0.16	79.81	80.13		80.13	0.000135	0.10	1.56	8.91	0.08
Tributary 3	3427.29	100yr-12hrSCS	0.85	80.00	80.24		80.25	0.003487	0.49	1.73	11.07	0.39
Tributary 3	3427.29	5yr-12hrSCS	0.31	80.00	80.16		80.16	0.002596	0.34	0.91	8.18	0.32
Tributary 3	3427.29	2yr-12hrSCS	0.16	80.00	80.12		80.12	0.002029	0.26	0.63	7.09	0.27
Tributary 3	3419.8*	100yr-12hrSCS	0.85	80.00	80.22		80.23	0.003077	0.45	1.88	12.37	0.37
Tributary 3	3419.8*	5yr-12hrSCS	0.31	80.00	80.14		80.14	0.002281	0.30	1.01	9.57	0.30
Tributary 3	3419.8*	2yr-12hrSCS	0.16	80.00	80.11		80.11	0.001711	0.23	0.71	8.49	0.25
Tributary 3	3412.31*	100yr-12hrSCS	0.85	80.00	80.20		80.21	0.002989	0.43	1.97	13.69	0.36
Tributary 3	3412.31*	5yr-12hrSCS	0.31	80.00	80.12		80.13	0.002262	0.29	1.07	10.91	0.29
Tributary 3	3412.31*	2yr-12hrSCS	0.16	80.00	80.09		80.10	0.001639	0.21	0.77	9.87	0.24
Tributary 3	3404.82*	100yr-12hrSCS	0.85	80.00	80.17		80.18	0.003265	0.43	1.99	14.91	0.37
Tributary 3	3404.82*	5yr-12hrSCS	0.31	80.00	80.10		80.11	0.002734	0.29	1.05	12.13	0.32
Tributary 3	3404.82*	2yr-12hrSCS	0.16	80.00	80.08		80.09	0.001698	0.20	0.80	11.27	0.24
Tributary 3	3397.33	100yr-12hrSCS	0.85	80.00	80.09	80.08	80.12	0.028294	0.85	0.99	13.26	1.00

HEC-RAS Plan: Existing Con (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Tributary 3	3397.33	5yr-12hrSCS	0.31	80.00	80.07		80.08	0.008407	0.41	0.76	12.47	0.52
Tributary 3	3397.33	2yr-12hrSCS	0.16	80.00	80.04		80.05	0.022537	0.44	0.37	11.02	0.78
Tributary 3	3387.68*	100yr-12hrSCS	0.85	79.85	80.03		80.04	0.003940	0.49	1.72	11.86	0.41
Tributary 3	3387.68*	5yr-12hrSCS	0.31	79.85	79.90	79.90	79.93	0.032680	0.70	0.44	8.91	1.00
Tributary 3	3387.68*	2yr-12hrSCS	0.16	79.85	79.90		79.91	0.010949	0.39	0.42	8.84	0.57
Tributary 3	3378.03*	100yr-12hrSCS	0.85	79.70	80.02		80.02	0.000864	0.32	2.63	10.96	0.21
Tributary 3	3378.03*	5yr-12hrSCS	0.31	79.70	79.81	79.76	79.82	0.005119	0.43	0.72	7.51	0.44
Tributary 3	3378.03*	2yr-12hrSCS	0.16	79.70	79.75	79.75	79.76	0.025353	0.57	0.29	6.53	0.86
Tributary 3	3368.39*	100yr-12hrSCS	0.85	79.55	80.01		80.02	0.000433	0.28	3.06	9.51	0.16
Tributary 3	3368.39*	5yr-12hrSCS	0.31	79.55	79.80		79.80	0.000554	0.23	1.35	6.81	0.16
Tributary 3	3368.39*	2yr-12hrSCS	0.16	79.55	79.71	79.60	79.71	0.000816	0.21	0.77	5.76	0.19
Tributary 3	3358.74*	100yr-12hrSCS	0.85	79.40	80.01		80.01	0.000391	0.29	2.91	7.72	0.15
Tributary 3	3358.74*	5yr-12hrSCS	0.31	79.40	79.80		79.80	0.000286	0.20	1.52	5.55	0.12
Tributary 3	3358.74*	2yr-12hrSCS	0.16	79.40	79.70		79.71	0.000225	0.15	1.05	4.74	0.11
Tributary 3	3349.1	100yr-12hrSCS	0.85	79.25	80.00		80.01	0.000750	0.40	2.14	5.70	0.21
Tributary 3	3349.1	5yr-12hrSCS	0.31	79.25	79.79		79.80	0.000499	0.27	1.14	3.98	0.16
Tributary 3	3349.1	2yr-12hrSCS	0.16	79.25	79.70		79.70	0.000336	0.20	0.81	3.30	0.13
Tributary 3	3342.86*	100yr-12hrSCS	0.85	79.33	79.98		80.00	0.001742	0.53	1.61	5.27	0.31
Tributary 3	3342.86*	5yr-12hrSCS	0.31	79.33	79.78		79.79	0.001420	0.40	0.76	3.18	0.26
Tributary 3	3342.86*	2yr-12hrSCS	0.16	79.33	79.69		79.70	0.001171	0.32	0.51	2.60	0.23
Tributary 3	3336.63	100yr-12hrSCS	0.85	79.40	79.84	79.84	79.96	0.021047	1.55	0.55	2.23	1.00
Tributary 3	3336.63	5yr-12hrSCS	0.31	79.40	79.68	79.68	79.76	0.024023	1.24	0.25	1.59	1.00
Tributary 3	3336.63	2yr-12hrSCS	0.16	79.40	79.62	79.62	79.67	0.026265	1.06	0.15	1.31	1.00
Tributary 3	3327.51*	100yr-12hrSCS	0.85	79.24	79.56	79.60	79.72	0.033127	1.77	0.48	2.26	1.23
Tributary 3	3327.51*	5yr-12hrSCS	0.31	79.24	79.44	79.45	79.53	0.030754	1.31	0.23	1.65	1.11
Tributary 3	3327.51*	2yr-12hrSCS	0.16	79.24	79.39	79.40	79.44	0.026511	1.05	0.15	1.38	1.00
Tributary 3	3318.4*	100yr-12hrSCS	0.85	79.07	79.36	79.37	79.48	0.022907	1.51	0.56	2.55	1.03
Tributary 3	3318.4*	5yr-12hrSCS	0.31	79.07	79.21	79.23	79.31	0.042281	1.37	0.22	1.91	1.28
Tributary 3	3318.4*	2yr-12hrSCS	0.16	79.07	79.16	79.18	79.24	0.071526	1.31	0.12	1.68	1.55
Tributary 3	3309.28*	100yr-12hrSCS	0.85	78.91	79.14	79.15	79.26	0.028365	1.54	0.55	2.88	1.13
Tributary 3	3309.28*	5yr-12hrSCS	0.31	78.91	78.95	79.04	79.61	1.216703	3.60	0.09	2.20	5.81
Tributary 3	3309.28*	2yr-12hrSCS	0.16	78.91	79.01	78.99	79.04	0.016029	0.73	0.22	2.40	0.76

HEC-RAS Plan: Existing Con (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Tributary 3	3300.17	100yr-12hrSCS	0.85	78.75	78.94	78.96	79.05	0.031713	1.50	0.56	3.36	1.17
Tributary 3	3300.17	5yr-12hrSCS	0.31	78.75	78.85	78.87	78.91	0.030091	1.03	0.30	3.07	1.05
Tributary 3	3300.17	2yr-12hrSCS	0.16	78.75	78.82	78.82	78.85	0.030444	0.81	0.20	2.97	1.00
Tributary 3	3291.61*	100yr-12hrSCS	0.85	78.38	78.55	78.59	78.71	0.048266	1.79	0.47	3.03	1.44
Tributary 3	3291.61*	5yr-12hrSCS	0.31	78.38	78.47	78.49	78.55	0.056382	1.30	0.24	2.75	1.42
Tributary 3	3291.61*	2yr-12hrSCS	0.16	78.38	78.44	78.45	78.49	0.060384	1.05	0.15	2.65	1.38
Tributary 3	3283.05	100yr-12hrSCS	0.85	78.00	78.20	78.23	78.34	0.037158	1.65	0.51	3.03	1.28
Tributary 3	3283.05	5yr-12hrSCS	0.31	78.00	78.11	78.13	78.18	0.033192	1.13	0.27	2.65	1.12
Tributary 3	3283.05	2yr-12hrSCS	0.16	78.00	78.07	78.08	78.12	0.059117	1.08	0.15	2.44	1.38
Tributary 3	3277.27*	100yr-12hrSCS	0.85	77.87	78.07	78.08	78.17	0.026561	1.40	0.61	3.62	1.09
Tributary 3	3277.27*	5yr-12hrSCS	0.31	77.87	77.92	77.98	78.21	0.413607	2.37	0.13	2.79	3.50
Tributary 3	3277.27*	2yr-12hrSCS	0.16	77.87	77.94	77.94	77.98	0.040926	0.90	0.18	2.88	1.15
Tributary 3	3271.49	100yr-12hrSCS	0.99	77.75	78.00	77.96	78.06	0.011384	1.05	0.94	4.58	0.74
Tributary 3	3271.49	5yr-12hrSCS	0.37	77.75	77.89	77.86	77.92	0.012931	0.79	0.46	3.82	0.72
Tributary 3	3271.49	2yr-12hrSCS	0.20	77.75	77.81	77.84	77.87	0.077486	1.12	0.17	3.26	1.55
Tributary 3	3261.21*	100yr-12hrSCS	0.99	77.64	77.92		77.97	0.008583	0.96	1.03	4.60	0.65
Tributary 3	3261.21*	5yr-12hrSCS	0.37	77.64	77.81		77.83	0.007481	0.67	0.55	3.80	0.56
Tributary 3	3261.21*	2yr-12hrSCS	0.20	77.64	77.76	77.72	77.77	0.006391	0.52	0.38	3.47	0.50
Tributary 3	3250.94*	100yr-12hrSCS	0.99	77.52	77.75	77.75	77.85	0.021710	1.34	0.74	4.03	1.00
Tributary 3	3250.94*	5yr-12hrSCS	0.37	77.52	77.65	77.65	77.70	0.025775	1.04	0.35	3.22	1.00
Tributary 3	3250.94*	2yr-12hrSCS	0.20	77.52	77.60	77.60	77.65	0.036489	0.94	0.21	2.86	1.12
Tributary 3	3246.09		Culvert									
Tributary 3	3209.85*	100yr-12hrSCS	0.99	77.07	77.41		77.46	0.010720	1.06	0.93	4.22	0.72
Tributary 3	3209.85*	5yr-12hrSCS	0.37	77.07	77.27		77.30	0.011008	0.84	0.43	2.82	0.68
Tributary 3	3209.85*	2yr-12hrSCS	0.20	77.07	77.20		77.23	0.010928	0.71	0.27	2.28	0.66
Tributary 3	3199.58*	100yr-12hrSCS	0.99	76.95	77.31		77.37	0.010728	1.06	0.93	4.22	0.72
Tributary 3	3199.58*	5yr-12hrSCS	0.37	76.95	77.17		77.20	0.011044	0.85	0.43	2.71	0.69
Tributary 3	3199.58*	2yr-12hrSCS	0.20	76.95	77.10		77.12	0.010783	0.73	0.27	2.12	0.65
Tributary 3	3189.31*	100yr-12hrSCS	0.99	76.84	77.21		77.27	0.010700	1.05	0.94	4.25	0.72
Tributary 3	3189.31*	5yr-12hrSCS	0.37	76.84	77.07		77.10	0.010966	0.86	0.42	2.61	0.68
Tributary 3	3189.31*	2yr-12hrSCS	0.20	76.84	76.99		77.02	0.011678	0.76	0.26	2.00	0.68
Tributary 3	3179.04*	100yr-12hrSCS	0.99	76.73	77.12		77.17	0.010301	1.03	0.96	4.37	0.70

HEC-RAS Plan: Existing Con (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Tributary 3	3179.04*	5yr-12hrSCS	0.37	76.73	76.97		77.01	0.010687	0.87	0.42	2.54	0.68
Tributary 3	3179.04*	2yr-12hrSCS	0.20	76.73	76.88		76.92	0.012371	0.79	0.25	1.89	0.70
Tributary 3	3168.77*	100yr-12hrSCS	0.99	76.61	77.04		77.09	0.008523	0.94	1.05	4.73	0.64
Tributary 3	3168.77*	5yr-12hrSCS	0.37	76.61	76.88		76.92	0.008943	0.80	0.46	2.69	0.62
Tributary 3	3168.77*	2yr-12hrSCS	0.20	76.61	76.80		76.82	0.008930	0.72	0.27	1.87	0.60
Tributary 3	3158.5	100yr-12hrSCS	0.99	76.50	76.87	76.87	76.96	0.022807	1.33	0.74	4.11	1.01
Tributary 3	3158.5	5yr-12hrSCS	0.37	76.50	76.72	76.71	76.79	0.021940	1.20	0.31	1.88	0.95
Tributary 3	3158.5	2yr-12hrSCS	0.20	76.50	76.66	76.65	76.71	0.021562	0.99	0.20	1.61	0.91
Tributary 3	3150.03*	100yr-12hrSCS	0.99	76.31	76.67	76.67	76.77	0.025833	1.41	0.70	3.97	1.07
Tributary 3	3150.03*	5yr-12hrSCS	0.37	76.31	76.52	76.52	76.60	0.024159	1.24	0.30	1.88	1.00
Tributary 3	3150.03*	2yr-12hrSCS	0.20	76.31	76.46	76.46	76.51	0.025588	1.05	0.19	1.58	0.98
Tributary 3	3141.57*	100yr-12hrSCS	0.99	76.13	76.48	76.49	76.58	0.026202	1.41	0.70	4.01	1.08
Tributary 3	3141.57*	5yr-12hrSCS	0.37	76.13	76.34	76.33	76.41	0.022915	1.19	0.31	2.01	0.97
Tributary 3	3141.57*	2yr-12hrSCS	0.20	76.13	76.28	76.27	76.32	0.020882	0.98	0.20	1.63	0.90
Tributary 3	3133.10*	100yr-12hrSCS	0.99	75.94	76.28	76.30	76.39	0.027826	1.42	0.69	4.11	1.11
Tributary 3	3133.10*	5yr-12hrSCS	0.37	75.94	76.14	76.14	76.22	0.023935	1.23	0.30	1.95	1.00
Tributary 3	3133.10*	2yr-12hrSCS	0.20	75.94	76.08	76.08	76.13	0.026180	1.06	0.18	1.62	1.00
Tributary 3	3124.64	100yr-12hrSCS	0.99	75.75	76.15	76.12	76.21	0.015108	1.07	0.92	5.32	0.82
Tributary 3	3124.64	5yr-12hrSCS	0.37	75.75	75.99	75.95	76.04	0.012128	1.00	0.37	1.91	0.73
Tributary 3	3124.64	2yr-12hrSCS	0.20	75.75	75.85	75.88	75.97	0.078747	1.54	0.13	1.44	1.66
Tributary 3	3115.64*	100yr-12hrSCS	0.99	75.67	76.03		76.08	0.012572	0.98	1.00	5.77	0.75
Tributary 3	3115.64*	5yr-12hrSCS	0.37	75.67	75.90		75.94	0.011063	0.83	0.44	2.96	0.68
Tributary 3	3115.64*	2yr-12hrSCS	0.20	75.67	75.83	75.79	75.86	0.010193	0.71	0.27	2.15	0.64
Tributary 3	3106.64*	100yr-12hrSCS	0.99	75.58	75.92		75.97	0.011322	0.92	1.08	6.42	0.71
Tributary 3	3106.64*	5yr-12hrSCS	0.37	75.58	75.81		75.84	0.010363	0.74	0.50	3.83	0.65
Tributary 3	3106.64*	2yr-12hrSCS	0.20	75.58	75.74		75.76	0.010344	0.69	0.28	2.41	0.64
Tributary 3	3097.65*	100yr-12hrSCS	0.99	75.50	75.83		75.87	0.010162	0.85	1.17	7.26	0.67
Tributary 3	3097.65*	5yr-12hrSCS	0.37	75.50	75.72		75.75	0.010008	0.69	0.53	4.35	0.64
Tributary 3	3097.65*	2yr-12hrSCS	0.20	75.50	75.65		75.67	0.009830	0.69	0.28	2.33	0.63
Tributary 3	3088.65*	100yr-12hrSCS	0.99	75.42	75.74		75.77	0.009708	0.79	1.24	8.22	0.65
Tributary 3	3088.65*	5yr-12hrSCS	0.37	75.42	75.62		75.65	0.011671	0.77	0.48	3.81	0.69
Tributary 3	3088.65*	2yr-12hrSCS	0.20	75.42	75.56		75.58	0.010162	0.66	0.29	2.61	0.63

HEC-RAS Plan: Existing Con (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Tributary 3	3079.65*	100yr-12hrSCS	0.99	75.33	75.67		75.70	0.007582	0.68	1.46	10.20	0.57
Tributary 3	3079.65*	5yr-12hrSCS	0.37	75.33	75.53		75.56	0.008807	0.75	0.49	3.21	0.62
Tributary 3	3079.65*	2yr-12hrSCS	0.20	75.33	75.47		75.49	0.009351	0.64	0.31	2.74	0.61
Tributary 3	3070.66	100yr-12hrSCS	0.99	75.25	75.55	75.54	75.59	0.019745	0.91	1.09	10.05	0.88
Tributary 3	3070.66	5yr-12hrSCS	0.37	75.25	75.41		75.45	0.014681	0.91	0.40	2.91	0.78
Tributary 3	3070.66	2yr-12hrSCS	0.20	75.25	75.37		75.39	0.012655	0.70	0.28	2.67	0.70
Tributary 3	3062.05*	100yr-12hrSCS	0.99	75.15	75.41		75.45	0.015610	0.84	1.18	10.38	0.79
Tributary 3	3062.05*	5yr-12hrSCS	0.37	75.15	75.30		75.33	0.013644	0.78	0.47	4.19	0.74
Tributary 3	3062.05*	2yr-12hrSCS	0.20	75.15	75.26		75.28	0.013839	0.65	0.30	3.55	0.71
Tributary 3	3053.45*	100yr-12hrSCS	0.99	75.05	75.29	75.26	75.32	0.014136	0.78	1.26	11.29	0.75
Tributary 3	3053.45*	5yr-12hrSCS	0.37	75.05	75.20		75.22	0.011346	0.66	0.55	5.43	0.66
Tributary 3	3053.45*	2yr-12hrSCS	0.20	75.05	75.16		75.18	0.010613	0.54	0.36	4.54	0.61
Tributary 3	3044.84*	100yr-12hrSCS	0.99	74.95	75.15		75.19	0.017254	0.82	1.20	11.72	0.82
Tributary 3	3044.84*	5yr-12hrSCS	0.37	74.95	75.08		75.11	0.014124	0.66	0.55	6.46	0.72
Tributary 3	3044.84*	2yr-12hrSCS	0.20	74.95	75.05		75.06	0.015738	0.58	0.33	5.06	0.73
Tributary 3	3036.24*	100yr-12hrSCS	0.99	74.85	75.06	75.02	75.08	0.009601	0.64	1.54	13.99	0.62
Tributary 3	3036.24*	5yr-12hrSCS	0.37	74.85	74.98		75.00	0.011650	0.55	0.67	8.87	0.64
Tributary 3	3036.24*	2yr-12hrSCS	0.20	74.85	74.96		74.97	0.008221	0.42	0.46	7.01	0.53
Tributary 3	3027.64	100yr-12hrSCS	0.99	74.75	74.90	74.90	74.95	0.026587	0.91	1.08	12.54	0.99
Tributary 3	3027.64	5yr-12hrSCS	0.37	74.75	74.86		74.88	0.018306	0.62	0.59	9.25	0.78
Tributary 3	3027.64	2yr-12hrSCS	0.20	74.75	74.82	74.82	74.84	0.033597	0.67	0.29	6.43	1.00
Tributary 3	3020.29*	100yr-12hrSCS	0.99	74.55	74.86		74.88	0.004079	0.56	1.76	10.36	0.43
Tributary 3	3020.29*	5yr-12hrSCS	0.37	74.55	74.67	74.67	74.71	0.029508	0.92	0.40	4.89	1.03
Tributary 3	3020.29*	2yr-12hrSCS	0.20	74.55	74.65	74.66	74.67	0.018305	0.64	0.30	4.43	0.79
Tributary 3	3012.94*	100yr-12hrSCS	0.99	74.35	74.85		74.86	0.001338	0.40	2.45	10.22	0.26
Tributary 3	3012.94*	5yr-12hrSCS	0.37	74.35	74.63	74.50	74.64	0.001787	0.39	0.95	5.19	0.29
Tributary 3	3012.94*	2yr-12hrSCS	0.20	74.35	74.54	74.45	74.55	0.002651	0.37	0.52	4.09	0.33
Tributary 3	3005.6	100yr-12hrSCS	1.01	74.15	74.84		74.85	0.000924	0.36	2.83	10.56	0.22
Tributary 3	3005.6	5yr-12hrSCS	0.38	74.15	74.63		74.63	0.000486	0.27	1.38	4.79	0.16
Tributary 3	3005.6	2yr-12hrSCS	0.20	74.15	74.54		74.54	0.000352	0.20	0.98	4.12	0.13
Tributary 2	2310.70	100yr-12hrSCS	1.90	88.99	89.10	89.06	89.10	0.006464	0.43	4.37	46.94	0.45
Tributary 2	2310.70	5yr-12hrSCS	0.72	88.99	89.05	89.03	89.05	0.010302	0.35	2.09	45.04	0.51
Tributary 2	2310.70	2yr-12hrSCS	0.40	88.99	89.03	89.01	89.03	0.013648	0.30	1.33	44.28	0.55

HEC-RAS Plan: Existing Con (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Tributary 2	2305.00	100yr-12hrSCS	1.90	88.88	89.00	88.99	89.03	0.026566	0.79	2.41	30.49	0.90
Tributary 2	2305.00	5yr-12hrSCS	0.72	88.88	88.97		88.98	0.016998	0.49	1.47	27.33	0.67
Tributary 2	2305.00	2yr-12hrSCS	0.40	88.88	88.95		88.96	0.012552	0.36	1.10	25.93	0.56
Tributary 2	2295.00	100yr-12hrSCS	1.90	88.68	88.85		88.88	0.010821	0.67	2.82	23.11	0.62
Tributary 2	2295.00	5yr-12hrSCS	0.72	88.68	88.77		88.79	0.022748	0.63	1.14	17.99	0.80
Tributary 2	2295.00	2yr-12hrSCS	0.40	88.68	88.74	88.74	88.76	0.033900	0.58	0.68	16.22	0.91
Tributary 2	2285.00	100yr-12hrSCS	1.90	88.50	88.78		88.80	0.005886	0.60	3.15	19.39	0.48
Tributary 2	2285.00	5yr-12hrSCS	0.72	88.50	88.68		88.69	0.005927	0.48	1.51	13.18	0.45
Tributary 2	2285.00	2yr-12hrSCS	0.40	88.50	88.63		88.64	0.006095	0.41	0.96	10.58	0.44
Tributary 2	2275.00	100yr-12hrSCS	1.90	88.43	88.70		88.72	0.009267	0.75	2.55	15.94	0.60
Tributary 2	2275.00	5yr-12hrSCS	0.72	88.43	88.60		88.62	0.008835	0.57	1.28	11.68	0.55
Tributary 2	2275.00	2yr-12hrSCS	0.40	88.43	88.56		88.57	0.009342	0.49	0.81	9.72	0.54
Tributary 2	2265.00	100yr-12hrSCS	1.90	88.31	88.57		88.61	0.013689	0.99	2.20	18.55	0.74
Tributary 2	2265.00	5yr-12hrSCS	0.72	88.31	88.50		88.52	0.011902	0.67	1.10	12.10	0.64
Tributary 2	2265.00	2yr-12hrSCS	0.40	88.31	88.46		88.47	0.009940	0.53	0.74	8.10	0.56
Tributary 2	2255.00	100yr-12hrSCS	1.90	88.20	88.47		88.49	0.009152	0.69	2.73	18.87	0.58
Tributary 2	2255.00	5yr-12hrSCS	0.72	88.20	88.39		88.40	0.010971	0.54	1.34	15.40	0.59
Tributary 2	2255.00	2yr-12hrSCS	0.40	88.20	88.35		88.36	0.012179	0.48	0.82	12.18	0.59
Tributary 2	2245.00	100yr-12hrSCS	1.90	88.08	88.33		88.37	0.013578	0.94	2.13	15.75	0.73
Tributary 2	2245.00	5yr-12hrSCS	0.72	88.08	88.25		88.28	0.014809	0.66	1.09	11.63	0.69
Tributary 2	2245.00	2yr-12hrSCS	0.40	88.08	88.22	88.19	88.24	0.011820	0.52	0.76	9.76	0.60
Tributary 2	2235.00	100yr-12hrSCS	1.90	87.94	88.19		88.24	0.012634	0.99	2.05	13.66	0.72
Tributary 2	2235.00	5yr-12hrSCS	0.72	87.94	88.11		88.13	0.013785	0.71	1.02	9.72	0.68
Tributary 2	2235.00	2yr-12hrSCS	0.40	87.94	88.06		88.08	0.020716	0.68	0.58	7.53	0.78
Tributary 2	2225.00	100yr-12hrSCS	1.90	87.77	88.09		88.13	0.009434	1.00	2.50	21.26	0.64
Tributary 2	2225.00	5yr-12hrSCS	0.72	87.77	87.99		88.02	0.009449	0.73	0.98	6.22	0.59
Tributary 2	2225.00	2yr-12hrSCS	0.40	87.77	87.94		87.96	0.008159	0.59	0.67	5.27	0.53
Tributary 2	2215.00	100yr-12hrSCS	1.90	87.59	87.92	87.91	87.99	0.021553	1.15	1.65	10.15	0.91
Tributary 2	2215.00	5yr-12hrSCS	0.72	87.59	87.81	87.81	87.86	0.030622	1.01	0.71	6.86	1.00
Tributary 2	2215.00	2yr-12hrSCS	0.40	87.59	87.77	87.77	87.81	0.033571	0.86	0.46	5.99	0.99
Tributary 2	2205.00	100yr-12hrSCS	1.90	87.50	87.85		87.88	0.005563	0.75	2.53	10.70	0.49
Tributary 2	2205.00	5yr-12hrSCS	0.72	87.50	87.74	87.63	87.75	0.003163	0.48	1.52	8.26	0.35

HEC-RAS Plan: Existing Con (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Tributary 2	2205.00	2yr-12hrSCS	0.40	87.50	87.69	87.59	87.70	0.002345	0.36	1.11	7.40	0.30
Tributary 2	2195.00	100yr-12hrSCS	1.90	87.50	87.83		87.84	0.002490	0.44	4.36	22.77	0.32
Tributary 2	2195.00	5yr-12hrSCS	0.72	87.50	87.72		87.73	0.002201	0.32	2.23	16.51	0.28
Tributary 2	2195.00	2yr-12hrSCS	0.40	87.50	87.67		87.67	0.002049	0.27	1.47	13.61	0.26
Tributary 2	2185.00	100yr-12hrSCS	1.90	87.50	87.79		87.81	0.003868	0.54	3.52	18.64	0.40
Tributary 2	2185.00	5yr-12hrSCS	0.72	87.50	87.69		87.70	0.002986	0.38	1.90	14.00	0.33
Tributary 2	2185.00	2yr-12hrSCS	0.40	87.50	87.65		87.65	0.002483	0.30	1.32	12.06	0.29
Tributary 2	2175.00	100yr-12hrSCS	1.90	87.50	87.74		87.76	0.005737	0.62	3.06	17.56	0.48
Tributary 2	2175.00	5yr-12hrSCS	0.72	87.50	87.65		87.66	0.004635	0.43	1.66	13.90	0.40
Tributary 2	2175.00	2yr-12hrSCS	0.40	87.50	87.62		87.62	0.003818	0.34	1.17	12.38	0.35
Tributary 2	2165.00	100yr-12hrSCS	1.90	87.45	87.63		87.67	0.015879	0.84	2.25	17.47	0.75
Tributary 2	2165.00	5yr-12hrSCS	0.72	87.45	87.57		87.59	0.013009	0.58	1.25	14.89	0.63
Tributary 2	2165.00	2yr-12hrSCS	0.40	87.45	87.55		87.56	0.010642	0.44	0.90	13.83	0.55
Tributary 2	2155.00	100yr-12hrSCS	1.90	87.25	87.45		87.49	0.021501	0.90	2.10	18.52	0.86
Tributary 2	2155.00	5yr-12hrSCS	0.72	87.25	87.38	87.38	87.41	0.027408	0.72	1.00	14.70	0.89
Tributary 2	2155.00	2yr-12hrSCS	0.40	87.25	87.35	87.35	87.38	0.043230	0.71	0.56	12.12	1.05
Tributary 2	2145.00	100yr-12hrSCS	1.90	87.06	87.38		87.40	0.004536	0.57	3.30	17.88	0.43
Tributary 2	2145.00	5yr-12hrSCS	0.72	87.06	87.12	87.21	87.86	1.727271	3.81	0.19	5.17	6.36
Tributary 2	2145.00	2yr-12hrSCS	0.40	87.06	87.22	87.17	87.23	0.005933	0.41	0.96	10.53	0.43
Tributary 2	2135.00	100yr-12hrSCS	1.90	87.00	87.35		87.36	0.002798	0.51	3.74	16.97	0.35
Tributary 2	2135.00	5yr-12hrSCS	0.72	87.00	87.25	87.11	87.26	0.001566	0.32	2.26	13.22	0.25
Tributary 2	2135.00	2yr-12hrSCS	0.40	87.00	87.20		87.20	0.001190	0.24	1.62	11.58	0.21
Tributary 2	2125.00	100yr-12hrSCS	1.90	87.00	87.32		87.33	0.003411	0.48	3.94	22.51	0.37
Tributary 2	2125.00	5yr-12hrSCS	0.72	87.00	87.23		87.24	0.002397	0.33	2.19	16.86	0.29
Tributary 2	2125.00	2yr-12hrSCS	0.40	87.00	87.18		87.19	0.002175	0.27	1.45	13.78	0.27
Tributary 2	2115.00	100yr-12hrSCS	1.90	87.00	87.26		87.28	0.007172	0.65	3.15	27.08	0.52
Tributary 2	2115.00	5yr-12hrSCS	0.72	87.00	87.19		87.20	0.004948	0.43	1.67	14.84	0.41
Tributary 2	2115.00	2yr-12hrSCS	0.40	87.00	87.15		87.15	0.004880	0.37	1.07	11.82	0.39
Tributary 2	2105.00	100yr-12hrSCS	1.90	87.00	87.13	87.13	87.18	0.031410	0.95	2.01	21.99	1.00
Tributary 2	2105.00	5yr-12hrSCS	0.72	87.00	87.08	87.08	87.11	0.041207	0.75	0.96	18.25	1.04
Tributary 2	2105.00	2yr-12hrSCS	0.40	87.00	87.07	87.07	87.09	0.018658	0.47	0.84	17.45	0.69
Tributary 2	2096.37	100yr-12hrSCS	1.90	86.56	87.03	86.97	87.06	0.004835	0.87	3.01	23.90	0.51

HEC-RAS Plan: Existing Con (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Tributary 2	2096.37	5yr-12hrSCS	0.72	86.56	86.94	86.83	86.96	0.003166	0.56	1.38	9.89	0.39
Tributary 2	2096.37	2yr-12hrSCS	0.40	86.56	86.90	86.77	86.91	0.001948	0.39	1.03	6.80	0.30
Tributary 2	2087.51*	100yr-12hrSCS	1.90	86.60	87.02		87.03	0.001942	0.49	3.90	17.16	0.31
Tributary 2	2087.51*	5yr-12hrSCS	0.72	86.60	86.93		86.94	0.000979	0.28	2.61	14.54	0.21
Tributary 2	2087.51*	2yr-12hrSCS	0.40	86.60	86.89		86.89	0.000629	0.20	2.03	13.68	0.16
Tributary 2	2078.65*	100yr-12hrSCS	1.90	86.63	87.01		87.01	0.001366	0.37	5.19	23.47	0.25
Tributary 2	2078.65*	5yr-12hrSCS	0.72	86.63	86.93		86.93	0.000790	0.22	3.35	22.15	0.18
Tributary 2	2078.65*	2yr-12hrSCS	0.40	86.63	86.89		86.89	0.000524	0.16	2.52	19.70	0.14
Tributary 2	2069.80*	100yr-12hrSCS	1.90	86.66	87.00		87.00	0.001459	0.33	5.82	31.54	0.24
Tributary 2	2069.80*	5yr-12hrSCS	0.72	86.66	86.92		86.92	0.000956	0.21	3.51	27.56	0.18
Tributary 2	2069.80*	2yr-12hrSCS	0.40	86.66	86.88		86.88	0.000680	0.15	2.55	23.80	0.15
Tributary 2	2060.94*	100yr-12hrSCS	1.90	86.70	86.98		86.99	0.002344	0.34	5.60	39.37	0.29
Tributary 2	2060.94*	5yr-12hrSCS	0.72	86.70	86.91		86.91	0.001699	0.23	3.11	30.24	0.23
Tributary 2	2060.94*	2yr-12hrSCS	0.40	86.70	86.88		86.88	0.001386	0.18	2.15	25.45	0.20
Tributary 2	2052.09	100yr-12hrSCS	1.90	86.73	86.93		86.95	0.010830	0.55	3.47	35.96	0.56
Tributary 2	2052.09	5yr-12hrSCS	0.72	86.73	86.87		86.88	0.012387	0.45	1.61	24.97	0.56
Tributary 2	2052.09	2yr-12hrSCS	0.40	86.73	86.84		86.85	0.012747	0.39	1.00	19.20	0.55
Tributary 2	2042.77*	100yr-12hrSCS	1.90	86.59	86.83		86.85	0.010412	0.60	3.17	28.95	0.58
Tributary 2	2042.77*	5yr-12hrSCS	0.72	86.59	86.76		86.77	0.012226	0.51	1.41	18.37	0.59
Tributary 2	2042.77*	2yr-12hrSCS	0.40	86.59	86.73		86.74	0.012136	0.45	0.89	14.15	0.57
Tributary 2	2033.45*	100yr-12hrSCS	1.90	86.45	86.76		86.77	0.006709	0.56	3.37	25.20	0.49
Tributary 2	2033.45*	5yr-12hrSCS	0.72	86.45	86.65		86.67	0.010127	0.54	1.33	14.19	0.57
Tributary 2	2033.45*	2yr-12hrSCS	0.40	86.45	86.60		86.62	0.015117	0.56	0.70	9.74	0.67
Tributary 2	2024.13*	100yr-12hrSCS	1.90	86.31	86.72		86.73	0.003295	0.48	3.98	23.31	0.37
Tributary 2	2024.13*	5yr-12hrSCS	0.72	86.31	86.62		86.62	0.002600	0.36	2.00	14.84	0.31
Tributary 2	2024.13*	2yr-12hrSCS	0.40	86.31	86.57		86.58	0.001741	0.28	1.44	11.85	0.25
Tributary 2	2014.81*	100yr-12hrSCS	1.90	86.17	86.70		86.71	0.002006	0.48	3.98	16.68	0.31
Tributary 2	2014.81*	5yr-12hrSCS	0.72	86.17	86.60		86.61	0.001131	0.29	2.48	14.27	0.22
Tributary 2	2014.81*	2yr-12hrSCS	0.40	86.17	86.57		86.57	0.000579	0.20	2.00	12.33	0.16
Tributary 2	2005.5	100yr-12hrSCS	1.90	86.02	86.67		86.69	0.002324	0.63	4.14	36.23	0.36
Tributary 2	2005.5	5yr-12hrSCS	0.72	86.02	86.59		86.60	0.001161	0.36	2.04	14.74	0.24
Tributary 2	2005.5	2yr-12hrSCS	0.40	86.02	86.56		86.56	0.000542	0.23	1.72	8.57	0.16

HEC-RAS Plan: Existing Con (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Tributary 2	1997.22*	100yr-12hrSCS	1.90	86.12	86.67		86.68	0.000670	0.34	5.62	18.12	0.19
Tributary 2	1997.22*	5yr-12hrSCS	0.72	86.12	86.59		86.59	0.000188	0.17	4.30	15.28	0.10
Tributary 2	1997.22*	2yr-12hrSCS	0.40	86.12	86.56		86.56	0.000074	0.10	3.86	14.23	0.06
Tributary 2	1988.94*	100yr-12hrSCS	1.90	86.21	86.67		86.67	0.000463	0.28	6.84	22.53	0.16
Tributary 2	1988.94*	5yr-12hrSCS	0.72	86.21	86.59		86.59	0.000138	0.14	5.23	19.71	0.09
Tributary 2	1988.94*	2yr-12hrSCS	0.40	86.21	86.56		86.56	0.000057	0.08	4.67	18.75	0.05
Tributary 2	1980.66*	100yr-12hrSCS	1.90	86.31	86.66		86.67	0.000567	0.28	6.83	26.17	0.17
Tributary 2	1980.66*	5yr-12hrSCS	0.72	86.31	86.59		86.59	0.000197	0.14	5.01	23.19	0.10
Tributary 2	1980.66*	2yr-12hrSCS	0.40	86.31	86.56		86.56	0.000087	0.09	4.37	22.05	0.07
Tributary 2	1972.38*	100yr-12hrSCS	1.90	86.41	86.66		86.66	0.001180	0.34	5.66	28.31	0.24
Tributary 2	1972.38*	5yr-12hrSCS	0.72	86.41	86.59		86.59	0.000538	0.19	3.82	25.09	0.15
Tributary 2	1972.38*	2yr-12hrSCS	0.40	86.41	86.56		86.56	0.000282	0.12	3.17	23.84	0.11
Tributary 2	1964.11	100yr-12hrSCS	1.90	86.50	86.61		86.63	0.015409	0.74	2.56	26.90	0.77
Tributary 2	1964.11	5yr-12hrSCS	0.72	86.50	86.55	86.55	86.57	0.035788	0.68	1.06	23.86	1.03
Tributary 2	1964.11	2yr-12hrSCS	0.40	86.50	86.54		86.55	0.013462	0.40	0.99	23.71	0.62
Tributary 2	1955.41*	100yr-12hrSCS	1.90	86.34	86.45	86.44	86.49	0.018352	0.85	2.24	21.83	0.85
Tributary 2	1955.41*	5yr-12hrSCS	0.72	86.34	86.42	86.39	86.43	0.009200	0.48	1.50	20.45	0.57
Tributary 2	1955.41*	2yr-12hrSCS	0.40	86.34	86.38		86.39	0.023771	0.52	0.76	18.94	0.82
Tributary 2	1946.72*	100yr-12hrSCS	1.90	86.17	86.33		86.36	0.009692	0.75	2.52	18.27	0.65
Tributary 2	1946.72*	5yr-12hrSCS	0.72	86.17	86.23	86.23	86.27	0.040281	0.85	0.85	14.97	1.13
Tributary 2	1946.72*	2yr-12hrSCS	0.40	86.17	86.23		86.24	0.014177	0.49	0.81	14.88	0.67
Tributary 2	1938.02*	100yr-12hrSCS	1.90	86.01	86.31		86.32	0.002357	0.50	3.77	17.22	0.34
Tributary 2	1938.02*	5yr-12hrSCS	0.72	86.01	86.16	86.09	86.17	0.004135	0.46	1.57	12.57	0.41
Tributary 2	1938.02*	2yr-12hrSCS	0.40	86.01	86.07	86.06	86.10	0.022369	0.65	0.61	10.35	0.85
Tributary 2	1929.33*	100yr-12hrSCS	1.90	85.85	86.29		86.30	0.001922	0.46	4.11	18.31	0.31
Tributary 2	1929.33*	5yr-12hrSCS	0.72	85.85	86.15		86.15	0.001055	0.33	2.17	10.09	0.23
Tributary 2	1929.33*	2yr-12hrSCS	0.40	85.85	86.04		86.05	0.001537	0.32	1.25	8.20	0.26
Tributary 2	1920.64	100yr-12hrSCS	1.90	85.68	86.25		86.27	0.006303	0.63	3.00	20.32	0.53
Tributary 2	1920.64	5yr-12hrSCS	0.72	85.68	86.11		86.13	0.004853	0.64	1.13	6.11	0.48
Tributary 2	1920.64	2yr-12hrSCS	0.40	85.68	86.00		86.02	0.005172	0.62	0.64	3.85	0.48
Tributary 2	1911.35*	100yr-12hrSCS	1.90	85.63	86.20		86.22	0.006265	0.62	3.05	20.12	0.51
Tributary 2	1911.35*	5yr-12hrSCS	0.72	85.63	86.06		86.08	0.005878	0.60	1.20	7.96	0.49
Tributary 2	1911.35*	2yr-12hrSCS	0.40	85.63	85.96		85.98	0.005125	0.60	0.66	3.87	0.47

HEC-RAS Plan: Existing Con (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Tributary 2	1902.06*	100yr-12hrSCS	1.90	85.58	86.14		86.16	0.006086	0.62	3.05	19.73	0.51
Tributary 2	1902.06*	5yr-12hrSCS	0.72	85.58	86.01		86.03	0.005624	0.57	1.26	8.62	0.48
Tributary 2	1902.06*	2yr-12hrSCS	0.40	85.58	85.92		85.93	0.004703	0.58	0.68	3.98	0.45
Tributary 2	1892.77*	100yr-12hrSCS	1.90	85.53	86.08		86.10	0.005789	0.62	3.05	18.24	0.49
Tributary 2	1892.77*	5yr-12hrSCS	0.72	85.53	85.96		85.97	0.005633	0.55	1.32	9.39	0.46
Tributary 2	1892.77*	2yr-12hrSCS	0.40	85.53	85.87		85.89	0.005574	0.55	0.72	4.98	0.46
Tributary 2	1883.49*	100yr-12hrSCS	1.90	85.48	86.03		86.05	0.005539	0.63	3.03	16.65	0.47
Tributary 2	1883.49*	5yr-12hrSCS	0.72	85.48	85.91		85.92	0.005660	0.53	1.36	9.78	0.45
Tributary 2	1883.49*	2yr-12hrSCS	0.40	85.48	85.82		85.83	0.005769	0.54	0.74	5.23	0.46
Tributary 2	1874.20*	100yr-12hrSCS	1.90	85.42	85.98		86.00	0.005008	0.63	3.00	15.94	0.45
Tributary 2	1874.20*	5yr-12hrSCS	0.72	85.42	85.86		85.87	0.005308	0.52	1.40	9.98	0.44
Tributary 2	1874.20*	2yr-12hrSCS	0.40	85.42	85.77		85.78	0.005082	0.52	0.76	5.16	0.43
Tributary 2	1864.91*	100yr-12hrSCS	1.90	85.37	85.93		85.95	0.004910	0.65	2.95	16.19	0.44
Tributary 2	1864.91*	5yr-12hrSCS	0.72	85.37	85.81		85.82	0.005236	0.51	1.42	9.83	0.43
Tributary 2	1864.91*	2yr-12hrSCS	0.40	85.37	85.73		85.74	0.004755	0.50	0.79	5.24	0.41
Tributary 2	1855.62*	100yr-12hrSCS	1.90	85.32	85.89		85.91	0.004786	0.70	2.87	16.59	0.45
Tributary 2	1855.62*	5yr-12hrSCS	0.72	85.32	85.76		85.77	0.005316	0.53	1.37	9.04	0.43
Tributary 2	1855.62*	2yr-12hrSCS	0.40	85.32	85.68		85.69	0.005148	0.50	0.79	5.48	0.42
Tributary 2	1846.34	100yr-12hrSCS	1.90	85.27	85.82		85.85	0.007461	0.87	2.40	15.12	0.55
Tributary 2	1846.34	5yr-12hrSCS	0.72	85.27	85.70		85.72	0.007775	0.64	1.14	7.25	0.51
Tributary 2	1846.34	2yr-12hrSCS	0.40	85.27	85.62		85.64	0.007462	0.59	0.67	4.66	0.49
Tributary 2	1836.11*	100yr-12hrSCS	1.90	85.19	85.75		85.78	0.007045	0.87	2.42	15.13	0.53
Tributary 2	1836.11*	5yr-12hrSCS	0.72	85.19	85.62		85.64	0.007584	0.63	1.14	7.23	0.51
Tributary 2	1836.11*	2yr-12hrSCS	0.40	85.19	85.55		85.57	0.007085	0.56	0.71	5.10	0.48
Tributary 2	1825.88*	100yr-12hrSCS	1.90	85.11	85.68		85.71	0.006695	0.86	2.48	15.52	0.52
Tributary 2	1825.88*	5yr-12hrSCS	0.72	85.11	85.55		85.57	0.007159	0.63	1.15	7.28	0.50
Tributary 2	1825.88*	2yr-12hrSCS	0.40	85.11	85.48		85.50	0.006900	0.55	0.73	5.31	0.47
Tributary 2	1815.65*	100yr-12hrSCS	1.90	85.03	85.61		85.65	0.006388	0.85	2.56	16.48	0.51
Tributary 2	1815.65*	5yr-12hrSCS	0.72	85.03	85.49		85.51	0.006662	0.63	1.15	7.34	0.48
Tributary 2	1815.65*	2yr-12hrSCS	0.40	85.03	85.42		85.43	0.006623	0.54	0.74	5.39	0.46
Tributary 2	1805.42*	100yr-12hrSCS	1.90	84.95	85.55		85.59	0.006205	0.84	2.68	18.47	0.51
Tributary 2	1805.42*	5yr-12hrSCS	0.72	84.95	85.42		85.44	0.006226	0.63	1.17	7.65	0.47

