Appendix B:
Hydrologic & Hydraulic Modelling Technical Memorandum

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Drainage Master Plan

HYDROLOGIC & HYDRAULIC MODELLING - TECHNICAL MEMORANDUM

The Corporation of the City of Barrie

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1 Introduction

Tatham Engineering Limited (Tatham) has been retained by the City of Barrie (City) to prepare a Drainage Master Plan. The purpose of the Drainage Master Plan is to identify the existing deficiencies in the minor and major storm drainage systems across the City using the recently developed minor/major drainage system models and develop solutions to address the deficiencies. The Drainage Master Plan will provide the City with a set of preferred alternative solutions to the identified drainage deficiencies for each watershed that will have the greatest positive impact on the natural, physical, cultural, social and economic environments. A series of technical memorandum have been prepared to accompany the Drainage Master Plan. This technical memorandum has been prepared to summarize the work completed to update the existing minor/major drainage system models and model the improvement alternatives.

1.1 BACKGROUND

The minor/major drainage system models previously developed were used to identify deficiencies across the City as part of the City Wide Model Development Project in 2015/2016. Information regarding the identification and resolution of data gaps required for the models and the process for creating and calibrating the PCSWMM, Visual OTTHYMO and HEC RAS models are described in the following reports:

- Background Data Review and Data Gap Analysis Summary Report. C.C. Tatham & Associates Ltd. (April 2016); and
- Hydrologic/Hydraulic Model - Standard Operating Procedures. C.C. Tatham & Associates Ltd. (2017).

At the outset of the Drainage Master Plan, several areas were identified for improvement requiring an update to the existing models. Furthermore, a Technical Advisory Committee (TAC) was formed consisting of Tatham, the City, the Lake Simcoe Region Conservation Authority (LSRCA) and the Nottawasaga Valley Conservation Authority (NVCA). The TAC is responsible for the technical review of the Drainage Master Plan including the evaluation of the alternative improvement options.

1.2 OBJECTIVES

The objective of this memorandum is to summarize the updates made to the recently developed minor/major drainage system models and to summarize the modelling completed to evaluate the alternative solutions. The primary objectives of the updates were to:

- Apply the current 2016 GIS land use layers to the hydrologic models;
- Address the model deficiencies identified in the *Technical Proposal* (CCTA, March 2017);

- Verify the model calibration; and
- Analyze the locations of interwatershed spills.

The updates were completed to ensure the baseline models are accurate such that existing deficiencies could be established. Following the updates, the models were used to identify drainage deficiencies and evaluate potential solutions. Details of the work completed to update the models, identify the existing deficiencies and evaluate the alternative solutions are summarized in the following sections of this memorandum.

2 Minor Drainage System PCSWMM Model

The minor drainage system PCSWMM models were developed as part of the City Wide Model Development Project. For this study, a number of improvements and updates were applied to the existing models as described in the following sections.

2.1 HYDROLOGIC MODEL PARAMETERS

The main update to the existing PCSWMM models was to use the 2016 impervious GIS layers to update the subcatchment imperviousness and percent routed (percentage of impervious area draining onto a pervious surface). For the City Wide Model Development Project, 2007 impervious GIS layers were used to define the subcatchment imperviousness and percent routed. A watershed/drainage area comparison of the 2007 impervious GIS layers to the 2016 impervious GIS layers is provided in Table 1.

Table 1: Updated Subcatchment Imperviousness and Percent Routed Summary

WATERSHED/DRAINAGE AREA	AREA (ha)	RELATIVE CHANGE TO IMPERVIOUSNESS (%)	RELATIVE CHANGE TO PERCENT ROUTED (%)
Bayshore	50	38.0	17.1
Gray Lane	19	21.2	20.6
Hewitts Creek	762	27.1	14.3
Lovers Creek	2,538	1.5	-25.3
Royal Oak	14	6.1	9.2
Bunkers Creek	361	3.7	9.3
Dyments Creek	580	11.6	-0.7
Hotchkiss Creek	483	7.9	4.3
Huronia	93	-0.8	7.6
Johnson	83	3.7	10.3
Kidds Creek	488	0.4	13.8
Minets Point	6	6.7	-2.7
Mulcaster	41	3.6	20.8
Nelson	61	0.2	34.8
Rodney	29	6.7	13.3
Sophia Creek	463	3.4	11.0
St. Vincent	36	2.5	12.8
Whiskey Creek	638	3.4	3.8
Williams/Holgate	84	4.7	-39.8
Bear Creek	1,700	16.0	4.4
Georgian Creek	270	8.4	9.9
Little Lake	445	10.3	10.5
Total	**9,246**	**7.2**	**6.1**

As per Table 1, the imperviousness updates for most watersheds were minor (<10%). The largest changes resulted in the smaller drainage areas and the more rural watersheds.

The imperviousness update was the only wide scale change applied to the PCSWMM models. However, additional deficiencies/areas for improvement were identified during the update process. Minor improvements included updating the classification of pipes and inverts where necessary and refinement of the subcatchments and hydraulic networks based on the November 2016 AECOM Draft Drainage and Hydrology Report prepared in support of the proposed Highway 400 improvements. This report provided additional drainage details related to the Highway 400 culvert crossings. Therefore, the PCSWMM subcatchments and routing were updated based on the additional details now available for these crossings.

2.2 CALIBRATION AND VERIFICATION

Following the PCSWMM model updates, a calibration check was required. As part of the City Wide Model Development Project, the following steps were followed for calibration and verification:

- The subcatchment parameters that have inherent uncertainty and are appropriate for adjustment were identified;
- A sensitivity analysis was completed to determine the impact of each individual parameter (percent routed was consistently the most sensitive parameter);
- For watersheds with historical creek flow monitoring data, a six month continuous simulation was completed;
- The peak flows for the 20 largest storm events within the six month period were used to determine the appropriate parameter adjustments; and
- The best-fit parameter adjustments for the 20 individual storm events were applied to the models and six major storm events from 2011 to 2014 were simulated to verify the calibration adjustments.

A more detailed description of the calibration and verification process is provided in the Standard Operating Procedures (CCTA, 2017).

A similar process was followed for calibration and verification of the updated PCSWMM models. For the updated models, the resultant hydrographs were compared to the verification storms identified in the City Wide Model Development Project. Based on this comparison, we determined whether the original parameter adjustments should continue to be applied to the updated model, or if an adjusted calibration should be used. The calibration adjustments that were applied based on this analysis are summarized in Table 2.



Table 2: Updated Model Calibration Summary

WATERSHED/DRAINAGE AREA	UPDATED CALIBRATION	RELATIVE CHANGE TO PERCENT ROUTED (%)
Hewitts Creek	Original Calibration Applied	-100
Lovers Creek	Original Calibration Applied	-60
Bunkers Creek	Original Calibration Applied	+75
Dyments Creek	No Change	0
Hotchkiss Creek	Original Calibration Applied	+100
Kidds Creek	No Change	0
Sophia Creek	Original Calibration Applied	+85
Whiskey Creek	Original Calibration Applied	-46

Following the selection of the appropriate calibration adjustments, the calibration factors were applied to the PCSWMM models and the six month continuous simulation was reanalyzed to validate the model calibration. The results of the model calibration are summarized in Appendix B for reference.

2.3 FUTURE CONDITIONS ANALYSIS

In accordance with the *Technical Proposal* (CCTA, 2017), a 20% increase has been applied to the existing peak flows to represent future conditions, account for climate change and add a safety factor. As a dynamic wave unsteady model, PCSWMM uses rainfall data to generate hydrographs for each conduit and a direct 20% increase to existing peak flows is not possible. Therefore the 20% increase was applied to the rainfall data and the resulting peak flows were considered representative of future conditions. The updated PCSWMM models have been digitally submitted with this Technical Memorandum (Appendix V). The updated model results for future conditions may be accessed from the digital models.



3 Major Drainage System Visual OTTHYMO Model

As with the minor drainage system models, the major drainage system Visual OTTHYMO models that were developed as part of the City Wide Model Development Project were updated based on the new data. The Visual OTTHYMO model updates were more extensive as additional scenarios were required for the major storms and refinement of the stormwater management facility (SWMF) stage-storage-discharge (SSD) tables. A full description of the Visual OTTHYMO model updates is summarized in the following sections.

3.1 HYDROLOGIC MODEL PARAMETERS

As summarized in Section 2, the 2016 impervious GIS layers are notably different than the 2007 impervious GIS layers. Therefore, the Visual OTTHYMO major drainage system hydrologic model input parameters were updated using the 2016 impervious GIS layers. The major drainage system subcatchments that were delineated during the City Wide Model Development Project were also re-analyzed based on soil type and the updated 2016 GIS land use layers to generate new subcatchment curve numbers. Each subcatchment in the Visual OTTHYMO models were updated with the revised CN numbers, percent impervious and percent directly connected values.

Similar to the PCSWMM models, the Visual OTTHYMO model subcatchments and routing at the Highway 400 crossings were updated based on AECOM's *Draft Drainage and Hydrology Report*.

3.2 SWMF STAGE-STORAGE-DISCHARGE RELATIONSHIPS

As part of the *Technical Proposal*, the SWMF stage-storage-discharge (SSD) tables from the original models that were exceeded during the Regional storm event were identified as a required model update. Generally, the SSD tables did not account for the SWMF overflows/emergency spillways and provided unrealistic volume control in the Visual OTTHYMO models. During the model updates, these SSD tables were evaluated and extended where necessary to properly consider the Regional storm event. To update the SSD tables, the 2016 LiDAR data was used to extend the stage-area relationships and identify spillways/overflows as required. The updated SSD tables are included in Appendix C for reference.

3.3 REGIONAL STORM MODEL SCENARIO

An additional Visual OTTHYMO scenario was created for each study area to generate Regional Storm peak flows in accordance with the requirements of each conservation authority as resolved through the TAC. For the LSRCA study areas, the additional scenario considers the Hurricane Hazel storm under AMCIII conditions with all route reservoirs (SWMF's) removed. For the NVCA



study area, the additional scenario considers the Timmins storm under AMCII conditions with all SWMF's removed.

3.4 MODIFIED CN MODEL SCENARIO

During the model updates, the TAC reviewed the use of the SCS Curve Number (CN) method versus the Modified Curve Number (CN*) infiltration method. The TAC agreed that the Modified Curve Number is preferred for sizing and evaluating SWMF's and the SCS Curve Number method for sizing conveyance infrastructure (culverts, channels, sewers). Since the Modified Curve Number infiltration method was deemed useful, duplicate Visual OTTHYMO models were created for each study area and the infiltration method was adjusted to the Modified Curve Number method. The conversion tables for AMCII to AMCIII and CN to CN* are included in Appendix D for reference.

3.5 FUTURE CONDITIONS ANALYSIS

Future land use was not analyzed for future conditions scenarios. Instead, a 20% increase to the Visual OTTHYMO existing condition peak flows was applied as an allowance for future conditions, climate change and as a safety factor.

3.6 UPDATED MODEL RESULTS

Summaries of the updated model results for each watershed are provided in Appendix E. The summaries include a comparison of the model results from the original Master Drainage Plan, City Wide Models (using 2007 LiDAR) and the updated models (using 2016 LiDAR).

The updated Visual OTTHYMO models have been digitally submitted with this Technical Memorandum. The detailed model results may be accessed from the digital models.



4 Major Drainage System HEC RAS Model

The original hydraulic models of the 13 creeks in the City of Barrie were created in GeoHECRAS based on previously developed HEC RAS models using a terrain generated from the 2007 LiDAR data. The 2007 LiDAR data was considered accurate for this purpose and no hydraulic updates were applied based on the 2016 LiDAR data. The steady flow data in the HEC RAS models was updated based on flows generated in the updated Visual OTTHYMO models. An additional flow scenario was then created with the 20% increase applied to account for future conditions, climate change and as a safety factor.

An analysis of interwatershed spills was also completed. This analysis impacted the steady flow data for both existing and future conditions and is fully described in Section 5.

The updated HEC RAS models have been digitally submitted with this Technical Memorandum (Appendix V). The updated model results may be accessed from the digital models.



5 Spills Analysis

During major storm events, there is potential for interwatershed spills in some areas of the Barrie Creeks drainage study area. The original models and the background reports have identified the spill areas, however a detailed analysis and consistent approach for analyzing spills has not been established. A key component of the modelling updates for this Drainage Master Plan included completing the spills analysis and applying the results of this analysis in a manner agreed upon with the TAC. The following sections provide a detailed summary of the spills analysis methodology and results.

5.1 BACKGROUND SUMMARY

The first step was a review of the previous Master Drainage Plans (MDPs) completed for the watersheds in the Barrie Creeks drainage study area. The purpose of the review was to identify key spill locations and clarify the previous approaches used to analyze deficiencies and improvement options in watersheds impacted by spills.

In 2001, Trow Consulting Engineers Ltd. prepared the *Kidd's Creek Master Drainage Plan Class Environmental Assessment Report* which identified a significant spill from Kidd's Creek to Bunkers Creek at Highway 400 downstream of Sunnidale Park. The MDP quantified the spill from Kidd's Creek to Bunkers Creek as 29 m^3/s based on the depth of roadway overtopping during the Regulatory storm. Additional spills leaving Kidd's Creek watershed that were identified in the MDP are as follows:

- Spill northeast to Sophia Creek along Ross Street south of Wellington Street;
- Spill south to Bunkers Creek at the CNR railway during the 1:5-year return frequency storm and less frequent events; and
- Spill south to Bunkers Creek via Bradford Street during the Regional storm event at a rate of 13 m^3/s.

Since 2001, the spill northeast to Sophia Creek was eliminated by raising Ross Street south of Wellington Street. The CNR railway spill was eliminated through the construction of a floodway from Kempenfelt Bay to Toronto Street and the Bradford Street spill was eliminated by raising the Bradford Street road elevation south of Kidd's Creek.

In 2004, Giffels Associates Ltd. prepared the *Bunkers Creek Master Drainage Plan Update* which identified spill from Bunkers Creek to Kidd's Creek and from Bunkers Creek to Dyments Creek. In a July 2005 letter, Giffels Associates Ltd. noted that spills to Kidd's Creek and Dyments Creek were removed from the base hydrologic model as per the LSRCA's request. Spill to Dyments Creek was identified from Bunkers Creek at Highway 400 due to an undersized culvert. The



analysis indicated a spill of 17.5 m^3/s for the Hurricane Hazel storm and 21.6 m^3/s for the 1:100-year design storm. A second spill was identified along Bunkers Creek (North Branch) at Donald Street. This spill is predicted to travel east to the Kidd's Creek watershed due to an undersized culvert (5.5 m^3/s for the Hurricane Hazel storm and 6.3 m^3/s for the 1:100-year return frequency design storm). Construction of new storm sewer along the North Branch of Bunkers Creek has eliminated this spill.

In 2004, The Jones Consulting Group Ltd. prepared the *Dyments Creek Master Drainage Plan Municipal Class Environment Assessment* with *Final Revisions* dated June 2006 completed by the City of Barrie. The *Final Revisions* report defined the City's approach to spill analysis. The report notes that spill from Bunkers Creek to Dyments Creek was identified at a rate of 27.6 m^3/s for the 1:100-year return frequency design storm and 18.4 m^3/s for the Regional storm event. The spill from Kidd's Creek to Dyments Creek via Bunkers Creek was predicted to only occur during the Regional storm event at a rate of 29 m^3/s. Noting that the spill into the Dyments Creek watershed could seriously exacerbate flooding, the governing authorities agreed at the time that runoff from each watershed should be contained within their respective boundaries and analysis for the Dyments Creek MDP proceeded under this directive.

5.2 MODELLING APPROACH

Through consultation with the TAC, an appropriate method for analyzing spills in the Barrie Creeks drainage study area was established. The TAC agreed that a one-dimensional (1D) steady state HEC RAS model was the most defensible method to produce a conservative analysis of spill potential. The LSRCA noted that two separate supporting methods are required to validate the spills analysis. To fulfil this requirement, the following supporting calculation methods were selected:

- Two-dimensional (2D) PCSWMM model; and
- Discrete calculations (HY-8 analysis and weir calculations) at key locations.

5.2.1 HEC RAS

As per the TAC approved modelling approach, the HEC RAS models were updated to include lateral structures for the spills analysis. The lateral structures, additional channel reaches/cross-sections, junctions, and flow splits required for the spills analysis were all derived from the 2016 LiDAR data. The HEC RAS models were updated to include the updated Visual OTTHYMO model peak flows for the spills analysis. The HEC RAS modelling results and supporting calculations are provided in Appendix F. Digital copies of the models have been submitted with this Technical Memorandum (Appendix V). The detailed model results may be accessed from the digital models.



5.2.2 PCSWMM

The City's detailed DEM offers an excellent opportunity for 2D modelling of the spill areas. Therefore, PCSWMM 2D models were selected to validate the 1D HEC RAS model results. PCSWMM provides an integrated approach that allows for seamless transition between 1D and 2D modelling areas. PCSWMM discretizes the 2D domain with a hexagonal mesh and represents each cell by 2D nodes. 1D depth-averaged momentum and continuity equations are solved along each component of the computational cells to provide accurate 2D modelling of flood depths, flows and velocities.

The original PCSWMM models were used as the base for the 2D models and 2D meshes were created in the identified spill areas. The 1D watercourse conduits through the potential spill areas were trimmed and connected to the 2D mesh. Individual 2D PCSWMM models were developed for the Regional and 1:100-year return frequency storm events. The streamflow hydrographs from the Visual OTTHYMO models were used in the PCSWMM model spills analysis as the Visual OTTHYMO models produce greater peak flows. The streamflow hydrograph peak flows were extended for a 24 hour period to simulate steady-state flow conditions in the PCSWMM spills analysis. A summary of the PCSWMM modelling results is provided in Appendix G for reference. Digital copies of the models have been submitted with this Technical Memorandum (Appendix V). The detailed model results may be accessed from the digital models.

5.2.3 Discrete Calculations

To verify the results of the HEC RAS and PCSWMM spills analysis, discrete calculations were performed at a number of key locations. Specifically, a HY-8 analysis of the culvert crossings where spill occurs was completed. Weir calculations were also completed at key spill locations. The discrete calculations are included in Appendix H for reference.

5.3 EXISTING CONDITIONS

The spills analysis was completed under existing conditions. The results of the 1D HEC RAS analysis are summarized in the following sections. The results of the existing conditions spills analysis are illustrated on Figures 11, 12 and 13 included in Appendix A.

5.3.1 Kidd's Creek

The Kidd's Creek spill occurs at Highway 400 northeast of the Sunnidale Road overpass. A large SWMF (KD01) upstream of Highway 400 controls all flows generated by storms less than the Regional (Hurricane Hazel) storm event such that there is no spill during the 1:2-year through 1:100-year return frequency design storms. During the Regional storm, runoff will spill onto Highway 400 downstream of the SWMF. The flow that spills onto Highway 400 has a number of potential flow paths as follows:



- Upstream of the Sunnidale Road overpass, a large portion of the flow is conveyed southeast from the highway back to Kidd's Creek (main branch);
- The remaining flow spills south through the Sunnidale Road overpass at a peak flow rate of 5.4 m^3/s;
- Downstream of the Sunnidale Road overpass, flow from the highway spills southeast to a tributary of Kidd's Creek at a peak flow rate of 4.8 m^3/s; and
- Further downstream of the Sunnidale Road overpass, the remaining flow spills northwest or southeast from the highway to a small tributary of Bunkers Creek (north branch) at a peak flow rate of 0.6 m^3/s.

A summary of the spills from Kidd's Creek is provided in the following table.

Table 3: Existing Condition Kidd's Creek Spill Summary

STORM	FLOW FROM MAIN BRANCH TO TRIBUTARY (m^3/s)	SPILL TO BUNKERS CREEK (m^3/s)
Hurricane Hazel	4.8	0.6

5.3.2 Bunkers Creek and Dyments Creek

The Bunkers Creek watershed has three primary branches crossing Highway 400 (north branch, south branch and central branch) and one small tributary crossing that connects to the north branch just downstream of Highway 400. Each branch is subject to spill at different rates under the various design storms. Spill is predicted to occur from the north branch to the central branch during a 1:2-year return frequency design storm and less frequent storm events. Spill is predicted to occur from the central branch to the south branch during a 1:5-year return frequency design storm and less frequent storm events. Spill is predicted to occur from the south branch to Dyments Creek during a 1:10-year return frequency design storm and less frequent events. The spills across the Bunkers Creek branches and to Dyments Creek are as follows:

- Flows in the north branch upstream of Highway 400 split in two directions. A portion of the flow crosses Highway 400 through an existing culvert and the remainder spills south through a roadside ditch upstream of Highway 400 referred to as the west roadside ditch for this study;
- The west roadside ditch runs south to Anne Street and a culvert crossing. A portion of the flow spills onto Highway 400 at Anne Street from the west roadside ditch and travels south on Highway 400;

- The west roadside ditch crosses Anne Street upstream of Highway 400 through a culvert and joins the central branch. The central branch crosses under Highway 400 via a culvert southwest of the Anne Street overpass. The culvert capacity is limited and a portion of the flow in the central branch spills south through the west roadside ditch to the south branch;
- The south branch crosses under Highway 400 via a trunk storm sewer that has limited capacity and flow spills south through the west roadside ditch when the sewer capacity is exceeded;
- The spill in the west roadside ditch travels south to the Dunlop Street overpass and overtops Highway 400. The flow overtopping Highway 400 travels in two directions; 1) northeast across Highway 400 back into the south branch of Bunkers Creek and 2) across Highway 400 spilling southeast to Hart Drive and Dyments Creeks; and
- The flow split across Highway 400 back into the south branch of Bunkers Creek versus the spill into Dyments Creek is dependent on the flow and water level in Dyments Creek immediately downstream of Highway 400. As such, the spill varies for different storm events.

A summary of the spills across the Bunkers Creek branches and to Dyments Creek is provided in the following table.

Table 4: Existing Condition Bunkers Creek/Dyments Creek Spill Summary

STORM	NORTH BRANCH TO CENTRAL BRANCH (m^3/s)	CENTRAL BRANCH TO SOUTH BRANCH (m^3/s)	SOUTH BRANCH TO DYMENTS CREEK (m^3/s)
Hurricane Hazel	4.6	6.7	5.0
1:100-Year	4.4	7.9	7.7
1:50-Year	3.5	6.2	5.3
1:25-Year	2.8	4.4	3.4
1:10-Year	1.8	2.3	0.6
1:5-Year	1.1	1.1	0.0
1:2-Year	0.3	0.0	0.0

5.3.3 Whiskey Creek and Hotchkiss Creek

During the Regional (Hurricane Hazel) storm, the Whiskey Creek (main branch) culvert crossing Highway 400 does not have sufficient capacity to convey the peak flow and spills north onto

Highway 400. A SWMF (WK05) upstream of Highway 400 controls all flows generated by storms less than the Regional (Hurricane Hazel) storm event such that there is no spill during the 1:2-year through 1:100-year return frequency design storms. The flow that spills onto Highway 400 has a number of potential flow paths as follows:

- A portion of the flow spills north on Highway 400 to a tributary of Whiskey Creek or Hotchkiss Creek; and
- A majority of the flow spills northeast to a roadside ditch on the east side of Highway 400.

The flows entering the roadside ditch on the east side of Highway 400 also have a number of potential flow paths as follows:

- The majority of the flow spills east from the roadside ditch back into Whiskey Creek (Main Branch);
- A small portion of the flow passes under the Highway 400 on-ramp via a culvert that outlets into the Essa Road Service Centre SWMF; and
- The remaining flow drains back onto Highway 400 via the on-ramp and spills to Hotchkiss Creek.

The tributary of Whiskey Creek is also subject to spill at Highway 400 during the Regional storm event. The flow that does not cross Highway 400 through the culvert spills north to Hotchkiss Creek through the west roadside ditch along Highway 400. A summary of the spills from Whiskey Creek is provided in the following table.

Table 5: Existing Condition Whiskey Creek and Hotchkiss Creek Spill Summary

STORM	WHISKEY CREEK MAIN BRANCH TO TRIBUTARY BRANCH (m^3/s)	SPILL TO HOTCHKISS CREEK (m^3/s)
Hurricane Hazel	4.4	3.9

5.4 FUTURE CONDITIONS

The spills analysis was also completed for the future condition peak flows. As discussed, a 20% increase was applied to the peak flows to represent future conditions, account for climate change and as a safety factor for this study.

The spill locations are the same as described under existing conditions, however the magnitudes of each spill are greater. The results of the future condition 1D HEC RAS analysis is summarized in the following Tables. The results of the future conditions spills analysis are illustrated on Figures 11, 13 and 14 included in Appendix A.

Table 6: Future Condition Kidd's Creek Spill Summary

STORM	FLOW FROM MAIN BRANCH TO TRIBUTARY (m^3/s)	SPILL TO BUNKERS CREEK (m^3/s)
Hurricane Hazel	4.8	0.6

Table 7: Future Condition Bunkers Creek/Dyments Creek Spill Summary

STORM	NORTH BRANCH TO CENTRAL BRANCH (m^3/s)	CENTRAL BRANCH TO SOUTH BRANCH (m^3/s)	SOUTH BRANCH TO DYMENTS CREEK (m^3/s)
Hurricane Hazel	4.6	6.7	5.0
1:100-Year	5.7	9.6	7.7
1:50-Year	4.7	8.1	5.3
1:25-Year	3.7	6.3	3.4
1:10-Year	2.4	3.6	0.6
1:5-Year	1.6	1.7	0.0
1:2-Year	0.6	0.2	0.0

Table 8: Future Condition Kidd's Creek Spill Summary

STORM	WHISKEY CREEK MAIN BRANCH TO TRIBUTARY BRANCH (m^3/s)	SPILL TO BUNKERS CREEK (m^3/s)
Hurricane Hazel	4.4	3.9

5.5 MTO IMPROVEMENTS

The MTO is proposing Highway 400 improvements from approximately Highway 89 to Highway 11 including the stretch through the City of Barrie. The improvements include widening Highway 400 to 10 lanes, interchange improvements, centre median improvements to a standard concrete centre barrier, and drainage improvements including storm sewer and culvert upgrades. These

improvements will have a direct impact on the interwatershed spills. The MTO has indicated that alternative barrier designs will be considered at locations identified by the City to allow surface runoff to overtop the highway without impediment. However, the improvements will still impact the interwatershed spill characteristics.

The MTO proposes to replace the existing culverts that do not satisfy their *Highway Drainage Design Standards* (2008). Highway 400 has been designated as a Freeway by the MTO and according to their designs standards the culverts/bridges are to be designed in accordance with the following flood hazard criteria:

- 1:50-year design storm peak flow for spans less than 6 m; and
- 1:100-year design storm peak flow for spans greater than 6 m.

It is understood that the culverts proposed within the limits of the City are less than 6 m in span and will be designed to convey the 1:50-year design storm peak flow, except for the Dyments Creek crossing. The Dyments Creek culvert is being designed to convey the 1:100-year design storm peak flow. The MTO proposed culvert improvements are as follows:

- Kidd's Creek (Culvert 14) – existing culvert to be extended and remain;
- Bunkers Creek North Branch (Culvert 143) – 2400 mm × 1830 mm conc. box culvert;
- Bunkers Creek Central Branch (Culvert 142) – 4200 mm × 1500 mm conc. box culvert;
- Bunkers Creek South Branch (Culvert 141) – Twin 1800 mm × 1200 mm conc. box culvert;
- Dyments Creek (Culvert 33) – 9000 mm × 2000 mm conc. box culvert;
- Hotchkiss Creek main branch (Culvert 46) – 1800 mm Dia. CSP lined with 1070 mm Dia. liner and new 2100 mm Dia. CSP; and
- Whiskey Creek main branch (Culvert 55) – 2250 mm Dia. conc. culvert.

5.5.1 Modelling Approach

To assess the impact that the proposed Highway 400 improvements have on the interwatershed spills, the existing conditions spill analysis was updated to include the proposed road cross-section, road profile and culvert improvements. The 2016 LiDAR data was modified for the HEC RAS and PCSWMM models to include the proposed Highway 400 cross-section including super-elevated features according to AECOM's *Drainage and Hydrology Report* (2017). The upstream hydrology was not changed.

The existing HEC RAS models were updated to include the proposed culvert upgrades and the lateral structures, channel reaches/cross-sections, junctions and flow splits that were required for the modified spills analysis. The HEC RAS modelling results and supporting calculations are



provided in Appendix I and digital copies of the models have been submitted with this Technical Memorandum (Appendix V).

The 2D hydraulic analysis was also updated in PCSWMM to verify the results of the HEC RAS spills analysis following the process described in Section 7.2.2. The detailed DEM and the culvert crossings were updated according to the MTO's proposed improvements and the 2D elements were regenerated. A summary of the PCSWMM modelling results is provided in Appendix J for reference and digital copies of the models have been submitted with this Technical Memorandum (Appendix V).

The discrete calculations completed for the updated geometry are included in Appendix K for reference. The results of the flood spill analysis are summarized in the following sections.

5.5.2 Existing Conditions

The spills analysis was completed under existing condition flows with the proposed Highway 400 improvements applied. The results of the 1D HEC RAS analysis are summarized in the following sections. The results of the existing conditions spills analysis are illustrated on Figures 15 and 16 included in Appendix A.

Kidd's Creek

Following the proposed MTO improvements, the Kidd's Creek spill continues to occur during the Regional (Hurricane Hazel) storm event. However, flow is contained during the 1:2-year through 1:100-year return frequency design storms. The flow that spills onto Highway 400 has a number of potential flow paths as follows:

- Upstream of the Sunnidale Road overpass, a portion of the flow is conveyed southeast from the highway back to Kidd's Creek (main branch);
- The remaining flow spills south through the Sunnidale Road overpass at a peak flow rate of 11.0 m^3/s;
- Downstream of the Sunnidale Road overpass, flow from the highway spills southeast to a tributary of Kidd's Creek at a peak flow rate of 1.8 m^3/s; and
- Further downstream of the Sunnidale Road overpass, a portion of the flow spills northwest or southeast from Highway 400 to a small tributary of the Bunkers Creek (north branch) at a peak flow rate of 3.5 m^3/s. The remaining flow (5.7 m^3/s) is contained within the Highway 400 cross-section beyond the Bunkers Creek north branch.

A summary of the spills from Kidd's Creek is provided in the following table.

Table 9: Existing Condition Kidd's Creek Spill Summary

STORM	FLOW FROM MAIN BRANCH TO TRIBUTARY (m^3/s)	SPILL TO BUNKERS CREEK (m^3/s)
Hurricane Hazel	1.8	9.2

Bunkers Creek and Dyments Creek

As described in Section 5.3, the Bunkers Creek watershed has three primary branches crossing Highway 400 (north branch, south branch and central branch) and one small tributary crossing that connects to the north branch just downstream of Highway 400. Each branch is subject to spill at different rates under various design storms. Following the proposed MTO improvements, spill is predicted to occur from the north branch to the central branch during a 1:100-year return frequency design storm and less frequent storm events. Spill is predicted to occur from the central branch to the south branch during a 1:2-year return frequency design storm and less frequent storm events. Spill is predicted to occur from the south branch to Dyments Creek during a 1:100-year return frequency design storm and less frequent events. The spills across the Bunkers Creek branches and to Dyments Creek are as follows:

- The flow from the Kidd's Creek spill is mostly contained within the Highway 400 cross-section. As previously described, 1.8 m^3/s spills to a tributary of Kidd's Creek and 9.2 m^3/s spills to Bunkers Creek. Of the 9.2 m^3/s spill, approximately 3.5 m^3/s spills to the north branch, 0.3 m^3/s spills to the central branch and 5.4 m^3/s continues within the Highway 400 cross-section to Dyments Creek;
- Flows in the north branch upstream of Highway 400 split in two directions. A portion of the flow crosses Highway 400 through the proposed 2400 mm × 1830 mm box culvert and the remainder spills south through the west roadside ditch;
- The west roadside ditch crosses Anne Street upstream of Highway 400 through a culvert and joins the central branch. The central branch crosses under Highway 400 via the proposed 4200 mm × 1500 mm box culvert southwest of the Anne Street overpass. The west roadside ditch does not allow flow to build up at the culvert crossing and flow from the central branch spills south through the west roadside ditch to the south branch;
- The south branch crosses under Highway 400 via the proposed twin 1800 mm × 1200 mm box culverts to a trunk storm sewer that has limited capacity. Flow spills south through the west roadside ditch when the sewer capacity is exceeded;
- The spill in the west roadside ditch backs up until it spills to the Dyments Creek watershed upstream of the Highway 400 crossing. The super-elevation of Highway 400 prevents flow from overtopping Highway 400 through this portion;



- Dyments Creek crosses under Highway 400 through the proposed 9000 mm × 2000 mm box culvert with sufficient capacity for the Regional event plus the spills from Bunkers Creek and Kidd's Creek.

A summary of the spills across the Bunkers Creek branches and to Dyments Creek is provided in the following table.

Table 10: Existing Condition Bunkers Creek/Dyments Creek Spill Summary

STORM	NORTH BRANCH TO CENTRAL BRANCH (m^3/s)	CENTRAL BRANCH TO SOUTH BRANCH (m^3/s)	SOUTH BRANCH TO DYMENTS CREEK (m^3/s)
Hurricane Hazel	6.9*	8.0*	8.9*
1:100-Year	0.8	2.9	1.0
1:50-Year	0.5	2.3	0.0
1:25-Year	0.2	1.6	0.0
1:10-Year	0.0	0.9	0.0
1:5-Year	0.0	0.5	0.0
1:2-Year	0.0	0.1	0.0

Note: * includes spill from Kidd's Creek that is conveyed along Highway 400.

Whiskey Creek and Hotchkiss Creek

During the Regional (Hurricane Hazel) storm, the proposed Whiskey Creek (main branch) culvert crossing improvement has sufficient capacity to convey the peak flow, thus eliminating the spill between Whiskey Creek and Hotchkiss Creek.

5.5.3 Future Peak Flows

The spills analysis was also completed for the future peak flows following the proposed MTO improvements. As discussed, a 20% increase is applied to the peak flows to represent future conditions, account for climate change and as a safety factor for this study. The spill locations are the same as described for existing condition peak flows, however the magnitudes of each spill are greater. The results of the future peak flows 1D HEC RAS analysis is summarized in the following tables. The results of the future peak flows spill analysis are illustrated on Figures 15 and 17 enclosed.

Table 11: Future Kidd's Creek Condition Kidd's Creek Spill Summary

STORM	FLOW FROM MAIN BRANCH TO TRIBUTARY (m^3/s)	SPILL TO BUNKERS CREEK (m^3/s)
Hurricane Hazel	1.8	9.2

Table 12: Future Bunkers Creek/Dyments Creek Spill Summary

STORM	NORTH BRANCH TO CENTRAL BRANCH (m^3/s)	CENTRAL BRANCH TO SOUTH BRANCH (m^3/s)	SOUTH BRANCH TO DYMENTS CREEK (m^3/s)
Hurricane Hazel	6.9*	8.0*	8.9*
1:100-Year	1.3	4.2	3.4
1:50-Year	0.9	3.2	1.3
1:25-Year	0.5	2.2	0.0
1:10-Year	0.2	1.2	0.0
1:5-Year	0.0	0.8	0.0
1:2-Year	0.0	0.2	0.0

Note: * includes spill from Kidd's Creek that is conveyed along Highway 400.

6 Regulatory Storm Events

As discussed, the original model development and the background reports identified spills in the Barrie Creeks drainage study area, however the modelling completed ignored the spills under the assumption that runoff from each watershed should be contained within their respective boundaries. As such, the individual Master Drainage Plans were completed, and the existing floodplain mapping was prepared ignoring the interwatershed spills.

Ignoring the interwatershed spills in certain watersheds is conservative. For example, those creeks that spill into adjacent watershed lose flow. As such, carrying the total streamflow downstream ignoring the loss of water from the spill will produce conservative flood levels. However, the opposite can be said for those watersheds receiving spill. The flow downstream of a spill will increase in the watersheds receiving the spill. Carrying the total streamflow downstream without adding in the spill underestimates the peak flows in the reaches downstream of the spill and produces lower flood levels.

To address the interwatershed spills moving forward and accurately model the existing creeks, it was decided in consultation with the City, LSRCA and NVCA that the worst case peak flows for each creek considering no spill and spill would be used for this study moving forward. In the case of Kidd's Creek and Whiskey Creek there is no change to the peak flows as the worst-case scenario excludes the spill out of the watershed. As such, the floodplain delineation for the creek is still valid. However, for Bunkers Creek, Dyments Creek and Hotchkiss Creek, the most conservative approach includes the addition of the spill from the adjacent watersheds to their peak flows downstream of Highway 400. A summary of the updated existing conditions Regulatory peak flows for the Barrie Creeks is provided in the following table.

Table 13: Existing Condition Regulatory Peak Flows for Barrie Creeks Drainage Study Area

WATERSHED/DRAINAGE AREA	REGULATORY STORM EVENT	PEAK FLOW DOWNSTREAM OF HIGHWAY 400 (m^3/s)
Kidd's Creek	Hurricane Hazel	47.5
Bunkers Creek		
North Branch	Hurricane Hazel	8.8
Central Branch	1:100-Year SCS	7.7
South Branch	Hurricane Hazel	15.9
Dyments Creek	Hurricane Hazel	54.9
Hotchkiss Creek	Hurricane Hazel	25.0
Whiskey Creek	Hurricane Hazel	21.2

A summary of the future condition Regulatory peak flows for the Barrie Creeks is provided in the following table.

Table 14: Existing Condition Regulatory Peak Flows for Barrie Creeks Drainage Study Area

WATERSHED/DRAINAGE AREA	REGULATORY STORM EVENT	PEAK FLOW DOWNSTREAM OF HIGHWAY 400 (m^3/s)
Kidd's Creek	Hurricane Hazel	47.5
Bunkers Creek		
North Branch	1:100-Year SCS	10.1
Central Branch	1:100-Year SCS	9.2
South Branch	Hurricane Hazel	15.9
Dyments Creek	Hurricane Hazel	54.9
Hotchkiss Creek	Hurricane Hazel	29.5
Whiskey Creek	Hurricane Hazel	21.2

Similarly, the interwatershed spills dictate the governing peak flows for Kidd's Creek, Bunkers Creek and Dyments Creek following the proposed MTO improvements. Summaries of the existing and future conditions Regulatory peak flows for the Barrie Creeks following the proposed MTO improvements are provided in the following tables:

Table 15: Existing Regulatory Peak Flows for Barrie Creeks Drainage Study Area Following Proposed MTO Improvements

WATERSHED/DRAINAGE AREA	REGULATORY STORM EVENT	PEAK FLOW DOWNSTREAM OF HIGHWAY 400 (m^3/s)
Kidd's Creek	Hurricane Hazel	47.5
Bunkers Creek		
North Branch	Hurricane Hazel	11.0
Central Branch	Hurricane Hazel	7.8
South Branch	Hurricane Hazel	14.1
Dyments Creek	Hurricane Hazel	58.8

Table 16: Existing Regulatory Peak Flows for Barrie Creeks Drainage Study Area Following Proposed MTO Improvements

WATERSHED/DRAINAGE AREA	REGULATORY STORM EVENT	PEAK FLOW DOWNSTREAM OF HIGHWAY 400 (m^3/s)
Kidd's Creek	Hurricane Hazel	47.5
Bunkers Creek		
North Branch	Hurricane Hazel	11.0
Central Branch	1:100-Year SCS	9.2
South Branch	Hurricane Hazel	14.1
Dyments Creek	Hurricane Hazel	58.8



7 Minor System Deficiencies

The updated existing conditions PCSWMM minor drainage system model was used to establish the existing deficiencies in the minor drainage system across the study area. For the purpose of this study, the deficiencies were identified for the 1:5-year return frequency 6-hour SCS design storms. The minor drainage system deficiencies are illustrated on Figures 1A through 5A – Minor Drainage System Deficiencies included in Appendix A. For this study, the storm sewer has been characterized as follows based on conveyance capacity:

1. Peak Flow/Storm Sewer Full Flow Capacity (Qmax/Qfullflow) < 85% - storm sewer capacity exceeds design storm peak flow (storm sewer has adequate capacity) by greater than 15% and satisfies the current municipal conveyance criteria.
2. 85% < Peak Flow/Storm Sewer Full Flow Capacity (Qmax/Qfullflow) < 100% - storm sewer capacity exceeds design storm peak flow (storm sewer has adequate capacity) by less than 15%. As such, the peak flow is approaching full flow capacity.
3. 101% < Peak Flow/Storm Sewer Full Flow Capacity (Qmax/Qfullflow) < 115% - design storm peak flow exceeds storm sewer capacity (deficient conveyance capacity) by up to 15% - moderate exceedance.
4. Peak Flow/Storm Sewer Full Flow Capacity (Qmax/Qfullflow) > 115% - design storm peak flow exceeds storm sewer capacity (deficient conveyance capacity) by greater than 15% - severe exceedance.

The areas/streets absent of a minor drainage system are also illustrated on Figures 1A through 5A – Minor Drainage System Deficiencies. The streets absent of storm sewer where highlighted due to the length of road missing a minor drainage system. The City of Barrie Storm Drainage and Stormwater Management Policies and Design Guidelines specify a maximum catch basin spacing of 90 m. As such, any road longer than 90 m absent of existing storm sewer was identified.

In the same manner, the future minor drainage system deficiencies were identified for the 1:5-year return frequency 6-hour SCS design storms by applying a 20% increase to the rainfall data as discussed in Section 2.3. The future minor drainage system deficiencies are illustrated on Figures 6A through 10A – Future Minor Drainage System Deficiencies included in Appendix A.

8 Major System Deficiencies

The updated existing condition HEC RAS hydraulic models of the creeks have been used to establish the existing capacities of the major road culvert crossings, and consequently the level of service provided. The existing capacities of the road crossing culverts are summarized in Appendix L. The major drainage system deficiencies and the Regulatory floodplain are illustrated on Figures 1B through 5B – Major Drainage System Deficiencies included in Appendix A.

The existing conditions PCSWMM minor drainage system model was also used to establish the existing deficiencies in the overland flow routes throughout the study area. For the purpose of this study, deficiencies were defined by the NVCA/LSCRA safe access/egress criteria as follows:

1. Depth of flow exceeds 0.30 m;
2. Velocity of flow exceeds 1.7 m/s; or
3. Depth velocity product exceeds 0.4 m^2/s.

The results for the PCSWMM dual drainage system corresponding to the 1:100-year return frequency 6 Hour SCS design storm were evaluated against the safe access/egress criteria. The overland flow routes that do not satisfy the aforementioned criteria are deficient. The deficient overland flow routes are illustrated on Figures 1B through 5B – Major Drainage System Deficiencies included in Appendix A. The results of the PCSWMM dual drainage system are included in Appendix M for reference.

For this study, the major overland deficiencies have been evaluated using the dual drainage system in PCSWMM and standardized road cross-sections between storm structures. The cross-sections do not necessarily mimic existing conditions, however, they do provide an estimate of the overland flow depths and velocities along the roadway during major storm events. As such, it is recommended that solutions to address the major overland deficiencies be evaluated as part of future road reconstruction projects and improvements be made where feasible.

In the same manner, the future major drainage system deficiencies were identified by applying a 20% increase to the Visual OTTHYMO existing condition peak flows as discussed in Section 3.5. The future major drainage system deficiencies are illustrated on Figures 6B through 10B – Future Major Drainage System Deficiencies included in Appendix A.

9 Alternative Drainage Solution Evaluation

The updated existing and future condition PCSWMM minor drainage system and Visual OTTHYMO and HEC RAS major drainage system models have been used to evaluate the improvement options being considered under the Drainage Master Plan. The models have been revised to include the preliminary conceptual designs to evaluate their effectiveness at reducing peak flows and runoff volumes, improving water quality, reducing flooding and erosion and satisfying City and Conservation Authority Standards and Policies. The alternatives that have been evaluated are described below:

- Alternative 1A – "Do Nothing" Minor Drainage Systems;
- Alternative 1B – "Do Nothing" Major Drainage Systems;
- Alternative 2A – Retrofit/New Stormwater Management Facilities for Quantity Control;
- Alternative 2B – Retrofit/New Stormwater Management Facilities for Quality Control;
- Alternative 2C – Lot Level Low Impact Development;
- Alternative 2D – Linear Low Impact Development;
- Alternative 2E – Centralized Low Impact Development;
- Alternative 3A – Culvert/Watercourse/Major Drainage System Improvements (MDP Recommended Design Flood Frequency Criteria); and
- Alternative 3B – Culvert/Watercourse/Major Drainage System Improvements (City Design Flood Frequency Criteria).

The modelling completed to evaluate the respective alternatives is described in the following sections.

9.1 FLOW REDUCTION/WATER QUALITY IMPROVEMENTS

9.1.1 Alternatives 2A/2B

As described in the *Drainage Master Plan* (CCTA, 2018), an opportunity exists to retrofit and expand existing stormwater management facilities and to construct new stormwater management facilities within the City to improve water quantity control and improve watershed water quality. Retrofit/new SWMF's considered under Alternative 2A primarily address water quantity control through peak flow attenuation and reduction of downstream flooding. These SWMF's have secondary water quality benefits. Retrofit/new SWMF's considered under Alternative 2B primarily address water quality control, promote infiltration and improve the water balance. These SWMF's have secondary water quantity benefits. A full list of the potential

retrofit, expansion and creation opportunities that were considered and the pre-screening evaluation that was applied is described in the *Drainage Master Plan*. The retrofit/new SWMF's that were recommended for further evaluation are described in the following table.

Table 17: SWMF's Recommended for Further Evaluation

SWMF ID (RETROFIT NO.)	DESCRIPTION	INCREASED ACTIVE STORAGE VOLUME (m^3)	ADDITIONAL CONTROL PROVIDED
HT06 (3)	Retrofit existing SWMF to provide water quality treatment and phosphorous removal.	N/A	None
BK03 (10)	Construct underground infiltration system for water quality treatment and erosion control. SWMF outlet modifications for peak flow attenuation.	750	1:2-Year –1:100-Year
KD06 (11)	Construct underground infiltration system for water quality treatment, erosion control and active storage offset (KD02).	5,015	1:2-Year
KD03 (13)	Construct underground infiltration system for water quality treatment, erosion control and active storage offset (KD02).	785	25 mm Storm
DY02 (15)	Construct underground infiltration system for water quality treatment and phosphorous removal.	490	25 mm Storm
RO#17 (KD)	Construct a wet pond SWMF for water quality treatment and erosion control.	9,130	1:2-Year –1:5-Year
KD05 (18)	Construct underground infiltration system for water quality treatment and erosion control. Grade overland flow route from SWMF to Janice Drive.	620	25 mm Storm
WK04 (20)	Install oil grit separator to provide pre-treatment for SWMF.	N/A	None
WK01 (25)	Construct a wetland permanent pool cell to provide water quality treatment.	N/A	None
RO#26 (WK)	Construct a wet pond SWMF to provide water quality treatment, erosion control and peak flow attenuation.	7,250	1:2-Year –1:100-Year
RO#27 (HW)	Construct a wet pond SWMF for water quality treatment and phosphorus removal.	6,250	1:2 Year
HR01 (28)	Retrofit the existing SWMF to include a permanent pool wet pond cell for water quality treatment.	N/A	None
LV02 (30)	Retrofit the existing SWMF to include a permanent pool wet pond cell for water quality treatment.	N/A	None
LV03 (31)	Retrofit the existing SWMF to include a permanent pool wet pond cell for water quality treatment.	N/A	1:2-Year – 1:100 Year

Table 17: SWMF's Recommended for Further Evaluation (continued)

SWMF ID (RETROFIT NO.)	DESCRIPTION	INCREASED ACTIVE STORAGE VOLUME (m^3)	ADDITIONAL CONTROL PROVIDED
LV12 (32)	Retrofit the existing SWMF to include a permanent pool wet pond cell for water quality treatment.	560	25 mm Storm
LV10 (37)	Retrofit the existing SWMF to include a permanent pool wet pond cell for water quality treatment.	445	25 mm Storm
RO#40 (WK)	Construct combination underground infiltration system and dry SWMF in combination with Emergency Services Campus SWMF.	N/A	25 mm Storm
RO#42 (WK)	Construct combination underground infiltration system and dry SWMF for water quality treatment, erosion control and peak flow attenuation.	7,785	1:2-Year – 1:100-Year
RO#44 (HT)	Construct wetland SWMF for water quality treatment and phosphorous removal.	11,550	1:2-Year – 1:5-Year
LV05 (45)	SWMF cleanout and channel improvements to repair and stabilize existing bed and bank erosion.	N/A	None
HT13 (48)	Construct peak flow attenuation SWMF for erosion control and peak flow attenuation.	21,090	1:2-Year – 1:100-Year
BR08b (61)	Expand existing SWMF to increase the permanent pool volume provided for water quality treatment.	N/A	None
BR05 (62)	Expand existing SWMF to increase the permanent pool volume provided for water quality treatment.	N/A	None
LV07 (65)	Retrofit existing SWMF to include a sediment forebay and underground infiltration system for water quality treatment.	2,910	25 mm
LV01 (68)	Expand existing SWMF to increase the permanent pool volume provided for water quality treatment.	N/A	None
BR13 (69)	Expand existing SWMF to increase the permanent pool volume provided for water quality treatment.	20,160	1:2-Year – 1:100-Year
GR01 (75)	Retrofit the existing SWMF to include a permanent pool wet pond cell for water quality treatment.	N/A	None
GR04 (76)	Retrofit the existing SWMF to include a permanent pool wet pond cell for water quality treatment.	N/A	None



Table 17: SWMF's Recommended for Further Evaluation (continued)

SWMF ID (RETROFIT NO.)	DESCRIPTION	INCREASED ACTIVE STORAGE VOLUME (m^3)	ADDITIONAL CONTROL PROVIDED
LT01 (77)	Expand SWMF to include a permanent pool and increased active storage to provide erosion control and peak flow attenuation	19,030	1:25-Year – 1:100-Year
RO#78 (DY)	Construct SWMF above low flow channel for peak flow attenuation during major storms.	163,190	1:5-Year – Regional
DY01 (79)	Remove Victoria Street and extend SWMF DY01 downstream to Anne St. S. for additional water quality treatment, peak flow attenuation and erosion control.	62,810	1:2-Year – 1:100-Year
RO#81 (HT)	Construct peak flow attenuation SWMF for erosion control and peak flow attenuation.	43,300	1:2-Year – 1:100-Year
LTGM (83)	Expand existing SWMF to increase the permanent pool volume and active storage volume for water quality treatment and peak flow attenuation.	16,530	1:2-Year – 1:5-Year
RO#96(HT)	Construct peak flow attenuation SWMF for erosion control and peak flow attenuation.	23,000	1:5-Year – 1:100-Year
HR03 (85)	Expand existing SWMF to include a permanent pool wet pond cell and increased active storage for water quality treatment and peak flow attenuation.	12,860	1:2-Year – 1:100-Year
LV16 (86)	Construct wetland permanent pool cell for water quality treatment.	N/A	None
LV17 (87)	Construct wetland permanent pool cell for water quality treatment.	N/A	None
LT05 (89)	Expand existing SWMF to increase the permanent pool volume provided for water quality treatment.	4,090	1:2-Year – 1:5-Year
BR14 (90)	Regrade the permanent pool cell to increase the permanent pool volume for water quality treatment.	N/A	None
LT04 (91)	Expand existing SWMF to increase the permanent pool volume for water quality treatment.	N/A	None
WK05 (92)	Retrofit existing SWMF to include underground infiltration system for improved water quality treatment.	N/A	None
RO#94 (BK)	Construct SWMF to provide peak flow attenuation to maintain peak flows through south and central branches of Bunkers Creek.	16,400	1:2-Year – 1:100-Year
RO#72 (BK)	Construct SWMF to provide peak flow attenuation to maintain peak flows through south and central branches of Bunkers Creek.	16,400	1:2-Year – 1:100-Year



The SWMF's were designed to maximize their described purpose within the site constraints. For peak flow attenuation facilities, the active storage was maximized within the allowable footprint and for water quality control facilities, an infiltration component was included where feasible or permanent pool cells were incorporated into the design to meet the quality objectives. New/retrofit SWMF's that have a quantity control component were included in the proposed conditions major drainage system Visual OTTHYMO hydrologic models. The stage-storage-discharge tables for the proposed SWMF's are included in Appendix N for reference. The flow reductions achieved for each SWMF considered under improvement Alternatives 2A and 2B are summarized in the following table:

Table 18: Flow Reduction Hydrologic Model Results Summary – Alternative 2A/2B

SWMF ID (RETROFIT NO.)	FLOW REDUCTION – m^3/s (%)									
	2 YEAR		5 YEAR		25 YEAR		100 YEAR		REGIONAL	
HT06 (3)	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*
BK03 (10)	0.81	*50.2%*	0.88	*33.7%*	1.04	*23.6%*	1.03	*16.9%*	0.48	*8.1%*
KD06 (11)	0.63	*26.4%*	0.44	*11.3%*	0.24	*3.6%*	0.16	*1.6%*	1.82	*1.0%*
KD03 (13)	0.01	*0.8%*	0.03	*1.4%*	0.07	*1.7%*	0.13	*2.4%*	0.00	*0.0%*
DY02 (15)	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*
RO#17 (KD)	1.23	*36.9%*	0.90	*17.5%*	0.98	*12.1%*	0.94	*8.8%*	0.04	*0.9%*
KD05 (18)	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*
WK04 (20)	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*
WK01 (25)	0.93	*10.8%*	0.68	*5.2%*	3.37	*16.8%*	3.54	*10.3%*	7.04	*13.7%*
RO#26 (WK)	1.35	*70.7%*	1.39	*44.6%*	0.85	*16.2%*	0.70	*9.6%*	0.03	*0.8%*
RO#27 (HW)	0.54	*54.2%*	0.38	*21.2%*	0.91	*27.7%*	1.78	*36.7%*	0.17	*4.4%*
HR01 (28)	0.32	*9.0%*	0.31	*6.0%*	0.17	*2.1%*	0.43	*3.9%*	0.00	*0.0%*
LV02 (30)	0.03	*0.3%*	0.05	*0.3%*	0.05	*0.2%*	0.36	*1.2%*	0.06	*0.2%*
LV03 (31)	0.36	*71.2%*	0.54	*70.9%*	0.61	*47.4%*	0.47	*27.1%*	0.01	*1.4%*
LV12 (32)	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.05*
LV10 (37)	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.05*	0.00	*0.0%*
RO#40 (WK)	0.26	*72.1%*	0.46	*75.4%*	0.68	*63.1%*	0.60	*39.7%*	0.00	*0.0%*
RO#42 (WK)	0.78	*90.7%*	1.29	*87.2%*	1.30	*50.0%*	1.18	*32.1%*	0.01	*0.6%*
RO#44 (WK)	1.15	*45.6%*	1.06	*26.2%*	0.62	*9.2%*	0.04	*0.4%*	0.01	*0.2%*



Table 18: Flow Reduction Hydrologic Model Results Summary – Alternative 2A/2B (continued)

SWMF ID (RETROFIT NO.)	FLOW REDUCTION – m^3/s (%)									
	2 YEAR		5 YEAR		25 YEAR		100 YEAR		REGIONAL	
LV05 (45)	0.37	*12.7%*	0.34	*7.2%*	0.71	*8.6%*	0.55	*4.7%*	0.02	*0.2%*
HT13 (48)	0.14	*1.1%*	0.31	*1.7%*	0.67	*2.6%*	34.44	*53.4%*	0.24	*0.7%*
BR08b (61)	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*
BR05 (62)	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*
LV07 (65)	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*
LV01 (68)	0.21	*7.9%*	0.46	*10.2%*	1.43	*17.5%*	0.75	*6.4%*	0.00	*0.0%*
BR13 (69)	0.93	*40.6%*	0.80	*35.2%*	0.98	*24.9%*	1.31	*23.3%*	0.02	*0.4%*
GR01 (75)	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*
GR04 (76)	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*
LT01 (77)	1.24	*43.6%*	2.16	*45.3%*	3.54	*42.8%*	4.39	*39.4%*	0.41	*5.0%*
RO#78 (DY)	0.00	*0.0%*	0.65	*19.9%*	1.91	*37.2%*	3.88	*49.6%*	9.38	*58.3%*
DY01 (79)	0.91	*12.2%*	2.73	*23.3%*	5.61	*27.7%*	6.61	*23.7%*	0.81	*2.0%*
RO#81 (HT)	0.20	*2.9%*	2.29	*18.0%*	10.17	*44.8%*	19.54	*58.6%*	1.72	*7.2%*
LTGM (83)	2.43	*55.6%*	1.95	*29.0%*	1.34	*12.5%*	1.23	*8.5%*	0.04	*0.8%*
RO#96 (HT)	0.00	*0.0%*	0.65	*5.7%*	1.71	*11.9%*	22.45	*61.4%*	0.33	*1.4%*
HR03 (85)	1.94	*93.2%*	1.56	*56.0%*	1.67	*40.5%*	1.93	*36.2%*	0.01	*0.4%*
LV16 (86)	0.00	*1.1%*	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*
LV17 (87)	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*
LT05 (89)	0.42	*41.8%*	0.48	*28.9%*	0.25	*8.6%*	0.05	*1.3%*	0.01	*0.4%*
BR14 (90)	0.35	*14.0%*	0.75	*19.1%*	1.15	*17.4%*	1.74	*19.2%*	0.18	*2.6%*
LT04 (91)	0.15	*2.2%*	0.09	*0.8%*	0.16	*0.8%*	1.17	*4.5%*	0.55	*5.2%*
WK05 (92)	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*
RO#94 (BK)	0.60	*31.6%*	0.64	*19.9%*	1.10	*20.0%*	2.28	*29.0%*	0.00	*0.0%*
RO#72 (BK)	0.60	*31.6%*	0.64	*19.9%*	1.10	*20.0%*	2.28	*29.0%*	0.00	*0.0%*

This analysis demonstrates that the proposed SWMF's have a variable impact on peak flow reduction. The SWMF's that were primarily designed for water quality control have peak flow reductions in the range of 0% to 40%, while the SWMF's that were designed for water quantity control generally have a much larger impact.