HEC-RAS Plan: Existing Con (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Tributary 2	1805.42*	2yr-12hrSCS	0.40	84.95	85.36		85.37	0.006445	0.53	0.74	5.35	0.46
Tributary 2	1795.19*	100yr-12hrSCS	1.90	84.87	85.49		85.52	0.006183	0.83	2.84	21.15	0.50
Tributary 2	1795.19*	5yr-12hrSCS	0.72	84.87	85.36		85.38	0.006202	0.65	1.17	8.12	0.47
Tributary 2	1795.19*	2yr-12hrSCS	0.40	84.87	85.29		85.31	0.006547	0.55	0.72	4.89	0.46
Tributary 2	1784.97	100yr-12hrSCS	1.90	84.79	85.41		85.45	0.008107	0.89	2.70	23.23	0.56
Tributary 2	1784.97	5yr-12hrSCS	0.72	84.79	85.29		85.31	0.008372	0.74	1.05	8.00	0.54
Tributary 2	1784.97	2yr-12hrSCS	0.40	84.79	85.22		85.24	0.008528	0.63	0.63	4.45	0.53
Tributary 2	1775.95*	100yr-12hrSCS	1.90	84.73	85.34		85.38	0.008221	0.92	2.61	24.92	0.57
Tributary 2	1775.95*	5yr-12hrSCS	0.72	84.73	85.21		85.24	0.008345	0.73	1.02	7.27	0.54
Tributary 2	1775.95*	2yr-12hrSCS	0.40	84.73	85.14		85.16	0.008512	0.62	0.64	4.48	0.52
Tributary 2	1766.94*	100yr-12hrSCS	1.90	84.66	85.26	85.20	85.30	0.008482	0.95	2.53	25.12	0.58
Tributary 2	1766.94*	5yr-12hrSCS	0.72	84.66	85.14		85.16	0.008258	0.72	1.02	6.57	0.54
Tributary 2	1766.94*	2yr-12hrSCS	0.40	84.66	85.07		85.09	0.008607	0.62	0.64	4.53	0.53
Tributary 2	1757.92*	100yr-12hrSCS	1.90	84.59	85.19	85.12	85.23	0.008524	0.96	2.52	25.54	0.59
Tributary 2	1757.92*	5yr-12hrSCS	0.72	84.59	85.06		85.09	0.008236	0.71	1.02	5.95	0.54
Tributary 2	1757.92*	2yr-12hrSCS	0.40	84.59	84.99		85.01	0.008529	0.62	0.64	4.44	0.53
Tributary 2	1748.91*	100yr-12hrSCS	1.90	84.53	85.11	85.04	85.15	0.009023	0.98	2.48	25.32	0.60
Tributary 2	1748.91*	5yr-12hrSCS	0.72	84.53	84.99		85.02	0.008219	0.71	1.02	5.78	0.54
Tributary 2	1748.91*	2yr-12hrSCS	0.40	84.53	84.91		84.93	0.008665	0.63	0.62	4.28	0.53
Tributary 2	1739.89*	100yr-12hrSCS	1.90	84.46	85.03	84.96	85.08	0.008649	0.95	2.59	25.29	0.59
Tributary 2	1739.89*	5yr-12hrSCS	0.72	84.46	84.92		84.94	0.008204	0.71	1.02	5.67	0.54
Tributary 2	1739.89*	2yr-12hrSCS	0.40	84.46	84.83		84.85	0.008607	0.65	0.61	4.07	0.53
Tributary 2	1730.88*	100yr-12hrSCS	1.90	84.39	84.95	84.93	85.00	0.009883	0.99	2.52	25.01	0.62
Tributary 2	1730.88*	5yr-12hrSCS	0.72	84.39	84.84		84.87	0.008434	0.73	0.99	5.41	0.54
Tributary 2	1730.88*	2yr-12hrSCS	0.40	84.39	84.75		84.78	0.009112	0.68	0.58	3.75	0.55
Tributary 2	1721.87	100yr-12hrSCS	1.90	84.32	84.90		84.93	0.006074	0.80	3.25	26.10	0.49
Tributary 2	1721.87	5yr-12hrSCS	0.72	84.32	84.75		84.78	0.011342	0.84	0.86	4.73	0.63
Tributary 2	1721.87	2yr-12hrSCS	0.40	84.32	84.66		84.69	0.011068	0.78	0.51	3.03	0.61
Tributary 2	1711.9*	100yr-12hrSCS	1.90	84.21	84.79		84.85	0.010743	1.09	1.81	9.72	0.67
Tributary 2	1711.9*	5yr-12hrSCS	0.72	84.21	84.63		84.67	0.011195	0.86	0.84	4.60	0.64
Tributary 2	1711.9*	2yr-12hrSCS	0.40	84.21	84.55		84.58	0.011235	0.79	0.50	3.13	0.63
Tributary 2	1701.93*	100yr-12hrSCS	1.90	84.10	84.68		84.74	0.011001	1.10	1.75	8.58	0.68

HEC-RAS Plan: Existing Con (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Tributary 2	1701.93*	5yr-12hrSCS	0.72	84.10	84.52		84.56	0.011347	0.87	0.83	4.48	0.65
Tributary 2	1701.93*	2yr-12hrSCS	0.40	84.10	84.44		84.47	0.011327	0.79	0.50	3.14	0.63
Tributary 2	1691.96*	100yr-12hrSCS	1.90	83.98	84.57		84.64	0.010912	1.13	1.71	8.20	0.70
Tributary 2	1691.96*	5yr-12hrSCS	0.72	83.98	84.41		84.45	0.011307	0.90	0.80	4.32	0.66
Tributary 2	1691.96*	2yr-12hrSCS	0.40	83.98	84.33		84.36	0.011415	0.81	0.49	3.08	0.65
Tributary 2	1681.99*	100yr-12hrSCS	1.90	83.87	84.46		84.53	0.010928	1.16	1.66	8.13	0.71
Tributary 2	1681.99*	5yr-12hrSCS	0.72	83.87	84.30		84.34	0.011257	0.93	0.78	4.15	0.68
Tributary 2	1681.99*	2yr-12hrSCS	0.40	83.87	84.21		84.25	0.011270	0.83	0.48	3.00	0.66
Tributary 2	1672.02*	100yr-12hrSCS	1.90	83.76	84.35	84.29	84.42	0.010819	1.18	1.63	8.34	0.73
Tributary 2	1672.02*	5yr-12hrSCS	0.72	83.76	84.18		84.23	0.011458	0.96	0.75	3.95	0.71
Tributary 2	1672.02*	2yr-12hrSCS	0.40	83.76	84.10		84.13	0.011605	0.86	0.46	2.88	0.69
Tributary 2	1662.05*	100yr-12hrSCS	1.90	83.65	84.26	84.18	84.33	0.008445	1.10	1.86	13.83	0.65
Tributary 2	1662.05*	5yr-12hrSCS	0.72	83.65	84.09		84.13	0.009268	0.90	0.80	4.02	0.64
Tributary 2	1662.05*	2yr-12hrSCS	0.40	83.65	83.99		84.03	0.010095	0.82	0.48	2.92	0.65
Tributary 2	1652.08	100yr-12hrSCS	1.90	83.53	84.07	84.07	84.20	0.020023	1.56	1.22	4.98	1.00
Tributary 2	1652.08	5yr-12hrSCS	0.72	83.53	83.91	83.91	84.00	0.020930	1.28	0.56	3.15	0.97
Tributary 2	1652.08	2yr-12hrSCS	0.40	83.53	83.84	83.82	83.90	0.018370	1.09	0.36	2.36	0.89
Tributary 2	1641.63*	100yr-12hrSCS	1.90	83.49	83.92	83.89	83.99	0.014567	1.18	1.61	8.00	0.84
Tributary 2	1641.63*	5yr-12hrSCS	0.72	83.49	83.80		83.84	0.011284	0.88	0.82	5.21	0.71
Tributary 2	1641.63*	2yr-12hrSCS	0.40	83.49	83.73		83.76	0.010622	0.77	0.51	3.78	0.67
Tributary 2	1631.19*	100yr-12hrSCS	1.90	83.44	83.82		83.86	0.011659	0.95	1.99	11.55	0.73
Tributary 2	1631.19*	5yr-12hrSCS	0.72	83.44	83.72		83.74	0.008992	0.71	1.02	7.59	0.62
Tributary 2	1631.19*	2yr-12hrSCS	0.40	83.44	83.65		83.67	0.008584	0.64	0.62	5.11	0.59
Tributary 2	1620.75*	100yr-12hrSCS	1.90	83.39	83.72		83.76	0.010441	0.82	2.31	15.39	0.68
Tributary 2	1620.75*	5yr-12hrSCS	0.72	83.39	83.64		83.66	0.008024	0.60	1.21	10.77	0.57
Tributary 2	1620.75*	2yr-12hrSCS	0.40	83.39	83.58		83.60	0.007437	0.57	0.70	6.29	0.54
Tributary 2	1610.31*	100yr-12hrSCS	1.90	83.34	83.64		83.66	0.010142	0.74	2.55	19.42	0.65
Tributary 2	1610.31*	5yr-12hrSCS	0.72	83.34	83.57		83.58	0.009694	0.55	1.31	15.11	0.60
Tributary 2	1610.31*	2yr-12hrSCS	0.40	83.34	83.53		83.54	0.005338	0.47	0.84	7.88	0.46
Tributary 2	1599.87*	100yr-12hrSCS	1.90	83.30	83.57		83.58	0.006599	0.60	3.18	24.32	0.53
Tributary 2	1599.87*	5yr-12hrSCS	0.72	83.30	83.51		83.52	0.004636	0.38	1.90	22.12	0.41
Tributary 2	1599.87*	2yr-12hrSCS	0.40	83.30	83.48		83.48	0.006274	0.33	1.18	20.77	0.45

HEC-RAS Plan: Existing Con (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Tributary 2	1589.43	100yr-12hrSCS	1.90	83.25	83.43	83.43	83.48	0.030180	0.91	2.08	26.55	1.04
Tributary 2	1589.43	5yr-12hrSCS	0.72	83.25	83.39	83.39	83.43	0.026154	0.88	0.82	9.82	0.97
Tributary 2	1589.43	2yr-12hrSCS	0.40	83.25	83.35	83.35	83.38	0.025901	0.76	0.52	7.78	0.94
Tributary 2	1579.29*	100yr-12hrSCS	1.90	82.92	83.12	83.14	83.18	0.033074	1.07	1.78	19.04	1.12
Tributary 2	1579.29*	5yr-12hrSCS	0.72	82.92	83.05	83.07	83.11	0.048484	1.11	0.65	8.86	1.30
Tributary 2	1579.29*	2yr-12hrSCS	0.40	82.92	83.01	83.02	83.06	0.051008	0.99	0.40	6.63	1.29
Tributary 2	1569.15*	100yr-12hrSCS	1.90	82.58	82.80	82.81	82.87	0.036912	1.17	1.62	16.40	1.19
Tributary 2	1569.15*	5yr-12hrSCS	0.72	82.58	82.75	82.75	82.78	0.027219	0.85	0.85	11.21	0.98
Tributary 2	1569.15*	2yr-12hrSCS	0.40	82.58	82.68	82.70	82.75	0.060352	1.11	0.36	5.63	1.41
Tributary 2	1559.01*	100yr-12hrSCS	1.90	82.25	82.49	82.50	82.56	0.032166	1.17	1.63	14.95	1.13
Tributary 2	1559.01*	5yr-12hrSCS	0.72	82.25	82.41	82.42	82.47	0.041992	1.14	0.64	7.42	1.24
Tributary 2	1559.01*	2yr-12hrSCS	0.40	82.25	82.34	82.38	82.47	0.147013	1.60	0.25	4.41	2.16
Tributary 2	1548.87*	100yr-12hrSCS	1.90	81.91	82.18	82.20	82.26	0.035273	1.27	1.49	12.84	1.20
Tributary 2	1548.87*	5yr-12hrSCS	0.72	81.91	82.10	82.11	82.16	0.029036	1.03	0.70	7.21	1.05
Tributary 2	1548.87*	2yr-12hrSCS	0.40	81.91	82.06	82.06	82.10	0.027695	0.88	0.45	5.59	1.00
Tributary 2	1538.74	100yr-12hrSCS	1.90	81.58	81.96	81.91	81.99	0.008192	0.76	2.49	15.53	0.61
Tributary 2	1538.74	5yr-12hrSCS	0.72	81.58	81.87	81.81	81.89	0.006883	0.58	1.25	10.44	0.53
Tributary 2	1538.74	2yr-12hrSCS	0.40	81.58	81.81	81.75	81.83	0.005653	0.51	0.77	6.60	0.48
Tributary 2	1529.21*	100yr-12hrSCS	1.90	81.51	81.89		81.92	0.007239	0.71	2.68	15.60	0.55
Tributary 2	1529.21*	5yr-12hrSCS	0.72	81.51	81.80		81.82	0.008178	0.54	1.33	12.66	0.54
Tributary 2	1529.21*	2yr-12hrSCS	0.40	81.51	81.75		81.76	0.007244	0.48	0.83	8.72	0.50
Tributary 2	1519.68*	100yr-12hrSCS	1.90	81.45	81.77	81.75	81.81	0.018973	0.94	2.02	15.31	0.82
Tributary 2	1519.68*	5yr-12hrSCS	0.72	81.45	81.70		81.72	0.014852	0.65	1.11	12.18	0.69
Tributary 2	1519.68*	2yr-12hrSCS	0.40	81.45	81.68		81.69	0.008488	0.46	0.86	10.43	0.51
Tributary 2	1510.15	100yr-12hrSCS	1.90	81.38	81.68	81.63	81.70	0.007514	0.57	3.30	24.10	0.50
Tributary 2	1510.15	5yr-12hrSCS	0.72	81.38	81.62	81.58	81.63	0.007204	0.39	1.85	23.55	0.44
Tributary 2	1510.15	2yr-12hrSCS	0.40	81.38	81.59	81.55	81.60	0.008532	0.32	1.22	23.30	0.45
Tributary 2	1502.9*	100yr-12hrSCS	1.90	81.34	81.62	81.57	81.64	0.008153	0.61	3.13	22.53	0.52
Tributary 2	1502.9*	5yr-12hrSCS	0.72	81.34	81.55	81.52	81.56	0.009147	0.44	1.65	21.17	0.50
Tributary 2	1502.9*	2yr-12hrSCS	0.40	81.34	81.52	81.50	81.53	0.011423	0.37	1.06	20.43	0.52
Tributary 2	1495.65*	100yr-12hrSCS	1.90	81.30	81.56	81.50	81.58	0.007279	0.61	3.09	19.94	0.50
Tributary 2	1495.65*	5yr-12hrSCS	0.72	81.30	81.48	81.45	81.49	0.010346	0.48	1.52	18.78	0.53
Tributary 2	1495.65*	2yr-12hrSCS	0.40	81.30	81.46	81.43	81.47	0.008919	0.36	1.10	18.40	0.47

HEC-RAS Plan: Existing Con (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Tributary 2	1488.4	100yr-12hrSCS	1.90	81.26	81.52	81.44	81.53	0.005415	0.59	3.22	17.65	0.44
Tributary 2	1488.4	5yr-12hrSCS	0.72	81.26	81.42	81.38	81.43	0.009521	0.48	1.49	16.88	0.52
Tributary 2	1488.4	2yr-12hrSCS	0.40	81.26	81.39	81.38	81.40	0.010707	0.40	1.00	16.67	0.52
Tributary 2	1479.28*	100yr-12hrSCS	1.90	81.11	81.47	81.36	81.49	0.004548	0.62	3.07	13.80	0.42
Tributary 2	1479.28*	5yr-12hrSCS	0.72	81.11	81.35	81.30	81.36	0.007280	0.50	1.44	12.60	0.47
Tributary 2	1479.28*	2yr-12hrSCS	0.40	81.11	81.30	81.26	81.31	0.010386	0.47	0.84	10.38	0.53
Tributary 2	1470.17*	100yr-12hrSCS	1.90	80.96	81.42		81.45	0.005201	0.72	2.65	10.49	0.45
Tributary 2	1470.17*	5yr-12hrSCS	0.72	80.96	81.29		81.30	0.006038	0.54	1.33	8.87	0.45
Tributary 2	1470.17*	2yr-12hrSCS	0.40	80.96	81.23		81.24	0.005688	0.45	0.88	7.40	0.42
Tributary 2	1461.06	100yr-12hrSCS	1.90	80.81	81.28		81.37	0.018706	1.28	1.48	6.22	0.84
Tributary 2	1461.06	5yr-12hrSCS	0.72	80.81	81.17		81.21	0.018028	0.89	0.82	5.83	0.76
Tributary 2	1461.06	2yr-12hrSCS	0.40	80.81	81.13		81.15	0.018677	0.71	0.55	5.62	0.73
Tributary 2	1452.43*	100yr-12hrSCS	1.90	80.67	81.13		81.21	0.017775	1.21	1.56	6.96	0.82
Tributary 2	1452.43*	5yr-12hrSCS	0.72	80.67	81.01		81.05	0.019195	0.90	0.80	5.99	0.78
Tributary 2	1452.43*	2yr-12hrSCS	0.40	80.67	80.97		80.99	0.019421	0.75	0.53	5.21	0.75
Tributary 2	1443.80*	100yr-12hrSCS	1.90	80.53	80.99		81.06	0.016610	1.14	1.66	7.82	0.79
Tributary 2	1443.80*	5yr-12hrSCS	0.72	80.53	80.87		80.91	0.016635	0.86	0.84	5.99	0.74
Tributary 2	1443.80*	2yr-12hrSCS	0.40	80.53	80.81		80.84	0.016957	0.76	0.52	4.62	0.72
Tributary 2	1435.17*	100yr-12hrSCS	1.90	80.39	80.86		80.92	0.015830	1.07	1.78	8.91	0.76
Tributary 2	1435.17*	5yr-12hrSCS	0.72	80.39	80.74		80.77	0.014517	0.82	0.88	6.08	0.69
Tributary 2	1435.17*	2yr-12hrSCS	0.40	80.39	80.68		80.70	0.014003	0.72	0.55	4.52	0.66
Tributary 2	1426.55	100yr-12hrSCS	1.90	80.25	80.74		80.78	0.014697	0.97	1.95	10.63	0.72
Tributary 2	1426.55	5yr-12hrSCS	0.72	80.25	80.61		80.64	0.015930	0.83	0.87	6.31	0.72
Tributary 2	1426.55	2yr-12hrSCS	0.40	80.25	80.53		80.57	0.017338	0.83	0.48	3.68	0.74
Tributary 2	1416.32*	100yr-12hrSCS	1.90	80.09	80.64		80.68	0.010256	0.92	2.06	9.28	0.62
Tributary 2	1416.32*	5yr-12hrSCS	0.72	80.09	80.46		80.50	0.016306	0.91	0.79	5.11	0.74
Tributary 2	1416.32*	2yr-12hrSCS	0.40	80.09	80.39		80.42	0.015925	0.82	0.48	3.52	0.71
Tributary 2	1406.1*	100yr-12hrSCS	1.90	79.94	80.59		80.62	0.005048	0.78	2.46	10.38	0.46
Tributary 2	1406.1*	5yr-12hrSCS	0.72	79.94	80.34		80.38	0.012765	0.89	0.82	4.54	0.67
Tributary 2	1406.1*	2yr-12hrSCS	0.40	79.94	80.25		80.29	0.016035	0.87	0.45	3.06	0.72
Tributary 2	1395.87*	100yr-12hrSCS	1.90	79.78	80.56	80.33	80.59	0.002635	0.69	3.00	12.68	0.35
Tributary 2	1395.87*	5yr-12hrSCS	0.72	79.78	80.28	80.16	80.30	0.006438	0.73	0.99	4.44	0.49

HEC-RAS Plan: Existing Con (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Tributary 2	1395.87*	2yr-12hrSCS	0.40	79.78	80.15	80.08	80.18	0.009424	0.75	0.53	2.96	0.57
Tributary 2	1385.65	100yr-12hrSCS	1.90	79.63	80.55	80.24	80.57	0.001768	0.66	3.55	15.04	0.29
Tributary 2	1385.65	5yr-12hrSCS	0.72	79.63	80.24	80.05	80.26	0.003610	0.63	1.15	4.05	0.38
Tributary 2	1385.65	2yr-12hrSCS	0.40	79.63	80.11	79.96	80.12	0.004371	0.59	0.67	2.99	0.40
Tributary 2	1376.53*	100yr-12hrSCS	1.90	79.60	80.54	80.21	80.55	0.001242	0.57	4.15	19.33	0.26
Tributary 2	1376.53*	5yr-12hrSCS	0.72	79.60	80.21	80.02	80.23	0.003237	0.61	1.19	4.43	0.37
Tributary 2	1376.53*	2yr-12hrSCS	0.40	79.60	80.06	79.93	80.08	0.004628	0.62	0.64	2.98	0.43
Tributary 2	1367.41	100yr-12hrSCS	1.90	79.57	80.53	80.18	80.54	0.000844	0.51	4.96	26.22	0.23
Tributary 2	1367.41	5yr-12hrSCS	0.72	79.57	80.19	79.98	80.20	0.002777	0.60	1.21	4.65	0.37
Tributary 2	1367.41	2yr-12hrSCS	0.40	79.57	80.02	79.90	80.04	0.004199	0.66	0.60	2.70	0.44
Tributary 2	1358.81*	100yr-12hrSCS	1.90	79.55	80.53	80.13	80.54	0.000653	0.46	5.94	41.03	0.20
Tributary 2	1358.81*	5yr-12hrSCS	0.72	79.55	80.17	79.95	80.18	0.002109	0.54	1.34	4.91	0.33
Tributary 2	1358.81*	2yr-12hrSCS	0.40	79.55	79.99	79.86	80.01	0.004051	0.63	0.63	2.95	0.44
Tributary 2	1350.22*	100yr-12hrSCS	1.90	79.53	80.52	80.09	80.53	0.000500	0.41	6.59	39.26	0.18
Tributary 2	1350.22*	5yr-12hrSCS	0.72	79.53	80.15	79.91	80.17	0.001549	0.48	1.50	5.22	0.29
Tributary 2	1350.22*	2yr-12hrSCS	0.40	79.53	79.95	79.83	79.97	0.003755	0.60	0.66	3.21	0.42
Tributary 2	1341.62*	100yr-12hrSCS	1.90	79.50	80.52	80.05	80.53	0.000388	0.37	7.22	37.67	0.16
Tributary 2	1341.62*	5yr-12hrSCS	0.72	79.50	80.14	79.87	80.15	0.001114	0.42	1.70	5.57	0.25
Tributary 2	1341.62*	2yr-12hrSCS	0.40	79.50	79.93	79.79	79.94	0.003262	0.56	0.71	3.49	0.39
Tributary 2	1333.03*	100yr-12hrSCS	1.90	79.48	80.52	80.00	80.52	0.000306	0.34	7.81	36.49	0.14
Tributary 2	1333.03*	5yr-12hrSCS	0.72	79.48	80.14	79.84	80.14	0.000796	0.37	1.93	5.94	0.21
Tributary 2	1333.03*	2yr-12hrSCS	0.40	79.48	79.90	79.76	79.92	0.002623	0.50	0.79	3.80	0.35
Tributary 2	1324.44	100yr-12hrSCS	1.90	79.46	80.52	79.96	80.52	0.000245	0.31	8.40	35.82	0.13
Tributary 2	1324.44	5yr-12hrSCS	0.72	79.46	80.13	79.80	80.14	0.000571	0.33	2.18	6.31	0.18
Tributary 2	1324.44	2yr-12hrSCS	0.40	79.46	79.89	79.73	79.90	0.001936	0.44	0.89	4.15	0.31
Tributary 2	1316.78*	100yr-12hrSCS	1.90	79.42	80.52	79.92	80.52	0.000193	0.30	9.18	35.54	0.12
Tributary 2	1316.78*	5yr-12hrSCS	0.72	79.42	80.13	79.76	80.13	0.000434	0.30	2.39	6.40	0.16
Tributary 2	1316.78*	2yr-12hrSCS	0.40	79.42	79.87	79.69	79.88	0.001420	0.39	1.00	4.44	0.26
Tributary 2	1309.12*	100yr-12hrSCS	1.90	79.39	80.51	79.88	80.52	0.000158	0.28	9.91	35.30	0.11
Tributary 2	1309.12*	5yr-12hrSCS	0.72	79.39	80.13	79.72	80.13	0.000336	0.28	2.58	6.37	0.14
Tributary 2	1309.12*	2yr-12hrSCS	0.40	79.39	79.87	79.65	79.87	0.000946	0.34	1.15	4.59	0.22
Tributary 2	1301.46*	100yr-12hrSCS	1.90	79.35	80.51	79.83	80.52	0.000132	0.27	10.62	35.04	0.10

HEC-RAS Plan: Existing Con (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Tributary 2	1301.46*	5yr-12hrSCS	0.72	79.35	80.13	79.67	80.13	0.000268	0.26	2.74	6.23	0.13
Tributary 2	1301.46*	2yr-12hrSCS	0.40	79.35	79.86	79.61	79.87	0.000628	0.30	1.31	4.63	0.18
Tributary 2	1293.8	100yr-12hrSCS	2.14	79.32	80.51	79.82	80.52	0.000144	0.30	11.24	34.77	0.10
Tributary 2	1293.8	5yr-12hrSCS	0.82	79.32	80.12	79.65	80.13	0.000290	0.29	2.85	6.01	0.13
Tributary 2	1293.8	2yr-12hrSCS	0.45	79.32	79.86	79.57	79.86	0.000575	0.31	1.45	4.57	0.18
Tributary 2	1288.56*	100yr-12hrSCS	2.14	79.28	80.51	79.84	80.51	0.000254	0.39	8.61	32.30	0.13
Tributary 2	1288.56*	5yr-12hrSCS	0.82	79.28	80.12	79.64	80.12	0.000410	0.34	2.38	4.85	0.16
Tributary 2	1288.56*	2yr-12hrSCS	0.45	79.28	79.85	79.55	79.86	0.000739	0.36	1.24	3.67	0.20
Tributary 2	1283.33	100yr-12hrSCS	2.14	79.23	80.50	79.89	80.51	0.000545	0.53	5.94	26.01	0.19
Tributary 2	1283.33	5yr-12hrSCS	0.82	79.23	80.11	79.65	80.12	0.000744	0.45	1.83	3.74	0.20
Tributary 2	1283.33	2yr-12hrSCS	0.45	79.23	79.84	79.55	79.85	0.001265	0.47	0.96	2.73	0.25
Tributary 2	1281.23		Culvert									
Tributary 2	1273.98*	100yr-12hrSCS	2.14	79.22	80.23	79.80	80.26	0.001706	0.78	2.76	4.61	0.32
Tributary 2	1273.98*	5yr-12hrSCS	0.82	79.22	79.78	79.57	79.81	0.003325	0.78	1.05	2.89	0.41
Tributary 2	1273.98*	2yr-12hrSCS	0.45	79.22	79.59	79.46	79.62	0.005137	0.79	0.57	2.18	0.49
Tributary 2	1269.93		Culvert									
Tributary 2	1245.94	100yr-12hrSCS	2.14	79.18	80.13	79.49	80.14	0.000616	0.52	4.07	5.36	0.19
Tributary 2	1245.94	5yr-12hrSCS	0.82	79.18	79.75	79.34	79.75	0.000445	0.36	2.30	4.29	0.16
Tributary 2	1245.94	2yr-12hrSCS	0.45	79.18	79.58	79.29	79.59	0.000414	0.28	1.60	4.15	0.15
Tributary 2	1237.84		Culvert									
Tributary 2	1227.55*	100yr-12hrSCS	2.14	79.03	79.79	79.43	79.83	0.002516	0.89	2.40	4.22	0.38
Tributary 2	1227.55*	5yr-12hrSCS	0.82	79.03	79.48	79.25	79.50	0.001897	0.63	1.31	3.19	0.31
Tributary 2	1227.55*	2yr-12hrSCS	0.45	79.03	79.34	79.17	79.35	0.001999	0.52	0.87	2.98	0.31
Tributary 2	1218.36*	100yr-12hrSCS	2.14	78.95	79.76	79.42	79.80	0.002930	0.94	2.28	4.29	0.41
Tributary 2	1218.36*	5yr-12hrSCS	0.82	78.95	79.46	79.21	79.48	0.002161	0.67	1.22	2.93	0.33
Tributary 2	1218.36*	2yr-12hrSCS	0.45	78.95	79.32	79.12	79.34	0.001918	0.54	0.83	2.59	0.31
Tributary 2	1209.16*	100yr-12hrSCS	2.14	78.87	79.72	79.43	79.77	0.003304	0.97	2.20	4.37	0.44
Tributary 2	1209.16*	5yr-12hrSCS	0.82	78.87	79.44	79.19	79.46	0.002751	0.72	1.13	3.02	0.38
Tributary 2	1209.16*	2yr-12hrSCS	0.45	78.87	79.30	79.09	79.32	0.002285	0.59	0.76	2.37	0.33
Tributary 2	1199.97*	100yr-12hrSCS	2.14	78.80	79.69	79.43	79.74	0.003585	0.99	2.15	4.47	0.46
Tributary 2	1199.97*	5yr-12hrSCS	0.82	78.80	79.41	79.19	79.44	0.003357	0.77	1.07	3.10	0.42

HEC-RAS Plan: Existing Con (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Tributary 2	1199.97*	2yr-12hrSCS	0.45	78.80	79.27	79.08	79.29	0.003121	0.65	0.70	2.46	0.39
Tributary 2	1190.78	100yr-12hrSCS	2.14	78.72	79.66	79.41	79.71	0.003654	0.99	2.15	4.58	0.46
Tributary 2	1190.78	5yr-12hrSCS	0.82	78.72	79.37	79.19	79.40	0.003789	0.79	1.04	3.18	0.44
Tributary 2	1190.78	2yr-12hrSCS	0.45	78.72	79.24	79.09	79.26	0.003944	0.69	0.65	2.52	0.43
Tributary 2	1182.55*	100yr-12hrSCS	2.14	78.69	79.63	79.37	79.68	0.003337	0.95	2.24	4.73	0.44
Tributary 2	1182.55*	5yr-12hrSCS	0.82	78.69	79.34	79.15	79.37	0.003465	0.76	1.08	3.29	0.42
Tributary 2	1182.55*	2yr-12hrSCS	0.45	78.69	79.21	79.05	79.23	0.003646	0.67	0.68	2.60	0.42
Tributary 2	1174.32*	100yr-12hrSCS	2.14	78.65	79.61	79.33	79.65	0.002917	0.91	2.36	4.93	0.42
Tributary 2	1174.32*	5yr-12hrSCS	0.82	78.65	79.32	79.12	79.34	0.003043	0.72	1.14	3.43	0.40
Tributary 2	1174.32*	2yr-12hrSCS	0.45	78.65	79.18	79.02	79.20	0.003212	0.63	0.71	2.72	0.39
Tributary 2	1166.09*	100yr-12hrSCS	2.14	78.62	79.59	79.29	79.63	0.002318	0.85	2.53	5.12	0.38
Tributary 2	1166.09*	5yr-12hrSCS	0.82	78.62	79.30	79.07	79.32	0.002527	0.67	1.23	3.65	0.37
Tributary 2	1166.09*	2yr-12hrSCS	0.45	78.62	79.16	78.98	79.18	0.002643	0.58	0.78	2.90	0.36
Tributary 2	1157.86*	100yr-12hrSCS	2.14	78.59	79.58	79.24	79.61	0.001474	0.73	3.71	16.07	0.31
Tributary 2	1157.86*	5yr-12hrSCS	0.82	78.59	79.28	79.03	79.30	0.001981	0.60	1.36	3.95	0.33
Tributary 2	1157.86*	2yr-12hrSCS	0.45	78.59	79.14	78.94	79.16	0.002027	0.52	0.87	3.15	0.32
Tributary 2	1149.64	100yr-12hrSCS	2.14	78.56	79.58	79.19	79.60	0.000968	0.64	4.52	16.09	0.25
Tributary 2	1149.64	5yr-12hrSCS	0.82	78.56	79.27	78.99	79.29	0.001322	0.53	1.55	4.17	0.27
Tributary 2	1149.64	2yr-12hrSCS	0.45	78.56	79.13	78.90	79.14	0.001427	0.45	1.00	3.52	0.27
Tributary 2	1141.07*	100yr-12hrSCS	2.14	78.54	79.55	79.21	79.58	0.001949	0.79	2.70	5.49	0.35
Tributary 2	1141.07*	5yr-12hrSCS	0.82	78.54	79.25	79.00	79.27	0.001971	0.61	1.34	3.76	0.33
Tributary 2	1141.07*	2yr-12hrSCS	0.45	78.54	79.11	78.89	79.13	0.001926	0.52	0.87	3.02	0.31
Tributary 2	1132.51*	100yr-12hrSCS	2.14	78.52	79.52	79.22	79.56	0.002678	0.89	2.41	4.78	0.40
Tributary 2	1132.51*	5yr-12hrSCS	0.82	78.52	79.23	78.99	79.25	0.002503	0.68	1.21	3.38	0.36
Tributary 2	1132.51*	2yr-12hrSCS	0.45	78.52	79.09	78.89	79.11	0.002406	0.58	0.78	2.73	0.34
Tributary 2	1123.94*	100yr-12hrSCS	2.14	78.50	79.49	79.21	79.54	0.003386	0.98	2.18	4.37	0.44
Tributary 2	1123.94*	5yr-12hrSCS	0.82	78.50	79.20	78.99	79.23	0.003105	0.75	1.10	3.11	0.40
Tributary 2	1123.94*	2yr-12hrSCS	0.45	78.50	79.06	78.88	79.08	0.002939	0.63	0.72	2.51	0.38
Tributary 2	1115.38*	100yr-12hrSCS	2.14	78.48	79.44	79.21	79.50	0.004406	1.09	1.96	4.02	0.50
Tributary 2	1115.38*	5yr-12hrSCS	0.82	78.48	79.16	78.97	79.20	0.003996	0.83	0.99	2.86	0.45
Tributary 2	1115.38*	2yr-12hrSCS	0.45	78.48	79.03	78.87	79.06	0.003740	0.70	0.65	2.32	0.42
Tributary 2	1106.82	100yr-12hrSCS	2.14	78.45	79.38	79.20	79.46	0.006231	1.25	1.70	3.66	0.59

HEC-RAS Plan: Existing Con (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Tributary 2	1106.82	5yr-12hrSCS	0.82	78.45	79.11	78.96	79.16	0.005598	0.95	0.87	2.61	0.53
Tributary 2	1106.82	2yr-12hrSCS	0.45	78.45	78.99	78.85	79.02	0.005220	0.80	0.57	2.12	0.49
Tributary 2	1095.57*	100yr-12hrSCS	2.14	78.46	79.33	79.14	79.41	0.005729	1.21	1.76	3.77	0.57
Tributary 2	1095.57*	5yr-12hrSCS	0.82	78.46	79.07	78.91	79.11	0.004904	0.90	0.91	2.72	0.50
Tributary 2	1095.57*	2yr-12hrSCS	0.45	78.46	78.95	78.80	78.98	0.004394	0.75	0.61	2.23	0.46
Tributary 2	1084.32*	100yr-12hrSCS	2.14	78.47	79.29	79.09	79.36	0.005397	1.18	1.81	3.89	0.55
Tributary 2	1084.32*	5yr-12hrSCS	0.82	78.47	79.03	78.87	79.07	0.004466	0.87	0.95	2.85	0.48
Tributary 2	1084.32*	2yr-12hrSCS	0.45	78.47	78.92	78.76	78.94	0.003896	0.71	0.64	2.37	0.43
Tributary 2	1073.07*	100yr-12hrSCS	2.14	78.48	79.25	79.05	79.31	0.005210	1.16	1.84	4.03	0.55
Tributary 2	1073.07*	5yr-12hrSCS	0.82	78.48	79.00	78.83	79.03	0.004237	0.84	0.98	2.99	0.47
Tributary 2	1073.07*	2yr-12hrSCS	0.45	78.48	78.89	78.74	78.91	0.003648	0.68	0.67	2.51	0.42
Tributary 2	1061.82*	100yr-12hrSCS	2.14	78.49	79.20	79.02	79.27	0.005214	1.15	1.86	4.18	0.55
Tributary 2	1061.82*	5yr-12hrSCS	0.82	78.49	78.96	78.81	79.00	0.004253	0.83	0.99	3.13	0.47
Tributary 2	1061.82*	2yr-12hrSCS	0.45	78.49	78.86	78.72	78.88	0.003680	0.67	0.68	2.66	0.42
Tributary 2	1050.57*	100yr-12hrSCS	2.14	78.49	79.16	78.98	79.22	0.005510	1.15	1.85	4.33	0.56
Tributary 2	1050.57*	5yr-12hrSCS	0.82	78.49	78.93	78.79	78.96	0.004653	0.84	0.97	3.25	0.49
Tributary 2	1050.57*	2yr-12hrSCS	0.45	78.49	78.82	78.70	78.85	0.004144	0.68	0.66	2.79	0.45
Tributary 2	1039.32	100yr-12hrSCS	2.14	78.50	79.10	78.96	79.17	0.006383	1.20	1.79	4.47	0.60
Tributary 2	1039.32	5yr-12hrSCS	0.82	78.50	78.87	78.77	78.92	0.006145	0.91	0.90	3.33	0.56
Tributary 2	1039.32	2yr-12hrSCS	0.45	78.50	78.77	78.69	78.80	0.006186	0.77	0.59	2.85	0.54
Tributary 2	1029.91*	100yr-12hrSCS	2.14	78.43	79.04	78.90	79.11	0.006497	1.19	1.79	4.59	0.61
Tributary 2	1029.91*	5yr-12hrSCS	0.82	78.43	78.82	78.71	78.86	0.006194	0.91	0.90	3.37	0.56
Tributary 2	1029.91*	2yr-12hrSCS	0.45	78.43	78.72	78.63	78.75	0.006182	0.77	0.59	2.85	0.54
Tributary 2	1020.51*	100yr-12hrSCS	2.14	78.36	78.98	78.84	79.05	0.006487	1.18	1.81	4.73	0.61
Tributary 2	1020.51*	5yr-12hrSCS	0.82	78.36	78.76	78.65	78.80	0.006198	0.90	0.91	3.43	0.56
Tributary 2	1020.51*	2yr-12hrSCS	0.45	78.36	78.66	78.58	78.69	0.006141	0.76	0.59	2.87	0.54
Tributary 2	1011.10*	100yr-12hrSCS	2.14	78.29	78.92	78.78	78.99	0.006395	1.16	1.84	4.88	0.60
Tributary 2	1011.10*	5yr-12hrSCS	0.82	78.29	78.70	78.59	78.74	0.006186	0.90	0.92	3.51	0.56
Tributary 2	1011.10*	2yr-12hrSCS	0.45	78.29	78.60	78.52	78.63	0.006170	0.76	0.59	2.92	0.54
Tributary 2	1001.70*	100yr-12hrSCS	2.14	78.21	78.86	78.73	78.93	0.006123	1.13	1.89	5.05	0.59
Tributary 2	1001.70*	5yr-12hrSCS	0.82	78.21	78.64	78.54	78.68	0.005977	0.88	0.94	3.62	0.55
Tributary 2	1001.70*	2yr-12hrSCS	0.45	78.21	78.54	78.45	78.57	0.006035	0.75	0.60	2.99	0.53

HEC-RAS Plan: Existing Con (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Tributary 2	992.298*	100yr-12hrSCS	2.14	78.14	78.81	78.67	78.87	0.005605	1.09	1.97	5.25	0.57
Tributary 2	992.298*	5yr-12hrSCS	0.82	78.14	78.59	78.48	78.63	0.005485	0.84	0.98	3.79	0.53
Tributary 2	992.298*	2yr-12hrSCS	0.45	78.14	78.49	78.40	78.52	0.005554	0.72	0.63	3.10	0.51
Tributary 2	982.894*	100yr-12hrSCS	2.14	78.07	78.77	78.59	78.82	0.004825	1.02	2.10	5.52	0.53
Tributary 2	982.894*	5yr-12hrSCS	0.82	78.07	78.55	78.42	78.58	0.004538	0.77	1.06	4.03	0.48
Tributary 2	982.894*	2yr-12hrSCS	0.45	78.07	78.45	78.34	78.47	0.004418	0.66	0.69	3.30	0.46
Tributary 2	973.49	100yr-12hrSCS	2.14	78.00	78.73	78.53	78.78	0.003841	0.93	2.30	5.86	0.47
Tributary 2	973.49	5yr-12hrSCS	0.82	78.00	78.52	78.36	78.54	0.003324	0.68	1.20	4.37	0.42
Tributary 2	973.49	2yr-12hrSCS	0.45	78.00	78.42	78.28	78.44	0.003000	0.56	0.80	3.62	0.38
Tributary 2	964.252*	100yr-12hrSCS	2.14	78.00	78.70	78.50	78.74	0.003880	0.91	2.34	6.21	0.47
Tributary 2	964.252*	5yr-12hrSCS	0.82	78.00	78.49	78.33	78.51	0.003168	0.66	1.24	4.54	0.41
Tributary 2	964.252*	2yr-12hrSCS	0.45	78.00	78.39	78.26	78.41	0.002795	0.54	0.83	3.79	0.37
Tributary 2	955.015*	100yr-12hrSCS	2.14	78.00	78.66	78.47	78.70	0.003890	0.90	2.37	6.46	0.47
Tributary 2	955.015*	5yr-12hrSCS	0.82	78.00	78.46	78.31	78.48	0.003086	0.65	1.26	4.73	0.40
Tributary 2	955.015*	2yr-12hrSCS	0.45	78.00	78.37	78.23	78.38	0.002666	0.53	0.86	3.97	0.36
Tributary 2	945.778*	100yr-12hrSCS	2.14	78.00	78.63	78.45	78.67	0.003894	0.89	2.39	6.59	0.47
Tributary 2	945.778*	5yr-12hrSCS	0.82	78.00	78.43	78.28	78.45	0.003079	0.64	1.28	4.92	0.40
Tributary 2	945.778*	2yr-12hrSCS	0.45	78.00	78.34	78.21	78.36	0.002632	0.51	0.88	4.16	0.36
Tributary 2	936.541*	100yr-12hrSCS	2.14	78.00	78.59	78.41	78.63	0.003994	0.90	2.38	6.69	0.48
Tributary 2	936.541*	5yr-12hrSCS	0.82	78.00	78.40	78.26	78.43	0.003198	0.64	1.29	5.13	0.41
Tributary 2	936.541*	2yr-12hrSCS	0.45	78.00	78.32	78.19	78.33	0.002707	0.51	0.89	4.37	0.36
Tributary 2	927.304*	100yr-12hrSCS	2.14	78.00	78.55	78.39	78.59	0.004276	0.91	2.34	6.75	0.49
Tributary 2	927.304*	5yr-12hrSCS	0.82	78.00	78.37	78.24	78.39	0.003517	0.65	1.27	5.34	0.42
Tributary 2	927.304*	2yr-12hrSCS	0.45	78.00	78.29	78.18	78.31	0.002975	0.52	0.88	4.58	0.37
Tributary 2	918.067*	100yr-12hrSCS	2.14	78.00	78.50	78.37	78.55	0.004971	0.95	2.24	6.75	0.53
Tributary 2	918.067*	5yr-12hrSCS	0.82	78.00	78.34	78.23	78.36	0.004292	0.68	1.21	5.46	0.46
Tributary 2	918.067*	2yr-12hrSCS	0.45	78.00	78.26	78.16	78.28	0.003711	0.54	0.83	4.74	0.41
Tributary 2	908.83	100yr-12hrSCS	2.14	78.00	78.34	78.34	78.46	0.019600	1.52	1.40	5.93	1.00
Tributary 2	908.83	5yr-12hrSCS	0.82	78.00	78.25	78.21	78.30	0.011519	0.93	0.88	5.24	0.72
Tributary 2	908.83	2yr-12hrSCS	0.45	78.00	78.20	78.15	78.23	0.008816	0.72	0.63	4.52	0.61
Tributary 2	900.026*	100yr-12hrSCS	2.14	78.00	78.31	78.23	78.34	0.006800	0.84	2.54	11.83	0.58
Tributary 2	900.026*	5yr-12hrSCS	0.82	78.00	78.21	78.13	78.22	0.004895	0.56	1.46	9.74	0.46
Tributary 2	900.026*	2yr-12hrSCS	0.45	78.00	78.16	78.10	78.17	0.003970	0.44	1.03	8.46	0.40

HEC-RAS Plan: Existing Con (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Tributary 2	891.223*	100yr-12hrSCS	2.14	78.00	78.26		78.29	0.005311	0.67	3.19	17.50	0.50
Tributary 2	891.223*	5yr-12hrSCS	0.82	78.00	78.17		78.19	0.003898	0.46	1.79	13.71	0.41
Tributary 2	891.223*	2yr-12hrSCS	0.45	78.00	78.13		78.14	0.003351	0.37	1.24	11.91	0.36
Tributary 2	882.42	100yr-12hrSCS	2.14	78.00	78.19		78.22	0.010905	0.79	2.70	19.70	0.68
Tributary 2	882.42	5yr-12hrSCS	0.82	78.00	78.11		78.13	0.012785	0.63	1.30	14.91	0.69
Tributary 2	882.42	2yr-12hrSCS	0.45	78.00	78.08		78.09	0.009322	0.47	0.97	13.77	0.57
Tributary 2	870.168*	100yr-12hrSCS	2.14	77.87	78.12		78.14	0.005871	0.69	3.11	17.62	0.52
Tributary 2	870.168*	5yr-12hrSCS	0.82	77.87	77.99		78.02	0.011325	0.66	1.25	12.43	0.66
Tributary 2	870.168*	2yr-12hrSCS	0.45	77.87	77.94		77.97	0.021574	0.68	0.67	10.32	0.85
Tributary 2	857.916*	100yr-12hrSCS	2.14	77.74	78.09		78.10	0.002547	0.55	3.90	16.60	0.36
Tributary 2	857.916*	5yr-12hrSCS	0.82	77.74	77.96		77.97	0.002251	0.40	2.05	12.80	0.32
Tributary 2	857.916*	2yr-12hrSCS	0.45	77.74	77.92		77.92	0.001620	0.30	1.51	11.33	0.26
Tributary 2	845.665*	100yr-12hrSCS	2.14	77.61	78.07		78.08	0.001411	0.47	4.50	15.21	0.28
Tributary 2	845.665*	5yr-12hrSCS	0.82	77.61	77.95		77.96	0.000737	0.29	2.85	12.51	0.19
Tributary 2	845.665*	2yr-12hrSCS	0.45	77.61	77.91		77.92	0.000379	0.19	2.36	11.54	0.14
Tributary 2	833.413*	100yr-12hrSCS	2.14	77.47	78.06	77.78	78.07	0.001060	0.46	4.64	13.21	0.25
Tributary 2	833.413*	5yr-12hrSCS	0.82	77.47	77.95	77.65	77.95	0.000416	0.25	3.26	11.34	0.15
Tributary 2	833.413*	2yr-12hrSCS	0.45	77.47	77.91	77.59	77.91	0.000186	0.16	2.84	10.70	0.10
Tributary 2	821.161*	100yr-12hrSCS	2.14	77.34	78.05	77.75	78.06	0.001142	0.51	4.20	10.79	0.26
Tributary 2	821.161*	5yr-12hrSCS	0.82	77.34	77.95	77.61	77.95	0.000376	0.26	3.15	9.55	0.14
Tributary 2	821.161*	2yr-12hrSCS	0.45	77.34	77.91	77.52	77.91	0.000157	0.16	2.81	9.10	0.09
Tributary 2	808.91	100yr-12hrSCS	2.14	77.21	78.02	77.78	78.05	0.002193	0.69	3.09	8.02	0.35
Tributary 2	808.91	5yr-12hrSCS	0.82	77.21	77.94	77.63	77.94	0.000625	0.34	2.45	7.32	0.18
Tributary 2	808.91	2yr-12hrSCS	0.45	77.21	77.91	77.58	77.91	0.000250	0.20	2.22	7.03	0.12
Tributary 2	801.24*	100yr-12hrSCS	2.14	77.24	78.02	77.71	78.03	0.001153	0.52	4.07	9.97	0.26
Tributary 2	801.24*	5yr-12hrSCS	0.82	77.24	77.94	77.59	77.94	0.000309	0.25	3.31	9.24	0.13
Tributary 2	801.24*	2yr-12hrSCS	0.45	77.24	77.91	77.53	77.91	0.000122	0.15	3.02	8.99	0.08
Tributary 2	793.569*	100yr-12hrSCS	2.14	77.27	78.02	77.65	78.02	0.000657	0.40	5.39	19.45	0.20
Tributary 2	793.569*	5yr-12hrSCS	0.82	77.27	77.94	77.54	77.94	0.000169	0.19	4.33	11.59	0.10
Tributary 2	793.569*	2yr-12hrSCS	0.45	77.27	77.91	77.49	77.91	0.000065	0.11	3.99	11.14	0.06
Tributary 2	785.9*	100yr-12hrSCS	2.14	77.30	78.01	77.59	78.02	0.000317	0.30	7.75	22.98	0.14
Tributary 2	785.9*	5yr-12hrSCS	0.82	77.30	77.94	77.50	77.94	0.000088	0.14	6.02	21.13	0.07

HEC-RAS Plan: Existing Con (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Tributary 2	785.9*	2yr-12hrSCS	0.45	77.30	77.91	77.46	77.91	0.000035	0.09	5.39	20.32	0.04
Tributary 2	778.23	100yr-12hrSCS	2.14	77.33	78.01	77.53	78.02	0.000166	0.24	10.27	26.14	0.10
Tributary 2	778.23	5yr-12hrSCS	0.82	77.33	77.94	77.45	77.94	0.000043	0.11	8.34	23.65	0.05
Tributary 2	778.23	2yr-12hrSCS	0.45	77.33	77.91	77.42	77.91	0.000015	0.07	7.49	21.34	0.03
Tributary 2	769.43*	100yr-12hrSCS	2.14	77.39	78.01	77.58	78.02	0.000181	0.23	10.14	26.90	0.11
Tributary 2	769.43*	5yr-12hrSCS	0.82	77.39	77.94	77.50	77.94	0.000049	0.11	8.14	25.15	0.05
Tributary 2	769.43*	2yr-12hrSCS	0.45	77.39	77.91	77.48	77.91	0.000019	0.07	7.39	24.53	0.03
Tributary 2	760.63*	100yr-12hrSCS	2.14	77.45	78.01	77.63	78.01	0.000214	0.23	9.80	28.16	0.11
Tributary 2	760.63*	5yr-12hrSCS	0.82	77.45	77.94	77.56	77.94	0.000062	0.11	7.72	26.59	0.06
Tributary 2	760.63*	2yr-12hrSCS	0.45	77.45	77.91	77.54	77.91	0.000025	0.07	6.94	25.80	0.04
Tributary 2	751.83*	100yr-12hrSCS	2.14	77.51	78.01	77.68	78.01	0.000275	0.24	9.26	29.65	0.13
Tributary 2	751.83*	5yr-12hrSCS	0.82	77.51	77.93	77.62	77.94	0.000086	0.12	7.12	27.77	0.07
Tributary 2	751.83*	2yr-12hrSCS	0.45	77.51	77.91	77.60	77.91	0.000036	0.07	6.34	25.65	0.04
Tributary 2	743.03*	100yr-12hrSCS	2.14	77.57	78.01	77.74	78.01	0.000391	0.26	8.49	31.00	0.15
Tributary 2	743.03*	5yr-12hrSCS	0.82	77.57	77.93	77.69	77.93	0.000137	0.13	6.37	27.74	0.08
Tributary 2	743.03*	2yr-12hrSCS	0.45	77.57	77.90	77.67	77.91	0.000061	0.08	5.60	26.06	0.06
Tributary 2	734.23*	100yr-12hrSCS	2.14	77.63	78.00	77.80	78.00	0.000645	0.29	7.48	31.55	0.18
Tributary 2	734.23*	5yr-12hrSCS	0.82	77.63	77.93	77.75	77.93	0.000269	0.15	5.39	29.06	0.11
Tributary 2	734.23*	2yr-12hrSCS	0.45	77.63	77.90	77.74	77.90	0.000131	0.10	4.60	27.75	0.08
Tributary 2	725.43*	100yr-12hrSCS	2.14	77.69	77.99	77.86	78.00	0.001387	0.35	6.11	32.88	0.26
Tributary 2	725.43*	5yr-12hrSCS	0.82	77.69	77.93	77.82	77.93	0.000748	0.20	4.08	31.11	0.18
Tributary 2	725.43*	2yr-12hrSCS	0.45	77.69	77.90	77.81	77.90	0.000422	0.14	3.31	29.27	0.13
Tributary 2	716.63	100yr-12hrSCS	2.14	77.75	77.94	77.92	77.97	0.012744	0.67	3.21	34.21	0.69
Tributary 2	716.63	5yr-12hrSCS	0.82	77.75	77.89	77.89	77.91	0.014257	0.51	1.62	28.25	0.68
Tributary 2	716.63	2yr-12hrSCS	0.45	77.75	77.89	77.89	77.89	0.006679	0.32	1.39	26.87	0.46
Tributary 2	706.634*	100yr-12hrSCS	2.14	77.53	77.82	77.77	77.84	0.012925	0.61	3.50	26.83	0.54
Tributary 2	706.634*	5yr-12hrSCS	0.82	77.53	77.74	77.71	77.76	0.016100	0.51	1.62	19.24	0.56
Tributary 2	706.634*	2yr-12hrSCS	0.45	77.53	77.71	77.68	77.72	0.019467	0.46	0.99	15.94	0.58
Tributary 2	696.638*	100yr-12hrSCS	2.14	77.30	77.71		77.73	0.010914	0.55	3.89	21.45	0.41
Tributary 2	696.638*	5yr-12hrSCS	0.82	77.30	77.59		77.60	0.016336	0.50	1.65	14.21	0.47
Tributary 2	696.638*	2yr-12hrSCS	0.45	77.30	77.54		77.55	0.016601	0.43	1.06	11.58	0.45
Tributary 2	686.642*	100yr-12hrSCS	2.14	77.08	77.61		77.62	0.009338	0.50	4.24	17.63	0.33

HEC-RAS Plan: Existing Con (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Tributary 2	686.642*	5yr-12hrSCS	0.82	77.08	77.43		77.45	0.014788	0.47	1.73	11.11	0.38
Tributary 2	686.642*	2yr-12hrSCS	0.45	77.08	77.36		77.37	0.019933	0.46	0.99	8.31	0.43
Tributary 2	676.646*	100yr-12hrSCS	2.14	76.86	77.52	77.27	77.53	0.008358	0.48	4.46	14.43	0.27
Tributary 2	676.646*	5yr-12hrSCS	0.82	76.86	77.33	77.14	77.33	0.008905	0.39	2.10	9.70	0.27
Tributary 2	676.646*	2yr-12hrSCS	0.45	76.86	77.24	77.09	77.24	0.009035	0.34	1.32	7.50	0.26
Tributary 2	666.65	100yr-12hrSCS	2.14	76.64	77.43	77.11	77.45	0.009285	0.50	4.24	11.11	0.26
Tributary 2	666.65	5yr-12hrSCS	0.82	76.64	77.26	76.96	77.26	0.005292	0.32	2.54	8.50	0.19
Tributary 2	666.65	2yr-12hrSCS	0.45	76.64	77.19	76.89	77.19	0.003163	0.23	1.97	7.41	0.14
Tributary 2	657.006*	100yr-12hrSCS	2.14	76.76	77.37	77.08	77.38	0.004722	0.42	5.11	15.57	0.23
Tributary 2	657.006*	5yr-12hrSCS	0.82	76.76	77.22	76.96	77.23	0.002694	0.27	3.07	12.03	0.17
Tributary 2	657.006*	2yr-12hrSCS	0.45	76.76	77.17	76.91	77.17	0.001559	0.19	2.41	10.62	0.13
Tributary 2	647.363*	100yr-12hrSCS	2.14	76.88	77.33		77.34	0.003523	0.40	5.36	22.56	0.26
Tributary 2	647.363*	5yr-12hrSCS	0.82	76.88	77.20		77.20	0.002411	0.28	2.91	15.49	0.21
Tributary 2	647.363*	2yr-12hrSCS	0.45	76.88	77.15		77.15	0.001549	0.21	2.20	13.53	0.16
Tributary 2	637.72	100yr-12hrSCS	2.14	77.00	77.31		77.31	0.002026	0.41	5.19	29.29	0.31
Tributary 2	637.72	5yr-12hrSCS	0.82	77.00	77.14		77.16	0.009407	0.56	1.46	15.90	0.59
Tributary 2	637.72	2yr-12hrSCS	0.45	77.00	77.11		77.12	0.010814	0.51	0.90	12.76	0.61
Tributary 2	629.835*	100yr-12hrSCS	2.14	76.91	77.30		77.30	0.001129	0.36	5.89	26.02	0.24
Tributary 2	629.835*	5yr-12hrSCS	0.82	76.91	77.10		77.11	0.004780	0.46	1.80	16.23	0.44
Tributary 2	629.835*	2yr-12hrSCS	0.45	76.91	77.03		77.04	0.008995	0.50	0.90	11.28	0.57
Tributary 2	621.95*	100yr-12hrSCS	2.14	76.81	77.29		77.29	0.000939	0.37	5.85	21.64	0.22
Tributary 2	621.95*	5yr-12hrSCS	0.82	76.81	77.08		77.09	0.001588	0.35	2.35	13.72	0.27
Tributary 2	621.95*	2yr-12hrSCS	0.45	76.81	76.99		77.00	0.003303	0.37	1.24	11.73	0.36
Tributary 2	614.065*	100yr-12hrSCS	2.14	76.72	77.28	76.99	77.29	0.001096	0.43	5.03	16.52	0.25
Tributary 2	614.065*	5yr-12hrSCS	0.82	76.72	77.07	76.90	77.08	0.000933	0.34	2.44	10.01	0.22
Tributary 2	614.065*	2yr-12hrSCS	0.45	76.72	76.98	76.85	76.99	0.001123	0.29	1.57	9.44	0.23
Tributary 2	606.18	100yr-12hrSCS	2.14	76.62	77.25	76.98	77.27	0.002291	0.63	3.37	10.46	0.36
Tributary 2	606.18	5yr-12hrSCS	0.82	76.62	77.06	76.86	77.07	0.001249	0.44	1.85	6.17	0.26
Tributary 2	606.18	2yr-12hrSCS	0.45	76.62	76.97	76.82	76.98	0.001038	0.34	1.34	5.83	0.23
Tributary 2	597.306*	100yr-12hrSCS	2.14	76.65	77.23	76.98	77.25	0.002412	0.63	3.38	11.00	0.36
Tributary 2	597.306*	5yr-12hrSCS	0.82	76.65	77.05	76.86	77.06	0.001272	0.44	1.86	6.34	0.26
Tributary 2	597.306*	2yr-12hrSCS	0.45	76.65	76.96	76.80	76.97	0.001065	0.34	1.34	6.01	0.23

HEC-RAS Plan: Existing Con (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Tributary 2	588.432*	100yr-12hrSCS	2.14	76.67	77.21	76.97	77.23	0.002906	0.63	3.46	17.09	0.39
Tributary 2	588.432*	5yr-12hrSCS	0.82	76.67	77.03	76.85	77.04	0.001439	0.45	1.84	6.79	0.27
Tributary 2	588.432*	2yr-12hrSCS	0.45	76.67	76.95	76.80	76.96	0.001185	0.35	1.31	6.18	0.24
Tributary 2	579.558*	100yr-12hrSCS	2.14	76.70	77.18		77.20	0.002668	0.65	3.49	16.94	0.38
Tributary 2	579.558*	5yr-12hrSCS	0.82	76.70	77.02		77.03	0.001661	0.46	1.78	6.99	0.29
Tributary 2	579.558*	2yr-12hrSCS	0.45	76.70	76.94		76.95	0.001451	0.36	1.25	6.35	0.26
Tributary 2	570.684*	100yr-12hrSCS	2.14	76.72	77.16		77.18	0.002720	0.69	3.42	16.89	0.39
Tributary 2	570.684*	5yr-12hrSCS	0.82	76.72	77.00		77.01	0.002118	0.50	1.66	7.05	0.33
Tributary 2	570.684*	2yr-12hrSCS	0.45	76.72	76.92		76.93	0.002125	0.40	1.12	6.56	0.31
Tributary 2	561.81	100yr-12hrSCS	2.14	76.75	77.12		77.15	0.003340	0.77	3.23	19.08	0.43
Tributary 2	561.81	5yr-12hrSCS	0.82	76.75	76.97		76.99	0.003395	0.58	1.43	6.91	0.40
Tributary 2	561.81	2yr-12hrSCS	0.45	76.75	76.89		76.90	0.005084	0.53	0.86	6.51	0.46
Tributary 2	552.312*	100yr-12hrSCS	2.14	76.67	77.10		77.12	0.004017	0.66	3.68	18.30	0.35
Tributary 2	552.312*	5yr-12hrSCS	0.82	76.67	76.94		76.95	0.004198	0.48	1.70	7.89	0.33
Tributary 2	552.312*	2yr-12hrSCS	0.45	76.67	76.85		76.86	0.004937	0.43	1.04	6.40	0.34
Tributary 2	542.814*	100yr-12hrSCS	2.14	76.59	77.06		77.08	0.004678	0.58	4.03	17.72	0.30
Tributary 2	542.814*	5yr-12hrSCS	0.82	76.59	76.91		76.91	0.004848	0.42	1.97	8.86	0.28
Tributary 2	542.814*	2yr-12hrSCS	0.45	76.59	76.80		76.81	0.004895	0.37	1.21	6.38	0.27
Tributary 2	533.316*	100yr-12hrSCS	2.14	76.50	77.02		77.03	0.005293	0.53	4.36	17.76	0.27
Tributary 2	533.316*	5yr-12hrSCS	0.82	76.50	76.86		76.87	0.005276	0.37	2.20	9.73	0.24
Tributary 2	533.316*	2yr-12hrSCS	0.45	76.50	76.76		76.77	0.005091	0.33	1.38	6.80	0.23
Tributary 2	523.818*	100yr-12hrSCS	2.14	76.42	76.97		76.98	0.005949	0.48	4.68	18.62	0.24
Tributary 2	523.818*	5yr-12hrSCS	0.82	76.42	76.82		76.82	0.005828	0.34	2.40	10.35	0.22
Tributary 2	523.818*	2yr-12hrSCS	0.45	76.42	76.72		76.72	0.005564	0.30	1.53	7.44	0.21
Tributary 2	514.32	100yr-12hrSCS	2.14	76.34	76.92		76.93	0.006531	0.44	5.04	20.83	0.22
Tributary 2	514.32	5yr-12hrSCS	0.82	76.34	76.76		76.76	0.006973	0.33	2.51	10.62	0.21
Tributary 2	514.32	2yr-12hrSCS	0.45	76.34	76.67		76.67	0.006124	0.27	1.66	7.88	0.19
Tributary 2	506.612*	100yr-12hrSCS	2.14	76.32	76.87		76.88	0.006097	0.50	4.52	19.07	0.25
Tributary 2	506.612*	5yr-12hrSCS	0.82	76.32	76.70		76.71	0.006947	0.38	2.16	9.73	0.25
Tributary 2	506.612*	2yr-12hrSCS	0.45	76.32	76.62		76.62	0.006183	0.31	1.45	7.38	0.23
Tributary 2	498.905*	100yr-12hrSCS	2.14	76.30	76.82		76.83	0.004957	0.56	4.19	18.08	0.28
Tributary 2	498.905*	5yr-12hrSCS	0.82	76.30	76.65		76.66	0.006333	0.44	1.87	9.12	0.29
Tributary 2	498.905*	2yr-12hrSCS	0.45	76.30	76.57		76.57	0.005847	0.36	1.26	6.81	0.27

HEC-RAS Plan: Existing Con (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Tributary 2	491.197*	100yr-12hrSCS	2.14	76.27	76.79		76.80	0.003112	0.61	4.16	18.11	0.30
Tributary 2	491.197*	5yr-12hrSCS	0.82	76.27	76.60		76.62	0.004342	0.50	1.69	9.17	0.32
Tributary 2	491.197*	2yr-12hrSCS	0.45	76.27	76.53		76.54	0.004242	0.40	1.13	6.30	0.30
Tributary 2	483.49	100yr-12hrSCS	2.14	76.25	76.77		76.78	0.001564	0.66	4.42	18.88	0.31
Tributary 2	483.49	5yr-12hrSCS	0.82	76.25	76.58		76.60	0.001969	0.52	1.72	10.27	0.32
Tributary 2	483.49	2yr-12hrSCS	0.45	76.25	76.51		76.52	0.001893	0.41	1.10	6.28	0.30
Tributary 2	474.957*	100yr-12hrSCS	2.14	76.25	76.75		76.77	0.001710	0.65	4.04	17.32	0.32
Tributary 2	474.957*	5yr-12hrSCS	0.82	76.25	76.56		76.58	0.002345	0.51	1.63	8.63	0.34
Tributary 2	474.957*	2yr-12hrSCS	0.45	76.25	76.49		76.50	0.002201	0.41	1.09	6.32	0.32
Tributary 2	466.425*	100yr-12hrSCS	2.14	76.25	76.73		76.75	0.001919	0.64	3.74	15.70	0.34
Tributary 2	466.425*	5yr-12hrSCS	0.82	76.25	76.54		76.56	0.003145	0.54	1.53	7.76	0.39
Tributary 2	466.425*	2yr-12hrSCS	0.45	76.25	76.47		76.48	0.002564	0.44	1.04	6.21	0.34
Tributary 2	457.892*	100yr-12hrSCS	2.14	76.25	76.71		76.74	0.002271	0.65	3.49	13.95	0.36
Tributary 2	457.892*	5yr-12hrSCS	0.82	76.25	76.51		76.53	0.004080	0.61	1.36	7.04	0.44
Tributary 2	457.892*	2yr-12hrSCS	0.45	76.25	76.44		76.46	0.003237	0.48	0.95	5.99	0.38
Tributary 2	449.36	100yr-12hrSCS	2.14	76.25	76.69		76.71	0.003052	0.67	3.21	13.25	0.41
Tributary 2	449.36	5yr-12hrSCS	0.82	76.25	76.43		76.47	0.012059	0.88	0.93	6.19	0.73
Tributary 2	449.36	2yr-12hrSCS	0.45	76.25	76.38		76.41	0.012186	0.73	0.62	5.62	0.70
Tributary 2	443.33*	100yr-12hrSCS	2.14	76.25	76.70		76.70	0.000696	0.38	5.61	15.53	0.20
Tributary 2	443.33*	5yr-12hrSCS	0.82	76.25	76.43		76.44	0.002201	0.41	2.01	11.90	0.32
Tributary 2	443.33*	2yr-12hrSCS	0.45	76.25	76.37		76.37	0.002714	0.35	1.30	11.42	0.33
Tributary 2	437.3	100yr-12hrSCS	2.14	76.25	76.70		76.70	0.000273	0.26	8.29	20.38	0.13
Tributary 2	437.3	5yr-12hrSCS	0.82	76.25	76.43		76.43	0.000908	0.26	3.11	18.22	0.20
Tributary 2	437.3	2yr-12hrSCS	0.45	76.25	76.36		76.36	0.001295	0.23	1.94	17.95	0.23
Tributary 2	430.05*	100yr-12hrSCS	2.14	76.20	76.69		76.70	0.000614	0.37	5.82	15.50	0.19
Tributary 2	430.05*	5yr-12hrSCS	0.82	76.20	76.41		76.42	0.001944	0.40	2.04	11.25	0.30
Tributary 2	430.05*	2yr-12hrSCS	0.45	76.20	76.35		76.35	0.002029	0.34	1.35	10.07	0.29
Tributary 2	422.8	100yr-12hrSCS	2.14	76.15	76.67		76.69	0.001593	0.60	3.54	9.06	0.31
Tributary 2	422.8	5yr-12hrSCS	0.82	76.15	76.37		76.40	0.005452	0.67	1.23	6.83	0.50
Tributary 2	422.8	2yr-12hrSCS	0.45	76.15	76.31		76.33	0.005721	0.55	0.83	6.49	0.49
Tributary 2	417.33*	100yr-12hrSCS	2.14	76.08	76.66		76.68	0.001711	0.60	3.56	9.74	0.32
Tributary 2	417.33*	5yr-12hrSCS	0.82	76.08	76.29	76.28	76.34	0.018428	1.03	0.79	5.74	0.89

HEC-RAS Plan: Existing Con (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Tributary 2	417.33*	2yr-12hrSCS	0.45	76.08	76.25	76.24	76.28	0.013485	0.78	0.58	5.12	0.74
Tributary 2	411.86	100yr-12hrSCS	2.14	76.00	76.66		76.67	0.001123	0.51	4.20	10.71	0.26
Tributary 2	411.86	5yr-12hrSCS	0.82	76.00	76.23		76.27	0.009498	0.88	0.93	5.21	0.66
Tributary 2	411.86	2yr-12hrSCS	0.45	76.00	76.12	76.12	76.18	0.030595	1.08	0.42	4.15	1.08
Tributary 2	402.745*	100yr-12hrSCS	2.14	75.73	76.64		76.66	0.000982	0.58	3.68	6.75	0.25
Tributary 2	402.745*	5yr-12hrSCS	0.82	75.73	76.20		76.22	0.002306	0.62	1.31	4.11	0.35
Tributary 2	402.745*	2yr-12hrSCS	0.45	75.73	76.07	75.92	76.08	0.002697	0.56	0.81	3.35	0.37
Tributary 2	393.63	100yr-12hrSCS	2.14	75.47	76.58	76.28	76.64	0.003947	1.09	1.97	3.54	0.46
Tributary 2	393.63	5yr-12hrSCS	0.82	75.47	76.05	76.03	76.17	0.017731	1.50	0.55	1.87	0.89
Tributary 2	393.63	2yr-12hrSCS	0.45	75.47	75.91	75.91	76.02	0.023987	1.45	0.31	1.41	0.98
Tributary 2	389.83		Culvert									
Tributary 2	382.36	100yr-12hrSCS	2.14	75.42	76.23	76.23	76.43	0.020188	2.01	1.06	2.59	1.00
Tributary 2	382.36	5yr-12hrSCS	0.82	75.42	75.97	75.97	76.11	0.022885	1.66	0.50	1.77	1.00
Tributary 2	382.36	2yr-12hrSCS	0.45	75.42	75.85	75.85	75.96	0.025249	1.48	0.31	1.39	1.01
Tributary 2	373.825*	100yr-12hrSCS	2.14	75.46	75.84	75.95	76.18	0.048404	2.59	0.83	2.95	1.56
Tributary 2	373.825*	5yr-12hrSCS	0.82	75.46	75.80	75.74	75.87	0.010399	1.14	0.72	2.80	0.71
Tributary 2	373.825*	2yr-12hrSCS	0.45	75.46	75.74	75.66	75.77	0.006941	0.83	0.55	2.54	0.57
Tributary 2	365.29	100yr-12hrSCS	2.14	75.50	75.94	75.83	75.96	0.002392	0.72	4.12	18.99	0.38
Tributary 2	365.29	5yr-12hrSCS	0.82	75.50	75.78		75.80	0.004506	0.67	1.42	14.44	0.47
Tributary 2	365.29	2yr-12hrSCS	0.45	75.50	75.70		75.72	0.005267	0.60	0.75	4.74	0.48
Tributary 2	354.745*	100yr-12hrSCS	2.14	75.44	75.90		75.93	0.003403	0.89	3.18	14.79	0.45
Tributary 2	354.745*	5yr-12hrSCS	0.82	75.44	75.73		75.76	0.004604	0.72	1.21	8.45	0.48
Tributary 2	354.745*	2yr-12hrSCS	0.45	75.44	75.65		75.67	0.005132	0.62	0.74	4.40	0.48
Tributary 2	344.2*	100yr-12hrSCS	2.14	75.37	75.86		75.90	0.003371	0.93	3.07	13.29	0.45
Tributary 2	344.2*	5yr-12hrSCS	0.82	75.37	75.68		75.71	0.004390	0.75	1.17	7.30	0.48
Tributary 2	344.2*	2yr-12hrSCS	0.45	75.37	75.60		75.62	0.004884	0.63	0.72	3.99	0.47
Tributary 2	333.655*	100yr-12hrSCS	2.14	75.31	75.82		75.86	0.003641	1.01	2.92	12.57	0.48
Tributary 2	333.655*	5yr-12hrSCS	0.82	75.31	75.64		75.67	0.004581	0.81	1.10	6.39	0.49
Tributary 2	333.655*	2yr-12hrSCS	0.45	75.31	75.55		75.57	0.004767	0.66	0.69	3.50	0.47
Tributary 2	323.11	100yr-12hrSCS	2.14	75.25	75.69	75.68	75.80	0.010466	1.55	1.79	9.41	0.78
Tributary 2	323.11	5yr-12hrSCS	0.82	75.25	75.56		75.61	0.007142	0.99	0.87	4.70	0.60
Tributary 2	323.11	2yr-12hrSCS	0.45	75.25	75.50		75.52	0.005341	0.72	0.63	2.94	0.50

HEC-RAS Plan: Existing Con (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Tributary 2	315.99*	100yr-12hrSCS	2.14	75.25	75.65		75.72	0.007439	1.20	2.02	9.52	0.65
Tributary 2	315.99*	5yr-12hrSCS	0.82	75.25	75.53		75.56	0.005262	0.76	1.10	5.64	0.51
Tributary 2	315.99*	2yr-12hrSCS	0.45	75.25	75.47		75.49	0.004320	0.58	0.78	4.55	0.44
Tributary 2	308.87*	100yr-12hrSCS	2.14	75.25	75.61		75.67	0.006776	1.04	2.18	10.04	0.61
Tributary 2	308.87*	5yr-12hrSCS	0.82	75.25	75.50		75.52	0.005343	0.67	1.22	6.63	0.50
Tributary 2	308.87*	2yr-12hrSCS	0.45	75.25	75.44		75.45	0.004532	0.53	0.85	5.86	0.44
Tributary 2	301.75	100yr-12hrSCS	2.14	75.25	75.55		75.61	0.009816	1.07	2.03	10.15	0.71
Tributary 2	301.75	5yr-12hrSCS	0.82	75.25	75.42		75.46	0.013730	0.87	0.95	7.15	0.76
Tributary 2	301.75	2yr-12hrSCS	0.45	75.25	75.37		75.40	0.015427	0.75	0.61	6.24	0.77
Tributary 2	293.98*	100yr-12hrSCS	2.14	75.12	75.49		75.54	0.008648	0.99	2.16	9.52	0.66
Tributary 2	293.98*	5yr-12hrSCS	0.82	75.12	75.34		75.37	0.010532	0.84	0.98	6.36	0.68
Tributary 2	293.98*	2yr-12hrSCS	0.45	75.12	75.28		75.30	0.010917	0.73	0.62	5.03	0.67
Tributary 2	286.21	100yr-12hrSCS	2.14	75.00	75.33	75.33	75.43	0.020656	1.45	1.47	6.91	1.00
Tributary 2	286.21	5yr-12hrSCS	0.82	75.00	75.18	75.18	75.25	0.022876	1.22	0.68	4.46	1.00
Tributary 2	286.21	2yr-12hrSCS	0.45	75.00	75.13	75.12	75.18	0.023826	1.01	0.45	4.03	0.97
Tributary 2	279.57*	100yr-12hrSCS	2.14	74.79	75.18	75.17	75.28	0.016756	1.40	1.53	6.51	0.92
Tributary 2	279.57*	5yr-12hrSCS	0.82	74.79	75.01	75.01	75.10	0.024765	1.31	0.62	3.89	1.05
Tributary 2	279.57*	2yr-12hrSCS	0.45	74.79	74.95	74.95	75.01	0.024059	1.10	0.41	3.28	0.99
Tributary 2	272.93*	100yr-12hrSCS	2.14	74.59	75.16	75.02	75.21	0.005011	0.94	2.28	7.10	0.53
Tributary 2	272.93*	5yr-12hrSCS	0.82	74.59	74.94	74.86	74.98	0.007055	0.83	0.99	4.85	0.58
Tributary 2	272.93*	2yr-12hrSCS	0.45	74.59	74.84	74.79	74.88	0.009915	0.81	0.56	3.59	0.66
Tributary 2	266.29	100yr-12hrSCS	2.43	74.38	75.14	74.92	75.18	0.003274	0.85	2.85	7.36	0.44
Tributary 2	266.29	5yr-12hrSCS	0.94	74.38	74.93	74.75	74.95	0.002658	0.63	1.51	5.33	0.38
Tributary 2	266.29	2yr-12hrSCS	0.52	74.38	74.83	74.67	74.84	0.002309	0.51	1.02	4.40	0.34
Northwest Branch	206.99	100yr-12hrSCS	3.44	74.25	74.60	74.60	74.72	0.019317	1.55	2.22	9.05	1.00
Northwest Branch	206.99	5yr-12hrSCS	1.32	74.25	74.47	74.47	74.54	0.023012	1.18	1.11	7.73	1.00
Northwest Branch	206.99	2yr-12hrSCS	0.72	74.25	74.41	74.41	74.46	0.025231	1.04	0.69	6.31	1.00
Northwest Branch	198.495*	100yr-12hrSCS	3.44	74.00	74.40	74.41	74.55	0.020441	1.72	2.00	7.22	1.04
Northwest Branch	198.495*	5yr-12hrSCS	1.32	74.00	74.23	74.24	74.34	0.026198	1.43	0.92	5.32	1.09
Northwest Branch	198.495*	2yr-12hrSCS	0.72	74.00	74.17	74.17	74.24	0.027033	1.20	0.60	4.61	1.06
Northwest Branch	190	100yr-12hrSCS	3.44	73.75	74.23	74.20	74.37	0.013793	1.66	2.06	5.75	0.89
Northwest Branch	190	5yr-12hrSCS	1.32	73.75	74.07	74.01	74.13	0.008855	1.07	1.22	4.74	0.67

HEC-RAS Plan: Existing Con (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Northwest Branch	190	2yr-12hrSCS	0.72	73.75	74.00	73.93	74.03	0.006832	0.81	0.89	4.33	0.57
Northwest Branch	181.195*	100yr-12hrSCS	3.44	73.75	74.18		74.26	0.008714	1.31	2.63	7.51	0.71
Northwest Branch	181.195*	5yr-12hrSCS	1.32	73.75	74.03		74.06	0.006018	0.84	1.57	6.63	0.55
Northwest Branch	181.195*	2yr-12hrSCS	0.72	73.75	73.96		73.98	0.004766	0.63	1.14	6.20	0.47
Northwest Branch	172.39	100yr-12hrSCS	3.44	73.75	74.06	74.04	74.16	0.015237	1.45	2.37	8.94	0.90
Northwest Branch	172.39	5yr-12hrSCS	1.32	73.75	73.92		73.98	0.015921	1.05	1.25	7.94	0.84
Northwest Branch	172.39	2yr-12hrSCS	0.72	73.75	73.87		73.91	0.016262	0.85	0.85	7.51	0.81
Northwest Branch	164.525*	100yr-12hrSCS	3.44	73.63	73.94	73.92	74.05	0.014453	1.41	2.44	9.17	0.87
Northwest Branch	164.525*	5yr-12hrSCS	1.32	73.63	73.81		73.86	0.015098	1.04	1.27	7.86	0.82
Northwest Branch	164.525*	2yr-12hrSCS	0.72	73.63	73.76		73.79	0.012469	0.79	0.91	7.39	0.72
Northwest Branch	156.66*	100yr-12hrSCS	3.44	73.50	73.89		73.95	0.007804	1.13	3.04	10.04	0.66
Northwest Branch	156.66*	5yr-12hrSCS	1.32	73.50	73.69		73.75	0.015637	1.05	1.25	7.76	0.84
Northwest Branch	156.66*	2yr-12hrSCS	0.72	73.50	73.62	73.61	73.67	0.021847	0.96	0.75	6.93	0.93
Northwest Branch	148.795*	100yr-12hrSCS	3.44	73.38	73.87		73.91	0.003401	0.82	4.20	12.12	0.44
Northwest Branch	148.795*	5yr-12hrSCS	1.32	73.38	73.65		73.67	0.004838	0.70	1.87	8.83	0.49
Northwest Branch	148.795*	2yr-12hrSCS	0.72	73.38	73.56		73.58	0.006126	0.63	1.14	7.48	0.52
Northwest Branch	140.93	100yr-12hrSCS	3.44	73.25	73.87		73.88	0.001444	0.58	5.93	15.07	0.29
Northwest Branch	140.93	5yr-12hrSCS	1.32	73.25	73.64		73.65	0.001463	0.45	2.93	11.03	0.28
Northwest Branch	140.93	2yr-12hrSCS	0.72	73.25	73.55		73.56	0.001197	0.36	2.02	9.22	0.24
Northwest Branch	133.316*	100yr-12hrSCS	3.44	73.25	73.85		73.87	0.001864	0.67	5.13	12.65	0.34
Northwest Branch	133.316*	5yr-12hrSCS	1.32	73.25	73.62		73.64	0.002069	0.51	2.56	10.17	0.33
Northwest Branch	133.316*	2yr-12hrSCS	0.72	73.25	73.54		73.54	0.001987	0.42	1.71	8.95	0.31
Northwest Branch	125.703*	100yr-12hrSCS	3.44	73.25	73.82		73.85	0.002963	0.85	4.06	9.90	0.42
Northwest Branch	125.703*	5yr-12hrSCS	1.32	73.25	73.60		73.62	0.003105	0.63	2.08	8.16	0.40
Northwest Branch	125.703*	2yr-12hrSCS	0.72	73.25	73.51		73.53	0.002991	0.51	1.42	7.57	0.37
Northwest Branch	118.09	100yr-12hrSCS	3.44	73.25	73.64	73.64	73.79	0.018503	1.76	1.96	6.28	1.00
Northwest Branch	118.09	5yr-12hrSCS	1.32	73.25	73.47	73.47	73.56	0.021312	1.33	0.99	5.41	0.99
Northwest Branch	118.09	2yr-12hrSCS	0.72	73.25	73.41	73.41	73.47	0.022137	1.08	0.67	5.12	0.96
Northwest Branch	109.985*	100yr-12hrSCS	3.44	73.00	73.32	73.39	73.57	0.049616	2.23	1.54	7.41	1.56
Northwest Branch	109.985*	5yr-12hrSCS	1.32	73.00	73.21	73.24	73.34	0.041427	1.55	0.85	6.17	1.33
Northwest Branch	109.985*	2yr-12hrSCS	0.72	73.00	73.17	73.18	73.25	0.038646	1.24	0.58	5.54	1.23
Northwest Branch	101.88	100yr-12hrSCS	3.44	72.74	73.45	73.12	73.47	0.000804	0.51	6.81	13.51	0.23

HEC-RAS Plan: Existing Con (Continued)

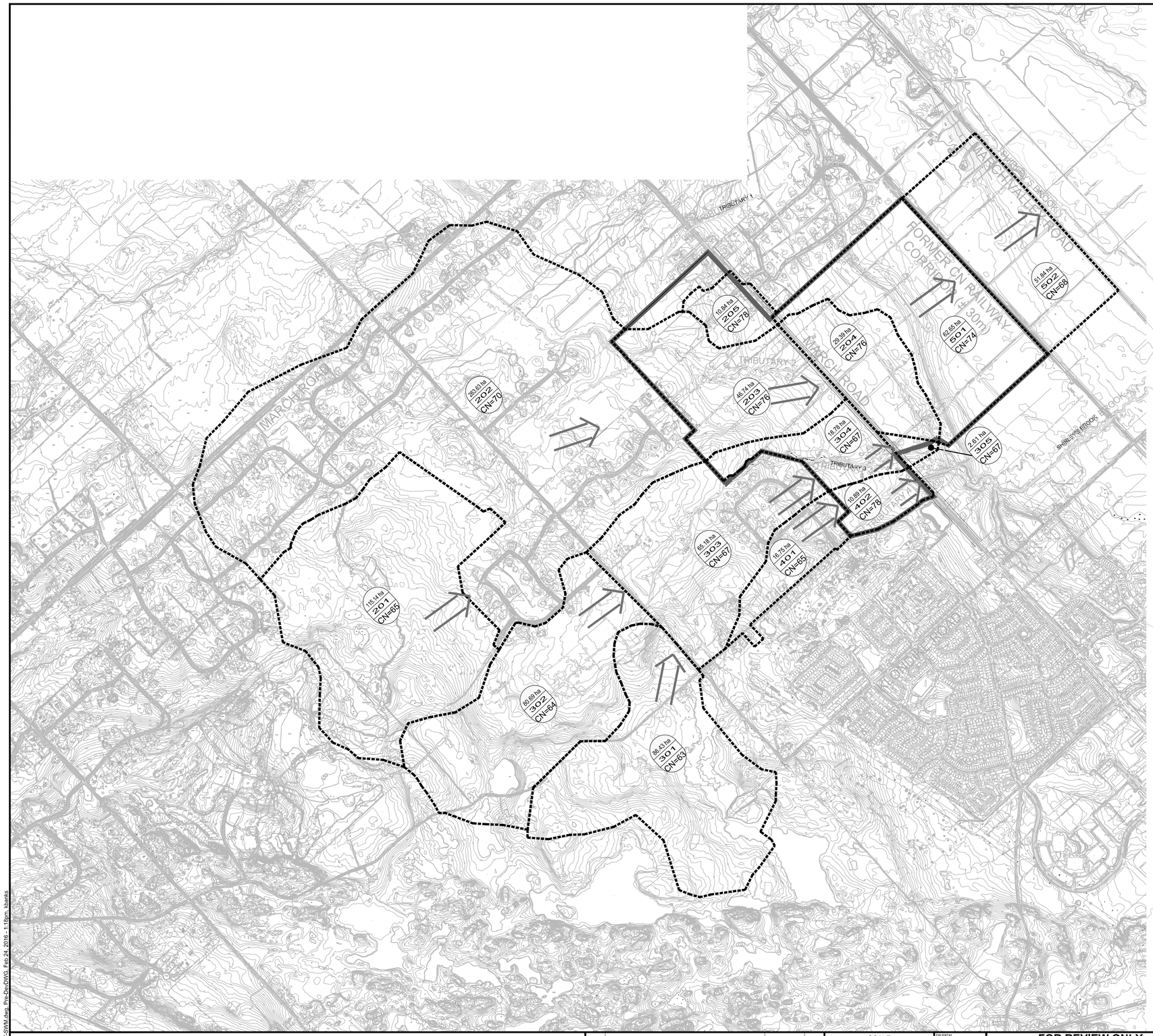
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Northwest Branch	101.88	5yr-12hrSCS	1.32	72.74	73.25	73.00	73.26	0.000565	0.32	4.15	12.87	0.18
Northwest Branch	101.88	2yr-12hrSCS	0.72	72.74	73.18	72.95	73.19	0.000360	0.22	3.28	12.55	0.14
Northwest Branch	94.5666*	100yr-12hrSCS	3.44	72.83	73.45	73.16	73.46	0.001045	0.53	6.44	14.46	0.26
Northwest Branch	94.5666*	5yr-12hrSCS	1.32	72.83	73.25	73.04	73.25	0.000935	0.36	3.63	13.56	0.22
Northwest Branch	94.5666*	2yr-12hrSCS	0.72	72.83	73.18	72.98	73.18	0.000657	0.26	2.75	12.78	0.18
Northwest Branch	87.2533*	100yr-12hrSCS	3.44	72.91	73.43	73.20	73.45	0.001583	0.59	5.81	15.40	0.31
Northwest Branch	87.2533*	5yr-12hrSCS	1.32	72.91	73.23	73.09	73.24	0.001947	0.46	2.89	13.25	0.31
Northwest Branch	87.2533*	2yr-12hrSCS	0.72	72.91	73.17	73.04	73.18	0.001495	0.34	2.09	11.99	0.26
Northwest Branch	79.94	100yr-12hrSCS	3.44	73.00	73.41		73.44	0.003182	0.72	4.79	16.06	0.42
Northwest Branch	79.94	5yr-12hrSCS	1.32	73.00	73.18		73.21	0.011398	0.83	1.59	11.27	0.70
Northwest Branch	79.94	2yr-12hrSCS	0.72	73.00	73.09	73.09	73.14	0.033309	0.98	0.74	9.05	1.10
Northwest Branch	73.53*	100yr-12hrSCS	3.44	72.87	73.40		73.42	0.001579	0.57	6.06	17.42	0.30
Northwest Branch	73.53*	5yr-12hrSCS	1.32	72.87	73.16		73.17	0.002957	0.54	2.45	12.00	0.38
Northwest Branch	73.53*	2yr-12hrSCS	0.72	72.87	73.05		73.06	0.005187	0.56	1.29	9.13	0.47
Northwest Branch	67.12	100yr-12hrSCS	3.44	72.75	73.40		73.41	0.000806	0.47	7.37	17.80	0.23
Northwest Branch	67.12	5yr-12hrSCS	1.32	72.75	73.15		73.16	0.001157	0.39	3.39	13.37	0.25
Northwest Branch	67.12	2yr-12hrSCS	0.72	72.75	73.04		73.05	0.001176	0.34	2.09	10.00	0.24
Northwest Branch	61.485*	100yr-12hrSCS	3.44	72.75	73.38		73.40	0.001761	0.69	5.19	14.83	0.33
Northwest Branch	61.485*	5yr-12hrSCS	1.32	72.75	73.13		73.15	0.002448	0.57	2.31	9.02	0.36
Northwest Branch	61.485*	2yr-12hrSCS	0.72	72.75	73.03		73.04	0.002431	0.50	1.45	6.90	0.35
Northwest Branch	55.85	100yr-12hrSCS	3.44	72.75	73.21	73.21	73.37	0.018304	1.78	1.94	6.06	1.00
Northwest Branch	55.85	5yr-12hrSCS	1.32	72.75	73.02	73.01	73.11	0.018855	1.40	0.94	4.33	0.95
Northwest Branch	55.85	2yr-12hrSCS	0.72	72.75	72.94		73.01	0.017278	1.12	0.64	3.88	0.88
Northwest Branch	46.32*	100yr-12hrSCS	3.44	72.63	73.00	73.02	73.18	0.024176	1.85	1.86	6.85	1.13
Northwest Branch	46.32*	5yr-12hrSCS	1.32	72.63	72.89	72.85	72.95	0.013301	1.13	1.16	5.65	0.80
Northwest Branch	46.32*	2yr-12hrSCS	0.72	72.63	72.81	72.78	72.86	0.012593	0.95	0.76	4.70	0.75
Northwest Branch	36.79	100yr-12hrSCS	3.44	72.50	72.83	72.86	72.99	0.026155	1.78	1.93	7.95	1.16
Northwest Branch	36.79	5yr-12hrSCS	1.32	72.50	72.71	72.71	72.79	0.022345	1.25	1.05	6.63	1.00
Northwest Branch	36.79	2yr-12hrSCS	0.72	72.50	72.65	72.64	72.70	0.019629	1.04	0.69	5.22	0.91
Northwest Branch	33.33	100yr-12hrSCS	3.44	72.50	72.68	72.74	72.86	0.051614	1.83	1.87	12.46	1.51
Northwest Branch	33.33	5yr-12hrSCS	1.32	72.50	72.67	72.63	72.70	0.010890	0.79	1.66	12.09	0.68
Northwest Branch	33.33	2yr-12hrSCS	0.72	72.50	72.63		72.64	0.009103	0.61	1.18	11.03	0.60

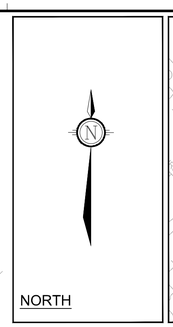
HEC-RAS Plan: Existing Con (Continued)

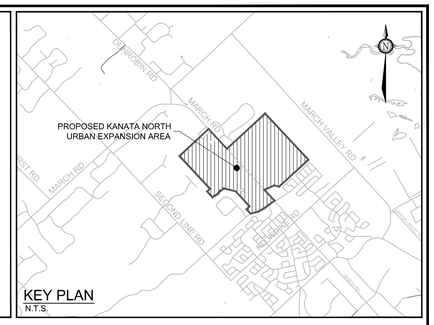
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Northwest Branch	30.31	100yr-12hrSCS	3.63	72.50	72.65	72.69	72.81	0.050480	1.75	2.08	14.52	1.47
Northwest Branch	30.31	5yr-12hrSCS	1.39	72.50	72.61	72.61	72.66	0.021079	0.92	1.52	14.43	0.91
Northwest Branch	30.31	2yr-12hrSCS	0.77	72.50	72.59		72.61	0.017196	0.68	1.12	14.37	0.78
Northwest Branch	20.4933*	100yr-12hrSCS	3.63	72.25	72.39	72.48	72.71	0.113890	2.50	1.45	10.92	2.19
Northwest Branch	20.4933*	5yr-12hrSCS	1.39	72.25	72.37	72.37	72.43	0.025178	1.09	1.28	10.86	1.01
Northwest Branch	20.4933*	2yr-12hrSCS	0.77	72.25	72.33	72.33	72.38	0.037179	0.97	0.79	10.69	1.14
Northwest Branch	10.6766*	100yr-12hrSCS	3.63	72.00	72.43	72.31	72.49	0.006028	1.10	3.31	9.35	0.59
Northwest Branch	10.6766*	5yr-12hrSCS	1.39	72.00	72.22	72.16	72.26	0.009027	0.92	1.52	7.63	0.66
Northwest Branch	10.6766*	2yr-12hrSCS	0.77	72.00	72.02	72.11	73.33	5.051074	5.07	0.15	6.79	10.85
Northwest Branch	0.86	100yr-12hrSCS	3.63	71.75	72.23	72.23	72.38	0.018518	1.74	2.09	6.79	1.00
Northwest Branch	0.86	5yr-12hrSCS	1.39	71.75	72.02	72.02	72.13	0.020774	1.49	0.94	4.20	1.00
Northwest Branch	0.86	2yr-12hrSCS	0.77	71.75	71.92	71.93	72.01	0.028570	1.36	0.56	3.65	1.11

Appendix C: Drawings

- KNUEA Pre-Development Drainage Area Plan – DWG 112117-PRE







LEGEND

- Subcatchment Drainage Boundaries
- Kanata North Expansion Area
- Waterway
- 115.14 ha / SBT2-1 / CN=65 — Subcatchment Area (ha), Subcatchment Name, SCS Curve Number / Runoff Coefficient
- Continuous Flow Monitoring Locations
- DIRECTION OF MAJOR OVERLAND FLOW

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

No.	REVISION	DATE	BY
1.	ISSUED FOR REVIEW	FEB16	CMS

SCALE 1:10000

1:10000
0 100 200 300 400

DESIGN KJA
CHECKED MJP
DRAWN MJH
CHECKED CMS
APPROVED MJP

FOR REVIEW ONLY

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LOCATION
CITY OF OTTAWA
KANATA NORTH URBAN EXPANSION AREA

DRAWING NAME
PRE-DEVELOPMENT DRAINAGE AREA PLAN

PROJECT No. 112117
REV REV # 1
DRAWING No. 112117-PRE

PLAN4.1.DWG - 841mmx594mm

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Appendix K

Existing Conditions Natural Environment Features

Kanata North Urban Expansion Area

(Muncaster Environmental Planning Inc. – January 2016)

EXISTING CONDITIONS

NATURAL ENVIRONMENT FEATURES

KANATA NORTH URBAN EXPANSION AREA

A report prepared for Novatech Engineering Consultants Ltd

by Muncaster Environmental Planning Inc.

Revised January, 2016

TABLE OF CONTENTS

1.0 INTRODUCTION 1

2.0 EXISTING CONDITIONS 3

2.1 Aquatic Habitat 3
2.1.1 North Branch of Shirley`s Brook 3
2.1.2 North Tributary 9
2.1.3 Other Channels 16
2.1.4 Fish Habitat Summary 21

2.2 Terrestrial Habitat 22
2.2.1 Woodlot S20 22
2.2.2 Woodlot S23 31
2.2.3 Southwest Wooded Area and Woodlot S12 41
2.2.4 Hedgerows 44
2.2.5 Other Treed Areas 50
2.2.6 Agricultural Fields and Cultural Meadows/Thickets 52
2.2.7 Linkages 58

2.3 Species at Risk and Other Species of Interest 58

3.0 SUMMARY and RECOMMENDATIONS 66

4.0 REFERENCES 71

5.0 RELIANCE CLAUSE 73

FIGURES

Figure 1 – Vegetation Communities 2
Figure 2 – Fish Sampling and Aquatic Habitat Sites – 2013 - 2015 4
Figure 3 – Larger Trees in Woodlot S20 25
Figure 4 – Woodlot S23 and Adjacent Lands 33
Figure 5 – 2013 Butternut Health Assessment Results 63
Figure 6 – 2014 Turtle Observations 64
Figure 7 – Blanding's Turtle Habitat 65
Figure 8 – Natural Heritage System within the Urban Expansion Study Area 74

APPENDIX

A – Bird Species List

1.0 INTRODUCTION

This report represents a summary of the existing information on the natural environment features within the study area for the Kanata North Urban Expansion Area (KNUEA), including field observations made in December, 2012 and the spring and summer of 2013, 2014 and 2015. The objective is to provide information on the natural environment features and associated functions they represent for input into the completion of the Environmental Management Plan (EMP), Master Servicing Study (MSS) and Community Design Plan (CDP) for the KNUEA. The urban expansion area extends along both sides of March Road north of Old Carp Road and the previous Urban Area boundary north of Maxwell Bridge Road. The expansion area extends for approximately 1.3 and one kilometre on the west and east sides of March Road, respectively. The east boundary is marked by a former railway line (rails are now removed) between March Road and March Valley Road with the existing residences along the east side of Marchbrook Crescent and Nadia Lane generally marking the west boundary (Figure 1). The study area for this assignment includes the urban expansion area and adjacent lands. The location of Woodlot S23 east of the former railway on Figure 1 at the beginning of this report is taken from mapping in Dillon (1999). The woodlot appears to have been mapped to the south of the actual feature location as shown on the aerial photography. For the purposes of this report March Road is considered to be in a north-south orientation.