On a watershed basis, the flow reductions resulting from the implementation of Improvement Alternatives 2A and 2B in combination are summarized in the following table:

Table 19: Flow Reduction Hydrologic Model Results Summary (Watershed) – Alternative 2A and 2B in Combination

WATERSHED / DRAINAGE AREA	FLOW REDUCTION – m^3/s (%)									
	2 YEAR		5 YEAR		25 YEAR		100 YEAR		REGIONAL	
Kidd's Creek	0.45	*12.0%*	0.32	*5.0%*	0.21	*2.1%*	0.11	*0.8%*	0.23	*0.7%*
Bunkers Creek	1.63	*15.9%*	0.11	*10.5%*	1.35	*6.9%*	8.27	*26.3%*	2.20	*7.3%*
Dyments Creek	0.23	*6.1%*	0.85	*11.0%*	1.90	*10.6%*	2.38	*8.6%*	8.58	*20.7%*
Hotchkiss Creek	5.05	*28.5%*	8.85	*30.9%*	20.24	*42.4%*	32.9	*49.7%*	12.19	*26.6%*
Whiskey Creek	0.29	*4.1%*	-1.34	*-13.7%*	-6.88	*-44.8%*	-9.31	*-42.7%*	0.00	*0.0%*
Little Lake	0.73	*22.9%*	1.28	*20.5%*	3.48	*27.5%*	6.94	*35.6%*	0.00	*0.0%*
Bear Creek	0.32	*10.6%*	0.42	*6.8%*	0.42	*3.4%*	0.53	*2.9%*	0.21	*0.7%*
Georgian Creek	0.00	*0%*	0.00	*0%*	0.00	*0%*	0.00	*0%*	0.00	*0.0%*
Lovers Creek	0.15	*0.9%*	0.02	*0.0%*	0.00	*0.0%*	0.77	*0.8%*	4.88	*1.9%*
Hewitts Creek	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*
Huronia Creek	0.28	*18.1%*	0.22	*12.0%*	0.27	*11.7%*	0.28	*10.2%*	0.00	*0.0%*

The updated Visual OTTHYMO models have been digitally submitted with this Technical Memorandum. The detailed model results may be accessed from the digital models. A summary of the model results is included in Appendices R and S for reference.

9.1.2 Alternatives 2C/2D/2E

As described in the *Drainage Master Plan*, an opportunity exists to use Low Impact Development (LID) measures across the City to promote infiltration, improve the water balance and improve watershed water quality. Alternative 2C is to promote the use of lot level LID measures (rain barrels and soakaway pits) on private property by residents and property owners. Alternative 2D is to implement linear LID measures (perforated pipe systems or infiltration systems) as part of local road reconstruction projects and intensification in the City of Barrie. Alternative 2E is to implement centralized LID measures (bio-retention facilities and infiltration galleries) within existing parkland and at locations absent of any water quantity or quality controls throughout



the City. PCSWMM minor drainage system models for each drainage study area were created to model the impacts of Alternatives 2C, 2D and 2E individually and to model the impacts of all the LID measures being implemented in combination.

Alternatives 2C and 2D Modelling Methodology

The usage and application of lot level LID measures were calculated and applied to each minor drainage system subcatchment in PCSWMM. Rain barrels were assumed to have surface areas of approximately 0.34 m^2 and heights of 1.25 m. The application rate for rain barrels was assumed to be 1 unit per 4 roofs in areas zoned residential for each subcatchment. The area that drained to the rain barrels was assumed to be 6.25% of the residential building areas within each subcatchment. Soakaway pits were assumed to have surface areas of 4.0 m^2 and the depths were calculated based on a design infiltration rate and a 48 hour drain time. The maximum soakaway pit depth was set to 900 mm and the minimum depth was set to 300 mm. The design infiltration rates were calculated based on the hydraulic conductivity and safety factor associated with the subcatchment soil type. Details for the design infiltration rate calculation are included in Appendix O. Similar to rain barrels, the application rate for soakaway pits was assumed to be 1 unit per 4 roofs in areas zoned residential and the corresponding drainage area was assumed to be 6.25% of the residential building areas. For each subcatchment, the number of rain barrels and soakaway pits and the corresponding drainage areas were calculated and applied to the PCSWMM model. Detailed descriptions of the design parameters, usage characteristics and methodology of application for the rain barrels and soakaway pits are included in Appendix O. A typical soakaway pit detail is also included in Appendix O.

Similarly, the usage and application of linear LID measures were calculated and applied to each minor drainage system subcatchment in PCSWMM. Implementation of the linear LID measures is assumed to occur within the municipal road allowance for local roads only. The LID footprint area for each subcatchment is assumed to be 16% of the road area which corresponds to 1.4 m of an 8.5 m paved roadway. The total driveway area and road area within each subcatchment is assumed to drain to the linear LID. There are generally three cases for the linear LIDs:

1. For the linear LIDs within WHPA-A or WHPA-B, infiltration is not recommended and therefore the linear LIDs within these areas are wrapped in an impervious liner to prevent infiltration. A 200 mm underdrain is included in the system as an outlet. There are no water quality or water balance benefits for these systems, however, peak flow attenuation is provided.
2. For the linear LIDs outside WHPA-A and WHPA-B and with appropriate infiltration characteristics, there is no liner and the system outlets by infiltrating through the soil. The design depth is calculated based on a design infiltration rate and a drain time of 48 hours.



As with the soakaway pits, the maximum design depth is capped at 900 mm and the minimum design depth is 300 mm.

3. If the design infiltration rate will not allow for a design depth of 300 mm, a second outlet scenario is applied. In these cases, the design depth is set to the maximum depth of 900 mm and an underdrain is installed at the bottom of the trench to ensure the system is drained within 48 hours.

A detailed description of the design parameters, usage characteristics and methodology of application for the PCSWMM modelling of linear LIDs is included in Appendix O. The typical linear LID detail is also included in Appendix O.

Alternatives 2E

As described in the *Drainage Master Plan* (CCTA, 2018), an opportunity exists to construct centralized LIDs within parks owned by the City to improve watershed water quality and reduce phosphorus. A full list of the potential parks was considered and the pre-screening evaluation that was applied is described in the *Drainage Master Plan*. The parks that were recommended for further evaluation for centralized LIDs are described in the following table.

Table 20: Centralized LIDs Recommended for Further Evaluation

PARK		
Carter Park	Madelaine Park	Shoreview Park
Kuzmich Park	Greenfield Park	Sandringham Park
Assikinack Park	Queensway/Hyde Park	Montserrand Park
Cartwright Park	Harvie Park	Mapleton Park
Sunnidale Park	Gibbon Park	Cloughley Park
Allandale Heights Park	Bear Creek Park	Golden Meadow Park
Wessenger Park	Lougheed Park	Starbane Park
Dunsmore Park		

The preliminary design concepts for the centralized LIDs utilized in the PCSWMM model are consistent with the City of Barrie Draft Underground Infiltration Chamber System (Drawing BSD-1502) and utilized either infiltration chambers or perforated CSP/HDPE pipe. The design infiltration rates were measured in the field through infiltration testing conducted by Peto



MacCallum Ltd. The geotechnical investigation report is included in Appendix P for reference. Centralized LIDs were designed to treat the runoff produced from the contributing area for the 25 mm design storm. Details of the storage characteristics for the infiltration chambers and perforated pipe systems are included in Appendix O. Detailed design sheets for each Centralized LID are also included in Appendix O. A summary of each centralized LID characteristics is provided in the following table:

Table 21: Centralized LID Summary

PARK	DRAINAGE ARES (ha)	STORAGE VOLUME (m^3)	RUNOFF VOLUME CAPTURED (mm)
Carter Park	4.6	313	6.80
Kuzmich Park	1.3	116	8.92
Assikinack Park	7.3	546	7.48
Cartwright Park	3.1	209	6.74
Sunnidale Park	7.7	150	1.94
Allandale Heights Park	2.5	69	1.70
Wessenger Park	9.3	635	6.82
Dunsmore Park	16.1	928	5.76
Madelaine Park	5.6	487	8.68
Greenfield Park	27.1	1,353	4.99
Queensway/Hyde Park	42.3	2,242	5.30
Harvie Park	2.5	180	7.18
Gibbon Park	4.3	143	3.31
Bear Creek Park	73.0	4,592	6.29
Lougheed Park	14.6	999	6.84
Shoreview Park	20.3	944	4.65
Sandringham Park	79.4	2,345	4.91
Montserrand Park	12.3	959	7.79
Mapleton Park	2.1	179	8.50
Cloughley Park	1.5	105	6.97
Golden Meadow Park	34.0	2,380	7.00
Starbane Park	4.9	243	4.95

Model Results

Individual PCSWMM models were created for Improvement Alternatives 2C, 2D and 2E and for Alternatives 2C, 2D and 2E applied in combination. These models have been digitally submitted with this Technical Memorandum and the detailed model results may be accessed from the digital models (Appendix V). The purpose of the PCSWMM modelling was to evaluate the impact of each alternative on infiltration and on peak flows throughout the watershed. This evaluation was completed for the 25 mm storm, 1:5-year and 1:100-year return frequency design storms and the results are summarized in Appendix Q. Consolidated summaries for Alternatives 2C, 2D and 2E are provided in the following tables.

Table 22: Infiltration and Peak Flow Reduction Summary – Alternative 2C

WATERSHED / DRAINAGE AREA	Δ INTERCEPTION/ INFILTRATION (mm) – 25 mm STORM	PEAK FLOW REDUCTION (m^3/s / %) – 100 YEAR STORM	
Kidd's Creek	0.16	0.04	*0.7%*
Bunkers Creek	0.10	0.11	*0.6%*
Dyments Creek	0.09	0.01	*0.1%*
Hotchkiss Creek	0.04	0.25	*2.3%*
Whiskey Creek	0.12	0.13	*0.9%*
Johnson	0.23	N/A	
Nelson	0.23	N/A	
Rodney	0.23	N/A	
St. Vincent	0.21	N/A	
Williams & Holgate	0.19	N/A	
Huronia	0.17	N/A	
Minets	0.26	N/A	
Little Lake	0.28	0.40	*2.3%*
Bear Creek	0.10	0.00	*0.2%*
Georgian Creek	0.28	0.13	*2.8%*
Lovers Creek	0.22	-0.01	*0.0%*
Hewitts Creek	0.25	0.25	*1.9%*
Bayshore	0.25	N/A	
Gray Lane	0.19	N/A	
Royal Oak	0.19	N/A	

Table 23: Infiltration Summary – Alternative 2D

WATERSHED / DRAINAGE AREA	DRAINAGE AREA (ha)	INCREASE IN INFILTRATION (mm) – 25 mm STORM	ROAD AND DRIVEWAY AREA (ha)	TARGET CONTROL VOLUME (mm)*
Kidd's Creek	488.3	1.02	34.7	14
Bunkers Creek	360.4	0.92	37.6	9
Dyments Creek	579.92	0.66	28.6	13
Hotchkiss Creek	483.4	0.36	22.8	8
Whiskey Creek	638.4	0.92	35.7	16
Johnson	82.6	0.85	7.4	9
Nelson	61.7	2.30	9.2	15
Rodney	29.0	2.49	4.9	15
St. Vincent	35.9	1.06	2.5	15
Williams & Holgate	84.1	0.92	5.1	15
Huronia	93.0	1.79	11.3	15
Minets	6.3	3.40	1.4	15
Little Lake	445.1	1.43	45.2	14
Bear Creek	1699.8	0.80	108.0	13
Georgian Creek	270.4	1.76	35.8	13
Lovers Creek	1636.1	0.64	78.1	13
Hewitts Creek	516.9	1.68	50.1	17
Bayshore	50.0	1.67	6.5	13
Gray Lane	19.3	2.07	2.7	15
Royal Oak	14.1	2.60	2.6	14

Note: * Target Control Volume is the total increase in infiltration across the watershed averaged over the local road area and driveway area where the LIDs are to be applied.

Table 24: Flow Reduction Hydrologic Model Results Summary – Alternative 2D

WATERSHED / DRAINAGE AREA	FLOW REDUCTION (m^3/s / %)					
	25 mm STORM		5 YEAR STORM		100 YEAR STORM	
Kidd's Creek	0.06	*4.3%*	0.37	*11.3%*	0.11	*1.8%*
Bunkers Creek	0.26	*7.3%*	0.38	*4.8%*	0.83	*4.7%*
Dyments Creek	0.05	*4.1%*	0.08	*2.5%*	0.07	*1.1%*
Hotchkiss Creek	0.25	*5.4%*	0.12	*1.5%*	0.50	*4.6%*
Whiskey Creek	0.73	*19.7%*	0.44	*5.7%*	0.48	*3.1%*
Little Lake	0.76	*34.2%*	1.37	*27.3%*	2.07	*11.7%*
Bear Creek	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*
Georgian Creek	0.05	*36.7%*	0.11	*5.1%*	0.50	*11.2%*
Lovers Creek	0.15	*7.0%*	0.27	*4.0%*	0.32	*1.6%*
Hewitts Creek	0.12	*23.2%*	1.08	*40.4%*	0.25	*18.5%*

Table 25: Flow Reduction Hydrologic Model Results Summary – Alternative 2D

WATERSHED / DRAINAGE AREA	FLOW REDUCTION (m^3/s / %)					
	25 mm STORM		5 YEAR STORM		100 YEAR STORM	
Kidd's Creek	0.00	*0.2%*	0.01	*0.2%*	0.00	*0.0%*
Bunkers Creek	-0.05	*-1.4%*	0.00	*0.1%*	0.02	*0.1%*
Dyments Creek	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*
Hotchkiss Creek	0.02	*0.4%*	0.01	*0.1%*	1.09	*10.0%*
Whiskey Creek	0.13	*3.4%*	0.02	*0.2%*	0.08	*0.5%*
Little Lake	0.00	*0.2%*	-0.07	*-1.3%*	0.16	*0.9%*
Bear Creek	0.00	*0.0%*	0.00	*0.0%*	0.00	*0.0%*
Georgian Creek	0.04	*4.7%*	0.00	*0.2%*	0.02	*0.4%*
Lovers Creek	0.08	*3.6%*	0.05	*0.8%*	-0.07	*-0.3%*
Hewitts Creek	0.05	*8.9%*	0.34	*12.9%*	0.53	*4.0%*



As described in the *Master Drainage Plan*, the LID measures have a limited impact on the major storm event peak flows. However, LID measures have the potential to improve peak flow attenuation of minor storm events and reduce frequent nuisance flooding. To determine the extent of this impact, the combined scenario PCSWMM model (Alternatives 2C, 2D and 2E applied in combination) was used to establish the minor drainage system deficiencies across the study area following application of all potential LID measures. The updated deficiencies were identified for the 1:5-year return frequency 6-hour SCS design storms using the same criteria that was used to establish the existing condition minor drainage system deficiencies. The results for the combined LID scenario under existing condition flows are summarized on Figures 1C through 5C – Combined LID Scenario Existing Minor Drainage System Deficiencies. Similarly, results for the combined LID scenario under future condition flows (20% increase to rainfall) are summarized on Figures 6C through 10C – Combined LID Scenario Future Minor Drainage System Deficiencies. These figures show the decrease in minor drainage system deficiencies that can be achieved through the implementation of LID measures alone.

9.2 CONVEYANCE CAPACITY IMPROVEMENTS

As described in the *Drainage Master Plan*, there are opportunities in the study area to implement conveyance capacity improvements to reduce flooding on both private and municipal property. These opportunities include culvert improvements, watercourse improvements, major drainage system improvements and minor drainage system improvements. Based on the *Sophia Creek Watershed and Mulcaster Drainage Area Environmental Assessment Update* (2017), it is clear that flow reduction opportunities (new/retrofit SWMF's) provide significant cost savings by reducing the conveyance capacity required for downstream stormwater infrastructure. This is in addition to the benefits new/retrofit SWMF's provide to the natural and social environments. Therefore, the TAC agreed that the conveyance capacity improvements will be analyzed under a proposed conditions scenario with the new/retrofit SWM facilities in place. It was also agreed that the conveyance capacity improvements should be designed for the future condition flows (20% increase).

9.2.1 Modelling Approach

The Visual OTTHYMO models that were created to analyze Alternatives 2A/2B were used to generate peak flows for the conveyance capacity analysis. For proposed condition flows, the spills at the Highway 400 crossings need to be analyzed. For proposed conditions, the spills are determined with the Highway 400 MTO improvements in place and were generated from the Visual OTTHYMO model directly. To do this, the 1-D HEC RAS analysis described in Section 7 was used to generate rating curves at each potential spill location. DivertHyd commands were then used in Visual OTTHYMO to apply these rating curves to the appropriate hydrographs.



As previously described, the Visual OTTHYMO generated peak flows are increased by 20% to account for future condition flows. This application is not valid at the spill locations. To account for this, additional Visual OTTHYMO scenarios were created for the 1:100-year and 1:50-year return frequency design storms that applied a 20% factor upstream of the DivertHyds such that flow entering the DivertHyds would be properly divided according to the rating curves generated from the HEC RAS analysis.

Following the proposed conditions Visual OTTHYMO modelling updates, worst case peak flows for each creek considering no spill and spill were determined at key junctions along the watercourse. These flows were used for the conveyance capacity improvements analysis and are included in Appendices R and S for reference. The proposed condition Visual OTTHYMO models with and without spills have been digitally submitted with this Technical Memorandum. The detailed model results may be accessed from the digital models.

For the conveyance capacity improvements, culvert improvements were sized in HEC RAS for each watercourse. The general methodology was to size culverts from the downstream end of the watercourse and work upstream. Similarly, watercourse improvements required for conveyance were analyzed in HEC RAS working upstream from the downstream end of the watercourse. Trunk storm sewers that were required to convey specific major storm events were sized based on the future adjusted hydrographs from the Visual OTTHYMO analysis. Initial sizing was completed using the Manning's equation and the sizes were confirmed through a separate PCSWMM analysis. Trunk storm sewers that were required to eliminate overland flow route deficiencies were sized in PCSWMM. The sizes were selected to eliminate surcharging over the affected areas for the future adjusted 100-year storm (20% increase). Trunk storm sewers that changed the routing of major drainage system flows were added to the proposed condition Visual OTTHYMO models and this routing was updated to generate the peak flows used in HEC-RAS to size the proposed culvert and channel improvements.

9.2.2 Alternatives 3A/3B

As discussed, culvert and watercourse improvements can be implemented along the main channels of the various Creeks in the study area. Culvert and watercourse improvements considered under Alternative 3A are applied in accordance with the recommendations of the original MDPs. These culvert improvements satisfy the 1:25-year return frequency design storm peak flow as a minimum. The watercourse improvements reduce flooding of existing buildings and/or property where feasible. Culvert improvements considered under Alternative 3B are applied in accordance with the City's design flood frequency criteria as a minimum. As the roads in the study area are generally classified as local urban/collector and arterial roads, the design flood frequency criteria are the 1:50-year and 1:100-year return frequency design storm peak flows, respectively. The proposed condition future flow HEC RAS hydraulic models of the various



creeks were updated to determine the required culvert sizes under Alternatives 3A and 3B respectively as described in Section 9.2.1 and the proposed crossing improvements are summarized in the following tables for the final preferred alternative solution. Additional details regarding the crossings are summarized in Appendices T and U.

Table 26: Culvert Improvement Summary – Alternative 3A/3B

CULVERT ID	LOCATION	SIZE	CAPACITY (m^3/s)	LEVEL OF SERVICE
16	Thomson St.	1800 mm x 900 mm conc. box culvert	3.9	1:100-Year
18	Wellington St.	1345 mm x 855 conc. Elliptical culvert	2.5	Regional
22	Innisfil St.	10.06 m open bottom span structure	28.7	1:100-Year
23	Commercial Plaza Entrance Road	Culvert crossing to be removed		
30	Sarjeant Dr.	Twin 3000 mm × 1500 mm conc. box culverts	18.0	1:100-Year
31	Highway 400 E/W-S and N-E/W Ramp	9000 mm x 1500 mm conc. box culvert (MTO)	29.6	1:100-Year
32	Hart Dr.	Extend Highway 400 culvert under Hart Drive	54.0	Regional
33	Highway 400	9000 mm × 2000 mm conc. box culvert	54.0	Regional
34	George St.	Twin 3660 mm × 1830 mm conc. box culverts	32.2	1:100-Year
35	Victoria St.	Culvert crossing to be removed		
36	Anne St. S. / John St.	Extend twin 3000 mm × 2100 mm conc. box culverts	28.9	1:100-Year
37	Innisfil St.	6.71 m open bottom span structure	26.0	1:50-Year
38	Sanford St.	4200 mm × 2100 mm conc. box culvert	26.3	1:50-Year
39	Bradford St.	10.67 m open bottom span structure	30.1	1:100-Year
50	Innisfil St.	3962 mm × 2134 mm conc. box culvert	37.3	1:100-Year
55	Highway 400	2250 mm dia. conc. culvert	21.2	Regional
57	Bayview Dr.	Twin 2400 mm × 900 mm conc. box culvert	8.2	1:50-Year
147	Railway Crossing	Twin 1800 mm dia. conc. culvert	29.2	1:100-Year
138	Railway Crossing	3000 mm dia. conc. culvert	37.6	1:100-Year
65	The Boulevard	10.67 m open bottom span structure	37.4	1:100-Year
66	Brennan Ave.	Twin 9.14 m open bottom span structures	37.4	1:100-Year
126	Railway Crossing	Twin 2100 mm dia. conc. culverts	26.0	Regional
123	Railway Crossing	3000 mm dia. conc. culvert	19.6	Regional
13	Cundles Rd. W.	3455 mm x 2195 mm conc. Elliptical culvert	23.2	1:100-Year
145	Dunlop St. W.	6000 mm × 1500 mm conc. box culvert	14.8	1:100-Year



Table 26: Culvert Improvement Summary – Alternative 3A/3B (Continued)

CULVERT ID	LOCATION	SIZE	CAPACITY (m^3/s)	LEVEL OF SERVICE
146	Bradford St.	6000 mm × 1500 mm conc. box culvert	14.8	1:100-Year
143	Highway 400	2400 mm x 1830 mm conc. box culvert (MTO)	8.8	1:50-Year
142	Highway 400	4200 mm x 1500 mm conc. box culvert (MTO)	9.0	1:50-Year
141	Highway 400	Twin 1800 mm x 1200 mm conc. box culvert (MTO)	10.7	1:50-Year
24	Bradford St.	Twin 7.62 m open span structures	41.7	Regional
28	Dunlop St. W.	3043 mm × 914 mm conc. box culvert	8.4	1:100-Year
29	Ferndale Dr. N.	10.67 m open bottom span structure	12.3	1:100-Year
41	Mayfair Dr.	750 mm Dia. conc. pipe	1.6	1:100-Year
42	Ardagh Rd.	900 mm Dia. conc. pipe	2.5	1:100-Year
44	Essa Rd.	3048 mm × 914 mm conc. box culvert	8.3	Regional
135	Railway Crossing	4878 mm × 914 mm conc. box culvert	19.8	1:100-Year
48	Tiffin St.	4267 mm × 1829 mm conc. box culvert	17.0	1:50-Year
49	Anne St. S.	Extend existing 4270 mm × 2440 mm conc. box culvert	34.6	1:100-Year
53	Harvie Rd.	2100 mm × 900 mm conc. box culvert	3.9	1:100-Year
54	Harvie Rd.	1800 mm Dia. Conc. Pipe	6.4	1:100-Year
56	Fairview Rd.	1800 mm × 1200 mm conc. box culvert	8.4	1:100-Year
60	Huronia Rd.	10.67 m open bottom span structure	26.1	1:50-Year
62	Little Ave.	Twin 7.36 m open bottom span structures	27.1	1:25-Year
63	Yonge St.	Twin 3000 mm × 1800 mm conc. Box culverts	39.9	1:100-Year
64	Hurst Dr.	3000 mm × 2100 mm conc. box culvert	38.3	1:100-Year
89	Lockhart Rd.	10.67 m open bottom span structure	13.5	1:100-Year
91	Lockhart Rd.	Twin 10.67 m open bottom span structures	96.7	1:100-Year
92	Huronia Rd.	3600 mm x 1500 mm conc. box culvert	13.3	1:100-Year
99	Ellis Dr.	3000 mm × 1200 mm conc. box culvert	8.3	1:50-Year
98	Welham Rd.	3000 mm × 1200 mm conc. box culvert	30.9	1:50-Year



Table 26: Culvert Improvement Summary – Alternative 3A/3B (Continued)

CULVERT ID	LOCATION	SIZE	CAPACITY (m^3/s)	LEVEL OF SERVICE
97	Huronia Rd.	3000 mm × 1200 mm conc. box culvert	8.0	1:100-Year
105	Tollendal Mill Rd.	10356 mm x 3892 mm Low Profile Bridge Plate Arch	119.0	1:100-Year
83	Mapleview Dr. E.	10.67 m open bottom span structure	70.8	1:100-Year
82	Penetanguishene Rd.	2400 mm × 1200 mm conc. box culvert	5.1	1:100-Year
78	Ardagh Rd.	900 mm dia. CSP	2.3	1:100-Year

As shown in the above tables, the analysis demonstrates that the level of service provided by the improved road culvert crossings under these alternatives generally satisfies or exceeds the City's current design flood frequency criteria.

Similar to the culvert designs, the proposed condition future flow HEC RAS hydraulic models of the various creeks were updated to determine the required watercourse capacity improvements. The watercourse conveyance improvements for the final preferred alternative solution are summarized in the following table:



Table 27: Watercourse Improvement Summary – Alternatives 3A/3B

WATERCOURSE IMPROVEMENT	WATERSHED	DESCRIPTION	CHANNEL WORKS
No. 9	Dyments Creek	Realign Dyments Creek from Dunlop St. W. to Ferndale Dr. N. (Reach Dy-2a)	Construct new channel at approximately 0.4% grade. Low flow trapezoidal channel to be 1 m wide and 0.5 m deep with 1:1 side slopes. Floodplain constructed above low flow channel to be trapezoidal with approximate 50 m width and 2.5:1 side slopes
No. 10	Dyments Creek	Re-grade/shape Dyments Creek from Ferndale Dr. N. to Sarjeant Dr. to increase conveyance capacity and drainage (Reach Dy-2b)	Regrade channel at approximately 0.3% grade. Channel to be rectangular with 15 m width and retaining walls to support vertical side slopes for approximately 10 m upstream of Ferndale crossing and 140 m downstream of Ferndale crossing. Channel cleanout to maintain positive slope for remaining 240 m
No. 11	Dyments Creek	Daylight Dyments Creek through 55 Hart Drive downstream of Hart Drive (Reach Dy-3)	Construct new channel matching geometry of the existing downstream channel at 0.5% grade
No. 13	Hotchkiss Creek	Daylight Hotchkiss Creek through 108 and 120 Tiffin St. between Anne St. S. and Innisfil St. (Reach Ho-9)	Construct new channel matching geometry of the existing downstream channel at 0.1% grade
No. 15	Whiskey Creek	Realign Whiskey Creek from Harvie Rd. to Highway 400 (Reach Wh-3)	Construct new channel according to Hatch's proposed design. Channel to be triangular with 1:1 side slopes at 0.6% grade
No. 20	Whiskey Creek	Reconstruct/regrade Whiskey Creek between The Boulevard and Brennan Ave. to increase conveyance capacity (Reach Wh-10)	Widen existing channel on the east side to construct a trapezoidal floodplain with 10 m – 18 m width and 3:1 side slopes. Trapezoidal low flow channel to be 2 m wide and 0.5 deep with 1:1 side slopes. Channel bottom elevation to be fixed at 218.80 m (0% grade)
No. 21	Whiskey Creek	Re-grade/shape Whiskey Creek between Brennan Ave. and Kempenfelt Bay to increase conveyance capacity (Reach Wh-10)	Construct new trapezoidal floodplain with approximately 18 m width and 3:1 side slopes by widening existing channel on the east side. Trapezoidal low flow channel to be 2 m wide and 0.5 m deep with 1:1 side slopes. Channel bottom elevation to be fixed at 218.80 m (0% grade)
No. 6	Hotchkiss Creek	Daylight Hotchkiss Creek through 115 Brock St., 128 Anne St. S. and 134 Tiffin St. (Reach Ho-8)	Construct new channel matching geometry of the existing upstream channel at 1.1% grade.



Table 27: Watercourse Improvement Summary – Alternatives 3A/3B (continued)

WATERCOURSE IMPROVEMENT	WATERSHED	DESCRIPTION	CHANNEL WORKS
No. 25	Kidd's Creek	Daylight Kidd's Creek through 150 Dunlop St. W. between Eccles St. and Dunlop St. W. (Reach Ki-11)	Construct new channel and match geometry of upstream section trapezoidal channel with 6 m bottom width and 3:1 side slopes at 0.2% grade
No. 26	Kidd's Creek	Daylight Kidd's Creek through 125 Dunlop St. W. between Dunlop St. W. and Bradford St. (Reach Ki-11)	Construct new channel at 0.2% grade and match geometry of upstream section trapezoidal channel with 6 m bottom width and 3:1 side slopes. Retaining walls to be installed in proximity of Dunlop St. W. crossing
No. 27	Bunkers Creek	Natural channel enhancement on Bunkers Creek to increase conveyance capacity, habitat and canopy downstream of the Bradford St. to Lakeshore Drive	Construct new trapezoidal floodplain with approximately 15 m bottom width and 3:1 side slopes. Trapezoidal low flow channel to be 2 m wide and 0.5 m deep with 1:1 side slopes at 0.4% grade
No. 28	Dyments Creek	Channel improvements on Dyments Creek to increase conveyance capacity and decrease flooding downstream of Bradford St. to Lakeshore Drive	Construct new channel to daylight portion of Bradford Street crossing matching geometry of downstream cross-section trapezoidal channel with 6 m bottom width and 2:1 side slopes at 0.3% grade
No. 29	Dyments Creek	Realign Dyments Creek from Sproule Drive to Dunlop St. W	Construct new watercourse matching approximate geometry and slope of the existing channel to accommodate new SWMF design
No. 30	Whiskey Creek	Channel improvements on Whiskey Creek to increase conveyance capacity and reduce flooding (Reaches Wh-4a through Wh-4c)	Widen channel bottom to 10 m by excavating right bank and match to existing ground at 2:1 side slopes. Channel to be graded at 0.2% grade
No. 31	Whiskey Creek	Realign Whiskey Creek between Huronia Rd. and SWMF WK01	Realign 40 m section of channel shifting it approximately 15 m south of Little Avenue. Match geometry of existing channel.
No. 32	Whiskey Creek	Channel improvements on Whiskey Creek to increase conveyance capacity downstream of Little Ave. (Reach Wh-9)	Construct 15 m wide trapezoidal floodplain with 3:1 side slopes. Construct 5 m wide rectangular low flow channel by installing retaining walls as required at Little Avenue and surrounding properties. Channel at 0.6% grade

The HEC RAS models with the proposed culvert sizing and channel improvements have been digitally submitted with this Technical Memorandum and the detailed model results may be accessed from the digital models (Appendix V).

In addition to culvert and channel improvements, trunk storm sewer improvements are proposed to divert flow and address major overland flow deficiencies. The PCSWMM hydrologic/hydraulic models were updated to analyze the trunk storm sewer improvements being evaluated. The purpose of each trunk storm sewer improvement and the required trunk storm sewer sizing are summarized as follows:

1. Trunk Storm Sewer Improvement No. 9 – Construct a trunk storm sewer on Thomson St., Sophia St. W. Florence St., Park St. and Eccles St. N. to reduce flows and erosion through Kidd's Creek from Thomson St. to Eccles St. N. 475 m of 1345 mm x 855 mm Horizontal Ellipse trunk storm sewer is required;
2. Trunk Storm Sewer Improvement No. 1 – Construct a trunk storm sewer on Anne St. N. from SWMF BK03 to Edgehill Dr. to divert flows reducing flooding and erosion in Bunkers Creek downstream. 965 m of 1200 mm diameter trunk storm sewer and 60 m of 2311 mm x 1473 mm Horizontal Ellipse conc. trunk storm sewer are required;
3. Trunk Storm Sewer Improvement No. 2 – Construct a trunk storm sewer on Dunlop St. W. and Anne St. S. from Dunlop St. W. to Perry St. to convey the 100-year peak flows from Bunkers Creek (central and south branches). 260 m of twin 1800 mm x 1200 mm concrete box culvert is required;
4. Trunk Storm Sewer Improvement No. 10 – Construct a trunk storm sewer on Essa Rd. from Fairview Rd. to Innisfil St. to divert flows away from Hotchkiss Creek and the W.P.C.C. 425 m of 1200 mm dia. storm sewer is required;
5. Trunk Storm Sewer Improvement No. 7 – Construct a trunk storm sewer on Esther Dr. from Dean Ave. to SWMF LV19 to eliminate overland flow route deficiencies. 970 m of trunk storm sewer ranging in size from 1800 mm diameter to 3000 mm x 1500 mm sewer is required;
6. Trunk Storm Sewer Improvement No. 6 – Construct a trunk storm sewer on Princess Margaret Gate to Camelot Sq. from Loyalist Sq. to SWMF HW06 to eliminate overland flow route deficiencies. 470 m of trunk storm sewer ranging in size from 1200 mm diameter to 2400 mm x 1200 mm sewer is required;
7. Trunk Storm Sewer Improvements No. 3 – Construct a trunk storm sewer between SWMF GR04 and SWMF GR01 to convey the 100-year peak flow from SWMF GR04. 770 m of 3000 mm x 1200 mm conc. Box culvert trunk storm sewer is required;

8. Trunk Storm Sewer Improvement No. 4 – Construct a trunk storm sewer on Harrogate Ct., Johnson St., Cheltenham Rd., Larkin Dr. and Quintan Rd. from Dunsmore Park to Penetanguishene Rd. to eliminate overland flow route deficiencies. 1650 m of trunk storm sewer ranging in size from 1245 mm x 813 m HE conc. Sewer to 1800 mm x 1500 mm conc. box culvert is required;
9. Trunk Storm Sewer Improvement No. 5 – Construct a trunk storm sewer between SWMF LT02 and SWMF LT01 to eliminate overland flow route deficiencies. 530 m 2400 mm x 1200 mm conc. box culvert is required; and
10. Trunk Storm Sewer Improvement No. 8 – Construct a trunk storm sewer on Johnson St. from Steel St. to Kempenfelt Bay to eliminate overland flow route deficiencies. 930 m of trunk storm sewer ranging in size from 900 mm diameter to 3000 mm x 1800 mm conc. box culvert is required.
11. Trunk Storm Sewer Improvement No. 11 – Extend the existing 6000 mm x 1500 mm conc. Trunk storm sewer upstream of Bradford St. (~75 m) to satisfy the City of Barrie Flow Design Guidelines for Road Crossings (Arterial Road – 100-year design flood); and
12. Trunk Storm Sewer Improvement No. 12 – Construct a trunk storm sewer on Blake St. from Downsview Dr. to Puget St. to provide a minor drainage system and eliminate overland flow deficiencies. 260 m of trunk storm sewer ranging in size from 600 mm dia. To 750 mm dia. sewer is required.

Four alignments were considered and evaluated for Trunk Storm Sewer Improvement No. 9 as follows:

- Alignment 1 – Thomson St., Sophia St. W., Florence St., Park St. and Eccles St. N.;
- Alignment 2 – Thomson St., Sophia St. W., and Florence St. then through 53 Park St.;
- Alignment 3 – Thomson St., Sophia St. W., Florence St., Park St. and Mulholland St. then through 13 Mulholland St.; and
- Alignment 4 – Thomson St., Sophia St. W., Florence St., Park St. and Parkside Dr.

Through the evaluation it was determined that Alignment 1 provides the greatest overall benefit to the watershed.

For Trunk Storm Sewer No. 11, replacing the existing trunk storm sewer with an appropriately sized (1:100-year capacity) was considered and evaluated against daylighting the watercourse, culvert improvements and the trunk storm sewer extension. A 6000 mm x 1500 mm conc. trunk storm sewer (~250 m) is required to satisfy the City of Barrie Flow Design Guidelines for Road Crossings (Arterial Road – 100-year design flood). Through the project evaluation it was determined that daylighting the watercourse, the culvert improvements and trunk storm sewer extension provides the greatest overall benefit to the watershed.



For Trunk Storm Sewer Improvement No. 1, a second alignment was considered and evaluated. The second option included replacing the existing local storm sewer through the existing alignment on Valley Dr., Castle Dr., and Wesley St. from Anne St. N. to Bunkers Creek (Reach Bu-3). Through the project evaluation is was determined that constructing a trunk storm sewer on Anne St. N. from SWMF BK03 to Edgehill Dr. provides the greatest overall benefit to the watershed.

For Trunk Storm Sewer Improvement No. 2, installing a second trunk storm sewer beside the existing trunk storm sewer along the existing alignment through the existing easement was considered. The existing trunk storm sewer is centered in the easement. Constructing a second trunk storm sewer (twin 1800 mm x 1200 mm conc. box) may require the existing sewer to be relocated within the easement. Through the project evaluation it was determined that constructing a second trunk storm sewer on Dunlop St. W. and Anne St. S. to supplement the capacity of the existing trunk storm sewer provides the greatest benefit to the watershed.

For Project No. 74, constructing a trunk storm sewer through 279 Bayview Dr. was considered and evaluated against the watercourse improvements. A 3000 mm x 1800 mm conc. trunk storm sewer (~385 m) is required to convey the flows exceeding the capacity of the existing channel through 279 Bayview Dr., eliminating the need for watercourse improvements and future flooding. Through the project evaluation, the watercourse improvements provided the greatest benefit to the watershed.

For the outlet of Whiskey Creek to Kempenfelt Bay (downstream of Hurst Dr.), two trunk storm sewer alignments were considered and evaluated against the culvert (No. 65 and No. 66) and watercourse (No. 20 and No. 21) improvements proposed. Trunk Storm Sewer Improvement No. 13 (Project No. 90) included the two following alignments:

- Alignment A – Minets Point Rd. and White Oaks Rd. from Hurst Dr. to Brennan Ave.; and
- Alignment B – Minets Point Rd. to Kempenfelt Bay though the White Oaks Rd. unopened road allowance.

Alignment A diverts flow around a reach of Whiskey Creek with existing bed erosion and downstream of The Boulevard and a deficient culvert. Alignment B diverts flow greater than the limiting capacity of the culverts/channel downstream of Hurst Dr. to Kempenfelt Bay, eliminating the need to improve the downstream channel and culverts. Through the evaluation it was determined that the culvert and culvert improvements provide the greatest benefit to the watershed.

The PCSWMM models with the proposed trunk storm sewer improvements have been digitally submitted with this Technical Memorandum and the detailed model results may be accessed from the digital models (A1ppendix V).



10 Conclusion

In conclusion, the hydrologic and hydraulic modelling updates have been completed for existing and future conditions. The model updates defined in the *Technical Proposal* and refined through consultation with the TAC have been applied and the deficiencies for existing and future condition flows have been identified. A spills analysis has been completed to establish interwatershed spills and consequently the Regulatory storm events and peak flows for each creek moving forward. The updated models have been used to evaluate the alternative drainage solutions developed under the Drainage Master Plan and the modelling results will be used to select a preferred alternative solution(s) for implementation moving forward.

Appendix A: Figures

Disclaimer

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N

SPRINGWATER

LITTLE LAKE WATERSHED

GEORGIAN CREEK WATERSHED

SOPHIA CREEK WATERSHED

ORO-MEDONTE

MULCASTER DRAINAGE AREA

ST. VINCENT DRAINAGE AREA

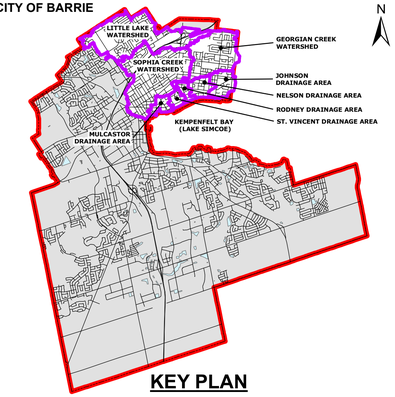
RODNEY DRAINAGE AREA

NELSON DRAINAGE AREA

JOHNSON DRAINAGE AREA

KEMPENFELT BAY (LAKE SIMCOE)

CITY OF BARRIE



KEY PLAN

LEGEND

- STORM DEVICES
- CULVERT
- DITCH
- WATERCOURSE
- STORM SEWER (QMAX/QFULL FLOW > 115%)
- STORM SEWER (QMAX/QFULL FLOW 101%-115%)
- STORM SEWER (QMAX/QFULL FLOW 85%-100%)
- STORM SEWER (QMAX/QFULL FLOW < 85%)
- ABSENT OF MINOR DRAINAGE SYSTEM
- ROAD
- SWMF
- WATERSHED/DRAINAGE AREA BOUNDARY
- MUNICIPAL BORDER

TATHAM ENGINEERING

Barrie

SCALE = 1:10,000

0 125 250 500 750 1,000 Meters

DRAINAGE MASTER PLAN

SOPHIA CREEK, GEORGIAN CREEK & LITTLE LAKE WATERSHEDS;

JOHNSON, MULCASTOR, NELSON, RODNEY & ST VINCENT DRAINAGE AREAS

FIGURE 1A - MINOR DRAINAGE SYSTEM DEFICIENCIES (5 YEAR STORM)

DATE: MARCH 2019

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SPRINGWATER

ORO-MEDONTE

LITTLE LAKE WATERSHED

SOPHIA CREEK WATERSHED

GEORGIAN CREEK WATERSHED

MULCASTER DRAINAGE AREA

ST. VINCENT DRAINAGE AREA

RODNEY DRAINAGE AREA

NELSON DRAINAGE AREA

JOHNSON DRAINAGE AREA

KEMPENFELT BAY (LAKE SIMCOE)

DEFICIENT CULVERTS / CROSSINGS

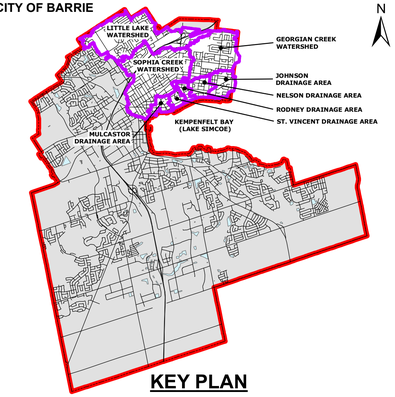
SOPHIA CREEK WATERSHED

1. HOWARD CRESCENT
2. LAY STREET
3. GROVE STREET
4. GROVE STREET
5. ST. VINCENT STREET
6. OTTAWAY AVENUE/ROSE STREET
7. LAURIE CRESCENT
8. BOTHWELL CRESCENT
9. GROVE STREET
10. PARKDALE CRESCENT
11. DAVIDSON STREET/GUNN STREET
12. WELLINGTON STREET/BERCZY STREET

GEORGIAN CREEK WATERSHED

82. PENETANGUISHENE ROAD

CITY OF BARRIE



KEY PLAN

LEGEND

- DEFICIENT CULVERTS
- MAJOR OVERLAND FLOW ROUTE DEFICIENCIES
- STORM SEWER
- CULVERT
- DITCH
- WATERCOURSE
- ROAD
- SWMF
- REGULATORY FLOODPLAIN
- REGULATORY FLOODLINE
- BUILDINGS
- WATERSHED/DRAINAGE AREA BOUNDARY
- MUNICIPAL BORDER

TATHAM ENGINEERING

Barrie

SCALE = 1:10,000

0 125 250 500 750 1,000 Meters

DRAINAGE MASTER PLAN

SOPHIA CREEK, GEORGIAN CREEK & LITTLE LAKE WATERSHEDS

JOHNSON, MULCASTOR, NELSON, RODNEY & ST VINCENT DRAINAGE AREAS

FIGURE 1B - MAJOR DRAINAGE SYSTEM DEFICIENCIES

DATE: MARCH 2019

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LOW IMPACT DEVELOPMENT MEASURES

1) LOT LEVEL LID (RAIN BARRELS AND SOAKAWAY PITS)

2) LINEAR LID ON ALL LOCAL ROADS
(PERFORATED PIPE SYSTEMS/INFILTRATION TRENCHES)

3) CENTRALIZED LID (UNDERGROUND INFILTRATION SYSTEM)

N

SPRINGWATER

LITTLE LAKE WATERSHED

SOPHIA CREEK WATERSHED

GEORGIAN CREEK WATERSHED

ORO-MEDONTE

CARTWRIGHT PARK

DUNSMORE PARK

STRABANE PARK

SHOREVIEW PARK

JOHNSON DRAINAGE AREA

RODNEY DRAINAGE AREA

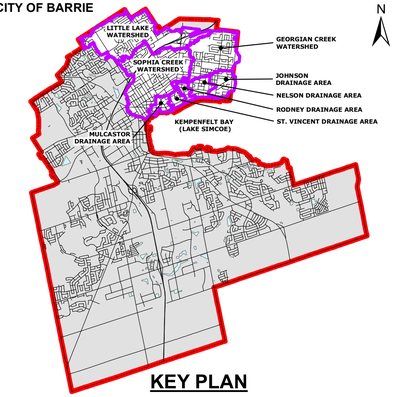
NELSON DRAINAGE AREA

ST. VINCENT DRAINAGE AREA

MULCASTER DRAINAGE AREA

KEMPENFELT BAY
(LAKE SIMCOE)

CITY OF BARRIE



KEY PLAN

LEGEND

- STORM DEVICES
- CULVERT
- DITCH
- WATERCOURSE
- STORM SEWER (QMAX/QFULL FLOW > 115%)
- STORM SEWER (QMAX/QFULL FLOW 101%-115%)
- STORM SEWER (QMAX/QFULL FLOW 85%-100%)
- STORM SEWER (QMAX/QFULL FLOW < 85%)
- ABSENT OF MINOR DRAINAGE SYSTEM
- ROAD
- CENTRALIZED LID
- SWMF
- WATERSHED/DRAINAGE AREA BOUNDARY
- MUNICIPAL BORDER

C.C. Tatham & Associates Ltd.
Consulting Engineers
Collingwood Bracebridge Orillia Barrie

Barrie

SCALE = 1:10,000

0 125 250 500 750 1,000 Meters

DRAINAGE MASTER PLAN

SOPHIA CREEK, GEORGIAN CREEK
& LITTLE LAKE WATERSHEDS;

JOHNSON, MULCASTOR, NELSON, RODNEY
& ST VINCENT DRAINAGE AREAS

FIGURE 1C - COMBINED LID SCENARIO
EXISTING MINOR DRAINAGE SYSTEM DEFICIENCIES
WITH LOW IMPACT DEVELOPMENT MEASURES IMPLEMENTED

DATE: MARCH 2019

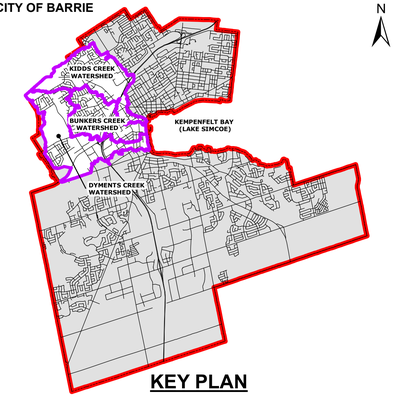
SPRINGWATER

KIDDS CREEK WATERSHED

DYMENTS CREEK WATERSHED

BUNKERS CREEK WATERSHED

KEMPENFELT BAY (LAKE SIMCOE)



KEY PLAN

LEGEND

- STORM DEVICES
- CULVERT
- DITCH
- WATERCOURSE
- STORM SEWER (QMAX/QFULL FLOW > 115%)
- STORM SEWER (QMAX/QFULL FLOW 101%-115%)
- STORM SEWER (QMAX/QFULL FLOW 85%-100%)
- STORM SEWER (QMAX/QFULL FLOW < 85%)
- ROADS
- ABSENT OF MINOR DRAINAGE SYSTEM
- SWMF
- WATERSHED/DRAINAGE AREA BOUNDARY
- MUNICIPAL BORDER

TATHAM ENGINEERING

Barrie

SCALE = 1:10,000

0 125 250 500 750 1,000 Meters

DRAINAGE MASTER PLAN

BUNKERS CREEK, DYMENTS CREEK & KIDDS CREEK WATERSHEDS

FIGURE 2A - MINOR DRAINAGE SYSTEM DEFICIENCIES (5 YEAR STORM)

DATE: MARCH 2019

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DEFICIENT CULVERTS / CROSSINGS

DYMENTS CREEK WATERSHED

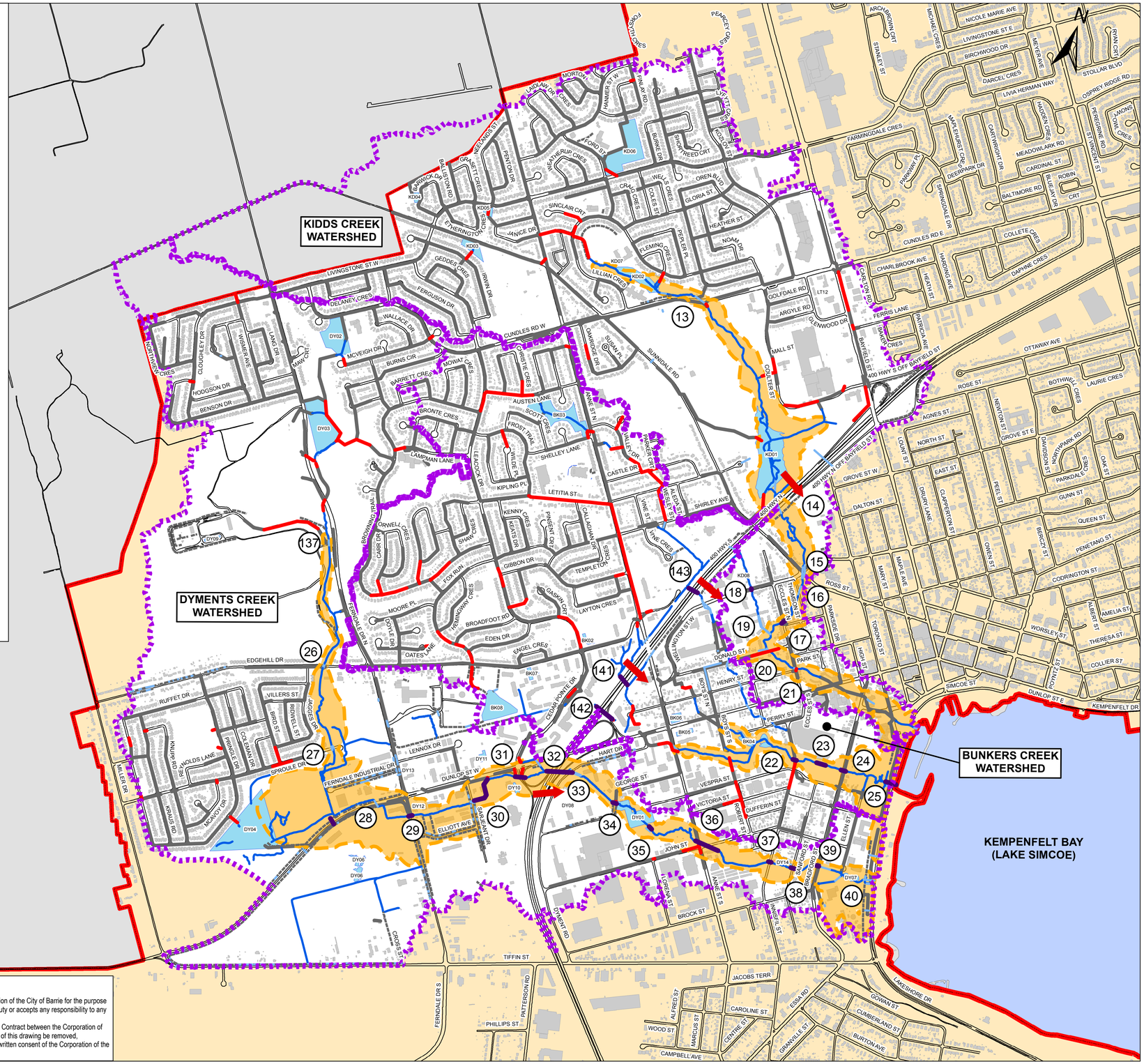
28 DUNLOP STREET WEST
29 FERNDALE DRIVE NORTH
30 SARJEANT DRIVE
31 DUNLOP STREET/HIGHWAY 400 ON-RAMP
32 HIGHWAY 400
33 HART DRIVE
34 GEORGE STREET
35 VICTORIA STREET
36 JOHN STREET
37 INNISFIL STREET
38 SANFORD STREET
39 BRADFORD STREET

KIDDS CREEK WATERSHED

13 CUNDLES ROAD WEST
16 THOMSON STREET
17 ECCLES STREET
18 WELLINGTON STREET

BUNKERS CREEK WATERSHED

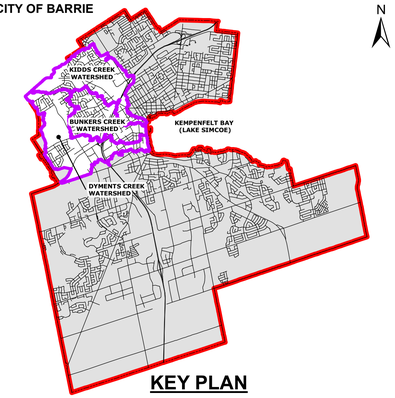
22 INNISFIL STREET
23 COMMERCIAL PLAZA ENTRANCE ROAD
24 BRADFORD STREET
141 HIGHWAY 400
142 HIGHWAY 400
143 HIGHWAY 400



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CITY OF BARRIE



KEY PLAN

LEGEND

- DEFICIENT CULVERTS
- MAJOR OVERLAND FLOW ROUTE DEFICIENCIES
- STORM SEWER
- CULVERT
- DITCH
- WATERCOURSE
- ROADS
- REGULATORY FLOODLINE
- SWMF
- REGULATORY FLOODPLAIN
- BUILDINGS
- WATERSHED/DRAINAGE AREA BOUNDARY
- MUNICIPAL BORDER

TATHAM ENGINEERING
Barrie

SCALE = 1:10,000

0 125 250 500 750 1,000 Meters

DRAINAGE MASTER PLAN

BUNKERS CREEK, DYMENTS CREEK & KIDDS CREEK WATERSHEDS

FIGURE 2B - MAJOR DRAINAGE SYSTEM DEFICIENCIES

DATE: MARCH 2019

LOW IMPACT DEVELOPMENT MEASURES

1) LOT LEVEL LID (RAIN BARRELS AND SOAKAWAY PITS)

2) LINEAR LID ON ALL LOCAL ROADS
(PERFORATED PIPE SYSTEMS/INFILTRATION TRENCHES)

3) CENTRALIZED LID (UNDERGROUND INFILTRATION SYSTEM)

KIDDS CREEK WATERSHED

DYMENTS CREEK WATERSHED

BUNKERS CREEK WATERSHED

KEMPENFELT BAY (LAKE SIMCOE)

SPRINGWATER

SUNNIDALE PARK

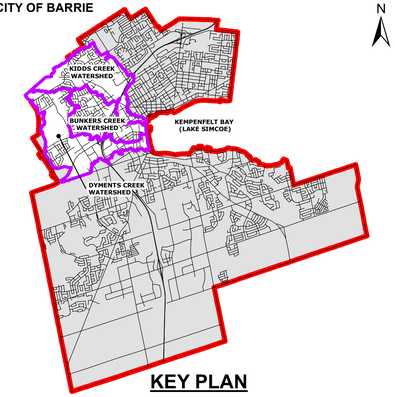
CLOUGHLEY PARK

GIBBON PARK

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CITY OF BARRIE



N

KEY PLAN

LEGEND

- STORM DEVICES
- CULVERT
- DITCH
- WATERCOURSE
- STORM SEWER (QMAX/QFULL FLOW > 115%)
- STORM SEWER (QMAX/QFULL FLOW 101%-115%)
- STORM SEWER (QMAX/QFULL FLOW 85%-100%)
- STORM SEWER (QMAX/QFULL FLOW < 85%)
- ABSENT OF MINOR DRAINAGE SYSTEM
- ROADS
- CENTRALIZED LID
- SWMF
- WATERSHED/DRAINAGE AREA BOUNDARY
- MUNICIPAL BORDER