The vast majority of the urban expansion area is dominated by agricultural activity including a mixture of cultivation, pasture and specialty crops. Aquatic features within the study area include the North Branch of Shirley's Brook, a tributary flowing into the North Branch beginning in the northwest portion of the study area and crossing March Road at the boundary between 936 and 1020 March Road and numerous smaller drainage channels tributary to these features. This channel will be referred to as the 'North Tributary' (Figures 1 and 2). Terrestrial features include many deciduous hedgerows between the agricultural fields and a woodlot, identified in the Shirley's Brook and Watt's Creek Subwatershed Study (Dillon, 1999) as Woodlot S20, between the former railway and March Road in the east portion of the KNUEA . Other deciduous woodlots are adjacent to the KNUEA east of the former railway and in the southwest corner. These woodlots are identified on Schedule L3 of the City's candidate Natural Heritage System Overlay within the City's Official Plan, identifying the requirement for an Environmental Impact Statement for development proposed in or adjacent to the woodlot. Additional lands in the central-west portion of the study area north of Marchbrook Crescent are also identified on Schedule L3 (Figure 1).

There are no natural areas identified in the Natural Environment Systems Strategy or the Urban Natural Environmental Evaluation Systems Strategy in or adjacent to the study area (Muncaster and Brunton, 2005; Brunton, 1997). No Provincially significant wetlands or Areas of Natural and Scientific Interest are within or adjacent to the study area with Shirley's Bay to the east of the study area representing the closest representation of both features. The closest portion of the Shirley's Bay wetland is approximately 1.3 kilometres to the east of the study area.

2011 air photo from City of Ottawa E-Map

Legend

- Urban Expansion Area
- Woodlot S20 (Dillon, 1999)
- Natural heritage System (City of Ottawa)
- Adjacent Natural Areas (Dillon, 1999)
- 1020 March Road Addresses
- Major Property Boundaries
- Vegetation Communities

Vegetation Communities

1. Agricultural field/Cultural meadow
2. Cultural thicket
3. Cultural woodland
4. Coniferous hedgerow
5. Deciduous hedgerow
6. Dry-fresh white cedar coniferous forest
7. Fresh-moist white cedar coniferous forest
8. Dry-fresh white pine mixed forest
9. Fresh-moist white cedar-ash mixed forest
10. Fresh-moist elm-ash deciduous forest
11. Fresh-moist ash-poplar deciduous forest
12. Fresh-moist poplar deciduous forest
13. White cedar coniferous swamp
14. Willow thicket swamp

Approx. Scale 1:8,200 (on a 11 x 17 plot)

Prepared for: Novatech Engineering Consultants Ltd.

Prepared by: Muncaster Environmental Planning Inc.

FILE: 12-25
January 26, 2016

Figure 1

VEGETATION COMMUNITIES
URBAN EXPANSION AREA

Kanata North, City of Ottawa

2.0 EXISTING CONDITIONS

2.1 Aquatic Habitat

Fish habitat in the study area was assessed during multiple field visits completed in the summer 2009 and the spring and summer 2013, and in 2014 and 2015 for channels in proximity to Woodlot S20. The purpose of the visits was to assess the extent of fish habitat and collect information on fish communities. The assessed channels consist of the North Branch of Shirley's Brook as well as headwater tributaries to Shirley's Brook including the North Tributary flowing from the northwest to the southeast in the study area. As shown on Figure 2 other tributaries and side branches were also assessed. A total of eighteen sampling sites were created, with sixteen on Shirley's Brook and tributaries (Sites 1-16) and one on each of the larger ponds on the North Branch of Shirley's Brook (Pond 1) and the North Tributary (Pond 2). In addition some less defined farm swales and ditches are present. These features are assessed in the Fluvial Geomorphic Assessment completed by Parish Aquatic Services (2015).

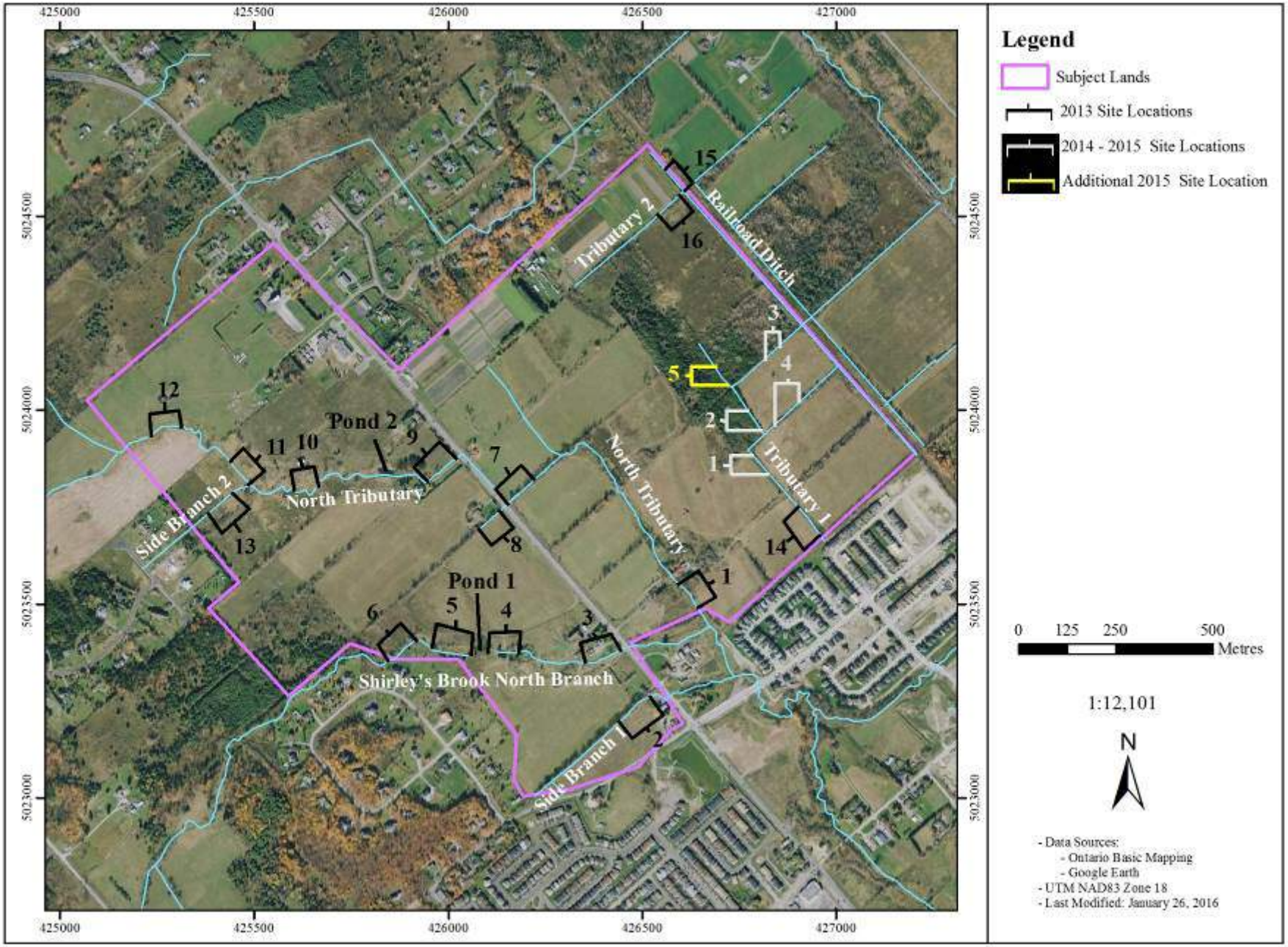
Field work was completed on April 26th and 29th, May 3rd and 6th, August 20th and September 3rd, 2013, June 23rd, 2014 and May 25th, June 2nd and July 27th, 2015 with work on the portion of the North Tributary at 936 March Road completed in 2009. The spring and early summer of 2013 was considered wet, with frequent rain storms. The flood conditions were Normal during the entire sampling period (as per the Mississippi Valley Conservation Authority website (http://www.mvc.on.ca/watershed-conditions-current/).

2.1.1 North Branch of Shirley's Brook

The North Branch of Shirley`s Brook enters the study area east of Marchbrook Crescent and flows to the southeast to March Road through 927 March Road. The North Branch meanders within a modest valley with defined top-of-slopes (Photo 1). Exposed rock is common in the channel and valley (Photo 4). Large ponds are the dominant features of this channel in the urban expansion area (Photo 2). Pond habitat was created and divided into three habitats by concrete weirs which block potential fish movement except during high flows (Photo 5). The ponds included deep pool habitat, reaching depths greater than 0.75 metres approximately five metres from the shoreline. Exposed bedrock is common at the downstream ends of the ponds. Aquatic vegetation (broad-leaved cattail, common arrowhead, chara species, giant bur-reed and sago pondweed) was the only in-stream cover present in the ponds. The pond banks were fully vegetated primarily with herbaceous species such as reed canary grass, spotted jewelweed and purple loosestrife. Woody vegetation cover was intermittent with no appreciable canopy cover over the ponds and included pussy willow, Manitoba maple, white cedar, white spruce and white ash.

Elsewhere in the study area the North Branch of Shirley's Brook is generally a channel over bedrock with limited wetted widths in glide habitats (Photos 3 and 4). At the downstream end, just west of March Road, the average channel and wetted widths were 3.2 metres and 0.4 metres, respectively on August 20th, 2013. The average bankfull depth was approximately 21cm and the average water depth ranged from 1 to 3cm. The banks were generally fully vegetated with

FISH SAMPLING and AQUATIC HABITAT SITES – 2013 - 2015



herbaceous species and also with scattered woody species. Herbaceous vegetation consisted of reed canary grass, grass-leaved goldenrod, wild carrot, spotted jewel-weed and purple loosestrife. The woody species included apple, Manitoba maple, common buckthorn, tartarian honeysuckle, crack willow, white ash and large-toothed aspen. The bedrock substrate was often covered in algae. In-stream cover included overhanging and aquatic vegetation (reed canary grass, spotted jewelweed and purple loosestrife). No signs of erosion were observed. At the upstream, west, end of the study area the substrate is still bedrock and the corridor is part of a manicured residential yard. There was no in-stream cover, only exposed bedrock within the channel. The banks had no vegetation except for the lawn and a few trees, white ash, white elm and crack willow, which provided canopy cover.

On May 3rd 2013 Site 3, the closest site to March Road (Figure 2), was shocked for 286 seconds over an area approximately 84 m^2. The average water depth and wetted width in May were 10cm and 2.1 metres, respectively. A total of seven fish were captured representing five species: central mudminnow, northern redbelly dace, finescale dace, blacknose dace and creek chub. Site 4, including Pond 1 where possible, was shocked on May 3rd, 2013 for 261 seconds. A total of 20 fish were captured at Site 4 and Pond 1 representing six species: central mudminnow, northern redbelly dace, creek chub, white sucker, brook stickleback and pumpkinseed. Several of the brook sticklebacks were too small to net and not included in the total of 20 fish. During the August 20th, 2013 visit only the pond was sampled due to insufficient water in the channel. Five baited minnow traps were set overnight. A total of 11 fish were caught representing three fish species: central mudminnow (size range 50mm), northern redbelly dace (32-48mm) and creek chub (39-98mm). Further upstream, upstream of the ponds at Site 5 (Figure 2) a total of 25 fish were captured on May 6th representing two fish species: northern redbelly dace (41-52mm) and brook stickleback (39-49mm). Iron staining was noted at this location on May 6th, although Site 5 had insufficient water to sample during the summer. At the furthest upstream site, Site 6 (Figure 2), on May 6th the site was shocked for 378 seconds over an area approximately 68 m^2. No fish were caught. This site was also dry during the August 20th visit.

The valleylands along the North Branch have many areas that are well vegetated with trees and shrubs. Crack willows up to 50cm dbh are common, along with smaller white cedar, white elm, green ash and white spruce trees. Hawthorn, slender willow, blackberry and common buckthorn shrubs are among the trees. However the woody vegetation does not generally extend beyond the top of slope, with the adjacent tablelands dominated by corn fields or, adjacent to the urban expansion area, mowed lawns in the rear yards of Marchbrook Crescent residences.

The downstream end of the North Branch of Shirley`s Brook, immediately south of the urban expansion area, was surveyed as part of the Kanata North Environmental/Stormwater Management Plan (CH2M Hill, 2001). CH2M Hill (2001) noted that the channel upstream of the confluence with Shirley's Brook has sufficient meandering, with a bankfull width in the range of 2.5 metres. Closer to March Road stream cover becomes nil and the bankfull width increases to almost five metres. Exposed bedrock is very common and the watercourse appears to have been channelized. There appears to be no barrier to fish migration associated with the culvert under March Road. Algae appeared to be more prolific than in the main branch. Amphipods were common among the aquatic vegetation (CH2M Hill, 2001). There was a thin

layer of gravel on top of clay. CH2M Hill (2001) observed that the entrenchment is lower than in the main branch of Shirley's Brook. During the time of CH2M Hill (2001) observations, cattle trampling had caused significant impacts to the bank stability of the North Branch. Cattle are no longer present in this reach of the North Branch with agriculture replaced by urban residential developments. Although not sampled by CH2M Hill (2001) forage fish were observed throughout the North Branch downstream of March Road. The North Branch was considered by Dillon (1999) to be 'Type 2' fish habitat, the middle of three fish habitat quality types used by Dillon (1999). This reach of the North Branch was considered a high priority for restoration and enhancement by Dillon (1999). A major component of the recommendations was restriction of cattle access, which has occurred. Dillon (1999) also recommended removal of barriers to enhance fish movement and additional restoration using other natural channel design techniques. The North Branch upstream of the confluence with the North Tributary was considered by Aquafor Beech (2006) to support a moderately tolerant/tolerant warmwater fish community, with a moderately tolerant warmwater fish community downstream of the confluence with the North Tributary.

Photo 1 – The North Branch of Shirley's Brook looking upstream from just west of March Road (Site 3, May 3rd, 2013)

Photo 2 – Pond 1 in the North Branch of Shirley's Brook at Site 4 (May 3rd, 2013)

Photo 3 –North Branch of Shirley`s Brook in the southwest portion of the urban expansion area at Site 5. View looking upstream (May 3rd, 2013)

Photo 4 –Exposed bedrock is common in the North Branch of Shirley`s Brook in the southwest portion of the urban expansion area (927 March Road)

Photo 5 – Weir and dry channel along North Branch of Shirley`s Brook in the southwest portion of the urban expansion area at Site 6. View looking downstream, southeast on August 20th, 2013

Photo 6 – Water present upstream of the weir in Photo 5(May 6th, 2013)

2.1.2 North Tributary

East Side of March Road

The North Tributary, a north-south tributary entering the North Branch of Shirley's Brook approximately 200 metres east of March Road, was sampled in the spring of 2009 to determine the extent of fish habitat in the tributary at 936 March Road (Muncaster, 2009b). A diversity of cool and warmwater forage and coarse fish were observed in the tributary. At a sampling station (Site 1 on Figure 2) upstream of the confluence with the North Branch (Photo 7) 124 fish were captured representing five forage fish species: central mudminnow, northern redbelly dace, blacknose dace, creek chub, and brook stickleback. Further upstream, south of the north boundary of 936 March Road, 434 fish were captured representing six fish species: white sucker, central mudminnow, northern redbelly dace, blacknose dace, creek chub, and brook stickleback. Muncaster (2009b) noted a beaver dam upstream of this sampling station. Site 1 (Figure 2) was also sampled on August 20th, 2013 (Photo 8). The site was shocked for 554 seconds over an area approximately 88 m^2 and ten dip net samples were taken. Ninety fish were captured representing four species: white sucker (46-53mm), longnose dace (29-46mm), creek chub (35-144mm) and brook stickleback (15-48mm).

The average wetted widths of the North Tributary in the south portion of the urban expansion area on May 8th, 2009 were between 2.2 and 3.2 metres (Photos 7 and 9). The average bankfull depth was between 32 and 46cm, and the average water depth was 15cm, with a range of 5 – 35cm. The substrate was dominated by silt in the upstream reach and bedrock and sand in the downstream reach, with some clay, pebble, gravel and hard packed clay. The habitat type consisted of pool with a run at the downstream end. The maximum pool depths were 20-34 cm.

The substrate was composed of fines and bedrock in the pool habitat and gravel, pebble and cobble in the run. In-stream cover was limited. Where cover was present it consisted of aquatic vegetation (reed canary grass, purple loosestrife and spotted jewelweed) and large woody debris.

The banks were fully vegetated with herbaceous and woody species. Herbaceous vegetation consisted of reed canary grass, purple loosestrife and enchanter's nightshade. Woody species included common buckthorn, wild black currant, wild red raspberry, Manitoba maple, crack willow and white ash. Canopy cover is intermittent with good tree cover in the deciduous hedgerows east of March Road (Photo 10). No areas of active erosion were observed in the downstream reaches. Two log weirs likely impact potential fish migration during lower flow periods east of March Road as well as a stone weir associated with Pond 2 on the west side of March Road. No potential blockages were observed at the culverts under March Road or a laneway at 1035 March Road. Cattle access to the North Tributary appeared extensive along the south side of 1020 March Road east of March Road. On August 20th, 2013 the downstream end of Site 1 near the south edge of the study area (Figure 1) was dry.

Further upstream, just east of March Road at Site 7 (Figure 2) the habitat type consisted of glides, pool (maximum depth 45 cm) and run morphological units (Photo 10). The substrate was fines. In-stream cover was sparse. In-stream cover consisted of aquatic vegetation (algae, common arrowhead, reed canary grass and moss) and undercut banks (only in the spring when water levels are high). Signs of erosion included undercut banks. The average channel and wetted widths were 2.6 m and 1.6 m respectively. The average bankfull depth was approximately 29cm and the average water depth was approximately 13cm. On May 3rd, Site 7 was shocked for 960 seconds over an area approximately 112 m^2. No fish were captured.

Due to a lack of water no fish sampling could be completed in a small channel (Site 8) entering the North Tributary at Site 7 from the west side of March Road. The average water depth was 3cm, with a maximum depth of 5cm. The channel has a typical trapezoid cross-section with a channel width of 1.8 metres and appears to be fed from a tile drain. Fines dominate the substrate and no in-stream cover was observed. An adjacent deciduous hedgerow provided full canopy cover of the channel.

Photo 7 – Downstream reach of the North Tributary at the south end of 936 March Road on May 8th, 2009. View downstream to the existing urban development south of the urban expansion area

Photo 8 - Site 1 on the North Tributary upstream of the south boundary of the study area boundary (August 20th, 2013)

Photo 9 – North Tributary in upper portion of 936 March Road. View looking downstream, south (May 8th, 2009)

Photo 10 – West to east leg of the North Tributary (Site 7) along property line between 936 and 1020 March Road. View looking downstream, east (May 3rd, 2013)

West Side of March Road

The North Tributary follows the roadside ditch on the east side of March Road upstream of Site 7 until it crosses March Road at 1035 March Road. Site 9, just west of March Road along the driveway of 1035 March Road, was shocked for 787 seconds over an area approximately 60 m^2. The average water depth and wetted width on April 29th, 2013 were 35cm and 1.5 metres, respectively. Three fish were captured representing two species: creek chub (116-119mm) and brook stickleback (43mm). On August 20th, 2013 Site 9 was dip netted 20 times as the site was choked with vegetation preventing sampling with the electrofisher. A total of seven fish were caught representing three species: central mudminnow (56mm), fathead minnow (15mm) and brook stickleback (15-38mm).
Pond 2 is along the North Tributary west of March Road between Sites 9 and 10 (Photo 11). The pond included deep pool habitat reaching depths of greater than 85cm approximately two metres from the shoreline. The area that was accessible by wading had an average depth of 72 cm. The substrate consisted of unconsolidated muck. The only in-stream cover present was aquatic vegetation (reed canary grass). A crushed stone weir appears to be a partial barrier to fish migration at the downstream end of the pond. The pond was sampled during the summer using minnow traps. The total catch (five traps) was thirty fish representing three species: finescale dace (50mm), creek chub (75-185mm) and brook stickleback (57mm).

Further west of March Road the upstream reaches flow through pasture lands and the North Tributary often meanders through dense patches of reed canary grass and other species such as spotted joe-pye-weed and purple loosestrife (Photos 12 and 13). The average channel and wetted widths were 7.8 metres and 1.1 metres, respectively along this reach (Site 10). The average water depth was approximately 9cm (range 3-25cm). The habitat type consisted of glide morphological units. The substrate was composed of bedrock. The channel was almost completely covered by the aquatic vegetation making it hard to access the channel (Photo 12). The channel was very difficult to locate in the summer at Sites 11 and 12 (Photo 14). These sites had no signs of erosion. The banks were fully vegetated with herbaceous species including the dominant reed canary grass, along with Canada goldenrod, purple loosestrife and wild carrot. Woody vegetation is generally lacking in the riparian corridor, with some hawthorn shrubs further upstream.

On April 29th, Site 10 was shocked for 529 seconds over an area approximately 36 m^2. Only one brook stickleback was captured (45mm). On August 20th Site 10 was dip netted five times as the site was too choked with vegetation to permit electrofishing. No fish were captured. On April 26th, Site 11 was shocked for 478 seconds over an area approximately 56 m^2. The average water depth and wetted width in April were 33cm and 1.4 metres. One creek chub was captured. Also on April 26th, Site 12 was shocked for 401 seconds over an area approximately 36 m^2. The average water depth and wetted width in April were 41cm and 0.9 metres. A total of three brook sticklebacks (54-56mm) were captured. During the September 3rd visit Sites 11 and 12 were not sampled for fish as they were too choked with vegetation to dip net and there was little water (Photo 14).

Although the North Tributary was considered by Dillon (1999) to have 'no discernible habitat`, the watercourse appears to add to the overall productivity of the Shirley's Brook system, especially during the spring period. Much of the fish community may migrate downstream to Shirley's Brook during the lower flow periods. The North Tributary was considered a low priority for restoration and enhancement by Dillon (1999) and to support a tolerant warmwater fish community by Aquafor Beech (2006).

Photo 11 – On-line Pond 2 in the North Tributary west of March Road at 1035 March Road. View looking upstream, northwest on August 20th, 2013

Photo 12 – North Branch of Shirley`s Brook further west of March Road (1075 March Road) at Site 10. Reed canary grass dominates the corridor. View looking upstream, north (August 20th)

Photo 13 – Site 12 on the North Tributary at the upstream (northwest) portion of the urban expansion area (April 26th, 2013)

Photo 14 - Site 12 during summer conditions on September 3rd, 2013

2.1.3 Other Channels

East Side of March Road

A tributary of Shirley's Brook, labelled Tributary 2 on Figure 2, is mapped on the Natural Heritage System Overlay in the northeast corner of the urban expansion area, in the east portion of the property line between 1020 and 1070 March Road. The Overlay shows this tributary beginning approximately 120 metres west of the former railway and channelized east to Shirley's Brook on the east side of March Valley Road. Little water was in the channel on May 3rd, 2013 and much of the channel was dry on September 3rd. The average channel width was 2.2 m. The wetted width at the downstream end of Site 16 averaged 0.8 metres and the water depth averaged 2cm on May 3rd (Photo 15). These sites (Sites 15 and 16 on Figure 2) were sampled for fish in the spring only due to insufficient water depth in the summer. During the spring visit the site was shocked for 175 seconds and then dip netted (105 dips), over an area approximately 105 m^2. No fish were captured at this site.

A series of channels dug as agricultural ditches, marked Tributary 1 on Figure 2, are in the southeast portion of 936 March Road. At Site 14 the average channel width and bank heights were 1.3 metres and 21cm, respectively. The site was dry during the summer (Photo 16). The substrate was composed of fines. There was scarce in-stream cover provided by large woody debris. The banks were completely vegetated with herbaceous and woody species. Herbaceous vegetation consisted of reed canary grass, purple loosestrife and common milkweed. Woody

vegetation included common buckthorn, tartarian honeysuckle, nannyberry, white ash, white oak and Manitoba maple. Moderate canopy cover was present.

Additional field surveys were completed on Tributary 1 and side branches entering the Tributary within and adjacent to Woodlot S20 in 2014 and 2015. As the channels do not drain a large watershed, the majority of the channel was dry despite recent rain events and normal water conditions. Thus only one of the four stations could be sampled for fish. The station was shocked for 256 seconds over an area of approximately 82 m^2. Using a dip net, a total of 20 dips were also completed in areas that were too shallow to shock. Two brook stickleback were captured and six others were visually noted (they were too small to net). A fish habitat assessment concluded that the agricultural channels provide seasonal fish habitat with some refuge pools in a reach south of Woodlot S20. While the refuge pools seemed to be sufficient to provide habitat for a few brook sticklebacks; it is unlikely that they would during a normal rainfall year. There was only 7 cm of water and the fish would be easy prey for predators. Other than the few brook sticklebacks, no other species were captured or observed. Brook stickleback is a common warm to cool water forage fish and it is not unusual for it to be documented in the upper headwaters of systems.

The agricultural channel marked as Tributary 1 provides seasonal fish habitat for a few common forage fish (brook stickleback) and a portion of this channel is along the edge of Woodland S20. Typically woodlands can help mitigation evaporation and water temperatures of watercourses through the shading provided by canopy cover. They can also provide food sources and structure such as insects from leaves, decomposition of leaf litter and fallen branches or trunks. The only reach of Tributary 1 that provided fish habitat during the field surveys completed in 2014 and 2015 was south and upstream of Woodlot S20 and did not receive any benefits due to the woodland. Agricultural channels supporting such species as brook stickleback often lack any canopy covering. Tributary 1 and the side branches do not represent a sensitive headwater in terms of fish habitat. The limited fish habitat observed in Tributary 1 is not supported or influenced by the adjacent Woodlot S20.

A headwater assessment was completed on Tributary 1 and two side branches within and adjacent to Woodlot S20. The conclusions of the headwaters assessment are based on four evaluation criteria: hydrology, riparian conditions, fish and fish Habitat and terrestrial habitat. The channels investigated yielded a very limited fish population in one area of one of the channels and no fish in the other two channels. The hydrology component was scored as contributing for two of the channels and limited for the third channel. The scores for the riparian and terrestrial habitat criteria were the highest due to the forested swamp, vegetation community 9, in Woodlot S20 and presence of amphibians.

Photo 15 – Tributary of Shirley`s Brook (Site 16, Tributary 2) in the northeast portion of the urban expansion area, on the property line between 1020 and 1070 March Road (May 3rd, 2013)

Photo 16 – Tributary 1 (Site 14) during summer conditions on September 3rd, 2013

Photo 17 – A dry Tributary 1 within the east edge of Woodlot S20 on June 23rd, 2014

West Side of March Road

A tributary of the North Tributary extends from the Nadia Lane area east to meet the North Tributary in the west portion of 1075 March Road. This channel is identified on Figure 2 as Side Branch 2, with sampling Site 13 located on the channel. The substrate in the channel was composed of fines. The in-stream cover consisted of aquatic vegetation (reed canary grass) (Photo 18) and terrestrial vegetation (Canada goldenrod and common milkweed). There were no signs of erosion along Site 13. On April 26th the site was dip netted 72 times as there was insufficient water to use the electroshocker. The average water depth and wetted width on April 26th were 13cm and 0.4 metres, respectively. There were no fish seen or captured at this site. There was no sampling during the summer visit on August 20th as the site was choked with vegetation and completely dry.

Another tributary, along a west-east deciduous hedgerow near the south end of 927 March Road, flows into the North Branch of Shirley's Brook south of the urban expansion area. This tributary, Site 2 of Side Branch 1 on Figure 2, was not sampled in 2013 due to a lack of water. In addition the channel is filled with woody debris (Photo 19).

Photo 18 – West to east tributary (Side Branch 2) flowing east to the North Tributary in the west–central part of 1075 March Road (Site 13, April 26th, 2013). View looking upstream, west

Photo 19 - Site 2 of Side Branch 1 in the southwest corner of the urban expansion area along a west-east deciduous hedgerow on 927 March Road (August 20th, 2013)

2.1.4 Fish Habitat Summary

A total of eight species were captured during the spring and eight species during the summer (Table 1). All of these fish species are commonly found in cool and warm water fish habitats in eastern Ontario and all, except for white sucker and pumpkinseed found in one of the four sites on the North Branch of Shirley's Brook and white sucker noted in the lower portion of the North Tributary, are common forage fish species. Observations of adult white sucker in the spring and young white sucker in the summer indicate white sucker is spawning in the lower reaches of the North Branch and North Tributary.

Based on the fish sampling and fish habitat assessments, the North Tributary and the North Branch of Shirley's Brook support direct fish habitat for the majority of the urban expansion area. Upstream of Site 10 the North Tributary is intermittent, with the North Branch of Shirley's Brook intermittent upstream of the second weir at Site 5. Other than Tributary 1, none of the other channels sampled contained fish and any fish habitat associated with these channel would be considered indirect.

Table 1 Summary of Fish Captured per Season

Species Name	Scientific Name	No. Caught (Size range, mm)	
		Spring	Summer
white sucker	*Catostomus commersonii*	3 (180-212)	2 (46-53)
central mudminnow	*Umbra limi*	5 (64-109)	1 (56)
northern redbelly dace	*Phoxinus eos*	4 (41-54)	2 (10-62)
finescale dace	*Phoxinus neogaeus*	1 (57)	1 (61)
longnose dace	*Rhinichthys cataractae*		21 (27-86)
blacknose dace	*Rhinichthys obtusus*	1 (80)	
fathead minnow	*Pimephales notatus*		1 (15)
creek chub	*Semotilus atromaculatus*	7 (46-119)	72 (30-157)
brook stickleback	*Culaea inconstans*	38 (35-56)	28 (15-48)
pumpkinseed	*Lepomis gibbosus*	1 (62)	
Total		**51**	**128**
No. of Species		**8**	**8**

2.2 Terrestrial Habitat

Wildlife and vegetation surveys were completed on December 4th and 13th, 2012 and May 3rd and June 19th and 21st, 2013. An additional survey in the vicinity of the southwest wooded area was completed on August 6th, 2014, while Woodlot S23 and adjacent lands were reviewed on June 5th, 2014 and May 14th, June 9th, June 10th and June 18th, 2015. In addition butternut health assessments were completed on July 16th and 25th, 2013 and breeding bird surveys were completed on June 13th and July 2nd, 2013. Breeding bird surveys were also completed for Woodlot S23 and adjacent lands on May 20th and June 4th, 2015. The breeding bird surveys met the following requirements:

- completed between first week of June and first week in July and completed a minimum of 15 days apart;
- completed by mid-day in response to decreasing calling;
- conducted on days with no rain, little to no wind and good visibility;
- consisted of 5-min point observations located 300m apart (if habitat is complex additional points within 100m can be added)
- while walking between points, any additional observations were recorded;
- a list of all birds observed was also compiled within the different habitats; and
- birds were identified by sound and/or sight.

Incidental wildlife and vegetation observations were gathered on all of the above dates as well as the fish sampling in late April, May and July and the fish habitat assessments in June, July, August and early September.

2.2.1 Woodlot S20

The wooded area in the east portion of the urban expansion area to the north and south of the boundary between 936 and 1020 March Road and west of the former railway was identified as 'Woodlot S20' by Dillon (1999). The wooded area was designated by Dillon (1999) as a "Natural Area Not Protected from Development", as were the wooded areas in the vicinity of Houston and Marchbrook Crescents that are now part of rural residential subdivisions. Woodlot S20 is dominated by white cedar trees, with white elm and trembling aspen well represented (Photos 20, 23 and 25). Green ash, trembling aspen, white ash, bur oak, white elm, white birch, butternut (Photo 22), Manitoba maple and sugar maple are also present, along with hawthorn, red raspberry, red elderberry, prickly gooseberry, glossy buckthorn, tartarian honeysuckle and red-osier dogwood shrubs. Although the majority of white cedars are young with the trees generally less than 15cm diameter at breast height (dbh) (Photo 25), older trees are in Woodlot S20 (Figure 3). The older trees include dozens of white cedars in the 40cm – 71cm dbh range (Photo 23), a few butternut and white ash up to 69cm dbh and six trembling aspen in the 40cm – 47cm dbh range. However as described in Section 3 below the density of larger trees in Woodlot S20 did not meet the provincial Significant Woodland criterion. Wind throw of several trees was observed in this area (Photo 24). Much of the ground flora is reflective of disturbed conditions

including bluegrass, brome grass, thicket creeper, wild madder, common burdock, wild grape, fragrant bedstraw, hog peanut, stinging nettle, heal-all, bull thistle, ground ivy, field horsetail, common mugwort, wild cucumber, yellow sorrel, tall buttercup, common dandelion and tufted vetch (Photo 26). Enchanter's nightshade, wild sarsaparilla, white snakeroot, jack-in-the-pulpit, lady fern, white trillium and white baneberry are also present. Thick duff layers of cedar leaves likely impacts the ground flora community in many areas. Purple loosestrife, spotted jewelweed, ostrich fern, red-osier dogwood shrubs and cattails are reflective of the lower lying areas in the cedar forest and in these areas the vegetation community on Figure 1 is described as a white cedar coniferous swamp.

The northeast corner of Woodlot S20 is a younger fresh-moist elm-ash deciduous forest. The largest trees are single white ash (41cm dbh) and bur oak (47cm dbh) with the forest dominated by smaller trembling aspen, balsam poplar, white elm and green ash (Photo 28). Red-osier dogwood, red raspberry, slender willow and common buckthorn shrubs are common, with regenerating ash stems dominant in many areas of the understorey. The ground flora is highly disturbed and includes meadow grass, tall buttercup, Canada goldenrod, red clover, common strawberry, heart-leaved aster, small white aster, wild cucumber, poison ivy, tufted vetch, yellow sorrel, white avens, yellow violet, daisy fleabane, common dandelion, thicket creeper and Pennsylvania sedge. A fresh-moist ash poplar deciduous forest is along the southwest side of Woodlot S20 (Photo 21). Green ash up to 27cm dbh are dominant, with Manitoba maple, white elm, butternut, white ash and trembling aspen also present. The largest trees are in a remnant hedgerow along the east side of the community including white ash and trembling aspen up to 68cm and 47cm dbh, respectively. Glossy buckthorn, common buckthorn, prickly ash and regenerating ash and Manitoba maple stems are in the understorey. The disturbed ground flora includes tall buttercup, tufted vetch, Canada thistle, elecampane, meadow grass, reed canary grass, orchard grass, daisy fleabane, Canada goldenrod, wild parsnip, thicket creeper, white avens, common strawberry, poison ivy and sensitive fern.

A small area of white cedar-ash mixed forest is in the northwest portion of Woodlot S20. White cedar and green ash stems are up to 53cm and 26cm dbh, respectively along with smaller white elm. Apple, red raspberrry and regenerating white elm and ash are common in the understorey. White avens is very common in the disturbed ground flora along with Philadelphia fleabane, thicket creeper, enchanter's nightshade, reed canary grass, tall buttercup, Canada goldenrod, white bedstraw, spotted jewelweed and common burdock (Photo 27).

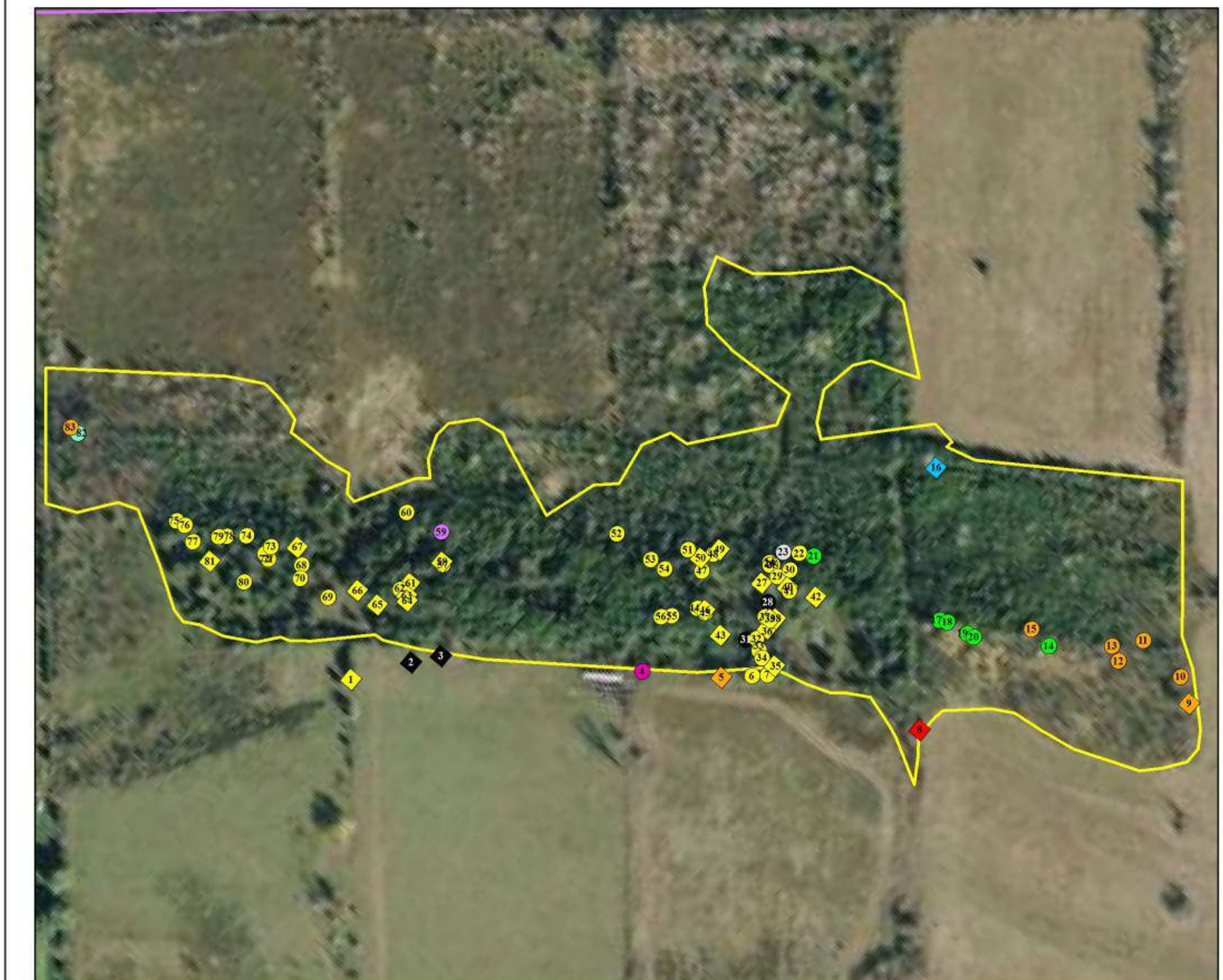
Wildlife observed in Woodlot S20 included, American robin with immatures, , American goldfinch, common yellowthroat, yellow warbler, cedar waxwing, great-crested flycatcher, white-tailed deer, coyote tracks and scat, American toad, gray treefrog and spring peeper. Additional bird observations are provided in Appendix A. No forest interior or area sensitive breeding birds were observed in Woodlot S20.

Dillon (1999) identified no interior habitat for Woodlot S20 and the woodlot scored low for size, biodiversity and hydrological features criteria. The woodlot scored higher for landscape attributes, wildlife concentrations and condition of natural area. The overall score assigned by

Dillon (1999) was 102, with scores for the other woodlots in the Shirley's Brook subwatershed ranging between 33 and 425. Woodlot S20 was not identified by Dillon (1999) for protection.

The woodlot was described by Aquafor Beech (2006) as a severely fragmented area with no interior forest representation or linkage potential. Aquafor Beech (2006) recommended protection for Category 1 lands, with an Environmental Impact Statement recommended for Category 2 lands should a land use change be considered. The woodlot was identified as a Category 1 component of the Natural Heritage System on Figure 2 of Aquafor Beech (2006). The woodlot does not meet any of the three Category 1 criteria of Aquafor Beech (2006). Based on the criteria the woodlot would be considered Category 2 – features located in areas considered to be high recharge. Paterson Group (2013) completed a site investigation of Woodlot S20 to provide a preliminary assessment of the infiltrative characteristics of the woodlot area. The site investigation found that the woodlot is generally overlain by upwards of 300 mm of organic topsoil which, in turn, is underlain by a compact silty sand to sandy silt composite with trace gravel. Refusal to augering was noted in all locations within the woodlot at depths ranging from 600 mm to more than 1 m below ground surface. The soil at the base of the alluvial deposits, near the point of refusal were noted to be approaching field saturation indicating that infiltrating water is perched at this interface. Paterson Group (2013) concluded that the recharge potential of Woodlot S20 is severely limited and from a hydrogeologic perspective is not considered to be unique in its contribution to groundwater recharge. While surface water can infiltrate readily into the alluvial soils, the presence of field saturated soils at the bedrock/glacial till layer beneath the woodlot would indicate that the infiltrate is perched in this area and unable to percolate readily into the underlying bedrock. Moreover, beyond the woodlot area, the alluvial soils are underlain by low permeable soils of sufficient natural compaction and thickness that infiltrating surface water has limited potential to recharge the bedrock aquifers.

FIGURE 3 - LARGER TREES (shown with tree number) in WOODLOT S20



Legend

Woodlot Boundary (8.1 ha)

White Cedar
- 40 to 49cm DBH
- Over 50cm DBH

American Elm
- 40 to 49cm DBH

White Ash
- 40 to 49cm DBH
- Over 50cm DBH

Trembling Aspen
- 40 to 49cm DBH

Red Maple
- 40 to 49cm DBH

Manitoba Maple
- Over 50cm DBH

Largetooth Aspen
- Over 50cm DBH

Butternut
- 40 to 49cm DBH
- Over 50cm DBH

Bur Oak
- 40 to 49cm DBH

Black Cherry
- 40 to 49cm DBH

0 15 30 60 90 120 Meters

1:2,106

- Data Sources:
  - Ontario Basic Mapping
  - Google Earth
- UTM NAD83 Zone 18
- Last Modified: November 11, 2014

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As shown on Figure 1, a cultural woodland and areas where the woody vegetation was mostly removed in 2014 (labelled as `now open` on Figure 1) are to the east of Woodlot S20. Cultural woodlots are described by Lee et al. (1998) as where the tree cover is greater than thicket and savannah habitats but less than or equal to sixty percent. The tree cover is based on absolute cover, which is the proportion of the ground area, determined by the shadow of a vertical projection and expressed as a percent, covered by a vegetation layer (Lee et al, 1988). The cultural woodlands were assessed during leaf-out. Cultural woodlands are a non-forest community as defined under the ELC system (Lee et al, 1988) and as outlined in Appendix 8 of the City's EIS Guidelines (2nd edition, 2012) are not included in the delineation of a significant woodland. Given the presence of the cultural woodland to the east of Woodlot S20 and a break of the forest canopy cover of greater than 20 metres at the former railway, Woodlot S20 and the wooded areas east of the former railway (known as Woodlot S23) are not considered a contiguous woodland.

Photo 20 - Central-west edge of Woodlot S20

Photo 21 – Young fresh-moist ash-poplar deciduous forest in the southwest portion of Woodlot S20

Photo 22 – Butternuts are present along the southwest edge of Woodlot S20

Photo 23 –Larger white cedar in the north part of Woodlot S20 (Photo by Judy Makin)

Photo 24 – Typical conditions in north-central portion of Woodlot S20

Photo 25 – Typical conditions in south-central portion of Woodlot S20

Photo 26 – Open canopy is common in many areas of the coniferous forest of Woodlot S20. This area is near the boundary between 936 and 1020 March Road.

Photo 27 – Disturbed ground flora in the mixed forest in the north portion of Woodlot S20

Photo 28 - Young deciduous forest in the northeast portion of Woodlot S20

2.2.2 Woodlot S23

Woodlot S23, as named by Dillon (1999) is to the east of the urban expansion area and former railway. A stormwater management pond is proposed in the vicinity of Woodlot S23. As shown on Figure 4 the following description of Woodlot S23 to the east of the former railway is divided into the Northwest, North-central and Northeast Forests. The vegetation and other natural environment features of Woodlot S23 and adjacent lands were reviewed on June 5th, 2014 and May 14th, June 9th, June 10th and June 18th, 2015, with breeding bird surveys completed between 06:30 and 10:00 on May 20th and June 4th, 2015.

Northeast Forest

Green ash is dominant in the northeast ash deciduous forest. Bur oak, white ash, white elm, soft maple (silver maple and Freeman maple), butternut, Manitoba maple and crack willow are well represented in areas of the northeast forest. Trembling aspen is common in the northwest portion, to the east of the adjacent thicket habitat. The largest aspens are in the range of 34cm dbh. Coniferous representation is generally limited to an area in the southwest corner of the northeast forest where white pines are up to 52cm dbh (Photo 31). A 23cm dbh white spruce was noted in the central portion of the northeast forest. Elsewhere in the northeast forest the largest trees are bur oaks up to 40cm dbh in the south portion (Photo 30) and crack willows and soft maples up to 48cm dbh and 38cm dbh, respectively along the west side of March Valley Road. The moisture regime appears wetter in this area along the west side of March Valley Road with sensitive fern the dominant ground flora in areas. The bur oak and maples appear to be in good condition, with reduced leaf-out on some of the ash. The canopy of the forest is generally more open in the northwest and south-central portions (Photo 32).

The understorey is very thick in most portions of the northeast forest with common and glossy buckthorn extensive in areas (Photo 29). Black current, hawthorn, gray dogwood, red raspberry, nannyberry and prickly ash are also present along with regenerating ash and Manitoba maple stems. Thicket creeper and wild grape are dominant in the ground flora in many areas. Other elements of the generally disturbed ground flora in the northeast forest include enchanter's nightshade, white avens, yellow avens, common burdock, Canada goldenrod, hog peanut, common milkweed, wild parsnip, elecampane, yellow violet, Virginia waterleaf, narrow-leaved goldenrod, purple flowering raspberry, tall meadow rue, common strawberry, Canada anemone, sensitive fern, wild cucumber, poison ivy, tall buttercup, white bedstraw, red baneberry and Philadelphia fleabane.

The functions of the northeast forest are reduced due to the dominance of ash and poplar in many areas, disturbed and very thick understorey, ground flora dominated by non-native and/or invasive flora, the lack of forest interior potential in the forest width up to 150 metres, road noise and open canopy in many areas.