TATHAM ENGINEERING

Barrie

SCALE = 1:10,000

0 125 250 500 750 1,000 Meters

DRAINAGE MASTER PLAN

BUNKERS CREEK, DYMENTS CREEK & KIDDS CREEK WATERSHEDS

FIGURE 2C - COMBINED LID SCENARIO
EXISTING MINOR DRAINAGE SYSTEM DEFICIENCIES
WITH LOW IMPACT DEVELOPMENT MEASURES IMPLEMENTED

DATE: MARCH 2019

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MINETS DRAINAGE AREA

ROYAL OAK DRAINAGE AREA

GRAY LANE DRAINAGE AREA

KEMPENFELT BAY (LAKE SIMCOE)

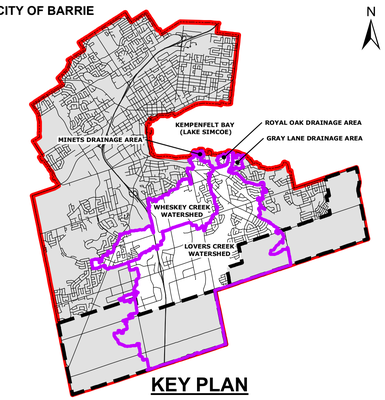
WHISKEY CREEK WATERSHED

LOVERS CREEK WATERSHED

HEWITT'S SECONDARY PLAN AREA (ANNEXATION LANDS) EXCLUDED FROM STUDY

SALEM SECONDARY PLAN AREA (ANNEXATION LANDS) EXCLUDED FROM STUDY

CITY OF BARRIE



KEY PLAN

LEGEND

- STORM DEVICES
- CULVERT
- DITCH
- WATERCOURSE
- STORM SEWER (QMAX/QFULL FLOW > 115%)
- STORM SEWER (QMAX/QFULL FLOW 101%-115%)
- STORM SEWER (QMAX/QFULL FLOW 85%-100%)
- STORM SEWER (QMAX/QFULL FLOW < 85%)
- ABSENT OF MINOR DRAINAGE SYSTEM
- ROAD
- ANNIXATION LANDS BOUNDARY
- SWMF
- WATERSHED/DRAINAGE AREA BOUNDARY
- MUNICIPAL BORDER

TATHAM ENGINEERING

Barrie

SCALE = 1:10,000

0 125 250 500 750 1,000 Meters

DRAINAGE MASTER PLAN

LOVERS CREEK & WHISKEY CREEK WATERSHEDS; MINETS, ROYAL OAK & GRAY LANE DRAINAGE AREAS

FIGURE 3A - MINOR DRAINAGE SYSTEM DEFICIENCIES (5 YEAR STORM)

DATE: MARCH 2019

DEFICIENT CULVERTS / CROSSINGS

LOVERS CREEK WATERSHED		WHISKEY CREEK WATERSHED	
88	BAYVIEW DRIVE	53	HARVIE ROAD
89	LOCKHART ROAD	54	HARVIE ROAD
91	LOCKHART ROAD	57	BAYVIEW DRIVE
92	HURONIA ROAD	59	MCCONKEY PLACE
94	WELHAM ROAD	60	HURONIA ROAD
95	MAPLEVIEW DRIVE EAST	62	LITTLE AVENUE
97	HURONIA ROAD	63	YONGE STREET
98	WELHAM ROAD	64	HURST DRIVE
99	ELLIS DRIVE	65	THE BOULEVARD
105	TOLLENDAL MILL ROAD	66	BRENNAN AVENUE
121	RAIL CROSSING	138	RAIL CROSSING
123	RAIL CROSSING		
	RAIL CROSSING		

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KEMPENFELT BAY (LAKE SIMCOE)

MINETS DRAINAGE AREA

ROYAL OAK DRAINAGE AREA

GRAY LANE DRAINAGE AREA

WHISKEY CREEK WATERSHED

LOVERS CREEK WATERSHED

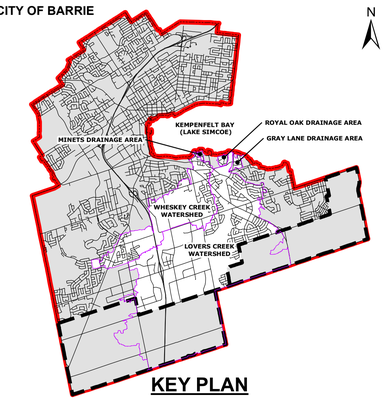
HEWITT'S SECONDARY PLAN AREA (ANNEXATION LANDS) EXCLUDED FROM STUDY

SALEM SECONDARY PLAN AREA (ANNEXATION LANDS) EXCLUDED FROM STUDY

ESSA

INNISFIL

CITY OF BARRIE



KEY PLAN

LEGEND

- DEFICIENT CULVERTS
- MAJOR OVERLAND FLOW ROUTE DEFICIENCIES
- STORM SEWER
- CULVERT
- DITCH
- WATERCOURSE
- RAILWAY
- ROAD
- ANNIXATION LANDS BOUNDARY
- SWMF
- REGULATORY FLOODLINE
- REGULATORY FLOODPLAIN
- BUILDINGS
- WATERSHED/DRAINAGE AREA BOUNDARY
- MUNICIPAL BORDER

TATHAM ENGINEERING

Barrie

SCALE = 1:15,000

0 190 380 760 1,140 1,520 Meters

DRAINAGE MASTER PLAN

LOVERS CREEK & WHISKEY CREEK WATERSHEDS; MINETS, ROYAL OAK & GRAY LANE DRAINAGE AREAS

FIGURE 3B - MAJOR DRAINAGE SYSTEM DEFICIENCIES

DATE: MARCH 2019

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LOW IMPACT DEVELOPMENT MEASURES

1) LOT LEVEL LID (RAIN BARRELS AND SOAKAWAY PITS)

2) LINEAR LID ON ALL LOCAL ROADS
(PERFORATED PIPE SYSTEMS/INFILTRATION TRENCHES)

3) CENTRALIZED LID (UNDERGROUND INFILTRATION SYSTEM)

MINETS DRAINAGE AREA

ROYAL OAK DRAINAGE AREA

GRAY LANE DRAINAGE AREA

KEMPENFELT BAY (LAKE SIMCOE)

WHISKEY CREEK WATERSHED

LOVERS CREEK WATERSHED

ASSIKINAK PARK

CARTER PARK

GOLDEN MEADOW PARK

MONTSERRAND PARK

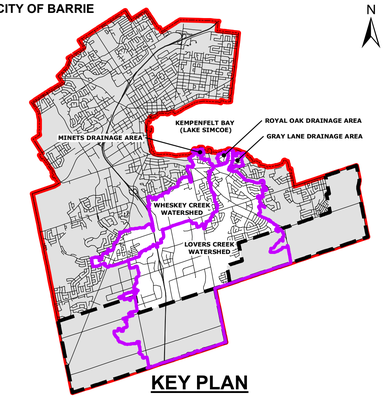
MAPLETON PARK

MADELAINE PARK

HEWITT'S SECONDARY PLAN AREA (ANNEXATION LANDS) EXCLUDED FROM STUDY

SALEM SECONDARY PLAN AREA (ANNEXATION LANDS) EXCLUDED FROM STUDY

CITY OF BARRIE



KEY PLAN

LEGEND

- STORM DEVICES
- CULVERT
- DITCH
- WATERCOURSE
- STORM SEWER (QMAX/QFULL FLOW > 115%)
- STORM SEWER (QMAX/QFULL FLOW 101%-115%)
- STORM SEWER (QMAX/QFULL FLOW 85%-100%)
- STORM SEWER (QMAX/QFULL FLOW < 85%)
- ROAD
- ABSENT OF MINOR DRAINAGE SYSTEM
- ANNIXATION LANDS BOUNDARY
- CENTRALIZED LID
- SWMF
- WATERSHED/DRAINAGE AREA BOUNDARY
- MUNICIPAL BORDER

TATHAM ENGINEERING

Barrie

SCALE = 1:10,000

0 125 250 500 750 1,000 Meters

DRAINAGE MASTER PLAN

LOVERS CREEK & WHISKEY CREEK WATERSHEDS;
MINETS, ROYAL OAK & GRAY LANE DRAINAGE AREAS

FIGURE 3C - COMBINED LID SCENARIO
EXISTING MINOR DRAINAGE SYSTEM DEFICIENCIES
WITH LOW IMPACT DEVELOPMENT MEASURES

DATE: MARCH 2019

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SPRINGWATER

ESSA

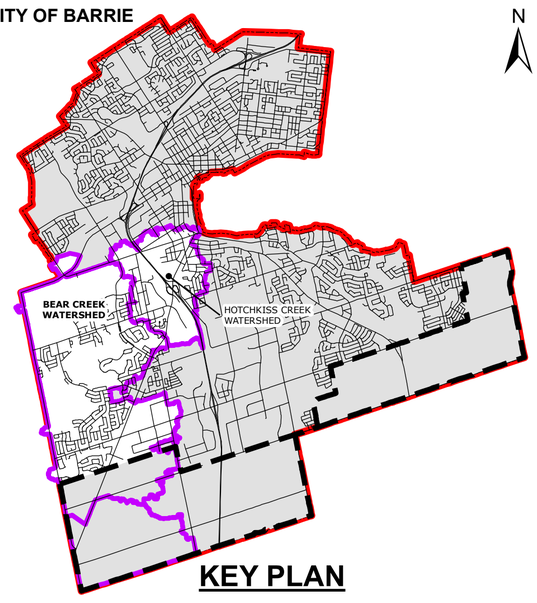
BEAR CREEK WATERSHED

HOTCHKISS CREEK WATERSHED

SALEM SECONDARY PLAN AREA (ANNEXATION LANDS) EXCLUDED FROM STUDY

N

CITY OF BARRIE



KEY PLAN

LEGEND

- STORM DEVICES
- CULVERT
- DITCH
- WATERCOURSE
- STORM SEWER (QMAX/QFULL FLOW > 115%)
- STORM SEWER (QMAX/QFULL FLOW 101%-115%)
- STORM SEWER (QMAX/QFULL FLOW 85%-100%)
- STORM SEWER (QMAX/QFULL FLOW < 85%)
- ABSENT OF MINOR DRAINAGE SYSTEM
- ROADS
- ANNIXATION LANDS BOUNDARY
- SWMF
- WATERSHED/DRAINAGE AREA BOUNDARY
- MUNICIPAL BORDER

TATHAM ENGINEERING

Barrie

SCALE = 1:10,000

0 125 250 500 750 1,000 Meters

DRAINAGE MASTER PLAN

BEAR CREEK & HOTCHKISS CREEK WATERSHEDS

FIGURE 4A - MINOR DRAINAGE SYSTEM DEFICIENCIES (5 YEAR STORM)

DATE: MARCH 2019

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SPRINGWATER

KEMPENFELT BAY (LAKE SIMCOE)

HOTCHKISS CREEK WATERSHED

BEAR CREEK WATERSHED

SALEM SECONDARY PLAN AREA (ANNEXATION LANDS) EXCLUDED FROM STUDY

ESSA

INNISFIL

DEFICIENT CULVERTS / CROSSING

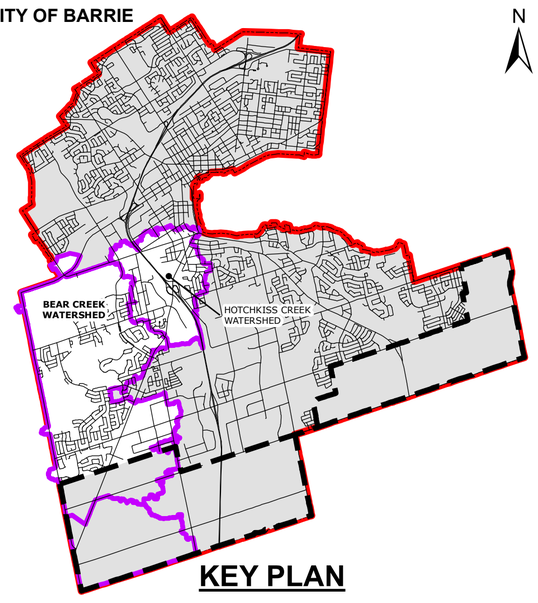
HOTCHKISS CREEK WATERSHED

- 41 MAYFAIR DRIVE
- 42 ARDAGH ROAD
- 43 MORROW ROAD
- 44 ESSA ROAD
- 46 HIGHWAY 400
- 47 WOOD STREET
- 48 TIFFIN STREET
- 49 ANNE STREET SOUTH
- 50 INNISFIL STREET
- 51 BRADFORD STREET
- 52 LAKESHORE DRIVE
- 135 RAIL CROSSING

BEAR CREEK WATERSHED

- 80 COUNTY ROAD 27
- 134 RAIL CROSSING

CITY OF BARRIE



KEY PLAN

LEGEND

- DEFICIENT CULVERTS
- MAJOR OVERLAND FLOW ROUTE DEFICIENCIES
- STORM SEWER
- CULVERT
- DITCH
- WATERCOURSE
- ROADS
- RAILWAY
- ANNIXATION LANDS BOUNDARY
- SWMF
- REGULATORY FLOODLINE
- REGULATORY FLOODPLAIN
- BUILDINGS
- WATERSHED/DRAINAGE AREA BOUNDARY
- MUNICIPAL BORDER

TATHAM ENGINEERING

Barrie

SCALE = 1:15,000

0 190 380 760 1,140 1,520 Meters

DRAINAGE MASTER PLAN

BEAR CREEK, THORNTON CREEK & HOTCHKISS CREEK WATERSHEDS

FIGURE 4B - MAJOR DRAINAGE SYSTEM DEFICIENCIES

DATE: MARCH 2019

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LOW IMPACT DEVELOPMENT MEASURES

1) LOT LEVEL LID (RAIN BARRELS AND SOAKAWAY PITS)

2) LINEAR LID ON ALL LOCAL ROADS
(PERFORATED PIPE SYSTEMS/INFILTRATION TRENCHES)

3) CENTRALIZED LID (UNDERGROUND INFILTRATION SYSTEM)

BEAR CREEK WATERSHED

HOTCHKISS CREEK WATERSHED

ESSA

SALEM SECONDARY PLAN AREA (ANNEXATION LANDS) EXCLUDED FROM STUDY

BEAR CREEK PARK

LOUGHEED PARK

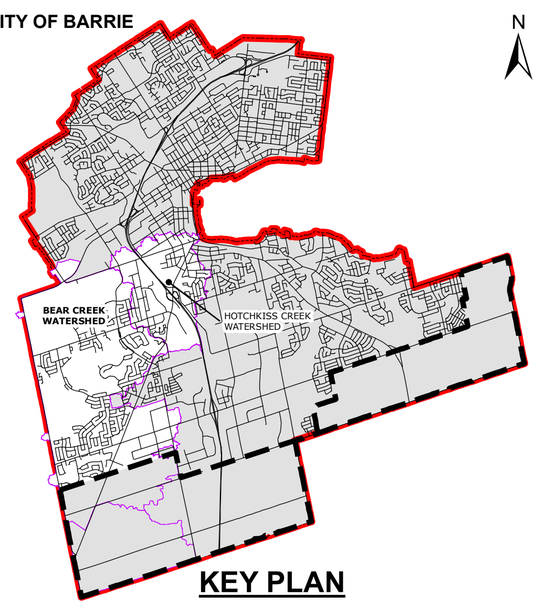
WESSENGER PARK

HARVIE PARK

ALLANDALE HEIGHTS PARK

KRAUS RD, KNUPP RD, MCAVOY DR, PRINGLE DR, MILLER DR, DUNLOP ST W, ELLIOTT AVE, SARJEANT DR, VESPRA ST, VICTORIA ST, JOHN ST, ROBERT ST, INNISFIL ST, SANFORD ST, BRADFORD ST, ELLEN ST, LAKESHORE DR, FERNDALE DR N, CROSS ST, DYMENT RD, LORENA ST, BROCK ST, ANNE ST S, TIFFIN ST, JACOBS TERR, GOWAN ST, ALFRED ST, CAROLINE ST, WOOD ST, MARCUS ST, CENTRE ST, CAMPBELL AVE, GRANVILLE ST, BURTON AVE, HOLGATE ST, PHILLIPS ST, ALVA ST, CRAWFORD ST, FRASER CRT, BALDWIN LANE, WILLIAM ST, ADELAIDE ST, MURRAY ST, 400 HWY N ON ESSA RD, 400 HWY S OFF ESSA RD, MORROW RD, BISHOP DR, BR14, BR09, BR22, KIERLAND RD, MARTA CRES, SUMMERSET DR, GRAIHAWK DR, PETER ST, TRASK DR, NICHOLSON DR, FERNDALE DR S, JAMES ST, PORRITT ST, ELIZABETH ST, CUTHBERT ST, ARCHER ST, MOON DR, PATTERSON RD, DEERA CRES, GLENRIDGE RD, HT10, HT12, HT07, ZEHRS ACCESS RD, PEACOCK LANE, THORNCREST RD, CAROL RD, JANE CRES, LITTLE AVE, MARSHALL ST, CHIEFTAIN CRES, HT03a, HT03b, HT06, QUAIL CRES, MAYFAIR DR, DOVE CRES, BR13, BR21, BR07, HAWTHORNE CRES, FERNDALE DR S ACCESS RD, WILDWOOD TRAIL, FAWN CRES, GROUSE GLEN, SHADOWOOD RD, LOGGERS RUN, SAWMILL RD, MEADOW LANE, BR23, HT16, HT15, HT11, HT13, HT17-P, HT08, HT14, WRIGHT DR, AUBURN CRT, NEVA RD, LONEYBROOK CRES, HAWKINS DR, GORE DR, MOCKINGBIRD CRES, PASS CRT, ARDAGH RD, CUNNINGHAM DR, BR18, DUNNETT DR, KELSEY CRES, GRANT'S WAY, MUIR DR, BELL ST, EAGLESTONE LANE, SEDGEWOOD WAY, WILDFLOWER CRT, PRIMROSE CRES, BR10, MCINTYRE DR, PENVILL TRAIL, LAMONT CRES, BATTEAUX ST, BLACK ASH TRAIL, SILVER TRAIL, SILVERCREEK CRES, WILLOW FERN DR, BR28, HUMBER ST, TOWN LINE, PINECLIFF CRES, OAKSIDE CRT, ORSI CRT, CUMMING DR, STAPLETON PL, BR06, BLOOM CRES, BR05, BROWN ST, STROUD PL, LOOKER DR, CITYVIEW CR, AIKENS CRES, BEACON RD, 400 HWY N, 400 HWY S, SPEIRS RD, HARVIE RD, LESLIE AVE, ALLSOP CRES, WILLOW DR, WHITE ELM RD, SILVER MAPLE CRES, FARMSTEAD CRES, MAPLETON AVE, BIBBY CRT, CLUTE CRES, BASSWOOD DR, ESSA RD, JACKSON ST, EMMS DR, SRIGLEY ST, BOAG CRT, WARNER RD, O'SHAUGHNESSY CRES, WHITE CRES, ELMBROOK DR, MEGAN CRES, RAMBLEWOOD DR, LAKE CRES, QUANCE ST, BROOKWOOD DR, THRUSHWOOD DR, COUGHLIN RD, KENWELL CRES, HOLLY MEADOW RD, CANARY REED CRT, MARSELLUS DR, BUTTERNUT DR, BRUCKER RD, WICE RD, LISTER DR, GIRDWOOD DR, GOLDS CRES, HERSEY CRES, DOWNING CRES, VICTORWAY DR, BLACK CHERRY CRES, CHURCHLAND DR, TWISS DR, SUNDEW DR, BLACK WILLOW DR, RED OAK DR, VIOLET ST, LUCAS AVE, GINGER DR, LEE CRES, BR08b, BR08a, BR27, BR20, BR26, VETERAN'S DR, CAPLAN AVE, HUNTER RD, BARRIE VIEW DR, CONCERT WAY, NORTH VILLAGE WAY, PARK PLACE BLVD, LIVE EIGHT WAY, CHURCHILL DR, MAPLEVIEW DR W, MAPLEVIEW DR E, ASSINIBOINE DR, SEYMOUR CRES, GARIBALDI DR, REDFERN AVE, LOGAN CRT, LOUGHEED RD, BR03, COLUMBIA RD, RUNDLE CRES, DYER BLVD, WADDINGTON CRES, ATHABASKA RD, WHITEHORN CRES, DUNN ST, BR01, BR11, BR25-P, BR24, KING ST, BR16, REID DR, BR19, BRYNE DR, HOOPER RD, SAUNDERS RD, SELKIRK CRES, COUNTY ROAD 27, SALEM RD, MILLS RD, NORRIS DR, COMMERCE PARK DR, LOCKHART RD, BR15, BEACON RD, BIG BAY POINT RD, BAYVIEW DR, MOLLARD CRT, FAIRVIEW RD

CITY OF BARRIE



KEY PLAN

LEGEND

- STORM DEVICES
- CULVERT
- DITCH
- WATERCOURSE
- STORM SEWER (QMAX/QFULL FLOW > 115%)
- STORM SEWER (QMAX/QFULL FLOW 101%-115%)
- STORM SEWER (QMAX/QFULL FLOW 85%-100%)
- STORM SEWER (QMAX/QFULL FLOW < 85%)
- ABSENT OF MINOR DRAINAGE SYSTEM
- ROADS
- ANNIXATION LANDS BOUNDARY
- CENTRALIZED LID
- SWMF
- WATERSHED/DRAINAGE AREA BOUNDARY
- MUNICIPAL BORDER

TATHAM ENGINEERING

Barrie

SCALE = 1:10,000

0 125 250 500 750 1,000 Meters

DRAINAGE MASTER PLAN

BEAR CREEK & HOTCHKISS CREEK WATERSHEDS

FIGURE 4C - COMBINED LID SCENARIO
EXISTING MINOR DRAINAGE SYSTEM DEFICIENCIES
WITH LOW IMPACT DEVELOPMENT MEASURES

DATE: MARCH 2019

WILLIAMS & HOLGATE CREEK DRAINAGE AREAS

HURONIA CREEK DRAINAGE AREA

KEMPENFELT BAY
LAKE SIMCOE

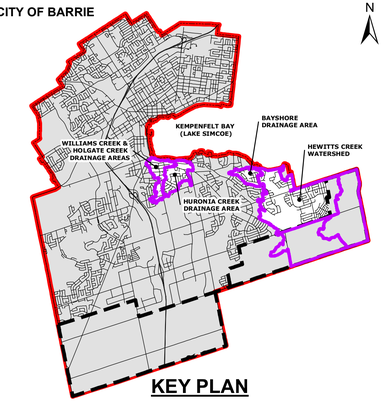
BAYSHORE DRAINAGE AREA

INNISFIL

HEWITTS CREEK WATERSHED

HEWITT'S SECONDARY PLAN AREA (ANNEXATION LANDS) EXCLUDED FROM STUDY

CITY OF BARRIE



KEY PLAN

LEGEND

- STORM DEVICES
- CULVERT
- DITCH
- WATERCOURSE
- STORM SEWER (QMAX/QFULL FLOW > 115%)
- STORM SEWER (QMAX/QFULL FLOW > 115%)
- STORM SEWER (QMAX/QFULL FLOW 101%-115%)
- STORM SEWER (QMAX/QFULL FLOW 85%-100%)
- STORM SEWER (QMAX/QFULL FLOW < 85%)
- ROADS
- ABSENT OF MINOR DRAINAGE SYSTEM
- ANNIXATION LANDS BOUNDARY
- SWMF
- WATERSHED/DRAINAGE AREA BOUNDARY
- MUNICIPAL BORDER

TATHAM ENGINEERING

Barrie

SCALE = 1:10,000

0 125 250 500 750 1,000 Meters

DRAINAGE MASTER PLAN

HEWITTS CREEK WATERSHED;
BAYSHORE, WILLIAMS, HOLGATE & HURONIA CREEKS DRAINAGE AREAS

FIGURE 5A - MINOR DRAINAGE SYSTEM DEFICIENCIES (5 YEAR STORM)

DATE: MARCH 2019

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ORO-MEDONTE

KEMPENFELT BAY
LAKE SIMCOE

INNISFIL

WILLIAMS & HOLGATE CREEK DRAINAGE AREAS

HURONIA CREEK DRAINAGE AREA

BAYSHORE DRAINAGE AREA

HEWITTS CREEK WATERSHED

HEWITT'S SECONDARY PLAN AREA (ANNEXATION LANDS) EXCLUDED FROM STUDY

CITY OF BARRIE

KEY PLAN

KEMPENFELT BAY (LAKE SIMCOE)

BAYSHORE DRAINAGE AREA

WILLIAMS CREEK & HOLGATE CREEK DRAINAGE AREAS

HEWITTS CREEK WATERSHED

HURONIA CREEK DRAINAGE AREA

LEGEND

- DEFICIENT CULVERTS
- MAJOR OVERLAND FLOW ROUTE DEFICIENCIES
- CULVERT
- DITCH
- WATERCOURSE
- REGULATORY FLOODLINE
- SWMF
- REGULATORY FLOODPLAIN
- BUILDINGS
- ROADS
- RAILWAY
- ANNIXATION LANDS BOUNDARY
- WATERSHED/DRAINAGE AREA BOUNDARY
- MUNICIPAL BORDER

DEFICIENT CULVERTS / CROSSINGS

HEWITTS CREEK WATERSHED

(83) MAPLEVIEW DRIVE EAST

(84) PRINCE WILLIAM WAY

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TATHAM ENGINEERING

Barrie

SCALE = 1:15,000

0 190 380 760 1,140 1,520 Meters

DRAINAGE MASTER PLAN

HEWITTS CREEK WATERSHED;
BAYSHORE, WILLIAMS, HOLGATE & HURONIA CREEKS DRAINAGE AREAS

FIGURE 5B - MAJOR DRAINAGE SYSTEM DEFICIENCIES

DATE: MARCH 2019

WILLIAMS & HOLGATE CREEK DRAINAGE AREAS

HURONIA CREEK DRAINAGE AREA

KEMPENFELT BAY
LAKE SIMCOE

BAYSHORE DRAINAGE AREA

INNISFIL

GREENFIELD PARK

KUZMICH PARK

SANDRINGHAM PARK

QUEENSWAY/HYDE PARK

HEWITT'S SECONDARY PLAN AREA
(ANNEXATION LANDS)
EXCLUDED FROM STUDY

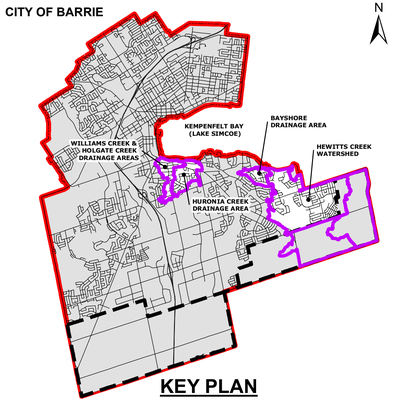
LOW IMPACT DEVELOPMENT MEASURES

1) LOT LEVEL LID (RAIN BARRELS AND SOAKAWAY PITS)

2) LINEAR LID ON ALL LOCAL ROADS
(PERFORATED PIPE SYSTEMS/INFILTRATION TRENCHES)

3) CENTRALIZED LID (UNDERGROUND INFILTRATION SYSTEM)

CITY OF BARRIE



KEY PLAN

LEGEND

- STORM DEVICES
- CULVERT
- DITCH
- WATERCOURSE
- STORM SEWER (QMAX/QFULL FLOW > 115%)
- STORM SEWER (QMAX/QFULL FLOW > 115%)
- STORM SEWER (QMAX/QFULL FLOW 101%-115%)
- STORM SEWER (QMAX/QFULL FLOW 85%-100%)
- STORM SEWER (QMAX/QFULL FLOW < 85%)
- ABSENT OF MINOR DRAINAGE SYSTEM
- ROADS
- ANNIXATION LANDS BOUNDARY
- CENTRALIZED LID
- SWMF
- WATERSHED/DRAINAGE AREA BOUNDARY
- MUNICIPAL BORDER

TATHAM ENGINEERING

Barrie

SCALE = 1:10,000

0 125 250 500 750 1,000 Meters

DRAINAGE MASTER PLAN

HEWITTS CREEK WATERSHED;
BAYSHORE, WILLIAMS, HOLGATE & HURONIA CREEKS DRAINAGE AREAS

FIGURE 5C - COMBINED LID SCENARIO
EXISTING MINOR DRAINAGE SYSTEM DEFICIENCIES
WITH LOW IMPACT DEVELOPMENT MEASURES

DATE:MARCH 2019

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N

SPRINGWATER

LITTLE LAKE WATERSHED

GEORGIAN CREEK WATERSHED

SOPHIA CREEK WATERSHED

ORO-MEDONTE

MULCASTER DRAINAGE AREA

ST. VINCENT DRAINAGE AREA

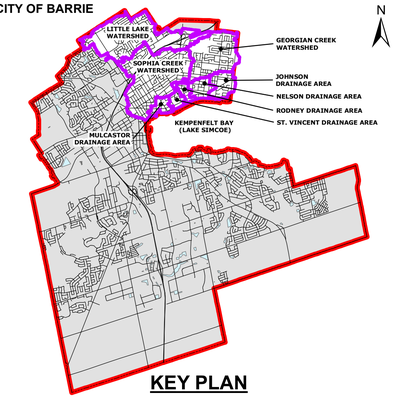
RODNEY DRAINAGE AREA

NELSON DRAINAGE AREA

JOHNSON DRAINAGE AREA

KEMPENFELT BAY (LAKE SIMCOE)

CITY OF BARRIE



KEY PLAN

LEGEND

- STORM DEVICES
- CULVERT
- DITCH
- WATERCOURSE
- STORM SEWER (QMAX/QFULL FLOW > 115%)
- STORM SEWER (QMAX/QFULL FLOW 101%-115%)
- STORM SEWER (QMAX/QFULL FLOW 85%-100%)
- STORM SEWER (QMAX/QFULL FLOW < 85%)
- ABSENT OF MINOR DRAINAGE SYSTEM
- ROAD
- SWMF
- WATERSHED/DRAINAGE AREA BOUNDARY
- MUNICIPAL BORDER

TATHAM ENGINEERING

Barrie

SCALE = 1:10,000

0 125 250 500 750 1,000 Meters

DRAINAGE MASTER PLAN

SOPHIA CREEK, GEORGIAN CREEK & LITTLE LAKE WATERSHEDS;

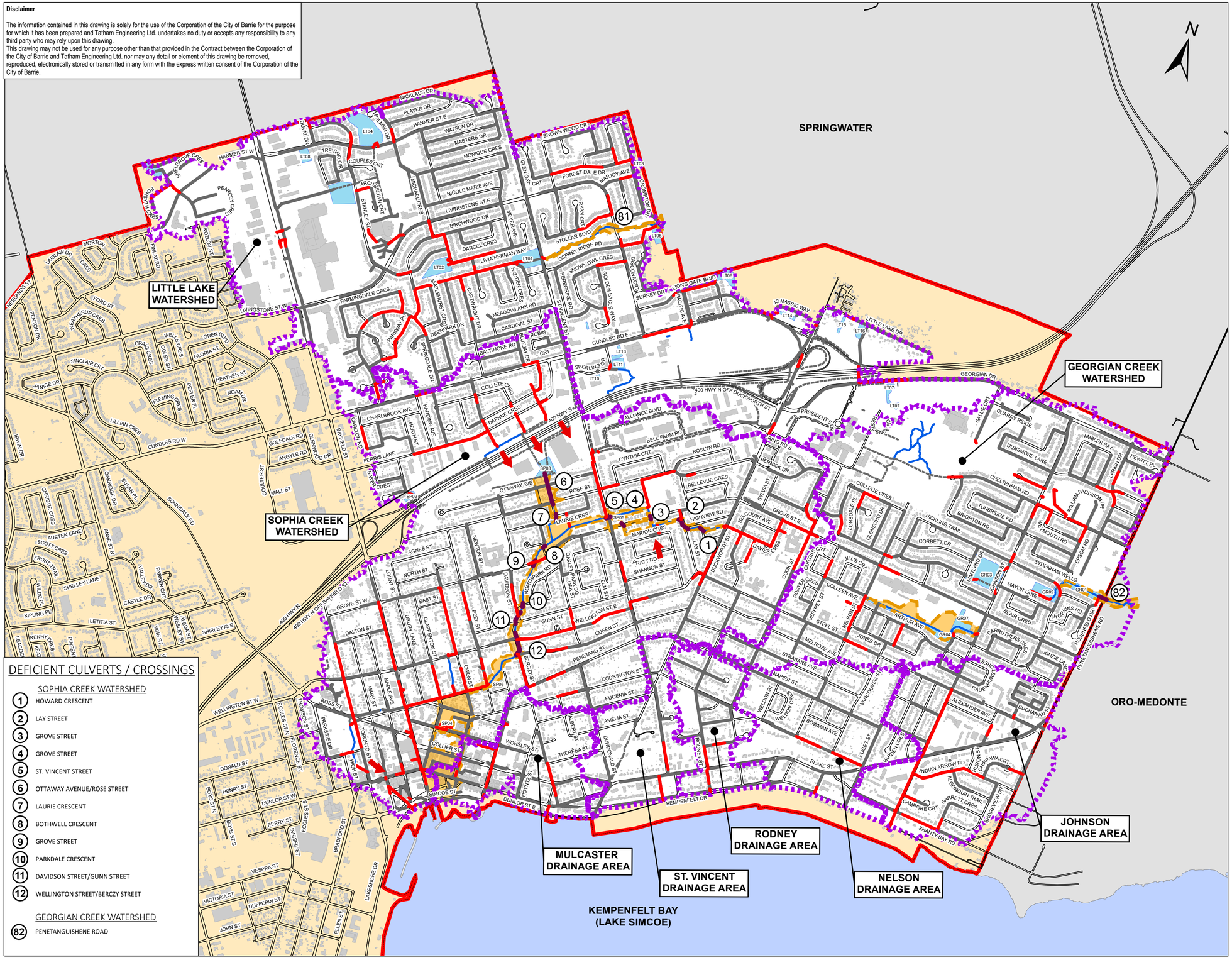
JOHNSON, MULCASTOR, NELSON, RODNEY & ST VINCENT DRAINAGE AREAS

FIGURE 6A - MINOR DRAINAGE SYSTEM DEFICIENCIES (5 YEAR STORM) FUTURE FLOWS (20% INCREASE)

DATE: MARCH 2019

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DEFICIENT CULVERTS / CROSSINGS

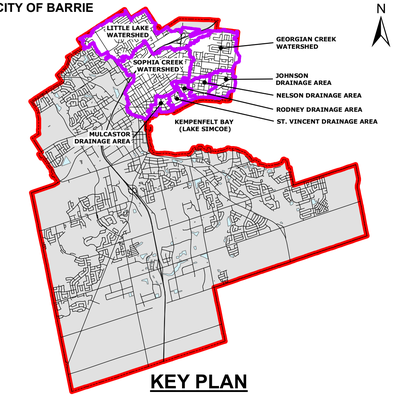
SOPHIA CREEK WATERSHED

1. HOWARD CRESCENT
2. LAY STREET
3. GROVE STREET
4. GROVE STREET
5. ST. VINCENT STREET
6. OTTAWAY AVENUE/ROSE STREET
7. LAURIE CRESCENT
8. BOTHWELL CRESCENT
9. GROVE STREET
10. PARKDALE CRESCENT
11. DAVIDSON STREET/GUNN STREET
12. WELLINGTON STREET/BERCZY STREET

GEORGIAN CREEK WATERSHED

82. PENETANGUISHENE ROAD

CITY OF BARRIE



KEY PLAN

LEGEND

- DEFICIENT CULVERTS
- MAJOR OVERLAND FLOW ROUTE DEFICIENCIES
- STORM SEWER
- CULVERT
- DITCH
- WATERCOURSE
- ROAD
- SWMF
- REGULATORY FLOODPLAIN
- REGULATORY FLOODLINE
- BUILDINGS
- WATERSHED/DRAINAGE AREA BOUNDARY
- MUNICIPAL BORDER

TATHAM ENGINEERING

Barrie

SCALE = 1:10,000

0 125 250 500 750 1,000 Meters

DRAINAGE MASTER PLAN

SOPHIA CREEK, GEORGIAN CREEK & LITTLE LAKE WATERSHEDS

JOHNSON, MULCASTOR, NELSON, RODNEY & ST VINCENT DRAINAGE AREAS

FIGURE 6B - MAJOR DRAINAGE SYSTEM DEFICIENCIES FUTURE FLOWS (20% INCREASE)

DATE: MARCH 2019

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LOW IMPACT DEVELOPMENT MEASURES

1) LOT LEVEL LID (RAIN BARRELS AND SOAKAWAY PITS)

2) LINEAR LID ON ALL LOCAL ROADS
(PERFORATED PIPE SYSTEMS/INFILTRATION TRENCHES)

3) CENTRALIZED LID (UNDERGROUND INFILTRATION SYSTEM)

N

SPRINGWATER

LITTLE LAKE WATERSHED

SOPHIA CREEK WATERSHED

GEORGIAN CREEK WATERSHED

ORO-MEDONTE

CARTWRIGHT PARK

DUNSMORE PARK

STRABANE PARK

SHOREVIEW PARK

JOHNSON DRAINAGE AREA

RODNEY DRAINAGE AREA

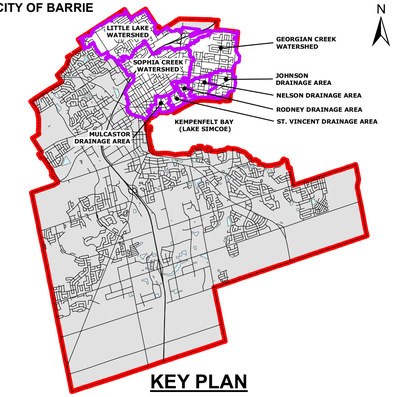
NELSON DRAINAGE AREA

ST. VINCENT DRAINAGE AREA

MULCASTER DRAINAGE AREA

KEMPENFELT BAY
(LAKE SIMCOE)

CITY OF BARRIE



KEY PLAN

LEGEND

- STORM DEVICES
- CULVERT
- DITCH
- WATERCOURSE
- STORM SEWER (QMAX/QFULL FLOW > 115%)
- STORM SEWER (QMAX/QFULL FLOW 101%-115%)
- STORM SEWER (QMAX/QFULL FLOW 85%-100%)
- STORM SEWER (QMAX/QFULL FLOW < 85%)
- ABSENT OF MINOR DRAINAGE SYSTEM
- ROAD
- CENTRALIZED LID
- SWMF
- WATERSHED/DRAINAGE AREA BOUNDARY
- MUNICIPAL BORDER

TATHAM ENGINEERING

Barrie

SCALE = 1:10,000

0 125 250 500 750 1,000 Meters

DRAINAGE MASTER PLAN

SOPHIA CREEK, GEORGIAN CREEK
& LITTLE LAKE WATERSHEDS;

JOHNSON, MULCASTOR, NELSON, RODNEY
& ST VINCENT DRAINAGE AREAS

FIGURE 6C - COMBINED LID SCENARIO
FUTURE MINOR DRAINAGE SYSTEM DEFICIENCIES
WITH LOW IMPACT DEVELOPMENT MEASURES IMPLEMENTED

DATE: MARCH 2019

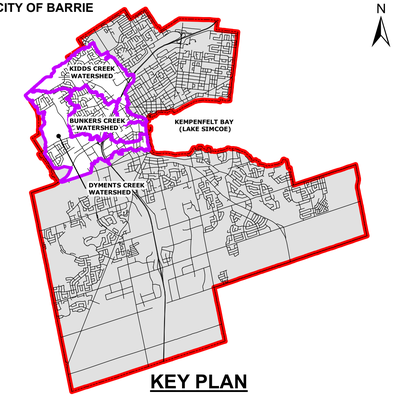
SPRINGWATER

KIDDS CREEK WATERSHED

DYMENTS CREEK WATERSHED

BUNKERS CREEK WATERSHED

KEMPENFELT BAY (LAKE SIMCOE)



KEY PLAN

LEGEND

- STORM DEVICES
- CULVERT
- DITCH
- WATERCOURSE
- STORM SEWER (QMAX/QFULL FLOW > 115%)
- STORM SEWER (QMAX/QFULL FLOW 101%-115%)
- STORM SEWER (QMAX/QFULL FLOW 85%-100%)
- STORM SEWER (QMAX/QFULL FLOW < 85%)
- ROADS
- ABSENT OF MINOR DRAINAGE SYSTEM
- SWMF
- WATERSHED/DRAINAGE AREA BOUNDARY
- MUNICIPAL BORDER

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TATHAM ENGINEERING

Barrie

SCALE = 1:10,000

0 125 250 500 750 1,000 Meters

DRAINAGE MASTER PLAN

BUNKERS CREEK, DYMENTS CREEK & KIDDS CREEK WATERSHEDS

FIGURE 7A - MINOR DRAINAGE SYSTEM DEFICIENCIES (5 YEAR STORM) FUTURE FLOWS (20% INCREASE)

DATE: MARCH 2019

DEFICIENT CULVERTS / CROSSINGS

DYMENTS CREEK WATERSHED

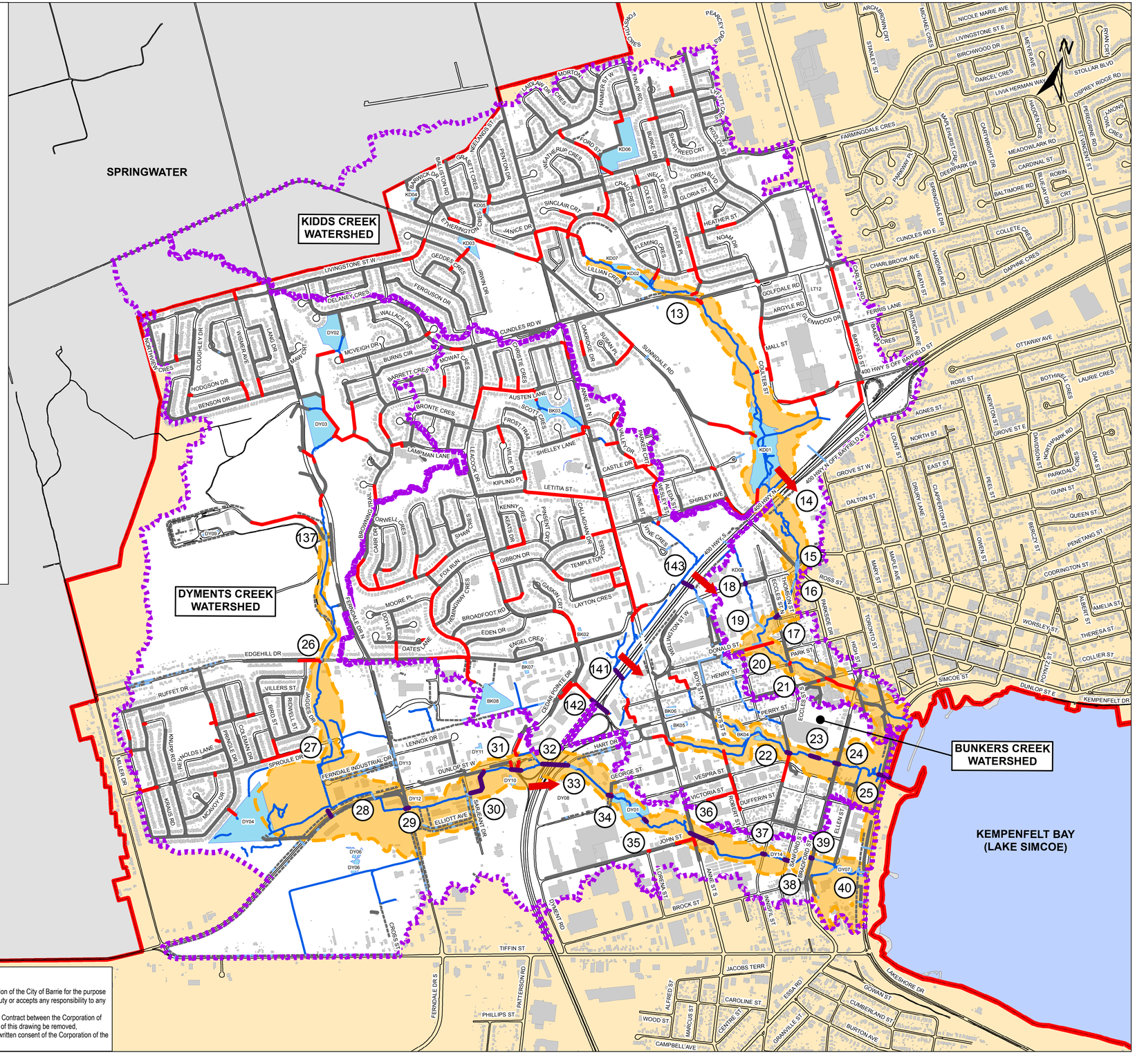
28 DUNLOP STREET WEST
29 FERNDALE DRIVE NORTH
30 SARJEANT DRIVE
31 DUNLOP STREET/HIGHWAY 400 ON-RAMP
32 HIGHWAY 400
33 HART DRIVE
34 GEORGE STREET
35 VICTORIA STREET
36 JOHN STREET
37 INNISFIL STREET
38 SANFORD STREET
39 BRADFORD STREET

KIDDS CREEK WATERSHED

13 CUNDLES ROAD WEST
16 THOMSON STREET
17 ECCLES STREET
18 WELLINGTON STREET

BUNKERS CREEK WATERSHED

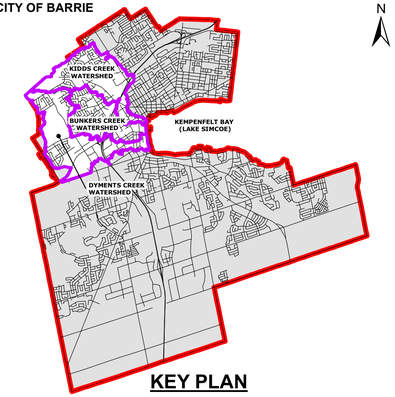
22 INNISFIL STREET
23 COMMERCIAL PLAZA ENTRANCE ROAD
24 BRADFORD STREET
25 LAKESHORE DRIVE
141 HIGHWAY 400
142 HIGHWAY 400
143 HIGHWAY 400



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CITY OF BARRIE



KEY PLAN

LEGEND

- DEFICIENT CULVERTS
- MAJOR OVERLAND FLOW ROUTE DEFICIENCIES
- STORM SEWER
- CULVERT
- DITCH
- WATERCOURSE
- ROADS
- SWMF
- REGULATORY FLOODPLAIN
- REGULATORY FLOODLINE
- BUILDINGS
- WATERSHED/DRAINAGE AREA BOUNDARY
- MUNICIPAL BORDER

TATHAM ENGINEERING

Barrie

SCALE = 1:10,000

0 125 250 500 750 1,000 Meters

DRAINAGE MASTER PLAN

BUNKERS CREEK, DYMENTS CREEK & KIDDS CREEK WATERSHEDS

FIGURE 7B - MAJOR DRAINAGE SYSTEM DEFICIENCIES FUTURE FLOWS (20% INCREASE)

DATE: MARCH 2019

LOW IMPACT DEVELOPMENT MEASURES

1) LOT LEVEL LID (RAIN BARRELS AND SOAKAWAY PITS)

2) LINEAR LID ON ALL LOCAL ROADS
(PERFORATED PIPE SYSTEMS/INFILTRATION TRENCHES)

3) CENTRALIZED LID (UNDERGROUND INFILTRATION SYSTEM)

SPRINGWATER

KIDDS CREEK WATERSHED

DYMENTS CREEK WATERSHED

BUNKERS CREEK WATERSHED

KEMPENFELT BAY (LAKE SIMCOE)

CLOUGHLEY PARK

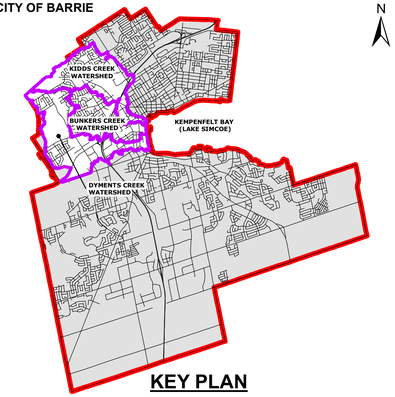
SUNNIDALE PARK

GIBBON PARK

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CITY OF BARRIE



KEY PLAN

LEGEND

- STORM DEVICES
- CULVERT
- DITCH
- WATERCOURSE
- STORM SEWER (QMAX/QFULL FLOW > 115%)
- STORM SEWER (QMAX/QFULL FLOW 101%-115%)
- STORM SEWER (QMAX/QFULL FLOW 85%-100%)
- STORM SEWER (QMAX/QFULL FLOW < 85%)
- ABSENT OF MINOR DRAINAGE SYSTEM
- ROADS
- CENTRALIZED LID
- SWMF
- WATERSHED/DRAINAGE AREA BOUNDARY
- MUNICIPAL BORDER

TATHAM ENGINEERING

Barrie

0 125 250 500 750 1,000 Meters

DRAINAGE MASTER PLAN

BUNKERS CREEK, DYMENTS CREEK & KIDDS CREEK WATERSHEDS

FIGURE 7C - COMBINED LID SCENARIO
FUTURE MINOR DRAINAGE SYSTEM DEFICIENCIES
WITH LOW IMPACT DEVELOPMENT MEASURES IMPLEMENTED

DATE: MARCH 2019

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MINETS DRAINAGE AREA

ROYAL OAK DRAINAGE AREA

GRAY LANE DRAINAGE AREA

KEMPENFELT BAY (LAKE SIMCOE)

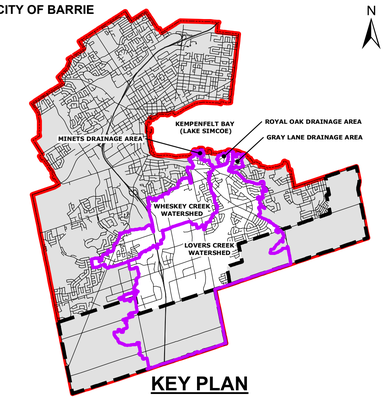
WHISKEY CREEK WATERSHED

LOVERS CREEK WATERSHED

HEWITT'S SECONDARY PLAN AREA (ANNEXATION LANDS) EXCLUDED FROM STUDY

SALEM SECONDARY PLAN AREA (ANNEXATION LANDS) EXCLUDED FROM STUDY

CITY OF BARRIE



KEY PLAN

LEGEND

- CULVERT
- DITCH
- WATERCOURSE
- STORM SEWER (QMAX/QFULL FLOW > 115%)
- STORM SEWER (QMAX/QFULL FLOW 101%-115%)
- STORM SEWER (QMAX/QFULL FLOW 85%-100%)
- STORM SEWER (QMAX/QFULL FLOW < 85%)
- ABSENT OF MINOR DRAINAGE SYSTEM
- ROAD
- ANNIXATION LANDS BOUNDARY
- SWMF
- WATERSHED/DRAINAGE AREA BOUNDARY
- MUNICIPAL BORDER

TATHAM ENGINEERING

Barrie

SCALE = 1:10,000

0 125 250 500 750 1,000 Meters

DRAINAGE MASTER PLAN

LOVERS CREEK & WHISKEY CREEK WATERSHEDS; MINETS, ROYAL OAK & GRAY LANE DRAINAGE AREAS

FIGURE 8A - MINOR DRAINAGE SYSTEM DEFICIENCIES (5 YEAR STORM) FUTURE FLOWS (20% INCREASE)

DATE: MARCH 2019

DEFICIENT CULVERTS / CROSSINGS

LOVERS CREEK WATERSHED		WHISKEY CREEK WATERSHED	
88	BAYVIEW DRIVE	53	HARVIE ROAD
89	LOCKHART ROAD	54	HARVIE ROAD
90	HURONIA ROAD	56	FAIRVIEW ROAD
91	LOCKHART ROAD	57	BAYVIEW DRIVE
92	HURONIA ROAD	59	MCCONKEY PLACE
94	WELHAM ROAD	60	HURONIA ROAD
95	MAPLEVIEW DRIVE EAST	61	HERRELL AVENUE
97	HURONIA ROAD	62	LITTLE AVENUE
98	WELHAM ROAD	63	YONGE STREET
99	ELLIS DRIVE	64	HURST DRIVE
105	TOLLENDAL MILL ROAD	65	THE BOULEVARD
121	RAIL CROSSING	66	BRENNAN AVENUE
123	RAIL CROSSING	138	RAIL CROSSING
126	RAIL CROSSING		

DISCLAIMER

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KEMPENFELT BAY (LAKE SIMCOE)

MINETS DRAINAGE AREA

ROYAL OAK DRAINAGE AREA

GRAY LANE DRAINAGE AREA

WHISKEY CREEK WATERSHED

LOVERS CREEK WATERSHED

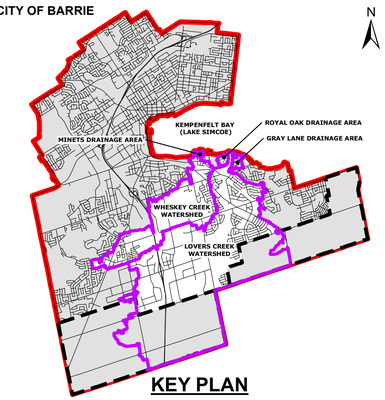
HEWITT'S SECONDARY PLAN AREA (ANNEXATION LANDS) EXCLUDED FROM STUDY

SALEM SECONDARY PLAN AREA (ANNEXATION LANDS) EXCLUDED FROM STUDY

ESSA

INNISFIL

CITY OF BARRIE



KEY PLAN

LEGEND

- DEFICIENT CULVERTS
- MAJOR OVERLAND FLOW ROUTE DEFICIENCIES
- STORM SEWER
- CULVERT
- DITCH
- WATERCOURSE
- RAILWAY
- ROAD
- ANNIXATION LANDS BOUNDARY
- SWMF
- REGULATORY FLOODLINE
- REGULATORY FLOODPLAIN
- BUILDINGS
- WATERSHED/DRAINAGE AREA BOUNDARY
- MUNICIPAL BORDER

TATHAM ENGINEERING

Barrie

SCALE = 1:15,000

0 190 380 760 1,140 1,520 Meters

DRAINAGE MASTER PLAN

LOVERS CREEK & WHISKEY CREEK WATERSHEDS; MINETS, ROYAL OAK & GRAY LANE DRAINAGE AREAS

FIGURE 8B - MAJOR DRAINAGE SYSTEM DEFICIENCIES FUTURE FLOWS (20% INCREASE)

DATE: MARCH 2019

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LOW IMPACT DEVELOPMENT MEASURES

1) LOT LEVEL LID (RAIN BARRELS AND SOAKAWAY PITS)

2) LINEAR LID ON ALL LOCAL ROADS
(PERFORATED PIPE SYSTEMS/INFILTRATION TRENCHES)

3) CENTRALIZED LID (UNDERGROUND INFILTRATION SYSTEM)

MINETS DRAINAGE AREA

ROYAL OAK DRAINAGE AREA

GRAY LANE DRAINAGE AREA

KEMPENFELT BAY (LAKE SIMCOE)

WHISKEY CREEK WATERSHED

LOVERS CREEK WATERSHED

ASSIKINAK PARK

CARTER PARK

GOLDEN MEADOW PARK

MADELAINE PARK

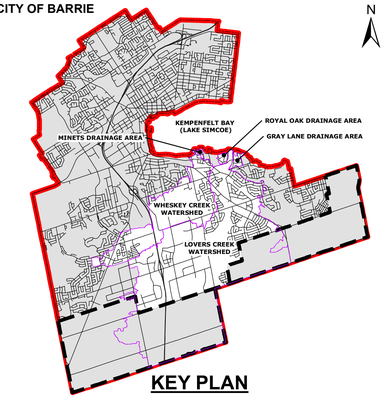
MONTSERRAND PARK

MAPLETON PARK

HEWITT'S SECONDARY PLAN AREA (ANNEXATION LANDS) EXCLUDED FROM STUDY

SALEM SECONDARY PLAN AREA (ANNEXATION LANDS) EXCLUDED FROM STUDY

CITY OF BARRIE



KEY PLAN

LEGEND

- STORM DEVICES
- CULVERT
- DITCH
- WATERCOURSE
- STORM SEWER (QMAX/QFULL FLOW > 115%)
- STORM SEWER (QMAX/QFULL FLOW 101%-115%)
- STORM SEWER (QMAX/QFULL FLOW 85%-100%)
- STORM SEWER (QMAX/QFULL FLOW < 85%)
- ABSENT OF MINOR DRAINAGE SYSTEM
- ROAD
- ANNIXATION LANDS BOUNDARY
- CENTRALIZED LID
- SWMF
- WATERSHED/DRAINAGE AREA BOUNDARY
- MUNICIPAL BORDER