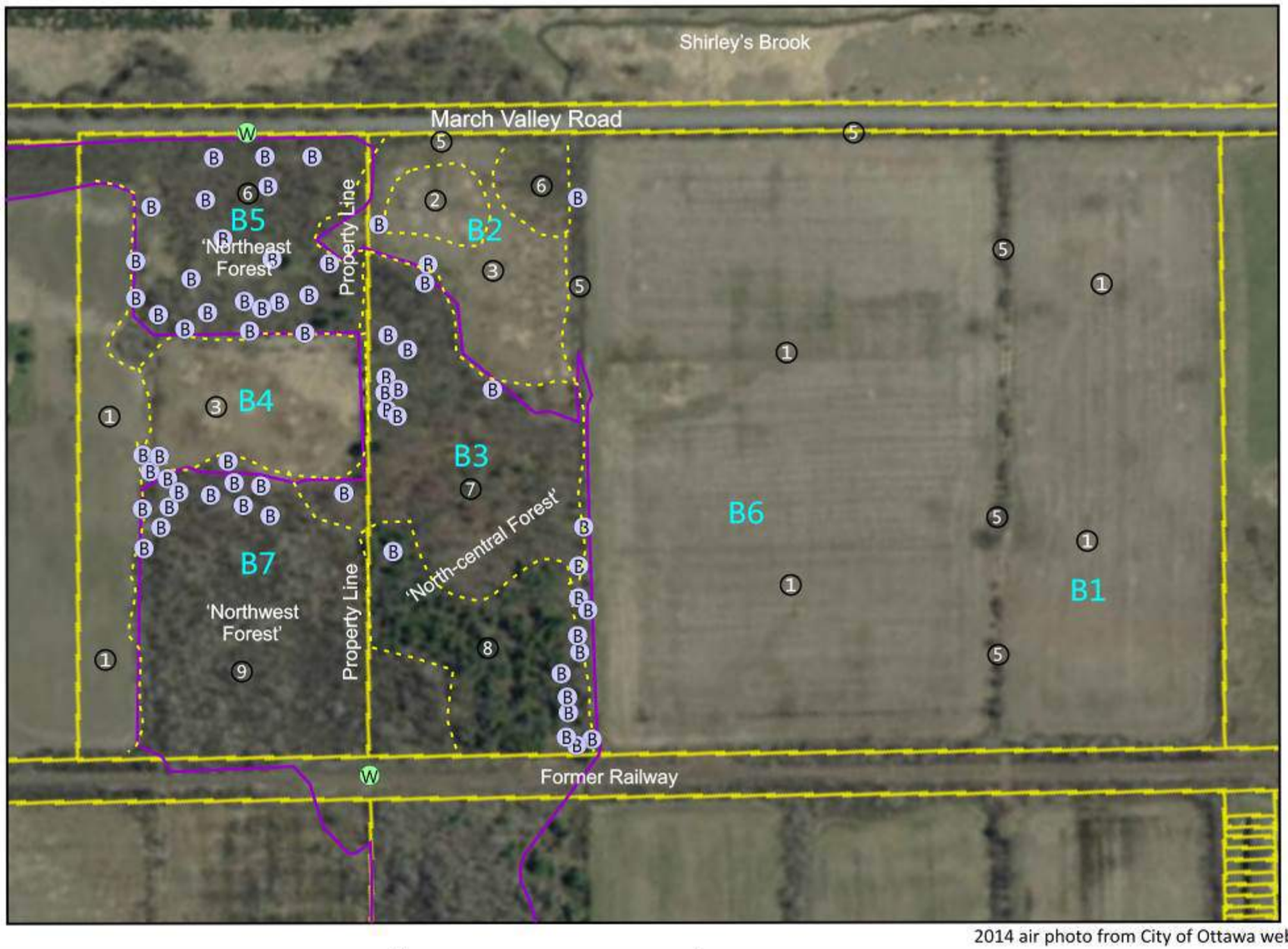
A smaller and younger area of ash forest (Photo 33) is just to the west of March Valley Road, south of the northeast forest and a meadow habitat. In addition to green ash up to 15cm dbh, apple and Manitoba maple are present. Regenerating ash stems are very common, along with common buckthorn, red raspberry and red-osier dogwood shrubs. The ground flora is reflective

of the disturbed conditions and included wild grape, thicket creeper, common dandelion, Canada goldenrod, common burdock, blue violet and field horsetail.

Wildlife observed in the northeast deciduous forests included red-winged blackbird, black-capped chickadee, common yellowthroat, yellow warbler, yellow-rumped warbler, mourning dove, American woodcock, great-crested flycatcher, alder flycatcher, blue jay, Baltimore oriole, northern cardinal, northern flicker and American goldfinch. A rock pile is in the north-central portion of the northeast forest (18T 427048E/5024729N).

Photo 29 – Typical condition in the centre portion of the 'Northeast Forest' (June 9th, 2015)

FIGURE 4 – WOODLOT 23 and ADJACENT LANDS



2014 air photo from City of Ottawa web site

Legend

- Vegetation Communities
- Candidate Natural Heritage System (OP Schedule L3)
- B2 Breeding Bird Point Counts
- W Whip-poor-will Survey Points
- B Areas of Butternuts (only shown in proximity to potential swm areas)

Vegetation Communities

1. Cultivated field
2. Cultural meadow
3. Cultural thicket
4. Cultural woodland
5. Deciduous hedgerow
6. Ash deciduous forest
7. Ash-maple deciduous forest
8. White cedar-hardwood mixed forest
9. Ash-poplar deciduous forest

Approx. Scale 1:3,300 (on a 11 x 17 plot)

0 50 100 150 200 METRES

Prepared for: Novatech Engineering Consultants Ltd.

Prepared by: Muncaster Environmental Planning Inc.

FILE: 12-25

June 18, 2015

Figure 4

WOODLOT S23 and ADJACENT LANDS

Kanata North Community Design Plan, City of Ottawa

Photo 30 – Bur oaks up to 40cm dbh are in the south portion of the 'Northeast Forest' (June 9th, 2015)

Photo 31 – Mature white pine in the southwest portion of the 'Northeast Forest' (June 9th, 2015)

Photo 32 – Open canopy and thick shrub component in the north portion of the 'Northeast Forest' (June 9th, 2015)

Photo 33 – Young green ash in small ash deciduous forest west of March Valley Road, south of cultural meadow habitat (May 14th, 2015)

North-central Forest

As shown on Figure 1 the north-central forest is composed of a deciduous forest generally in the east portion and a mixed forest in the west.

Ash Deciduous Forest in the North-central Forest

Green ash is dominant in the deciduous forest component of the north-central forest. Red maple, Manitoba maple, sugar maple, trembling aspen, white cedar, white elm, bur oak, butternut, yellow birch, basswood, bitternut hickory and white pine are also present. Many large trees are in the central portion of the forest including white pine up to 90cm dbh, bur oak up to 100cm dbh (Photo 34), white ash and yellow birch up to 65cm dbh and red maple, sugar maple, white cedar, butternut and basswood in the 42cm – 55cm dbh range (Photo 35). Most of the trees appear to be in good condition, with the exception of poor leaf-out on many of the butternuts and ash and trunk decay on some of the larger ash.

Along the north edge of the deciduous forest, south of the cultural thicket to the north, a 100cm dbh white pine is approximately four metres south of the 'Property Line' which separates the forest and the thicket (Photo 37). White cedar between 34 and 43cm dbh and green ash, white ash and trembling aspen up to 35cm dbh are closer to the 'Property Line'. Butternut, many in poor condition, up to 50cm dbh are between 8 and 15 metres south of the 'Property Line'. The northeast tip of the deciduous forest, just south of the 'Property Line', is much scrubbier in nature than the core of the forest to the west, although a 54cm dbh bur oak is along the forest edge. The majority of trees in this area adjacent to the thicket habitat are smaller green ash and bur oak up to 20cm dbh, with much less representation up to 30cm dbh (Photo 36). Tartarian honeysuckle and glossy buckthorn are well established in this area. Further south the largest trees along the east forest edge are white pine and red maple up to 32cm and 25cm dbh, respectively. Deer stands were in the larger white pine and a bur oak (Photo 38).

Shrubs in the deciduous forest understorey include nannyberry, red raspberry, prickly ash, glossy buckthorn, common buckthorn, tartarian honeysuckle, prickly gooseberry and red elderberry. Sensitive fern and ostrich fern are dominant in portions of the ground flora. Canada goldenrod, white snakeroot, Philadelphia fleabane, wild ginger, white avens, Virginia waterleaf, yellow violet, thicket creeper, hog peanut, white trillium, enchanter's nightshade, jack-in-the pulpit, poison ivy, inland sedge, awl-fruited sedge, honewort, white avens, red baneberry and false nettle are representative of the other ground flora. Much of the ground flora is reflective of a wetter moisture regime and is generally much less disturbed once inside of the forest edges by about 30 metres.

Wildlife observed in and adjacent to the fresh-moist ash forest included downy woodpecker, eastern wood pewee, common grackle, grey catbird, , black-billed cuckoo, American redstart, common yellowthroat, veery, white-breasted nuthatch, pileated woodpecker, a skull of a young white-tailed deer buck, common gartersnake and red squirrel. Additional bird observations are provided in Appendix A. Woodpecker cavities were noted in a few of the larger trees (Photo 39)

Photo 34 – Mature bur oak just east of the former rail line in the northwest corner of the 'North-central Forest' (June 18th, 2015)

Photo 35 – Mature yellow birch in the northeast portion of the 'North-central Forest' (June 10th, 2015)

Photo 36 – Younger vegetation along the northeast edge of the of the 'North-central Forest' (June 10th, 2015)

Photo 37 – Mature white pine near north edge of the 'North-central Forest', south of the cultural thicket to the north (June 10th, 2015)

Photo 38 – Deer stand in bur oak along east edge of the 'North-central Forest' (June 10th, 2015)

Photo 39 – Mature basswood with woodpecker cavities in the central-east portion of the 'North-central Forest' (June 10th, 2015)

Mixed White Cedar – Hardwood Forest in the North-central Forest

This mixed forest in the west portion of the north-central forest is identified as vegetation community 8 on Figure 1. In addition to the dominant white cedar, white birch, sugar maple, white pine, red maple, bur oak, green ash, white ash, balsam poplar, white elm, butternut and basswood are well represented. Many white cedar, white pine and butternut trees are in the 40 – 60 cm dbh range.

Mature white pines and bur oak are along the south edge of the mixed forest east of the former rail line. Butternut, ash and trembling aspen up to 50cm dbh are also along the forest edge. Many of the ash and butternut are in poorer condition with decreased leaf-out and canker, respectively, although good leaf-out in 2015 was observed on some of the butternut. There is generally a five metre width of shrubs between the edge of trees and the cultivated field to the south.

The understorey is relatively open in many areas and includes nannyberry, tartarian honeysuckle, prickly ash, black current, apple, prickly gooseberry and red raspberry. Ostrich fern is dominant in areas of the ground flora. Elsewhere the ground flora is a combination of native and non-native and/or invasive species including lady fern, white snakeroot, red baneberry, white trillium, white baneberry, poison ivy, thicket creeper, yellow avens, scouring rush, brome grass, common strawberry, barren strawberry, yellow violet, wild cucumber, enchanter's nightshade, inland sedge, jack-in-the pulpit, tall meadow rue, stinging nettle and purple-flowering raspberry.

Wildlife observed in and adjacent to the mixed forest included blue jay, American robin, red-winged blackbird, downy woodpecker, northern cardinal, American crow, common yellowthroat, yellow warbler, great-crested flycatcher and red squirrel. Woodpecker holes were noted in a few of the larger cedars, along with a deer stand in one.

Northwest Forest

An ash-poplar deciduous forest is dominant in the northwest forest. This deciduous forest is generally younger than the contiguous ash-maple deciduous and mixed forests to the south. Trembling aspens and green ash are dominant, with a good representation of white ash, red maple, butternut, large-toothed aspen, white birch, grey birch and white elm. Bur oak and balsam poplar are also present. The largest trees are up to 40cm dbh, but most stems are smaller than 25cm dbh (Photo 40). Piles of firewood were noted in the east portion of this forest.

Prickly ash, tartarian honeysuckle, glossy buckthorn and blackberry are common in the understorey, which is dense in areas. Dominant areas of ostrich fern and sensitive fern indicate a wetter moisture regime. Other ground flora present in the northwest forest include white bedstraw, white snakeroot, wild grape, thicket creeper, Philadelphia fleabane, crested wood-fern, Canada goldenrod, white trillium, field horsetail and virgin's bower.

Wildlife observed in the northwest forest included eastern wood pewee, common yellowthroat, grey catbird, veery, white-breasted nuthatch, northern cardinal, black-and-white warbler, yellow warbler, ovenbird, hairy woodpecker, eastern phoebe and red squirrel.

Photo 40 – East portion of the 'Northwest Forest' (June 10th, 2015)

2.2.3 Southwest Wooded Area and Woodlot S12

The southwest wooded area is a 1.2 hectare forest at the west end of the rectangular land holding identified as 1015 March Road. To the west and southwest of the KNUEA is Woodlot S12; as mapped by Dillon (1999) the northeast edge of Woodlot S12 is approximately 160 metres southwest of the southwest corner of the.KNUEA. Forests and other regenerating habitats are between Woodlot S12 and the southwest wooded area (Figure 1).

. The mixed and cedar forests in the southwest wooded area are relatively young. 1976 aerial photography indicates no contiguous tree cover with only scattered trees on or adjacent to the current southwest wooded area. The mixed forest in the east portion of the southwest wooded area includes white pines up to 36cm dbh (Photo 41), with smaller green ash, white elm, white ash and white cedar also present. Hawthorn, prickly ash, tartarian honeysuckle and common buckthorn are in the understorey, along with regenerating ash stems. The ground flora is reflected of disturbed conditions including common dandelion, Pennsylvania sedge, common strawberry, blue grass, white avens, tall buttercup, heal-all, tufted vetch, heart-leaved aster, bladder campion, common burdock, thicket creeper and wild grape.

To the west of the mixed forest is a small area of dense white cedar coniferous forest (Photo 42) with white pine well represented. The largest cedars are up to 34cm dbh (Photo 43). Smaller green ash, white birch and white elm up to 18cm are also in the coniferous forest. The understorey includes regenerating ash stems along with hawthorn, prickly gooseberry, prickly ash and common juniper shrubs. Thicket creeper, wild grape, yellow violet and Canada

goldenrod are representative of the ground flora, which appears limited due to the shading (Photo 43).

Wildlife observations in and adjacent to the southwest wooded area included black-capped chickadee, , turkey vulture, , European starling, , great-crested flycatcher, common yellowthroat, yellow warbler, song sparrow, grey catbird, Baltimore oriole, American goldfinch, red squirrel, woodchuck and white-tailed deer and raccoon tracks. Additional bird observations are provided in Appendix A. No stick nests were observed on or adjacent to the southwest wooded area.

There is no interior forest habitat present within this part of the KNUEA, although the City's mapping indicates that interior habitat is present in the larger woodland beyond the study area boundary.

Photo 41 - White pines in the mixed forest in the east portion of the southwest wooded area

Photo 42 - Dense white cedar in small area of coniferous forest in the west portion of the southwest wooded area

Photo 43 – Larger white cedar in the coniferous forest in the west portion of the southwest wooded area. Note lack of ground flora on August 6th, 2014

2.2.4 Hedgerows

Many deciduous hedgerows are between the agricultural fields throughout the study area. White ash is dominant in some of the deciduous hedgerows including those on 927 and 1015 March Road, with Manitoba maple dominant in others. Some of the ash are in poor condition with trunk decay and stripped bark. White elm, bur oak, white cedar, sugar maple, basswood, crack willow, white pine, red maple, white birch, apple, black cherry and trembling aspen are other common tree species in the deciduous hedgerows, with butternut present in some of the deciduous hedgerows east of March Road. Vine growth is extensive on many of the poplars and willows. Common buckthorn and hawthorn shrubs are common among the hedgerow trees. There are several examples of mature trees in the deciduous hedgerows. The following examples are grouped west and east of March Road, beginning in the north portion of the urban expansion area:

West Side of March Road

- A mature, 73cm dbh, sugar maple in the front yard of 1111 March Road, west of March Road and north of St. Isidore School (Photo 44);
- An over-mature white ash, 72cm dbh, with several broken limbs in the central portion of 1075 March Road;
- Bur oaks up to 66cm dbh and smaller white elm along west portion of boundary between 1035 and 1075 March Road (Photo 45);
- A mature white elm to the west of March Road, south of 1035 March Road;
- Bur oaks up to 63cm dbh and smaller white elm and white ash in the east-west deciduous hedgerows along the south side of 1015 March Road (Photo 46);
- A mature bur oak in the southwest corner of 927 March Road; and,
- A mature, 86cm dbh, bur oak in the south east-west deciduous hedgerow, south of 927 March Road and north of Old Carp Road. White ash up to 58cm dbh are also in this hedgerow (Photo 47).

East Side of March Road

- A mature weeping willow in the northwest portion of 1070 March Road;
- Mature crack willow up to 84cm dbh along the central portion of the boundary between 1020 and 1070 March Road and to the north in the central portion of 1070 March Road;
- Coppice 54cm dbh white ash in an intermittent hedgerow in the central portion of 1020 March Road;
- A mature, 74cm dbh, white elm in the intermittent east-west deciduous hedgerow in the middle of 1020 March Road (Photo 48);
- A mature, approximately 115cm dbh, white elm on the property line between 936 and 1020 March Road, west of the coniferous forest (Photo 49);
- Mature sugar maples in the west portion of a south east-west hedgerow, approximately 70 metres east of March Road at 936 March Road;
- Red maples and white ash up to 48cm dbh in the south east-west hedgerow at 936 March Road west of the former railway; and,

- A mature, 70cm dbh, bur oak along the south boundary of 936 March Road, adjacent to 413 Celtic Ridge Crescent.

Coniferous hedgerows include a hedgerow of white pines up to 38cm dbh in apparent good condition along the central west urban expansion area boundary east of Nadia Lane (Photo 51). Two coniferous hedgerows are in the vicinity of St. Isidore School, west of March Road. A row of red pines up to 29cm dbh are to the west of the school yard (Photo 50) and a mature row of white cedars are to the north of the school in the cemetery west of March Road. Also on the west side of March Road a row of white spruce up to 20cm dbh is south of the driveway for 1035 March Road (Photo 52) and a row of white pines is on the west side of and parallel to March Road, beginning at 1035 March Road and continuing north. A row of white pine and deciduous trees is along the north bank of the North Branch of Shirley's Brook in the southwest corner of 936 March Road.

Wildlife observed in the hedgerows included house wren, red-tailed hawk, pileated woodpecker, northern flicker, eastern kingbird, tree swallow, song sparrow, savannah sparrow, American robin, common yellowthroat, , yellow warbler, northern cardinal, indigo bunting, European starling and grey squirrel. See Appendix A for additional bird observations. The red-tailed hawk was observed in the same general location, in a north-south deciduous hedgerow in the north-central portion of 1020 March Road, during both breeding bird surveys but no nest was observed and only one bird was observed during each survey.

Photo 44 - Mature sugar maple in the front yard of 1111 March Road

Photo 45 - Cultivated field and deciduous hedgerow with ash, bur oak and basswood along the boundary between 1035 and 1075 March Road. View looking east

Photo 46 - Cultivated field and deciduous hedgerow with mature bur oak and smaller white elm along the south side of 1015 March Road. View looking northeast

Photo 47 - Deciduous hedgerow in the southwest corner of the urban expansion area north of Old Carp Road. View looking east to March Road

Photo 48 - Mature white elm in intermittent east-west deciduous hedgerow on 1020 March Road, east of March Road

Photo 49 - Mature white elm near the boundary between 936 and 1020 March Road. View looking north

Photo 50 - Red pine hedgerow to the west of St. Isidore school

Photo 51 – White pine hedgerow east of Nadia Lane along west edge of 1075 March Road

Photo 52 - Row of white spruce along the south edge 1035 March Road.
View looking west from March Road

2.2.5 Other Treed Areas

A few cultural woodlots, where the tree cover is greater than thicket habitats but up to sixty percent, are scattered through the urban expansion area (Figure 1, Photos 53, 54 and 55). The largest trees are white pine up to 46cm dbh, with smaller green ash, bur oak, Manitoba maple, red pine, trembling aspen, basswood, grey birch and white elm also present. Wild grape growth is often common on the trees. Some of these areas appear to be used for firewood. Common buckthorn, slender willow, red-osier dogwood, gray dogwood, red raspberry, tartarian honeysuckle and prickly ash shrubs are common among the trees. Common strawberry, purple loosestrife, goldenrod and tufted vetch are typical ground flora.

Several mature coniferous and deciduous trees, including mature white cedar, ash, crack willow, sugar maple and Manitoba maple, are around many of the farmhouses in the urban expansion area including those at 927, 936, 1035 and 1053 March Road. Smaller white elm, green ash and butternut are also present. A mature bur oak (72cm dbh) is north of the driveway to 1035 March Road (Photo 56), with sugar maples between 48cm and 74cm dbh just east of March Road at 1020 March Road. Some of the older maples appear to be over-mature with trunk rot.

A deciduous ash forest is to the north of 1070 March Road and the urban expansion area, in the rear yards of the residences on the south side of Houston Crescent.

Wildlife observed in the cultural woodlots included song sparrow, chipping sparrow, white-throated sparrow, white-breasted nuthatch, downy woodpecker, eastern phoebe, , rose-breasted grosbeak, red-eyed vireo, ruffed grouse, cedar waxwing, American goldfinch and European starling. See Appendix A for additional bird observations.

Photo 53 - Cultural woodland west of St. Isidore School and March Road

Photo 54 - Cultural woodland in the southeast corner of 1020 March Road. View looking east

Photo 55 - Cultural woodland in the southwest corner of 1035 March Road

Photo 56 - Mature bur oak to the northwest of 1053 March Road. View looking southeast to March Road

2.2.6 Agricultural Fields and Cultural Meadows/Thickets

The majority of the site was planted in soybeans or corn in 2013 (Photos 58, 59, 61 and 62), with a large pasture area in the northwest portion of 1113 March Road. Common mullein, brome grass, bluegrass, orchard grass, reed canary grass, Canada anemone, timothy, meadow grass, white bedstraw, Canada thistle, wild carrot, common plantain, New England aster, wild parsnip, goat's-beard, common milkweed, white clover, alsike clover, tufted vetch, tall buttercup, Canada goldenrod, bird's-foot trefoil, ox-eyed daisy, tall buttercup and common dandelion are typical of the vegetation along the perimeter of the cultivated fields and in the lands used for pasture, haying and vacant land (Photos 57, 60 and 63). Woody vegetation includes a buckthorn, slender willow, apple, red raspberrry and red-osier dogwood shrubs and regenerating ash, white elm and white pine stems up to 14cm dbh but the woody vegetation component is less than 10 percent.

Scattered cultural thickets are dominated by prickly ash, common juniper, red-osier dogwood, common buckthorn, chokecherry, red raspberry, slender willow, Bebb's willow, hawthorn red raspberry and nannyberry shrubs, with regenerating green ash, white elm, bur oak, white cedar, apple and white pine stems up to 16cm dbh (Photos 64 and 65). Typical ground flora in the cultural thicket habitat includes reed canary grass, meadow grass, blue grass, orchard grass, brome grass, tufted vetch, yellow hawkweed, black medic, ox-eyed daisy, goat's-beard, thicket creeper, common strawberry, lesser stitchwort, bladder campion, red clover, heal-all, wild carrot, goldenrod, common mullein, purple loosestrife, common milkweed and bull thistle.

Wildlife observed in the cultural meadows and thickets and agricultural fields included great-blue heron (flying overhead), ring-billed gull, Canada goose, northern harrier, wild turkey, turkey vulture, killdeer, red-winged blackbird, northern flicker, black-capped chickadee, savannah sparrow, , field sparrow, swamp sparrow, , barn swallow, house wren, northern cardinal, yellow warbler, common yellowthroat, black-and-white warbler, chestnut-sided warbler, red-eyed vireo, cedar waxwing, eastern phoebe, eastern kingbird, alder flycatcher, great-crested flycatcher, brown thrasher, gray catbird, bobolink, rose-breasted grosbeak, European starling and white-tailed deer. A green heron was observed foraging in the larger pond (Pond 1) along the North Branch of Shirley's Brook at 927 March Road. See Appendix A for additional bird observations. A snapping turtle and mallards were also observed in this pond.

Photo 57 – Cultural meadow in the west portion of 1075 March Road. View looking west

Photo 58 – Cultivated corn field at 1035 March Road.
View looking east to from west edge of the site

Photo 59 – Cultivated corn field at 1015 March Road.
View looking east to from west edge of the site

Photo 60 - Hayfields in the east portion of 1070 March Road. View looking west

Photo 61 – Cultivated lands on central and west portion of 1020 March Road. View looking southwest to March Road

Photo 62 – Cultivated soybean field in the central-west portion of 936 March Road. View looking west to March Road

Photo 63– Meadow habitat in the northeast portion of 1020 March Road. View looking east to former railway

Photo 64 – Cultural thicket in the west portion of 1015 March Road

Photo 65 – Cultural thicket in the southeast portion of 1020 March Road. View looking north

2.2.7 Linkages

The potential linkage function in the general area between Shirley's Bay and the Ottawa River to the east and South March Highlands to the west, including the Kanata North Urban Expansion Area, is limited by extensive agricultural lands, DND activities, the north-south March Road and March Valley Road and rural residential developments. Woody vegetation along the North Tributary corridor is minimal further west of March Road, which further impacts the potential linkage function along the corridor. Aquafor Beech (2006) concluded that it is apparent that the scattered woodlots between Second Line Road and March Valley Road have deteriorated in terms of the quality and diversity of the woodland habitat they previously provided. Dillon (1999) noted that Woodlot S20 has a good connection to Woodlot S23 to the east of the former railway. However there is no extension of the linkage potential to the north, west or south of Woodlot S20. Aquafor Beech (2006) identified three potential linkage locations; one along the North Branch, one along the North Tributary and one along Constance Creek to the north of the urban expansion area. As noted above there are many disturbances to potential linkages along both the North Branch or the North Tributary, including a crossing of March Road, extensive agricultural lands and rural residential developments.

2.3 Species at Risk and other Species of Interest

The Ontario Ministry of Natural Resources's new biodiversity explorer website was reviewed (http://www.biodiversityexplorer.mnr.gov.on.ca/nhicWEB/main.jsp). This site allows for a search of threatened and endangered species covered by the 2008 *Endangered Species Act*, as well as other species of interest. Searches conducted on the 10 km square including the study area and adjacent lands (18VR22) identified three Species at Risk. Blanding's turtle and least bittern are threatened Species at Risk, along with the endangered American ginseng identified for the overall 10 km square, with two provincially rare species, ram's-head lady's-slipper and prairie dropseed, and one species of special concern, milksnake, reported. In addition the endangered butternut is found in the Ottawa area in a variety of habitats. The breeding birds listed in the Ontario Breeding Bird Atlas for the 10 km square 18VR22 identified eastern whip-poor-will, barn swallow, eastern meadowlark and bobolink as threatened Species at Risk, as well as golden-winged warbler, a species of special concern, in the overall 10 km square including the study area.

The potential Species at Risk reported for the City of Ottawa were also reviewed, with an emphasis on the endangered and threatened species historically reported in the overall City, including butternut, American ginseng, eastern prairie fringed-orchid, flooded jellyskin, wood turtle, spiny softshell, Blanding's turtle, musk turtle, bobolink, eastern meadowlark, barn swallow, Henslow's sparrow, loggerhead shrike, eastern whip-poor-will, bald eagle, cerulean warbler, golden eagle, least bittern, little brown myotis, northern long-eared bat, olive hickorynut, eastern cougar, lake sturgeon and American eel. The habitat requirements of these species along with those listed as special concern were reviewed.

Butternut is common in some of the lands to the east of the urban expansion area (Figure 4) as well as portions of the South March Highlands. Butternut health assessments were completed for the KNUEA in July, 2013, but not the butternut in and adjacent to Woodlot S23. All butternuts within and adjacent to Woodlot S23 that may be impacted by servicing or other

components of the development must be assessed well in advance of proposed tree removal. Butternuts can only be assessed during the leaf-out period, generally from the end of May to the end of August. The butternut health assessments completed on July, 2013 in the KNUEA will need to be repeated prior to proposed tree removal to account for potential changes in the health of the butternuts and the potential for more regenerating stems.

One-hundred and sixty-seven butternut trees were assessed on and within 25 metres of the KNUEA. All of the butternuts were observed east of March Road, with 87 percent of the butternuts on 936 March Road. The highest density of butternuts was around the farmhouse at 936 March Road, with a good representation of the butternuts also in the east-west deciduous hedgerow south of Woodlot S20, along the east portion of Woodlot S20 and along the east edge of the site, west of the former railway (Figure 5). Of the 167 butternuts assessed 137 (82 percent) were assessed as healthy ('retainable'), with 30 assessed as non-retainable. The high percentage of healthy stems likely relates to the large percentage of small butternuts assessed. Approximately 10 percent (14 healthy butternuts) were 15cm dbh or larger, with 45 percent (61) of the healthy butternuts 2cm dbh or less and 69 percent 5cm dbh or less. All 95 of butternuts 5cm dbh or less were assessed as healthy except one 3cm dbh stems. Butternuts are now assessed in one of three categories; Category 1 trees are assessed as unhealthy. Category 2 trees are assessed as healthy and Category 3 trees are assessed as healthy, are at least 20cm dbh and are within 40 metres of a non-healthy tree (Category 1) butternut. Six of the butternuts meet the Category 3 criteria. These Category 3 trees have the potential to be archived as they may have features that are resistant to the canker fungus. Two of these trees were in the vicinity of the farmhouse at 936 March Road with four along the west edge of Woodlot S20.

For the butternuts assessed as healthy ('retainable') a mitigation or compensation plan that provides an overall net benefit for the species must be developed in consultation with of the Ministry of Natural Resources prior to their removal or operations within 25 metres that may harm the trees. In the absence of a compensation or mitigation plan, certain operations such as excavating or paving that would remove or significantly compact the roots and soil, and cause direct harm to the tree are not permitted within the 25 metre radius protective buffer.

Most of the agricultural fields were ploughed in 2013 and do not represent potential habitat for the grassland Species at Risk such as bobolink and eastern meadowlark. However some of the fields that were historically used for agricultural represent potential habitat for these species in the current condition. Bobolinks were observed during the 2013 field studies in fields in the northeast corner of 1020 March Road, west of the former railway and in central west portion of 1075 March Road between the North Tributary and the west edge of the study area. A calling eastern meadowlark was heard in the north portion of the study area west of March Road on April 29th but was not observed during the breeding period.

Structures in the fields west of March Road at 927 and 1075 March Road and in the east portion of 1070 March Road could potentially be utilized by barn swallow (see an example in Photo 66). Barn swallows were observed flying the fields of 927, 1070 and 1075 March Road in June, 2013. Potential chimney utilization by chimney swifts is possible in some of the farmhouses. Detailed studies following MNRF protocols should be completed for each land parcel that contains non-cultivated fields with less than ten percent woody vegetation (for grassland Species at Risk) or

the structures described above (for barn swallow and chimney swift) as part of the individual subdivision process.

Sightings of Blanding's turtle, a threatened Species at Risk in Ontario, have been recorded within two kilometres of the study area in Shirley's Bay and South March Highlands. Sightings have also been recorded to the north of March Road and Riddell Drive, to the north of the site. Five turtle surveys were completed on May 5th, 8th, 12th and 27th and June 2nd, 2014. One Blanding's Turtle was observed within a pond along the North Tributary corridor on the west side of March Road on two separate occasions; first on May 5th and again on May 12th (Figure 6). It is thought to be the same turtle as it was of similar size and was basking in the same location, on the south bank near the water's edge, on both occasions. A painted turtle and two unconfirmed turtles (likely painted turtles) were also observed along the North Tributary corridor on May 5th, 2014.

The general habitat description for the Blanding's turtle developed by the Ontario Ministry of Natural Resources identifies three habitat categorizations. Category 1 lands include overwintering/hibernation and nesting areas and an associated thirty metre buffer. Blanding's turtle nests are created in open habitats with low vegetation cover and high sun exposure such as in forest clearings, meadows, shorelines, beaches, rock outcrops, cornfields, gravel roads, road shoulders, ploughed fields, gardens, powerline rights-of-ways, yards and abandoned railroad beds, with females often showing a high fidelity to the same general nesting areas (OMNR, 2013). Blanding's turtles also display overwintering site fidelity, using some sites year after year and many individuals may aggregate at one site while overwintering (OMNR, 2013). Suitable Blanding's Turtle overwintering habitat typically includes permanent bogs, fens, marshes, ponds, channels or other habitats with free (unfrozen) shallow water. No evidence of nesting activity has been observed on the site and loose coarse overburden material is generally not available. Hibernation areas are identified by very early spring emergence and late fall observations in combination with habitat composition. Since the Blanding's turtle was observed early in the season, likely before it would have begun migrating, it is anticipated that this pond provides overwintering habitat for this species and thus the pond would be considered Category 1 habitat, as well as the surrounding 30 metre area.

Category 2 lands are wetland complexes that extend up to two kilometres from an occurrence and 30 metres around these suitable wetlands/waterbodies (OMNR, 2013). For the purpose of general habitat protection for Blanding's Turtle, a wetland complex is defined as all wetlands that are within 500 m of each other. Suitable on-site wetland habitat for Category 2 lands include the corridors associated with the North Tributary and the North Branch of Shirley's Brook. Although a wooded swamp is in Woodlot S20 (vegetation community 13 on Figure 1) our field observations and discussions with the Ministry of Natural Resources and Forestry concluded that no Category 2 Blanding's turtle habitat was present on the site outside of the North Branch and North Tributary corridors. Category 3 lands are between 30 and 250 metres around suitable Category 2 wetlands and waterbodies. The primary purpose with respective to Blanding's turtle habitat of the Category 3 lands is to provide movement corridors between wetlands, a function which is essential for carrying out life processes associated with the Category 1 and 2 habitats. The Blanding's turtle habitats, as reviewed and approved by the Ministry of Natural Resources and Forestry, are shown on Figure 7

The on-site wooded areas appeared too small and the understorey too thick for utilization by eastern whip-poor-will and none were heard during three targeted surveys completed in the spring and early summer of 2014.

A species of special concern, snapping turtle, was observed in Pond 1 along the North Branch of Shirley's Brook. This turtle occurs in almost any freshwater habitat, though it is most often found in slow-moving water with a soft mud or sand bottom and abundant vegetation. Another species of special concern, eastern wood pewee, was observed in Woodlot S23 during the breeding bird period.

The other potential species of interest identified in the background databases were not observed:

- Milksnake is relatively common in portions of eastern Ontario but is not often seen. It is found in open woodlands, clearings and around farmhouses where it hunts its major prey item, mice;
- Ram's-head lady's-slipper orchid is found in mature coniferous forests or coniferous fens and swamps, habitat not on or adjacent to the study area;
- Prairie dropseed is found in rocky soil in full sun and is known from Shirley's Bay to the east of the study area;
- Larger areas of wetland habitat necessary to support least bittern are not present on the urban expansion lands;
- Golden-winged warbler breeds in scrubby habitats and is known from the South March Highlands area to the west of the study area; and,
- American ginseng is also known from the South March Highlands. Ginseng requires rich, moist, undisturbed and relatively mature sugar maple-dominated deciduous woods in areas of circumneutral soil such as over limestone or marble bedrock.

Of the potential Species at Risk described above butternut, Blanding's turtle, bobolink, eastern meadowlark (not in the breeding season) and barn swallow were observed in the study area in 2013 and 2014.

Photo 66 – One of the structures on 1075 March Road that may be utilized by barn swallow

FIGURE 5 – 2013 BUTTERNUT HEALTH ASSESSMENT RESULTS

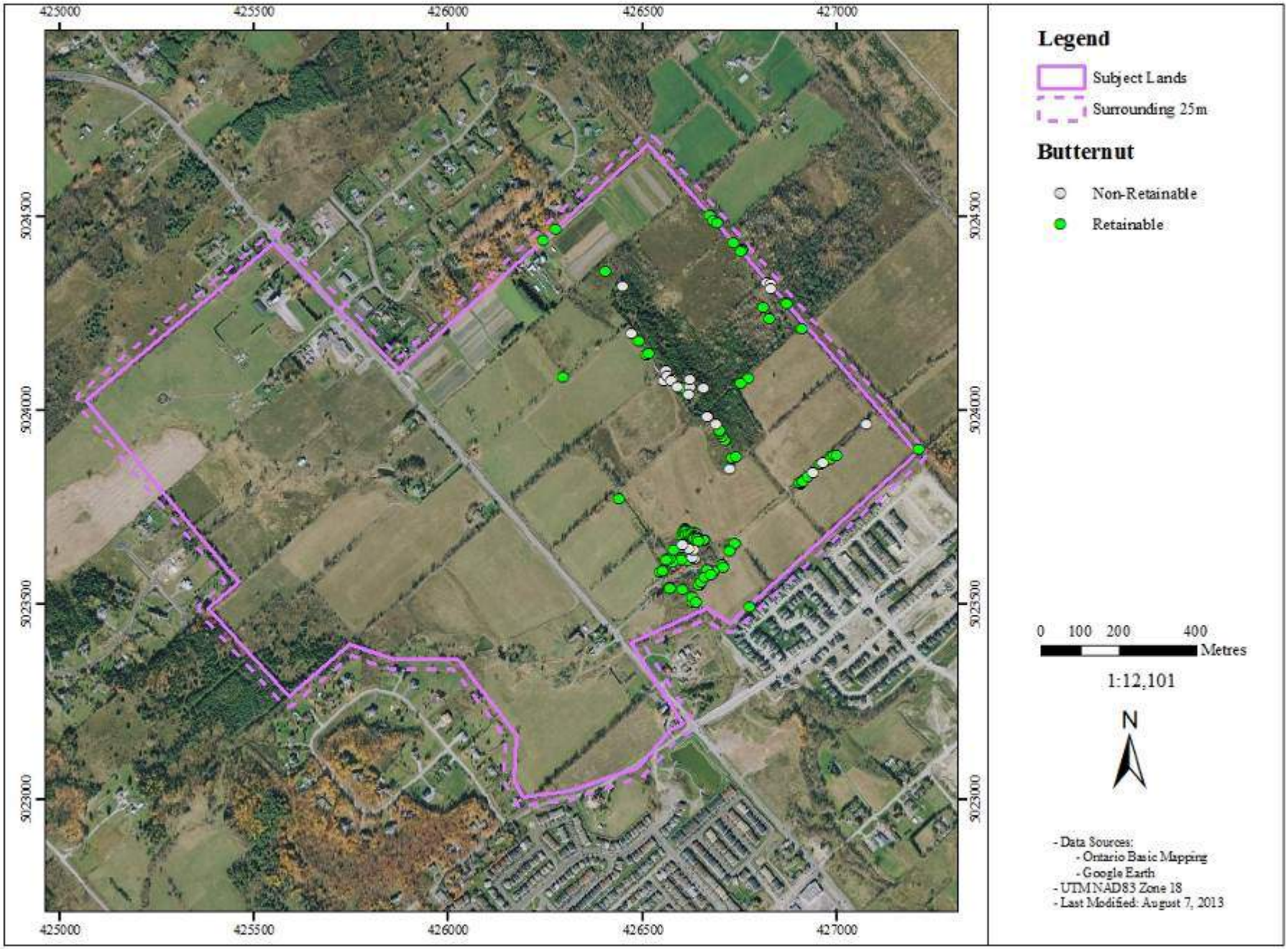


FIGURE 6 – 2014 TURTLE OBSERVATIONS

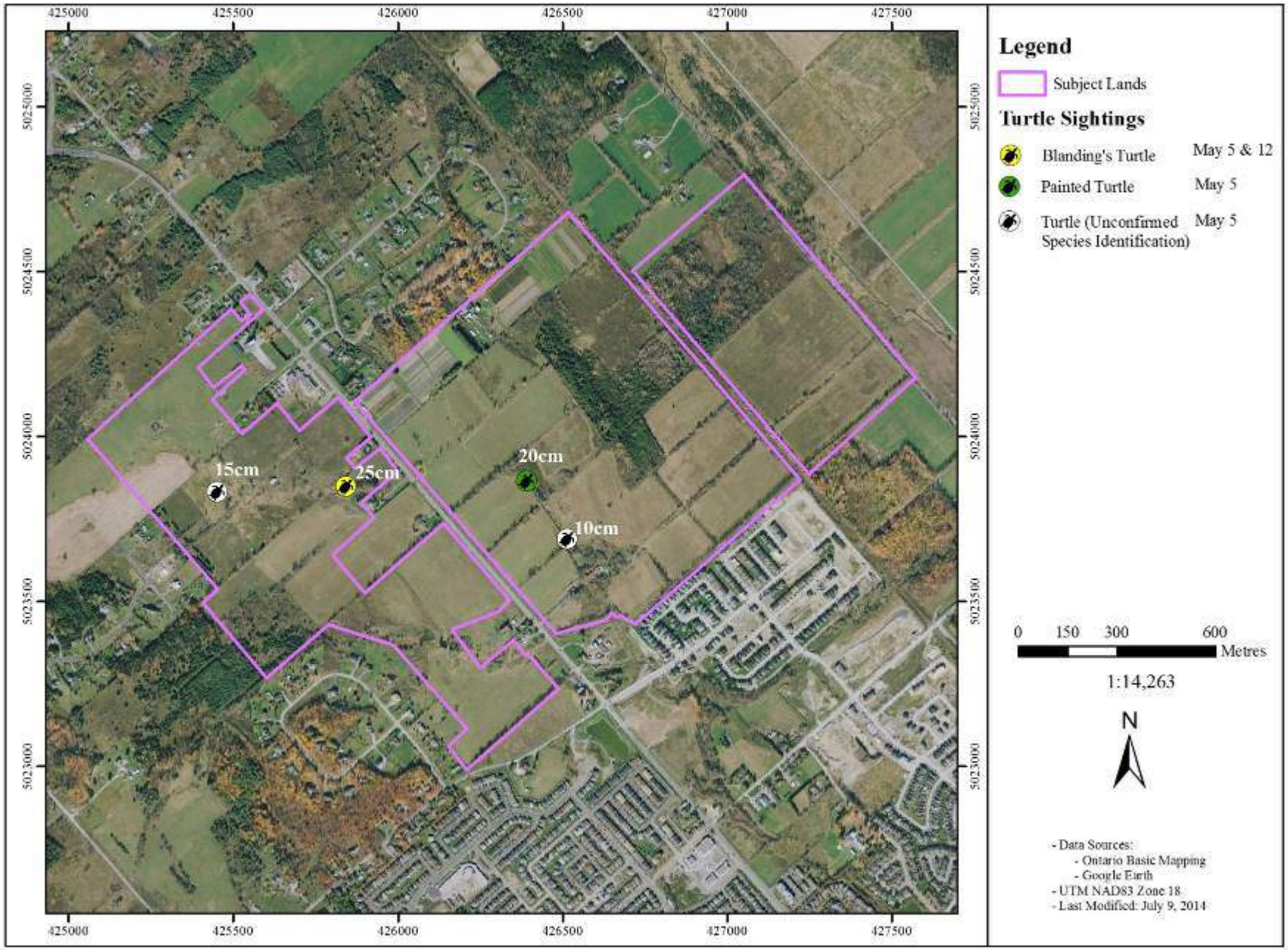
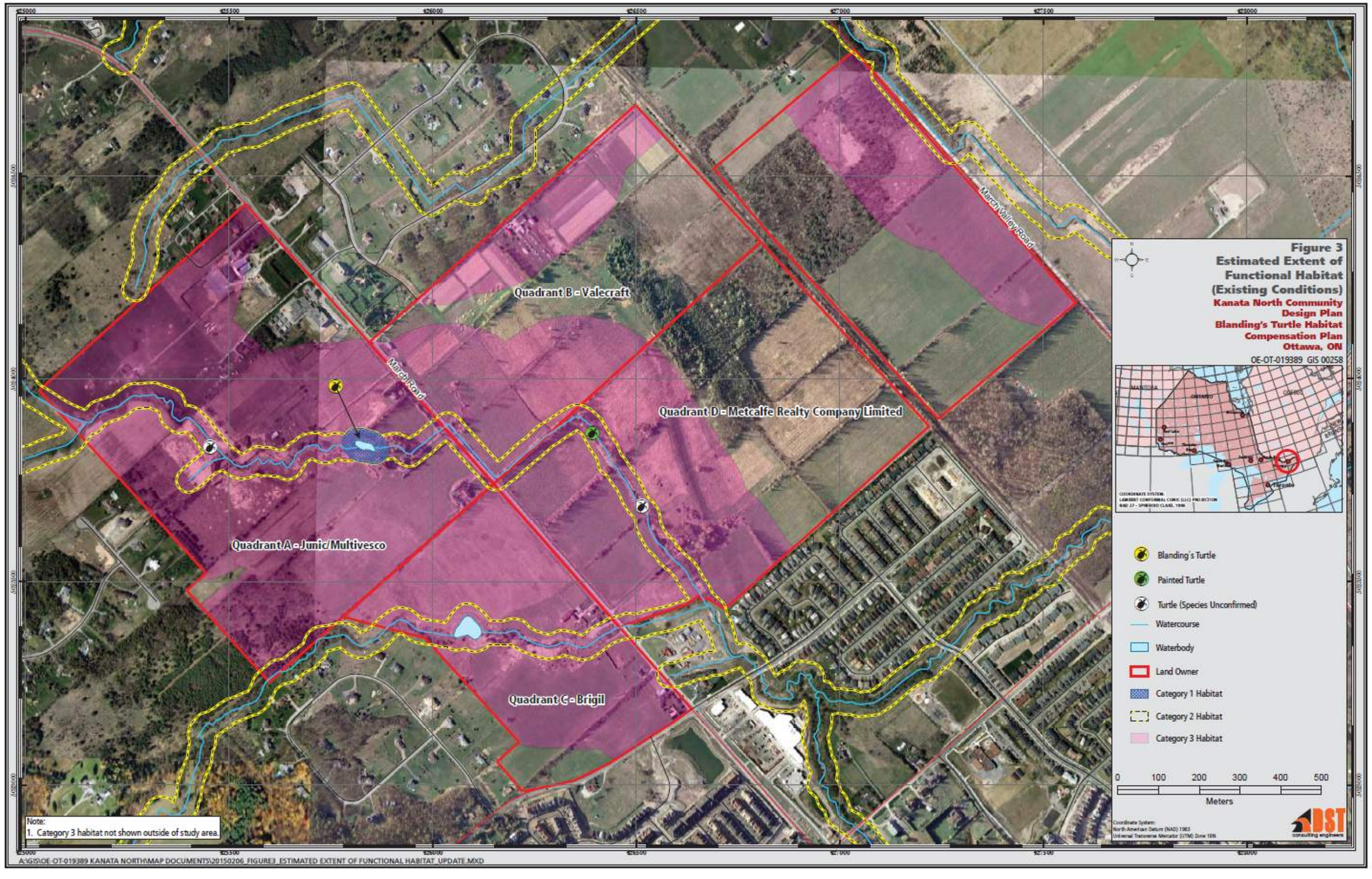


FIGURE 7 – BLANDING'S TURTLE HABITAT (Figure 3 in DST (2016))



3.0 SUMMARY and RECOMMENDATIONS

This section provides a summary of the natural heritage features and recommendations for features to be included in the Natural Heritage System.