TATHAM ENGINEERING

Barrie

SCALE = 1:10,000

0 125 250 500 750 1,000 Meters

DRAINAGE MASTER PLAN

LOVERS CREEK & WHISKEY CREEK WATERSHEDS;
MINETS, ROYAL OAK & GRAY LANE DRAINAGE AREAS

FIGURE 8C - COMBINED LID SCENARIO
EXISTING MINOR DRAINAGE SYSTEM DEFICIENCIES
WITH LOW IMPACT DEVELOPMENT MEASURES

DATE: MARCH 2019

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SPRINGWATER

ESSA

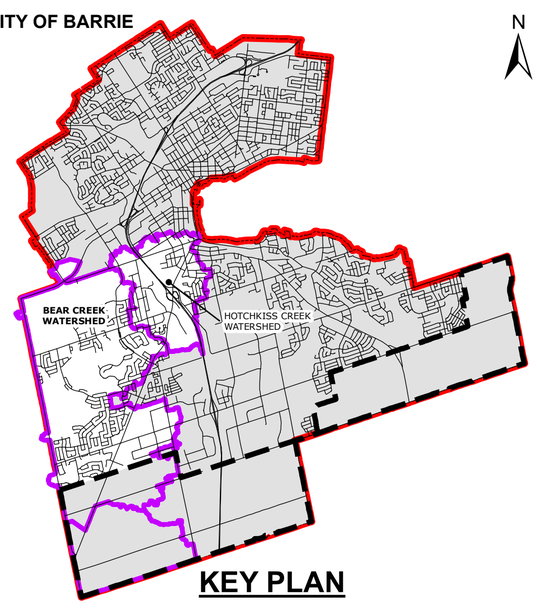
BEAR CREEK WATERSHED

HOTCHKISS CREEK WATERSHED

SALEM SECONDARY PLAN AREA (ANNEXATION LANDS) EXCLUDED FROM STUDY

N

CITY OF BARRIE



KEY PLAN

LEGEND

- STORM DEVICES
- CULVERT
- DITCH
- WATERCOURSE
- STORM SEWER (QMAX/QFULL FLOW > 115%)
- STORM SEWER (QMAX/QFULL FLOW 101%-115%)
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- ABSENT OF MINOR DRAINAGE SYSTEM
- ROADS
- ANNIXATION LANDS BOUNDARY
- SWMF
- WATERSHED/DRAINAGE AREA BOUNDARY
- MUNICIPAL BORDER

TATHAM ENGINEERING

Barrie

SCALE = 1:10,000

0 125 250 500 750 1,000 Meters

DRAINAGE MASTER PLAN

BEAR CREEK & HOTCHKISS CREEK WATERSHEDS

FIGURE 9A - MINOR DRAINAGE SYSTEM DEFICIENCIES (5 YEAR STORM) FUTURE FLOWS (20% INCREASE)

DATE: MARCH 2019

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SPRINGWATER

KEMPENFELT BAY
(LAKE SIMCOE)

HOTCHKISS CREEK WATERSHED

BEAR CREEK WATERSHED

SALEM SECONDARY PLAN AREA
(ANNEXATION LANDS)
EXCLUDED FROM STUDY

ESSA

INNISFIL

DEFICIENT CULVERTS / CROSSING

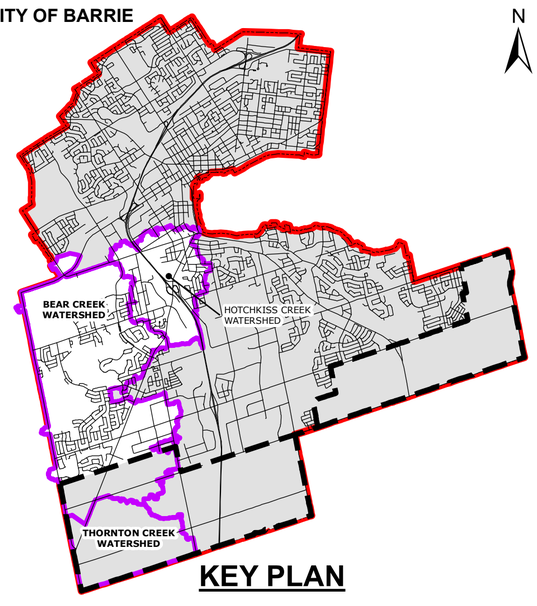
HOTCHKISS CREEK WATERSHED

- 41 MAYFAIR DRIVE
- 42 ARDAGH ROAD
- 43 MORROW ROAD
- 44 ESSA ROAD
- 46 HIGHWAY 400
- 47 WOOD STREET
- 48 TIFFIN STREET
- 49 ANNE STREET SOUTH
- 50 INNISFIL STREET
- 51 BRADFORD STREET
- 52 LAKESHORE DRIVE
- 135 RAIL CROSSING

BEAR CREEK WATERSHED

- 78 ARDAGH ROAD
- 79 SUMMERSET DRIVE
- 80 COUNTY ROAD 27
- 134 RAIL CROSSING

CITY OF BARRIE



KEY PLAN

LEGEND

- DEFICIENT CULVERTS
- STORM SEWER
- MAJOR OVERLAND FLOW ROUTE DEFICIENCIES
- CULVERT
- DITCH
- WATERCOURSE
- RAILWAY
- ROADS
- ANNIXATION LANDS BOUNDARY
- SWMF
- REGULATORY FLOODLINE
- REGULATORY FLOODPLAIN
- BUILDINGS
- WATERSHED/DRAINAGE AREA BOUNDARY
- MUNICIPAL BORDER

TATHAM ENGINEERING

Barrie

SCALE = 1:15,000

0 190 380 760 1,140 1,520 Meters

DRAINAGE MASTER PLAN

BEAR CREEK, THORNTON CREEK
& HOTCHKISS CREEK WATERSHEDS

FIGURE 9B - MAJOR DRAINAGE SYSTEM DEFICIENCIES
FUTURE FLOWS (20% INCREASE)

DATE: MARCH 2019

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LOW IMPACT DEVELOPMENT MEASURES

1) LOT LEVEL LID (RAIN BARRELS AND SOAKAWAY PITS)

2) LINEAR LID ON ALL LOCAL ROADS
(PERFORATED PIPE SYSTEMS/INFILTRATION TRENCHES)

3) CENTRALIZED LID (UNDERGROUND INFILTRATION SYSTEM)

BEAR CREEK WATERSHED

HOTCHKISS CREEK WATERSHED

SALEM SECONDARY PLAN AREA (ANNEXATION LANDS) EXCLUDED FROM STUDY

ESSA

ALLANDALE HEIGHTS PARK

BEAR CREEK PARK

HARVIE PARK

LOUGHEED PARK

WESSENGER PARK

KRAUS RD, KNUPP RD, MCAVOY DR, PRINGLE DR, MILLER DR, DUNLOP ST W, ELLIOTT AVE, SARJEANT DR, VESPRA ST, VICTORIA ST, JOHN ST, ROBERT ST, INNISFIL ST, SANFORD ST, BRADFORD ST, ELLEN ST, LAKESHORE DR, N, CROSS ST, FERNDALE DR N, HT16, HT15, DYMENT RD, LORENA ST, BROCK ST, HT11, ANNE ST S, HT13, HT17-P, HT08, TIFFIN ST, JACOBS TERR, GOWAN ST, ALFRED ST, CAROLINE ST, PHILLIPS ST, WOOD ST, MARCUS ST, CENTRE ST, GRANVILLE ST, BURTON AVE, CAMPBELL AVE, HOLGATE ST, ALVA ST, HT14, CRAWFORD ST, FRASER CRT, ADELAIDE ST, BALDWIN LANE, WILLIAM ST, 400 HWY N ON ESSA RD, MURRAY ST, BR14, BISHOP DR, BR09, BR22, KIERLAND RD, MARTA CRES, SUMMERSET DR, PETER ST, JAMES ST, ELIZABETH ST, PORRITT ST, NICHOLSON DR, FERNDALE DR S, TRASK DR, GRAIHAWK DR, HAWKINS DR, GORE DR, MOCKINGBIRD CRES, CUTHBERT ST, ARCHER ST, MOON DR, MORROW RD, 400 HWY S OFF ESSA RD, DELRA CRES, HT10, GLENRIDGE RD, PATTERSON RD, ZEHRS ACCESS RD, HT12, HT07, JANE CRES, PEACOCK LANE, THORNCREST RD, CAROL RD, LITTLE AVE, WRIGHT DR, AUBURN CRT, LONEYBROOK CRES, NEVA RD, ARDAGH RD, PASS CRT, BR18, CUNNINGHAM DR, BR21, SEDGEWOOD WAY, DUNNETT DR, KELSEY CRES, GRANT'S WAY, MUIR DR, BELL ST, EAGLESTONE LANE, BR10, MCINTYRE DR, PENVILL TRAIL, LAMONT CRES, BATTEAUX ST, BLACK ASH TRAIL, SILVER TRAIL, SILVERCREEK CRES, WILLOW FERN DR, WILDFLOWER CRT, PRIMROSE CRES, BR28, HUMBER ST, TOWN LINE, PINECLIFF CRES, OAKSIDE CRT, BR07, HAWTHORNE CRES, FERNDALE DR S ACCESS RD, WILDWOOD TRAIL, FAWN CRES, GROUSE GLEN, DOVE CRES, BR13, MAYFAIR DR, QUAIL CRES, HT03a, HT03b, HT06, SHADOWOOD RD, LOGGERS RUN, SAWMILL RD, BR23, MEADOW LANE, CHIEFTAIN CRES, FAIRVIEW RD, MOLLARD CRT, CUMMING DR, ORSI CRT, STAPLETON PL, BR06, BLOOM CRES, BR15, CITYVIEW CR, AIKENS CRES, BEACON RD, 400 HWY N, 400 HWY S, BROWN ST, STROUD PL, LOOKER DR, BR05, SPEIRS RD, HARVIE RD, LESLIE AVE, ESSA RD, BASSWOOD DR, O'SHAUGHNESSY CRES, WHITE CRES, ELMBROOK DR, MEGAN CRES, RAMBLEWOOD DR, BROOKWOOD DR, THRUSHWOOD DR, JACKSON ST, EMMS DR, SRIGLEY ST, BOAG CRT, WARNER RD, LAKE CRES, QUANCE ST, BAYVIEW DR, CHURCHILL DR, CONCERT WAY, NORTH VILLAGE WAY, PARK PLACE BLVD, LIVE EIGHT WAY, BARRIE VIEW DR, VETERAN'S DR, REID DR, BR19, BR16, BRYNE DR, HOOPER RD, SAUNDERS RD, MILLS RD, NORRIS DR, COMMERCE PARK DR, LOCKHART RD, BIG BAY POINT RD, MAPLEVIEW DR E, MAPLEVIEW DR W, CAPLAN AVE, HUNTER RD, BR20, BR26, BR27, BR24, KING ST, BR11, BR25-P, BR03, BR01, BR08b, BR08a, KENWELL CRES, HOLLY MEADOW RD, FARMSTEAD CRES, CANARY REED CRT, MARSELLUS DR, BUTTERNUT DR, COUGHLIN RD, WICE RD, LISTER DR, BRUCKER RD, GIRDWOOD DR, GOLDS CRES, HERSEY CRES, DOWNING CRES, VICTORWAY DR, BLACK CHERRY CRES, CHURCHLAND DR, TWISS DR, WESSENGER DR, SUNDEW DR, BLACK WILLOW DR, RED OAK DR, VIOLET ST, LUCAS AVE, GINGER DR, LEE CRES, ASSINIBOINE DR, SEYMOUR CRES, GARIBALDI DR, REDFERN AVE, LOGAN CRT, LOUGHEED RD, COLUMBIA RD, RUNDLE CRES, WADDINGTON CRES, ATHABASKA RD, WHITEHORN CRES, DYER BLVD, DUNN ST, SELKIRK CRES, COUNTY ROAD 27, SALEM RD

CITY OF BARRIE

KEY PLAN

LEGEND

- STORM DEVICES
- CULVERT
- DITCH
- WATERCOURSE
- STORM SEWER (QMAX/QFULL FLOW > 115%)
- STORM SEWER (QMAX/QFULL FLOW 101%-115%)
- STORM SEWER (QMAX/QFULL FLOW 85%-100%)
- STORM SEWER (QMAX/QFULL FLOW < 85%)
- ABSENT OF MINOR DRAINAGE SYSTEM
- ROADS
- ANNIXATION LANDS BOUNDARY
- CENTRALIZED LID
- SWMF
- WATERSHED/DRAINAGE AREA BOUNDARY
- MUNICIPAL BORDER

TATHAM ENGINEERING

Barrie

SCALE = 1:10,000

0 125 250 500 750 1,000 Meters

DRAINAGE MASTER PLAN

BEAR CREEK & HOTCHKISS CREEK WATERSHEDS

FIGURE 9C - COMBINED LID SCENARIO
FUTURE MINOR DRAINAGE SYSTEM DEFICIENCIES
WITH LOW IMPACT DEVELOPMENT MEASURES

DATE: MARCH 2019

WILLIAMS & HOLGATE CREEK DRAINAGE AREAS

HURONIA CREEK DRAINAGE AREA

KEMPENFELT BAY
LAKE SIMCOE

BAYSHORE DRAINAGE AREA

INNISFIL

HEWITTS CREEK WATERSHED

HEWITT'S SECONDARY PLAN AREA (ANNEXATION LANDS) EXCLUDED FROM STUDY

CITY OF BARRIE

KEY PLAN

LEGEND

- STORM DEVICES
- CULVERT
- DITCH
- WATERCOURSE
- STORM SEWER (QMAX/QFULL FLOW > 115%)
- STORM SEWER (QMAX/QFULL FLOW 101%-115%)
- STORM SEWER (QMAX/QFULL FLOW 85%-100%)
- STORM SEWER (QMAX/QFULL FLOW < 85%)
- ABSENT OF MINOR DRAINAGE SYSTEM
- ROADS
- ANNIXATION LANDS BOUNDARY
- SWMF
- WATERSHED/DRAINAGE AREA BOUNDARY
- MUNICIPAL BORDER

TATHAM ENGINEERING

Barrie

SCALE = 1:10,000

0 125 250 500 750 1,000 Meters

DRAINAGE MASTER PLAN

HEWITTS CREEK WATERSHED;
BAYSHORE, WILLIAMS, HOLGATE & HURONIA CREEKS DRAINAGE AREAS

FIGURE 10A - MINOR DRAINAGE SYSTEM
DEFICIENCIES (5 YEAR STORM)
FUTURE FLOWS (20% INCREASE)

DATE:MARCH 2019

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ORO-MEDONTE

INNISFIL

KEMPENFELT BAY
LAKE SIMCOE

WILLIAMS & HOLGATE CREEK DRAINAGE AREAS

HURONIA CREEK DRAINAGE AREA

BAYSHORE DRAINAGE AREA

HEWITTS CREEK WATERSHED

HEWITT'S SECONDARY PLAN AREA (ANNEXATION LANDS) EXCLUDED FROM STUDY

N

CITY OF BARRIE

N

KEMPENFELT BAY (LAKE SIMCOE)

BAYSHORE DRAINAGE AREA

WILLIAMS CREEK & HOLGATE CREEK DRAINAGE AREAS

HEWITTS CREEK WATERSHED

HURONIA CREEK DRAINAGE AREA

KEY PLAN

LEGEND

- DEFICIENT CULVERTS
- MAJOR OVERLAND FLOW ROUTE DEFICIENCIES
- CULVERT
- DITCH
- WATERCOURSE
- ROADS
- RAILWAY
- ANNIXATION LANDS BOUNDARY
- REGULATORY FLOODLINE
- SWMF
- REGULATORY FLOODPLAIN
- BUILDINGS
- WATERSHED/DRAINAGE AREA BOUNDARY
- MUNICIPAL BORDER

DEFICIENT CULVERTS / CROSSINGS

HEWITTS CREEK WATERSHED

83 MAPLEVIEW DRIVE EAST

84 PRINCE WILLIAM WAY

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TATHAM ENGINEERING

Barrie

SCALE = 1:15,000

0 190 380 760 1,140 1,520 Meters

DRAINAGE MASTER PLAN

HEWITTS CREEK WATERSHED;
BAYSHORE, WILLIAMS, HOLGATE & HURONIA CREEKS DRAINAGE AREAS

FIGURE 10B - MAJOR DRAINAGE SYSTEM DEFICIENCIES .
FUTURE FLOWS (20% INCREASE)

DATE: MARCH 2019

WILLIAMS & HOLGATE CREEK DRAINAGE AREAS

HURONIA CREEK DRAINAGE AREA

KEMPENFELT BAY
LAKE SIMCOE

BAYSHORE DRAINAGE AREA

INNISFIL

GREENFIELD PARK

KUZMICH PARK

SANDRINGHAM PARK

QUEENSWAY/HYDE PARK

HEWITTS CREEK WATERSHED

HEWITT'S SECONDARY PLAN AREA
(ANNEXATION LANDS)
EXCLUDED FROM STUDY

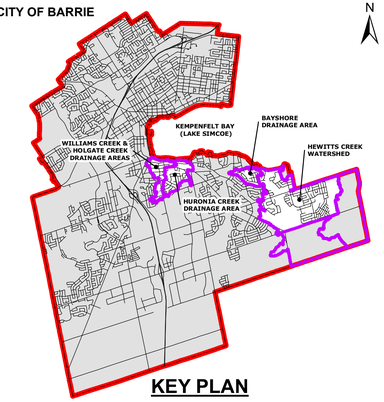
LOW IMPACT DEVELOPMENT MEASURES

1) LOT LEVEL LID (RAIN BARRELS AND SOAKAWAY PITS)

2) LINEAR LID ON ALL LOCAL ROADS
(PERFORATED PIPE SYSTEMS/INFILTRATION TRENCHES)

3) CENTRALIZED LID (UNDERGROUND INFILTRATION SYSTEM)

CITY OF BARRIE



KEY PLAN

LEGEND

- STORM DEVICES
- CULVERT
- DITCH
- WATERCOURSE
- STORM SEWER (QMAX/QFULL FLOW > 115%)
- STORM SEWER (QMAX/QFULL FLOW > 115%)
- STORM SEWER (QMAX/QFULL FLOW 101%-115%)
- STORM SEWER (QMAX/QFULL FLOW 85%-100%)
- STORM SEWER (QMAX/QFULL FLOW < 85%)
- ABSENT OF MINOR DRAINAGE SYSTEM
- ROADS
- ANNIXATION LAND BOUNDARY
- CENTRALIZED LID
- SWMF
- WATERSHED/DRAINAGE AREA BOUNDARY
- MUNICIPAL BORDER

TATHAM ENGINEERING

Barrie

SCALE = 1:10,000

0 125 250 500 750 1,000 Meters

DRAINAGE MASTER PLAN

HEWITTS CREEK WATERSHED;
BAYSHORE, WILLIAMS, HOLGATE & HURONIA CREEKS DRAINAGE AREAS

FIGURE 10C - COMBINED LID SCENARIO
FUTURE MINOR DRAINAGE SYSTEM DEFICIENCIES
WITH LOW IMPACT DEVELOPMENT MEASURES

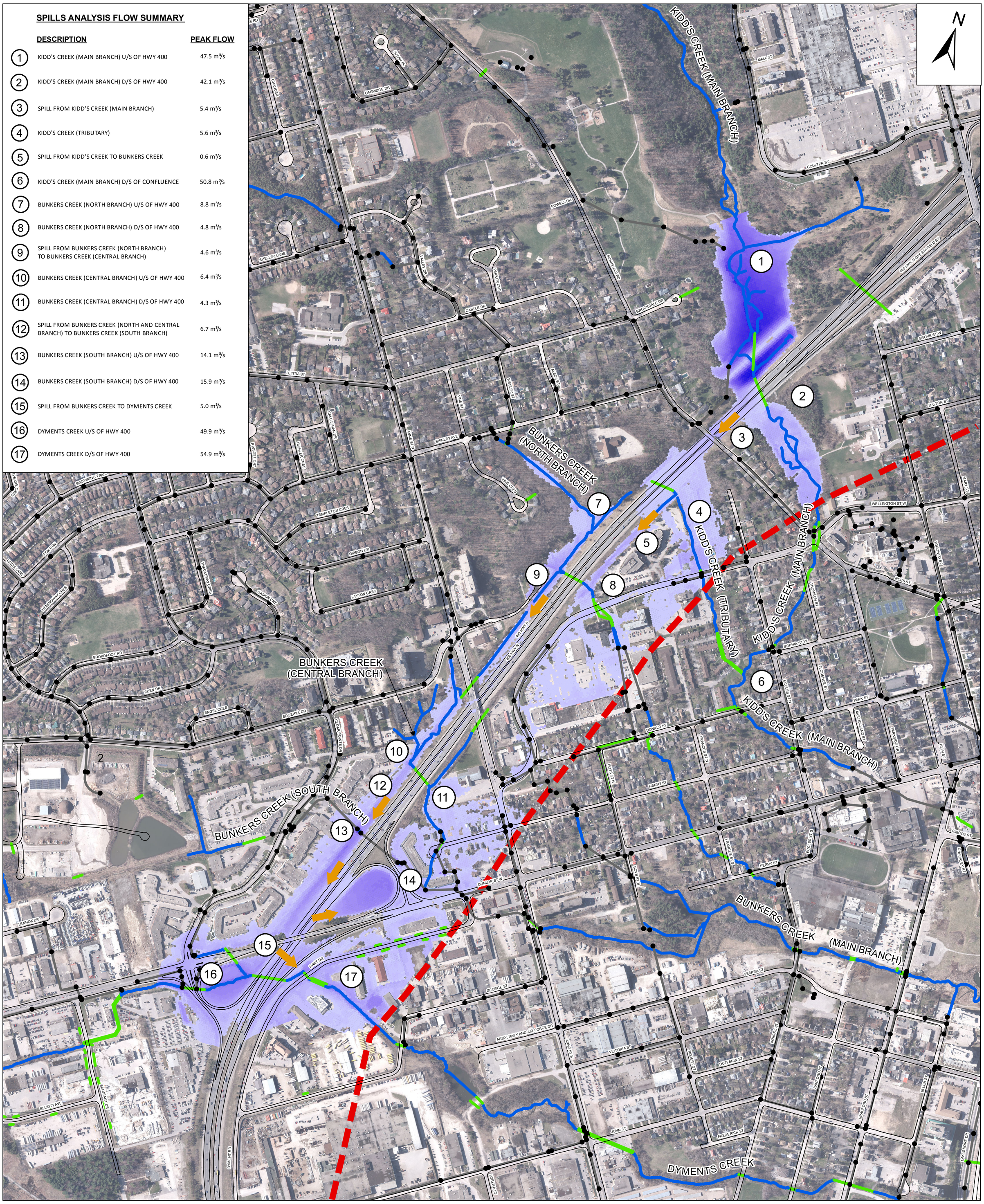
DATE: MARCH 2019

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SPILLS ANALYSIS FLOW SUMMARY

	DESCRIPTION	PEAK FLOW
1	KIDD'S CREEK (MAIN BRANCH) U/S OF HWY 400	47.5 m³/s
2	KIDD'S CREEK (MAIN BRANCH) D/S OF HWY 400	42.1 m³/s
3	SPILL FROM KIDD'S CREEK (MAIN BRANCH)	5.4 m³/s
4	KIDD'S CREEK (TRIBUTARY)	5.6 m³/s
5	SPILL FROM KIDD'S CREEK TO BUNKERS CREEK	0.6 m³/s
6	KIDD'S CREEK (MAIN BRANCH) D/S OF CONFLUENCE	50.8 m³/s
7	BUNKERS CREEK (NORTH BRANCH) U/S OF HWY 400	8.8 m³/s
8	BUNKERS CREEK (NORTH BRANCH) D/S OF HWY 400	4.8 m³/s
9	SPILL FROM BUNKERS CREEK (NORTH BRANCH) TO BUNKERS CREEK (CENTRAL BRANCH)	4.6 m³/s
10	BUNKERS CREEK (CENTRAL BRANCH) U/S OF HWY 400	6.4 m³/s
11	BUNKERS CREEK (CENTRAL BRANCH) D/S OF HWY 400	4.3 m³/s
12	SPILL FROM BUNKERS CREEK (NORTH AND CENTRAL BRANCH) TO BUNKERS CREEK (SOUTH BRANCH)	6.7 m³/s
13	BUNKERS CREEK (SOUTH BRANCH) U/S OF HWY 400	14.1 m³/s
14	BUNKERS CREEK (SOUTH BRANCH) D/S OF HWY 400	15.9 m³/s
15	SPILL FROM BUNKERS CREEK TO DYMENTS CREEK	5.0 m³/s
16	DYMENTS CREEK U/S OF HWY 400	49.9 m³/s
17	DYMENTS CREEK D/S OF HWY 400	54.9 m³/s



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LEGEND

- STORM STRUCTURE
- ROADS
- STORM SEWER
- DOWNSTREAM LIMIT OF SPILLS ANALYSIS
- CULVERT
- WATERCOURSE
- EXISTING FLOODPLAIN/SPILL
- SPILL FLOW DIRECTION

TATHAM ENGINEERING

Barrie

SCALE = 1:4,000

0 50 100 200 300 400 Meters

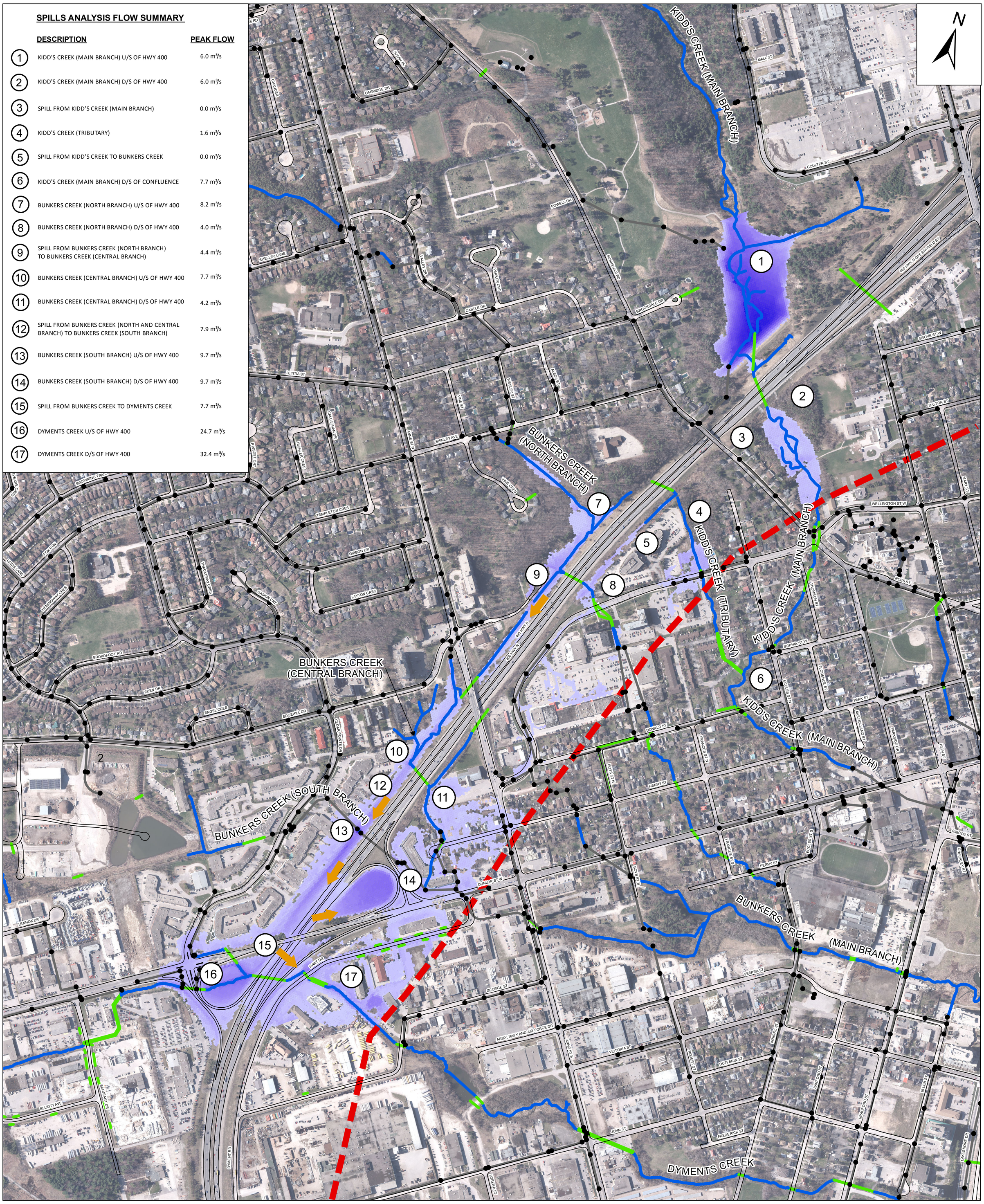
DRAINAGE MASTER PLAN

FIGURE 11 - EXISTING REGIONAL (HURRICANE HAZEL) FLOWS KIDD'S CREEK, DYMENTS CREEK AND BUNKERS CREEK SPILLS

DATE: MARCH 2019

SPILLS ANALYSIS FLOW SUMMARY

	DESCRIPTION	PEAK FLOW
1	KIDD'S CREEK (MAIN BRANCH) U/S OF HWY 400	6.0 m³/s
2	KIDD'S CREEK (MAIN BRANCH) D/S OF HWY 400	6.0 m³/s
3	SPILL FROM KIDD'S CREEK (MAIN BRANCH)	0.0 m³/s
4	KIDD'S CREEK (TRIBUTARY)	1.6 m³/s
5	SPILL FROM KIDD'S CREEK TO BUNKERS CREEK	0.0 m³/s
6	KIDD'S CREEK (MAIN BRANCH) D/S OF CONFLUENCE	7.7 m³/s
7	BUNKERS CREEK (NORTH BRANCH) U/S OF HWY 400	8.2 m³/s
8	BUNKERS CREEK (NORTH BRANCH) D/S OF HWY 400	4.0 m³/s
9	SPILL FROM BUNKERS CREEK (NORTH BRANCH) TO BUNKERS CREEK (CENTRAL BRANCH)	4.4 m³/s
10	BUNKERS CREEK (CENTRAL BRANCH) U/S OF HWY 400	7.7 m³/s
11	BUNKERS CREEK (CENTRAL BRANCH) D/S OF HWY 400	4.2 m³/s
12	SPILL FROM BUNKERS CREEK (NORTH AND CENTRAL BRANCH) TO BUNKERS CREEK (SOUTH BRANCH)	7.9 m³/s
13	BUNKERS CREEK (SOUTH BRANCH) U/S OF HWY 400	9.7 m³/s
14	BUNKERS CREEK (SOUTH BRANCH) D/S OF HWY 400	9.7 m³/s
15	SPILL FROM BUNKERS CREEK TO DYMENTS CREEK	7.7 m³/s
16	DYMENTS CREEK U/S OF HWY 400	24.7 m³/s
17	DYMENTS CREEK D/S OF HWY 400	32.4 m³/s



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LEGEND

- STORM STRUCTURE
- ROADS
- STORM SEWER
- DOWNSTREAM LIMIT OF SPILLS ANALYSIS
- CULVERT
- WATERCOURSE
- EXISTING FLOODPLAIN/SPILL
- SPILL FLOW DIRECTION

TATHAM ENGINEERING

Barrie

SCALE = 1:4,000

0 50 100 200 300 400 Meters

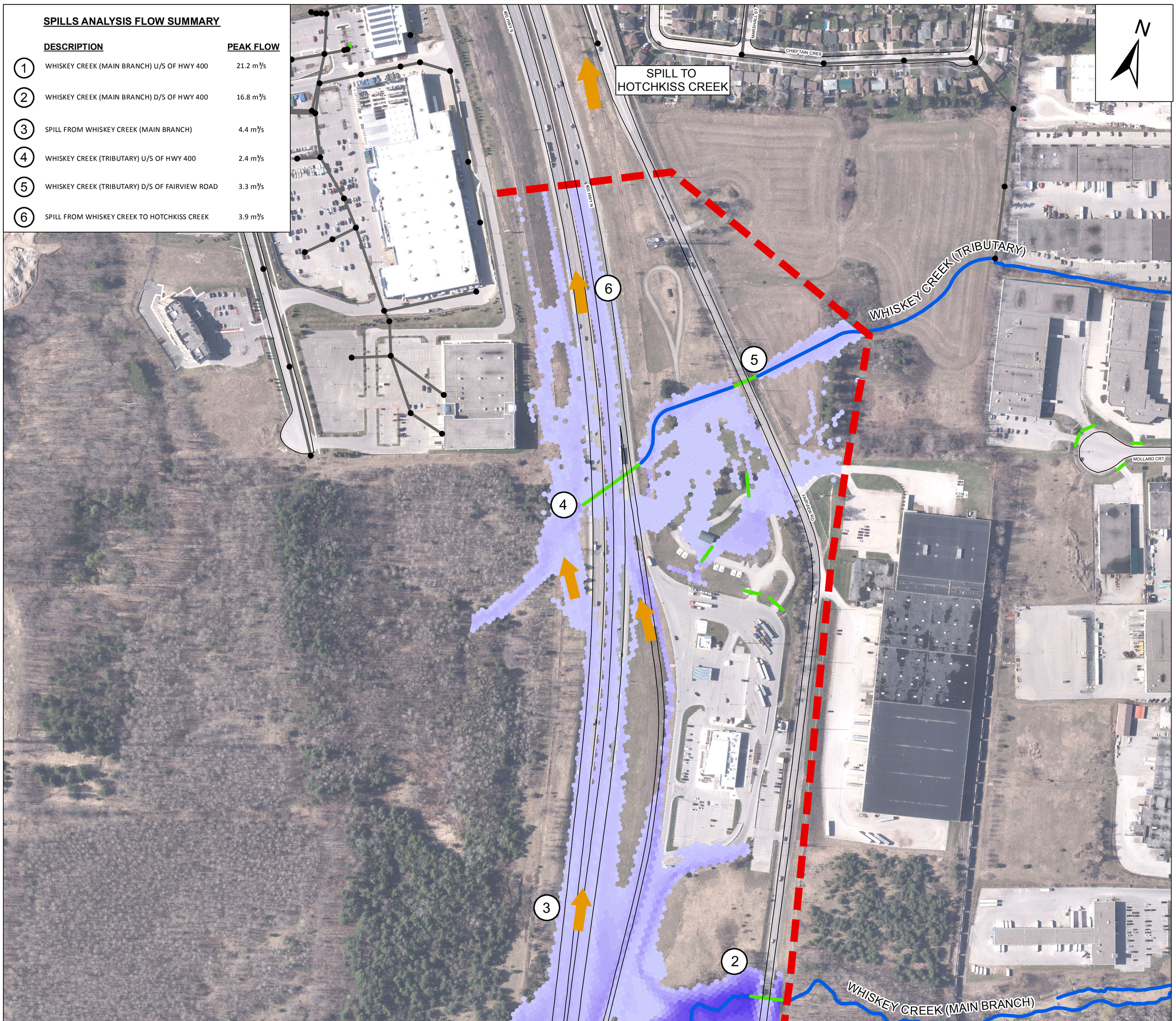
DRAINAGE MASTER PLAN

FIGURE 12 - EXISTING 100 YEAR FLOWS
KIDD'S CREEK, DYMENTS CREEK AND BUNKERS CREEK SPILLS

DATE: MARCH 2019

SPILLS ANALYSIS FLOW SUMMARY

	DESCRIPTION	PEAK FLOW
1	WHISKEY CREEK (MAIN BRANCH) U/S OF HWY 400	21.2 m³/s
2	WHISKEY CREEK (MAIN BRANCH) D/S OF HWY 400	16.8 m³/s
3	SPILL FROM WHISKEY CREEK (MAIN BRANCH)	4.4 m³/s
4	WHISKEY CREEK (TRIBUTARY) U/S OF HWY 400	2.4 m³/s
5	WHISKEY CREEK (TRIBUTARY) D/S OF FAIRVIEW ROAD	3.3 m³/s
6	SPILL FROM WHISKEY CREEK TO HOTCHKISS CREEK	3.9 m³/s



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LEGEND

- STORM STRUCTURE
- STORM SEWER
- ROADS
- DOWNSTREAM LIMIT OF SPILLS ANALYSIS
- CULVERT
- WATER COURSE
- EXISTING FLOODPLAIN/SPILL
- SPILL FLOW DIRECTION

TATHAM ENGINEERING

Barrie

SCALE = 1:2,000

0 25 50 100 150 200 Meters

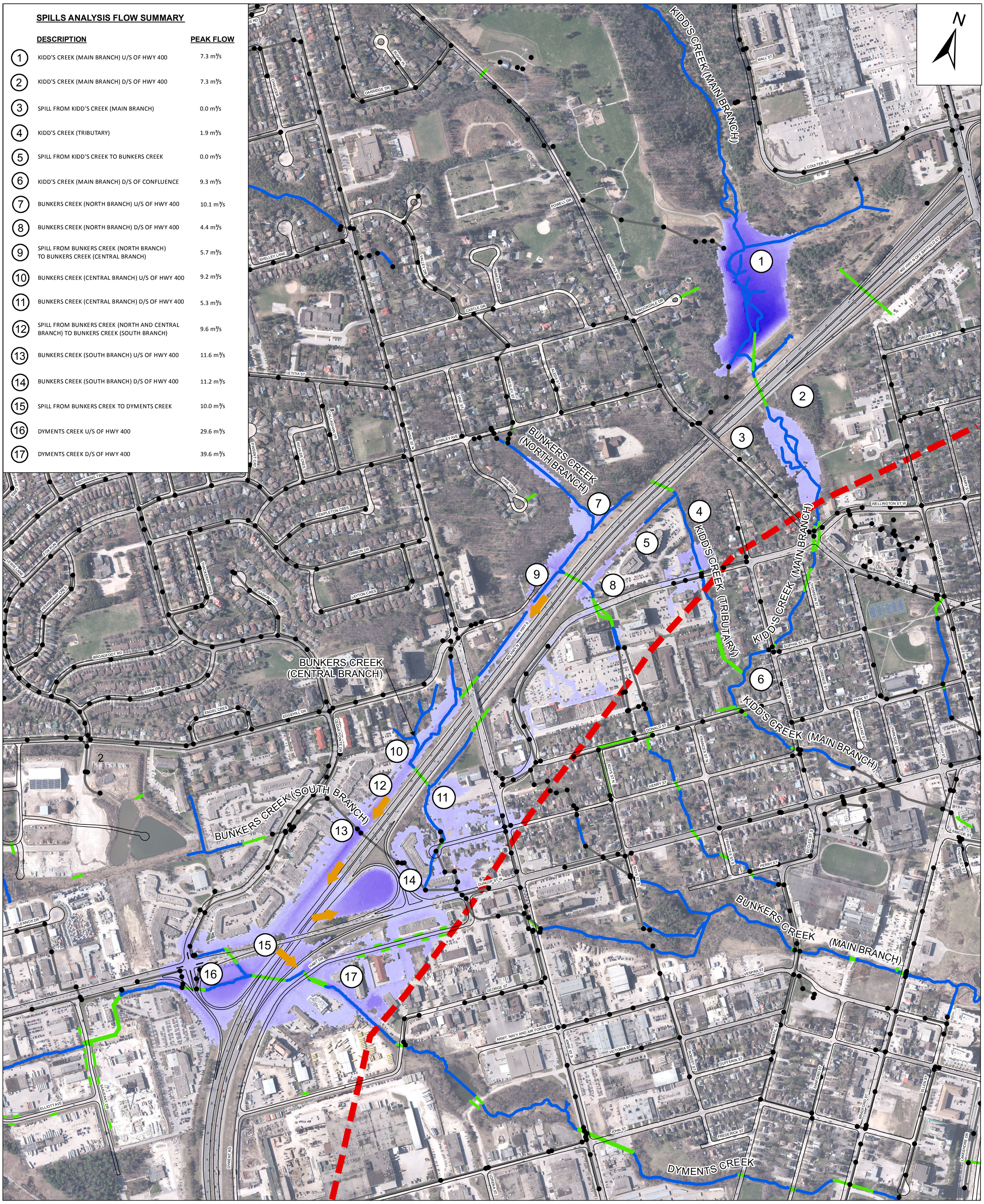
DRAINAGE MASTER PLAN

FIGURE 13 - EXISTING REGIONAL (HURRICANE HAZEL) FLOWS WHISKEY CREEK TO HOTCHKISS CREEK SPILL

DATE: MARCH 2019

SPILLS ANALYSIS FLOW SUMMARY

	DESCRIPTION	PEAK FLOW
1	KIDD'S CREEK (MAIN BRANCH) U/S OF HWY 400	7.3 m³/s
2	KIDD'S CREEK (MAIN BRANCH) D/S OF HWY 400	7.3 m³/s
3	SPILL FROM KIDD'S CREEK (MAIN BRANCH)	0.0 m³/s
4	KIDD'S CREEK (TRIBUTARY)	1.9 m³/s
5	SPILL FROM KIDD'S CREEK TO BUNKERS CREEK	0.0 m³/s
6	KIDD'S CREEK (MAIN BRANCH) D/S OF CONFLUENCE	9.3 m³/s
7	BUNKERS CREEK (NORTH BRANCH) U/S OF HWY 400	10.1 m³/s
8	BUNKERS CREEK (NORTH BRANCH) D/S OF HWY 400	4.4 m³/s
9	SPILL FROM BUNKERS CREEK (NORTH BRANCH) TO BUNKERS CREEK (CENTRAL BRANCH)	5.7 m³/s
10	BUNKERS CREEK (CENTRAL BRANCH) U/S OF HWY 400	9.2 m³/s
11	BUNKERS CREEK (CENTRAL BRANCH) D/S OF HWY 400	5.3 m³/s
12	SPILL FROM BUNKERS CREEK (NORTH AND CENTRAL BRANCH) TO BUNKERS CREEK (SOUTH BRANCH)	9.6 m³/s
13	BUNKERS CREEK (SOUTH BRANCH) U/S OF HWY 400	11.6 m³/s
14	BUNKERS CREEK (SOUTH BRANCH) D/S OF HWY 400	11.2 m³/s
15	SPILL FROM BUNKERS CREEK TO DYMENTS CREEK	10.0 m³/s
16	DYMENTS CREEK U/S OF HWY 400	29.6 m³/s
17	DYMENTS CREEK D/S OF HWY 400	39.6 m³/s



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LEGEND

- STORM STRUCTURE
- ROADS
- STORM SEWER
- DOWNSTREAM LIMIT OF SPILLS ANALYSIS
- CULVERT
- WATERCOURSE
- EXISTING FLOODPLAIN/SPILL
- SPILL FLOW DIRECTION

TATHAM ENGINEERING

Barrie

SCALE = 1:4,000

0 50 100 200 300 400 Meters

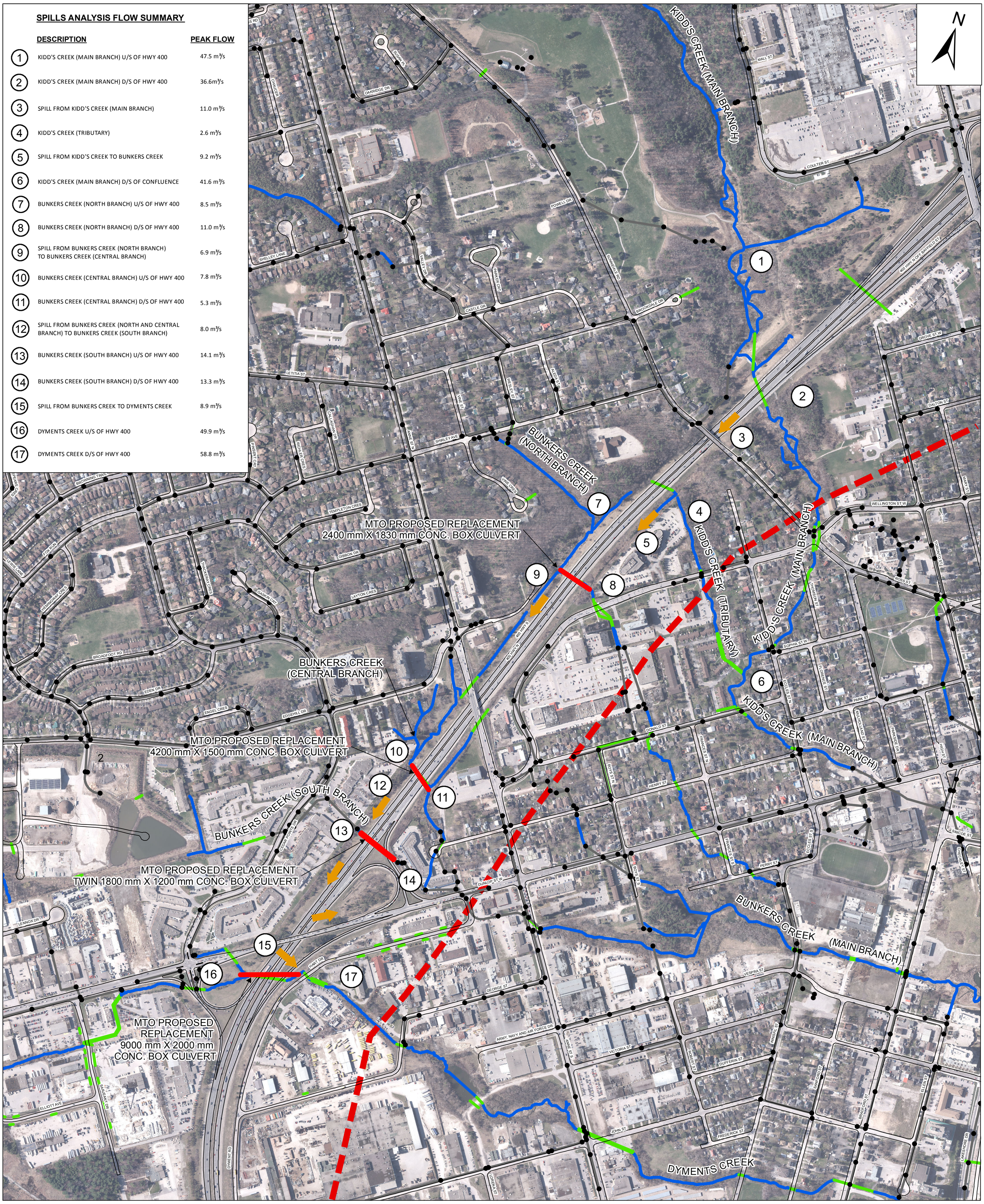
DRAINAGE MASTER PLAN

FIGURE 14 - FUTURE 100 YEAR FLOWS
KIDD'S CREEK, DYMENTS CREEK AND BUNKERS CREEK SPILLS

DATE: MARCH 2019

SPILLS ANALYSIS FLOW SUMMARY

	DESCRIPTION	PEAK FLOW
1	KIDD'S CREEK (MAIN BRANCH) U/S OF HWY 400	47.5 m³/s
2	KIDD'S CREEK (MAIN BRANCH) D/S OF HWY 400	36.6m³/s
3	SPILL FROM KIDD'S CREEK (MAIN BRANCH)	11.0 m³/s
4	KIDD'S CREEK (TRIBUTARY)	2.6 m³/s
5	SPILL FROM KIDD'S CREEK TO BUNKERS CREEK	9.2 m³/s
6	KIDD'S CREEK (MAIN BRANCH) D/S OF CONFLUENCE	41.6 m³/s
7	BUNKERS CREEK (NORTH BRANCH) U/S OF HWY 400	8.5 m³/s
8	BUNKERS CREEK (NORTH BRANCH) D/S OF HWY 400	11.0 m³/s
9	SPILL FROM BUNKERS CREEK (NORTH BRANCH) TO BUNKERS CREEK (CENTRAL BRANCH)	6.9 m³/s
10	BUNKERS CREEK (CENTRAL BRANCH) U/S OF HWY 400	7.8 m³/s
11	BUNKERS CREEK (CENTRAL BRANCH) D/S OF HWY 400	5.3 m³/s
12	SPILL FROM BUNKERS CREEK (NORTH AND CENTRAL BRANCH) TO BUNKERS CREEK (SOUTH BRANCH)	8.0 m³/s
13	BUNKERS CREEK (SOUTH BRANCH) U/S OF HWY 400	14.1 m³/s
14	BUNKERS CREEK (SOUTH BRANCH) D/S OF HWY 400	13.3 m³/s
15	SPILL FROM BUNKERS CREEK TO DYMENTS CREEK	8.9 m³/s
16	DYMENTS CREEK U/S OF HWY 400	49.9 m³/s
17	DYMENTS CREEK D/S OF HWY 400	58.8 m³/s



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LEGEND

- ROADS
- STORM STRUCTURE
- STORM SEWER
- DOWNSTREAM LIMIT OF SPILLS ANALYSIS
- CULVERT
- WATERCOURSE
- PROPOSED MTO CULVERT IMPROVEMENTS
- EXISTING FLOODPLAIN/SPILL
- SPILL FLOW DIRECTION

TATHAM ENGINEERING

Barrie

SCALE = 1:4,000

0 50 100 200 300 400 Meters

DRAINAGE MASTER PLAN

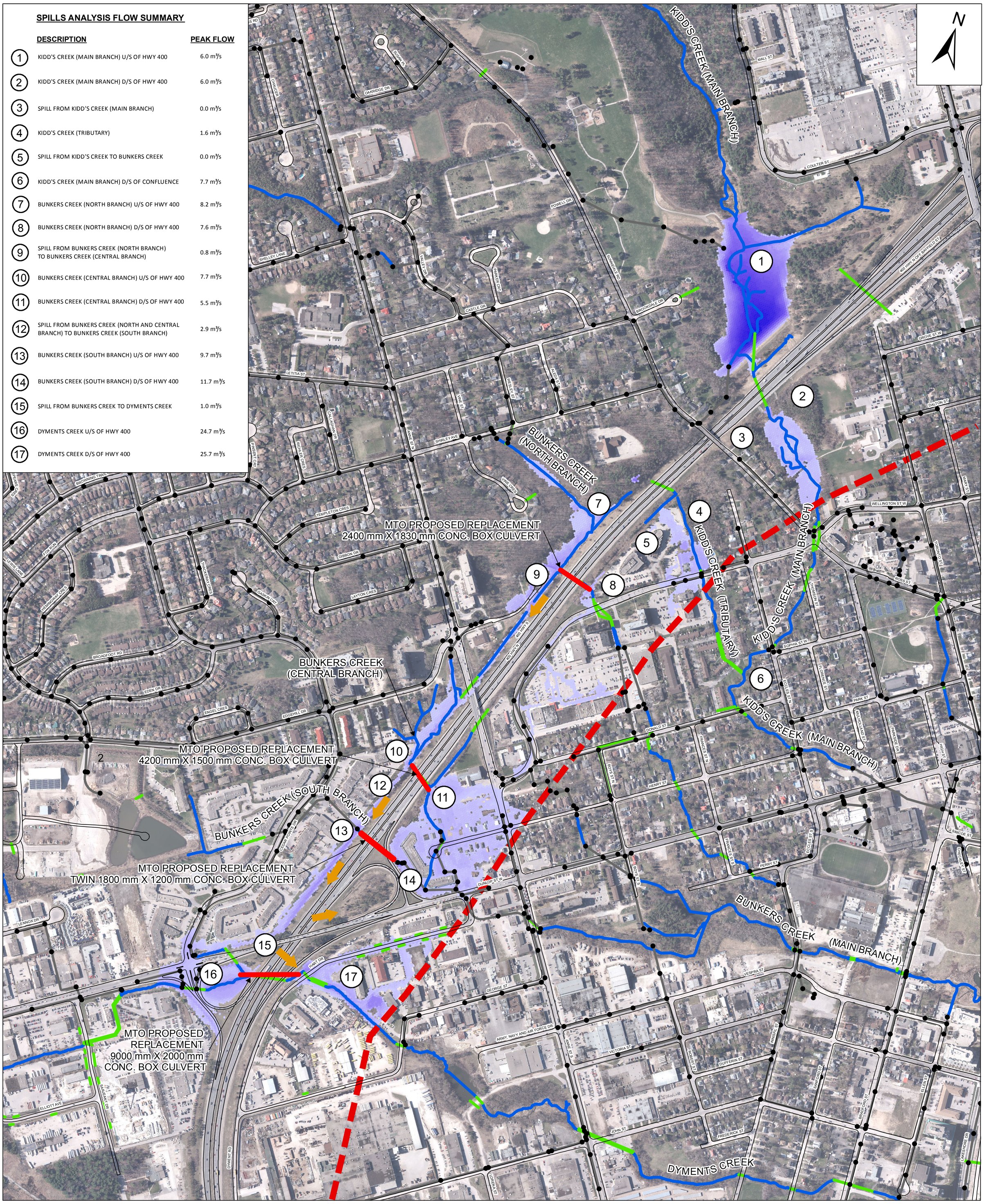
FIGURE 15 - EXISTING REGIONAL (HURRICANE HAZEL) FLOWS KIDD'S CREEK, DYMENTS CREEK AND BUNKERS CREEK SPILLS

FOLLOWING PROPOSED HIGHWAY 400 IMPROVEMENTS

DATE: MARCH 2019

SPILLS ANALYSIS FLOW SUMMARY

	DESCRIPTION	PEAK FLOW
1	KIDD'S CREEK (MAIN BRANCH) U/S OF HWY 400	6.0 m³/s
2	KIDD'S CREEK (MAIN BRANCH) D/S OF HWY 400	6.0 m³/s
3	SPILL FROM KIDD'S CREEK (MAIN BRANCH)	0.0 m³/s
4	KIDD'S CREEK (TRIBUTARY)	1.6 m³/s
5	SPILL FROM KIDD'S CREEK TO BUNKERS CREEK	0.0 m³/s
6	KIDD'S CREEK (MAIN BRANCH) D/S OF CONFLUENCE	7.7 m³/s
7	BUNKERS CREEK (NORTH BRANCH) U/S OF HWY 400	8.2 m³/s
8	BUNKERS CREEK (NORTH BRANCH) D/S OF HWY 400	7.6 m³/s
9	SPILL FROM BUNKERS CREEK (NORTH BRANCH) TO BUNKERS CREEK (CENTRAL BRANCH)	0.8 m³/s
10	BUNKERS CREEK (CENTRAL BRANCH) U/S OF HWY 400	7.7 m³/s
11	BUNKERS CREEK (CENTRAL BRANCH) D/S OF HWY 400	5.5 m³/s
12	SPILL FROM BUNKERS CREEK (NORTH AND CENTRAL BRANCH) TO BUNKERS CREEK (SOUTH BRANCH)	2.9 m³/s
13	BUNKERS CREEK (SOUTH BRANCH) U/S OF HWY 400	9.7 m³/s
14	BUNKERS CREEK (SOUTH BRANCH) D/S OF HWY 400	11.7 m³/s
15	SPILL FROM BUNKERS CREEK TO DYMENTS CREEK	1.0 m³/s
16	DYMENTS CREEK U/S OF HWY 400	24.7 m³/s
17	DYMENTS CREEK D/S OF HWY 400	25.7 m³/s



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LEGEND

- ROADS
- STORM STRUCTURE
- STORM SEWER
- DOWNSTREAM LIMIT OF SPILLS ANALYSIS
- CULVERT
- WATERCOURSE
- PROPOSED MTO CULVERT IMPROVEMENTS
- EXISTING FLOODPLAIN/SPILL
- SPILL FLOW DIRECTION