The urban expansion area is dominated by cultivated agricultural fields with pasture activity in the northwest portion. The deciduous hedgerows contain many mature trees, including bur oak, sugar maple, red maple, white pine and white spruce. Generally undesirable species for retention such as ash, Manitoba maple, crack willow and white elm are also present. Woodlots S20 and the other smaller wooded areas in the urban expansion area have limited ecological functions, including providing local wildlife habitat. Aquafor Beech (2006) concluded that it is apparent that the scattered woodlots between Second Line Road and March Valley Road, including the urban expansion area, have deteriorated in terms of the quality and diversity of the woodland habitat they previously provided.
As defined in Section 2.4.2 of the Official Plan, potential components of a Natural Heritage System are:

a) Provincially significant wetlands;
b) significant habitat for endangered and threatened species;
c) significant woodlands;
d) wetlands found in association with significant woodlands;
e) significant valleylands;
f) significant wildlife habitat as part of a significant natural heritage feature or identified within the subwatershed study or the site investigations;
g) Life Science Areas of Natural and Scientific Interest;
h) Earth Science Areas of Natural and Scientific Interest;
i) Urban Natural Features;,
j) forest remnants that have been identified as linkages between significant natural heritage features; and
l) surface water features.

Criterion k) addresses groundwater features and is addressed in a surface and subsurface hydrogeologic investigation by Paterson Group (2015).

Most of the potential components listed above were not observed in the study area. Significant habitat for endangered and threatened species, significant woodlands and surface water features are discussed below.

Surface Water Features

The North Branch of Shirley's Brook and the North Tributary are watercourses that contain fish habitat and are considered part of the Natural Heritage System, as shown in Figure 8.

All eight of the fish species netted from the North Branch of Shirley's Brook and the North Tributary are commonly found in cool and warm water fish habitats in eastern Ontario and all, except for white sucker and pumpkinseed are common forage fish species. Based on the fish

sampling and fish habitat assessments, the North Tributary and the North Branch of Shirley's Brook support direct fish habitat for the majority of the study area. Upstream of Site 10 the North Tributary is intermittent, with the North Branch of Shirley's Brook intermittent upstream of the second weir at Site 5.

The Kanata North Environmental/Stormwater Management Plan (CH2M Hill, 2001) recommended a fifteen metre setback from the top of slope for these features adjacent to and to the south of the urban expansion area. The fish community and habitat observations in the study area for these channels indicate that a fifteen metre setback from the top of slope would provide more than adequate protection for the aquatic habitat of these channels. For Type 2 and 3 fish habitat, representing the habitat present in the urban expansion area, Dillon (1999) recommended a 15 metre riparian buffer area, measured on both sides of the watercourse from centreline. Unless low impact pathways are proposed, multi-purpose pathways are to be located outside of the fifteen metre top-of-slope setback.

Where re-aligning sections of the channels could provide fewer disturbances over the long-term in a greenspace corridor, relocation could be completed to provide an overall benefit to the aquatic habitat through natural channel design and other mitigation and enhancement measures. In consultation with the agencies a detailed plan will be produced for any proposed realignments. The plan will be reviewed on a case by case basis by Mississippi Valley Conservation Authority and other agencies as required.

Rehabilitation and enhancement measures recommended along the North Branch and the North Tributary include removal of blockages for fish passage such as the weirs west of March Road along both watercourses and the beaver dam on the North Tributary east of March Road. It is recommended that the water levels in Pond 1 be controlled to allow fish passage during higher flows but to retain water during lower flows so the pond can continue to provide turtle habitat and a refuge pool for fish. The riparian corridor should be allowed to naturalize, with plantings of native trees and shrubs such as sugar maple, bur oak, red maple, basswood, white spruce and tamarack along the corridors to encourage the naturalization, add to the protection for the adjacent aquatic systems, and to provide a diversity of vegetation and associated wildlife habitat. Consideration should be given to improving the diversity of in-stream structure through placement of riffles, boulders, pools and root wads.

A few smaller channels tributary to the North Branch and North Tributary are present. Other than one station along Tributary 1 no fish were netted from these channels. From a fish habitat perspective their retention is not required and the stormwater management will ensure water quality and quantity entering downstream fish habitat is maintained to required levels. A headwater assessment concluded that the hydrology and fish habitat functions of the man-made Tributary 1 and associated side branches in and adjacent to Woodlot S20 are marginal at best, with riparian cover and amphibian utilization along portions of the side branches (Bowfin and Muncaster, 2015). Mitigation area requirements for these channels should not be comparable to off-setting mitigation for removal of channels that provide higher ecological functions such as fish habitat and with more significant hydrology characteristics. Habitat enhancement could be considered off-site to provide off-setting mitigation for removal of these intermittent features.

Significant Woodlands

Woodlot S20 was initially assessed for a Significant Woodland using the criteria in Policy 1c of Section 2.4.2 of the City of Ottawa Official Plan. Woodlot S20 did not satisfy the interior forest habitat criteria as there is no portion of the woodlot that is greater than 100 metres from a forest edge. As all three criteria must be met, Woodlot S20 was not considered a Significant Woodland using the Official Plan criteria.

Following the 2014 Provincial Policy Statement, Woodlot S20 was assessed for significance using the criteria in OMNR (2010). Woodlot S20 has 3.2 trees per hectare at least 50cm dbh. Woodlot S20 does not meet the larger tree structure criteria used in Criterion 3 of Table 7-2 (OMNR, 2010) of 10 or more trees/ha at least 50cm dbh. Woodlot S20's basal area of trees greater than 40 cm dbh was determined to be 1.97 m^2/ha. For basal area, Criteria 3 of OMNR (2010) requires a basal area of 8 or more m^2 per hectare in trees that are at least 40cm dbh. Woodlot S20 does not meet this larger tree criteria used in Criterion 3 of Table 7-2 of OMNR (2010). Woodlot S20 does not satisfy any of the uncommon characteristics identified in Criterion 3 of Table 7-2 of the Natural Heritage Reference Manual. Other criteria for Significant Woodlands outlined in OMNR (2010) were also not met by Woodlot S20, with no rare vegetation communities or unique species composition present. The woodlot is not of sufficient size to be considered significant, does not have interior habitat and is not within 30 meters of a significant natural feature. The limited fish habitat observed in the agricultural channel Tributary 1 is not significant and is not supported or influenced by the adjacent Woodlot S20. Woodlot S20 is not considered to have any significance for groundwater recharge as the water is effectively being impounded by poor topographical drainage and being underlain by a stiff silty clay parent material.

The features and functions of Woodlot S20 are limited by:

- a lack of interior habitat with no observations of forest interior of area sensitive wildlife;
- no observations of vernal pools;
- no observations of Species at Risk other than butternut;
- limited amount and diversity of regenerating stems;
- a high level of disturbance from non-native species, wind throw and historical logging; and,
- a linear shape that further reduces the ecological features and functions due to increased edge effects

In conclusion Woodlot S20 contains several mature trees but overall does not have the attributes to be considered a Significant Woodland and is not considered a natural heritage system feature. This is consistent with the conclusions for Woodlot S20 described by City of Ottawa (2015).

The forests to the east of the former railway line, Woodlot S23, would likely be considered a Significant Woodland due to the older tree structure present, some interior forest habitat and

presence of a drainage feature. The functions of the northeast forest component of Woodlot S23 are reduced due to the dominance of ash and poplar in many areas, disturbed and very thick understorey, ground flora dominated by non-native and/or invasive flora, the lack of forest interior potential in the forest width up to 150 metres, road noise and open canopy in many areas. The presence of a Significant Woodland on the lands to the east would trigger a requirement for an Environmental Impact Statement to be prepared in support of any development application on the adjacent lands to the west within the urban area. As described in Section 2.2.1 due to the areas of cultural woodland east of Woodlot S20 and the forest canopy break at the former railway, the forests (Woodlot S23) to the east of the former railway and Woodlot S20 are not considered to be contiguous.

A small area, referred to as the southwest wooded area, in the southwest portion of 1015 March Road is also included on the Schedule L3 Natural Heritage System Overlay. This area has been historically disturbed by agricultural and had no contiguous tree cover on 1976 aerial photography. However the woodlot does extend in a continuous, although tenuous, manner to west and southwest to the core Woodland S12 area as mapped by Dillon (1999). As a watercourse is present and the contiguous forest to the southwest of the site does have small areas of forest that are greater than 100 metres from a forest edge the entire contiguous forest would be considered a significant woodland if mature stands of trees are present to the southwest of the site. Access to this area was not obtained and in the absence of the age information and with forests present in this area on 1976 aerial photography the entire forest is tentatively considered a Significant Woodland. Further to Section 3.11, Policy 6B of the Official Plan the portion of the woodland within the urban expansion area was further evaluated using the criteria of the Urban Natural Areas Environmental Evaluation Study. The woodland in the urban expansion area rated '3' (out of '5') for the connectivity, regeneration and ecological integrity criteria; '2' for the natural communities and wildlife habitat criteria and '1' for the size and shape, habitat maturity, representative flora and fauna and significant flora and fauna criteria. The average rating of the nine evaluation criteria is 1.89, which would indicate that the portion of the woodland in the urban expansion area would be considered to have a low overall significance. Privately owned urban natural areas scoring low overall are not considered by the City as a priority for acquisition or retention.

Given the distance of 160 metres to the closest portion of the core Woodlot S12 from the west edge of the southwest wooded area and several breaks in the forest canopy in the intervening lands, in combination with the minimal features of the southwest wooded area described above it is concluded that removal of a portion of the southwest wooded area will not impact the ability of the overall contiguous forest to function as a significant woodland. The ground flora of the woodland reflects the past agricultural disturbances. As this area does not contain mature trees, interior habitat or habitat for Species at Risk and contains many open areas of reduced tree cover with a disturbed ground flora there are minimal ecological features and functions in this area, which is reflected in the above evaluation ratings. Individual tree retention of white pine and white cedar for aesthetic and local wildlife values is recommended. It is recognized however that retention of trees in an urban development is often difficult due to the servicing and associated grading requirements. A portion of the southwest wooded area will be retained as part of the North Branch corridor. City of Ottawa (2015) have also concluded that much of the

southwest wooded area does not reflect a Significant Woodlot when minimum patch width is considered. City of Ottawa (2015) recommend that a small portion of the southwest wooded area along the west edge of the KNUEA be part of the natural heritage system. This portion of the southwest wooded area, shown on Figure 8, appears contiguous with and forms part of the larger woodlot to the west and southwest, including Woodlot S12.

Where feasible, retention of hedgerows is recommended, especially around the edges of the urban expansion area. These hedgerows should be managed during the development process to remove existing and potential hazard trees (e.g., dead or dying trees, ash trees) and to replace them with new healthy native stock. Enhancement plantings may be needed in some areas to fill in existing gaps in the retained hedgerows. Retention of individual healthy native trees (e.g., bur oak, sugar maple, red maple, white pine and white spruce) from the hedgerows is also recommended elsewhere within the development area where possible.

Significant Habitat for Endangered and Threatened Species

The vacant agricultural land and pasture lands in the study area may provide habitat for grasslands Species at Risk such as bobolink and eastern meadowlark. Bobolink was observed in the late spring of 2013 in northeast corner of 1020 March Road and the west portion of 1075 March Road. As part of the subdivision process these areas are to be further assessed with detailed breeding bird surveys following MNRF protocols. Several structures on the west side of March Road and in the east portion of 1070 March Road may be used by barn swallows for nesting. Barn swallows were observed west of March Road in late spring and early summer of 2013. These structures are also to be assessed further as part of the subdivision process.

Many butternuts, an Endangered Species at Risk, were observed in the east portions of 936 and 1020 March Road, around the farmhouse and in some of the hedgerows of 936 March Road and associated with Woodlot S23. Butternut health assessments were completed for the KNUEA in July, 2013, but not the butternut in and adjacent to Woodlot S23. All butternuts within and adjacent to Woodlot S23 that may be impacted by servicing or other components of the development must be assessed well in advance of proposed tree removal. Butternuts can only be assessed during the leaf-out period, generally from the end of May to the end of August. The butternut health assessments completed in the KNUEA in July, 2013 will need to be repeated prior to proposed tree removal to account for potential changes in the health of the butternuts and the potential for more regenerating stems. . Prior to removal or excavation and other major disturbances within 25 metres of the butternuts assessed as healthy a compensation or mitigation agreement must be developed following MNRF policies.

A Blanding`s turtle was observed in 2014 along the North Tributary corridor west of March Road. Consideration should be given to enhancing the agricultural-dominated North Tributary and North Branch corridors with natural channel design to provide additional wildlife habitat. The enhancements could include digging of deep pockets along the channel to provide refuge areas, creation of shallow wetland marshes, creation of new deep ponds that will function as potential hibernacula sites, building of artificial nesting areas, plantings and/or seeding of native species and placement of additional structural habitat components.

Significant Wildlife Habitat

The potential for significant wildlife habitat was assessed using the guidance in OMNR (2010) and MNRF (2015). Potential components which may lead to a designation of significant wildlife habitat include seasonal concentration areas of animals, rare vegetation communities or specialized habitat for wildlife, habitat for species of conservation concern and animal movement corridors. The larger pond along the South Branch would be considered significant wildlife habitat if the snapping turtle was overwintering in the pond. The South Branch is included in the proposed Natural Heritage System.

Woodlot S23 may also represent significant wildlife habitat as eastern wood pewee, a Species of Special Concern, was observed in Woodlot S23, fulfilling the special concern and rare wildlife species criterion. Of the woodland area-sensitive bird breeding habitat wildlife species only veery was observed in Woodlot S23. Three or more species are required to trigger this criterion. In addition Woodlot S23 does not meet the 30 hectare size threshold, although the forest appears to meet the 60 year age threshold.

Other field observations would not trigger a significant wildlife habitat designation with respect to the ELC communities present. For example the cultural habitats do not support waterfowl stopover or staging areas, colonial nesting bird breeding habitat or other examples of seasonal concentration areas. Although a green heron was observed, insufficient numbers were observed to trigger the colonial or marsh breeding bird criteria. No rare vegetation communities as noted in MNRF (2015) or rare or specialized habitats were observed. The amphibian observations were not in sufficient numbers to meet the defining criteria in MNRF (2015). The deciduous forests and adjacent cultivated fields and cultural woodlands do not appear to support raptor wintering areas, old growth forest is not present and the forests are not large enough to meet the size criterion for deer winter congregation areas. Areas of broken and fissured rock for potential use by snakes were not observed. The forests are too small to meet the criterion in MNRF (2015) for area-sensitive bird breeding habitat.

Corridor functions in the overall area between Shirley`s Bay and the South March Highlands including the study area are impaired by road crossings, agricultural lands, DND activity and rural residential developments.

4.0 REFERENCES

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5.0 RELIANCE CLAUSE

This report has been prepared for Novatech Engineering Consultants Ltd., on behalf of the Kanata North Landowner's Group and in support of the Kanata North Community Design Plan. It is hereby acknowledged that Metcalfe Realty Company Limited, J. G. Rivard Limited and 8409706 Canada Inc. (Valecraft Homes), 3223701 Canada Inc. and 7089121 Canada Inc. (Junic/Multivesco) can rely upon and utilize this report for the purpose of obtaining approval of the community design plan and for their own use to seek development approval.

It is further acknowledged that future confirmed participating landowners within the Kanata North Landowner's Group can rely upon and utilize this report for the purpose of obtaining approval of the community design plan and for their own use to seek development approval.

APPENDIX A

BIRD SPECIES LIST

APPENDIX A – BIRD SPECIES LIST for KANATA NORTH URBAN EXPANSION STUDY AREA

Common Name	Scientific Name	SRank	Provincial Status (SARO)	Habitat Observed in	Species observed during Breeding Bird Surveys	Comments
Green Heron	*Butorides virescens*	S4B		North Branch pond	✓	Foraging in pond along Shirley's Brook North Branch
Great Blue Heron	Ardea herodias	S4		Agricultural fields		Flying overhead west of March Road
Turkey Vulture	Cathartes aura	S5B		Agricultural fields		
Canada Goose	*Branta canadensis*	S5		Pair obs. in fields, flying overhead	✓	
Mallard	*Anas platyrhynchos*	S5		Agricultural fields and North Branch pond.	✓	
Red-tailed Hawk	*Buteo jamaicensis*	S5		Perched in deciduous hedgerow at 1020 March Road, Woodlot S23	✓	Seen during both breeding bird visits in the same area but only one bird and no nest observed.
Northern Harrier	Circus cyaneus	S4B		Agricultural fields		
Ruffed Grouse	*Bonasa umbellus*	S4		Cultural woodland southeast of Nadia Lane	✓	
Wild Turkey	*Meleagris gallopava*	S5		Agricultural fields near Woodlot S20 and on either side of former railway, cultural thicket west of March Valley Road	✓	
Killdeer	*Charadrius vociferus*	S5B, S5N		Agricultural fields	✓	
American Woodcock	*Scolopax minor*	S5		Northeast forest of Woodlot S23	✓	
Ring-billed Gull	*Larus delawarensis*	S5B, S4N		Agricultural fields	✓	Foraging
Mourning Dove	*Zenaida macroura*	S5		Hedgerow, Cedar forest (Woodlot S20), Northeast forest of Woodlot S23	✓	
Black-billed Cuckoo	*Coccyzus erythropthalmus*	S4		Along east edge of north-central forest in Woodlot S23	✓	

APPENDIX A – BIRD SPECIES LIST for KANATA NORTH URBAN EXPANSION STUDY AREA

Common Name	Scientific Name	SRank	Provincial Status (SARO)	Habitat Observed in	Species observed during Breeding Bird Surveys	Comments
Downy Woodpecker	*Picoides pubescens*	S5		Cultural woodland, Cedar forest (Woodlot S20)	✓	Foraging
Hairy Woodpecker	*Picoides villosus*	S5		Hedgerow east of former railway	✓	
Northern Flicker	*Colaptes auratus*	S4B		Hedgerow, agricultural fields	✓	
Pileated Woodpecker	*Dryocopus pileatus*	S5		Hedgerow, Cedar forest (Woodlot S20), North-central forest of Woodlot S23	✓	Heard calling (hedgerow); feeding holes seen (S20)
Least Flycatcher	*Empidonax minimus*	S5		Cedar forest (Woodlot S20)		
Alder Flycatcher	*Empidonax alnorum*	S5B		Cultural thicket, Northeast forest of Woodlot S23	✓	
Eastern Wood Pewee	*Contopus virens*	S5	SC	Northwest and north-central forest of Woodlot S23	✓	
Great Crested flycatcher	*Myiarchus crinitus*	S4B		Cedar-poplar forest (Woodlot S20), cultural woodland, cultural thicket	✓	
Eastern Phoebe	*Sayornis phoebe*	S5B		Cultural woodland, cultural thicket	✓	
Eastern Kingbird	*Tyrannus tyrannus*	S4B		Hedgerow along North Tributary pond, cultural thicket	✓	
Red-eyed Vireo	*Vireo olivaceus*	S5B		Cultural woodland, cultural thicket, Cedar forest (Woodlot S20)	✓	
Blue Jay	*Cyanocitta cristata*	S5		Hedgerow, cultural woodland, poplar deciduous forest (Woodlot S20), cultural thicket	✓	
American Crow	*Corvus brachyrhynchos*	S5B		Cultural woodland, cedar-poplar forest (Woodlot S20), cultural thicket, hedgerow, agricultural fields, cedar forest (Woodlots S20 and S12)	✓	
Tree Swallow	*Tachycineta bicolor*	S4B		Hedgerow, North Branch pond, agricultural fields	✓	Flying

APPENDIX A – BIRD SPECIES LIST for KANATA NORTH URBAN EXPANSION STUDY AREA

Common Name	Scientific Name	SRank	Provincial Status (SARO)	Habitat Observed in	Species observed during Breeding Bird Surveys	Comments
Barn Swallow	*Hirundo rustica*	S4B	THR	Agricultural fields	✓	Flying around the fields and barns at 927 and 1075 March Road (west side of March Road)
Black-capped Chickadee	*Poecile atricapilla*	S5		Hedgerow, forest edge, cultural thicket, cultural woodland, cedar forest (Woodlots S20 and S12)	✓	Confirmed nesting in cavity in edge of cultural woodland
White-breasted Nuthatch	*Sitta carolinensis*	S5		Cultural thicket, cultural woodland, North-central forest of Woodlot S23	✓	
House Wren	*Troglodytes aedon*	S5B		Hedgerow, cultural thicket	✓	Bird in cultural thicket calling from a distance
Veery	*Catharus fuscescens*	S4		North-central forest of Woodlot S23	✓	
American Robin	*Turdus migratorius*	S5B		Cedar forest (Woodlots S20 and S12), cultural woodland, cultural thicket, agricultural fields	✓	Immatures observed
Gray Catbird	*Dumetella carolinensis*	S4B		Cultural woodland, cultural thicket, hedgerow east of former railway	✓	
Brown Thrasher	*Toxostoma rufum*	S4B		Cultural thicket	✓	
European Starling	*Sturnus vulgaris*	SNA		Hedgerow, cultural woodland, agricultural fields	✓	
Cedar Waxwing	*Bombycilla cedrorum*	S5B		Cedar poplar forest (Woodlot S20), cultural woodland, cultural thicket, cedar forest (Woodlot S12)	✓	
Yellow Warbler	*Dendroica petechia*	S5B		Hedgerow, cultural thicket, cultural woodland, cedar forest (Woodlot S20)	✓	
Wilson's Warbler	*Wilsonia pusilla*	S5		Cultural thicket west of March Valley Road	✓	

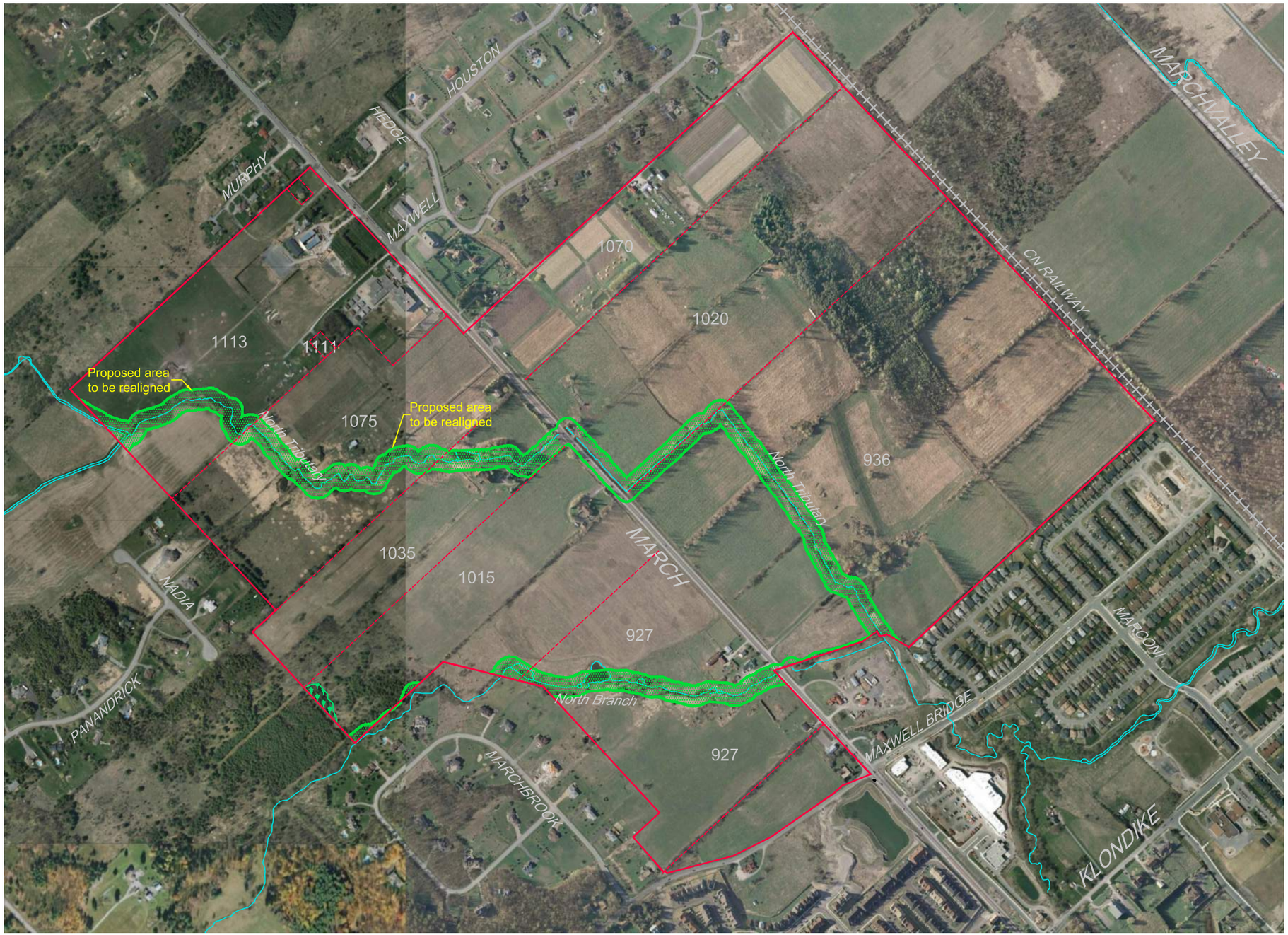
APPENDIX A – BIRD SPECIES LIST for KANATA NORTH URBAN EXPANSION STUDY AREA

Common Name	Scientific Name	SRank	Provincial Status (SARO)	Habitat Observed in	Species observed during Breeding Bird Surveys	Comments
Magnolia Warbler	*Dendroica magnolia*	S5		Cultural thicket east of Woodlot S23	✓	
Chestnut-sided Warbler	*Dendroica pensylvanica*	S5B		Cultural thicket	✓	
Black-and-white Warbler	*Mniotilta varia*	S5B		Cultural thicket, hedgerow east of former railway	✓	
American Redstart	*Setophaga ruticilla*	S5		Northeast forest of Woodlot S23	✓	
Common Yellowthroat	*Geothlypis trichas*	S5B		Hedgerow, cultural thicket, pond (North Tributary), poplar deciduous forest (Woodlot S20), North-central forest of Woodlot S23	✓	
Yellow-rumped warbler	*Dendroica coronata*	S5		Northeast forest of Woodlot S23	✓	
Chipping Sparrow	*Spizella passerina*	S5B		Cultural woodland	✓	
Field Sparrow	*Spizella pusilla*	S4B		Agricultural field, cultural thicket west of March Valley Road	✓	
Savannah Sparrow	*Passerculus sandwichensis*	S4B		Hedgerow, agricultural field, cultural thicket	✓	
Song Sparrow	*Melospiza melodia*	S5B		Hedgerow, cedar forest (Woodlot S20 and S12), cultural woodland, cultural thicket, cedar-poplar forest (Woodlot S20), pond (North Tributary), agricultural fields	✓	Confirmed nesting pair in cedar forest
Swamp Sparrow	*Melospiza georgiana*	S5B		Cultural thicket	✓	
White-throated Sparrow	*Zonotrichia albicollis*	S5B		Cultural woodland	✓	Confirmed nesting
Northern Cardinal	*Cardinalis cardinalis*	S5		Hedgerow, cultural thicket, cedar-poplar forest (Woodlot S20)	✓	

APPENDIX A – BIRD SPECIES LIST for KANATA NORTH URBAN EXPANSION STUDY AREA

Common Name	Scientific Name	SRank	Provincial Status (SARO)	Habitat Observed in	Species observed during Breeding Bird Surveys	Comments
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	S4B		Cultural woodland, cultural thicket	✓	Heard calling from a distance
Indigo Bunting	*Passerina cyanea*	S4B		Hedgerow	✓	
Bobolink	*Dolichonyx oryzivorus*	S4B	THR	Agricultural field	✓	1 male flying & calling near berry farm (1070) and a male near North Tributary west of March Road
Red-winged Blackbird	*Agelaius phoeniceus*	S4		Agricultural field, hedgerow, cultural thicket	✓	
Eastern Meadowlark	*Sturnella magna*	S4B	THR	Calling from near school in north end west of March Road		calling during the migration period (April) and was not observed or heard again
Common Grackle	*Quiscalus quiscula*	S5B		Agricultural fields, hedgerow, cultural thicket	✓	
Brown-headed Cowbird	*Molothrus ater*	S4B		Hedgerow	✓	
Baltimore Oriole	*Icterus galbula*	S4B		Cedar-poplar forest (Woodlot S20), cultural thicket	✓	
American Goldfinch	*Carduelis tristis*	S5B		Hedgerow, cultural thicket, cultural woodland, cedar forest (Woodlots S20 and S12)	✓	Confirmed nesting pairs in NE cultural thicket

.



Legend

- Urban Expansion Area
- Tributary Corridor
- Southwest Wooded Area
- 1020 — March Road Addresses
- Major Property Boundaries

Approx. Scale 1:8,500 (on a 11 x 17 plot)

0 100 200 300 400
Metres

2011 air photo from City of Ottawa

Prepared for: Novatech Engineering Consultants Ltd.

Prepared by: Muncaster Environmental Planning Inc.

FILE: 12-25
December 15, 2015

Figure 8

Natural Heritage System in the Urban Expansion Study Area

Kanata North, City of Ottawa

Appendix L

Consolidated Preliminary Geotechnical Investigation
Kanata North Urban Expansion Area Community Design Plan

(Patterson Group – October 7, 2013)

Geotechnical Engineering

Environmental Engineering

Archaeological Studies

Hydrogeology

Geological Engineering

Materials Testing

Archaeological Studies

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Consolidated Preliminary Geotechnical Investigation

Kanata North Urban Expansion Area
Community Development Plan
March Road
Ottawa, Ontario

Prepared For

Novatech Engineering Consultants

October 7, 2013

Report PG2878-1R

TABLE OF CONTENTS

PAGE

1.0 INTRODUCTION. 1

2.0 PROPOSED DEVELOPMENT. 2

3.0 METHOD OF INVESTIGATION
- 3.1 Field Investigation. 3
- 3.2 Field Survey. 3
- 3.3 Laboratory Testing. 4
- 3.4 Analytical Testing. 4

4.0 OBSERVATIONS
- 4.1 Surface and Subsurface Observations. 5
- 4.2 Groundwater. 7

5.0 DISCUSSION
- 5.1 Geotechnical Assessment. 12
- 5.2 Site Grading and Preparation. 12
- 5.3 Foundation Design. 15
- 5.4 Design for Earthquakes. 16
- 5.5 Basement Slab. 16

6.0 DESIGN AND CONSTRUCTION PRECAUTIONS
- 6.1 Foundation Drainage and Backfill. 17
- 6.2 Protection of Footings Against Frost Action. 17
- 6.3 Excavation Side Slopes. 17
- 6.4 Groundwater Control. 18
- 6.5 Winter Construction. 18
- 6.6 Corrosion Potential and Sulphate. 19

7.0 RECOMMENDATIONS. 20

8.0 STATEMENT OF LIMITATIONS. 21

APPENDICES

Appendix 1 Soil Profile and Test Data Sheets
Symbols and Terms
Analytical Testing Results

Appendix 2 Figure 1 - Key Plan
Drawing PG2878-1 - Test Hole Location Plan
Drawing PG2878-2 - Permissible Grade Raise Areas - Housing

1.0 INTRODUCTION

Paterson Group (Paterson) was commissioned by Novatech Engineering Consultants to prepare a preliminary geotechnical report outlining the geotechnical constraints for the Kanata North Urban Expansion Area Community Design Plan (CDP) along March Road in the City of Ottawa, Ontario (refer to Figure 1 - Key Plan in Appendix 2 of this report).

The current report consolidates the existing geotechnical studies completed for the individual properties. The relevant geotechnical studies are listed below:

- ❑ Paterson Report PG2878-2 dated April 8, 2013 entitled "Preliminary Geotechnical Investigation, 936 March Road, Ottawa, Ontario".
- ❑ Paterson Report PG2878-3 dated April 8, 2013 entitled "Preliminary Geotechnical Investigation, 1075 March Road, Ottawa, Ontario".
- ❑ Paterson Letter Report PG2256-LET.01 dated February 7, 2011 entitled "Geotechnical Investigation Proposed Residential Development, Dekok Lands, March Road, Ottawa."
- ❑ Paterson Letter Report PG1823-LET.01 dated March 18, 2009 entitled "Preliminary Geotechnical Investigation, Proposed Residential Development, Burke and Maxwell Properties, March Road, Ottawa."
- ❑ Paterson Letter Report PG1716-LET.01 dated August 25, 2009 entitled "Preliminary Geotechnical Investigation Proposed Residential Development, Foley Lands, March Road, Ottawa."
- ❑ Paterson Letter Report PG1626-LET.01 dated March 12, 2008 entitled "Preliminary Geotechnical Investigation, Vacant Property, 927 March Road, Ottawa (Kanata), Ontario."
- ❑ Morey Associates Ltd. Report 012417 dated February 2013 entitled "Report on Geotechnical Investigation, Proposed Residential Development, 1020 March Road, Ottawa, Ontario."

The following report has been prepared specifically and solely for the aforementioned project which is described herein. It contains our findings and includes preliminary geotechnical recommendations pertaining to the design and construction of the proposed development as they are understood at the time of writing this report.

2.0 PROPOSED DEVELOPMENT

Details of the development were not available at the time of issuance of this report. It is understood that the following properties are part of the Kanata North Urban Expansion Area Community Design Plan:

- ❑ 927 March Road - Owner: 6095186 Canada Inc.
- ❑ 936 March Road - Owner: Metcalfe Realty Company Limited
- ❑ 1020 March Road - Owner: Kanata Research Park
- ❑ 1015 March Road - Owner: Multivesco
- ❑ 1035 March Road - Owner: Multivesco
- ❑ 1070 March Road - Owner: Valecraft
- ❑ 1075 March Road - Owner: Multivesco
- ❑ 1145 March Road - Owner: 7089121 Canada Inc.

3.0 METHOD OF INVESTIGATION

3.1 Field Investigation

Field Program

Test pits excavated by a hydraulic shovel or rubber tired backhoe were completed throughout the subject properties. The test holes were distributed in a manner to provide general coverage of the subject sites. Approximate locations of the test holes are shown in Drawing PG2878-1 - Test Hole Location Plan included in Appendix 2.

Sampling and In Situ Testing

Soil samples from the test pits were recovered from the side walls of the open excavation and all soil samples were initially classified on site. All samples were transported to our laboratory for further examination and classification. The depths at which the grab samples were recovered from the test holes are shown as G on the Soil Profile and Test Data sheets in Appendix 1.

Undrained shear strength testing, using a hand held vane apparatus, was carried out at regular intervals of depth in cohesive soils.

The subsurface conditions observed in the test holes were recorded in detail in the field. The soil profiles are logged on the Soil Profile and Test Data sheets in Appendix 1 of this report.

Groundwater

Open hole groundwater infiltration levels were observed at the time of excavation at each test pit location. Our observations are presented in the Soil Profile and Test Data sheets in Appendix 1.

Sample Storage

All samples will be stored in the laboratory for a period of one month after issuance of this report. They will then be discarded unless we are otherwise directed.

3.2 Field Survey

The ground surface elevations at the test pit locations are presented on Drawing PG2878-1 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

The soil samples recovered from the subject site were examined in our laboratory to review the results of the field logging.

3.4 Analytical Testing

Four (4) soil samples were submitted for analytical testing to assess the corrosion potential for exposed ferrous metals and the potential of sulphate attacks against subsurface concrete structures. The samples were submitted to determine the concentration of sulphate and chloride, the resistivity and the pH of the soil. The analytical test results are presented in Appendix 1 and discussed in Subsection 6.6 of this report.

4.0 OBSERVATIONS

4.1 Surface and Subsurface Observations

The subject site currently covers an area of approximately 194 hectares. The majority of the site is undeveloped (tilled agricultural or treed) areas. Observations at the subject properties are presented below.

927 March Road

The vacant property located at 927 March Road is relatively flat, grass covered agricultural farm land. Several mature trees follow the 1.5 to 2.5 m deep creek that meanders diagonally through the subject site. It was observed during out field investigation that the shallow creek is flowing on the bedrock surface in several locations across the site.

The subsoil conditions at the test hole locations consist of a surficial topsoil layer underlain by a very stiff silty clay deposit followed by a glacial till layer and sound bedrock encountered at all test holes on the two parcels of land located on 927 March Road.

936 March Road

The vacant property located at 936 March Road consists of mostly undeveloped land. Dense bush was noted in the northwestern portion of the site. The site is bisected by an existing rail track. The remainder of the site consists of agricultural land or an existing fam house. A significant slope was noted to exist north of the residential house, but south of the existing rail tracks.

The subsoil conditions at the test hole locations consist of topsoil, agricultural soil or fill underlain by a stiff to very stiff silty clay deposit. Glacial till was noted below the silty clay in the southern portion of the property. Practical refusal to excavation was also noted in the southern portion of the site.

1015 and 1035 March Road

1015 and 1035 March Road is currently grass covered with several large trees bordering the property. The site slopes gradually downward to the east toward to the meandering creek located within the east portion of the subject site.

Generally, the subsoil conditions at the test hole locations consist of topsoil underlain by very stiff brown silty clay or bedrock. Glacial till was encountered below the silty clay at TP 1,TP 3, TP 4, TP 5, TP 9, TP 10 and TP 11 at depths varying between 1.1 m and 2.1 m below ground surface. Practical refusal to excavation was encountered at all test hole locations between ground surface to 3.2 m depth.

1020 March Road

1020 March Road is divided into two parcels by a railway line easement. The portion of the site located to the east of the railway line easement is heavily wooded, whereas the remainder of the subject site is grass covered with some young tree growth. An approximately 9 m high slope running in a north-south direction crosses the central portion of the subject site.

The subsurface profile encountered at the test pit locations, consists of topsoil, compact silty sand, stiff silty clay and/or a glacial till layer. Practical refusal to excavation was encountered between 0.2 and 4 m depth at all test pit locations, except TP 1, TP 3, TP 4, TP 7 to TP 12.

1070 March Road

1070 March Road consists of a berry farm. The majority of the site is agricultural fields with associated outbuildings and a residential dwelling located within the central portion of the site. Based on available topographic mapping, the west portion of the site is relatively flat and approximately at grade with neighbouring properties and the east portion of the site slopes gradually downward to the east. An approximately 4 to 5 m high slope running in a north-south direction located within the central portion of the site divides the east and west portions of the subject site.

The subsurface profile encountered at the test pit locations, consists of topsoil and compact silty sand or stiff silty clay. A glacial till layer was noted at all test pit locations. Practical refusal to excavation was encountered between 0.9 and 4.6 m depth at all test pit locations, except TP 6, which extended to a 4.6 m depth.

1075 March Road

1075 March Road consists of undeveloped, agricultural land. The ground surface across the site is relatively flat and a shallow ditch was noted to bisect the subject site.

Generally, the subsoil conditions at the test hole locations consist of topsoil underlain by very stiff brown silty clay, glacial till and/or bedrock.

1145 March Road

1145 March Road is undeveloped and grass covered. The site slopes gradually downward to the east.

The subsoil conditions at the test hole locations consist of topsoil underlain by very stiff brown silty clay, silty sand/sandy silt, glacial till and/or bedrock. Practical refusal to excavation was encountered between 0.7 to 3.2 m below surface at all test hole locations.

Based on available geological mapping, the bedrock below the majority of the subject site consists of interbedded sandstone and dolomite of the March formation. Below the east portion of the site, bedrock consists of either dolomite of the Oxford formation or sandstone of the Nepean formation. The overburden thickness varies from 0 to 10 m depth throughout the proposed development area, with shallow bedrock encountered within the west portion of the site.

4.2 Groundwater

Groundwater levels (GWL) were measured in the test pits upon completion of the field program. The results are summarized in Table 1. It should be noted that groundwater levels are subject to seasonal fluctuations. Therefore, the groundwater levels could vary at the time of construction.

Table 1 - Summary of Groundwater Level Readings

Test Pit Number	Ground Surface Elevation (m)	Groundwater Level (m)	Groundwater Depth (m)	Recording Date
PG1626 - 927 March Road				
TP 1	--	1.60	--	February 25, 2008
TP 2	--	0.70	--	February 25, 2008
TP 3	--	dry	--	February 25, 2008
TP 4	--	1.00	--	February 25, 2008
TP 5	--	1.60	--	February 25, 2008
PG1716 - 1015 and 1035 March Road				
TP 1	81.70	1.75	79.95	July 9, 2008
TP 2	83.10	dry	--	July 9, 2008
TP 3	83.80	1.75	82.05	July 9, 2008
TP 4	86.20	1.20	85.00	July 9, 2008
TP 5	86.80	1.10	85.70	July 9, 2008

Table 1 - Summary of Groundwater Level Readings				
Test Pit Number	**Ground Surface Elevation (m)**	**Groundwater Level (m)**	**Groundwater Depth (m)**	**Recording Date**
PG1716 - 1015 and 1035 March Road				
TP 6	90.70	dry	--	July 9, 2008
TP 7	89.40	dry	--	July 9, 2008
TP 8	88.80	dry	--	July 9, 2008
TP 9	81.90	1.50	80.40	July 9, 2008
TP 10	88.40	2.65	85.75	July 9, 2008
TP 11	89.50	dry	--	July 9, 2008
PG1823 - 1145 March Road				
TP 1	88.10	dry	--	February 9, 2009
TP 2	88.57	1.40	87.17	February 9, 2009
TP 3	85.48	dry	--	February 9, 2009
TP 4	88.13	dry	--	February 9, 2009
TP 5	88.50	dry	--	February 9, 2009
TP 6	89.10	dry	--	February 9, 2009
TP 7	88.06	1.80	86.26	February 9, 2009
TP 8	89.86	1.10	88.76	February 9, 2009
TP 9	91.42	1.90	89.52	February 9, 2009
TP 10	90.76	2.50	88.26	February 9, 2009
TP 11	90.22	1.00	89.22	February 9, 2009
TP 12	89.26	dry	--	February 9, 2009
PG2256 - 1070 March Road				
TP 1	--	1.80	--	November 4, 2010
TP 2	--	2.40	--	November 4, 2010
TP 3	--	1.40	--	November 4, 2010
TP 4	--	1.80	--	November 4, 2010
TP 5	--	1.70	--	November 4, 2010
TP 6	--	dry	--	November 4, 2010
TP 7	--	dry	--	November 4, 2010
TP 8	--	2.10	--	November 4, 2010
TP 9	--	dry	--	November 4, 2010
TP 10	--	1.80	--	November 4, 2010

Table 1 - Summary of Groundwater Level Readings				
Test Pit Number	**Ground Surface Elevation (m)**	**Groundwater Level (m)**	**Groundwater Depth (m)**	**Recording Date**
PG2256 - 1070 March Road				
TP 11	--	1.10	--	November 4, 2010
TP 12	--	2.00	--	November 4, 2010
TP 13	--	2.20	--	November 4, 2010
PG2878 - 936 and 1075 March Road				
TP 1	78.55	dry	--	March 11, 2013
TP 2	77.89	1.70	76.19	March 11, 2013
TP 3	78.58	dry		March 11, 2013
TP 4	78.91	1.80	77.11	March 11, 2013
TP 5	78.22	1.20	77.02	March 11, 2013
TP 6	79.28	1.80	77.48	March 11, 2013
TP 7	78.81	dry	--	March 11, 2013
TP 8	78.84	dry	--	March 11, 2013
TP 9	78.71	dry	--	March 11, 2013
TP 10	70.43	0.76	69.67	March 20, 2013
TP 11	70.02	0.38	69.64	March 20, 2013
TP 12	69.71	2.30	67.41	March 20, 2013
TP 13	69.87	2.70	67.17	March 20, 2013
TP 14	69.90	dry	--	March 20, 2013
TP 15	68.82	dry	--	March 20, 2013
TP 16	69.61	3.30	66.31	March 21, 2013
TP 17	69.25	dry	--	March 21, 2013
TP 18	67.12	1.22	65.90	March 20, 2013
TP 19	66.43	1.50	64.93	March 20, 2013
TP 20	66.31	2.70	63.61	March 20, 2013
TP 21	65.90	2.10	63.80	March 20, 2013
TP 22	66.83	2.70	64.13	March 20, 2013
TP 23	66.94	1.80	65.14	March 20, 2013
TP 24	75.76	dry	--	March 21, 2013
TP 25	89.66	dry	--	March 21, 2013
TP 26	89.74	dry	--	March 21, 2013

Table 1 - Summary of Groundwater Level Readings				
Test Pit Number	**Ground Surface Elevation (m)**	**Groundwater Level (m)**	**Groundwater Depth (m)**	**Recording Date**
PG2878 - 936 and 1075 March Road				
TP 27	88.96	dry	--	March 21, 2013
TP 28	86.85	dry	--	March 21, 2013
TP 29	86.13	dry	--	March 21, 2013
TP 30	86.42	dry	--	March 21, 2013
TP 31	88.37	dry	--	March 21, 2013
TP 32	86.81	dry	--	March 21, 2013
TP 33	84.00	dry	--	March 21, 2013
TP 34	84.02	dry	--	March 21, 2013
TP 35	82.99	2.70	80.29	March 21, 2013
TP 36	84.76	2.60	82.16	March 21, 2013
Test Holes by Others - 1020 March Road				
TP 1	81.35	3.00	78.35	December 10, 2012
TP 2	79.06	1.50	77.56	December 10, 2012
TP 3	78.49	1.50	76.99	December 10, 2012
TP 4	79.62	4.10	75.52	December 10, 2012
TP 5	79.42	2.70	76.72	December 10, 2012
TP 6	78.40	1.50	76.90	December 10, 2012
TP 7	79.41	4.00	75.41	December 10, 2012
TP 8	79.41	dry	--	December 10, 2012
TP 9	79.59	dry	--	December 10, 2012
TP 10	79.21	4.00	75.21	December 10, 2012
TP 11	78.57	0.80	77.77	December 10, 2012
TP 12	80.02	3.40	76.62	December 10, 2012
TP 13	72.12	dry	--	December 10, 2012
TP 14	70.57	1.80	68.77	December 10, 2012
TP 15	70.32	3.90	66.42	December 10, 2012
TP 16	70.73	1.20	69.53	December 10, 2012
TP 17	70.77	1.20	69.57	December 10, 2012
TP 18	70.96	2.00	68.96	December 10, 2012
TP 19	70.36	dry	--	December 10, 2012

Table 1 - Summary of Groundwater Level Readings				
Test Pit Number	**Ground Surface Elevation (m)**	**Groundwater Level (m)**	**Groundwater Depth (m)**	**Recording Date**
Test Holes by Others - 1020 March Road				
TP 20	70.03	dry	--	December 10, 2012
TP 21	70.09	dry	--	December 10, 2012

5.0 DISCUSSION

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is adequate for the anticipated development. It is expected that low rise wood framed buildings or mid to high rise buildings could be founded on conventional shallow footings placed on an undisturbed, stiff silty clay, compact silty sand, compact glacial till or surface-sounded bedrock bearing surface.

A permissible grade raise restriction is required for the proposed residential development where the silty clay layer is present below the proposed buildings. Areas effected by a permissible grade raise restriction due to the presence of a silty clay deposit are indicated in Drawing PG2878-2 - Permissible Grade Raise Areas - Housing in Appendix 2.

The above and other considerations are discussed in the following paragraphs.

5.2 Site Grading and Preparation

Stripping Depth

Topsoil, and any deleterious fill, such as those containing organic materials, should be stripped from under any buildings and other settlement sensitive structures. Other settlement sensitive structures include, but are not limited to, underground services and paved areas.

Existing foundation walls and other construction debris should be entirely removed from within the building perimeter. Under paved areas, existing construction remnants such as foundation walls should be excavated to a minimum of 1 m below final grade.

Bedrock Removal

It is expected that line-drilling in conjunction with hoe-ramming or controlled blasting may required to remove the bedrock. In areas of weathered bedrock and where only a small quantity of bedrock is to be removed, bedrock removal may be possible by hoe-ramming.

Prior to considering blasting operations, the blasting effects on the existing services, buildings and other structures should be addressed. A pre-blast or pre-construction survey of the existing structures located in proximity of the blasting operations should be carried out prior to commencing site activities. The extent of the survey should be determined by the blasting consultant and should be sufficient to respond to any inquiries/claims related to the blasting operations.

As a general guideline, peak particle velocities (measured at the structures) should not exceed 25 mm per second during the blasting program to reduce the risks of damage to the existing structures.

The blasting operations should be planned and conducted under the supervision of a licensed professional engineer who is also an experienced blasting consultant.

Excavation side slopes in sound bedrock can be carried out using almost vertical side walls. A minimum 1 m horizontal ledge, should be left between the bottom of the overburden excavation and the top of the bedrock surface to provide an area to allow for potential sloughing or to provide a stable base for the overburden shoring system. However, should the entire area be required to accommodate the parking garage, drilled piles into the weathered portion of the bedrock can be used to support the upper levels of the excavation and can be placed at the property boundary.

Vibration Considerations

Construction operations are also the cause of vibrations, and possibly, sources of nuisance to the community. Therefore, means to reduce the vibration levels as much as possible should be incorporated in the construction operations to maintain, as much as possible, a cooperative environment with the residents.

The following construction equipments could be a source of vibrations: piling rig, hoe ram, compactor, dozer, crane, truck traffic, etc. The construction of the shoring system using soldier piles or sheet piling will require the use of this equipment. Vibrations, whether it is caused by blasting operations or by construction operations, could be the cause of the source of detrimental vibrations on the adjoining buildings and structures. Therefore, it is recommended that all vibrations be limited.

Two parameters are used to determine the permissible vibrations, namely, the maximum peak particle velocity and the frequency. For low frequency vibrations, the maximum allowable peak particle velocity is less than that for high frequency vibrations. As a guideline, the peak particle velocity should be less than 15 mm/s between frequencies of 4 to 12 Hz, and 50 mm/s above a frequency of 40 Hz (interpolate between 12 and 40 Hz). It should be noted that these guidelines are for today's construction standards. Considering that these guidelines are above perceptible human level and, in some cases, could be very disturbing to some people, it is recommended that a pre-construction survey be completed to minimize the risks of claims during or following the construction of the proposed building.

Fill Placement

Fill used for grading beneath the building areas should consist, unless otherwise specified, of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II material. The fill should be placed in lifts no greater than 300 mm thick and compacted using suitable compaction equipment for the lift thickness. Fill placed beneath the buildings should be compacted to at least 98% of its standard Proctor maximum dry density (SPMDD).

Non-specified existing fill along with site-excavated soil can be used as general landscaping fill where settlement of the ground surface is of minor concern. These materials should be spread in thin lifts and at least compacted by the tracks of the spreading equipment to minimize voids. If excavated stiff brown silty clay, free of organics and deleterious materials, is to be used to build up the subgrade level for areas to be paved, the silty clay, under dry conditions, should be compacted in thin lifts to a minimum density of 95% of their respective SPMDD. Non-specified existing fill and site-excavated soils are not suitable for use as backfill against foundation walls unless a composite drainage blanket connected to a perimeter drainage system is provided.

5.3 Foundation Design

Shallow Foundation

Strip footings, up to 2 m wide, and pad footings, up to 4 m wide, placed on an undisturbed, stiff silty clay bearing surface can be designed using a bearing resistance value at serviceability limit state (SLS) of **150 kPa** and a factored bearing resistance value at ultimate limit state (ULS) of **225 kPa**. Footings placed on an undisturbed, compact silty sand or compact glacial till bearing surface can be designed using a bearing resistance value at SLS of **150 kPa** and a factored bearing resistance value at ULS of **225 kPa**. Footings placed on a clean, weathered bedrock can be designed using a bearing resistance value at SLS of **500 kPa** and a factored bearing resistance value at ULS of **750 kPa**.

An undisturbed soil bearing surface consists of a surface from which all topsoil and deleterious materials, such as loose, frozen or disturbed soil, whether in situ or not, have been removed, in the dry, prior to the placement of concrete for footings.

A clean, weathered bedrock surface consists of one from which all topsoil, soils, deleterious materials and loose rock have been removed prior to concrete placement.

Footings designed using the bearing resistance value at SLS given above will be subjected to potential post construction total and differential settlements of 25 and 20 mm, respectively. A geotechnical resistance factor of 0.5 was applied to the above noted bearing resistance value at ULS.

A **permissible grade raise restriction of 2 m** is recommended for areas where building foundations are founded over a silty clay deposit. Areas effected by a permissible grade raise restriction due to the presence of a silty clay deposit are indicated in Drawing PG2878-2 - Permissible Grade Raise Areas - Housing in Appendix 2. Footings bearing on a dense glacial till are not subjected to permissible grade raise restrictions.

Lateral Support

The bearing medium under footing-supported structures is required to be provided with adequate lateral support. Adequate lateral support is provided to a stiff silty clay or compact glacial till bearing medium when a plane extending down and out from the bottom edge of the footing, at a minimum of 1.5H:1V.

5.4 Design for Earthquakes

The site class for seismic site response can be taken as **Class C** for the foundations considered within the subject site. A higher site class, such as site Class A or B may be applicable for the areas within the subject site. However, the higher site class would need to be confirmed with site specific shear wave velocity testing.

Soils underlying the subject site are not susceptible to liquefaction. Reference should be made to the latest revision of the 2006 Ontario Building Code for a full discussion of the earthquake design requirements.

5.5 Basement Slab

With the removal of all topsoil and fill, if any, within the footprint of the proposed buildings, the native soil surface will be considered to be an acceptable subgrade on which to commence backfilling for floor slab construction.

Any soft areas should be removed and backfilled with appropriate backfill material prior to placing any fill. OPSS Granular B Type II, with a maximum particle size of 50 mm, are recommended for backfilling below the floor slab. It is recommended that the upper 200 mm of sub-floor fill consists of 19 mm clear crushed stone. All backfill material within the footprint of the proposed buildings should be placed in maximum 300 mm thick loose layers and compacted to at least 98% of its SPMDD.

6.0 DESIGN AND CONSTRUCTION PRECAUTIONS

6.1 Foundation Drainage and Backfill

It is recommended that a perimeter foundation drainage system be provided for proposed structures. The system should consist of a 100 to 150 mm diameter, geotextile-wrapped, perforated, corrugated, plastic pipe, surrounded on all sides by 150 mm of 10 mm clear crushed stone, placed at the footing level around the exterior perimeter of the structure. The pipe should have a positive outlet, such as a gravity connection to the storm sewer.

Backfill against the exterior sides of the foundation walls should consist of free-draining, non frost susceptible granular materials. The site materials will be frost susceptible and, as such, are not recommended for re-use as backfill unless a composite drainage system (such as system Platon or Miradrain G100N) connected to a drainage system is provided.

6.2 Protection of Footings Against Frost Action

Perimeter footings of heated structures are required to be insulated against the deleterious effect of frost action. A minimum of 1.5 m thick soil cover (or equivalent) should be provided in this regard.

A minimum of 2.1 m thick soil cover (or equivalent) should be provided for other exterior unheated footings.

6.3 Excavation Side Slopes

The side slopes of excavations in the soil and fill overburden materials should either be cut back at acceptable slopes or should be retained by shoring systems from the start of the excavation until the structure is backfilled. It is assumed that sufficient room will be available for the greater part of the excavations to be undertaken by open-cut methods (i.e. unsupported excavations).

The excavation side slopes above the groundwater level extending to a maximum depth of 3 m should be cut back at 1H:1V or flatter. The flatter slope is required for excavation below groundwater level. The subsoil at this site is considered to be mainly a Type 2 and 3 soil according to the Occupational Health and Safety Act and Regulations for Construction Projects.

Excavated soil should not be stockpiled directly at the top of excavations and heavy equipment should be kept away from the excavation sides.

Slopes in excess of 3 m in height should be periodically inspected by the geotechnical consultant in order to detect if the slopes are exhibiting signs of distress.

It is recommended that a trench box be used at all times to protect personnel working in trenches with steep or vertical sides. It is expected that services will be installed by "cut and cover" methods and excavations will not be left open for extended periods of time.

6.4 Groundwater Control

The contractor should be prepared to direct water away from all bearing surfaces and subgrades, regardless of the source, to prevent disturbance to the founding medium.

It is anticipated that pumping from open sumps will be sufficient to control the groundwater influx through the sides of the excavations.

Pumping of more than 50,000 L/day to an off site receptor requires a temporary Ontario Ministry of Environment (MOE) permit to take water (PTTW). During service installation for the proposed development, it is anticipated that a PTTW should be taken to avoid any delays at the time of construction. At least 4 months should be allowed for completion of the application and issuance of the permit by the MOE.

6.5 Winter Construction

Precautions must be taken if winter construction is considered for this project. The subsoil conditions at this site consist of frost susceptible materials. In the presence of water and freezing conditions, ice could form within the soil mass. Heaving and settlement upon thawing could occur.

In the event of construction during below zero temperatures, the founding stratum should be protected from freezing temperatures by the use of straw, propane heaters and tarpaulins or other suitable means. In this regard, the base of the excavations should be insulated from sub-zero temperatures immediately upon exposure and until such time as heat is adequately supplied to the building and the footings are protected with sufficient soil cover to prevent freezing at founding level.

Trench excavations and pavement construction are also difficult activities to complete during freezing conditions without introducing frost in the subgrade or in the excavation walls and bottoms. Precautions should be taken if such activities are to be carried out during freezing conditions.

6.6 Corrosion Potential and Sulphate

The results of analytical testing show that the sulphate content is less than 0.1%. This result is indicative that Type 10 Portland cement (normal cement) would be appropriate for this site. The chloride content and the pH of the sample indicate that they are not significant factors in creating a corrosive environment for exposed ferrous metals at this site, whereas the resistivity is indicative of a non-aggressive to slightly aggressive corrosive environment.

7.0 RECOMMENDATIONS

It is a requirement for the foundation design data provided herein to be applicable that a materials testing and observation services program including the following aspects be performed by the geotechnical consultant.

- ❑ A detailed geotechnical investigation should be completed to City of Ottawa standards for the subject site.
- ❑ Observation of all bearing surfaces prior to the placement of concrete.
- ❑ Sampling and testing of the concrete and fill materials used.
- ❑ Periodic observation of the condition of unsupported excavation side slopes in excess of 3 m in height, if applicable.
- ❑ Observation of all subgrades prior to backfilling
- ❑ Field density tests to determine the level of compaction achieved.
- ❑ Sampling and testing of the bituminous concrete including mix design reviews.

A report confirming that these works have been conducted in general accordance with our recommendations could be issued, upon request, following the completion of a satisfactory materials testing and observation program by the geotechnical consultant.

8.0 STATEMENT OF LIMITATIONS

The recommendations made in this report are in accordance with our present understanding of the project. We request that we be permitted to review the grading plan once available. Also, our recommendations should be reviewed when the project drawings and specifications are complete.

A soils investigation is a limited sampling of a site. Should any conditions at the site be encountered which differ from those at the test locations, we request that we be notified immediately in order to permit reassessment of our recommendations.

The present report applies only to the project described in this document. This report has been prepared for Novatech Engineering Consultants Ltd., on behalf of the Kanata North Landowner's Group and in support of the Kanata North Community Design Plan. It is hereby acknowledged that Metcalfe Realty Company Limited, J.G Rivard Limited and 8409706 Canada Inc. (Valecraft Homes), 3223701 Canada Inc. and 7089121 Canada Inc. (Junic/Multivesco) can rely upon and utilize this report for the purpose of obtaining approval of the community design plan and for their own use to seek development approval.

It is further acknowledged that future confirmed participating landowners within the Kanata North Landowner's Group, can rely upon and utilize this report for the purpose of obtaining approval of the community design plan and for their own use to seek development approval.

Paterson Group Inc.

Carlos P. Da Silva, P.Eng.

David J. Gilbert, P.Eng.

Report Distribution:

- ❑ Metcalfe Realty Company Limited (3 copies)
- ❑ Paterson Group (1 copy)

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

ANALYTICAL TESTING RESULTS

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Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Future Development Lands - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Ltd.

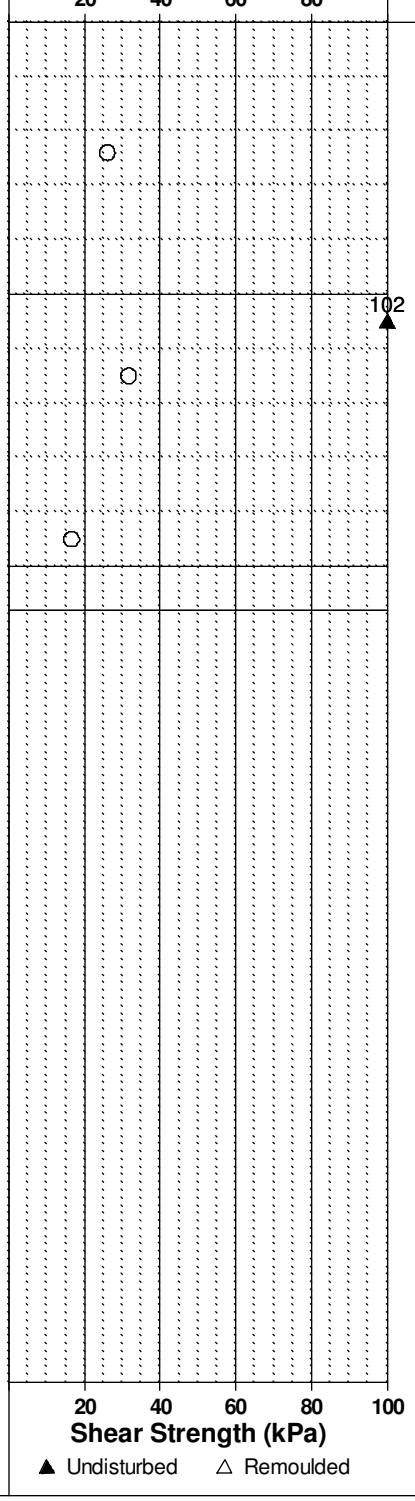
FILE NO. PG2878

REMARKS 18T 0426497; 5023431

HOLE NO. TP 1

BORINGS BY Backhoe **DATE** March 11, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	78.55
TOPSOIL							
0.36							
Brown **SILTY CLAY,** with sand, trace cobbles		G	1				
0.60						1	77.55
Very stiff, brown **SILTY CLAY**		G	2				
1.83							
GLACIAL TILL: Brown silty clay with sand, gravel, cobbles, boulders		G	3			2	76.55
2.16							
End of Test Pit							
Practical refusal to excavation on inferred bedrock surface at 2.16m depth							
(TP dry upon completion)							



Piezometer Construction

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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Future Development Lands - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PG2878

REMARKS 18T 0426480; 5023614

HOLE NO. TP 2

BORINGS BY Backhoe **DATE** March 11, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	77.89
TOPSOIL							
0.38							
Brown **SILTY SAND**		G	1				
0.79		G	2			1	76.89
Very stiff, brown **SILTY CLAY**						2	75.89
		G	3			3	74.89
3.81		G	4				
End of Test Pit							
(GWL @ 1.7m depth based on field observations)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %

20 40 60 80

180

102

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

Piezometer Construction

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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Future Development Lands - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PG2878

REMARKS 18T 0426014; 5023349

HOLE NO. TP 3

BORINGS BY Backhoe **DATE** March 11, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	78.58
TOPSOIL		G	1				
0.46		G	2				
Very stiff, brown **SILTY CLAY**						1	77.58
		G	3				
1.88							
End of Test Pit Practical refusal to excavation on inferred bedrock surface at 1.88m depth (TP dry upon completion)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Future Development Lands - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PG2878

REMARKS 18T 0426309; 5023646

HOLE NO. TP 4

BORINGS BY Backhoe **DATE** March 11, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	78.91	20 40 60 80	
TOPSOIL									
0.43									
Very stiff to stiff, brown **SILTY CLAY**		G	1			1	77.91	○	▽
						2	76.91		
2.90		G	2					○	
End of Test Pit									
Practical refusal to excavation on inferred bedrock surface at 2.90m depth									
(GWL @ 1.8m depth based on field observations)									

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Future Development Lands - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PG2878

REMARKS 18T 0426398; 5023724

HOLE NO. TP 5

BORINGS BY Backhoe **DATE** March 11, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	78.22	20 40 60 80	
TOPSOIL									
0.36									
Brown **SILTY SAND**									
0.53									
						1	77.22		▽
Stiff, brown **SILTY CLAY**						2	76.22		
						3	75.22		
3.66									
End of Test Pit									
(GWL @ 1.2m depth based on field observations)									

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Future Development Lands - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PG2878

REMARKS 18T 0426218; 5023755

HOLE NO. TP 6

BORINGS BY Backhoe **DATE** March 11, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	79.28		
TOPSOIL									
0.38									
Brown **SILTY SAND**		G	1						
0.60									
		G	2			1	78.28		
								127	
		G	3			2	77.28		
Very stiff to stiff, brown **SILTY CLAY**									
						3	76.28		
3.66									
End of Test Pit									

Practical refusal to excavation on inferred bedrock surface at 3.66m depth

(GWL @ 1.8m depth based on field observations)

Water Content % scale: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Future Development Lands - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PG2878

REMARKS 18T 0426305; 5023849

HOLE NO. TP 7

BORINGS BY Backhoe **DATE** March 11, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	78.81
TOPSOIL							
0.33							
Brown **SILTY SAND**						1	77.81
1.24		G	1				
Very stiff to stiff, brown **SILTY CLAY**						2	76.81
		G	2				
						3	75.81
3.66							
End of Test Pit							
(TP dry upon completion)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %

20 40 60 80

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

Piezometer Construction

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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Future Development Lands - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PG2878

REMARKS 18T 0426590; 5023475

HOLE NO. TP 8

BORINGS BY Backhoe **DATE** March 11, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	78.84
FILL: Brown silty clay with cobbles, asphalt, sand		G	1				
						1	77.84
1.22							
TOPSOIL							
1.52							
Stiff, brown **SILTY CLAY**		G	2			2	76.84
2.44							
GLACIAL TILL: Brown silty sand with gravel, cobbles, boulders, trace clay		G	3			3	75.84
3.66							
End of Test Pit							
Practical refusal to excavation on inferred bedrock surface at 3.66m depth							
(TP dry upon completion)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %

20 40 60 80

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

Piezometer Construction

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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Future Development Lands - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PG2878

REMARKS 18T 0426599; 5023722

HOLE NO. TP 9

BORINGS BY Backhoe **DATE** March 11, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	78.71		
TOPSOIL 0.25									
Brown **SILTY SAND**		G	1			1	77.71		
1.07									
		G	2			2	76.71		
Very stiff to stiff, brown **SILTY CLAY**		G	3			3	75.71		
3.66									
End of Test Pit									
(TP dry upon completion)									

Pen. Resist. Blows/0.3m: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Future Development Lands - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PG2878

REMARKS 18T 0426757; 5023823

HOLE NO. TP10

BORINGS BY Hydraulic Excavator **DATE** March 20, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	70.43
TOPSOIL 0.30							
Very stiff, brown **SILTY CLAY**		G	1			1	69.43
1.83		G	2				
End of Test Pit Practical refusal to excavation on inferred bedrock surface at 1.83m depth (GWL @ 0.8m depth based on field observations)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Future Development Lands - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PG2878

REMARKS 18T 0426913; 5023651

HOLE NO. TP11

BORINGS BY Hydraulic Excavator **DATE** March 20, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	70.02		
TOPSOIL 0.38									
Very stiff, brown **SILTY CLAY**		G	1						
						1	69.02		
1.27		G	2						
End of Test Pit Practical refusal to excavation on inferred bedrock surface at 1.27m depth (GWL @ 0.4m depth based on field observations)									

Pen. Resist. Blows/0.3m: 20, 40, 60, 80

Shear Strength (kPa): 20, 40, 60, 80, 100

▲ Undisturbed △ Remoulded

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Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Future Development Lands - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PG2878

REMARKS 18T 0426831; 5024114

HOLE NO. TP12

BORINGS BY Hydraulic Excavator **DATE** March 20, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	69.71
TOPSOIL 0.30		G	1				
Loose to compact, brown **SILTY SAND** 1.22						1	68.71
Stiff to very stiff, brown **SILTY CLAY**		G	2			2	67.71
		G	3				
3.20						3	66.71
GLACIAL TILL: Compact to dense, grey silty sand with clay, gravel, cobbles, boulders		G	4				
3.66							
End of Test Pit							
(GWL @ 2.3m depth based on field observations)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Future Development Lands - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PG2878

REMARKS 18T 0426963; 5023959

HOLE NO. TP13

BORINGS BY Hydraulic Excavator **DATE** March 20, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	69.87		
TOPSOIL 0.30		G	1						
Loose to compact, brown **SILTY SAND** 1.52						1	68.87		
		G	2			2	67.87		
Very stiff to stiff, brown **SILTY CLAY**									
- stiff to firm and grey by 3.2m depth		G	3			3	66.87		
3.66 End of Test Pit									
(GWL @ 2.7m depth based on field observations)									

Pen. Resist. Blows/0.3m: 20 40 60 80

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Future Development Lands - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PG2878

REMARKS 18T 0427084; 5023843

HOLE NO. TP14

BORINGS BY Hydraulic Excavator **DATE** March 20, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	69.90
TOPSOIL							
0.41							
Loose to compact, brown **SILTY SAND**		G	1			1	68.90
1.52							
Very stiff to stiff, brown **SILTY CLAY**		G	2			2	67.90
- stiff to firm and grey by 2.7m depth							
		G	3			3	66.90
3.66							
End of Test Pit							
(TP dry upon completion)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %

20 40 60 80

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

Piezometer Construction

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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Future Development Lands - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PG2878

REMARKS 18T 0427248; 5024000

HOLE NO. TP15

BORINGS BY Hydraulic Excavator **DATE** March 20, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	68.82		
TOPSOIL									
0.40									
Loose to compact, brown **SILTY SAND**		G	1			1	67.82		
2.13						2	66.82		
Very stiff to stiff, brown **SILTY CLAY**		G	2						
		G	3			3	65.82		
4.27						4	64.82		
End of Test Pit Practical refusal to excavation at 4.27m depth (TP dry upon completion)									

Pen. Resist. Blows/0.3m: ● 50 mm Dia. Cone; ○ Water Content %

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Future Development Lands - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PG2878

REMARKS 18T 0427121; 5024097

HOLE NO. TP16

BORINGS BY Hydraulic Excavator **DATE** March 21, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	69.61
TOPSOIL							
0.46		G	1				
Loose to compact, brown **SILTY SAND**						1	68.61
1.37		G	2				
Very stiff, brown **SILTY CLAY**		G	3			2	67.61
3.35							
GLACIAL TILL: Grey silty clay with sand, gravel, cobbles, boulders		G	4			3	66.61
3.66							
End of Test Pit							
(GWL @ 3.3m depth based on field observations)							

Pen. Resist. Blows/0.3m
50 mm Dia. Cone

Water Content %

20 40 60 80

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

Piezometer Construction

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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Future Development Lands - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PG2878

REMARKS 18T 0426980; 5024232

HOLE NO. TP17

BORINGS BY Hydraulic Excavator **DATE** March 21, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	69.25
TOPSOIL							
0.41							
Loose to compact, brown **SILTY SAND**		G	1			1	68.25
1.68							
Very stiff to stiff, brown **SILTY CLAY**						2	67.25
		G	2			3	66.25
3.66							
End of Test Pit							
(TP dry upon completion)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %

20 40 60 80

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

Piezometer Construction

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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Future Development Lands - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PG2878

REMARKS 18T 0427350; 5024107

HOLE NO. TP18

BORINGS BY Hydraulic Excavator **DATE** March 20, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	67.12		
TOPSOIL									
0.46									
Very stiff to stiff, brown **SILTY CLAY**		G	1			1	66.12		▽
		G	2			2	65.12		
		G	3			3	64.12		
3.66									
End of Test Pit									
(GWL @ 1.2m depth based on field observations)									

Pen. Resist. Blows/0.3m — ● 50 mm Dia. Cone / ○ Water Content %

20 40 60 80

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Future Development Lands - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PG2878

REMARKS 18T 0427495; 5024209

HOLE NO. TP19

BORINGS BY Hydraulic Excavator **DATE** March 20, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	66.43		
TOPSOIL									
0.46									
		G	1			1	65.43		
		G	2						▽
Very stiff to stiff, brown **SILTY CLAY**						2	64.43		
		G	3						
		G	4			3	63.43		
3.66									
End of Test Pit									
(GWL @ 1.5m depth based on field observations)									

Pen. Resist. Blows/0.3m: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Future Development Lands - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PG2878

REMARKS 18T 0427413; 5024301

HOLE NO. TP20

BORINGS BY Hydraulic Excavator **DATE** March 20, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	66.31		
TOPSOIL									
0.41									
Very stiff to stiff, brown **SILTY CLAY**		G	1			1	65.31		
		G	2			2	64.31		▽
						3	63.31		
3.66									
End of Test Pit									
(GWL @ 2.7m depth based on field observations)									

Shear Strength (kPa): 20, 40, 60, 80, 100

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Future Development Lands - March Road
Ottawa, Ontario

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FILE NO. PG2878

REMARKS 18T 0427255; 5024489

HOLE NO. TP21

BORINGS BY Hydraulic Excavator **DATE** March 20, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	65.90
TOPSOIL							
0.46							
Very stiff to stiff, brown **SILTY CLAY**		G	1			1	64.90
		G	2			2	63.90
3.35						3	62.90
GLACIAL TILL: Grey silty clay with sand, gravel, cobbles, boulders		G	3				
3.66							
End of Test Pit							
(GWL @ 2.1m depth based on field observations)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Future Development Lands - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PG2878

REMARKS 18T 0427167; 5024410

HOLE NO. TP22

BORINGS BY Hydraulic Excavator **DATE** March 20, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	66.83		
TOPSOIL 0.30									
		G	1			1	65.83		
Very stiff to stiff, brown **SILTY CLAY**						2	64.83		▽
		G	2			3	63.83		
3.66									
End of Test Pit (GWL @ 2.7m depth based on field observations)									

Pen. Resist. Blows/0.3m: 20 40 60 80

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Future Development Lands - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PG2878

REMARKS 18T 0427276; 5024206

HOLE NO. TP23

BORINGS BY Hydraulic Excavator **DATE** March 20, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	66.94
TOPSOIL							
0.41							
Very stiff to stiff, brown **SILTY CLAY**		G	1			1	65.94
		G	2			2	64.94
2.84							
End of Test Pit Practical refusal to excavation on inferred bedrock surface at 2.84m depth (GWL @ 1.8m depth based on field observations)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Future Development Lands - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PG2878

REMARKS 18T 0426555; 5024059

HOLE NO. TP24

BORINGS BY Hydraulic Excavator **DATE** March 21, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	75.76
TOPSOIL							
0.51							
Loose to compact, red to brown **SILTY SAND**		G	1			1	74.76
1.52							
Very stiff to stiff, brown **SILTY CLAY**		G	2			2	73.76
						3	72.76
3.25							
End of Test Pit Practical refusal to excavation on inferred bedrock surface at 3.25m depth (TP dry upon completion)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %

20 40 60 80

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

Piezometer Construction

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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Future Development Lands - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PG2878

REMARKS 18T 0425287; 5023780

HOLE NO. TP25

BORINGS BY Hydraulic Excavator **DATE** March 21, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	89.66		
TOPSOIL 0.30									
Very stiff to stiff, brown **SILTY CLAY**		G	1					○	
0.61									
End of Test Pit Practical refusal to excavation on inferred bedrock surface at 0.61m depth (TP dry upon completion)									

Pen. Resist. Blows/0.3m: 20 40 60 80

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Future Development Lands - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PG2878

REMARKS 18T 0425362; 5023727

HOLE NO. TP26

BORINGS BY Hydraulic Excavator **DATE** March 21, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	89.74		
TOPSOL									
0.60									
Very stiff to stiff, brown **SILTY CLAY**						1	88.74		
1.22									
GLACIAL TILL: Brown silty clay with sand, gravel, cobbles, boulders		G	1					○	
1.52									
End of Test Pit									
Practical refusal to excavation on inferred bedrock surface at 1.52m depth									
(TP dry upon completion)									

Pen. Resist. Blows/0.3m: 20 40 60 80

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Future Development Lands - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PG2878

REMARKS 18T 0425446; 5023599

HOLE NO. TP27

BORINGS BY Hydraulic Excavator **DATE** March 21, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	88.96		
TOPSOIL									
0.60									
Very stiff to stiff, brown **SILTY CLAY,** trace sand						1	87.96		
						2	86.96		
2.44									
End of Test Pit Practical refusal to excavation on inferred bedrock surface at 2.44m depth (TP dry upon completion)									

Pen. Resist. Blows/0.3m: ● 50 mm Dia. Cone; ○ Water Content %

20 40 60 80

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Future Development Lands - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PG2878

REMARKS 18T 0425582; 5023702

HOLE NO. TP28

BORINGS BY Hydraulic Excavator **DATE** March 21, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	86.85		
TOPSOIL									
0.41									
Very stiff to stiff, brown **SILTY CLAY**		G	1			1	85.85		
1.52									
End of Test Pit									
Practical refusal to excavation on inferred bedrock surface at 1.52m depth									
(TP dry upon completion)									

Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %

20 40 60 80

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Future Development Lands - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PG2878

REMARKS 18T 0425480; 5023826

HOLE NO. TP29

BORINGS BY Hydraulic Excavator **DATE** March 21, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	86.13		
TOPSOIL									
0.41									
Firm to stiff, brown **SILTY CLAY**						1	85.13		
1.07									
GLACIAL TILL: Brown silty clay with sand, gravel, cobbles, boulders		G	1						
1.52									
End of Test Pit									
Practical refusal to excavation on inferred bedrock surface at 1.52m depth									
(GWL @ 0.7m depth based on field observations)									

Pen. Resist. Blows/0.3m: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Future Development Lands - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PG2878

REMARKS 18T 0425420; 5023875

HOLE NO. TP30

BORINGS BY Hydraulic Excavator **DATE** March 21, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	86.42		
TOPSOIL									
0.38									
Very stiff to stiff, brown **SILTY CLAY,** trace sand		G	1			1	85.42		
1.83									
End of Test Pit Practical refusal to excavation on inferred bedrock surface at 1.83m depth (TP dry upon completion)									

Pen. Resist. Blows/0.3m: ● 50 mm Dia. Cone; ○ Water Content %

20 40 60 80

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Future Development Lands - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PG2878

REMARKS 18T 0425562; 5023981

HOLE NO. TP31

BORINGS BY Hydraulic Excavator **DATE** March 21, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	88.37		
TOPSOIL									
0.41									
Stiff, brown **SILTY CLAY,** some sand, trace gravel									
0.81									
End of Test Pit Practical refusal to excavation on inferred bedrock surface at 0.81m depth (TP dry upon completion)									

Pen. Resist. Blows/0.3m: ● 50 mm Dia. Cone; ○ Water Content %

20 40 60 80

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Future Development Lands - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PG2878

REMARKS 18T 0425629; 5023917

HOLE NO. TP32

BORINGS BY Hydraulic Excavator **DATE** March 21, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	86.81		
TOPSOIL									
0.66									
End of Test Pit Practical refusal to excavation on inferred bedrock surface at 0.66m depth (TP dry upon completion)									

Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Future Development Lands - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PG2878

REMARKS 18T 0425702; 5023822

HOLE NO. TP33

BORINGS BY Hydraulic Excavator **DATE** March 21, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	84.00		
TOPSOIL									
0.61									
End of Test Pit Practical refusal to excavation on inferred bedrock surface at 0.61m depth (TP dry upon completion)									

Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Future Development Lands - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PG2878

REMARKS 18T 0425799; 5023895

HOLE NO. TP34

BORINGS BY Hydraulic Excavator **DATE** March 21, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	84.02		
TOPSOIL									
0.41									
Hard to very stiff, brown **SILTY CLAY**		G	1			1	83.02	○ 122	
1.52									
GLACIAL TILL: Brown silty sand with gravel, cobbles, boulder,		G	2					○	
1.92									
End of Test Pit									
Practical refusal to excavation on inferred bedrock surface at 1.92m depth									
(TP dry upon completion)									

Pen. Resist. Blows/0.3m: 20 40 60 80

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Future Development Lands - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PG2878

REMARKS 18T 0425826; 5024040

HOLE NO. TP35

BORINGS BY Hydraulic Excavator **DATE** March 21, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	82.99
TOPSOIL							
0.46							
Hard to very stiff, brown **SILTY CLAY**		G	1			1	81.99
						2	80.99
						3	79.99
						4	78.99
4.27		G	2				
End of Test Pit Practical refusal to excavation on inferred bedrock surface at 4.27m depth (GWL @ 2.7m depth based on field observations)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Future Development Lands - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Annis, O'Sullivan, Vollebekk Ltd.

FILE NO. PG2878

REMARKS 18T 0425699; 5024001

HOLE NO. TP36

BORINGS BY Hydraulic Excavator **DATE** March 21, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	84.76		
TOPSOIL									
0.41									
Hard to very stiff, brown **SILTY CLAY**		G	1			1	83.76	○ 108	
						2	82.76		
2.74									
End of Test Pit Practical refusal to excavation on inferred bedrock surface at 2.74m depth (GWL @ 2.6m depth based on field observations)									

Pen. Resist. Blows/0.3m: 20 40 60 80

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Dekok Lands
March Road, Ottawa, Ontario

DATUM

REMARKS

BORINGS BY Backhoe **DATE** 4 November 2010

FILE NO. PG2256

HOLE NO. TP 1

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	
TOPSOIL 0.25							
Stiff, brown **SILTY CLAY** with sand 0.56		G	1				
		G	2			1	
GLACIAL TILL: Dense, brown silty clay with sand, gravel, cobbles and boulders		G	3			2	
3.35						3	
End of Test Pit Practical refusal to excavation @ 3.35m depth (Groundwater infiltration @ 1.8m depth)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

Piezometer Construction

▽

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Dekok Lands
March Road, Ottawa, Ontario

DATUM

REMARKS

FILE NO. PG2256

HOLE NO. TP 2

BORINGS BY Backhoe **DATE** 4 November 2010

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0			
TOPSOIL 0.30		G	1						
		G	2			1			
Very stiff, brown **SILTY CLAY,** some sand 2.39						2			▽
		G	3						
GLACIAL TILL: Dense to very dense, grey silty clay with sand and gravel 3.63		G	4			3			
End of Test Pit									
Practical refusal to excavation @ 3.63m depth									
(Groundwater infiltration @ 2.4m depth)									

Pen. Resist. Blows/0.3m: ● 50 mm Dia. Cone; ○ Water Content %

20 40 60 80

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Dekok Lands
March Road, Ottawa, Ontario

DATUM

REMARKS

BORINGS BY Backhoe **DATE** 4 November 2010

FILE NO. PG2256

HOLE NO. TP 3

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	
TOPSOIL 0.18							
Brown **SILTY CLAY** with sand 0.33		G	1				
GLACIAL TILL: Dense, brown silty clay with sand and gravel						1	
						2	
		G	2			3	
3.66 End of Test Pit							
Practical refusal to excavation @ 3.66m depth							
(Groundwater infiltration @ 1.4m depth)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %
20 40 60 80

Piezometer Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Dekok Lands
March Road, Ottawa, Ontario

DATUM

REMARKS

BORINGS BY Backhoe **DATE** 4 November 2010

FILE NO. PG2256

HOLE NO. TP 4

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	
TOPSOIL 0.18							
Stiff, brown **SILTY CLAY,** some sand		G	1				
		G	2				
0.71						1	
GLACIAL TILL: Dense to very dense, grey-brown silty clay with sand, gravel and cobbles		G	3				
3.05						2	
End of Test Pit							
Practical refusal to excavation @ 3.05m depth						3	
(Groundwater infiltration @ 1.8m depth)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Dekok Lands
March Road, Ottawa, Ontario

DATUM

REMARKS

BORINGS BY Backhoe **DATE** 4 November 2010

FILE NO. PG2256

HOLE NO. TP 5

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	
TOPSOIL 0.20							
Compact, brown **SILTY SAND**		G	1				
0.97		G	2			1	
GLACIAL TILL: Compact to dense, brown silty clay with sand, gravel, cobbles and boulders						2	
						3	
3.66							
End of Test Pit Practical refusal to excavation @ 3.66m depth (Groundwater infiltration @ 1.7m depth)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Dekok Lands
March Road, Ottawa, Ontario

DATUM

REMARKS

BORINGS BY Backhoe **DATE** 4 November 2010

FILE NO. PG2256

HOLE NO. TP 6

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0			
TOPSOIL 0.10									
Compact, brown **SILTY SAND**		G	1			1			
1.22									
GLACIAL TILL: Compact to dense, grey silty clay with sand, gravel, cobbles and boulders		G	2			2			
						3			
						4			
4.55									
End of Test Pit (TP dry upon completion)									

Pen. Resist. Blows/0.3m: ● 50 mm Dia. Cone; ○ Water Content %

20 40 60 80

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Dekok Lands
March Road, Ottawa, Ontario

DATUM

REMARKS

BORINGS BY Backhoe **DATE** 4 November 2010

FILE NO. PG2256

HOLE NO. TP 7

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0			
TOPSOIL 0.25									
GLACIAL TILL: Compact, grey silty clay with sand, gravel, cobbles and boulders 0.91									
End of Test Pit Practical refusal to excavation @ 0.91m depth (TP dry upon completion)									

20 40 60 80

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Dekok Lands
March Road, Ottawa, Ontario

DATUM

REMARKS

BORINGS BY Backhoe **DATE** 4 November 2010

FILE NO. PG2256

HOLE NO. TP 8

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0		20 40 60 80	
TOPSOIL 0.30									
GLACIAL TILL: Compact, grey-brown silty clay with sand, gravel, cobbles and boulders						1			
2.13						2			▽
End of Test Pit Practical refusal to excavation @ 2.13m depth (Groundwater infiltration @ 2.1m depth)								20 40 60 80 100 Shear Strength (kPa) ▲ Undisturbed △ Remoulded	

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28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Dekok Lands
March Road, Ottawa, Ontario

DATUM

REMARKS

FILE NO. PG2256

HOLE NO. TP 9

BORINGS BY Backhoe **DATE** 4 November 2010

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0			
TOPSOIL 0.30									
		G	1			1			
GLACIAL TILL: Compact, grey silty clay with sand, gravel, cobbles and boulders						2			
2.44		G	2						
End of Test Pit Practical refusal to excavation @ 2.44m depth (TP dry upon completion)									

Pen. Resist. Blows/0.3m: 20 40 60 80

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Dekok Lands
March Road, Ottawa, Ontario

DATUM

REMARKS

BORINGS BY Backhoe **DATE** 4 November 2010

FILE NO. PG2256

HOLE NO. TP10

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	
TOPSOIL 0.30		G	1				
Compact, brown **SILTY SAND,** trace clay 0.86		G	2			1	
GLACIAL TILL: Compact, grey silty clay with sand, gravel, cobbles and boulders		G	3			2	
2.44							
End of Test Pit Practical refusal to excavation @ 2.44m depth (Groundwater infiltration @ 1.8m depth)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Dekok Lands
March Road, Ottawa, Ontario

DATUM

REMARKS

FILE NO. PG2256

HOLE NO. TP11

BORINGS BY Backhoe **DATE** 4 November 2010

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0		20 40 60 80	
TOPSOIL 0.15									
Compact, brown **SILTY SAND** 0.74						1			▽
GLACIAL TILL: Compact to dense, brown silty clay with sand, gravel, cobbles and boulders 2.84						2			
End of Test Pit Practical refusal to excavation @ 2.84m depth (Groundwater infiltration @ 1.1m depth)								20 40 60 80 100 **Shear Strength (kPa)** ▲ Undisturbed △ Remoulded	

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Dekok Lands
March Road, Ottawa, Ontario

DATUM

REMARKS

BORINGS BY Backhoe **DATE** 4 November 2010

FILE NO. PG2256

HOLE NO. TP12

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE									
TOPSOIL 0.25						0			
Compact, brown **SILTY SAND** 0.76									
GLACIAL TILL: Compact to dense, grey-brown silty clay with sand, gravel, cobbles and boulders 1.98						1			
End of Test Pit Practical refusal to excavation @ 1.98m depth (Groundwater infiltration @ bottom of test pit)									

Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - Dekok Lands
March Road, Ottawa, Ontario

DATUM

REMARKS

BORINGS BY Backhoe **DATE** 4 November 2010

FILE NO. PG2256

HOLE NO. TP13

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0		20 40 60 80	
TOPSOIL 0.30									
Compact, brown **SILTY SAND** 0.74						1			
GLACIAL TILL: Compact to dense, grey silty clay with sand, gravel, cobbles and boulders 2.49						2			▽
End of Test Pit Practical refusal to excavation @ 2.49m depth (Groundwater infiltration @ 2.2m depth)								20 40 60 80 100 **Shear Strength (kPa)** ▲ Undisturbed △ Remoulded	

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28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Proposed Residential Development - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Novatech Engineering Consultants Ltd.

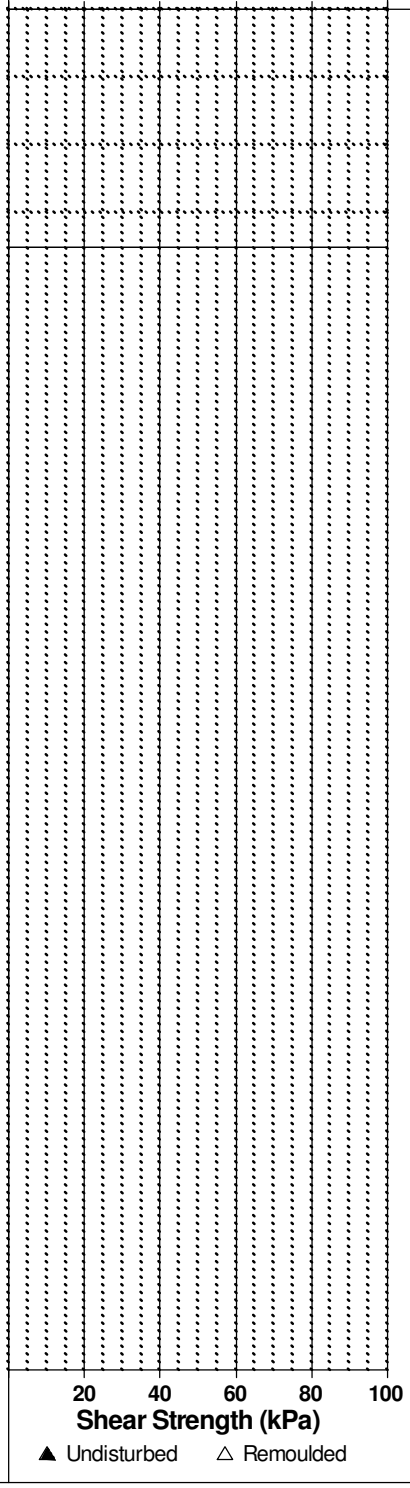
FILE NO. PG1823

REMARKS

HOLE NO. TP 1

BORINGS BY Hydraulic Shovel **DATE** 9 Feb 09

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	88.10		
TOPSOIL 0.18									
Brown **SILTY SAND**, trace organic matter 0.55		G	1						
GLACIAL TILL: Brown silty sand with gravel, cobbles and boulders 0.70									
End of Test Pit									
Practical refusal to excavation on inferred bedrock surface @ 0.70m depth									
(TP dry upon completion)									



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28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Proposed Residential Development - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Novatech Engineering Consultants Ltd.

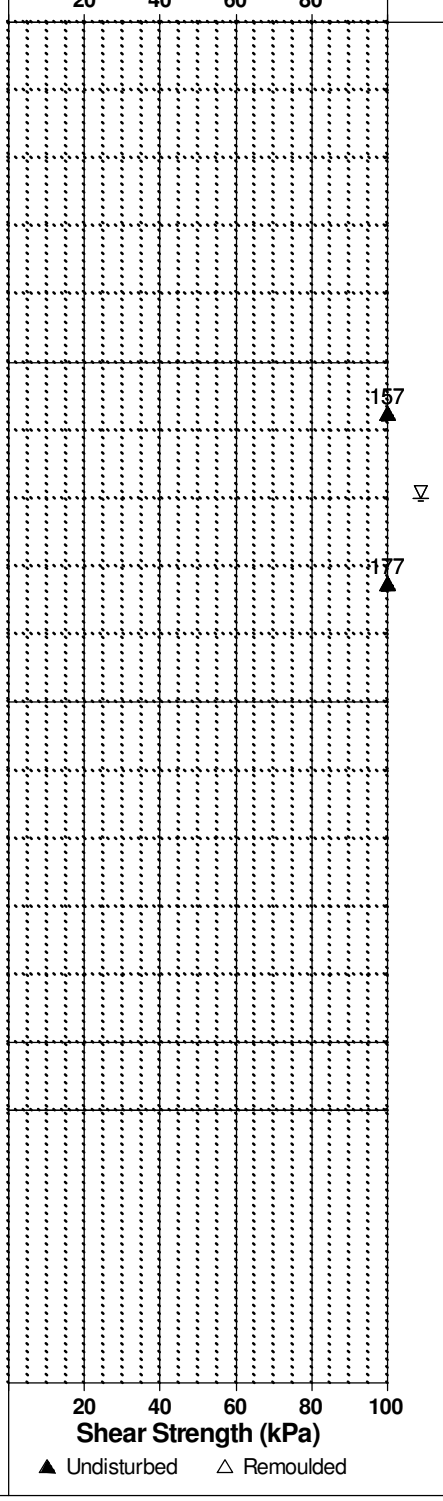
FILE NO. PG1823

REMARKS

HOLE NO. TP 2

BORINGS BY Hydraulic Shovel **DATE** 9 Feb 09

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	88.57
TOPSOIL 0.25							
Very stiff, brown **SILTY CLAY**		G	1				
- grey by 0.75m depth		G	2			1	87.57
						2	86.57
2.90							
GLACIAL TILL: Grey silty clay with sand, gravel, cobbles and boulders 3.20						3	85.57
End of Test Pit							
Practical refusal to excavation on inferred bedrock surface @ 3.20m depth							
(Open hole GWL @ 1.4m depth)							



Piezometer Construction

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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Proposed Residential Development - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Novatech Engineering Consultants Ltd.

FILE NO. PG1823

REMARKS

HOLE NO. TP 3

BORINGS BY Hydraulic Shovel **DATE** 9 Feb 09

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	85.48		
TOPSOIL 0.18									
Brown **SILTY CLAY** 0.47		G	1						
		G	2						
GLACIAL TILL: Brown silty clay with sand, gravel, cobbles and boulders						1	84.48		
1.90									
End of Test Pit Practical refusal to excavation on inferred bedrock surface @ 1.90m depth (TP dry upon completion)									

Pen. Resist. Blows/0.3m: 20 40 60 80

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Proposed Residential Development - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Novatech Engineering Consultants Ltd.

FILE NO. PG1823

REMARKS

HOLE NO. TP 4

BORINGS BY Hydraulic Shovel **DATE** 9 Feb 09

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	88.13		
TOPSOIL 0.20									
Brown **SILTY SAND** 0.50		G	1						
		G	2						
GLACIAL TILL: Grey clayey silt, some gravel, trace sand, cobbles and boulders						1	87.13		
1.40									
End of Test Pit									
Practical refusal to excavation on inferred bedrock surface @ 1.40m depth									
(TP dry upon completion)									

Pen. Resist. Blows/0.3m: 20 40 60 80

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Proposed Residential Development - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Novatech Engineering Consultants Ltd.