TATHAM ENGINEERING

Barrie

SCALE = 1:4,000

0 50 100 200 300 400 Meters

DRAINAGE MASTER PLAN

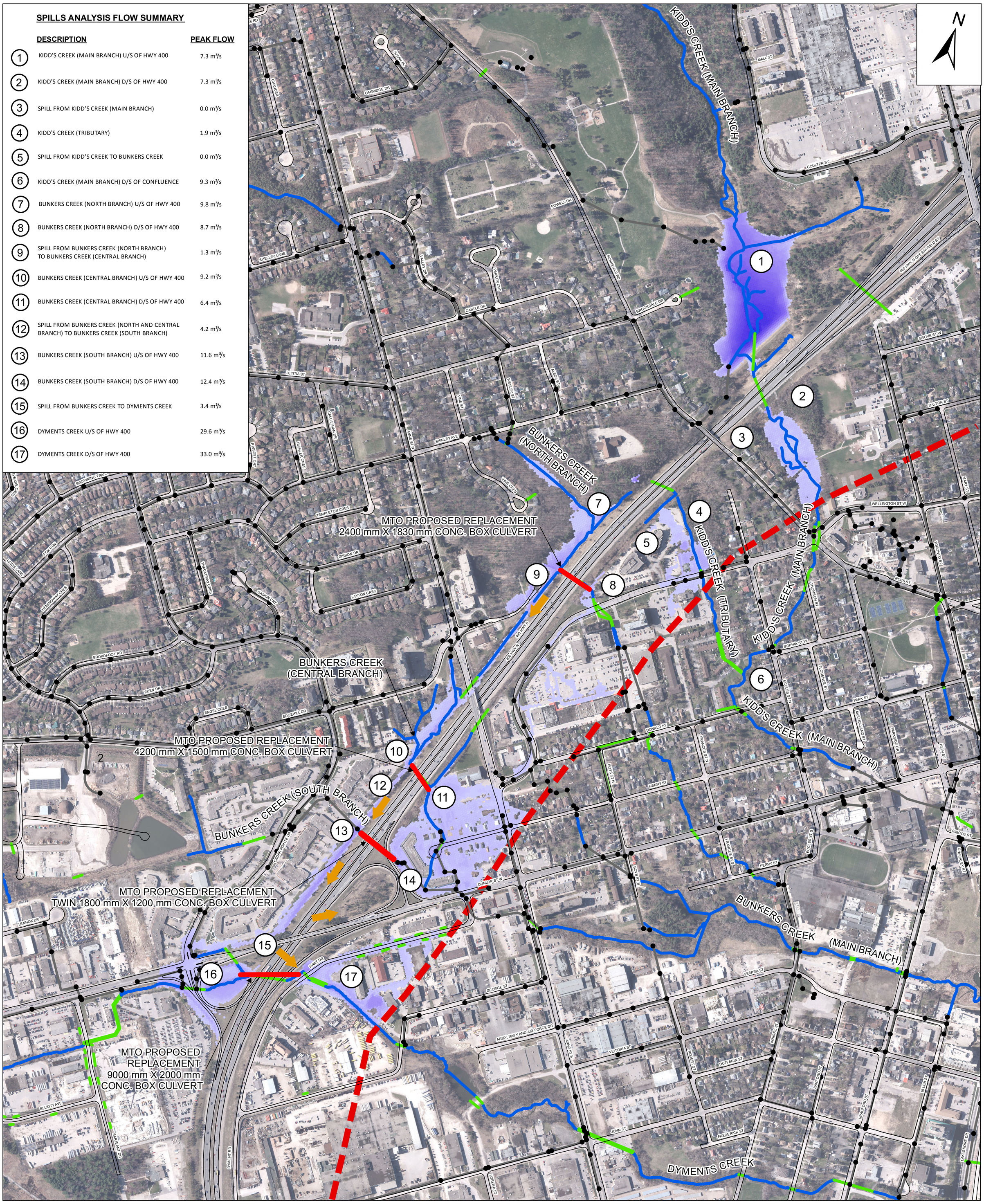
FIGURE 16 - EXISTING 100 YEAR FLOWS
KIDD'S CREEK, DYMENTS CREEK AND BUNKERS CREEK SPILLS

FOLLOWING PROPOSED HIGHWAY 400 IMPROVEMENTS

DATE: MARCH 2019

SPILLS ANALYSIS FLOW SUMMARY

	DESCRIPTION	PEAK FLOW
1	KIDD'S CREEK (MAIN BRANCH) U/S OF HWY 400	7.3 m³/s
2	KIDD'S CREEK (MAIN BRANCH) D/S OF HWY 400	7.3 m³/s
3	SPILL FROM KIDD'S CREEK (MAIN BRANCH)	0.0 m³/s
4	KIDD'S CREEK (TRIBUTARY)	1.9 m³/s
5	SPILL FROM KIDD'S CREEK TO BUNKERS CREEK	0.0 m³/s
6	KIDD'S CREEK (MAIN BRANCH) D/S OF CONFLUENCE	9.3 m³/s
7	BUNKERS CREEK (NORTH BRANCH) U/S OF HWY 400	9.8 m³/s
8	BUNKERS CREEK (NORTH BRANCH) D/S OF HWY 400	8.7 m³/s
9	SPILL FROM BUNKERS CREEK (NORTH BRANCH) TO BUNKERS CREEK (CENTRAL BRANCH)	1.3 m³/s
10	BUNKERS CREEK (CENTRAL BRANCH) U/S OF HWY 400	9.2 m³/s
11	BUNKERS CREEK (CENTRAL BRANCH) D/S OF HWY 400	6.4 m³/s
12	SPILL FROM BUNKERS CREEK (NORTH AND CENTRAL BRANCH) TO BUNKERS CREEK (SOUTH BRANCH)	4.2 m³/s
13	BUNKERS CREEK (SOUTH BRANCH) U/S OF HWY 400	11.6 m³/s
14	BUNKERS CREEK (SOUTH BRANCH) D/S OF HWY 400	12.4 m³/s
15	SPILL FROM BUNKERS CREEK TO DYMENTS CREEK	3.4 m³/s
16	DYMENTS CREEK U/S OF HWY 400	29.6 m³/s
17	DYMENTS CREEK D/S OF HWY 400	33.0 m³/s



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LEGEND

- ROADS
- STORM STRUCTURE
- STORM SEWER
- DOWNSTREAM LIMIT OF SPILLS ANALYSIS
- CULVERT
- WATERCOURSE
- PROPOSED MTO CULVERT IMPROVEMENTS
- EXISTING FLOODPLAIN/SPILL
- SPILL FLOW DIRECTION

TATHAM ENGINEERING

Barrie

SCALE = 1:4,000

0 50 100 200 300 400 Meters

DRAINAGE MASTER PLAN

FIGURE 17 - FUTURE 100 YEAR FLOWS
KIDD'S CREEK, DYMENTS CREEK AND BUNKERS CREEK SPILLS

FOLLOWING PROPOSED HIGHWAY 400 IMPROVEMENTS

DATE: MARCH 2019

Appendix B:
Calibration Verification

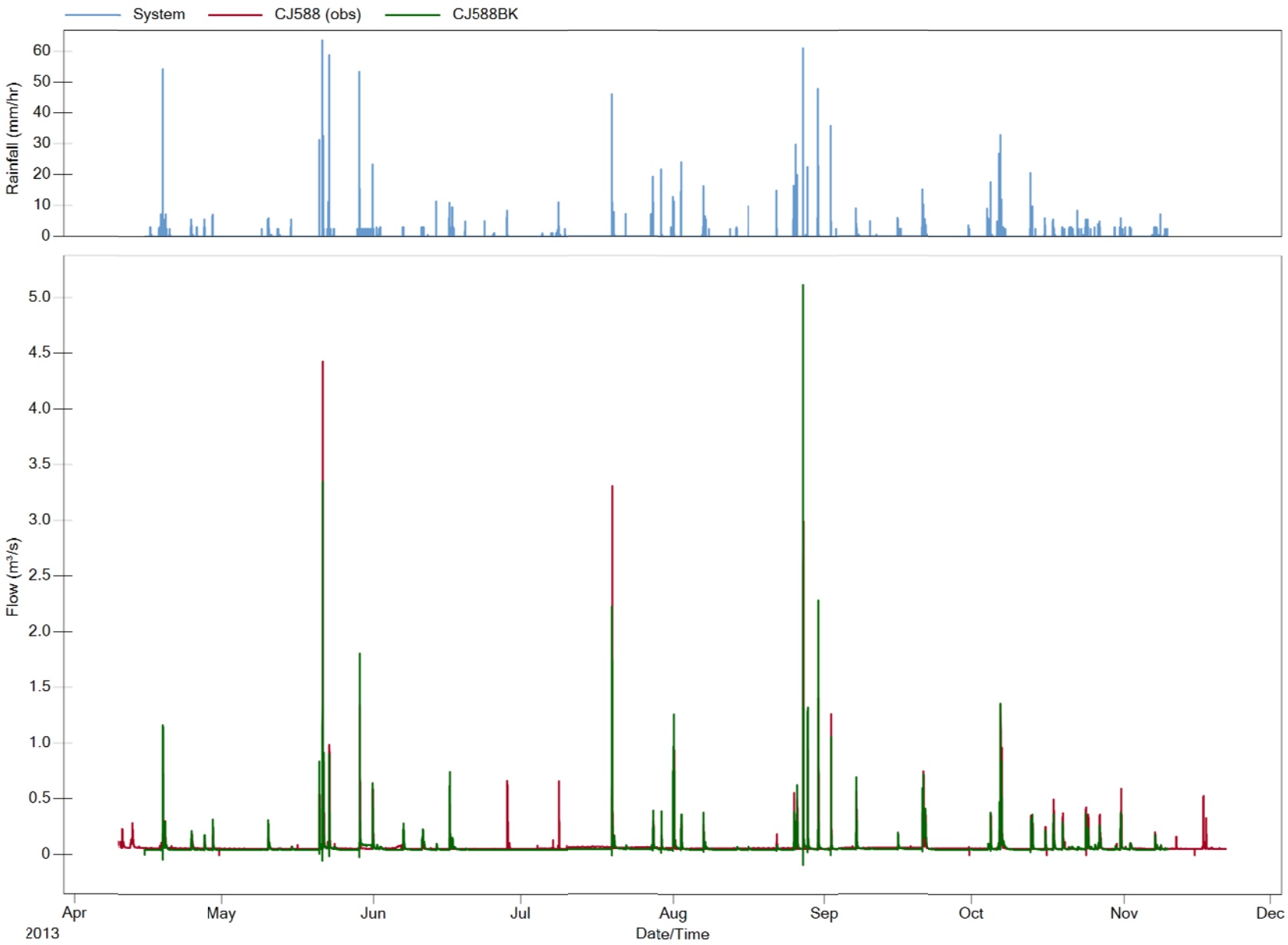
Bunkers Creek

Applied Calibration = 75% Routed Increase

Event #	Event Date	Obs Peak Flow	Calibrated Peak Flow	% difference
1	18-Apr-13	0.7338	1.167	59%
2	20-May-13	0.5467	0.8389	53%
3	21-May-13	4.433	3.352	-24%
4	21-May-13	0.8364	0.9203	10%
5	22-May-13	0.9912	0.9073	-8%
6	29-May-13	1.345	1.81	35%
7	31-May-13	0.5933	0.6444	9%
8	16-Jun-13	0.4576	0.7487	64%
9	19-Jul-13	3.308	2.227	-33%
10	31-Jul-13	0.9425	1.262	34%
11	26-Aug-13	0.5014	0.6049	21%
12	27-Aug-13	2.994	5.007	67%
13	28-Aug-13	0.9467	1.237	31%
14	30-Aug-13	1.411	2.27	61%
15	2-Sep-13	1.266	1.056	-17%
16	7-Sep-13	0.5674	0.6969	23%
17	20-Sep-13	0.5363	0.599	12%
18	21-Sep-13	0.7463	0.7193	-4%
19	6-Oct-13	1.357	1.359	0%
20	7-Oct-13	0.9635	0.8398	-13%

verification run within 10% of observed peak flow
verification run within 60% of observed peak flow
verification run greater than 60% difference from observed peak flow

Bunkers Creek Modelled vs. Observed Hydrograph



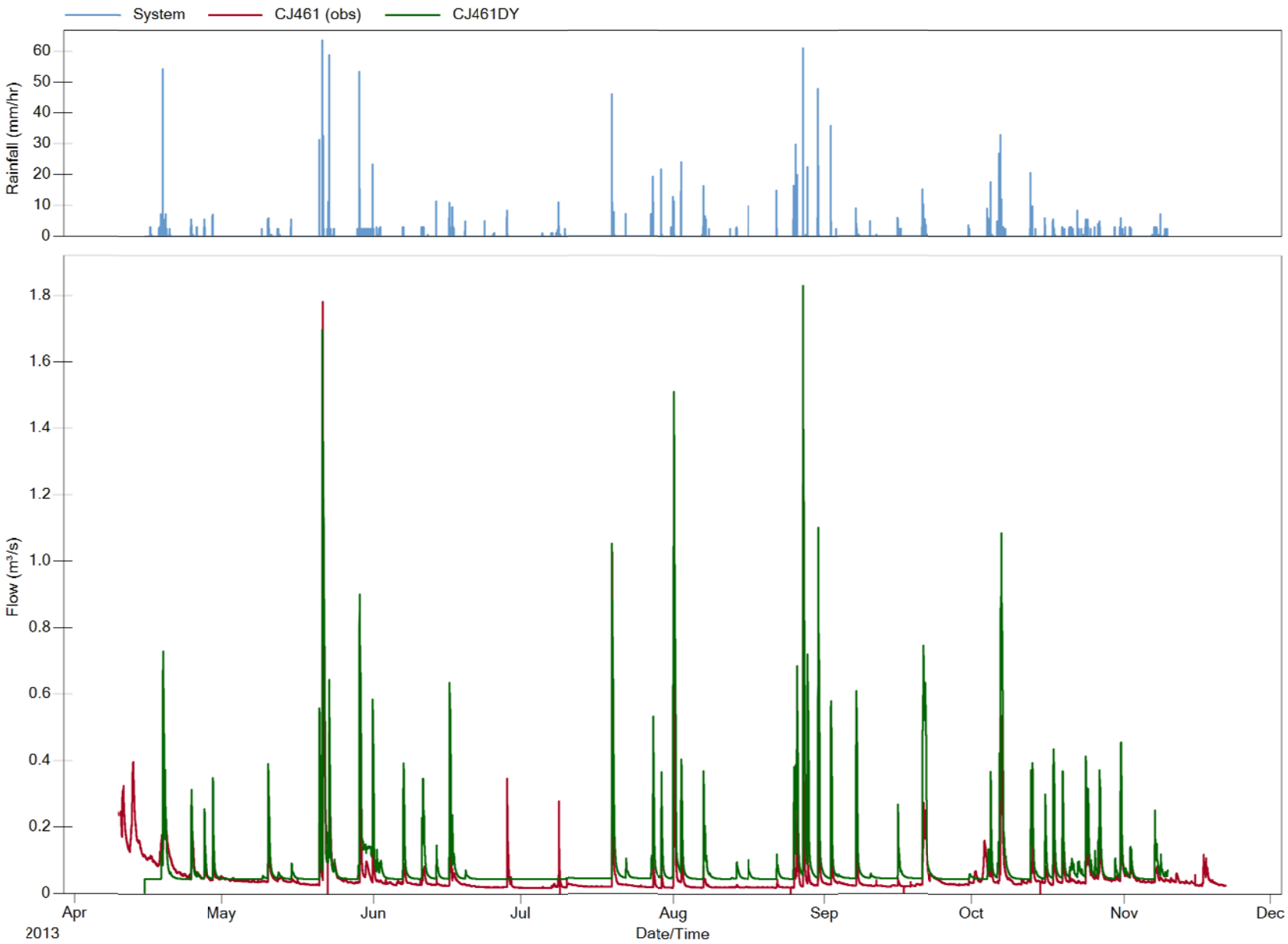
Dyments Creek

Applied Calibration = No Change

Event #	Event Date	Obs Peak Flow	Calibrated Peak Flow	% difference
1	18-Apr-13	0.4458	0.7297	64%
2	20-May-13	0.2127	0.5585	163%
3	21-May-13	1.782	1.698	-5%
4	22-May-13	0.4842	0.6449	33%
5	29-May-13	0.512	0.901	76%
6	19-Jul-13	1.028	1.054	3%
7	31-Jul-13	0.8277	1.511	83%
8	26-Aug-13	0.2577	0.6746	162%
9	27-Aug-13	1.236	1.827	48%
10	28-Aug-13	0.2183	0.7206	230%
11	30-Aug-13	0.5119	1.102	115%
12	2-Sep-13	0.298	0.5815	95%
13	20-Sep-13	0.2721	0.7466	174%
14	6-Oct-13	0.5349	1.086	103%
15	31-Oct-13	0.2095	0.4563	118%

verification run within 10% of observed peak flow
verification run within 60% of observed peak flow
verification run greater than 60% difference from observed peak flow

Dyments Creek Modelled vs. Observed Hydrograph



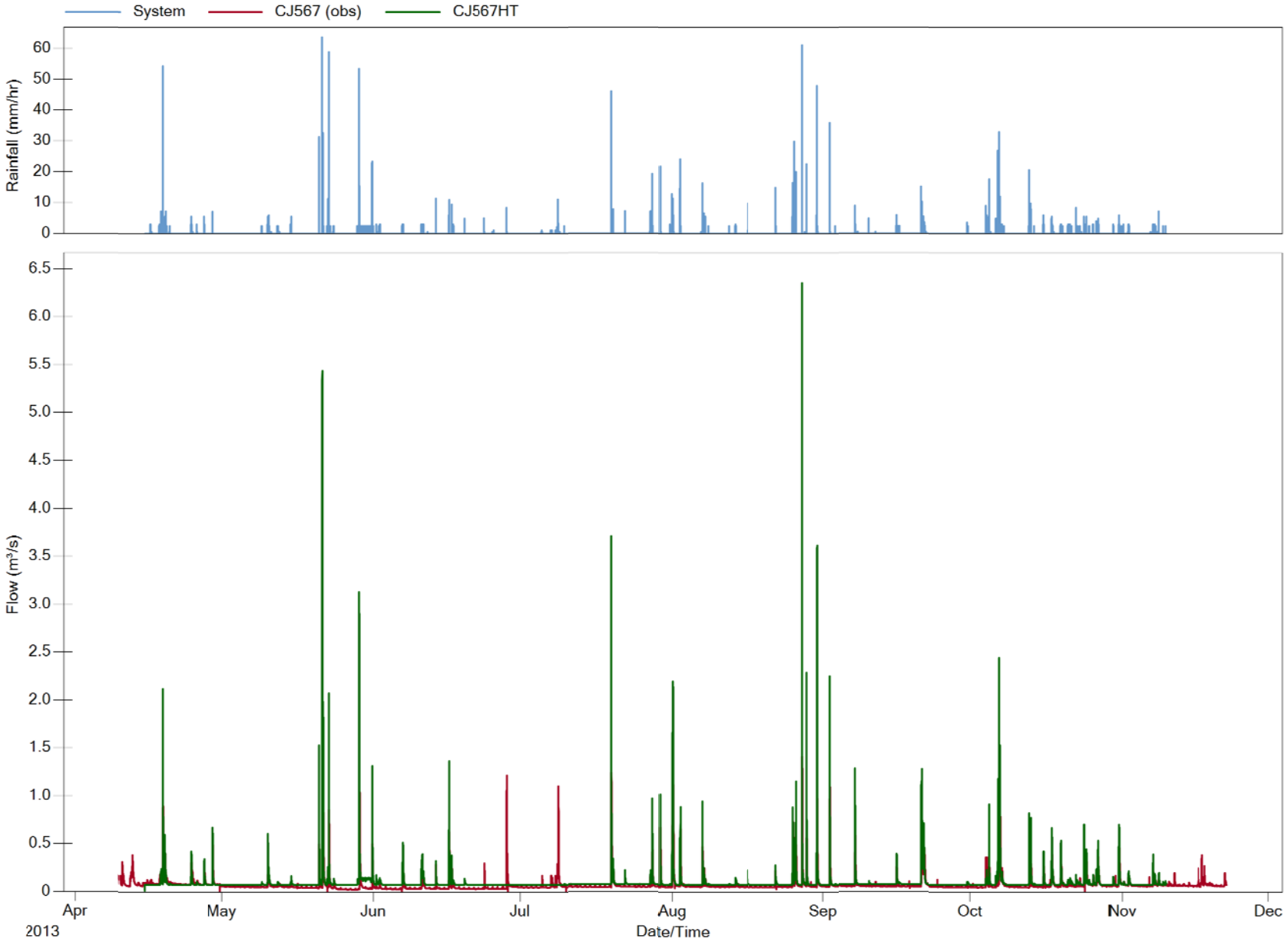
Hotchkiss Creek

Applied Calibration = 100% Routed Increase

Event #	Event Date	Obs Peak Flow	Calibrated Peak Flow	% difference
1	18-Apr-13	0.8935	2.12	137%
2	29-Apr-13	0.4881	0.6752	38%
3	20-May-13	0.499	1.529	206%
4	21-May-13	1.183	5.441	360%
5	22-May-13	0.8598	2.075	141%
6	29-May-13	1.045	3.131	200%
7	31-May-13	0.5035	1.317	162%
8	16-Jun-13	0.6274	1.366	118%
9	19-Jul-13	1.236	3.709	200%
10	31-Jul-13	1.119	2.199	97%
11	7-Aug-13	0.4769	0.9436	98%
12	26-Aug-13	0.4954	1.156	133%
13	27-Aug-13	1.411	6.334	349%
14	28-Aug-13	0.5666	2.292	305%
15	30-Aug-13	0.9752	3.615	271%
16	2-Sep-13	1.092	2.253	106%
17	7-Sep-13	0.5823	1.279	120%
18	20-Sep-13	0.6628	1.28	93%
19	6-Oct-13	0.8117	2.442	201%
20	31-Oct-13	0.4598	0.7054	53%

verification run within 10% of observed peak flow
verification run within 60% of observed peak flow
verification run greater than 60% difference from observed peak flow

Hotchkiss Creek Modelled vs. Observed Hydrograph



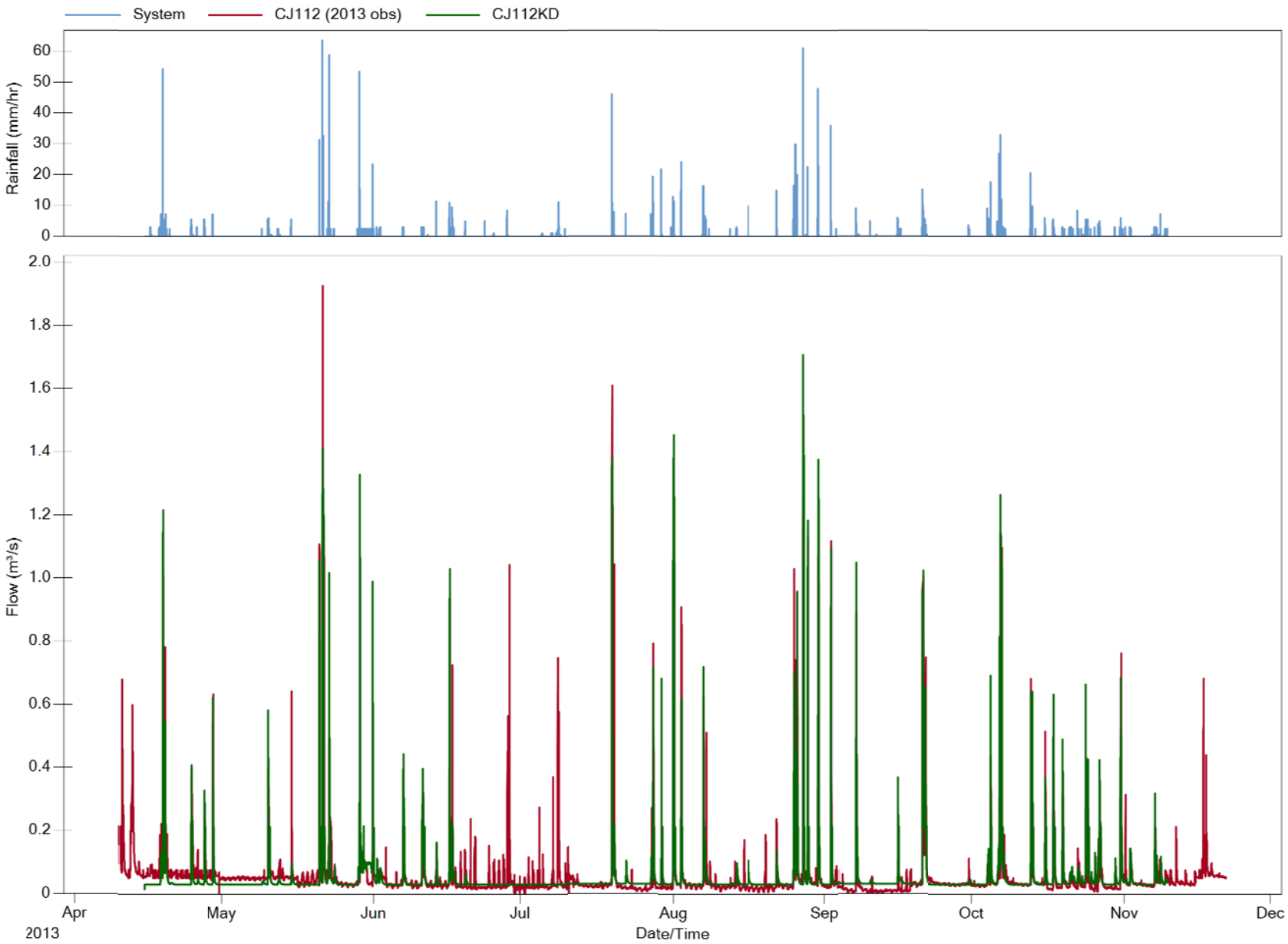
Kidd's Creek

Applied Calibration = No Change

Event #	Event Date	Obs Peak Flow	Calibrated Peak Flow	% difference
1	18-Apr-13	1.006	1.216	21%
2	20-May-13	1.108	1.057	-5%
3	21-May-13	1.926	1.410	-27%
4	22-May-13	0.491	1.018	107%
5	16-Jun-13	0.935	1.029	10%
6	19-Jul-13	1.609	1.383	-14%
7	27-Jul-13	0.792	0.716	-10%
8	31-Jul-13	1.05	1.453	38%
9	6-Aug-13	0.625	0.719	15%
10	26-Aug-13	0.958	0.955	0%
11	27-Aug-13	1.363	1.705	25%
12	28-Aug-13	1.13	1.184	5%
13	30-Aug-13	1.073	1.376	28%
14	2-Sep-13	1.118	1.093	-2%
15	7-Sep-13	0.893	1.049	17%
16	20-Sep-13	1.006	1.024	2%
17	6-Oct-13	1.146	1.264	10%

verification run within 10% of observed peak flow
verification run within 60% of observed peak flow
verification run greater than 60% difference from observed peak flow

Kidds Creek Modelled vs. Observed Hydrograph



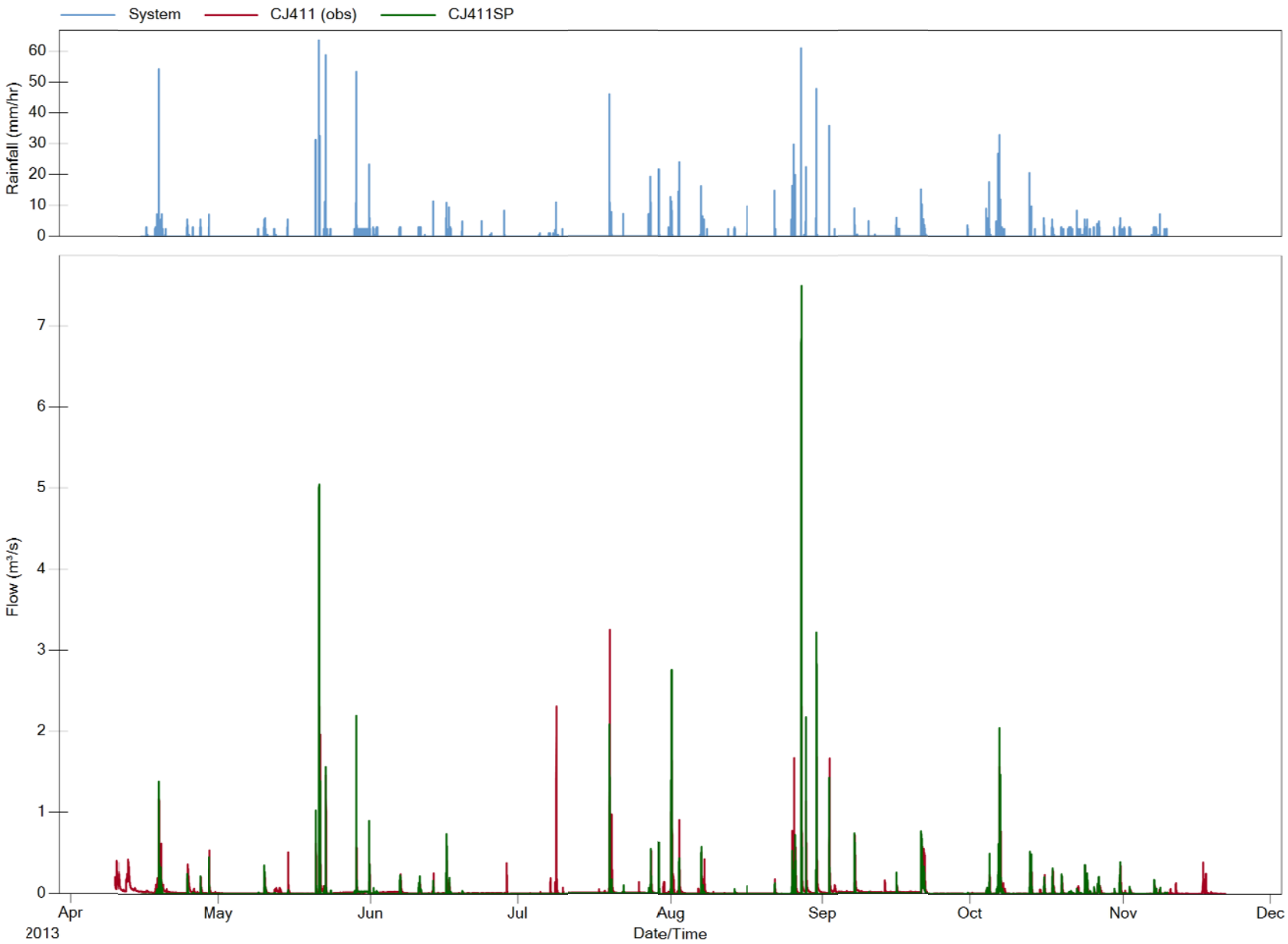
Sophia Creek

Applied Calibration = 85% Routed Increase

Event #	Event Date	Obs Peak Flow	Calibrated Peak Flow	% difference
1	18-Apr-13	1.174	1.389	18%
2	23-Apr-13	0.36	0.2482	-31%
3	20-May-13	0.6257	1.033	65%
4	21-May-13	2.313	5.053	118%
5	22-May-13	1.467	1.574	7%
6	6-Jun-13	0.2437	0.2306	-5%
7	16-Jun-13	0.4164	0.7417	78%
8	19-Jul-13	3.253	2.082	-36%
9	27-Jul-13	0.5216	0.5498	5%
10	1-Aug-13	1.65	2.765	68%
11	2-Aug-13	0.91	0.4421	-51%
12	6-Aug-13	0.5148	0.5853	14%
13	25-Aug-13	0.79	0.36	-54%
14	27-Aug-13	2.2	7.46	239%
15	28-Aug-13	1.15	2.19	90%
16	30-Aug-13	1.7	3.23	90%
17	2-Sep-13	1.625	1.44	-11%
18	7-Sep-13	0.71	0.743	5%
19	21-Sep-13	0.57	0.7467	31%
20	6-Oct-13	1.568	2.049	31%

verification run within 10% of observed peak flow
verification run within 60% of observed peak flow
verification run greater than 60% difference from observed peak flow

Sophia Creek Modelled vs. Observed Hydrograph



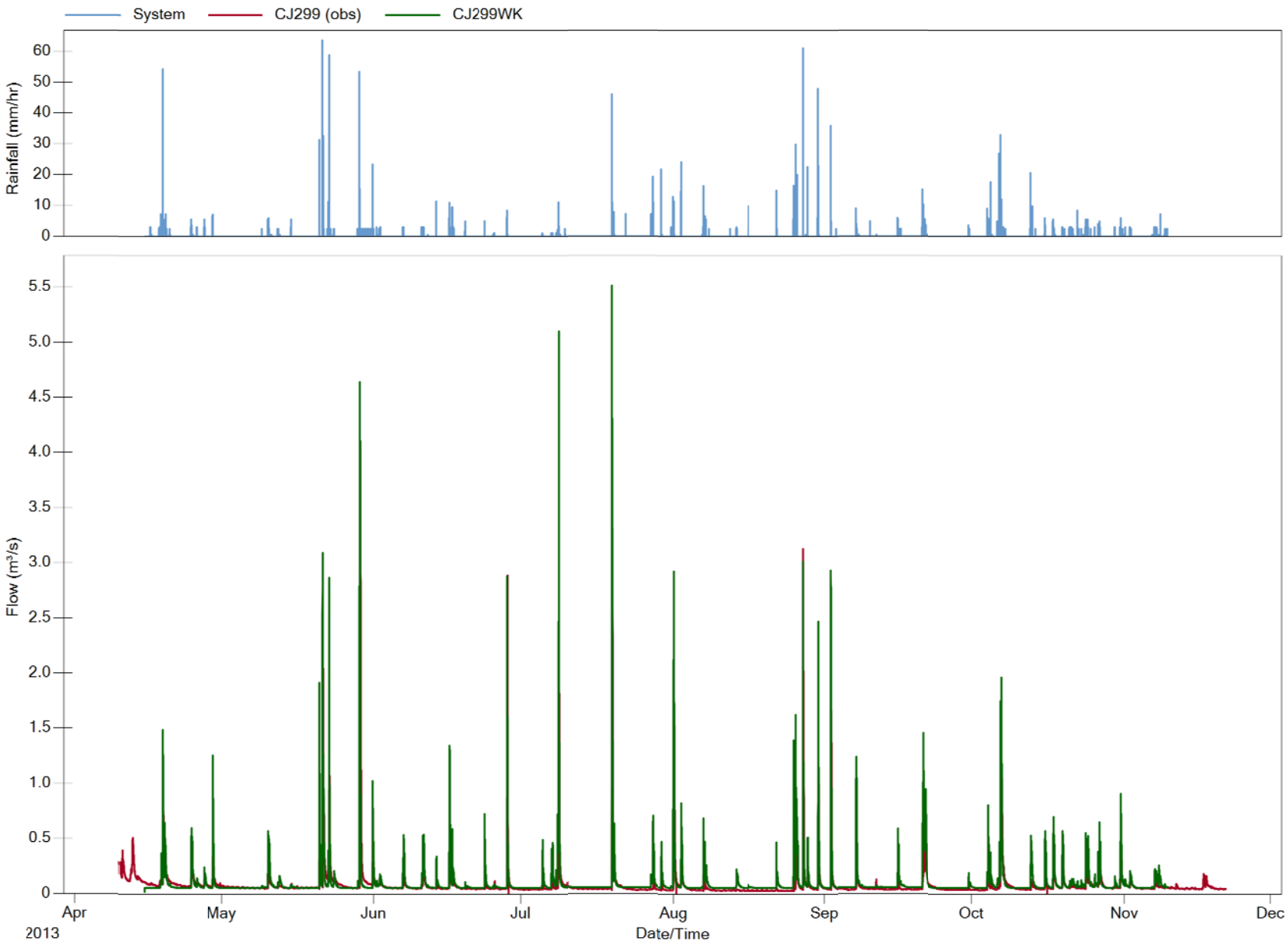
Whiskey Creek

Applied Calibration = 46% Routed Decrease

Event #	Event Date	Obs Peak Flow	Calibrated Peak Flow	% difference
1	18-Apr-13	0.7549	1.490	97%
2	29-Apr-13	0.4368	1.256	188%
3	21-May-13	2.045	3.096	51%
4	22-May-13	1.071	2.868	168%
5	28-May-13	4.105	4.644	13%
6	16-Jun-13	0.4388	1.347	207%
7	28-Jun-13	2.89	2.879	0%
8	8-Jul-13	1.819	5.102	180%
9	19-Jul-13	3.308	5.513	67%
10	31-Jul-13	1.522	2.927	92%
11	2-Aug-13	0.4863	0.825	70%
12	27-Aug-13	3.131	2.796	-11%
13	30-Aug-13	0.9974	2.185	119%
14	2-Sep-13	1.66	2.427	46%
15	20-Sep-13	0.5453	1.458	167%
16	6-Oct-13	1.095	1.965	79%

verification run within 10% of observed peak flow
verification run within 60% of observed peak flow
verification run greater than 60% difference from observed peak flow

Whiskey Creek Modelled vs. Observed Hydrograph



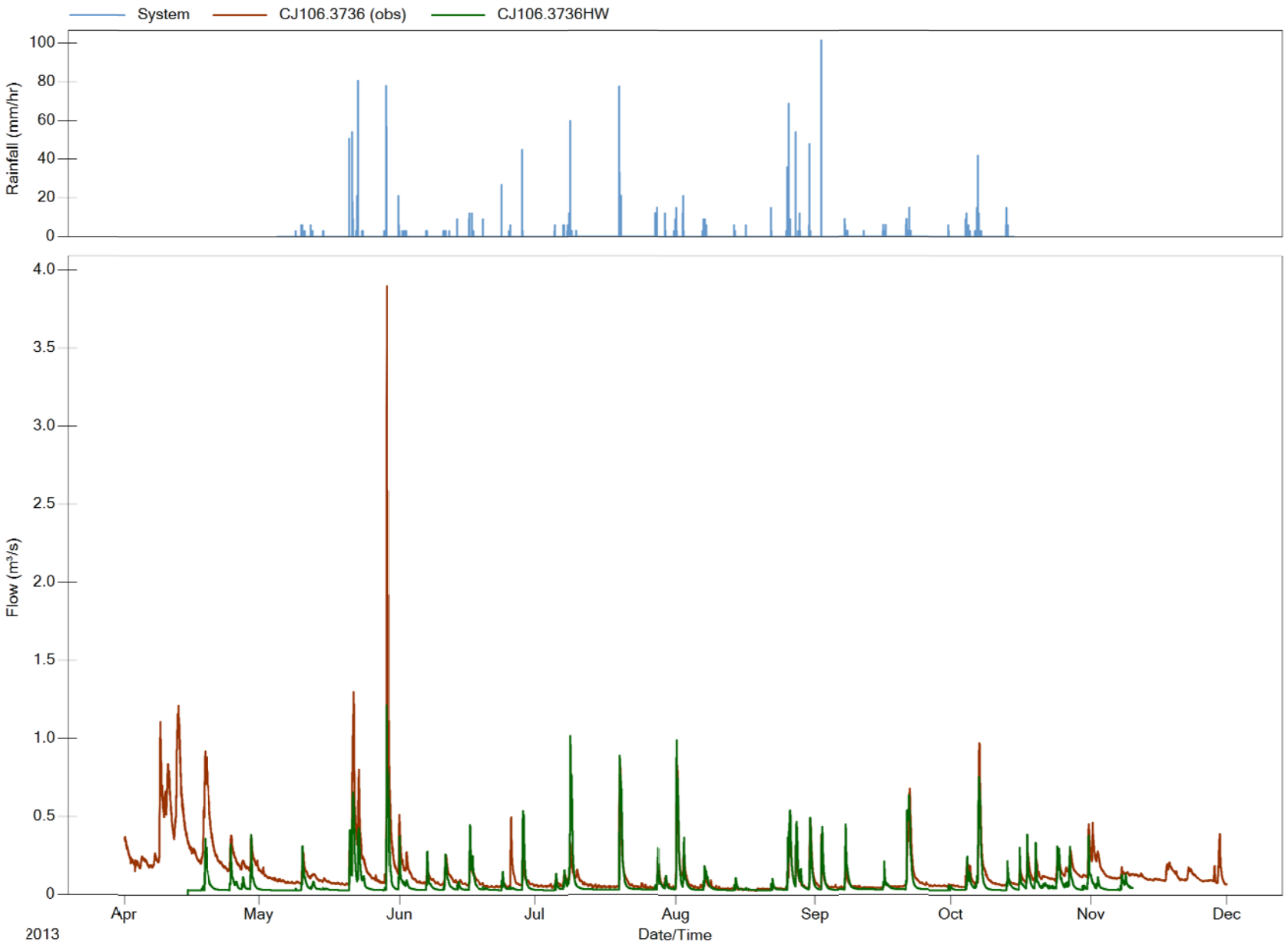
Hewitt's Creek

Applied Calibration = 100% Routed Decrease

Event #	Event Date	Obs Peak Flow	Calibrated Peak Flow	% difference
1	21-May-13	1.302	0.6578	-49%
2	28-May-13	3.897	1.217	-69%
3	16-Jun-13	0.282	0.448	59%
4	28-Jun-13	0.261	0.5394	107%
5	8-Jul-13	0.333	1.015	205%
6	19-Jul-13	0.828	0.8888	7%
7	1-Aug-13	0.83	0.9916	19%
8	26-Aug-13	0.371	0.5415	46%
9	27-Aug-13	0.318	0.4689	47%
10	30-Aug-13	0.49	0.4969	1%
11	2-Sep-13	0.39	0.4395	13%
12	6-Oct-13	0.974	0.7558	-22%

verification run within 10% of observed peak flow
verification run within 60% of observed peak flow
verification run greater than 60% difference from observed peak flow

Hewitts Creek Modelled vs. Observed Hydrograph



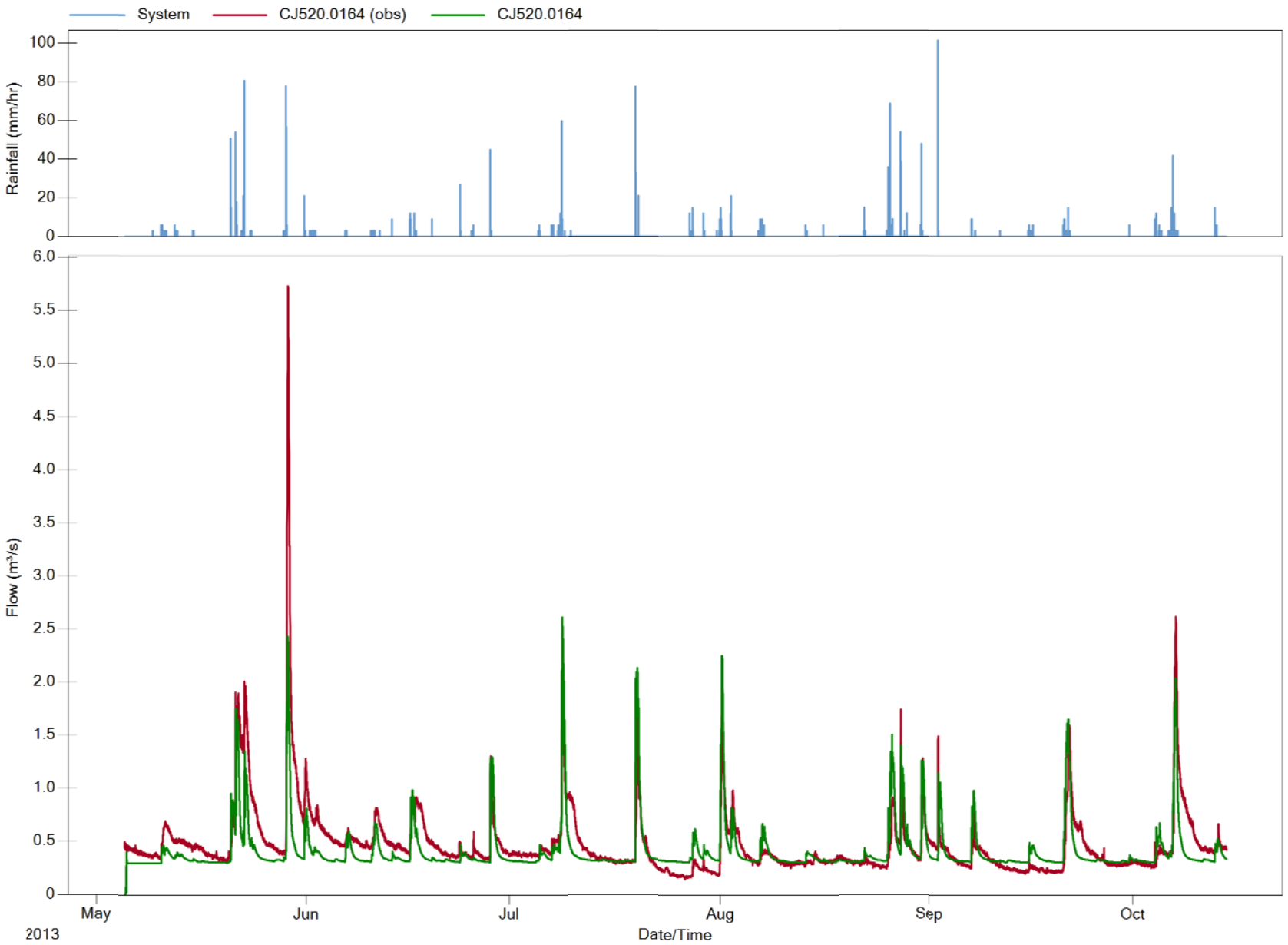
Lovers Creek

Applied Calibration = 60% Routed Decrease, 50% N Imperv Decrease

Event #	Event Date	Obs Peak Flow	Calibrated Peak Flow	% difference
1	21-May-13	2.009	2.428	21%
2	29-May-13	5.731	3.797	-34%
3	10-Jun-13	0.817	0.9854	21%
4	16-Jun-13	0.93	1.285	38%
5	28-Jun-13	1.305	1.946	49%
6	8-Jul-13	1.795	3.793	111%
7	19-Jul-13	1.954	3.454	77%
8	1-Aug-13	2.15	3.325	55%
9	26-Aug-13	0.913	1.854	103%
10	27-Aug-13	1.742	1.769	2%
11	30-Aug-13	1.282	1.812	41%
12	2-Sep-13	1.494	1.448	-3%
13	7-Sep-13	0.804	1.358	69%
14	21-Sep-13	1.598	2.12	33%
15	6-Oct-13	2.621	2.856	9%

verification run within 10% of observed peak flow
verification run within 60% of observed peak flow
verification run greater than 60% difference from observed peak flow

Lovers Creek Modelled vs. Observed Hydrograph



Appendix C:
SSD Table Updates

TATHAM ENGINEERING

Project:	Barrie Drainage Master Plan	Prepared By:	DAM / ASB / NHF
File No.:	117076	Reviewed By:	Daniel Twigger
Revision:	1	Date:	12-Mar-19
Description:	Existing SWMF Stage-Storage-Discharge Relationship Summary		

SWMF ID	Stage-Storage Relationship		Stage-Discharge Relationship		Comment
	Method of Determination	Source	Method of Determination	Source	
KD01	Provided	City of Barrie	Provided	City of Barrie	No revisions to City of Barrie SSD Table
KD02	Provided	City of Barrie	Provided	City of Barrie	Tatham revised City of Barrie SSD Table - Weir calculation below orifice centroid (calculated) and extended SWMF vertically to contain Regional storm (2016 LiDAR)
KD03	Provided	City of Barrie	Provided	City of Barrie	No revisions to City of Barrie SSD Table
KD04	Calculated	2016 LiDAR	Calculated	City of Barrie	Tatham utilized GIS mapping to calculate stage-storage relationship, discharge extracted from City-provided VO model
KD05	Provided	City of Barrie	Provided	City of Barrie	Tatham revised City of Barrie SSD Table - Revised discharge calculations below 283.10 m (calculated) and extended SWMF vertically to contain Regional storm (2016 LiDAR)
KD06	Provided	City of Barrie	Provided	City of Barrie	Tatham revised City of Barrie SSD Table - Weir calculation below orifice centroid (calculated) and extended SWMF vertically to contain Regional storm (2016 LiDAR)
BK03	Provided	City of Barrie	Provided	City of Barrie	Tatham revised City of Barrie SSD Table - Revised orifice discharge calculations below 290.5 m (calculated)
BK04	Provided	City of Barrie	Provided	City of Barrie	Tatham revised City of Barrie SSD Table - Revised orifice discharge calculations below 221.25 m (calculated)
BK08	Provided	City of Barrie	Provided	City of Barrie	No revisions to City of Barrie SSD Table
DY01	Provided	City of Barrie	Provided	City of Barrie	Tatham revised City of Barrie SSD Table - Revised orifice discharge calculations below point that orifice head supersedes orifice diameter (calculated), interpolated SWMF area below 225.50 m and calculated discharge below 225.50

TATHAM ENGINEERING

Project:	Barrie Drainage Master Plan	Prepared By:	DAM / ASB / NHF
File No.:	117076	Reviewed By:	Daniel Twigger
Revision:	1	Date:	12-Mar-19
Description:	Existing SWMF Stage-Storage-Discharge Relationship Summary		

SWMF ID	Stage-Storage Relationship		Stage-Discharge Relationship		Comment
	Method of Determination	Source	Method of Determination	Source	
DY02	Provided	City of Barrie	Provided	City of Barrie	No revisions to City of Barrie SSD Table
DY03	Provided	City of Barrie	Provided	City of Barrie	Tatham revised City of Barrie SSD Table - Revised orifice discharge calculations below 272.25 m (calculated)
DY041	Provided	City of Barrie	Provided	City of Barrie	Tatham revised City of Barrie SSD Table - Interpolated area below 234.75 m and calculated discharge below 234.75 m
DY042	Provided	City of Barrie	Provided	City of Barrie	Tatham revised City of Barrie SSD Table - Interpolated area below 234.00 m and revised discharge calculations below 234.25 m (calculated)
DY07	Provided	City of Barrie	Provided	City of Barrie	Tatham revised City of Barrie SSD Table - Revised orifice discharge calculations below 219.75 m (calculated) and utilized GIS mapping to identify spillway (crest at 219.90 m, 150 m bottom width, 10 m length, 150H:1V side slopes)
DY09	Provided	City of Barrie	Provided	City of Barrie	Tatham revised City of Barrie SSD Table - Revised orifice discharge calculations below 303.00, utilized GIS mapping to extend SWMF below 302.75 and above 303.75 and to identify spillway (crest at 303.75 m, 14 m bottom width, 10 m length, 50H:1V side
DY10	Calculated	2016 LiDAR	Provided	SWM Report	Tatham utilized GIS mapping to calculate stage-storage, whereas discharge provided in background SWM report, "Proposed Car Dealership - 395 Dunlop Street West, Barrie, ON - SWM Concept Plan and Design" (CH2M Gore & Storrie Limited, 1997)
WK01	Provided	City of Barrie	Provided	City of Barrie	No revisions to City of Barrie SSD Table
WK02	Provided	City of Barrie	Provided	City of Barrie	Tatham revised City of Barrie SSD Table - Revised orifice discharge calculations below 242.25 m (calculated)
WK04	Provided	City of Barrie	Provided	City of Barrie	Tatham revised City of Barrie SSD Table - Area below 227.50 m determined through GIS mapping, SWMF data extrapolated above 229.50 m

TATHAM ENGINEERING

Project:	Barrie Drainage Master Plan	Prepared By:	DAM / ASB / NHF
File No.:	117076	Reviewed By:	Daniel Twigger
Revision:	1	Date:	12-Mar-19
Description:	Existing SWMF Stage-Storage-Discharge Relationship Summary		

SWMF ID	Stage-Storage Relationship		Stage-Discharge Relationship		Comment
	Method of Determination	Source	Method of Determination	Source	
WK05	Provided	City of Barrie	Provided	City of Barrie	No revisions to City of Barrie SSD Table
WK08	Available	SWM Report	Available	SWM Report	No revisions to SSD Table provided in Garaga Doors Addition Stormwater Management Pond Hydraulic Calculation Sheet prepared by Richardson Foster Ltd. (2004)
WK16	Calculated	2016 LiDAR	Calculated	Topographic Survey	Tatham utilized GIS mapping to calculate stage-storage relationship, extrapolated data above 268.00 m, conducted topographic survey to determine outlets and calculated discharge
WK18	Calculated	2016 LiDAR	Calculated	Topographic Survey	Tatham utilized GIS mapping to calculate stage-storage relationship, conducted topographic survey to determine outlets and calculated discharge
HR01	Calculated	2016 LiDAR	Calculated	Topographic Survey	Tatham utilized GIS mapping to calculate stage-storage relationship, conducted topographic survey to determine outlets and calculated discharge
HR02	Calculated	2016 LiDAR	Calculated	Topographic Survey	Tatham utilized GIS mapping to calculate stage-storage relationship, conducted topographic survey to determine outlets and calculated discharge
HR031	Calculated	2016 LiDAR	Calculated	2016 LiDAR	Tatham utilized GIS mapping to calculate stage-storage relationship and to determine overflow weir dimensions, calculated discharge through weirs
HR032	Calculated	2016 LiDAR	Calculated	Topographic Survey	Tatham utilized GIS mapping to calculate stage-storage relationship, conducted topographic survey to determine outlets and calculated discharge
HT03A	Calculated	SWM Report	Calculated	SWM Report	Tatham obtained a few data points from background report, "SWM Report for Timberwalk Condominium" (1988) and interpolated pond areas between 275.50 and 278.57 m, outlet information provided in the same report used by Tatham to calculate
HT03B	Calculated	SWM Report	Calculated	SWM Report	Tatham obtained a few data points from background report, "SWM Report for Timberwalk Condominium" (1988) and interpolated pond areas between 284.50 and 286.20 m, outlet information provided in the same report used by Tatham to calculate

TATHAM ENGINEERING

Project:	Barrie Drainage Master Plan	Prepared By:	DAM / ASB / NHF
File No.:	117076	Reviewed By:	Daniel Twigger
Revision:	1	Date:	12-Mar-19
Description:	Existing SWMF Stage-Storage-Discharge Relationship Summary		

SWMF ID	Stage-Storage Relationship		Stage-Discharge Relationship		Comment
	Method of Determination	Source	Method of Determination	Source	
HT06	Provided	City of Barrie	Provided	SWM Report	No revisions to City of Barrie Stage-Storage Table, discharge information from Markborough Properties Stormwater Management Calculations prepared by R. G. Robinson and Associates Ltd. (1996)
HT17	Calculated	2016 LiDAR	Calculated	City of Barrie	Tatham revised City of Barrie SSD Table - Tatham utilized GIS mapping to calculate stage-storage relationship, revised discharge calculations to include weir (dimensions determined through GIS mapping
WL01	Calculated	2016 LiDAR	Calculated	Topographic Survey	Tatham utilized GIS mapping to calculate stage-storage relationship, conducted topographic survey to determine outlets and calculated discharge
LV01	Calculated	2016 LiDAR	Calculated	SWM Report	Tatham utilized GIS mapping to calculate stage-storage relationship, outlet information from Pond Detail Record Drawing prepared by Richard Engineering Ltd. (1999), used by Tatham to calculate discharge
LV02	Calculated	2016 LiDAR	Calculated	Topographic Survey	Tatham utilized GIS mapping to calculate stage-storage relationship, conducted topographic survey to determine outlets and calculated discharge
LV03	Available	SWM Report	Available	SWM Report	No revisions to SSD Table provided in "South Barrie Business Park" design information, prepared by R. E. Winters & Associates Ltd. (1989)
LV04	Calculated	2016 LiDAR	Calculated	Topographic Survey	Tatham utilized GIS mapping to calculate stage-storage relationship, conducted topographic survey to determine outlets and calculated discharge
LV05	Calculated	2016 LiDAR	Calculated	Topographic Survey	Tatham utilized GIS mapping to calculate stage-storage relationship, extrapolated data to permanent pool level, conducted topographic survey to determine outlets and calculated discharge
LV06	Calculated	2016 LiDAR	Calculated	Topographic Survey	Tatham utilized GIS mapping to calculate stage-storage relationship, conducted topographic survey to determine outlets and calculated discharge
LV07	Calculated	2016 LiDAR	Calculated	Topographic Survey	Tatham utilized GIS mapping to calculate stage-storage relationship, conducted topographic survey to determine outlets and calculated discharge

TATHAM ENGINEERING

Project:	Barrie Drainage Master Plan	Prepared By:	DAM / ASB / NHF
File No.:	117076	Reviewed By:	Daniel Twigger
Revision:	1	Date:	12-Mar-19
Description:	Existing SWMF Stage-Storage-Discharge Relationship Summary		

SWMF ID	Stage-Storage Relationship		Stage-Discharge Relationship		Comment
	Method of Determination	Source	Method of Determination	Source	
LV08	Available	SWM Report	Available	SWM Report	No revisions to SSD table provided in "Greenville Business Park Stormwater Management Report" prepared by R. G. Robinson and Associates Ltd. (1989)
LV09	Available	SWM Report	Available	SWM Report	No revisions to SSD table provided in "Stormwater Management Update Study Barrie View Subdivision", prepared by Skelton, Brumwell & Associates Inc. (1995)
LV10	Calculated	2016 LiDAR	Calculated	Topographic Survey	Tatham utilized GIS mapping to calculate stage-storage relationship, conducted topographic survey to determine outlets and calculated discharge
LV11	Available	SWM Report	Available	SWM Report	No revisions to SSD table provided in "Stormwater Management and Erosion and Sedimentation Control Report for Lover's Creek Acres, Lawton Residential Limited", prepared by Higgins Engineering Limited (1990)
LV12	Available	SWM Report	Available	SWM Report	No revisions to SSD table provided in "South Barrie Business Park-6B" design information, prepared by R. E. Winters & Associates Ltd. (1989)
LV13	Calculated	2016 LiDAR	Calculated	Topographic Survey	Tatham utilized GIS mapping to calculate stage-storage relationship, conducted topographic survey to determine outlets and calculated discharge
LV14	Available	SWM Report	Available	SWM Report	No revisions to SSD Table provided in "Lovers Creek Stormwater Management Pond (LV14) Retrofit Detail Design Report" prepared by City of Barrie Engineering Department (2009)
LV15	Available	SWM Report	Available	SWM Report	SSD Table provided in "Stormwater Management Report Barrie View Business Centre Phase III, Barrie View Subdivision" prepared by Skelton, Brumwell & Associates Inc. (2002) was extrapolated to 303.70 m
LV16	Available	SWM Report	Available	SWM Report	No revisions to SSD table provided in "Greenville Business Park Stormwater Management Report" prepared by R. G. Robinson and Associates Ltd. (1989)
LV17	Available	SWM Report	Available	SWM Report	No revisions to SSD table provided in "Greenville Business Park Stormwater Management Report" prepared by R. G. Robinson and Associates Ltd. (1989)

TATHAM ENGINEERING

Project:	Barrie Drainage Master Plan	Prepared By:	DAM / ASB / NHF
File No.:	117076	Reviewed By:	Daniel Twigger
Revision:	1	Date:	12-Mar-19
Description:	Existing SWMF Stage-Storage-Discharge Relationship Summary		

SWMF ID	Stage-Storage Relationship		Stage-Discharge Relationship		Comment
	Method of Determination	Source	Method of Determination	Source	
LV18	Calculated	2016 LiDAR	Calculated	SWM Report	Tatham utilized GIS mapping to calculate stage-storage relationship, outlet information from Deer Creek Homes Ltd. Pond Detail Drawing prepared by Reindeers Engineers (1997), used by Tatham to calculate discharge
LV19	Calculated	2016 LiDAR	Available	SWM Report	Tatham utilized GIS mapping to calculate stage-storage relationship, discharge information from "Master Stormwater Management Design Report Barrie Heritage Developments Ltd." prepared by R.G. Robinson and Associates Ltd. (1998)
LV20	Available	SWM Report	Available	SWM Report	No revisions to SSD Table provided in "Mason Homes Limited Stormwater Management Report", prepared by City of Barrie Engineering Department (1999)
LV21	Available	SWM Report	Available	SWM Report	Tatham utilized SSD Table provided in "Stormwater Management Report Lorne Investments (Sudbury) Limited Lover's Creek Estates" prepared by Jones Consulting (1997), and extrapolated data to 244.80 m
LV22	Available	SWM Report	Available	SWM Report	No revisions to SSD Table provided in "Addendum to Stormwater Management Report Argento Industrial Subdivision" prepared by R.G. Robinson and Associates Ltd. (2006)
LV23	Available	SWM Report	Available	SWM Report	No revisions to SSD Table provided in "Detailed Stormwater Management Report L J Mapleview Subdivision" prepared by Richardson Engineering Ltd. (2006)
LV25	Available	SWM Report	Available	SWM Report	No revisions to SSD Table provided in "Detailed Stormwater Management Report 1818 Subdivision" prepared by Richardson Foster Ltd. (2004)
LV26	Calculated	2016 LiDAR	Calculated	Topographic Survey	Tatham utilized GIS mapping to calculate stage-storage relationship, conducted topographic survey to determine outlets and calculated discharge
LV27	Calculated	SWM Report	Available	SWM Report	Tatham calculated stage-storage based on data points provided in "Hurst Drive Extension - Tollendal Mill Road to Coxmill Road Drainage and Storm Water Management Plan" prepared by McCormick Rankin (2003), discharge information from
LV30	Calculated	SWM Report	Calculated	SWM Report	Tatham calculated stage-storage based on areas provided in "SWM Analysis for Mapleview Mini Storage Site Development" prepared by J. Foster Engineering Ltd.(2004), outlet information from same report used by Tatham to calculate discharge

TATHAM ENGINEERING

Project:	Barrie Drainage Master Plan	Prepared By:	DAM / ASB / NHF
File No.:	117076	Reviewed By:	Daniel Twigger
Revision:	1	Date:	12-Mar-19
Description:	Existing SWMF Stage-Storage-Discharge Relationship Summary		

SWMF ID	Stage-Storage Relationship		Stage-Discharge Relationship		Comment
	Method of Determination	Source	Method of Determination	Source	
LV31	Available	SWM Report	Available	SWM Report	No revisions to SSD Table provided in background letter report regarding "Building Addition - St. Peter's Secondary School" prepared by Pearson-McCuaig Engineering Ltd. (2010)
LV32	Calculated	2016 LiDAR	Calculated	Topographic Survey	Tatham utilized GIS mapping to calculate stage-storage relationship and extrapolated data above 231.50 m, conducted topographic survey to determine outlets and calculated discharge
LV37	Available	Certificate of Approval	Available	Certificate of Approval	No revisions to SSD information presented in C of A Number 3-0274-96-006
LV41	Calculated	2016 LiDAR	Calculated	Topographic Survey	Tatham utilized GIS mapping to calculate stage-storage relationship, conducted topographic survey to determine outlets and calculated discharge
LV48	Calculated	2016 LiDAR	Calculated	Topographic Survey	Tatham utilized GIS mapping to calculate stage-storage relationship and extrapolated data below 246.25 m, conducted topographic survey to determine outlets and calculated discharge
LV49	Available	SWM Report	Available	SWM Report	No revisions to SSD Table provided in "Stormwater Management Design Brief Park Place Development - Phase 1" prepared by Sabourin Kimble & Associates Ltd. (2008)
LV50	Available	SWM Report	Available	SWM Report	No revisions to SSD Table provided in "Detailed Stormwater Management Report Mapleview Industrial Subdivision - Phase 3" prepared by Richardson Foster Ltd. (2006)
LVBVCH	Calculated	Aerial Photography	Calculated	Topographic Survey	Tatham determined areas at top and bottom of pond using aerial photography and interpolated areas in between, conducted topographic survey to determine outlets and calculated discharge
BY01	Calculated	Design Drawing	Calculated	Design Drawings	Tatham interpolated areas from "Melia Corp. Property Part Lots 14 & 15, Concession 13 Storm Water Management Facility General Layout" prepared by Genivar Inc. (2008) to determine stage-storage, outlet information from same drawing used to calculate
BY03	Available	Design Drawing	Calculated	Design Drawings	Tatham utilized areas from "Melia Corp. Property Part Lots 14 & 15, Concession 13 Storm Water Management Facility General Layout" prepared by Genivar Inc. (2008) to determine stage-storage, outlet information from same drawing used to calculate

TATHAM ENGINEERING

Project:	Barrie Drainage Master Plan	Prepared By:	DAM / ASB / NHF
File No.:	117076	Reviewed By:	Daniel Twigger
Revision:	1	Date:	12-Mar-19
Description:	Existing SWMF Stage-Storage-Discharge Relationship Summary		

SWMF ID	Stage-Storage Relationship		Stage-Discharge Relationship		Comment
	Method of Determination	Source	Method of Determination	Source	
HW01	Available	SWM Report	Available	SWM Report	No revisions to SSD Table provided in "Stormwater Management Report Lance Gate Subdivision" prepared by G. M. Sernas & Associates Ltd. (1995)
HW04	Calculated	SWM Report	Calculated	SWM Report	SSD table provided in "Stormwater Management Report Simcoe Shores Subdivision" prepared by Jones Consulting Group Ltd. (2000) was revised by extending data above 227.00 m and adding discharge from weir (dimensions determined through GIS
HW05	Calculated	2016 LiDAR	Available	SWM Report	Tatham utilized GIS mapping to calculate stage-storage relationship, discharge information is available in "Stormwater Management Report Craigmel Subdivision" prepared by Richardson Engineering Ltd. (1999)
HW06	Calculated	SWM Report	Calculated	SWM Report	SSD table provided in "Stormwater Management Report Simcoe Shores - Phase 2" prepared by Jones Consulting Group Ltd. (2002) was revised by extending data above 230.00 m and adding discharge from weir (dimensions determined through GIS
HW08	Available	SWM Report	Available	SWM Report	No revisions to SSD Table provided in "Stormwater Management and Pond Design Report Maplecort Subdivision" prepared by Valdor Engineering Inc. (2003)
HW09	Available	SWM Report	Available	SWM Report	No revisions to SSD Table provided in "Stormwater Management Report Pratt Residential Subdivision" prepared by R. G. Robinson and Associates Ltd. (2003)
HW10	Calculated	2016 LiDAR	Calculated	SWM Report	Tatham utilized GIS mapping to determine areas, interpolated as required to establish stage-storage relationship, outlet information from Barrie South Station Stormwater Management Details & Sections drawing prepared by RJ Burnside (2010) used to
GR01	Calculated	2016 LiDAR	Calculated	Topographic Survey	Tatham utilized GIS mapping to calculate stage-storage relationship, conducted topographic survey to determine outlets and calculated discharge
GR03	Calculated	2016 LiDAR	Calculated	Topographic Survey	Tatham utilized GIS mapping to calculate stage-storage relationship, conducted topographic survey to determine outlets and calculated discharge
GR04	Calculated	2016 LiDAR	Calculated	Topographic Survey	Tatham utilized GIS mapping to calculate stage-storage relationship, conducted topographic survey to determine outlets and calculated discharge

TATHAM ENGINEERING

Project:	Barrie Drainage Master Plan	Prepared By:	DAM / ASB / NHF
File No.:	117076	Reviewed By:	Daniel Twigger
Revision:	1	Date:	12-Mar-19
Description:	Existing SWMF Stage-Storage-Discharge Relationship Summary		

SWMF ID	Stage-Storage Relationship		Stage-Discharge Relationship		Comment
	Method of Determination	Source	Method of Determination	Source	
LT01	Available	SWM Report	Available	SWM Report	No revisions to SSD table provided in "City of Barrie Little Lake SWM Pond LT1 Drainage Improvements: Class Environmental Assessment" (2013)
LT02	Calculated	2016 LiDAR	Calculated	SWM Report	Tatham utilized GIS mapping to calculate stage-storage relationship, dishcarge information provided in Proposed Kerbal Development Stormwater Management Report prepared by Richardson Engineering Ltd. (1999) was revised to include weir flow above
LT03	Calculated	2016 LiDAR	Calculated	SWM Report	Tatham utilized GIS mapping to calculate stage-storage relationship, outlet information from "Stollar Plan of Subdivision, Osprey Ridge Draft Plan" prepared by R.G. Robinson & Associates Ltd. (1997) used to calculate discharge
LT04	Calculated	2016 LiDAR	Calculated	SWM Report	Tatham utilized GIS mapping to calculate stage-storage relationship, outlet information from "East Bayfield Secondary Plan Area Pond 1 Stormwater Management Report" prepared by Richardson Engineering Ltd. (1999) used to calculate discharge
LT05	Calculated	2016 LiDAR	Calculated	SWM Report	Tatham utilized GIS mapping to calculate stage-storage relationship, outlet information from "Stollar Plan of Subdivision, Osprey Ridge Draft Plan" prepared by R.G. Robinson & Associates Ltd. (1997) used to calculate discharge
LT06	Calculated	2016 LiDAR	Calculated	SWM Report	Tatham utilized GIS mapping to calculate stage-storage relationship, discharge information from "Lions Gate Subdivision Lot 21 Concession 3 SWM Report" prepared by Richardson Engineering Ltd. (2002)
LT07	Calculated	2016 LiDAR	Calculated	SWM Report	Tatham utilized GIS mapping to calculate stage-storage relationship, discharge information from "SWM Report - Royal Victoria Hospital" prepared by Skelton Brumwell & Associates Inc. (1993)
LT08	Calculated	2016 LiDAR	Available	Certificate of Approval	Tatham utilized GIS mapping to calculate stage-storage relationship, discharge information from C of A Number 3-1167-90-006
LTXX	Calculated	2016 LiDAR	Calculated	SWM Report	Tatham utilized GIS mapping to calculate stage-storage relationship, discharge information from "Stormwater Management Report for Adam's Funeral Home" prepared by Skelton, Brumwell & Associates Inc. (2006)
LTCnd	Available	SWM Report	Provided	City of Barrie	Tatham utilized Stage-Storage table from background report, "Cundles Road / Duckworth Street Widening" (2010) and interpolated areas as required, outlet information provided in the same report used by Tatham to calculate discharge

TATHAM ENGINEERING

Project:	Barrie Drainage Master Plan	Prepared By:	DAM / ASB / NHF
File No.:	117076	Reviewed By:	Daniel Twigger
Revision:	1	Date:	12-Mar-19
Description:	Existing SWMF Stage-Storage-Discharge Relationship Summary		

SWMF ID	Stage-Storage Relationship		Stage-Discharge Relationship		Comment
	Method of Determination	Source	Method of Determination	Source	
LTKoz	Available	SWM Report	Available	SWM Report	No revisions to SSD table provided in "Fernbrooke Homes Ltd. Mooregate Estates Inc. Stormwater Management Report" (2008)
LTGM	Calculated	Design Drawing	Calculated	Design Drawings	Tatham utilized Georgian Mall Expansion design drawings prepared by Richardson Foster Ltd. (2005) to calculate stage-storage relationship, outlet information from same design drawings used to calculate discharge
BR01	Calculated	2016 LiDAR	Calculated	Topographic Survey	Tatham utilized GIS mapping to calculate stage-storage relationship, conducted topographic survey to determine outlets and calculated discharge
BR03	Calculated	2016 LiDAR	Available	SWM Report	Tatham utilized GIS mapping to calculate stage-storage relationship, discharge information from "Stormwater Management Report Holly Residential Subdivision" prepared by Marshall Macklin Monaghan Ltd. (1994)
BR05	Calculated	2016 LiDAR	Available	SWM Report	Tatham utilized GIS mapping to calculate stage-storage relationship, discharge information from "Stormwater Management Report Barrie-Holly Residential Subdivision (Patrician Homes Ltd.)" prepared by R.G. Robinson & Associates Ltd. (1996)
BR06	Calculated	2016 LiDAR	Calculated	Master Drainage Plan	Tatham utilized GIS mapping to calculate stage-storage relationship, discharge information from "Stormwater Management Report Ardaugh Secondary Plan Area" prepared by Tatham (1999) was revised to include weir flow above 281.90 m
BR07	Calculated	2016 LiDAR	Calculated	Topographic Survey	Tatham utilized GIS mapping to calculate stage-storage relationship, conducted topographic survey to determine outlets and calculated discharge
BR08A	Calculated	2016 LiDAR	Available	SWM Report	Tatham utilized GIS mapping to calculate stage-storage relationship, discharge information from "West View Estates Subdivision Stormwater Management Report" prepared by Reinders and Associates Ltd. (1997)
BR08B	Calculated	2016 LiDAR	Calculated	SWM Report	Tatham utilized GIS mapping to calculate stage-storage relationship, discharge information from "West View Estates Subdivision Stormwater Management Report" prepared by Reinders and Associates Ltd. (1997) was revised to include weir flow above
BR09	Calculated	2016 LiDAR	Available	SWM Report	Tatham utilized GIS mapping to calculate stage-storage relationship, discharge information from "Stormwater Management Pond 4 Parkland Chase Subdivision SWM Report" prepared by R.G. Robinson and Associates Ltd. (1998)

TATHAM ENGINEERING

Project:	Barrie Drainage Master Plan	Prepared By:	DAM / ASB / NHF
File No.:	117076	Reviewed By:	Daniel Twigger
Revision:	1	Date:	12-Mar-19
Description:	Existing SWMF Stage-Storage-Discharge Relationship Summary		

SWMF ID	Stage-Storage Relationship		Stage-Discharge Relationship		Comment
	Method of Determination	Source	Method of Determination	Source	
BR10	Calculated	2016 LiDAR	Calculated	SWM Report	Tatham utilized GIS mapping to calculate stage-storage relationship, discharge information from "West View Estates Subdivision Stormwater Management Report" prepared by Reinders and Associates Ltd. (1997) was revised to include weir flow above
BR11	Available	SWM Report	Available	SWM Report	SSD table provided in "Stormwater Management Report Forest Hill Three Subdivision" prepared by Richardson Engineering Ltd. (2003) was extended above 304.41 m using 2016 LiDAR data
BR13	Calculated	2016 LiDAR	Available	SWM Report	Tatham utilized GIS mapping to calculate stage-storage relationship, discharge information from "Deer Valley Subdivision SWM Study" prepared by Reid and Associates Limited (1991) was revised to include weir flow above 266.00 m
BR14	Available	SWM Report	Available	SWM Report	SSD table provided in "Ferndale Drive Stormwater Management Pond Retrofit Design" prepared by Ainley Group (2005) was revised by extending SWMF above 239.00 m using 2016 LiDAR data and including weir flow above 239.00 m
BR15	Calculated	2016 LiDAR	Calculated	Topographic Survey	Tatham utilized GIS mapping to calculate stage-storage relationship, conducted topographic survey to determine outlets and calculated discharge
BR16	Calculated	2016 LiDAR	Available	SWM Report	Tatham utilized GIS mapping to calculate stage-storage relationship, discharge information from "Detailed Stormwater Management Report Mapleview Industrial Park Lands - Phase I" prepared by Richardson Foster Ltd. (2006)
BR20	Calculated	2016 LiDAR	Available	SWM Report	Tatham utilized GIS mapping to calculate stage-storage relationship, discharge information from "Detailed Stormwater Management Report Mapleview West Industrial Park" prepared by Richardson Engineering Ltd. (2003)
BR22	Available	SWM Report	Available	SWM Report	No revisions to SSD table provided in "Final Storm Water Management Report for The Meadows of Bear Creek Phase 1" prepared by Walterfredy (2004)
BR23	Available	SWM Report	Available	SWM Report	No revisions to SSD table provided in letter to City of Barrie regarding Timberwalk Condominiums Stormwater Calculations prepared by Higgins Engineering (1989)
BR24	Calculated	SWM Report	Calculated	SWM Report	Tatham interpolated SSD data from information provided in "Mapleview Industrial Subdivision - Phase 2" SWM Report and design drawings prepared by Richardson Foster Ltd. (2006)

SP02
Sophia Creek Watershed
(Patricia Avenue Park)

Permenant Pool Elev=	n/a m
Top of Berm =	275.000 m
Berm/Spillway Elev. Between Cells=	n/a m

Orifice 1 Data (CB inlet with 250mm orifice outlet)		**Orifice 2 Data**	
c =	0.630	c =	0.630
Diameter =	0.250 m	Diameter =	0.600 m
Area[1] =	0.049 m^2	Area[1] =	0.283 m^2
Invert Elev. =	272.000 m	Invert Elev. =	270.973 m
Inlet Elevation =	273.50 m		
Shape (yes /no)		**Shape (yes /no)**	
Spillway/Weir 1 Data		**Spillway/Weir 2 Data**	
Spillway or Weir? =	Weir	Spillway or Weir? =	Weir
c =	1.700	c =	1.700
Side Slope[2] =	0.10 m	Side Slope[2] =	3.00 m
Number of Sides =	2	Number of Sides =	1
Height of Sides =	0.6 m	Height of Sides =	0.2 m
Length =	0.300 m	Length =	1.800 m
Effective Length[3] =	0.180 m	Effective Length[3] =	1.200 m
Invert Elev. =	274.100 m	Invert Elev. =	274.900 m

Formulas

(1)	**Orifice Area**	(π x Orifice Diameter^)/4
(2)	**Side Slope**	Horizontal Distance / Vertical Distance
(3)	**Effective Length**	Length of Spillway/Wier - Side Slope Ratio x Number of Sides x Height of Sides
(4)	**Stage**	Current Elev. - Invert of Permanent Pool Elev.
(5)	**Storage**	[(Current Area+Previous Area)/2 ×(Current Stage-Previous Stage)]／10000+Previous Storage
(6)	**Orifice Head**	Elev. - Invert Elev. - (Orifice Diameter/2)
(7)	**Spillway/Weir Head**	Elev. - Weir Invert Elev.
(8)	**Orifice Flow**	c x Orifice Area x √(2x9.81x Orifice Head)
(9)	**Spillway/Weir Flow**	c x Weir Length x Weir $Head^{1.5}$
(10)	**Total Storage**	Cell 1 Storage + Cell 2 Storage
(11)	**Total Flow**	Orifice Flow + Wier Flow

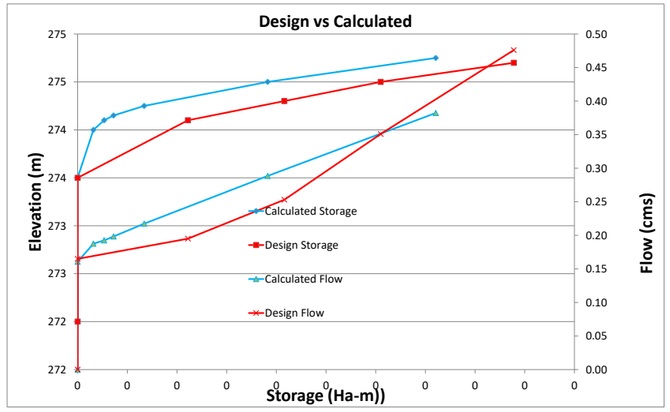
*In cases where the sides are perpendicular to the bottom of the spillway/weir, the slope ratio of 0.1 is used and the number of sides is 2. In cases where the sides are not perpendicular to the bottom, the number of sides used is 1.

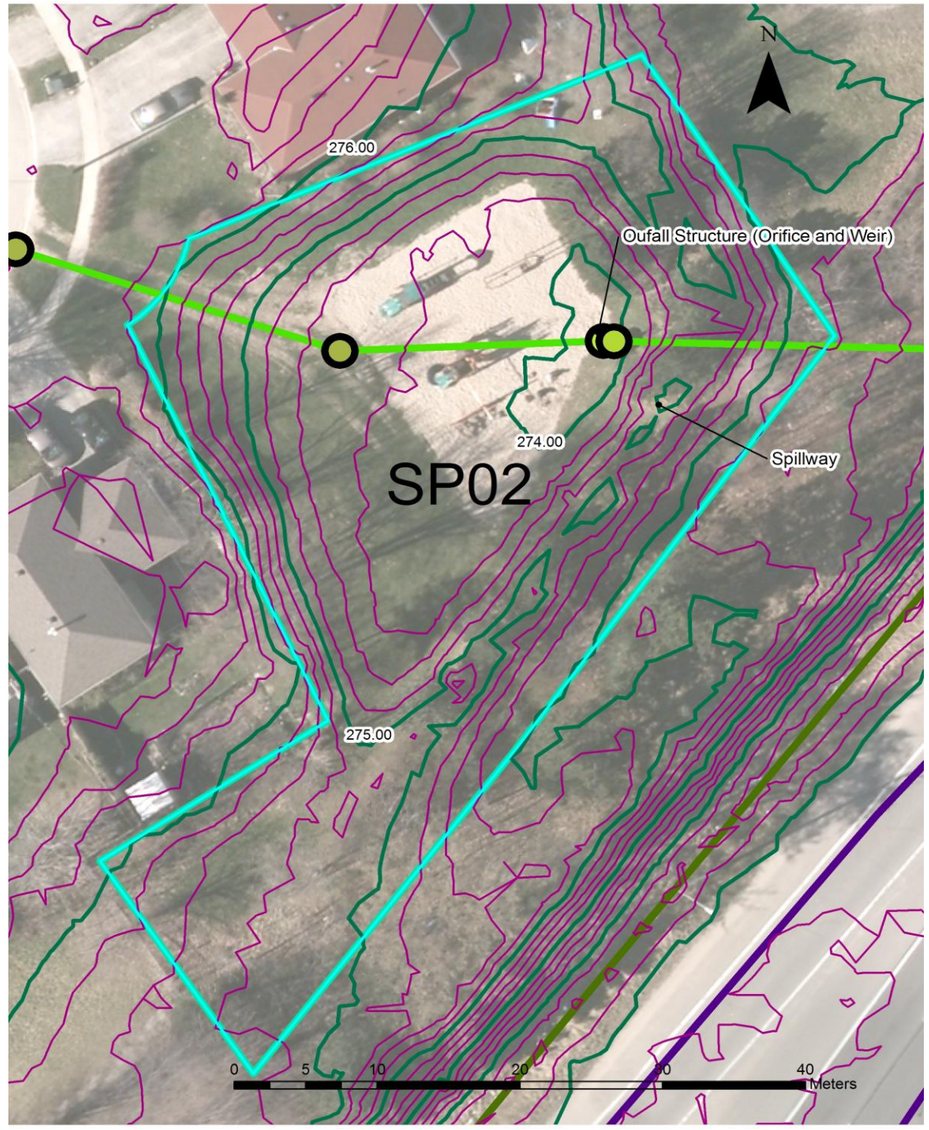
Stage and Storage								**Flow Calculations**									
Cell 1				**Cell 2**				**Orifice 1**		**Spillway/Weir 1**		**Orifice 2**		**Spillway/Weir 2**		**Summary**	
Elev (m)	**Stage[4] (m)**	**Area (m^2)**	**Storage[5] (ha*m)**	**Elev (m)**	**Stage[4] (m)**	**Area (m^2)**	**Storage[5] (ha*m)**	**Head[6] (m)**	**Flow[8] (m^3/s)**	**Head [7] (m)**	**Flow[8] (m^3/s)**	**Head[6] (m)**	**Flow[8] (m^3/s)**	**Head[6] (m)**	**Flow[8] (m^3/s)**	**Total Flow [11] (m^3/s)**	**Total Storage[10] (ha*m)**
272.00	0.00	0	0.000		0.00		0.000	0.00	n/a	n/a	n/a	0.73	0.673	0.00	0.000	n/a	0.000
273.50	1.50	0	0.000		1.50			1.38	0.161	n/a	n/a	2.23	1.177	0.00	0.000	0.161	0.000
274.00	2.00	64	0.002		2.00			1.88	0.188	n/a	n/a	2.73	1.303	0.00	0.000	0.188	0.002
274.10	2.10	152	0.003		2.10			1.98	0.193	0.00	0.000	2.83	1.327	0.00	0.000	0.193	0.003
274.15	2.15	228	0.004		2.15			2.02	0.195	0.05	0.003	2.88	1.338	0.00	0.000	0.198	0.004
274.25	2.25	390	0.007		2.25			2.13	0.200	0.15	0.018	2.98	1.361	0.00	0.000	0.217	0.007
274.50	2.50	604	0.019		2.50			2.38	0.211	0.40	0.077	3.23	1.417	0.00	0.000	0.289	0.019
274.75	2.75	749	0.036		2.75			2.63	0.222	0.65	0.160	3.48	1.471	0.00	0.000	0.382	0.036
274.80	2.80	**784**	0.040		2.80			2.68	0.224	0.70	0.179	3.53	1.482	0.00	0.000	0.403	0.040
274.90	2.90	**838**	0.048		2.90			2.77	0.228	0.80	0.219	3.63	1.503	**0.00**	**0.000**	0.447	0.048
275.00	3.00	**894**	0.057		3.00			2.88	0.232	0.90	0.261	3.73	1.523	**0.10**	**0.078**	0.571	0.057
275.10	3.10	**966**	0.066		3.10			2.98	0.236	1.00	0.306	3.83	1.544	**0.20**	**0.260**	0.803	0.066

Tatham Engineering Extended Values to Include Weir Flow and Additional Storage Based on 2016 LIDAR.

Stage-Storage-Discharge from Original Report					
Elevation		**Discharge**		**Storage**	
(ft)	**(m)**	**(ft^3/s)**	**(m^3/s)**	**(ha*m)**	**(m^3)**
	272.00		0	0.000	
	273.50		0.165	0.000	
	274.10		0.195	0.011	111
	274.30		0.253	0.021	208
	274.50		0.351	0.031	305
	274.70		0.476	0.044	439

Notes: -Red text indicates a value that has been calculated in this spreadsheet
- Orifice 2 is collecting from both Orifice 1 and Wier 1. Flow rate for Orifice 2 have been calculated but are not included in the total flow because flow rates from Orifice 1 and Orifice 2 are limiting.





KD02
Kidds Creek Watershed
(Cundles Rd/Lillian Cres)

Permenant Pool Elev=	n/a	m
Top of Berm =	268.700	m
Berm/Spillway Elev. Between Cells=	n/a	m

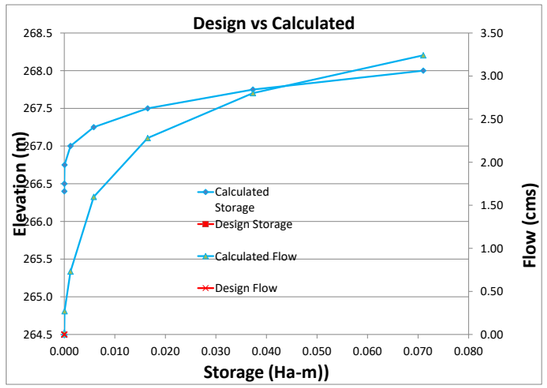
Orifice 1 Data			**Orifice 2 Data**		
c =	0.630		c =	0.630	
Diameter =	1.219	m	Diameter =	n/a	m
Area[1] =	1.167	m^2	Area[1] =	n/a	m^2
Invert Elev. =	266.400	m	Invert Elev. =	n/a	m

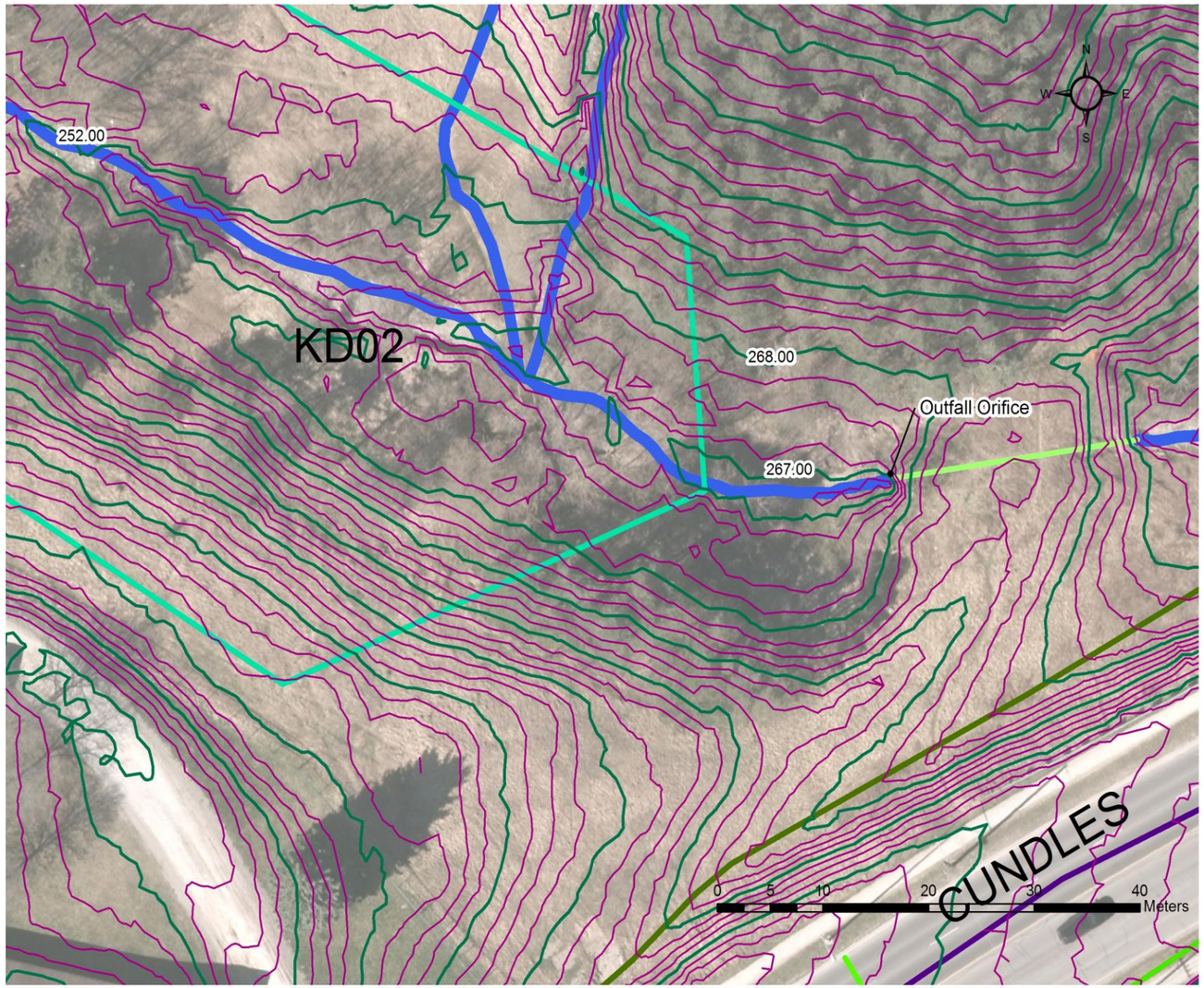
Shape (yes /no)			
Spillway/Weir 1 Data		**Spillway/Weir 2 Data**	
Spillway or Weir? =	Weir	Spillway or Weir?=	n/a
c =	1.700	c =	1.700
Side Slope[2] =	7.50	Side Slope =	n/a
Number of Sides =	1	Number of Sides =	n/a
Height of Sides =	0.6 m	Height of Sides =	n/a m
Length =	n/a m	Length =	n/a m
Effective Length[3] =	n/a m	Effective Length =	n/a m
Invert Elev. =	268.100 m	Invert Elev. =	n/a m

Stage and Storage								**Flow Calculations**				**Summary**	
Cell 1				**Cell 2**				**Orifice**		**Spillway/Weir**			
Elev	**Stage[4]**	**Area**	**Storage[5]**	**Elev**	**Stage[4]**	**Area**	**Storage[5]**	**Head[6]**	**Flow[8]**	**Head [7]**	**Flow[9]**	**Total Flow [11]**	**Total Storage[10]**
(m)	**(m)**	**(m^2)**	**(ha*m)**	**(m)**	**(m)**	**(m^2)**	**(ha*m)**	**(m)**	**(m^3/s)**	**(m)**	**(m^3/s)**	**(m^3/s)**	**(ha*m)**
266.40	0.00	0	0.000		0.00		0.000	0.00	0.000	0.00	n/a	0.000	0.000
266.50	0.10	0	0.000		0.00		0.000	0.10	0.024	0.00	n/a	0.024	0.000
266.75	0.35	4	0.000		0.00		0.000	0.35	0.270	0.00	n/a	0.270	0.000
267.00	0.60	91	0.001		0.00		0.000	0.60	0.731	0.00	n/a	0.731	0.001
267.25	0.85	277	0.006		0.00		0.000	0.24	1.597	0.00	n/a	1.597	0.006
267.50	1.10	576	0.016		0.00		0.000	0.49	2.281	0.00	n/a	2.281	0.016
267.75	1.35	1091	0.037		0.00		0.000	0.74	2.803	0.00	n/a	2.803	0.037
268.00	1.60	1605	0.071		0.00		0.000	0.99	3.241	0.00	n/a	3.241	0.071
268.28	1.88	2492	0.128		0.00		0.000	1.27	3.671	0.18	0.450	4.121	0.128
268.40	2.00	2805	0.160		0.00		0.000	1.39	3.840	0.30	1.020	4.860	0.160
268.57	2.17	3262	0.212		0.00		0.000	1.56	4.068	0.47	2.440	6.508	0.212
268.84	2.44	3978	0.309		0.00		0.000	1.83	4.406	0.74	6.490	10.896	0.309
268.97	2.57	4400	0.364		0.00		0.000	1.96	4.560	0.87	10.860	15.420	0.364
269.24	2.84	4982	0.491		0.00		0.000	2.23	4.864	1.14	24.030	28.894	0.491

Tatham Engineering Revised Calculation Applies NVCA Weir Calculation for Flow Below Orifice Centroid.
Tatham Engineering Extended Values to Include Weir Flow and Additional Storage Based on 2016 LIDAR.

Stage-Storage-Discharge from Original Report					
Elevation		**Discharge**		**Storage**	
(ft)	**(m)**	**(ft^3/s)**	**(m^3/s)**	**(ha*m)**	**(ft^3)**
	0.00		0	0.000	
	0.00		0	0.000	
	0.00		0	0.000	
	0.00		0	0.000	
	0.00		0	0.000	
	0.00		0	0.000	
	0.00		0	0.000	
	0.00		0	0.000	
	0.00		0	0.000	
	0.00		0	0.000	
	0.00		0	0.000	
	0.00		0	0.000	
	0.00		0	0.000	
	0.00		0	0.000	
	0.00		0	0.000	





1:250

Notes: -Red text indicates a value that has been calculated in this spreadsheet
-This pond was altered in 2005 following a flood event. The Design Stage-Storage-Discharge tables associated with it no longer apply to the current configuration of the pond.

*Note:There are no applicable design calculations for this pond

Formulas		
(1)	**Orifice Area**	(π x Orifice Diameter^2)/4
(2)	**Side Slope**	Horizontal Distance / Vertical Distance
(3)	**Effective Length**	Length of Spillway/Wier - Side Slope Ratio x Number of Sides x H
(4)	**Stage**	Current Elev. - Invert of Permanent Pool Elev.
(5)	**Storage**	[(Current Area+Previous Area)/2 ×(Current Stage-Previous
(6)	**Orifice Head**	Elev. - Invert Elev. - (Orifice Diameter/2)
(7)	**Spillway/Weir Head**	Elev. - Weir Invert Elev.
(8)	**Orifice Flow**	c x Orifice Area x $\sqrt{}$(2x9.81x Orifice Head)
(9)	**Spillway/Weir Flow**	c x Weir Length x Weir Head$^{1.5}$
(10)	**Total Storage**	Cell 1 Storage + Cell 2 Storage
(11)	**Total Flow**	Orifice Flow + Wier Flow

*In cases where the sides are perpendicular to the bottom of the spillway/weir, the slope ratio of 0.1 is used and the number of sides is 2. In cases where the sides are not perpendicular to the bottom, the number of sides used is 1.

Tatham Engineering Discharge Calculation Notes

Orifice Equation is: Q = C x A x (2gH)^0.5

Where:
- Q = flow rate (cms)
- C = constant
- A = area of opening(sq. m)
- H = net head on the orifice
- g = Acceleration due to gravity

NVCA Weir Flow Calculation Applied For Weir Flow Below Circular Orifice Centroid (Highlighted Cells)

$Q_w = 1.65\{[\pi*(D^2)/4)(2*\cos^{-1}[((D/2)-d)/(D/2)]*(180/\pi)]/360)-((D/2-d)(Dd-d^2)^{0.5})\}/d3d^{1.5}$

Where:
- Q_w is weir flow (m^3/s)
- D is orifice diameter (m)
- d is depth of flow above the invert (m)

KD05
Kidds Creek Watershed
(Livingston/Etherington)

	n/a	m
Top of Berm =	280.250	m
Berm/Spillway Elev. Between Cells=	n/a	m

Orifice 1 Data			**Orifice 2 Data**		
c =	0.630		c =	0.630	
Diameter =	0.442	m	Diameter =	n/a	m
Area[1] =	0.153	m^2	Area[1] =	n/a	m^2
Invert Elev. =	281.253	m	Invert Elev. =	n/a	m
Inlet Elevation =	283.10	m			
Shape (yes /no)			**Shape (yes /no)**		
Spillway/Weir 1 Data			**Spillway/Weir 2 Data**		
Spillway or Weir? =	Spillway		Spillway or Weir? =	n/a	
c =	1.7		c =	1.7	
Side Slope[2] =	3	m	Side Slope[2] =	3	m
Number of Sides =	1		Number of Sides =	1	
Height of Sides =	0.1	m	Height of Sides =	0.1	m
Length =	14.5	m	Length =	22	m
Effective Length[3] =	n/a	m	Effective Length[3] =	n/a	m
Invert Elev. =	285.400	m	Invert Elev. =	285.500	m

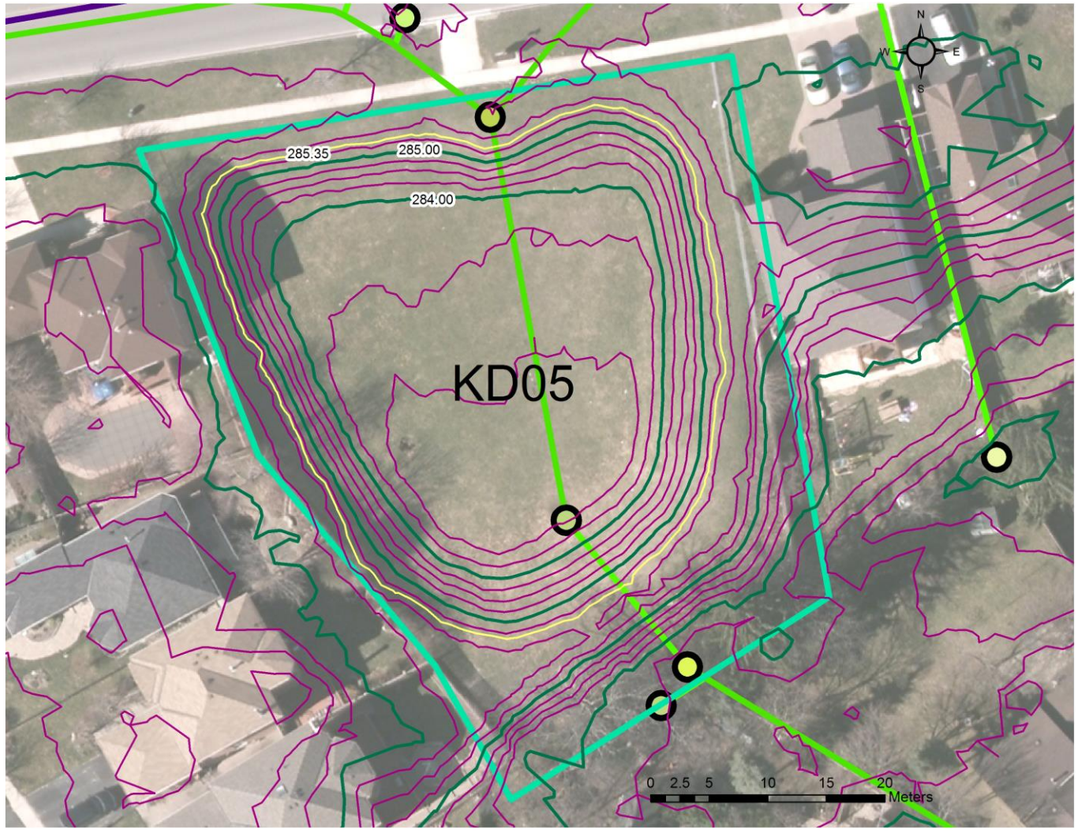
Formulas		
(1)	**Orifice Area**	(π x Orifice Diameter^2)/4
(2)	**Side Slope**	Horizontal Distance / Vertical Distance
(3)	**Effective Length**	Length of Spillway/Wier - Side Slope Ratio x Number of Sides x Height of Sides
(4)	**Stage**	Current Elev. - Invert of Permanent Pool Elev.
(5)	**Storage**	[(Current Area+Previous Area)/2 ×(Current Stage-Previous Stage)]/10000+Previous Storage
(6)	**Orifice Head**	Elev. - Invert Elev. - (Orifice Diameter/2)
(7)	**Spillway/Weir Head**	Elev. - Weir Invert Elev.
(8)	**Orifice Flow**	c x Orifice Area x √(2x9.81x Orifice Head)
(9)	**Spillway/Weir Flow**	c x Weir Length x Weir Head$^{1.5}$
(10)	**Total Storage**	Cell 1 Storage + Cell 2 Storage
(11)	**Total Flow**	Orifice Flow + Wier Flow

*In cases where the sides are perpendicular to the bottom of the spillway/weir, the slope ratio of 0.1 is used and the number of sides is 2. In cases where the sides are not perpendicular to the bottom, the number of sides used is 1.

Stage and Storage								**Flow Calculations**				**Summary**	
Cell 1				**Cell 2**				**Orifice**		**Spillway/Weir**			
Elev (m)	**Stage[4] (m)**	**Area (m^2)**	**Storage[5] (ha*m)**	**Elev (m)**	**Stage[4] (m)**	**Area (m^2)**	**Storage[5] (ha*m)**	**Head[6] (m)**	**Flow[8] (m^3/s)**	**Head [7] (m)**	**Flow[9] (m^3/s)**	**Total Flow [11] (m^3/s)**	**Total Storage[10] (ha*m)**
281.25	0.00	0	0.000		0.00		0.000	0.00	0.000	n/a	n/a	0.000	0.000
281.50	0.25	30	0.000		0.00		0.000	0.03	0.069	n/a	n/a	0.069	0.000
281.75	0.50	60	0.001		0.00		0.000	0.28	0.225	n/a	n/a	0.225	0.001
282.00	0.75	90	0.003		0.00		0.000	0.53	0.311	n/a	n/a	0.311	0.003
282.25	1.00	120	0.006		0.00		0.000	0.78	0.377	n/a	n/a	0.377	0.006
282.50	1.25	150	0.009		0.00		0.000	1.03	0.434	n/a	n/a	0.434	0.009
282.75	1.50	180	0.013		0.00		0.000	1.28	0.484	n/a	n/a	0.484	0.013
283.00	1.75	210	0.018		0.00		0.000	1.53	0.529	n/a	n/a	0.529	0.018
283.25	2.00	235	0.024		0.00		0.000	1.78	0.571	n/a	n/a	0.571	0.024
283.50	2.25	253	0.030		0.00		0.000	2.03	0.609	n/a	n/a	0.609	0.030
283.75	2.50	582	0.040		0.00		0.000	2.28	0.646	n/a	n/a	0.646	0.040
284.00	2.75	846	0.058		0.00		0.000	2.53	0.681	n/a	n/a	0.681	0.058
284.25	3.00	966	0.081		0.00		0.000	2.78	0.713	n/a	n/a	0.713	0.081
284.50	3.25	1074	0.106		0.00		0.000	3.03	0.745	n/a	n/a	0.745	0.106
284.75	3.50	1176	0.135		0.00		0.000	3.28	0.775	n/a	n/a	0.775	0.135
285.00	3.75	1279	0.165		0.00		0.000	3.53	0.804	n/a	n/a	0.804	0.165
285.25	4.00	1397	0.199		0.00		0.000	3.78	0.832	n/a	n/a	0.832	0.199
285.40	**4.15**	**1513**	0.221		0.00		0.000	3.93	0.848	**0.00**	**0.000**	0.848	0.221
285.50	**4.25**	**1678**	0.237		0.00		0.000	4.03	0.859	**0.10**	**0.707**	1.566	0.237
285.60	**4.35**	**1843**	0.254		0.00		0.000	4.13	0.870	**0.20**	**3.134**	4.004	0.254

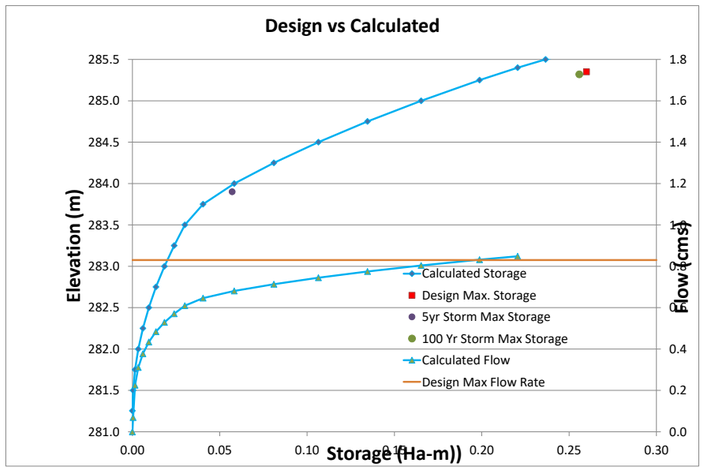
Tatham Engineering Revised Calculations Interpolate Areas Below 283.50 and Calculates Orifice Discharge Below 283.10. SWM Report Does Not Indicate Inlet Elevation of 283.10. Furthermore, Despite Incoming Pipes at 281.25 There Is No Sitting Water Evident From Aerial Photography.

Tatham Engineering Extended Values to Include Weir Flow and Additional Storage Based on 2016 LIDAR.



1:500

Stage-Storage-Discharge from Original Report					
	Elevation	**Discharge**		**Storage**	
	(m)	**(ft^3/s)**	**(m^3/s)**	**(ha*m)**	**(m^3)**
Max Storage	285.35		0	0.260	
5yr Storm Max Storage	283.90		0.83	0.057	
100 Yr Storm Max Storage	285.32		0.83	0.256	
Design Max Flow Rate			0.83	0.000	
			0.83	0.300	



Notes: - Red text indicates a value that has been calculated in this spreadsheet
- Outlet structure is a ditchinlet catch basin. Flows greater than 0.83cms will surcharge out of the control chamber and into the detention pond.
- No stage-storage calculations in the Storm Drainaage and Stormwater Management Report
- 285.35 is equal to the low point of the street for overland flow
Calculated storage is based on contours developed using 2007 LIDAR dat

KD06
Kidds Creek Watershed
(West Bayfield Secondary Plan Area)

Permenant Pool Elev=	n/a m
Top of Berm =	280.250 m
Berm/Spillway Elev. Between Cells=	n/a m

Orifice 1 Data (Hickenbottom)		**Orifice 2 Data**	
c =	0.630	c =	0.630
Diameter =	0.900 m	Diameter =	n/a m
Area[1] =	0.636 m^2	Area[1] =	n/a m^2
Invert Elev. =	278.000 m	Invert Elev. =	n/a m
Inlet Elevation =	n/a m		
Shape (yes /no)		**Shape (yes /no)**	
Spillway/Weir 1 Data		**Spillway/Weir 2 Data**	
Spillway or Weir? =	Spillway	Spillway or Weir? =	n/a
c =	1.7	c =	n/a
Side Slope[2] =	3 m	Side Slope[2] =	n/a m
Number of Sides =	1	Number of Sides =	n/a
Height of Sides =	0.1 m	Height of Sides =	n/a m
Length =	38 m	Length =	n/a m
Effective Length[3] =	n/a m	ffective Length[3] =	n/a m
Invert Elev. =	280.300 m	Invert Elev. =	n/a m

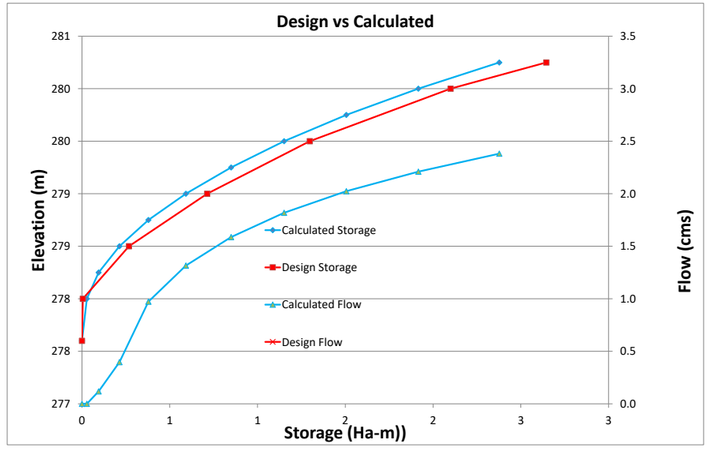
Formulas		
(1)	**Orifice Area**	(π x Orifice Diameter^2)/4
(2)	**Side Slope**	Horizontal Distance / Vertical Distance
(3)	**Effective Length**	Length of Spillway/Wier - Side Slope Ratio x Number of Sides x Height of Sides
(4)	**Stage**	Current Elev. - Invert of Permanent Pool Elev.
(5)	**Storage**	[(Current Area+Previous Area)/2 ×(Current Stage-Previous Stage)]/10000+Previous Storage
(6)	**Orifice Head**	Elev. - Invert Elev. - (Orifice Diameter/2)
(7)	**Spillway/Weir Head**	Elev. - Weir Invert Elev.
(8)	**Orifice Flow**	c x Orifice Area x $\sqrt{(2x9.81x}$ Orifice Head)
(9)	**Spillway/Weir Flow**	c x Weir Length x Weir Head$^{1.5}$
(10)	**Total Storage**	Cell 1 Storage + Cell 2 Storage
(11)	**Total Flow**	Orifice Flow + Wier Flow

*In cases where the sides are perpendicular to the bottom of the spillway/weir, the slope ratio of 0.1 is used and the number of sides is 2. In cases where the sides are not perpendicular to the bottom, the number of sides used is 1.

Stage and Storage				**Flow Calculations**						
Cell 1				**Orifice**			**Spillway/Weir**		**Summary**	
Elev (m)	**Stage[4] (m)**	**Area (m^2)**	**Storage[5] (ha*m)**	**Head[6] (m)**	**Head [7] (m)**	**Flow[8] (m^3/s)**	**Head [7] (m)**	**Flow[9] (m^3/s)**	**Total Flow [11] (m^3/s)**	**Total Storage[10] (ha*m)**
277.60	0.00	30	0.000	0.00	0.00	**0.000**	n/a	n/a	0.000	0.000
278.00	0.40	1371	0.028	0.00	0.00	**0.000**	n/a	n/a	0.000	0.028
278.25	0.65	3963	0.095	0.00	0.25	**0.119**	n/a	n/a	0.119	0.095
278.50	0.90	5541	0.214	0.05	0.00	**0.397**	n/a	n/a	0.397	0.214
278.75	1.15	7665	0.379	0.30	0.00	**0.972**	n/a	n/a	0.972	0.379
279.00	1.40	9408	0.592	0.55	0.00	**1.317**	n/a	n/a	1.317	0.592
279.25	1.65	11217	0.850	0.80	0.00	**1.588**	n/a	n/a	1.588	0.850
279.50	1.90	12937	1.152	1.05	0.00	**1.819**	n/a	n/a	1.819	1.152
279.75	2.15	15417	1.506	1.30	0.00	**2.024**	n/a	n/a	2.024	1.506
280.00	2.40	17428	1.917	1.55	0.00	**2.210**	n/a	n/a	2.210	1.917
280.25	2.65	19441	2.378	1.80	0.00	**2.382**	n/a	n/a	2.382	2.378
280.30	**2.70**	**20520**	2.477	1.85	0.00	**2.415**	**0.00**	**0.000**	2.415	2.477
280.40	**2.80**	**21475**	2.687	1.95	0.00	**2.479**	**0.10**	**1.692**	4.171	2.687
280.50	**2.90**	**22430**	2.907	2.05	0.00	**2.542**	**0.20**	**5.160**	7.702	2.907

Tatham Engineering Revised Calculation Applies NVCA Weir Calculation for Flow Below Orifice Centroid.
Tatham Engineering Extended Values to Include Weir Flow and Additional Storage Based on 2016 LIDAR.

Stage-Storage-Discharge from Original Report					
Elevation		**Discharge**		**Storage**	
(ft)	**(m)**	**(ft^3/s)**	**(m^3/s)**	**(ha*m)**	**(m^3)**
	277.60			0.000	0
	278			0.0051	51
	278.5			0.268	2680
	279			0.7135	7135
	279.5			1.2982	12982
	280			2.1	21000
	280.25			2.6455	26455





Notes: -Red text indicates a value that has been calculated in this spreadsheet
- 280.25m is equal to the low point road elevation, if water levels exceed this elevation water will spill out of the pond and become part of the major street system flow. (See page 6 of KD6-D12-174 FORD STREET.pdf)

- No design discharge values available

1:200

BK08
Bunkers Creek Watershed
(Operations Center Pond)

Permenant Pool Elev (both cells)=	234.2 m
Top of Berm =	236.400 m
Berm/Spillway Elev. Between Cells=	234.2 m

Orifice 1 Data (Hickenbottom)		**Orifice 2 Data**	
c =	0.63	c =	0.63
Diameter =	0.31 m	Diameter =	0.66 m
Area[1] =	0.07 m^2	Area[1] =	0.34 m^2
Invert Elev. =	234.20 m	Invert Elev. =	233.90 m
Inlet Elevation =	233.30 m	Inlet Elevation =	234.75 m
Shape (yes /no)	no yes	**Shape (yes /no)**	no yes
Emergency Spillway/Weir 1 Data		**Spillway/Weir 2 Data**	
Spillway or Weir? =	Spillway	Spillway or Weir? =	Spillway
c =	1.70	c =	1.70
Side Slope[2] =	0.10 m	Side Slope[2] =	0.10 m
Number of Sides =	1.00	Number of Sides =	1.00
Height of Sides =	0.50 m	Height of Sides =	0.20 m
Length =	13.00 m	Length =	300.00 m
Effective Length[3] =	12.95 m	Effective Length[3] =	299.98 m
Invert Elev. =	236.10 m	Invert Elev. =	236.40 m

Formulas

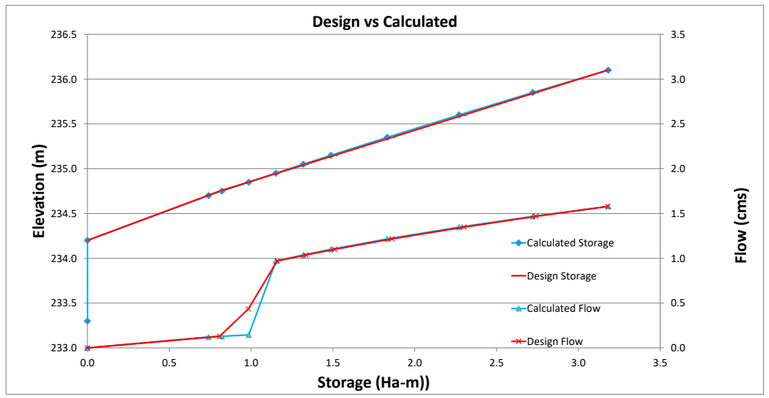
(1)	**Orifice Area**	(π x Orifice Diameter^2)/4
(2)	**Side Slope**	Horizontal Distance / Vertical Distance
(3)	**Effective Length**	Length of Spillway/Wier - Side Slope Ratio x Number of Sides x Height of Sides
(4)	**Stage**	Current Elev. - Invert of Permanent Pool Elev.
(5)	**Storage**	[(Current Area+Previous Area)/2 ×(Current Stage-Previous Stage)]/ 10000+Previous Storage
(6)	**Orifice Head**	Elev. - Invert Elev. - (Orifice Diameter/2)
(7)	**Spillway/Weir Head**	Elev. - Weir Invert Elev.
(8)	**Orifice Flow**	c x Orifice Area x √(2x9.81x Orifice Head)
(9)	**Spillway/Weir Flow**	c x Weir Length x Weir Head^1.5
(10)	**Total Storage**	Cell 1 Storage + Cell 2 Storage
(11)	**Total Flow**	Orifice Flow + Wier Flow

*In cases where the sides are perpendicular to the bottom of the spillway/weir, the slope ratio of 0.1 is used and the number of sides is 2. In cases where the sides are not perpendicular to the bottom, the number of sides used is 1.