FILE NO. PG1823

REMARKS

HOLE NO. TP 5

BORINGS BY Hydraulic Shovel **DATE** 9 Feb 09

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	88.50
TOPSOIL							
0.26							
Brown **SANDY SILT**, trace gravel		G	1				
0.80							
GLACIAL TILL: Grey silty clay with sand, gravel, cobbles and boulders		G	2			1	87.50
1.15							
End of Test Pit							
Practical refusal to excavation on inferred bedrock surface @ 1.15m depth							
(TP dry upon completion)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %

20 40 60 80

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

Piezometer Construction

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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Proposed Residential Development - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Novatech Engineering Consultants Ltd.

FILE NO. PG1823

REMARKS

HOLE NO. TP 6

BORINGS BY Hydraulic Shovel **DATE** 9 Feb 09

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	89.10		
TOPSOIL									
0.25									
Brown **SILTY CLAY**		G	1						
0.85									
GLACIAL TILL: Grey silty clay with sand, gravel, cobbles and boulders		G	2			1	88.10		
2.20						2	87.10		
End of Test Pit Practical refusal to excavation on inferred bedrock surface @ 2.20m depth (TP dry upon completion)									

Pen. Resist. Blows/0.3m: ● 50 mm Dia. Cone; ○ Water Content %
20 40 60 80

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Proposed Residential Development - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Novatech Engineering Consultants Ltd.

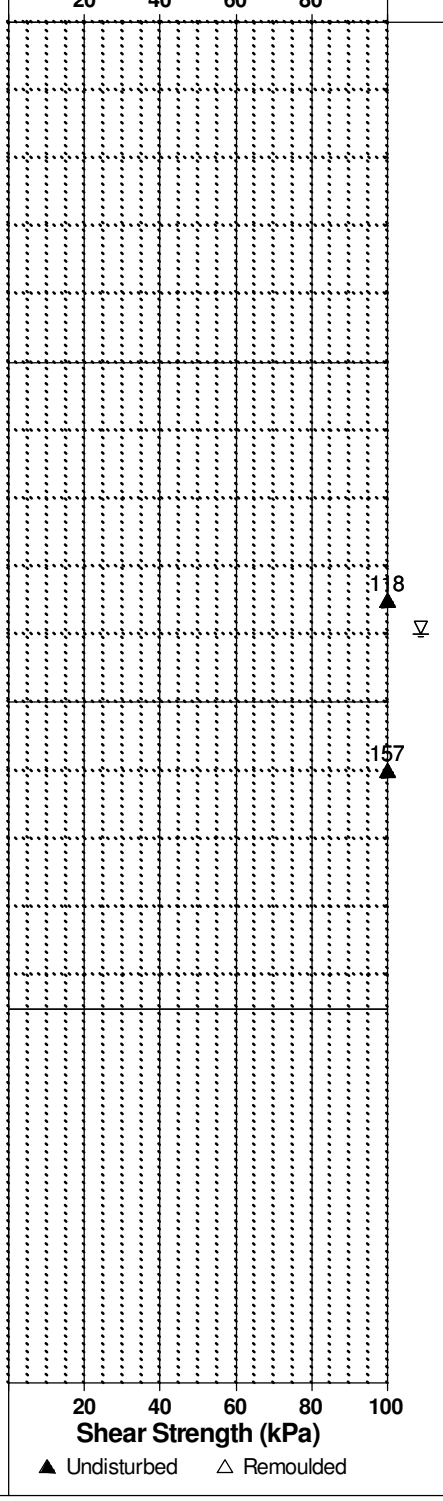
FILE NO. PG1823

REMARKS

HOLE NO. TP 7

BORINGS BY Hydraulic Shovel **DATE** 9 Feb 09

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	88.06
TOPSOIL 0.20							
Very stiff, brown **SILTY CLAY**		G	1			1	87.06
- grey-brown by 1.4m depth		G	2			2	86.06
2.60							
GLACIAL TILL: Grey-brown silty sand with clay, gravel, cobbles and boulders		G	3				
2.90							
End of Test Pit							
Practical refusal to excavation on inferred bedrock surface @ 2.90m depth							
(Open hole GWL @ 1.8m depth)							



Piezometer Construction

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Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Proposed Residential Development - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Novatech Engineering Consultants Ltd.

FILE NO. PG1823

REMARKS

HOLE NO. TP 8

BORINGS BY Hydraulic Shovel **DATE** 9 Feb 09

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	89.86		
TOPSOIL 0.25									
Brown **SANDY SILT** , trace organic matter 0.60		G	1						
		G	2						
Brown **SILTY CLAY**						1	88.86		▽
1.40 End of Test Pit									
Practical refusal to excavation on inferred bedrock surface @ 1.40m depth									
(Open hole GWL @ 1.1m depth)									

Pen. Resist. Blows/0.3m: ● 50 mm Dia. Cone; ○ Water Content %
20 40 60 80

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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Consulting Engineers

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Proposed Residential Development - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Novatech Engineering Consultants Ltd.

FILE NO. PG1823

REMARKS

HOLE NO. TP 9

BORINGS BY Hydraulic Shovel **DATE** 9 Feb 09

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	91.42		
TOPSOIL 0.20									
Brown **SILTY CLAY**		G	1			1	90.42		
1.30									
GLACIAL TILL: Grey-brown clayey silt with gravel, cobbles and boulders, trace sand		G	2			2	89.42		▽
2.30									
End of Test Pit Practical refusal to excavation on inferred bedrock surface @ 2.30m depth (Open hole GWL @ 1.9m depth)									

Pen. Resist. Blows/0.3m: ● 50 mm Dia. Cone; ○ Water Content %

20 40 60 80

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Proposed Residential Development - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Novatech Engineering Consultants Ltd.

FILE NO. PG1823

REMARKS

HOLE NO. TP10

BORINGS BY Hydraulic Shovel **DATE** 9 Feb 09

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	90.76		
TOPSOIL 0.20									
Brown **SANDY SILT** , some organic matter 0.70		G	1						
		G	2			1	89.76		
GLACAIL TILL: Grey silty sand with gravel, cobbles and boulders		G	3			2	88.76		▽
2.90									
End of Test Pit Practical refusal to excavation on inferred bedrock surface @ 2.90m depth (Open hole GWL @ 2.5m depth)									

Pen. Resist. Blows/0.3m — ● 50 mm Dia. Cone / ○ Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100 — ▲ Undisturbed △ Remoulded

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28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Proposed Residential Development - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Novatech Engineering Consultants Ltd.

FILE NO. PG1823

REMARKS

HOLE NO. TP11

BORINGS BY Hydraulic Shovel **DATE** 9 Feb 09

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	90.22		
TOPSOIL 0.25									
Brown **SILTY SAND** , some organic matter 0.90		G	1						
GLACIAL TILL: Grey-brown silty sand with clay and gravel 1.20		G	2			1	89.22		▽
End of Test Pit									
Practical refusal to excavation on inferred bedrock surface @ 1.20m depth									
(Open hole GWL @ 1.0m depth)									

Pen. Resist. Blows/0.3m — ● 50 mm Dia. Cone / ○ Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
Proposed Residential Development - March Road
Ottawa, Ontario

DATUM Ground surface elevations provided by Novatech Engineering Consultants Ltd.

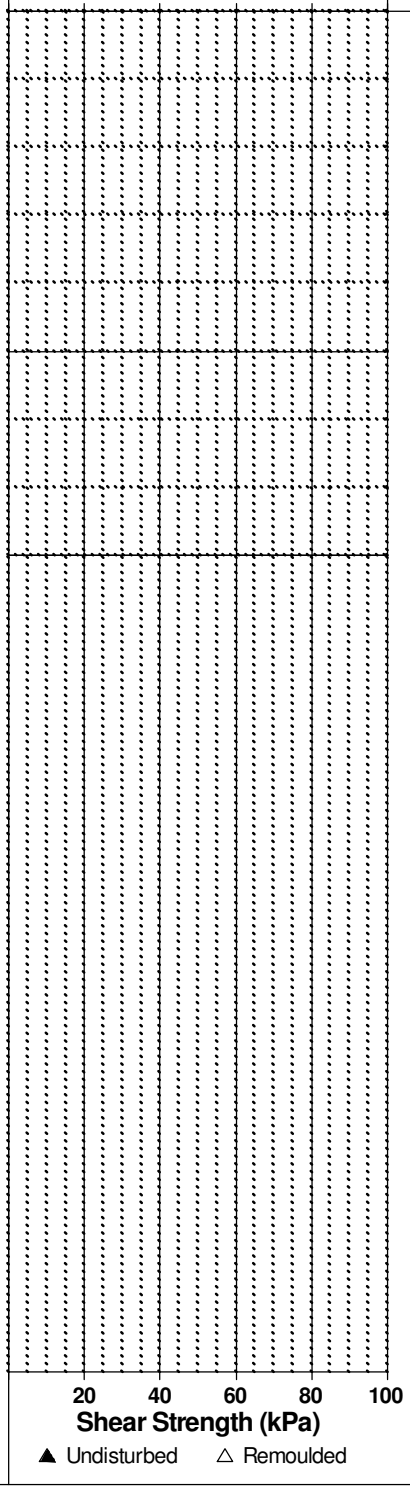
FILE NO. PG1823

REMARKS

HOLE NO. TP12

BORINGS BY Hydraulic Shovel **DATE** 9 Feb 09

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	89.26		
TOPSOIL 0.20									
Brown **SILTY SAND**						1	88.26		
1.00									
GLACIAL TILL: Grey silty sand with clay and gravel									
1.60									
End of Test Pit									
Practical refusal to excavation on inferred bedrock surface @ 1.60m depth									
(TP dry upon completion)									



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Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Foley Lands
Ottawa, Ontario

DATUM TBM - Centreline of March Road, adjacent to the north property limit, assumed geodetic elevation = 82.00m.

FILE NO. PG1716

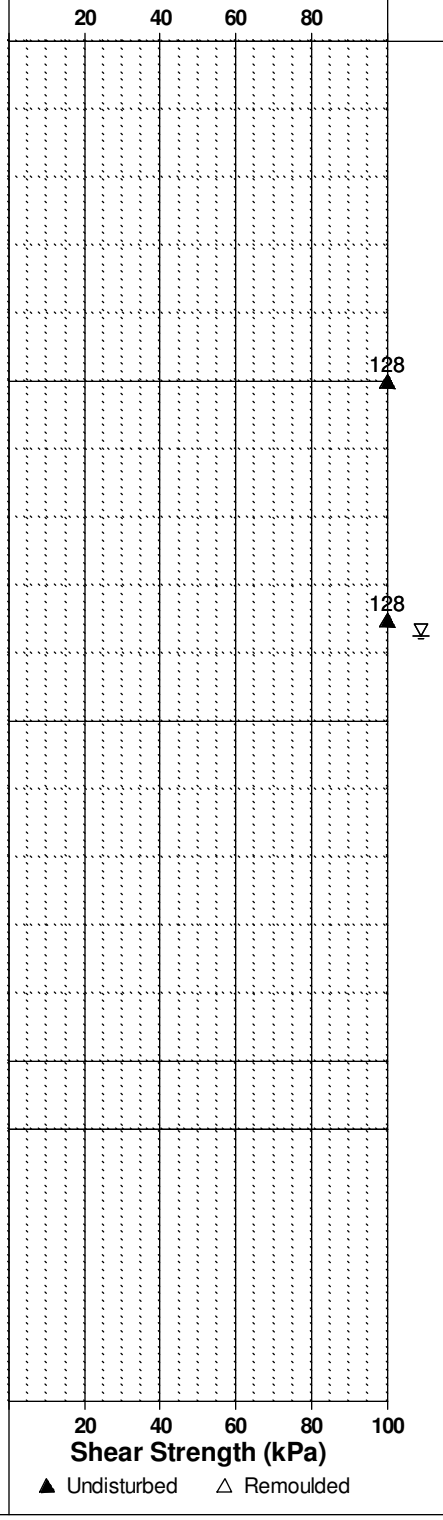
REMARKS

HOLE NO. TP 1

BORINGS BY Hydraulic Shovel **DATE** July 9, 2008

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	81.70
TOPSOIL							
0.25							
Very stiff, brown **SILTY CLAY**							
- grey by 0.5m depth						1	80.70
2.10							
GLACIAL TILL: Compact to dense grey silty clay, trace sand and gravel		G	1			2	79.70
						3	78.70
3.20							
End of Test Pit							
Practical refusal to excavation @ 3.20m depth							
(Open hole WL @ 1.75m depth)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %



Piezometer Construction

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Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Foley Lands
Ottawa, Ontario

DATUM TBM - Centreline of March Road, adjacent to the north property limit, assumed geodetic elevation = 82.00m.

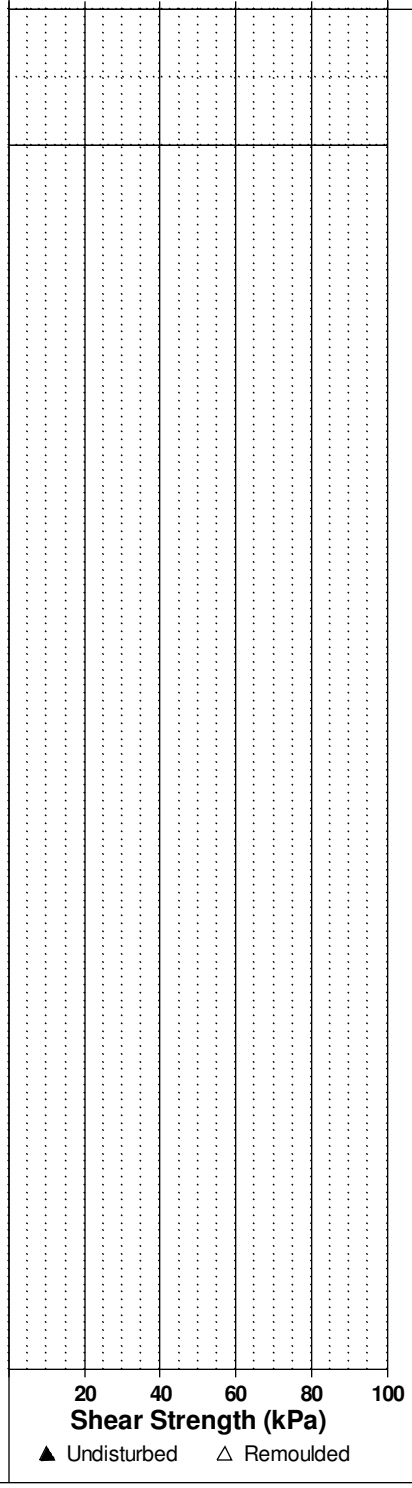
FILE NO. PG1716

REMARKS

HOLE NO. TP 2

BORINGS BY Rubber Tired Backhoe **DATE** July 9, 2008

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	83.10		
TOPSOIL		G	1						
0.40									
End of Test Pit Practical refusal to excavation @ 0.40m depth									



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Foley Lands
Ottawa, Ontario

DATUM TBM - Centreline of March Road, adjacent to the north property limit, assumed geodetic elevation = 82.00m.

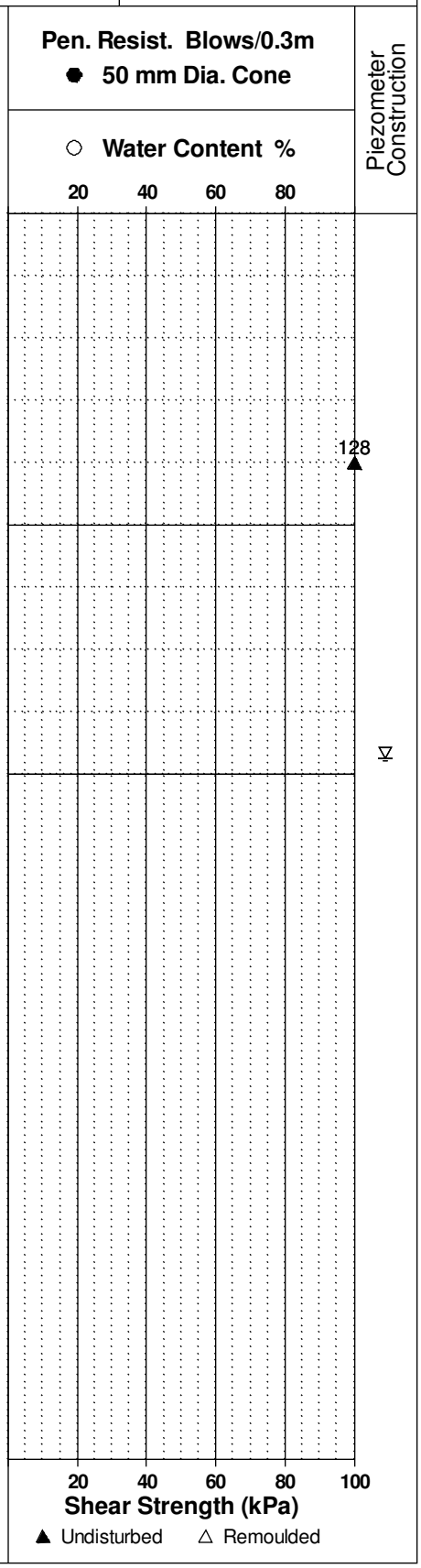
FILE NO. PG1716

REMARKS

HOLE NO. TP 3

BORINGS BY Rubber Tired Backhoe **DATE** July 9, 2008

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	83.80
TOPSOIL							
0.25							
Hard, brown **SILTY CLAY**		G	1				
1.10						1	82.80
GLACIAL TILL: Dense brown silty clay, trace gravel and cobbles		G	2				
1.80							
End of Test Pit Practical refusal to excavation on inferred bedrock surface @ 1.80m depth (Open hole WL @ 1.75m depth)							



Piezometer Construction

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Foley Lands
Ottawa, Ontario

DATUM TBM - Centreline of March Road, adjacent to the north property limit, assumed geodetic elevation = 82.00m.

FILE NO. PG1716

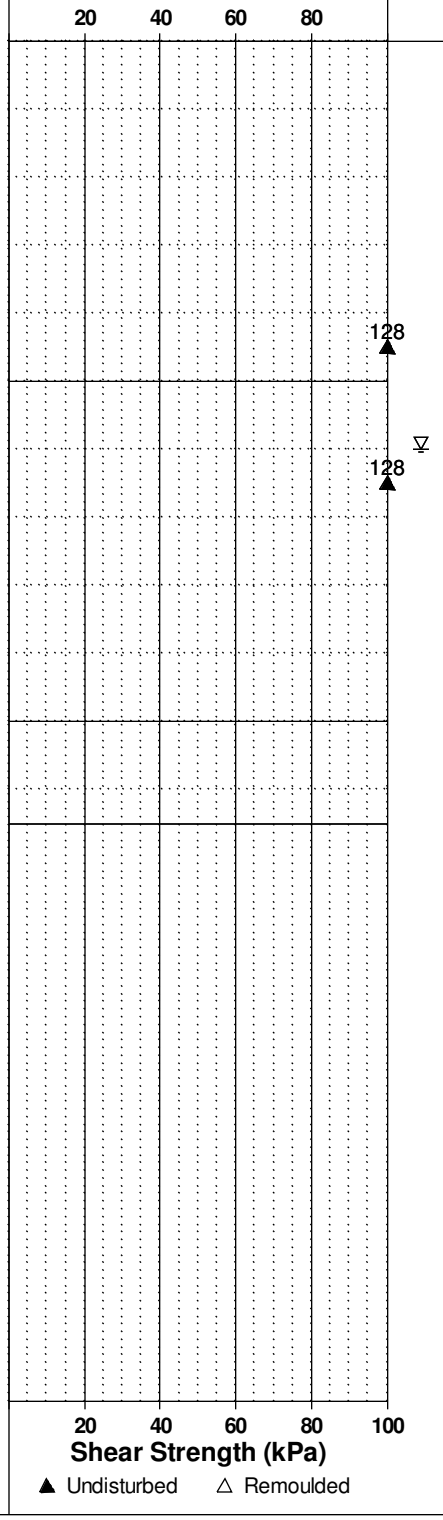
REMARKS

HOLE NO. TP 4

BORINGS BY Rubber Tired Backhoe **DATE** July 9, 2008

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	86.20
TOPSOIL							
0.30							
Hard, brown **SILTY CLAY**						1	85.20
1.55							
GLACIAL TILL: Brown-grey silty clay, some sand and cobbles		G	1			2	84.20
2.30							
End of Test Pit							
Practical refusal to excavation @ 2.30m depth							
(Open hole WL @ 1.2m depth)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %



Piezometer Construction

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Foley Lands
Ottawa, Ontario

DATUM TBM - Centreline of March Road, adjacent to the north property limit, assumed geodetic elevation = 82.00m.

FILE NO. PG1716

REMARKS

HOLE NO. TP 5

BORINGS BY Rubber Tired Backhoe **DATE** July 9, 2008

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	86.80		
TOPSOIL									
0.23									
Very stiff, brown **SILTY CLAY**		G	1			1	85.80		▽
1.60									
GLACIAL TILL: Compact to dense grey-brown silty clay, some gravel and cobbles		G	2			2	84.80		
2.50									
End of Test Pit									
Practical refusal to excavation @ 2.50m depth									
(Open hole WL @ 1.1m depth)									

Pen. Resist. Blows/0.3m: 20 40 60 80

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Foley Lands
Ottawa, Ontario

DATUM TBM - Centreline of March Road, adjacent to the north property limit, assumed geodetic elevation = 82.00m.

FILE NO. PG1716

REMARKS

HOLE NO. TP 6

BORINGS BY Rubber Tired Backhoe **DATE** July 9, 2008

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	90.70		
TOPSOIL 0.30									
End of Test Pit Practical refusal to excavation on bedrock surface @ 0.30m depth									

20 40 60 80

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Foley Lands
Ottawa, Ontario

DATUM TBM - Centreline of March Road, adjacent to the north property limit, assumed geodetic elevation = 82.00m.

FILE NO. PG1716

REMARKS

HOLE NO. TP 7

BORINGS BY Rubber Tired Backhoe **DATE** July 9, 2008

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	89.40		
TOPSOIL 0.15									
GLACIAL TILL: Silty sand with gravel, cobbles and boulders 0.54									
BEDROCK: Weathered limestone						1	88.40		
1.35 End of Test Pit									
(TP dry upon completion)									

Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Foley Lands
Ottawa, Ontario

DATUM TBM - Centreline of March Road, adjacent to the north property limit, assumed geodetic elevation = 82.00m.

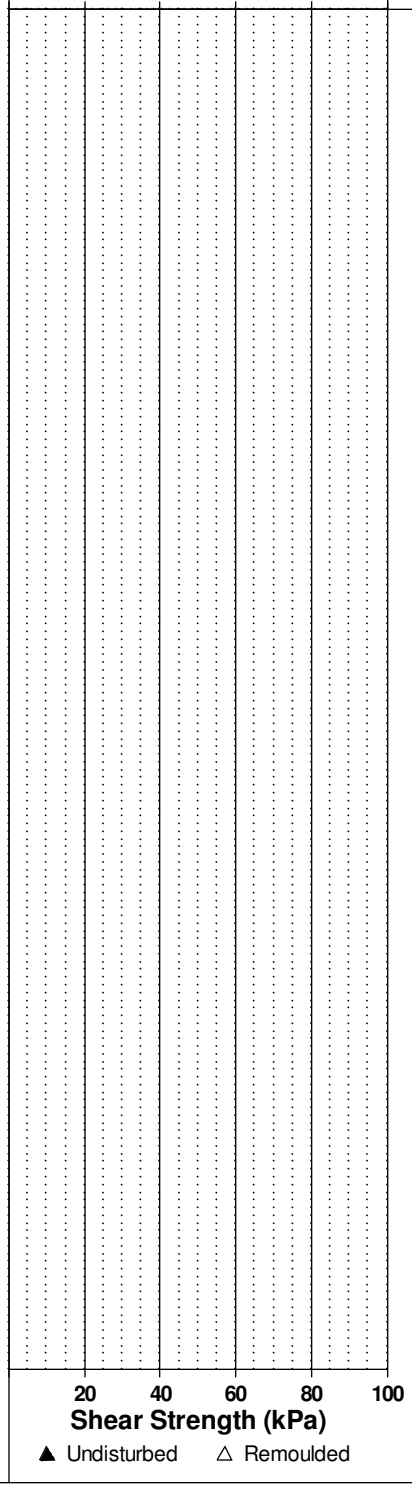
FILE NO. PG1716

REMARKS

HOLE NO. TP 8

BORINGS BY Rubber Tired Backhoe **DATE** July 9, 2008

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE									
Bedrock at surface						0	88.80		



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Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Foley Lands
Ottawa, Ontario

DATUM TBM - Centreline of March Road, adjacent to the north property limit, assumed geodetic elevation = 82.00m.

FILE NO. PG1716

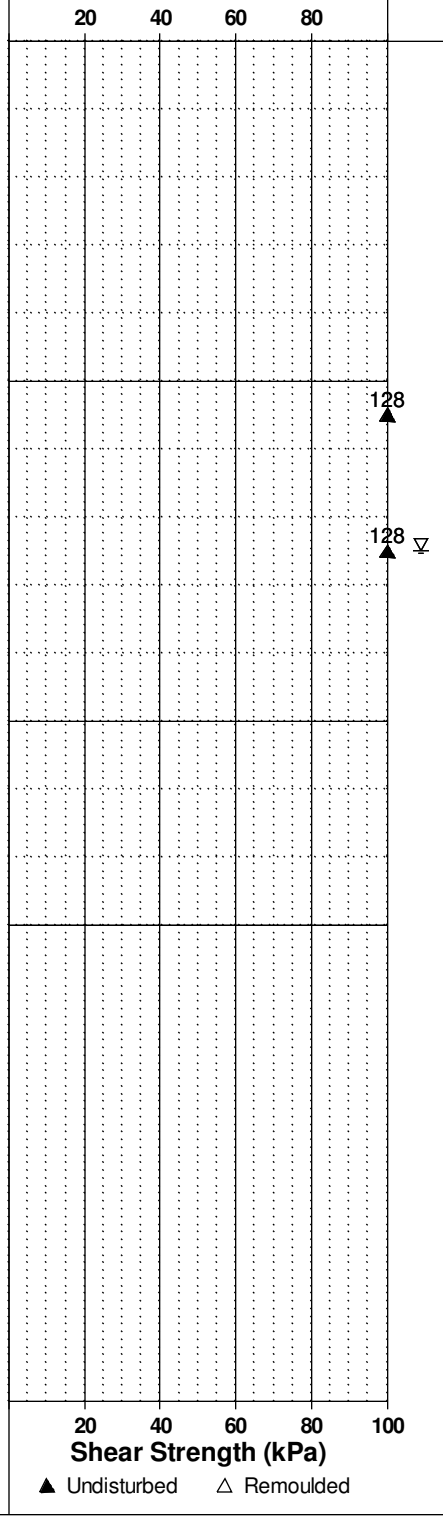
REMARKS

HOLE NO. TP 9

BORINGS BY Hydraulic Shovel **DATE** July 9, 2008

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	81.90
TOPSOIL							
0.30							
Very stiff, grey-brown **SILTY CLAY**		G	1			1	80.90
1.60							
GLACIAL TILL: Compact to dense brown-grey silty clay, trace gravel, cobbles and boulders						2	79.90
2.60		G	2				
End of Test Pit							
Practical refusal to excavation @ 2.60m depth							
(Open hole WL @ 1.5m depth)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %



Piezometer Construction

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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Foley Lands
Ottawa, Ontario

DATUM TBM - Centreline of March Road, adjacent to the north property limit, assumed geodetic elevation = 82.00m.

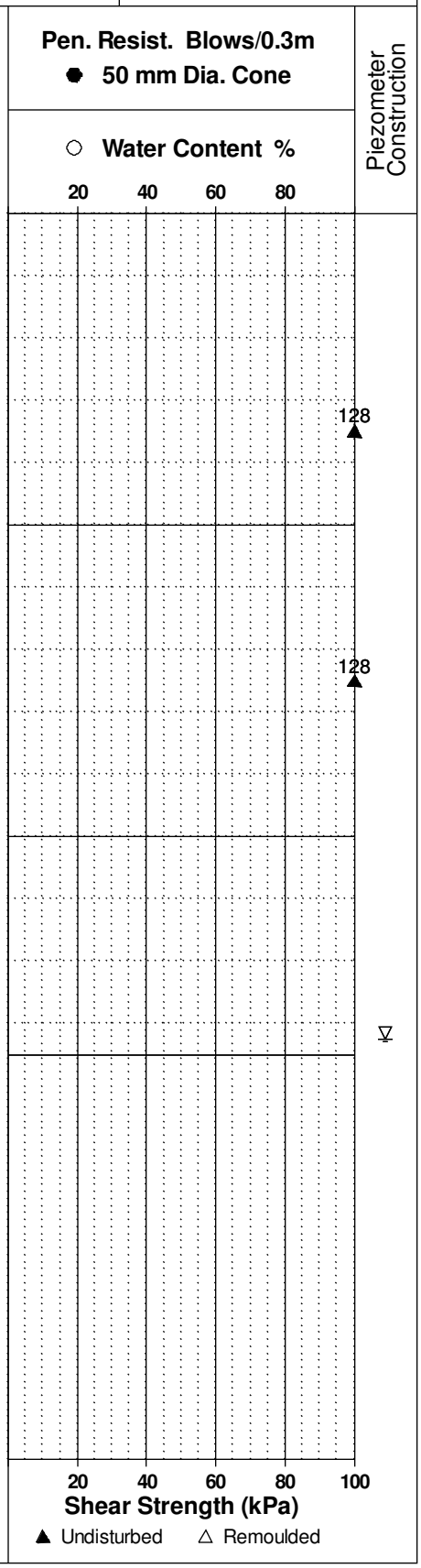
FILE NO. PG1716

REMARKS

HOLE NO. TP10

BORINGS BY Rubber Tired Backhoe **DATE** July 9, 2008

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	88.40		
TOPSOIL									
0.35									
Very stiff, brown **SILTY CLAY**						1	87.40		
1.60									
GLACIAL TILL: Brown-grey silty clay, some gravel and cobbles						2	86.40		
2.70									
End of Test Pit Practical refusal to excavation @ 2.70m depth (Open hole WL @ 2.65m depth)									



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Foley Lands
Ottawa, Ontario

DATUM TBM - Centreline of March Road, adjacent to the north property limit, assumed geodetic elevation = 82.00m.

FILE NO. PG1716

REMARKS

HOLE NO. TP11

BORINGS BY Rubber Tired Backhoe **DATE** July 9, 2008

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	89.50
TOPSOIL							
0.25							
Very stiff, brown **SILTY CLAY**						1	88.50
1.20							
GLACIAL TILL: Dense brown-grey silty clay, trace gravel and cobbles - boulders at 1.7m						2	87.50
2.00							
End of Test Pit Practical refusal to excavation @ 2.00m depth (TP dry upon completion)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %

20 40 60 80

128

128

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

Piezometer Construction

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154 Colonnade Road, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
927 March Road at Old Carp Rd.
Ottawa (Kanata), Ontario

DATUM Ground surface elevations provided by Novatech Engineering Consultants Ltd.

FILE NO. PG1626

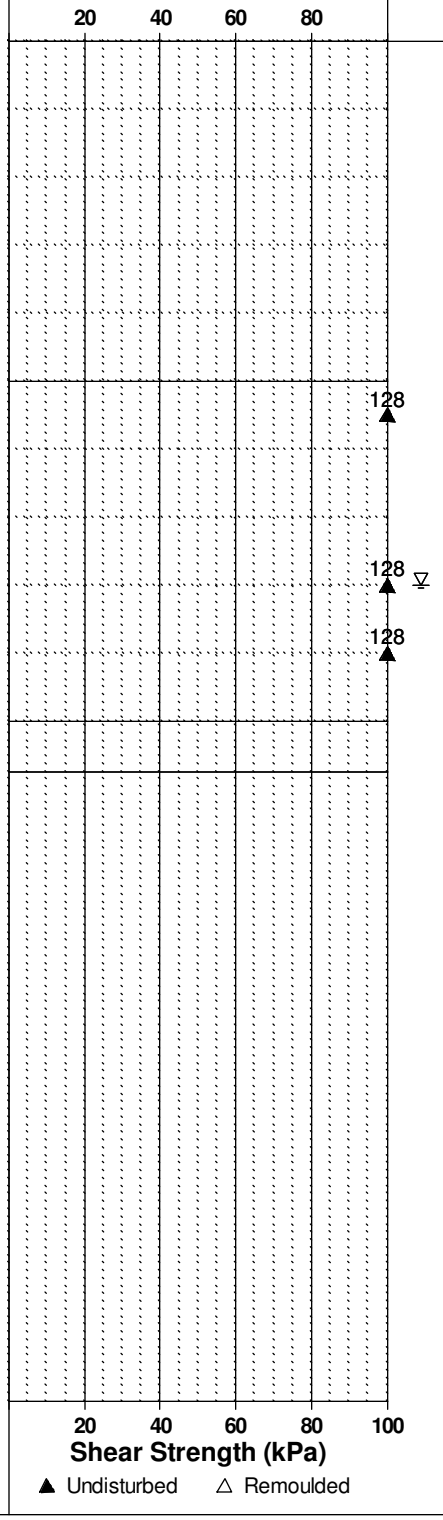
REMARKS

HOLE NO. TP 1

BORINGS BY Hydraulic Shovel **DATE** Feb 25, 08

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	81.47
TOPSOIL							
0.30							
Very stiff, brown **SILTY CLAY**		G	1			1	80.47
2.15						2	79.47
End of Test Pit TP terminated on bedrock surface @ 2.15m depth (Groundwater infiltration @ 1.6m depth)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %



Piezometer Construction

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Consulting Engineers

154 Colonnade Road, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
927 March Road at Old Carp Rd.
Ottawa (Kanata), Ontario

DATUM Ground surface elevations provided by Novatech Engineering Consultants Ltd.

FILE NO. PG1626

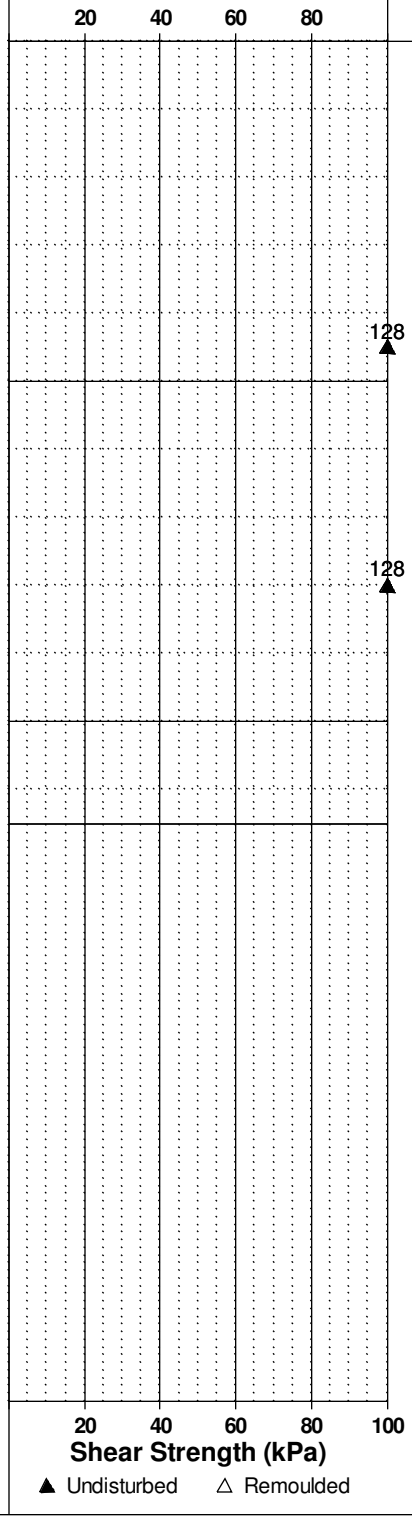
REMARKS

HOLE NO. TP 2

BORINGS BY Hydraulic Shovel **DATE** Feb 25, 08

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	83.13
TOPSOIL 0.25							
Very stiff, brown **SILTY CLAY**		G	1			1	82.13
1.80							
GLACIAL TILL: Brown silty sand with gravel, cobbles, boulders, trace clay		G	2			2	81.13
2.30							
End of Test Pit TP terminated on bedrock surface @ 2.30m depth (Groundwater infiltration @ 0.70m depth)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %



Piezometer Construction

patersongroup

Consulting Engineers

154 Colonnade Road, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Preliminary Geotechnical Investigation
927 March Road at Old Carp Rd.
Ottawa (Kanata), Ontario

DATUM Ground surface elevations provided by Novatech Engineering Consultants Ltd.

FILE NO. PG1626

REMARKS

HOLE NO. TP 3

BORINGS BY Hydraulic Shovel **DATE** Feb 25, 08

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	83.59		
TOPSOIL									
0.30									
Very stiff, brown **SILTY CLAY**									
0.70									
BEDROCK						1	82.59		
1.20									
End of Test Pit									
(TP dry upon completion)									

Pen. Resist. Blows/0.3m: ● 50 mm Dia. Cone; ○ Water Content %
20 40 60 80

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

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FILE NO. PG1626

REMARKS

HOLE NO. TP 4

BORINGS BY Hydraulic Shovel **DATE** Feb 25, 08

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	83.80
TOPSOIL							
0.30							
Very stiff, brown **SILTY CLAY**		G	1			1	82.80
1.65							
GLACIAL TILL: Brown silty sand with gravel, cobbles and boulders		G	2			2	81.80
		G	3				
2.70							
End of Test Pit							
TP terminated on bedrock surface @ 2.70m depth							
(Groundwater infiltration @ 1.0m depth)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %

20 40 60 80

128

128

▽

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

Piezometer Construction

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SOIL PROFILE AND TEST DATA

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DATUM Ground surface elevations provided by Novatech Engineering Consultants Ltd.

FILE NO. PG1626

REMARKS

HOLE NO. TP 5

BORINGS BY Hydraulic Shovel **DATE** Feb 25, 08

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	81.55
TOPSOIL 0.25							
Very stiff, brown **SILTY CLAY**		G	1			1	80.55
		G	2			2	79.55
2.80 **GLACIAL TILL**: Brown silty sand with clay, gravel, cobbles and boulders		G	3			3	78.55
3.10 End of Test Pit TP terminated on bedrock surface @ 3.10m depth (Groundwater infiltration @ 1.6m depth)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %

20 40 60 80

128
128
128
128
128

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

Piezometer Construction

TABLE II

PRELIMINARY RECORD OF TEST PITS
PROPOSED RESIDENTIAL DEVELOPMENT
1020 MARCH ROAD, KANATA
CITY OF OTTAWA, ONTARIO

TEST PIT NUMBER	DEPTH (METRES)	DESCRIPTION
TP1 Elev. 81.35m	0.00 – 0.23	TOPSOIL
	0.23 – 3.66	Very stiff to stiff grey brown, becoming grey with depth SILTY CLAY
	3.66 – 3.76	Grey brown coarse sand, some silt, clay, gravel and cobbles (GLACIAL TILL)
	3.76	End of test pit

Depth (m)	Undrained Shear Strength, Cu (kPa)
1.5	>100

Groundwater seepage into test pit observed at about 3.0 metres below existing ground surface, December 10, 2012.

TP2 Elev. 79.06m	0.00 – 0.30	TOPSOIL
	0.30 – 3.51	Very stiff to stiff grey brown, becoming grey with depth SILTY CLAY
	3.51	End of test pit, refusal on large boulder or possible bedrock

Depth (m)	Undrained Shear Strength, Cu (kPa)
1.2	>100
2.4	60

Groundwater seepage into test pit observed at about 1.5 metres below existing ground surface, December 10, 2012.

TABLE II (continued)

TEST PIT NUMBER	DEPTH (METRES)	DESCRIPTION
TP3 Elev. 78.49m	0.00 – 0.23	TOPSOIL
	0.23 – 0.69	Grey brown SILTY SAND
	0.69 – 1.14	Grey medium to coarse SAND, trace silt
	1.14 – 4.27	Very stiff to stiff SILTY CLAY
	4.27 – 4.42	Grey brown coarse sand, some silt, clay, gravel and cobbles (GLACIAL TILL)
	4.42	End of test pit

Depth (m)	Undrained Shear Strength, Cu (kPa)
2.4	84
3.4	56

Groundwater seepage into test pit observed at about 1.5 metres below existing ground surface, December 10, 2012.

TP4 Elev. 79.62m	0.00 – 0.30	TOPSOIL
	0.30 – 1.45	Yellow brown becoming grey brown at 0.7 metres depth SILTY SAND
	1.45 – 4.11	Very stiff to stiff grey brown, becoming grey at about 3.0 metres depth SILTY CLAY
	4.11	End of test pit

Groundwater seepage into test pit observed at about 4.1 metres below existing ground surface, December 10, 2012.

TABLE II (continued)

TEST HOLE NUMBER	DEPTH (METRES)	DESCRIPTION
TP5 Elev. 79.42m	0.00 – 0.48	TOPSOIL
	0.48 – 2.92	Very stiff to stiff grey brown, becoming grey at about 1.1 metres depth SILTY CLAY
	2.92	End of test pit, refusal on large boulder or possible bedrock

Groundwater seepage into test pit observed at about 2.7 metres below existing ground surface, December 10, 2012.

TP6 Elev. 78.40m	0.00 – 0.30	TOPSOIL
	0.30 – 4.00	Very stiff to stiff grey brown, becoming grey with depth SILTY CLAY
	4.00	End of test pit, refusal on large boulder or possible bedrock

Depth (m)	Undrained Shear Strength, Cu (kPa)
1.4	>100
2.0	60
3.0	50
4.0	50

Groundwater seepage into test pit observed at about 1.5 metres below existing ground surface, December 10, 2012.

TABLE II (continued)

TEST HOLE NUMBER	DEPTH (METRES)	DESCRIPTION
TP7 Elev. 79.41m	0.00 – 0.30	TOPSOIL
	0.30 – 1.40	Yellow brown medium to coarse SAND, trace silt
	1.40 – 4.00	Very stiff to stiff grey brown, becoming grey with depth SILTY CLAY
	4.00	End of test pit

Depth (m)	Undrained Shear Strength, Cu (kPa)
1.6	>100
3.0	60
4.0	50

Groundwater seepage into test pit observed at about 4.0 metres below existing ground surface, December 10, 2012.

TP8 Elev. 79.41m	0.00 – 0.30	TOPSOIL
	0.30 – 1.60	Yellow brown to grey brown medium to coarse SAND, trace silt
	1.60 – 4.00	Very stiff to stiff grey brown, becoming grey with depth SILTY CLAY
	4.00	End of test pit

Depth (m)	Undrained Shear Strength, Cu (kPa)
3.0	>100
4.0	>100

No groundwater seepage observed in test pit, December 10, 2012.

TABLE II (continued)

TEST HOLE NUMBER	DEPTH (METRES)	DESCRIPTION
TP9 Elev. 79.59m	0.00 – 0.30	TOPSOIL
	0.30 – 1.60	Yellow brown to grey brown medium to coarse SAND, trace silt
	1.60 – 4.00	Very stiff to stiff grey brown, becoming grey with depth SILTY CLAY
	4.00	End of test pit

No groundwater seepage observed in test pit, December 10, 2012.

TP10 Elev. 79.21m	0.00 – 0.30	TOPSOIL
	0.30 – 1.40	Yellow brown medium to coarse SAND, trace silt
	1.40 – 4.00	Very stiff to stiff grey brown, becoming grey with depth SILTY CLAY
	4.00	End of test pit

Groundwater seepage into test pit observed at about 4.0 metres below existing ground surface, December 10, 2012.

TABLE II (continued)

TEST HOLE NUMBER	DEPTH (METRES)	DESCRIPTION
TP11 Elev. 78.57m	0.00 – 0.30	TOPSOIL
	0.30 – 3.60	Very stiff to stiff grey brown, becoming grey with depth SILTY CLAY
	3.60 – 3.90	Grey brown coarse sand, some silt, clay, gravel and cobbles (GLACIAL TILL)
	3.90	End of test pit

Depth (m)	Undrained Shear Strength, Cu (kPa)
0.8	>100
1.5	80
2.0	70
3.0	80

Groundwater seepage observed in test pit at about 0.8 metres below existing ground surface, December 10, 2012.

TP12 Elev. 80.02m	0.00 – 0.30	TOPSOIL
	0.30 – 3.80	Very stiff to stiff grey brown, becoming grey with depth SILTY CLAY
	3.80 – 4.00	Grey brown coarse sand, some silt, clay, gravel and cobbles (GLACIAL TILL)
	4.00	End of test pit

Depth (m)	Undrained Shear Strength, Cu (kPa)
1.0	>100
3.0	80

Groundwater seepage observed in test pit at about 3.4 metres below existing ground surface, December 10, 2012.

TABLE II (continued)

TEST HOLE NUMBER	DEPTH (METRES)	DESCRIPTION
TP13 Elev. 72.12m	0.00 – 0.20	TOPSOIL
	0.20	End of test pit, refusal on large boulder or possible bedrock

No groundwater seepage observed in test pit, December 10, 2012.

TP14 Elev. 70.57m	0.00 – 0.30	TOPSOIL
	0.30 – 1.20	Grey brown SILTY SAND
	1.20 – 2.00	Very stiff to stiff grey brown, becoming grey with depth SILTY CLAY
	2.00	End of test pit, refusal on large boulder or possible bedrock

Depth (m)	Undrained Shear Strength, Cu (kPa)
1.8	80

Groundwater seepage observed in test pit at about 1.8 metres below existing ground surface, December 10, 2012.

TABLE II (continued)

TEST HOLE NUMBER	DEPTH (METRES)	DESCRIPTION
TP15 Elev. 70.32m	0.00 – 0.30	TOPSOIL
	0.30 – 1.40	Grey brown SILTY SAND
	1.40 – 3.90	Very stiff to firm grey brown, becoming grey with depth SILTY CLAY
	3.90	End of test pit, refusal on large boulder or possible bedrock

Depth (m)	Undrained Shear Strength, Cu (kPa)
1.6	80
2.0	60
3.0	52
3.6	40

Groundwater seepage observed in test pit at about 3.9 metres below existing ground surface, December 10, 2012.

TP16 Elev. 70.73m	0.00 – 0.30	TOPSOIL
	0.30 – 1.00	Grey brown medium SAND
	1.00 – 2.10	Very stiff to firm grey brown, becoming grey with depth SILTY CLAY
	2.10	End of test pit, refusal on large boulder or possible bedrock

Depth (m)	Undrained Shear Strength, Cu (kPa)
1.5	>100
1.8	50
2.0	40

Groundwater seepage observed in test pit at about 1.2 metres below existing ground surface, December 10, 2012.

TABLE II (continued)

TEST HOLE NUMBER	DEPTH (METRES)	DESCRIPTION
TP17 Elev. 70.77m	0.00 – 0.30	TOPSOIL
	0.30 – 1.00	Grey brown medium SAND
	1.00 – 2.10	Very stiff to firm grey brown, becoming grey with depth SILTY CLAY
	2.10	End of test pit, refusal on large boulder or possible bedrock

Groundwater seepage observed in test pit at about 1.2 metres below existing ground surface, December 10, 2012.

TP18 Elev. 70.96m	0.00 – 0.30	TOPSOIL
	0.30 – 0.60	Grey brown fine to medium SAND
	0.60 – 2.60	Very stiff to firm grey brown, becoming grey with depth SILTY CLAY
	2.60	End of test pit, refusal on large boulder or possible bedrock

Depth (m)	Undrained Shear Strength, Cu (kPa)
1.2	>100
1.8	50
2.4	38

Groundwater seepage observed in test pit at about 2.0 metres below existing ground surface, December 10, 2012.