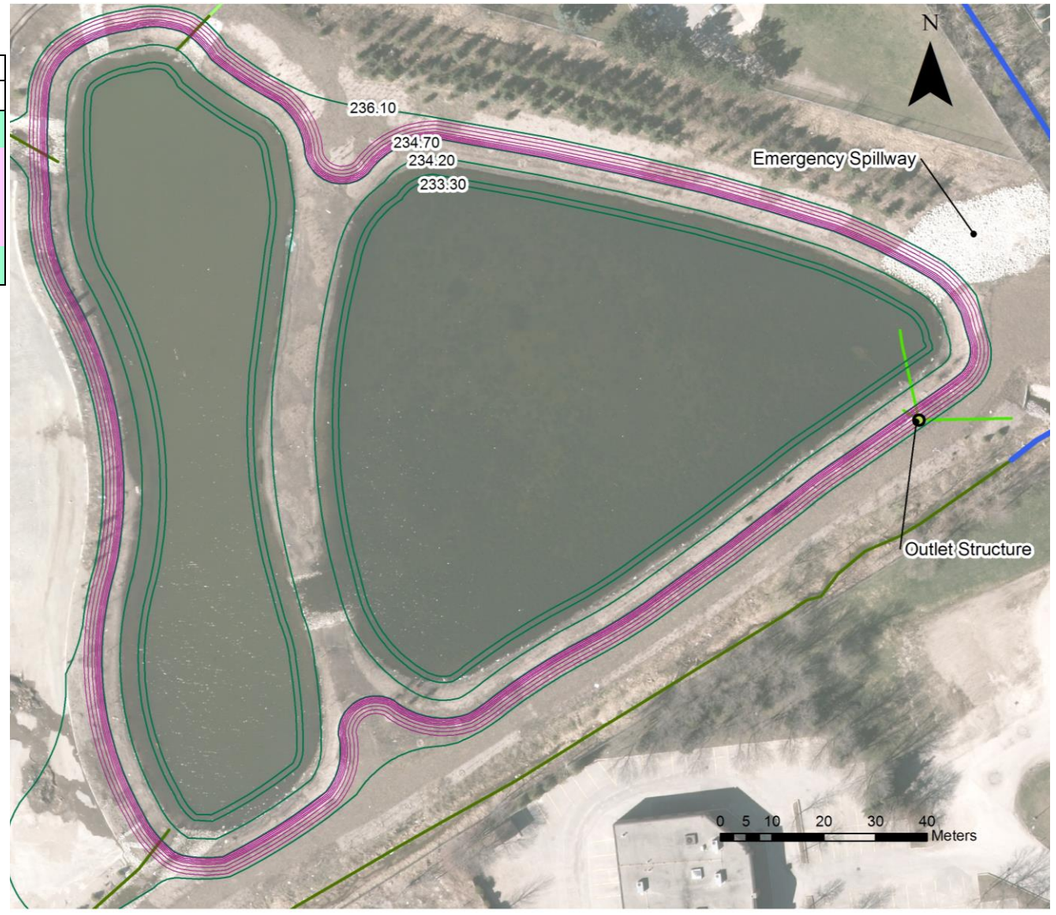
Stage and Storage								**Flow Calculations**									
Cell 1 and Cell 2				**NA**				**Orifice 1**		**Orifice 2**		**Emergency Spillway/Weir**		**Emergency Spillway/Weir**		**Summary**	
Elev (m)	**Stage[4] (m)**	**Area (m^2)**	**Storage[5] (ha*m)**	**Elev (m)**	**Stage[4] (m)**	**Area (m^2)**	**Storage[5] (ha*m)**	**Head[6] (m)**	**Flow[8] (m^3/s)**	**Head[6] (m)**	**Flow[8] (m^3/s)**	**Head [7] (m)**	**Flow[9] (m^3/s)**	**Head [7] (m)**	**Flow[9] (m^3/s)**	**Total Flow [11] (m^3/s)**	**Total Storage[10] (ha*m)**
233.30	0.00	0	0.000	233.30	0.00		0.000	0.00	n/a	0.00	n/a	n/a	n/a	n/a	n/a	n/a	0.000
234.20	0.00	13399	0.000	234.20	0.00		0.000	0.00	n/a	0.00	n/a	n/a	n/a	n/a	n/a	n/a	0.000
234.70	0.50	16230	0.741	234.70	0.50		0.000	0.35	0.122	0.47	n/a	n/a	n/a	n/a	n/a	0.122	0.741
234.75	0.55	16315	0.822	234.75	0.55		0.000	0.40	0.130	0.52	n/a	n/a	n/a	n/a	n/a	0.130	0.822
234.85	0.65	16486	0.986	234.85	0.65		0.000	0.50	0.146	0.62	n/a	n/a	n/a	n/a	n/a	0.146	0.986
234.95	0.75	16658	1.152	234.95	0.75		0.000	0.60	0.160	0.72	0.810	n/a	n/a	n/a	n/a	0.970	1.152
235.05	0.85	16830	1.319	235.05	0.85		0.000	0.70	0.172	0.82	0.865	n/a	n/a	n/a	n/a	1.037	1.319
235.15	0.95	17002	1.488	235.15	0.95		0.000	0.80	0.184	0.92	0.916	n/a	n/a	n/a	n/a	1.100	1.488
235.35	1.15	17349	1.832	235.35	1.15		0.000	1.00	0.206	1.12	1.010	n/a	n/a	n/a	n/a	1.217	1.832
235.60	1.40	17786	2.271	235.60	1.40		0.000	1.25	0.231	1.37	1.117	n/a	n/a	n/a	n/a	1.348	2.271
235.85	1.65	18227	2.721	235.85	1.65		0.000	1.50	0.253	1.62	1.215	n/a	n/a	n/a	n/a	1.468	2.721
236.10	1.90	18670	3.183	236.10	1.90		0.000	1.75	0.273	1.87	1.306	0.00	0.000	n/a	n/a	1.579	3.183
236.40	2.20	**25094**	3.839	236.40	2.20		0.000	2.05	0.296	2.17	1.406	0.30	3.617	0.00	0.000	5.319	3.839
236.50	2.30	**27320**	4.101	236.50	2.30		0.000	2.15	0.303	2.27	1.438	0.40	5.569	0.10	16.127	23.437	4.101

Tatham Engineering Extended Values to Include Weir Flow and Additional Storage Based on 2016 LIDAR.

Stage-Storage-Discharge from Original Report					
Elevation		**Discharge**		**Storage**	
(ft)	**(m)**	**(ft^3/s)**	**(m^3/s)**	**(ha*m)**	**(m^3)**
	234.20		0	0.000	0
	234.75		0.13	0.808	8079
	234.85		0.434	0.984	9836
	234.95		0.97	1.159	11593
	235.05		1.037	1.335	13350
	235.15		1.1	1.511	15107
	235.35		1.217	1.862	18621
	235.60		1.348	2.301	23014
	235.85		1.468	2.741	27407
	236.10		1.579	3.180	31800



Notes: -Red text indicates a value that has been calculated in this spreadsheet
-Contours in green are from the as-built drawings
-Contours highlighted in pink have been offset from the 234.70m contour using a 3:1 slope
-Flow from the emergency spillway has not been included in these calculations due to lack of freeboard past the 236.10m contour elevation



BARRIE DRAINAGE MASTER PLAN
WILLIAMS DRAINAGE AREA
WL01

SWM Pond Volume Table

Pond Characteristics:

Top Elevation: **269.70** m
Bottom Elev: **269.10** m

Pond Geometry				Pond Volume (m^3)			
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Accum. Dead	Live	Accum. Live
269.10	0.00	**484**	484	0	0	0	0
269.20	0.10	**874**	679	0	0	68	68
269.30	0.20	**956**	915	0	0	92	159
269.50	0.40	**1074**	1015	0	0	203	362
269.60	0.50	**1129**	1102	0	0	110	473
269.70	0.60	**1191**	1160	0	0	116	589
269.75	0.65	**2921**	1998	0	0	100	688

Total Active Storage = **688** m^3

Comments:

1 **Bold** text represents values that have been obtained from GIS or survey.

Tatham Engineering determined values to include additional storage based on 2016 LIDAR.

BARRIE DRAINAGE MASTER PLAN
WILLIAMS DRAINAGE AREA
WL01

Stage-Discharge Table

Orifice #1:		**Overflow Weir:**		
Diameter (mm):	165	Length of Weir	12	m
Area (m^2):	0.02	Weir Sill Elevation	269.60	m
C:	0.6	Weir constant K	1.55	
Invert (m):	267.6	Side Slope (H:V)	3	:1

Notes: 165 mm diameter orifice as per SWM report.

	Orifice #1		Overflow Spillway		
Elevation (m)	**Head (m)**	**Discharge (m^3/s)**	**Head (m)**	**Discharge (m^3/s)**	**Total Discharge (m^3/s)**
269.10	1.530	0.070	0.000	0.000	0.070
269.20	1.630	0.073	0.000	0.000	0.073
269.30	1.730	0.075	0.000	0.000	0.075
269.50	1.930	0.079	0.000	0.000	0.079
269.60	2.030	0.081	0.000	0.000	0.081
269.70	2.130	0.083	0.100	0.565	0.648
269.75	2.180	0.084	0.150	1.084	1.168

Comments:

1 **Bold** text represents values that have been obtained from field survey or investigation
2 Red text represents calculated values
Tatham Engineering Extended Values to Include Weir Flow Based on 2016 LIDAR.

Calculation Notes

Orifice Equation is: Q = C x A x (2gH)^0.5

Where:
Q = flow rate (cms)
C = constant
A = area of opening(sq. m)
H = net head on the orifice
g = Acceleration due to gravity

Overflow weir calculations completed in accordance with NVCA rectangular broad crested weir equation (NVCA Stormwater Technical Guide, December 2013)

BARRIE DRAINAGE MASTER PLAN
WILLIAMS DRAINAGE AREA
WL01

Stage-Storage-Discharge Table

Pond Geometry		Pond Volume		Discharge
Elevation (m)	Depth (m)	Total (m^3)	Total (ha-m)	(m^3/s)
269.10	0.00	0	0.000	0.070
269.20	0.10	68	0.007	0.073
269.30	0.20	159	0.016	0.075
269.50	0.40	362	0.036	0.079
269.60	0.50	473	0.047	0.081
269.70	0.60	589	0.059	0.648
269.75	0.65	688	0.069	1.168

Comments:

1	**Bold** text represents values that have been obtained from field survey or investigation
	Tatham Engineering Extended Values to Include Weir Flow and Additional Storage Based on 2016 LIDAR.

HW04

POND STORAGE VOLUMES

FILE: ROY-96103
PROJECT: SIMCOE SHORES

DATE: Oct-99
DESIGN BY: M. ROGOWSKI

ELEVATION	AREA m2	AVE AREA m2	DEPTH m	VOLUME m3	CUM. VOL. m3
223.00	48.20				
		82.35	0.50	41.18	41.18
223.50	116.50				
		124.95	0.10	12.49	53.67
223.60	133.40				
		142.35	0.10	14.23	67.90
223.70	151.30				
		160.60	0.10	16.06	83.97
223.80	169.90				
		179.60	0.10	17.96	101.93
223.90	189.30				
		195.30	0.10	19.53	121.46
224.00	201.30				
		218.40	0.10	21.84	143.29
224.10	235.50				
		253.10	0.10	25.31	168.60
224.20	270.70				
		289.50	0.10	28.95	197.56
224.30	308.30				
		328.05	0.10	32.80	230.36
224.40	347.80				
		368.45	0.10	36.84	267.21
224.50	389.10				
		410.65	0.10	41.06	308.27
224.60	432.20				
		454.60	0.10	45.46	353.73
224.70	477.00				
		500.25	0.10	50.03	403.76
224.80	523.50				
		547.60	0.10	54.76	458.52
224.90	571.70				
		611.85	0.10	61.18	519.70
225.00	652.00				
		685.25	0.10	68.52	588.22
225.10	718.50				
		753.30	0.10	75.33	663.55
225.20	788.10				
		824.70	0.10	82.47	746.03
225.30	861.30				
		899.70	0.10	89.97	836.00
225.40	938.10				
		998.20	0.10	99.82	935.82
225.50	1058.30				
		1099.40	0.10	109.94	1045.75
225.60	1140.50				
		1182.45	0.10	118.24	1164.00
225.70	1224.40				
		1267.15	0.10	126.72	1290.72
225.80	1309.90				
		1353.50	0.10	135.35	1426.07
225.90	1397.10				
		1468.55	0.10	146.85	1572.92
226.00	1540.00				
		1585.75	0.10	158.57	1731.49
226.10	1631.50				
		1678.05	0.10	167.80	1899.30
226.20	1724.60				
		1772.00	0.10	177.20	2076.50
226.30	1819.40				
		1867.60	0.10	186.76	2263.26
226.40	1915.8				
		1989.70	0.10	198.97	2462.23
226.50	2063.6				
		2113.90	0.10	211.39	2673.62
226.60	2164.2				
		2215.30	0.10	221.53	2895.15
226.70	2266.4				
		2318.35	0.10	231.84	3126.99
226.80	2370.3				
		2423.05	0.10	242.30	3369.29
226.90	2475.8				
		2528.20	0.10	252.82	3622.11
227.00	2580.6				
		2463	0.10	246.3	3868.41
227.10	2346	2398	0.10	239.8	4108.21
227.20	2449	2496	0.10	249.6	4357.81
227.30	2542				
227.40	2634	2588	0.10	258.8	4616.61

PERM POOL ELEV 225.75

As per 2016 LIDAR

HW04

THE JONES CONSULTING GROUP LTD.
64 Cedar Pointe Drive, Unit 1403
Barrie, Ontario L4N 5R7
Business (705) 734-2538 Ext. 223
Fax (705) 734-1056
jones@barint.on.ca

File ROYAL PARK
Subject STORMWATER MANAGEMENT
Page ____ of ____
Design by MR / RJL
Checked by ____
Date MARCH 8 2006

TOTAL POND VOLUME

As per 2016 LIDAR:
Weir inv. ≈ 227.10
D/S Length ≈ 10m
Width ≈ 4.5m
Assume 3:1 side slopes

① LEVEL 1 QUALITY CONTROL = 1280 m^3 At 227.
(REFER TO Pg 15 OF APPENDIX)

② POST DEVELOPMENT TO PRE DEVELOPMENT

2 YR PRE DEVELOPMENT OUTFLOW = 0.025 m^3

BASED ON 100mm ϕ ORIFICE

WHERE $Q = CdA(2gh)^{0.5}$

$C = 0.623$

$A = \frac{\pi \times 0.10^2}{4} = 0.008 m^2$

$Q = 0.0021 h^{0.5}$

∴ WHEN H = 0.1m Q = 0.007 m^3/s
H = 0.25m Q = 0.011 m^3/s
H = 0.50m Q = 0.016 m^3/s
H = 0.75m Q = 0.019 m^3/s
H = 1.00m Q = 0.022 m^3/s
227.00 → H = 1.25m Q = 0.025 m^3/s

Weir
227.10 → H = 1.35m, Q = 0.025 m^3/s + 0
227.20 → H = 1.45m, Q = 0.026 m^3/s + 0.209 m^3/s = 0.235 m^3/s
227.30 → H = 1.55m, Q = 0.027 m^3/s + 0.620 m^3/s = 0.647 m^3/s
227.40 → H = 1.65m, Q = 0.028 m^3/s + 1.225 m^3/s = 1.253 m^3/s

BASED ON Q = 0.022 AND H = 1.00

STORAGE = 900 m^3

DRAW DOWN = $\frac{\text{STORAGE}}{\text{AVE FLOW}}$ $\frac{900 m^3}{0.0221 m^3/s}$ = 40,724

$\frac{40,724}{3600}$ = 11.3 HOURS

As per 2016 LIDAR:
Weir inv. ≈ 229.90
D/S Length ≈ 1.5m
Width ≈ 7m
Assume 3:1 side slopes

STAGE STORAGE DISCHARGE TABLE

FILE: ROY 99151 DATE: Aug-01 Revised: 01-Aug-02
PROJECT: SIMCOE SHORES PHASE 2 DESIGN BY: S. LARGE 500mm @229.4

WEIR FLOW

ELEVATION	AREA m2	AVE AREA m2	DEPTH m	VOLUME m3	CUM. VOL. m3	CUM VOL ABOVE PERM POOL	HEAD ABOVE ORIFICE	170mm dia ORIFICE FLOW	HEAD ABOVE PIPE INVERT	500mm dia PIPE FLOW	CUM. OUTFLOW (CMS)	
226.70	235.16							0				SEDIMENT FOREBAY VOL.
		315.78	0.50	157.89	157.89	0.00						
227.20	396.39							0				
		478.14	0.50	239.07	396.96	0.00						
227.70	559.89							0				
227.70	3210.72							0				PERMANENT POOL
		3536.96	0.67	2369.76	2766.72	0.00						
228.37	3863.19							0				
		4373.75	0.43	1880.71	4647.43	0.00						
228.80	4884.30						0.00	0				
		5007.51	0.10	500.75	5148.18	500.75						EXTENDED DETENTION
228.90	5130.71						0.015	0.008			0.008	
		5255.45	0.10	525.54	5673.72	1026.30						
229.00	5380.19						0.115	0.023			0.023	
		5506.47	0.10	550.65	6224.37	1576.94						
229.10	5632.75						0.215	0.031			0.031	
		5760.57	0.10	576.06	6800.43	2153.00						
229.20	5888.39						0.315	0.037			0.037	
		5925.20	0.03	177.76	6978.18	2330.76						
229.23	5962.00						0.345	0.039			0.039	
		6023.49	0.07	421.64	7399.83	2752.40						
229.30	6084.98						0.415	0.043	0	0.000	0.043	
		6265.34	0.10	626.53	8026.36	3378.93						ACTIVE STORAGE
229.40	6445.69						0.515	0.048	0.00	0.000	0.048	
		6519.35	0.10	651.93	8678.30	4030.87						
229.50	6593.00						0.615	0.052	0.10	0.022	0.074	
		6667.88	0.10	666.79	9345.08	4697.66						
229.60	6742.76						0.715	0.056	0.20	0.101	0.157	
		6787.78	0.06	407.27	9752.35	5104.92						
229.66	6832.79						0.775	0.058	0.26	0.1580	0.216	
		6862.80	0.04	274.51	10026.86	5379.43						
229.70	6892.81						0.815	0.060	0.30	0.20600	0.266	
		6938.12	0.06	416.29	10443.15	5795.72						
229.76	6983.43						0.875	0.062	0.36	0.27000	0.332	
		7013.64	0.04	280.55	10723.69	6076.27						
229.80	7043.85						0.915	0.064	0.40	0.326	0.390	
		7119.88	0.10	711.99	11435.68	6788.25						
229.90	7195.91						1.015	0.067	0.50	0.375	0.442	
		7272.44	0.10	727.24	12162.93	7515.50						
230.00	7348.97						1.115	0.070	0.65	0.443	~~0.513~~	

0.352

230.10	7091	7220	0.10	722.0	12884.93	8237.5	1.215	0.073	0.75	0.475	1.060	0.865
		7241										1.608
230.20	7391	7616	0.10	761.6	13609.03	8961.6	1.315	0.075	0.85	0.505	2.037	2.617
230.30	7841		0.10		14370.63	9723.2	1.415	0.078	0.95	0.534	3.266	3.878

HW06
2 of 3

BARRIE DRAINAGE MASTER PLAN
GEORGIAN CREEK WATERSHED
GR03

Stage-Storage Table

Pond Characteristics:

Top Elevation: 260.75 m
Bottom Elev: 257.50 m
Stage 0.25 m

Pond Geometry				Pond Volume (m^3)			
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Accum. Dead	Live	Accum. Live
257.50	0.00	**16**	16	0	0	0	0
257.75	0.25	**240**	128	0	0	32	32
258.00	0.50	**912**	576	0	0	144	176
258.25	0.75	**1751**	1332	0	0	333	509
258.50	1.00	**2502**	2126	0	0	532	1041
258.75	1.25	**3234**	2868	0	0	717	1758
259.00	1.50	**4156**	3695	0	0	924	2681
259.25	1.75	**5759**	4957	0	0	1239	3921
259.50	2.00	**8004**	6882	0	0	1720	5641
259.75	2.25	**10418**	9211	0	0	2303	7944
260.00	2.50	**12465**	11442	0	0	2860	10804
260.20	2.70	**13954**	13210	0	0	2642	13446
260.25	2.75	**14190**	14072	0	0	704	14150
260.50	3.00	**15128**	14659	0	0	3665	17815

Total Active Storage = **17815** m^3

Comments:

1 **Bold** text represents values that have been obtained from GIS or survey

Tatham Engineering Extended Values to Include Additional Storage Based on 2016 LIDAR.

BARRIE DRAINAGE MASTER PLAN
GEORGIAN CREEK WATERSHED
GR03

Stage-Discharge Table

Orifice #1:		**Orifice #2**			**Overflow Weir:**		
Width (mm):	**450**	Width (mm):	**450**	mm	Length of Weir	65	m
Height (mm):	**600**	Height (mm):	**600**	mm	Weir Sill Elevation	260.20	m
Area (m^2):	0.2700	Area (m^2):	0.2700	m^2	Weir constant K	1.6	
C:	0.63	C:	0.63		Side Slope (H:V)	3	:1
Invert (m):	**257.3**	Invert (m):	**259.8**	m			
Notes: Concrete rectangular orifice 0.45m wide x 0.6m high.		Notes: Concrete rectangular orifice 0.45m wide x 0.6m high.					

	Orifice #1		Orifice #2		Overflow Spillway		
Elevation (m)	**Head (m)**	**Discharge (m^3/s)**	**Head (m)**	**Discharge (m^3/s)**	**Head (m)**	**Discharge (m^3/s)**	**Total Discharge (m^3/s)**
257.50	0.000	0.000	0.000	0.000	0.000	0.000	0.000
257.75	0.110	0.031	0.000	0.000	0.000	0.000	0.031
258.00	0.360	0.452	0.000	0.000	0.000	0.000	0.452
258.25	0.610	0.588	0.000	0.000	0.000	0.000	0.588
258.50	0.860	0.699	0.000	0.000	0.000	0.000	0.699
258.75	1.110	0.794	0.000	0.000	0.000	0.000	0.794
259.00	1.360	0.879	0.000	0.000	0.000	0.000	0.879
259.25	1.610	0.956	0.000	0.000	0.000	0.000	0.956
259.50	1.860	1.028	0.000	0.000	0.000	0.000	1.028
259.75	2.110	1.094	0.000	0.000	0.000	0.000	1.094
260.00	2.360	1.157	0.000	0.000	0.000	0.000	1.157
260.20	2.560	1.206	0.060	0.012	**0.000**	**0.000**	1.218
260.25	2.610	1.217	0.110	0.031	**0.050**	**1.019**	2.267
260.50	2.860	1.274	0.360	0.452	**0.300**	**16.148**	17.874

Comments:

1	**Bold** text represents values that have been obtained from field survey or investigation
2	Red text represents calculated values
	Orifice discharge calculated as weir flow.
	Tatham Engineering Extended Values to Include Weir Flow Based on 2016 LIDAR.

Calculation Notes

Orifice Equation is: Q = C x A x (2gH)^0.5

Where:
Q = flow rate (cms)
C = constant
A = area of opening(sq. m)
H = net head on the orifice
g = Acceleration due to gravity

Overflow weir calculations completed in accordance with NVCA rectangular broad crested weir equation (NVCA Stormwater Technical Guide, December 2013)

Additional Notes:

Rectangular Weir Flow Calculation Applied For Rectangular Orifices Below Top of Wall

Rectangular Weir Equation is: Q = 2/3 x C x (2g)^0.5 x L x H^1.5

Where:
Q = flow rate (cms)
C = constant (0.63)
L = bottom width (m)
H =head above orifice invert
g = Acceleration due to gravity

BARRIE DRAINAGE MASTER PLAN
GEORGIAN CREEK WATERSHED
GR03

Stage-Storage-Discharge Table

Pond Geometry				Pond Volume (m^3)			Pond Volume (ha-m)	Discharge
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Live	Total	Total	(m^3/s)
257.50	0.00	16	16	0	0	0	0	0.00
257.75	0.25	240	128	0	32	32	0	0.03
258.00	0.50	912	576	0	176	176	0	0.45
258.25	0.75	1751	1332	0	509	509	0	0.59
258.50	1.00	2502	2126	0	1041	1041	0	0.70
258.75	1.25	3234	2868	0	1758	1758	0	0.79
259.00	1.50	4156	3695	0	2681	2681	0	0.88
259.25	1.75	5759	4957	0	3921	3921	0	0.96
259.50	2.00	8004	6882	0	5641	5641	1	1.03
259.75	2.25	10418	9211	0	7944	7944	1	1.09
260.00	2.50	12465	11442	0	10804	10804	1	1.16
260.20	2.70	13954	13210	0	13446	13446	1	1.22
260.25	2.75	14190	14072	0	14150	14150	1	2.27
260.50	3.00	15128	14659	0	17815	17815	2	17.87

Comments:

1 **Bold** text represents values that have been obtained from field survey or investigation
2 Red text represents calculated values
Tatham Engineering Extended Values to Include Weir Flow and Additional Storage Based on 2016 LIDAR.

BARRIE DRAINAGE MASTER PLAN
GEORGIAN CREEK WATERSHED
GR01

Stage-Storage Table

Pond Characteristics:

Top Elevation: **257.00** m
Bottom Elev: **255.25** m

Pond Geometry				Pond Volume (m^3)			
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Accum. Dead	Live	Accum. Live
254.80	0.00	**0**	0	0	0	0	0
255.25	0.45	**206**	206	0	0	93	93
255.50	0.70	1973	1090	0	0	272	365
255.75	0.95	3740	2857	0	0	714	1080
256.00	1.20	**4422**	4081	0	0	1020	2100
256.25	1.45	**5801**	5112	0	0	1278	3378
256.50	1.70	**8183**	6992	0	0	1748	5126
256.75	1.95	**10808**	9496	0	0	2374	7500
257.00	2.20	**13047**	11928	0	0	2982	10482
257.25	2.45	**13225**	13136	0	0	3284	13766
257.50	2.70	16953	15089	0	0	3772	17538
257.75	2.95	20682	18818	1	1	4704	22242
258.00	3.20	**24410**	22546	2	3	5636	27879

Total Active Storage = **27879** m^3

Comments:

1 **Bold** text represents values that have been obtained from GIS or survey

BARRIE DRAINAGE MASTER PLAN
GEORGIAN CREEK WATERSHED
GR01

Stage-Discharge Table

Orifice #1:

Diameter:	**750**	mm
Area:	0.4418	m2
C:	0.63	
Invert:	**254.8**	m

Notes: 750mm diameter pipe in concrete headwall

Overflow Weir:

Length of Weir	**8.1**	m
Weir Sill Elevation	**256.91**	m
Weir constant K	1.6	
Side Slope (H:V)	**0.01**	:1

Notes: Headwall assumed to act as rectangular weir (8.1m wide x 10m long x 0.5m high)

	Orifice #1		Overflow Weir			
Elevation (m)	**Head (m)**	**Discharge (m^3/s)**	**Head (m)**	**Discharge (m^3/s)**	**Hydraulic Control**	**Total Discharge (m^3/s)**
254.800	0.000	0.000	0	0.000	Orifice	0.000
255.250	0.085	0.359	0	0.000	Orifice	0.359
255.500	0.335	0.714	0	0.000	Orifice	0.714
255.750	0.585	0.943	0	0.000	Orifice	0.943
256.000	0.835	1.127	0	0.000	Orifice	1.127
256.250	1.085	1.284	0	0.000	Orifice	1.284
256.500	1.335	1.424	0	0.000	Orifice	1.424
256.750	1.585	1.552	0	0.000	Orifice	1.552
257.000	1.835	1.670	0.09	0.036	Orifice / Weir	1.706
257.250	2.085	1.780	0.34	1.036	Orifice / Weir	2.816
257.500	2.335	1.884	0.59	2.036	Orifice / Weir	3.920
257.750	2.585	1.982	0.84	3.036	Orifice / Weir	5.018
258.000	2.835	2.076	1.09	4.036	Orifice / Weir	6.112

Comments:

1 **Bold** text represents values that have been obtained from field survey or investigation
2 Red text represents calculated values

Calculation Notes

Orifice Equation is: Q = C x A x (2gH)^0.5

Where:
Q = flow rate (cms)
C = constant
A = area of opening(sq. m)
H = net head on the orifice
g = Acceleration due to gravity

Overflow weir calculations completed in accordance with NVCA rectangular broad crested weir equation (NVCA Stormwater Technical Guide, December 2013)

BARRIE DRAINAGE MASTER PLAN
GEORGIAN CREEK WATERSHED
GR01

Stage-Storage-Discharge Table

Pond Geometry				Pond Volume (m^3)			Discharge (m^3/s)
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Live	Total	
254.80	0.00	0	0	0	0	0	0.00
255.25	0.45	206	206	0	93	93	0.36
255.50	0.70	1973	1090	0	365	365	0.71
255.75	0.95	3740	2857	0	1080	1080	0.94
256.00	1.20	4422	4081	0	2100	2100	1.13
256.25	1.45	5801	5112	0	3378	3378	1.28
256.50	1.70	8183	6992	0	5126	5126	1.42
256.75	1.95	10808	9496	0	7500	7500	1.55
257.00	2.20	13047	11928	0	10482	10482	1.71
257.25	2.45	13225	13136	0	13766	13766	2.82
257.50	2.70	16953	15089	0	17538	17538	3.92
257.75	2.95	20682	18818	1	22242	22243	5.02
258.00	3.20	24410	22546	3	27879	27882	6.11

BARRIE DRAINAGE MASTER PLAN
LITTLE LAKE WATERSHED
LT02

Stage-Volume Table

Pond Characteristics:

Top Elevation:	**269.50**	m
Bottom Elev:	**264.50**	m
Stage	0.25	m

Overflow Weir:

Bottom Width of Weir	25	m
D/S Length of Weir	1	m
Weir Sill Elevation	269.40	m
Weir constant K	1.6	
Side Slope (H:V)	3	:1

Pond Geometry				Pond Volume (m^3)			
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Accum. Dead	Live	Accum. Live
264.50	0.00	**0**	0	0.00	0.00	0.00	0.00
264.75	0.25	88	44	0.00	0.00	11.04	11.04
265.00	0.50	177	132	0.00	0.00	33.12	44.16
265.25	0.75	265	221	0.00	0.00	55.20	99.36
265.50	1.00	353	309	0.00	0.00	77.28	176.64
265.75	1.25	442	397	0.00	0.00	99.36	276.00
266.00	1.50	**530**	486	0.00	0.00	121.44	397.44
266.25	1.75	1154	842	0.00	0.00	210.51	607.95
266.50	2.00	1778	1466	0.00	0.00	366.58	974.54
266.75	2.25	2403	2091	0.00	0.00	522.65	1497.19
267.00	2.50	3027	2715	0.00	0.00	678.72	2175.90
267.25	2.75	3651	3339	0.00	0.00	834.78	3010.69
267.50	3.00	4276	3963	0.00	0.00	990.85	4001.54
267.75	3.25	4900	4588	0.00	0.00	1146.92	5148.46
268.00	3.50	5524	5212	0.00	0.00	1302.99	6451.45
268.25	3.75	6148	5836	0.00	0.00	1459.06	7910.50
268.50	4.00	6773	6460	0.00	0.00	1615.12	9525.62
268.75	4.25	7397	7085	0.00	0.00	1771.19	11296.82
269.00	4.50	8021	7709	0.00	0.00	1927.26	13224.07
269.25	4.75	8645	8333	0.00	0.00	2083.33	15307.40
269.40	4.90	**9020**	8833	0.00	0.00	1324.91	16632.31
269.45	4.95	**9399**	9210	0.00	0.00	460.48	17092.78
269.50	5.00	**9777**	9399	0.00	0.00	939.85	17572.16

Comments:

1 **Bold** text represents values obtained from GIS

Tatham Engineering Extended Values to Include Additional Storage Based on 2016 LIDAR.

BARRIE DRAINAGE MASTER PLAN
LITTLE LAKE WATERSHED
LT05

SWM Pond Volume Table

Pond Characteristics:

Top Elevation: 242.50 m
Bottom Elev: 241.00 m

Pond Geometry				Pond Volume (m^3)			
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Accum. Dead	Live	Accum. Live
241.00	0.00	**600**	600	0	0	0	0
241.05	0.05	615	607	0	0	30	30
241.10	0.10	629	622	0	0	31	61
241.15	0.15	644	636	0	0	32	93
241.20	0.20	658	651	0	0	33	126
241.25	0.25	673	665	0	0	33	159
241.30	0.30	687	680	0	0	34	193
241.35	0.35	702	695	0	0	35	228
241.40	0.40	716	709	0	0	35	263
241.45	0.45	731	724	0	0	36	299
241.50	0.50	745	738	0	0	37	336
241.55	0.55	760	753	0	0	38	374
241.60	0.60	774	767	0	0	38	412
241.65	0.65	789	782	0	0	39	451
241.70	0.70	803	796	0	0	40	491
241.75	0.75	**818**	811	0	0	41	532
241.80	0.80	824	821	0	0	41	573
242.00	1.00	**851**	838	0	0	168	740
242.20	1.20	**914**	882	0	0	176	917
242.40	1.40	**974**	944	0	0	189	1106
242.50	1.50	**1010**	992	0	0	99	1205

Total Active Storage = **1205** m^3

Comments:

1 **Bold** text represents values that have been obtained from GIS or survey

Tatham Engineering Extended Values to Include Additional Storage Based on 2016 LIDAR.

BARRIE DRAINAGE MASTER PLAN
LITTLE LAKE WATERSHED
LT05

Stage-Discharge Table

Orifice #1:

Diameter:	200	mm
Area:	0.0314	m^2
C:	0.63	
Invert:	240.55	m

Notes: Drawing D-1 provides orifice invert and diameter. Note outlet structure is perforated pipe with 3-25mm holes every 200mm - perforations not taken into account

Overflow Weir:

Bottom Width of Weir	2.5	m
Weir D/S Length	6	m
Weir Sill Elevation	242.00	m
Weir constant K	1.6	
Side Slope (H:V)	3	:1

	Orifice #1		Overflow Weir			
Elevation (m)	Head (m)	Discharge (m^3/s)	Head (m)	Discharge (m^3/s)	Hydraulic Control	Total Discharge (m^3/s)
241.00	0.350	0.052	0	0.000	Orifice	0.052
241.05	0.400	0.055	0	0.000	Orifice	0.055
241.10	0.450	0.059	0	0.000	Orifice	0.059
241.15	0.500	0.062	0	0.000	Orifice	0.062
241.20	0.550	0.065	0	0.000	Orifice	0.065
241.25	0.600	0.068	0	0.000	Orifice	0.068
241.30	0.650	0.071	0	0.000	Orifice	0.071
241.35	0.700	0.073	0	0.000	Orifice	0.073
241.40	0.750	0.076	0	0.000	Orifice	0.076
241.45	0.800	0.078	0	0.000	Orifice	0.078
241.50	0.850	0.081	0	0.000	Orifice	0.081
241.55	0.900	0.083	0	0.000	Orifice	0.083
241.60	0.950	0.085	0	0.000	Orifice	0.085
241.65	1.000	0.088	0	0.000	Orifice	0.088
241.70	1.050	0.090	0	0.000	Orifice	0.090
241.75	1.100	0.092	0	0.000	Orifice	0.092
241.80	1.150	0.094	0	0.000	Orifice	0.094
242.00	1.350	0.102	0	0.000	Orifice	0.102
242.20	1.550	0.109	0.2	0.384	Orifice / Weir	0.493
242.40	1.750	0.116	0.4	1.313	Orifice / Weir	1.429
242.50	1.850	0.119	0.5	1.983	Orifice / Weir	2.102

Comments:

1	Plain text represents values that have been obtained from "B.D.C./Brown Farm, Stollar Plan of Subdivision, Osprey Ridge Draft Plan" (RG Robinson and Associates (Barrie) Ltd, 1997), on Drawing D-1 for Osprey Ridge Subdivision
2	Red text represents calculated values
	Tatham Engineering Extended Values to Include Weir Flow Based on 2016 LIDAR.

Calculation Notes

Orifice Equation is: Q = C x A x (2gH)^0.5

Where:
Q = flow rate (cms)
C = constant
A = area of opening(sq. m)
H = net head on the orifice
g = Acceleration due to gravity

Overflow weir calculations completed in accordance with NVCA rectangular broad crested weir equation (NVCA Stormwater Technical Guide, December 2013)

BARRIE DRAINAGE MASTER PLAN
LITTLE LAKE WATERSHED
LT05

Stage-Storage-Discharge Table

Pond Geometry				Pond Volume (m^3)			Pond Volume (ha-m)	Discharge
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Live	Total	Total	(m^3/s)
241.00	0.00	600	600	0	0	0	0	0.05
241.05	0.05	615	607	0	30	30	0	0.06
241.10	0.10	629	622	0	31	61	0	0.06
241.15	0.15	644	636	0	32	93	0	0.06
241.20	0.20	658	651	0	33	126	0	0.07
241.25	0.25	673	665	0	33	159	0	0.07
241.30	0.30	687	680	0	34	193	0	0.07
241.35	0.35	702	695	0	35	228	0	0.07
241.40	0.40	716	709	0	35	263	0	0.08
241.45	0.45	731	724	0	36	299	0	0.08
241.50	0.50	745	738	0	37	336	0	0.08
241.55	0.55	760	753	0	38	374	0	0.08
241.60	0.60	774	767	0	38	412	0	0.09
241.65	0.65	789	782	0	39	451	0	0.09
241.70	0.70	803	796	0	40	491	0	0.09
241.75	0.75	818	811	0	41	532	0	0.09
241.80	0.80	824	821	0	41	573	0	0.09
242.00	1.00	851	838	0	168	740	0	0.10
242.20	1.20	914	882	0	176	917	0	0.49
242.40	1.40	974	944	0	189	1106	0	1.43
242.50	1.50	1010	992	0	99	1205	0	2.10

Comments:

Tatham Engineering Extended Values to Include Weir Flow and Additional Storage Based on 2016 LIDAR.

BARRIE MASTER DRAINAGE PLAN
LITTLE LAKE WATERSHED
LT XX-1 (Adam's Funeral Home - 445 St Vincent St)

SWM Pond Volume Table

Pond Characteristics:

Top Elevation:	**268.60**	m
Weir Crest Elev.:	**268.50**	m
Bottom Elev:	**267.10**	m
Stage	0.25	m

Overflow Weir:

Bottom Width of Weir	4.5	m
D/S Length of Weir	2	m
Weir Sill Elevation	268.50	m
Weir constant K	1.6	
Side Slope (H:V)	3	:1

Pond Geometry				Pond Volume (m^3)				Pond Volume (ha-m)	Discharge
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Accum. Dead	Live	Accum. Live	Total	(m^3/s)
267.25	**0.00**	**4**	4	0	0	0	0	0.000	0.000
267.50	0.25	70	37	0	0	9	9	0.001	0.005
267.75	0.50	**136**	103	0	0	26	35	0.004	0.006
268.00	0.75	259	197	0	0	49	84	0.008	0.006
268.25	1.00	**381**	320	0	0	80	164	0.016	0.027
268.50	1.25	**426**	403	0	0	101	265	0.027	0.039
268.60	1.35	**461**	444	0	0	44	309	0.031	0.226

Comments:

1 **Bold** text denotes values that have been obtained from GIS
2 "Stormwater Management Report for Adam's Funeral Home" (Skelton, Brumwell & Associates, 2006) in Stormwater Pond Database
Tatham Engineering Extended Values to Include Weir Flow and Additional Storage Based on 2016 LIDAR.

Calculation Notes

Overflow weir calculations completed in accordance with NVCA rectangular broad crested weir equation (NVCA Stormwater Technical Guide, December 2013)

BARRIE DRAINAGE MASTER PLAN
LITTLE LAKE WATERSHED
LTGM

Stage-Storage Table

Wet Pond Characteristics:

Top Elevation: 276.50 m
Bottom Elev: 273.90 m

Pond Geometry							Pond Volume (m^3)			
Elevation (m)	Depth (m)	Lower Cell Area (m^2)	Lower Avg. Area (m)	Upper Cell Area (m^2)	Upper Avg. Area (m)	Total Avg. Area (m)	Dead	Accum. Dead	Live	Accum. Live
273.9	**0.00**	**699**	699	**798**	798	1497	0	0	0	0
274.00	0.10	760	730	852	825	1555	155	155	0	0
274.10	0.20	821	790	905	879	1669	167	322	0	0
274.20	0.30	881	851	959	932	1783	178	501	0	0
274.30	0.40	942	912	1013	986	1898	190	691	0	0
274.40	0.50	1003	973	1067	1040	2012	201	892	0	0
274.50	0.60	1064	1033	1120	1093	2127	213	1104	0	0
274.60	0.70	1124	1094	1174	1147	2241	224	1329	0	0
274.70	0.80	1185	1155	1228	1201	2355	236	1564	0	0
274.80	0.90	1246	1215	1281	1254	2470	247	1811	0	0
274.90	1.00	1306	1276	1335	1308	2584	258	2069	0	0
275.00	1.10	**1367**	1337	**1389**	1362	2699	270	2339	0	0
275.01	1.11			**2789**	2089	2744	27	2367	0	0
275.10	1.20			2901	2845	2823	254	2621	0	0
275.20	1.30			3026	2964	2924	292	2913	0	0
275.30	1.40			**3151**	3089	3038	304	3217	0	0
275.40	1.50			3273	3212	3155	0	3217	316	316
275.50	1.60			3394	3333	3275	0	3217	327	643
275.60	1.70			3515	3455	3395	0	3217	339	982
275.70	1.80			3636	3576	3516	0	3217	352	1334
275.80	1.90			3758	3697	3637	0	3217	364	1698
275.90	2.00			3879	3818	3758	0	3217	376	2073
276.00	2.10			4000	3940	3879	0	3217	388	2461
276.10	2.20			4122	4061	4000	0	3217	400	2861
276.20	2.30			4243	4182	4122	0	3217	412	3274
276.30	2.40			4364	4304	4243	0	3217	424	3698
276.40	2.50			4486	4425	4364	0	3217	436	4134
276.50	2.60			**4607**	4546	4486	0	3217	449	4583

Permanent Pool Volume = **3217** m^3
Total Active Storage = **4583** m^3

Comments:

1 **Bold** text represents values that have been obtained from Civil 3D import of Drawings 1033-PD1 and
2 Red text represents interpolated values

BARRIE DRAINAGE MASTER PLAN
LITTLE LAKE WATERSHED
LTGM

Stage-Discharge Table

Orifice #1:

Diameter:	145
Area:	0.0165
C:	0.63
Invert:	275.30

Notes: Drawings PD1 and PD2 provide orifice invert and diameter. Note outlet structure is hickenbottom with 45-20mm to 25mm holes- perforations not taken into account

Overflow Weir:

Length of Weir	5	m
Weir Sill Elevation	275.69	m
Weir constant K	1.6	
Side Slope (H:V)	0	:1

Notes: Drawings PD1 and PD2 provide rectangular overflow weir sill elevation and length.

	Orifice #1		Overflow Weir			
Elevation (m)	Head (m)	Discharge (m^3/s)	Head (m)	Discharge (m^3/s)	Hydraulic Control	Total Discharge (m^3/s)
273.90	0.000	0.000	0	0.000	Orifice	0.000
274.00	0.000	0.000	0	0.000	Orifice	0.000
274.10	0.000	0.000	0	0.000	Orifice	0.000
274.20	0.000	0.000	0	0.000	Orifice	0.000
274.30	0.000	0.000	0	0.000	Orifice	0.000
274.40	0.000	0.000	0	0.000	Orifice	0.000
274.50	0.000	0.000	0	0.000	Orifice	0.000
274.60	0.000	0.000	0	0.000	Orifice	0.000
274.70	0.000	0.000	0	0.000	Orifice	0.000
274.80	0.000	0.000	0	0.000	Orifice	0.000
274.90	0.000	0.000	0	0.000	Orifice	0.000
275.00	0.000	0.000	0	0.000	Orifice	0.000
275.01	0.000	0.000	0	0.000	Orifice	0.000
275.10	0.000	0.000	0	0.000	Orifice	0.000
275.20	0.000	0.000	0	0.000	Orifice	0.000
275.30	0.000	0.000	0	0.000	Orifice	0.000
275.40	0.028	0.008	0	0.000	Orifice	0.008
275.50	0.128	0.016	0	0.000	Orifice	0.016
275.60	0.228	0.022	0	0.000	Orifice	0.022
275.70	0.328	0.026	0.01	0.007	Orifice	0.033
275.80	0.428	0.030	0.11	0.255	Orifice	0.285
275.90	0.528	0.033	0.21	0.708	Orifice	0.741
276.00	0.628	0.037	0.31	1.310	Orifice	1.347
276.10	0.728	0.039	0.41	2.027	Orifice	2.066
276.20	0.828	0.042	0.51	2.843	Orifice	2.885
276.30	0.928	0.044	0.61	3.749	Orifice	3.793
276.40	1.028	0.047	0.71	4.737	Orifice	4.784
276.50	1.128	0.049	0.81	5.801	Orifice	5.850

Comments:

1 Red text represents calculated values

Calculation Notes

Orifice Equation is: Q = C x A x (2gH)^0.5

Where:
Q = flow rate (cms)
C = constant
A = area of opening(sq. m)
H = net head on the orifice
g = Acceleration due to gravity

Overflow weir calculations completed in accordance with NVCA rectangular broad crested weir equation (NVCA Stormwater Technical Guide, December 2013)

BARRIE DRAINAGE MASTER PLAN
LITTLE LAKE WATERSHED
LTGM

Stage-Storage-Discharge Table

Pond Geometry				Pond Volume (m^3)			Discharge (m^3/s)
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Live	Total	
273.90	0.00	N/A	1497	0	0	0	0.00
274.00	0.10	N/A	1555	155	0	155	0.00
274.10	0.20	N/A	1669	322	0	322	0.00
274.20	0.30	N/A	1783	501	0	501	0.00
274.30	0.40	N/A	1898	691	0	691	0.00
274.40	0.50	N/A	2012	892	0	892	0.00
275.90	2.00	N/A	3758	3217	2073	5291	0.74
276.00	2.10	N/A	3879	3217	2461	5678	1.35
276.10	2.20	N/A	4000	3217	2861	6078	2.07
276.20	2.30	N/A	4122	3217	3274	6491	2.88
276.30	2.40	N/A	4243	3217	3698	6915	3.79
276.40	2.50	N/A	4364	3217	4134	7351	4.78
276.50	2.60	N/A	4486	3217	4583	7800	5.85

BARRIE CITYWIDE MINOR & MAJOR STORMWATER MODEL DEVELOPMENT
BEAR CREEK WATERSHED
BR06

Pond Volume Table

Wet Pond Characteristics:

Top Elevation:	**282.27**	m
Bottom Elev:	**280.00**	m

Overflow Weir:

Bottom Width of Weir	4	m
D/S Length of Weir	4	m
Weir Sill Elevation	281.90	m
Weir constant K	1.6	
Side Slope (H:V)	3	:1

Stormwater Management Pond									
Pond Geometry				Pond Volume (m^3)				Pond Volume (ha-m)	Discharge
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Accum. Dead	Live	Accum. Live	Accum. Live	(m^3/s)
280.00	0.00	**1260.3**	1260.3	0.0	0.0	0.0	0.0	0.0	0.000
280.60	0.60	2359.5	1809.9	0.0	0.0	1085.9	1085.9	0.1	0.050
281.10	1.10	3275.5	2817.5	0.0	0.0	1408.7	2494.6	0.2	0.100
281.40	1.40	3825.1	3550.3	0.0	0.0	1065.1	3559.7	0.4	0.270
281.90	1.90	**4742.1**	4283.6	0.0	0.0	2141.8	5701.5	0.6	0.523
282.25	2.25	**5382.3**	5062.2	0.0	0.0	1771.8	7473.3	0.7	2.244
282.27	2.27	5418.9	5400.6	0.0	0.0	108.0	7581.3	0.8	2.408
282.30	2.30	**5514.6**	5466.7	0.0	0.0	164.0	7745.3	0.8	2.668

Extrapolated orifice flows + weir flow (from 2016 LIDAR)

Comments:

1 **Bold** text denotes values that have been obtained from GIS or survey
2 Red text represents calculated values
3 "Stormwater Management Report Ardaugh Secondary Plan Area" (C.C. Tatham & Associates Ltd., 1999) in Stormwater Pond Database
Tatham Engineering Extended Values to Include Weir Flow and Additional Storage Based on 2016 LIDAR.

Calculation Notes:

Overflow weir calculations completed in accordance with NVCA rectangular broad crested weir equation (NVCA Stormwater Technical Guide, December 2013)

BARRIE DRAINAGE MASTER PLAN
BEAR CREEK WATERSHED
BR08B

Stage-Storage-Discharge Table

Wet Pond Characteristics:

Top Elevation:	**290.50**	m
Bottom Elev:	**285.25**	m
Stage	0.25	m

Overflow Weir:

Bottom Width of Weir	6	m
D/S Length of Weir	4	m
Weir Sill Elevation	290.20	m
Weir constant K	1.6	
Side Slope (H:V)	3	:1

Pond Geometry				Pond Volume (m^3)				Pond Volume (ha-m)	Discharge
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Accum. Dead	Live	Accum. Live	Accum. Live	(m^3/s)
285.25	0.00	**29**	29	0	0	0	0	0.000	0.000
285.50	0.25	**234**	132	0	0	33	33	0.003	0.216
285.75	0.50	**542**	388	0	0	97	130	0.013	0.259
286.00	0.75	**931**	737	0	0	184	314	0.031	0.300
286.25	1.00	**1345**	1138	0	0	285	599	0.060	0.333
286.50	1.25	**2006**	1676	0	0	419	1018	0.102	0.365
286.75	1.50	**2565**	2286	0	0	571	1589	0.159	0.393
287.00	1.75	**3105**	2835	0	0	709	2298	0.230	0.420
287.25	2.00	**3558**	3332	0	0	833	3131	0.313	0.444
287.50	2.25	**3968**	3763	0	0	941	4072	0.407	0.468
287.75	2.50	**4509**	4239	0	0	1060	5131	0.513	0.490
288.00	2.75	**4782**	4646	0	0	1161	6293	0.629	0.512
288.25	3.00	**7175**	5978	0	0	1495	7787	0.779	0.533
288.50	3.25	**7690**	7432	0	0	1858	9645	0.965	0.553
288.75	3.50	**8185**	7938	0	0	1984	11630	1.163	0.572
289.00	3.75	**8679**	8432	0	0	2108	13738	1.374	0.590
289.25	4.00	**9183**	8931	0	0	2233	15971	1.597	0.608
289.50	4.25	**9737**	9460	0	0	2365	18336	1.834	0.776
289.75	4.50	**10363**	10050	0	0	2512	20848	2.085	1.866
290.00	4.75	**11020**	10691	0	0	2673	23521	2.352	2.105
290.25	5.00	**11658**	11339	0	0	2835	26356	2.636	2.359
290.50	5.25	**12308**	11983	0	0	2996	29351	2.935	2.627
290.60	5.35	**12723**	12515	0	0	1252	30603	3.060	**2.739**
290.70	5.45	**12998**	12860	0	0	1286	31889	3.189	**3.991**
290.80	5.55	**13399**	13198	0	0	1320	33209	3.321	**5.453**

Comments:

1 **Bold** text represents values that have been obtained from GIS or survey.
2 Red text represents calculated/interpolated values
4 Blue text indicates data gathered from previous reports.
Tatham Engineering Extended Values to Include Weir Flow and Additional Storage Based on 2016 LIDAR.

Calculation Notes:

Overflow weir calculations completed in accordance with NVCA rectangular broad crested weir equation (NVCA Stormwater Technical Guide, December 2013)

BRII

Table 2: Pond Outlet Calculations

Dunn Drive Development
Simcoe Muskoka Catholic District School Board
Project No: 202064

Pond 1

Constants

Orifice 1 Diameter	115 mm	Orifice Equation	$=C_d*A*(2gH)^{1/2}$
C_d	0.62		
Elevation of Orifice 1	303.1 m		
Weir Coefficient	1.5	Weir Equation	$=C*(L-0.2H)*H^{1.5}$
B (m)	0.15 m	(accounting for end contractions)	
Side Slopes	2 :1		
Elevation of Weir Crest	303.7 m		

Additional Areas From 2016 GIS LIDAR Data. Additional Flow Calculated Using Consultant's Formulas.

Water Surface Elevation (m)	Area of Orifice 1 Flow (m^2)	Orifice 1 Outflow (m^3/s)	Weir Outflow (m^3/s)	Total Outflow (m^3/s)	Pond Segment Surface Area (m^2)	Average Area (m^2)	Segment Storage (m^3)	Cumulative Storage (ha m)	Active Storage (ha m)
302	0.010	0	0	0	3559	0	0	0	0.000
302.4	0.010	0	0	0	4136	3847.4	1539	0.154	0.000
302.8	0.010	0	0	0	4737	4436.4	1775	0.331	0.000
303	0.010	0	0	0	5048	4892.7	979	0.429	0.000
303.1	0.010	0.000	0	0	5206	5127.0	513	0.4805	0.000
303.2	0.010	0.006	0	0.006	5430	5317.7	532	0.534	0.053
303.4	0.010	0.014	0	0.014	5888	5658.5	1132	0.647	0.166
303.6	0.010	0.019	0.000	0.019	6358	6122.8	1225	0.769	0.289
303.7	0.010	0.021	0.000	0.021	6598	6478.2	648	0.834	0.354
303.8	0.010	0.023	0.025	0.048	6842	6720.0	672	0.901	0.421
303.84									***0.452***
303.9	0.010	0.025	0.122	0.147	9154	7997.8	800	0.981	0.501
303.94									***0.536***
304	0.010	0.026	0.318	0.344	9520	9336.8	934	1.075	0.594
304.01									***0.599***
304.25	0.010	0.030	1.371	1.400	10378	9948.9	2487	1.323	0.843
304.4	0.010	0.032	2.469	2.500	11939	11158.6	1674	1.491	1.010
304.41	0.010	0.032	2.556	2.556	11965	11952.0	120	1.503	1.022

Bold and italics represent 5, 25 and 100 year water levels within the pond

304.50 " 0.034 3.424 3.458 11,532 11,749 1,057 1.609 1.128

304.60 " 0.035 4.572 4.607 12,900 12,216 1,222 1.731 1.250

BARRIE DRAINAGE MASTER PLAN
BEAR CREEK WATERSHED
BR13

Stage-Storage-Discharge Table

Pond Characteristics:

Top Elevation:	**266.00**	m
Bottom Elev:	**262.95**	m
Stage	0.25	m

Overflow Weir:

Bottom Width of Weir	4	m
D/S Length of Weir	3	m
Weir Sill Elevation	266.00	m
Weir constant K	1.6	
Side Slope (H:V)	3	:1

Pond Geometry				Pond Volume (m^3)				Pond Volume (ha-m)	Discharge
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Accum. Dead	Live	Accum. Live	Accum. Live	(m^3/s)
262.95	0.00	**1400**	1400	0	0	0	0	0.000	0.000
263.45	0.50	1711	1556	0	0	778	778	0.078	0.520
263.95	1.00	2022	1867	0	0	933	1711	0.171	0.950
264.45	1.50	2334	2178	0	0	1089	2800	0.280	1.350
264.60	1.65	**2427**	2380	0	0	357	3157	0.316	1.425
264.95	2.00	2936	2682	0	0	939	4096	0.410	1.600
265.45	2.50	3257	3097	0	0	1548	5644	0.564	2.221
265.75	2.80	**3551**	3404	0	0	1021	6665	0.667	2.897
266.00	3.05	**3798**	3674	0	0	919	7584	0.758	3.461
266.10	3.15	**3904**	3851	0	0	385	7969	0.797	3.881
266.20	3.25	**4086**	3995	0	0	399	8369	0.837	4.523

Extrapolated orifice flows + weir flow (from 2016 LIDAR)

Comments:

1 **Bold** text represents values obtained from GIS
2 Red text represents interpolated/extrapolated/calculated values
3 Highlighted columns represent PCSWMM input values
4 Deer Valley Subdivision SWM Study" (Reid and Associates Limited, 1991) in Stormwater Pond Database
Tatham Engineering Extended Values to Include Weir Flow and Additional Storage Based on 2016 LIDAR.

Calculation Notes:

Overflow weir calculations completed in accordance with NVCA rectangular broad crested weir equation (NVCA Stormwater Technical Guide, December 2013)

BR14

Table 4: Proposed Pond Routing Characteristics

Ferndale Drive Stormwater Pond Retrofit

City of Barrie

Revised August , 2005

Pond 1

Constants

Orifice 1 Diameter	175		
C_d	0.62		
Elevation of Orifice 1	237.40		$Q=C_d*A*(2gH)^{1/2}$
Orifice 2	750	mm	
Elevation of Orifice 2	236.90	m	Q from CulvertMaster output
Weir 1 Coefficient	1.8		$Q=C*(L-0.2H)*H^{1.5}$
L (m)	3.85	m	
Side Slopes	0	:1 (vertical)	
Elevation of Weir 1 Crest	238.09	m	

Note: Orifice 2 does not engage until the water level rises above the DICB at 237.9
At this water level Orifice 1 is considered to not operate as Orifice 2 is the control.

As per 2016 GIS LIDAR, weir expands to spillway at 239.00 with following properties:
Length ≈ 225m (width)
D/S Length ≈ 7.5m
Assume 3:1 side slopes
Q @ 239.10 = 9.9711
@ 239.20 = 28.7431

Water Surface Elevation (m)	Orifice Area Orifice 1 (m^2)	Orifice 1 Outflow (m^3/s)	Orifice 2 Outflow (m^3/s)	Weir 1 Outflow (m^3/s)	Total Outflow (m^3/s)	Pond Segment Surface Area (m^2)	Average Area (m^2)	Segment Storage (m^3)	Cumulative Storage (ha m)
237.4	0.024	0.00	0.000	0.00	0.000	7009	7008.8	0	0.000
237.5	0.024	0.01	0.000	0.00	0.007	7347	7177.8	718	0.072
237.6	0.024	0.02	0.000	0.00	0.022	7688	7517.3	752	0.147
237.7	0.024	0.03	0.000	0.00	0.030	8032	7859.9	786	0.226
237.75	0.024	0.03	0.000	0.00	0.034	8373	8202.6	410	0.267
237.8	0.024	0.04	0.000	0.00	0.037	8715	8543.9	427	0.309
237.9	0.024	0.04	0.000	0.00	0.042	9035	8874.9	887	0.398
238	0.024	0.00	0.992	0.00	0.992	9350	9192.7	919	0.490
238.09	0.024	0.00	1.097	0.00	1.097	9607	9478.5	853	0.575
238.1	0.024	0.00	1.108	0.01	1.115	9635	9621.1	96	0.585
238.2	0.024	0.00	1.218	0.25	1.469	9928	9781.5	978	0.683
238.25	0.024	0.00	1.271	0.44	1.710	10076	10001.8	500	0.733
238.3	0.024	0.00	1.322	0.66	1.981	10225	10150.3	508	0.783
238.4	0.024	0.00	1.419	1.18	2.596	10525	10374.6	1037	0.887
238.435	***0.024***	***0.00***	***1.451***	***1.38***	***2.830***	***10725***	***10625.0***	***372***	***0.924***
238.5	0.024	0.00	1.511	1.78	3.291	10828	10776.7	700	0.994
238.6	0.024	0.00	1.598	2.46	4.055	11135	10981.3	1098	1.104
238.628	***0.024***	***0.00***	***1.621***	***2.66***	***4.279***	***11332***	***11233.1***	***315***	***1.136***
238.7	0.024	0.00	1.681	3.20	4.878	11445	11388.3	820	1.218
238.75	0.024	0.00	1.720	3.59	5.309	11602	11523.4	576	1.275
238.8	0.024	0.00	1.759	3.99	5.752	11759	11680.3	584	1.334
238.9	0.024	0.00	1.835	4.84	6.674	12076	11917.4	1192	1.453
239	0.024	0.00	1.908	5.73	7.639	12499	12287.5	1229	1.576

Spill

Bold and italics represent 25-year and 100-year water levels

239.1	"	"	1.918	6.67	9.97	18.56	13931	13215	1322	1.708
239.2	"	"	1.956	7.64	28.74	38.34	14409	14170	1417	1.850

Appendix D: AMC and CN to CN* Conversion Tables

117076 - Barrie Drainage Master Plan

AMCII to AMCIII CN and Modified CN Conversion Table

Watershed/Drainage Area:	**Bunkers Creek**
Date Completed:	**7-Jun-2017**

City of Barrie:

Precipitation 87.6 mm/hr

Standard Ia 5 mm

Catchment	AMCII CN	AMCIII CN	S (mm)	Ia (mm)	Q	S* (mm)	AMCIII CN*	AMCII CN*
BK101	45.3	65.76	132.25	26.45	19.34	270.26	48.45	28.90
BK102_1	50.4	70.24	107.62	21.52	25.14	188.84	57.36	36.75
BK102_2	45.2	65.67	132.78	26.56	19.22	272.29	48.26	28.75
BK103_1	44.6	65.12	136.06	27.21	18.56	284.96	47.13	27.83
BK103_2	44.9	65.39	134.41	26.88	18.89	278.53	47.70	28.29
BK103_3	44.2	64.75	138.30	27.66	18.12	293.86	46.36	27.22
BK104	48.2	68.35	117.61	23.52	22.60	219.29	53.67	33.36
BK105	51.6	71.24	102.54	20.51	26.54	174.51	59.28	38.60
BK106	41.7	62.37	153.25	30.65	15.43	359.59	41.40	23.42
BK107	40.9	61.59	158.42	31.68	14.59	385.12	39.74	22.21
BK108	35.8	56.34	196.81	39.36	9.50	635.94	28.54	14.76
BK109	53.1	72.47	96.50	19.30	28.31	158.44	61.58	40.90
BK110	46.2	66.58	127.51	25.50	20.34	252.86	50.11	30.29
BK111	58.2	76.43	78.31	15.66	34.44	115.49	68.74	48.65
BK112	44.8	65.30	134.96	26.99	18.78	280.65	47.51	28.14
BK113	55.3	74.22	88.25	17.65	30.93	137.98	64.80	44.26
BK114	55.7	74.53	86.81	17.36	31.41	134.60	65.36	44.87
BK115	43.9	64.47	140.01	28.00	17.80	300.80	45.78	26.76
BK116	47.4	67.65	121.47	24.29	21.69	231.95	52.27	32.13
BK117	60.2	77.91	72.02	14.40	36.89	102.33	71.28	51.65
BK118	54.0	73.19	93.04	18.61	29.37	149.66	62.92	42.27
BK119	59.0	77.03	75.75	15.15	35.42	110.02	69.78	49.85
BK120	57.6	75.98	80.29	16.06	33.71	119.79	67.95	47.74
BK121	56.4	75.07	84.36	16.87	32.26	128.92	66.33	45.93
BK122	56.8	75.37	82.98	16.60	32.74	125.79	66.88	46.53
BK123	51.2	70.91	104.21	20.84	26.07	179.13	58.64	37.98
BK124_1	36.6	57.20	190.08	38.02	10.26	582.52	30.36	15.89
BK124_2	49.1	69.13	113.41	22.68	23.63	206.11	55.20	34.75
BK125	52.4	71.90	99.28	19.86	27.48	165.70	60.52	39.82
BK126	41.4	62.08	155.17	31.03	15.11	368.87	40.78	22.97
BK127	47.0	67.29	123.44	24.69	21.24	238.65	51.56	31.52
BK128	43.8	64.37	140.58	28.12	17.69	303.16	45.59	26.61
BK129	38.8	59.48	173.01	34.60	12.43	466.38	35.26	19.09
BK130	47.0	67.27	123.57	24.71	21.21	239.07	51.51	31.48
BK131	45.7	66.13	130.12	26.02	19.78	262.33	49.19	29.52
BK132	41.5	62.17	154.53	30.91	15.22	365.74	40.98	23.12
BK133	43.8	64.37	140.58	28.12	17.69	303.16	45.59	26.61
BK134	41.3	61.98	155.81	31.16	15.01	372.04	40.57	22.82
BK135	44.7	65.21	135.51	27.10	18.67	282.79	47.32	27.99
BK136	43.1	63.71	144.67	28.93	16.93	320.47	44.21	25.54
BK137_1	44.6	65.12	136.06	27.21	18.56	284.96	47.13	27.83
BK137_2	44.7	65.21	135.51	27.10	18.67	282.79	47.32	27.99
BK138	50.2	70.05	108.60	21.72	24.87	191.69	56.99	36.41
BK139_1	47.5	67.74	120.98	24.20	21.80	230.32	52.44	32.29
BK139_2	45.0	65.49	133.87	26.77	19.00	276.43	47.89	28.44

117076 - Barrie Drainage Master Plan

AMCII to AMCIII CN and Modified CN Conversion Table

Watershed/Drainage Area:	**Bunkers Creek**
Date Completed:	**7-Jun-2017**

City of Barrie:

Precipitation 87.6 mm/hr

Standard Ia 5 mm

Catchment	AMCII CN	AMCIII CN	S (mm)	Ia (mm)	Q	S* (mm)	AMCIII CN*	AMCII CN*
BK140	47.8	68.00	119.52	23.90	22.14	225.50	52.97	32.75
BK141	64.8	81.14	59.02	11.80	42.61	77.51	76.62	58.45
BK142_1	67.0	82.62	53.44	10.69	45.38	67.74	78.94	61.64
BK142_2	46.3	66.67	126.99	25.40	20.45	251.02	50.29	30.44
BK142_3	42.9	63.52	145.86	29.17	16.71	325.67	43.82	25.24
BK142_4	60.4	78.05	71.42	14.28	37.14	101.10	71.53	51.95
BK143	64.5	80.94	59.82	11.96	42.24	78.94	76.29	58.01
BK144_1	68.9	83.86	48.90	9.78	47.79	60.17	80.85	64.37
BK144_2	69.1	83.98	48.44	9.69	48.04	59.41	81.04	64.65

AMCII CN Values Determined From Tatham Engineering Limited CN Calculators

AMCII to AMCIII CN Conversion Based on MTO Design Chart 1.10

CN to CN* Conversion As Per Process Outlined In Visual OTTHYMO Reference Manual

117076 - Barrie Drainage Master Plan

AMCII to AMCIII CN and Modified CN Conversion Table

Watershed/Drainage Area:	**Dyments Creek**
Date Completed:	**7-Jun-2017**

City of Barrie:

Precipitation 87.6 mm/hr

Standard Ia 5 mm

Catchment	AMCII CN	AMCIII CN	S (mm)	Ia (mm)	Q	S* (mm)	AMCIII CN*	AMCII CN*
DY101	45.5	65.94	131.18	26.24	19.56	266.25	48.82	29.21
DY102	50.8	70.55	106.03	21.21	25.57	184.27	57.96	37.32
DY103	35.8	56.33	196.90	39.38	9.49	636.65	28.52	14.74
DY104	44.1	64.65	138.87	27.77	18.01	296.15	46.17	27.07
DY105	50.0	69.86	109.59	21.92	24.61	194.60	56.62	36.06
DY106	47.2	67.51	122.25	24.45	21.51	234.60	51.98	31.89
DY107	47.2	67.45	122.60	24.52	21.43	235.77	51.86	31.78
DY108	38.0	58.62	179.29	35.86	11.59	506.20	33.41	17.86
DY109	67.6	82.98	52.10	10.42	46.08	65.47	79.51	62.43
DY110	54.2	73.31	92.48	18.50	29.55	148.26	63.14	42.50
DY111	46.9	67.22	123.88	24.78	21.14	240.16	51.40	31.38
DY112	68.5	83.57	49.93	9.99	47.23	61.86	80.42	63.74
DY113	49.0	69.05	113.87	22.77	23.52	207.53	55.03	34.60
DY114_1	38.4	59.07	175.97	35.19	12.03	484.73	34.38	18.50
DY115	68.8	83.78	49.18	9.84	47.64	60.63	80.73	64.20
DY116	53.9	73.11	93.42	18.68	29.26	150.61	62.78	42.12
DY117	53.2	72.58	95.96	19.19	28.47	157.04	61.79	41.11
DY118	52.9	72.26	97.49	19.50	28.01	160.99	61.21	40.51
DY119	46.5	66.81	126.17	25.23	20.63	248.12	50.59	30.69
DY120	44.3	64.82	137.85	27.57	18.21	292.05	46.52	27.34
DY121	47.4	67.62	121.61	24.32	21.66	232.45	52.22	32.09
DY122	52.7	72.15	98.04	19.61	27.84	162.44	60.99	40.30
DY123_1	53.4	72.74	95.18	19.04	28.71	155.06	62.09	41.42
DY123_2	55.4	74.27	87.99	17.60	31.01	137.38	64.90	44.36
DY124	59.0	77.03	75.75	15.15	35.42	110.02	69.78	49.85
DY125	53.2	72.51	96.31	19.26	28.36	157.94	61.66	40.97
DY126	48.8	68.90	114.66	22.93	23.32	209.96	54.75	34.33
DY127	42.7	63.33	147.04	29.41	16.50	330.92	43.42	24.94
DY128	39.5	60.17	168.11	33.62	13.12	437.48	36.73	20.09
DY129	42.4	63.00	149.19	29.84	16.12	340.62	42.72	24.40
DY130	60.0	77.78	72.57	14.51	36.67	103.45	71.06	51.38
DY131	59.0	77.03	75.75	15.15	35.42	110.02	69.78	49.85
DY132	61.3	78.68	68.82	13.76	38.21	95.94	72.58	53.24
DY133	37.4	58.01	183.88	36.78	11.01	537.32	32.10	17.00
DY134	47.8	68.02	119.42	23.88	22.17	225.19	53.01	32.78
DY135	56.9	75.46	82.61	16.52	32.87	124.95	67.03	46.70
DY136	54.9	73.86	89.88	17.98	30.39	141.90	64.16	43.57
DY137	56.0	74.79	85.61	17.12	31.82	131.81	65.84	45.38
DY138	49.0	69.05	113.87	22.77	23.52	207.53	55.03	34.60
DY139	47.9	68.07	119.13	23.83	22.24	224.24	53.11	32.87
DY140	52.3	71.81	99.72	19.94	27.35	166.88	60.35	39.66
DY141	51.0	70.70	105.26	21.05	25.78	182.10	58.24	37.60
DY142	68.2	83.43	50.45	10.09	46.95	62.72	80.20	63.42
DY143	48.9	68.97	114.29	22.86	23.41	208.81	54.88	34.46
DY145	61.7	78.98	67.60	13.52	38.73	93.54	73.08	53.87
DY146	47.5	67.76	120.83	24.17	21.84	229.83	52.50	32.33
DY147	66.0	81.98	55.83	11.17	44.17	71.87	77.95	60.25
DY148	43.6	64.14	142.02	28.40	17.41	309.19	45.10	26.23
DY149	38.3	58.97	176.72	35.34	11.93	489.48	34.16	18.35

117076 - Barrie Drainage Master Plan

AMCII to AMCIII CN and Modified CN Conversion Table

Watershed/Drainage Area:	**Dyments Creek**
Date Completed:	**7-Jun-2017**

City of Barrie:

Precipitation 87.6 mm/hr

Standard Ia 5 mm

Catchment	AMCII CN	AMCIII CN	S (mm)	Ia (mm)	Q	S* (mm)	AMCIII CN*	AMCII CN*
DY150	68.1	83.35	50.73	10.15	46.80	63.19	80.08	63.25
DY151	59.0	77.03	75.75	15.15	35.42	110.02	69.78	49.85
DY152	51.9	71.49	101.30	20.26	26.89	171.14	59.75	39.06
DY153	42.6	63.22	147.78	29.56	16.37	334.19	43.18	24.75
DY154	59.0	77.03	75.75	15.15	35.42	110.02	69.78	49.85
DY155	43.2	63.81	144.07	28.81	17.04	317.91	44.41	25.69
DY156	49.2	69.18	113.14	22.63	23.70	205.27	55.30	34.84
DY157	38.4	59.02	176.34	35.27	11.98	487.10	34.27	18.43
DY158	38.5	59.16	175.37	35.07	12.11	480.97	34.56	18.62
DY159	43.1	63.74	144.49	28.90	16.96	319.70	44.27	25.59
DY160	49.3	69.34	112.32	22.46	23.91	202.78	55.61	35.12
DY161	41.0	61.64	158.09	31.62	14.64	383.45	39.85	22.29
DY162	64.0	80.60	61.12	12.22	41.62	81.31	75.75	57.29
DY163	38.8	59.49	172.93	34.59	12.44	465.93	35.28	19.10

AMCII CN Values Determined From Tatham Engineering Limited CN Calculators

AMCII to AMCIII CN Conversion Based on MTO Design Chart 1.10

CN to CN* Conversion As Per Process Outlined In Visual OTTHYMO Reference Manual

117076 - Barrie Drainage Master Plan

AMCII to AMCIII CN and Modified CN Conversion Table

Watershed/Drainage Area:	**Huronia**
Date Completed:	**7-Jun-2017**

City of Barrie:

Precipitation 87.6 mm/hr

Standard Ia 5 mm

Catchment	AMCII CN	AMCIII CN	S (mm)	Ia (mm)	Q	S* (mm)	AMCIII CN*	AMCII CN*
HR101	56.7	75.30	83.32	16.66	32.62	126.56	66.74	46.38
HR102	58.3	76.51	77.99	15.60	34.56	114.79	68.87	48.80
HR103	58.0	76.28	78.97	15.79	34.20	116.91	68.48	48.35
HR104	56.6	75.22	83.67	16.73	32.50	127.34	66.61	46.23
HR105	56.3	74.99	84.71	16.94	32.14	129.71	66.20	45.78
HR106	56.5	75.15	84.01	16.80	32.38	128.13	66.47	46.08
HR107	55.8	74.61	86.46	17.29	31.53	133.77	65.50	45.02
HR108	56.6	75.22	83.67	16.73	32.50	127.34	66.61	46.23
HR109	57.6	75.98	80.29	16.06	33.71	119.79	67.95	47.74
HR110	55.0	73.98	89.33	17.87	30.57	140.58	64.37	43.80
HR111	56.6	75.22	83.67	16.73	32.50	127.34	66.61	46.23
HR112	56.6	75.22	83.67	16.73	32.50	127.34	66.61	46.23
HR113	54.8	73.82	90.06	18.01	30.33	142.34	64.09	43.49
HR114	48.5	68.61	116.19	23.24	22.94	214.78	54.18	33.83
HR115	61.8	79.06	67.28	13.46	38.87	92.93	73.21	54.03
HR116	34.0	54.38	213.11	42.62	7.84	787.85	24.38	12.26
HR117	53.9	73.11	93.42	18.68	29.26	150.61	62.78	42.12
HR118	44.0	64.56	139.43	27.89	17.90	298.46	45.98	26.91
HR119	54.5	73.59	91.17	18.23	29.97	145.04	63.65	43.04
HR120	58.0	76.28	78.97	15.79	34.20	116.91	68.48	48.35
HR121	47.3	67.56	121.96	24.39	21.58	233.60	52.09	31.98
HR122	44.3	64.84	137.74	27.55	18.23	291.60	46.55	27.37
HR123	45.1	65.58	133.32	26.66	19.11	274.35	48.07	28.60
HR124	47.8	68.00	119.52	23.90	22.14	225.50	52.97	32.75
HR125	46.0	66.40	128.54	25.71	20.11	256.59	49.75	29.98

AMCII CN Values Determined From Tatham Engineering Limited CN Calculators

AMCII to AMCIII CN Conversion Based on MTO Design Chart 1.10

CN to CN* Conversion As Per Process Outlined In Visual OTTHYMO Reference Manual

117076 - Barrie Drainage Master Plan	
AMCII to AMCIII CN and Modified CN Conversion Table	
Watershed/Drainage Area:	**Hotchkiss Creek**
Date Completed:	**7-Jun-2017**

City of Barrie:

Precipitation 87.6 mm/hr

Standard Ia 5 mm

Catchment	AMCII CN	AMCIII CN	S (mm)	Ia (mm)	Q	S* (mm)	AMCIII CN*	AMCII CN*
HT101_1	40.5	61.19	161.08	32.22	14.17	398.90	38.90	21.61
HT101_2	45.6	66.03	130.64	26.13	19.67	264.28	49.01	29.37
HT101_3	44.8	65.30	134.96	26.99	18.78	280.65	47.51	28.14
HT101_4	42.2	62.85	150.12	30.02	15.96	344.87	42.41	24.17
HT101_5	48.4	68.53	116.66	23.33	22.83	216.27	54.01	33.67
HT102_1	46.8	67.12	124.45	24.89	21.01	242.10	51.20	31.21
HT102_2	37.3	57.93	184.43	36.89	10.94	541.20	31.94	16.90
HT103_1	52.9	72.31	97.29	19.46	28.07	160.48	61.28	40.59
HT103_2	51.2	70.91	104.21	20.84	26.07	179.13	58.64	37.98
HT103_3	52.5	71.98	98.88	19.78	27.60	164.64	60.67	39.98
HT104	52.4	71.90	99.28	19.86	27.48	165.70	60.52	39.82
HT105	44.1	64.65	138.87	27.77	18.01	296.15	46.17	27.07
HT106	49.2	69.22	112.96	22.59	23.75	204.72	55.37	34.90
HT107	50.0	69.90	109.37	21.87	24.67	193.95	56.70	36.14
HT108	51.7	71.32	102.12	20.42	26.65	173.38	59.43	38.75
HT109	52.8	72.22	97.68	19.54	27.95	161.51	61.13	40.44
HT110	49.6	69.56	111.15	22.23	24.21	199.24	56.04	35.52
HT111	61.4	78.77	68.44	13.69	38.38	95.19	72.74	53.44
HT112	50.4	70.24	107.62	21.52	25.14	188.84	57.36	36.75
HT113	52.9	72.31	97.29	19.46	28.07	160.48	61.28	40.59
HT114_1	40.5	61.19	161.08	32.22	14.17	398.90	38.90	21.61
HT114_2	46.2	66.58	127.51	25.50	20.34	252.86	50.11	30.29
HT115_1	57.5	75.91	80.62	16.12	33.59	120.52	67.82	47.59
HT115_2	45.0	65.49	133.87	26.77	19.00	276.43	47.89	28.44
HT116_1	37.6	58.26	181.98	36.40	11.24	524.21	32.64	17.35
HT116_2	43.1	63.71	144.67	28.93	16.93	320.47	44.21	25.54
HT117_1	59.0	77.03	75.75	15.15	35.42	110.02	69.78	49.85
HT117_2	48.6	68.70	115.72	23.14	23.06	213.30	54.35	33.98
HT117_3	47.0	67.29	123.44	24.69	21.24	238.65	51.56	31.52
HT118	49.6	69.56	111.15	22.23	24.21	199.24	56.04	35.52
HT119_1	58.2	76.43	78.31	15.66	34.44	115.49	68.74	48.65
HT119_2	59.0	77.03	75.75	15.15	35.42	110.02	69.78	49.85
HT120	54.0	73.19	93.04	18.61	29.37	149.66	62.92	42.27
HT121	55.6	74.45	87.17	17.43	31.29	135.44	65.22	44.71
HT122	48.5	68.61	116.19	23.24	22.94	214.78	54.18	33.83
HT123_1	46.2	66.58	127.51	25.50	20.34	252.86	50.11	30.29
HT123_2	45.2	65.67	132.78	26.56	19.22	272.29	48.26	28.75
HT124	43.0	63.62	145.26	29.05	16.82	323.06	44.02	25.39
HT125_1	46.4	66.76	126.48	25.30	20.56	249.20	50.48	30.59
HT125_2	49.0	69.05	113.87	22.77	23.52	207.53	55.03	34.60
HT126_1	49.0	69.05	113.87	22.77	23.52	207.53	55.03	34.60
HT126_2	47.4	67.65	121.47	24.29	21.69	231.95	52.27	32.13
HT127_1	47.0	67.29	123.44	24.69	21.24	238.65	51.56	31.52
HT127_2	50.8	70.57	105.90	21.18	25.60	183.91	58.00	37.37
HT127_3	45.0	65.49	133.87	26.77	19.00	276.43	47.89	28.44
HT128	44.5	65.02	136.62	27.32	18.45	287.15	46.94	27.68
HT129	46.5	66.85	125.97	25.19	20.67	247.40	50.66	30.75
HT130	45.1	65.58	133.32	26.66	19.11	274.35	48.07	28.60
HT131_1	46.4	66.76	126.48	25.30	20.56	249.20	50.48	30.59
HT131_2	45.6	66.03	130.64	26.13	19.67	264.28	49.01	29.37
HT131_3	45.5	65.94	131.18	26.24	19.56	266.25	48.82	29.21
HT132	66.1	82.02	55.68	11.14	44.25	71.60	78.01	60.34
HT133	66.9	82.55	53.69	10.74	45.25	68.16	78.84	61.50

AMCII CN Values Determined From Tatham Engineering Limited CN Calculators

AMCII to AMCIII CN Conversion Based on MTO Design Chart 1.10

CN to CN* Conversion As Per Process Outlined In Visual OTTHYMO Reference Manual

117076 - Barrie Drainage Master Plan

AMCII to AMCIII CN and Modified CN Conversion Table

Watershed/Drainage Area:	**Johnson**
Date Completed:	**7-Jun-2017**

City of Barrie:

Precipitation 87.6 mm/hr

Standard Ia 5 mm

Catchment	AMCII CN	AMCIII CN	S (mm)	Ia (mm)	Q	S* (mm)	AMCIII CN*	AMCII CN*
JS101	68.3	83.47	50.31	10.06	47.03	62.48	80.26	63.51
JS102	68.0	83.27	51.02	10.20	46.65	63.67	79.96	63.08
JS103	67.6	83.01	51.98	10.40	46.14	65.27	79.56	62.50
JS104	67.3	82.82	52.71	10.54	45.76	66.50	79.25	62.07
JS105	66.8	82.49	53.93	10.79	45.13	68.59	78.74	61.35
JS106	67.8	83.14	51.50	10.30	46.39	64.46	79.76	62.79
JS107	67.0	82.62	53.44	10.69	45.38	67.74	78.94	61.64
JS108	65.9	81.89	56.19	11.24	43.99	72.48	77.80	60.05
JS109	67.3	82.82	52.71	10.54	45.76	66.50	79.25	62.07
JS110	72.6	86.17	40.75	8.15	52.52	47.32	84.30	69.59
JS111	66.6	82.35	54.43	10.89	44.88	69.44	78.53	61.06
JS112	66.8	82.49	53.93	10.79	45.13	68.59	78.74	61.35
JS113	66.8	82.49	53.93	10.79	45.13	68.59	78.74	61.35
JS114	66.7	82.42	54.18	10.84	45.00	69.01	78.64	61.21
JS115	48.8	68.87	114.79	22.96	23.29	210.39	54.70	34.29
JS116	46.7	67.03	124.95	24.99	20.90	243.85	51.02	31.06
JS117	47.0	67.29	123.44	24.69	21.24	238.65	51.56	31.52
JS118	46.7	67.03	124.95	24.99	20.90	243.85	51.02	31.06
JS119	42.8	63.43	146.46	29.29	16.60	328.32	43.62	25.09

AMCII CN Values Determined From Tatham Engineering Limited CN Calculators

AMCII to AMCIII CN Conversion Based on MTO Design Chart 1.10

CN to CN* Conversion As Per Process Outlined In Visual OTTHYMO Reference Manual

117076 - Barrie Drainage Master Plan

AMCII to AMCIII CN and Modified CN Conversion Table

Watershed/Drainage Area:	**Kidd's Creek**
Date Completed:	**7-Jun-2017**

City of Barrie:

Precipitation 87.6 mm/hr

Standard Ia 5 mm

Catchment	AMCII CN	AMCIII CN	S (mm)	Ia (mm)	Q	S* (mm)	AMCIII CN*	AMCII CN*
KD101	48.7	68.78	115.30	23.06	23.16	211.98	54.51	34.12
KD102	44.6	65.12	136.06	27.21	18.56	284.96	47.13	27.83
KD103	47.7	67.91	120.00	24.00	22.03	227.09	52.80	32.59
KD104	45.3	65.73	132.41	26.48	19.30	270.87	48.39	28.86
KD105	45.4	65.84	131.76	26.35	19.44	268.45	48.62	29.04
KD106	45.5	65.98	130.96	26.19	19.60	265.46	48.90	29.27
KD107	45.7	66.12	130.17	26.03	19.77	262.52	49.17	29.50
KD108	49.5	69.44	111.78	22.36	24.05	201.13	55.81	35.30
KD109	44.9	65.39	134.41	26.88	18.89	278.53	47.70	28.29
KD110	42.2	62.84	150.18	30.04	15.95	345.15	42.39	24.16
KD111	53.4	72.73	95.26	19.05	28.68	155.25	62.06	41.39
KD112	45.6	66.06	130.49	26.10	19.70	263.69	49.06	29.41
KD113	57.5	75.92	80.55	16.11	33.61	120.37	67.85	47.62
KD114	52.4	71.91	99.24	19.85	27.49	165.60	60.53	39.84
KD115	45.9	66.32	129.01	25.80	20.01	258.29	49.58	29.84
KD116	49.0	69.00	114.10	22.82	23.46	208.24	54.95	34.52
KD117	58.3	76.54	77.86	15.57	34.61	114.52	68.93	48.86
KD118	54.2	73.38	92.14	18.43	29.66	147.42	63.27	42.64
KD119	57.2	75.67	81.66	16.33	33.21	122.82	67.41	47.12
KD120	53.3	72.65	95.61	19.12	28.58	156.14	61.93	41.25
KD121	64.8	81.16	58.97	11.79	42.64	77.42	76.64	58.48
KD122	56.6	75.23	83.63	16.73	32.51	127.27	66.62	46.25
KD123	51.9	71.49	101.30	20.26	26.89	171.14	59.75	39.06
KD124	49.9	69.77	110.04	22.01	24.50	195.91	56.46	35.90
KD125	38.3	59.00	176.49	35.30	11.96	488.05	34.23	18.40
KD126	52.9	72.33	97.17	19.43	28.10	160.17	61.33	40.64
KD127	48.7	68.82	115.07	23.01	23.22	211.26	54.59	34.20
KD128	42.9	63.56	145.62	29.12	16.75	324.62	43.90	25.30
KD129	42.9	63.56	145.62	29.12	16.75	324.62	43.90	25.30
KD130	47.9	68.12	118.89	23.78	22.29	223.46	53.20	32.95
KD131	40.7	61.38	159.81	31.96	14.37	392.27	39.30	21.90
KD132	54.8	73.84	89.99	18.00	30.35	142.17	64.11	43.53
KD133	41.6	62.31	153.63	30.73	15.37	361.42	41.27	23.33
KD134	41.8	62.45	152.75	30.55	15.51	357.18	41.56	23.54
KD135	42.7	63.32	147.12	29.42	16.49	331.27	43.40	24.92
KD136	51.1	70.84	104.54	20.91	25.97	180.07	58.52	37.86
KD137	42.4	63.00	149.19	29.84	16.12	340.62	42.72	24.40
KD138	41.2	61.83	156.78	31.36	14.85	376.87	40.26	22.59
KD139	53.7	72.97	94.07	18.81	29.05	152.24	62.53	41.86
KD140	42.1	62.79	150.55	30.11	15.89	346.88	42.27	24.07
KD141	44.5	65.05	136.45	27.29	18.49	286.49	46.99	27.72
KD142	40.4	61.08	161.82	32.36	14.06	402.81	38.67	21.45

AMCII CN Values Determined From Tatham Engineering Limited CN Calculators

AMCII to AMCIII CN Conversion Based on MTO Design Chart 1.10

CN to CN* Conversion As Per Process Outlined In Visual OTTHYMO Reference Manual

117076 - Barrie Drainage Master Plan

AMCII to AMCIII CN and Modified CN Conversion Table

Watershed/Drainage Area:	**Mulcaster**
Date Completed:	**7-Jun-2017**

City of Barrie:

Precipitation 87.6 mm/hr

Standard Ia 5 mm

Catchment	AMCII CN	AMCIII CN	S (mm)	Ia (mm)	Q	S* (mm)	AMCIII CN*	AMCII CN*
MC101	41.1	61.82	156.85	31.37	14.84	377.19	40.24	22.57
MC102	40.0	60.72	164.35	32.87	13.67	416.40	37.89	20.90
MC103	55.7	74.53	86.81	17.36	31.41	134.60	65.36	44.87
MC104	40.2	60.89	163.11	32.62	13.86	409.70	38.27	21.17
MC105	40.1	60.80	163.73	32.75	13.77	413.03	38.08	21.03
MC106	45.4	65.89	131.50	26.30	19.49	267.45	48.71	29.12
MC107	42.1	62.75	150.80	30.16	15.84	348.03	42.19	24.01
MC108	47.3	67.58	121.86	24.37	21.60	233.27	52.13	32.01
MC109	49.0	69.01	114.06	22.81	23.47	208.09	54.97	34.53
MC110	45.8	66.24	129.43	25.89	19.93	259.82	49.43	29.72

AMCII CN Values Determined From Tatham Engineering Limited CN Calculators

AMCII to AMCIII CN Conversion Based on MTO Design Chart 1.10

CN to CN* Conversion As Per Process Outlined In Visual OTTHYMO Reference Manual

117076 - Barrie Drainage Master Plan	
AMCII to AMCIII CN and Modified CN Conversion Table	
Watershed/Drainage Area:	**Minets**
Date Completed:	**7-Jun-2017**

City of Barrie:

Precipitation 87.6 mm/hr

Standard Ia 5 mm

Catchment	AMCII CN	AMCIII CN	S (mm)	Ia (mm)	Q	S* (mm)	AMCIII CN*	AMCII CN*
MS101	55.0	73.98	89.33	17.87	30.57	140.58	64.37	43.80
MS102	54.1	73.27	92.67	18.53	29.49	148.73	63.07	42.43
MS103	51.1	70.83	104.63	20.93	25.95	180.31	58.48	37.83
MS104	55.7	74.53	86.81	17.36	31.41	134.60	65.36	44.87
MS105	55.5	74.37	87.53	17.51	31.17	136.28	65.08	44.56
MS106	57.0	75.53	82.30	16.46	32.98	124.26	67.15	46.84

AMCII CN Values Determined From Tatham Engineering Limited CN Calculators

AMCII to AMCIII CN Conversion Based on MTO Design Chart 1.10

CN to CN* Conversion As Per Process Outlined In Visual OTTHYMO Reference Manual

117076 - Barrie Drainage Master Plan	
AMCII to AMCIII CN and Modified CN Conversion Table	
Watershed/Drainage Area:	**Nelson**
Date Completed:	**7-Jun-2017**

City of Barrie:

Precipitation 87.6 mm/hr

Standard Ia 5 mm

Catchment	AMCII CN	AMCIII CN	S (mm)	Ia (mm)	Q	S* (mm)	AMCIII CN*	AMCII CN*
NS101	70.1	84.62	46.16	9.23	49.32	55.75	82.00	66.07
NS102	69.4	84.18	47.75	9.55	48.42	58.29	81.33	65.08
NS103	63.7	80.39	61.96	12.39	41.24	82.86	75.40	56.84
NS104	65.8	81.82	56.44	11.29	43.87	72.93	77.69	59.90
NS105	47.6	67.83	120.49	24.10	21.92	228.70	52.62	32.44
NS106	65.8	81.82	56.44	11.29	43.87	72.93	77.69	59.90
NS107	44.3	64.84	137.74	27.55	18.23	291.60	46.55	27.37
NS108	51.1	70.83	104.63	20.93	25.95	180.31	58.48	37.83
NS109	45.4	65.85	131.71	26.34	19.45	268.25	48.64	29.06

AMCII CN Values Determined From Tatham Engineering Limited CN Calculators

AMCII to AMCIII CN Conversion Based on MTO Design Chart 1.10

CN to CN* Conversion As Per Process Outlined In Visual OTTHYMO Reference Manual

117076 - Barrie Drainage Master Plan

AMCII to AMCIII CN and Modified CN Conversion Table

Watershed/Drainage Area:	**Rodney**
Date Completed:	**7-Jun-2017**

City of Barrie:

Precipitation 87.6 mm/hr

Standard Ia 5 mm

Catchment	AMCII CN	AMCIII CN	S (mm)	Ia (mm)	Q	S* (mm)	AMCIII CN*	AMCII CN*
RN101	44.6	65.12	136.06	27.21	18.56	284.96	47.13	27.83
RN102	41.8	62.47	152.62	30.52	15.54	356.58	41.60	23.57
RN103	44.4	64.93	137.18	27.44	18.34	289.36	46.75	27.53
RN104	44.9	65.39	134.41	26.88	18.89	278.53	47.70	28.29
RN105	47.2	67.47	122.45	24.49	21.46	235.27	51.91	31.82
RN106	46.6	66.94	125.46	25.09	20.79	245.62	50.84	30.90
RN107	48.1	68.26	118.08	23.62	22.49	220.82	53.49	33.21
RN108	45.0	65.49	133.87	26.77	19.00	276.43	47.89	28.44
RN109	42.3	62.95	149.50	29.90	16.07	342.03	42.62	24.33
RN110	41.4	62.08	155.17	31.03	15.11	368.87	40.78	22.97
RN111	48.0	68.18	118.56	23.71	22.37	222.37	53.32	33.06
RN112	43.7	64.28	141.15	28.23	17.58	305.55	45.39	26.46
RN113	49.0	69.05	113.87	22.77	23.52	207.53	55.03	34.60
RN114	46.4	66.76	126.48	25.30	20.56	249.20	50.48	30.59
RN115	45.3	65.76	132.25	26.45	19.34	270.26	48.45	28.90
RN116	52.5	71.98	98.88	19.78	27.60	164.64	60.67	39.98

AMCII CN Values Determined From Tatham Engineering Limited CN Calculators

AMCII to AMCIII CN Conversion Based on MTO Design Chart 1.10

CN to CN* Conversion As Per Process Outlined In Visual OTTHYMO Reference Manual

117076 - Barrie Drainage Master Plan	
AMCII to AMCIII CN and Modified CN Conversion Table	
Watershed/Drainage Area:	**Sophia Creek**
Date Completed:	**7-Jun-2017**

City of Barrie:

Precipitation 87.6 mm/hr

Standard IA 5 mm

Catchment	AMCII CN	AMCIII CN	S (mm)	IA (mm)	Q	S* (mm)	AMCIII CN*	AMCII CN*
SP101	63.6	80.35	62.12	12.42	41.16	83.16	75.33	56.75
SP102	73.5	86.72	38.89	7.78	53.67	44.52	85.09	70.84
SP103	81.3	91.22	24.45	4.89	63.84	24.28	91.28	81.43
SP104	76.0	88.20	34.00	6.80	56.87	37.37	87.18	74.26
SP105	76.9	88.75	32.20	6.44	58.10	34.82	87.94	75.55
SP106	77.3	88.98	31.46	6.29	58.62	33.78	88.26	76.09
SP107	76.9	88.71	32.33	6.47	58.01	35.01	87.89	75.45
SP108	75.8	88.10	34.32	6.86	56.65	37.83	87.04	74.02
SP109	61.7	78.99	67.54	13.51	38.76	93.43	73.11	53.90
SP110	37.0	57.59	187.07	37.41	10.62	560.10	31.20	16.42
SP111	76.5	88.50	32.99	6.60	57.56	35.94	87.61	74.98
SP112	73.9	86.94	38.14	7.63	54.15	43.40	85.41	71.35
SP113	77.1	88.86	31.85	6.37	58.35	34.33	88.09	75.81
SP114	61.3	78.67	68.85	13.77	38.20	96.00	72.57	53.23
SP115	38.5	59.22	174.92	34.98	12.17	478.18	34.69	18.71
SP116	43.8	64.33	140.87	28.17	17.63	304.35	45.49	26.53
SP117	77.0	88.81	32.00	6.40	58.25	34.54	88.03	75.70
SP118	52.1	71.67	100.41	20.08	27.15	168.72	60.09	39.39
SP119	76.8	88.68	32.43	6.49	57.95	35.14	87.85	75.39
SP120	45.9	66.34	128.86	25.77	20.05	257.72	49.64	29.89
SP121	61.7	79.01	67.48	13.50	38.78	93.32	73.13	53.93
SP122	53.9	73.11	93.42	18.68	29.26	150.61	62.78	42.12
SP123	43.8	64.35	140.69	28.14	17.66	303.64	45.55	26.58
SP124	56.9	75.47	82.54	16.51	32.90	124.79	67.06	46.73
SP125	78.7	89.76	28.96	5.79	60.42	30.33	89.33	77.95
SP126	40.3	61.01	162.30	32.46	13.98	405.33	38.52	21.34
SP127	77.1	88.85	31.89	6.38	58.32	34.38	88.08	75.78
SP128	77.7	89.20	30.75	6.15	59.13	32.79	88.57	76.62
SP129	73.9	86.97	38.06	7.61	54.20	43.28	85.44	71.41
SP130	76.9	88.71	32.33	6.47	58.01	35.01	87.89	75.45
SP131	77.0	88.76	32.17	6.43	58.13	34.77	87.96	75.58
SP132	46.7	67.02	125.00	25.00	20.89	244.03	51.00	31.04
SP133	69.4	84.20	47.66	9.53	48.48	58.15	81.37	65.14
SP134	81.4	91.28	24.27	4.85	63.98	24.04	91.35	81.58
SP135	56.4	75.06	84.39	16.88	32.24	129.00	66.32	45.91
SP136	65.4	81.56	57.41	11.48	43.39	74.64	77.29	59.35
SP137	47.7	67.87	120.25	24.05	21.97	227.89	52.71	32.52
SP138	57.7	76.07	79.89	15.98	33.86	118.92	68.11	47.93
SP139	43.9	64.50	139.78	27.96	17.84	299.86	45.86	26.82
SP140	46.8	67.10	124.55	24.91	20.99	242.45	51.16	31.18
SP141	44.6	65.09	136.23	27.25	18.53	285.61	47.07	27.79
SP142	47.8	68.04	119.33	23.87	22.19	224.87	53.04	32.81
SP143	49.0	69.03	113.96	22.79	23.49	207.81	55.00	34.57
SP144	49.0	69.05	113.87	22.77	23.52	207.53	55.03	34.60
SP145	49.0	69.00	114.10	22.82	23.46	208.24	54.95	34.52
SP146	77.3	88.98	31.46	6.29	58.62	33.78	88.26	76.09
SP147	55.4	74.28	87.96	17.59	31.03	137.30	64.91	44.38
SP148	49.0	69.05	113.87	22.77	23.52	207.53	55.03	34.60
SP149	53.5	72.82	94.80	18.96	28.83	154.08	62.24	41.57
SP150	36.9	57.53	187.47	37.49	10.57	563.05	31.09	16.35
SP151	40.3	60.96	162.64	32.53	13.93	407.14	38.42	21.27
SP152	46.5	66.87	125.81	25.16	20.71	246.86	50.71	30.79
SP153	43.6	64.14	142.02	28.40	17.41	309.19	45.10	26.23

117076 - Barrie Drainage Master Plan

AMCII to AMCIII CN and Modified CN Conversion Table

Watershed/Drainage Area:	**Sophia Creek**
Date Completed:	**7-Jun-2017**

City of Barrie:

Precipitation 87.6 mm/hr

Standard IA 5 mm

Catchment	AMCII CN	AMCIII CN	S (mm)	IA (mm)	Q	S* (mm)	AMCIII CN*	AMCII CN*
SP154	61.0	78.46	69.74	13.95	37.83	97.75	72.21	52.78
SP155	41.7	62.41	153.00	30.60	15.47	358.38	41.48	23.48
SP156	48.9	68.99	114.19	22.84	23.44	208.52	54.92	34.49
SP157	49.0	69.05	113.87	22.77	23.52	207.53	55.03	34.60
SP158	49.0	69.05	113.87	22.77	23.52	207.53	55.03	34.60
SP159	77.0	88.78	32.11	6.42	58.17	34.69	87.98	75.62
SP160	41.7	62.41	153.00	30.60	15.47	358.38	41.48	23.48
SP161	46.6	66.97	125.25	25.05	20.83	244.91	50.91	30.96
SP162	45.1	65.60	133.22	26.64	19.14	273.94	48.11	28.63
SP163	47.9	68.09	119.04	23.81	22.26	223.93	53.15	32.90
SP164	42.6	63.22	147.79	29.56	16.37	334.25	43.18	24.75
SP165	44.6	65.15	135.90	27.18	18.60	284.31	47.19	27.88
SP166	48.3	68.41	117.27	23.45	22.68	218.23	53.79	33.47
SP167	41.1	61.73	157.44	31.49	14.74	380.14	40.05	22.44
SP168	49.0	69.05	113.87	22.77	23.52	207.53	55.03	34.60
SP169	43.2	63.78	144.25	28.85	17.00	318.68	44.35	25.65
SP170	76.4	88.42	33.27	6.65	57.36	36.34	87.48	74.77
SP171	45.2	65.65	132.89	26.58	19.20	272.70	48.22	28.72
SP172	49.0	69.05	113.87	22.77	23.52	207.53	55.03	34.60
SP173	42.4	63.01	149.13	29.83	16.13	340.34	42.74	24.42
SP174	43.2	63.76	144.37	28.87	16.98	319.19	44.31	25.62
SP175	44.1	64.68	138.70	27.74	18.05	295.46	46.23	27.11
SP176	45.7	66.16	129.90	25.98	19.82	261.55	49.27	29.58
SP177	41.8	62.45	152.75	30.55	15.51	357.18	41.56	23.54
SP178	56.4	75.10	84.22	16.84	32.30	128.60	66.39	45.99
SP179	36.8	57.37	188.77	37.75	10.41	572.66	30.73	16.12
SP180	49.0	69.05	113.87	22.77	23.52	207.53	55.03	34.60
SP181	65.4	81.56	57.44	11.49	43.38	74.69	77.28	59.34
SP182	49.0	69.05	113.87	22.77	23.52	207.53	55.03	34.60
SP183	42.0	62.70	151.11	30.22	15.79	349.48	42.09	23.93
SP184	78.9	89.85	28.68	5.74	60.62	29.94	89.46	78.16

AMCII CN Values Determined From Tatham Engineering Limited CN Calculators

AMCII to AMCIII CN Conversion Based on MTO Design Chart 1.10

CN to CN* Conversion As Per Process Outlined In Visual OTTHYMO Reference Manual

117076 - Barrie Drainage Master Plan

AMCII to AMCIII CN and Modified CN Conversion Table

Watershed/Drainage Area:	**St. Vincent**
Date Completed:	**7-Jun-2017**

City of Barrie:

Precipitation 87.6 mm/hr

Standard Ia 5 mm

Catchment	AMCII CN	AMCIII CN	S (mm)	Ia (mm)	Q	S* (mm)	AMCIII CN*	AMCII CN*
SV101	43.8	64.34	140.81	28.16	17.64	304.12	45.51	26.55
SV102	41.7	62.37	153.25	30.65	15.43	359.59	41.40	23.42
SV103	38.1	58.80	178.00	35.60	11.76	497.73	33.79	18.10
SV104	38.5	59.14	175.52	35.10	12.09	481.91	34.52	18.59
SV105	40.9	61.56	158.62	31.72	14.56	386.13	39.68	22.17
SV106	45.3	65.76	132.25	26.45	19.34	270.26	48.45	28.90
SV107	42.7	63.37	146.82	29.36	16.54	329.92	43.50	24.99
SV108	44.1	64.67	138.75	27.75	18.04	295.69	46.21	27.10
SV109	38.2	58.90	177.24	35.45	11.86	492.86	34.01	18.25
SV110	39.9	60.57	165.38	33.08	13.52	422.10	37.57	20.67
SV111	45.0	65.51	133.70	26.74	19.04	275.80	47.94	28.49

AMCII CN Values Determined From Tatham Engineering Limited CN Calculators

AMCII to AMCIII CN Conversion Based on MTO Design Chart 1.10

CN to CN* Conversion As Per Process Outlined In Visual OTTHYMO Reference Manual

117076 - Barrie Drainage Master Plan

AMCII to AMCIII CN and Modified CN Conversion Table

Watershed/Drainage Area:	**Williams and Holgate**
Date Completed:	**7-Jun-2017**

City of Barrie:

Precipitation 87.6 mm/hr

Standard Ia 5 mm

Catchment	AMCII CN	AMCIII CN	S (mm)	Ia (mm)	Q	S* (mm)	AMCIII CN*	AMCII CN*
W&H101	45.7	66.13	130.12	26.02	19.78	262.33	49.19	29.52
W&H102	46.2	66.58	127.51	25.50	20.34	252.86	50.11	30.29
W&H103	44.5	65.02	136.62	27.32	18.45	287.15	46.94	27.68
W&H104	47.5	67.74	120.98	24.20	21.80	230.32	52.44	32.29
W&H105	48.7	68.79	115.26	23.05	23.17	211.84	54.53	34.13
W&H106	57.7	76.06	79.96	15.99	33.83	119.06	68.09	47.90
W&H107	53.8	73.03	93.80	18.76	29.14	151.56	62.63	41.97
W&H108	40.4	61.09	161.76	32.35	14.07	402.45	38.69	21.46
W&H109	42.0	62.66	151.36	30.27	15.75	350.65	42.01	23.87
W&H110	45.9	66.31	129.06	25.81	20.00	258.48	49.56	29.83
W&H111	43.4	64.00	142.90	28.58	17.25	312.89	44.81	26.00
W&H112	48.4	68.53	116.66	23.33	22.83	216.27	54.01	33.67
W&H113	56.5	75.15	84.01	16.80	32.38	128.13	66.47	46.08
W&H114	57.1	75.60	81.96	16.39	33.10	123.50	67.28	46.99
W&H115	52.5	71.98	98.88	19.78	27.60	164.64	60.67	39.98
W&H116	58.8	76.88	76.38	15.28	35.18	111.37	69.52	49.55
W&H117	47.5	67.74	120.98	24.20	21.80	230.32	52.44	32.29
W&H118	45.2	65.67	132.78	26.56	19.22	272.29	48.26	28.75
W&H119	43.2	63.81	144.07	28.81	17.04	317.91	44.41	25.69
W&H120	46.2	66.58	127.51	25.50	20.34	252.86	50.11	30.29
W&H121	42.9	63.52	145.86	29.17	16.71	325.67	43.82	25.24
W&H122	44.7	65.21	135.51	27.10	18.67	282.79	47.32	27.99
W&H123	46.9	67.21	123.94	24.79	21.13	240.37	51.38	31.36
W&H124	45.7	66.13	130.12	26.02	19.78	262.33	49.19	29.52
W&H125	56.3	74.99	84.71	16.94	32.14	129.71	66.20	45.78
W&H126	49.6	69.56	111.15	22.23	24.21	199.24	56.04	35.52
W&H127	55.2	74.14	88.61	17.72	30.81	138.84	64.66	44.10

AMCII CN Values Determined From Tatham Engineering Limited CN Calculators

AMCII to AMCIII CN Conversion Based on MTO Design Chart 1.10

CN to CN* Conversion As Per Process Outlined In Visual OTTHYMO Reference Manual

117076 - Barrie Drainage Master Plan

AMCII to AMCIII CN and Modified CN Conversion Table

Watershed/Drainage Area:	**Whiskey Creek**
Date Completed:	**7-Jun-2017**

City of Barrie:

Precipitation 87.6 mm/hr

Standard Ia 5 mm

Catchment	AMCII CN	AMCIII CN	S (mm)	Ia (mm)	Q	S* (mm)	AMCIII CN*	AMCII CN*
WK101	58.2	76.40	78.48	15.70	34.38	115.85	68.68	48.57
WK102	55.6	74.43	87.24	17.45	31.27	135.61	65.19	44.68
WK103	48.3	68.44	117.13	23.43	22.71	217.77	53.84	33.52
WK104	49.8	69.73	110.26	22.05	24.44	196.57	56.37	35.83
WK105	52.5	71.96	99.00	19.80	27.56	164.96	60.63	39.93
WK106	57.7	76.04	80.02	16.00	33.81	119.21	68.06	47.87
WK107	49.0	69.05	113.87	22.77	23.52	207.53	55.03	34.60
WK108	51.7	71.36	101.96	20.39	26.70	172.92	59.50	38.81
WK109	49.4	69.39	112.05	22.41	23.98	201.95	55.71	35.21
WK110	47.5	67.74	120.98	24.20	21.80	230.32	52.44	32.29
WK111	55.3	74.23	88.17	17.63	30.95	137.81	64.83	44.29
WK112	48.9	68.96	114.33	22.87	23.40	208.95	54.87	34.44
WK113	41.8	62.47	152.62	30.52	15.54	356.58	41.60	23.57
WK114	45.3	65.75	132.30	26.46	19.32	270.46	48.43	28.89
WK115	51.4	71.07	103.37	20.67	26.30	176.80	58.96	38.29
WK116	46.5	66.86	125.92	25.18	20.69	247.22	50.68	30.76
WK117	43.5	64.05	142.55	28.51	17.32	311.40	44.92	26.09
WK118	47.3	67.54	122.06	24.41	21.55	233.94	52.06	31.95
WK119	54.6	73.65	90.87	18.17	30.07	144.31	63.77	43.16
WK120	49.0	69.05	113.87	22.77	23.52	207.53	55.03	34.60
WK121	46.1	66.48	128.07	25.61	20.22	254.90	49.91	30.12
WK122	53.1	72.47	96.50	19.30	28.31	158.44	61.58	40.90
WK123	48.2	68.33	117.75	23.55	22.57	219.75	53.61	33.32
WK124	42.0	62.70	151.11	30.22	15.79	349.48	42.09	23.93
WK125	46.3	66.67	126.99	25.40	20.45	251.02	50.29	30.44
WK126	43.3	63.89	143.54	28.71	17.13	315.64	44.59	25.83
WK127	47.3	67.56	121.96	24.39	21.58	233.60	52.09	31.98
WK128	53.7	72.91	94.38	18.88	28.96	153.01	62.41	41.74
WK129	59.4	77.32	74.49	14.90	35.91	107.39	70.28	50.45
WK130	59.0	77.01	75.84	15.17	35.38	110.22	69.74	49.81
WK131	56.7	75.30	83.32	16.66	32.62	126.56	66.74	46.38
WK132	57.6	75.99	80.25	16.05	33.72	119.72	67.97	47.76
WK133	55.5	74.37	87.53	17.51	31.17	136.28	65.08	44.56
WK134	52.8	72.19	97.84	19.57	27.90	161.92	61.07	40.38
WK135	52.4	71.90	99.28	19.86	27.48	165.70	60.52	39.82
WK136	54.1	73.25	92.78	18.56	29.46	149.01	63.03	42.38
WK137	62.4	79.48	65.57	13.11	39.62	89.63	73.92	54.92
WK138	58.0	76.29	78.93	15.79	34.21	116.84	68.49	48.36
WK139	56.3	74.99	84.71	16.94	32.14	129.71	66.20	45.78
WK140	56.8	75.38	82.95	16.59	32.75	125.71	66.89	46.55
WK141	58.7	76.78	76.83	15.37	35.00	112.31	69.34	49.34
WK142	60.3	77.97	71.78	14.36	36.99	101.84	71.38	51.77
WK143	65.1	81.35	58.24	11.65	42.99	76.11	76.94	58.88
WK144	69.9	84.49	46.61	9.32	49.06	56.47	81.81	65.79
WK145	60.6	78.22	70.72	14.14	37.42	99.71	71.81	52.29
WK146	57.0	75.54	82.23	16.45	33.01	124.11	67.18	46.87
WK147	57.8	76.12	79.69	15.94	33.93	118.48	68.19	48.02
WK148	57.7	76.07	79.92	15.98	33.85	118.99	68.10	47.91
WK149	58.3	76.49	78.09	15.62	34.53	115.00	68.83	48.75
WK150	52.7	72.10	98.28	19.66	27.77	163.06	60.90	40.21
WK151	57.9	76.21	79.30	15.86	34.08	117.62	68.35	48.20
WK152	59.0	77.03	75.75	15.15	35.42	110.02	69.78	49.85
WK153	53.6	72.86	94.61	18.92	28.89	153.59	62.32	41.65

117076 - Barrie Drainage Master Plan

AMCII to AMCIII CN and Modified CN Conversion Table

Watershed/Drainage Area:	**Whiskey Creek**
Date Completed:	**7-Jun-2017**

City of Barrie:

Precipitation 87.6 mm/hr

Standard Ia 5 mm

Catchment	AMCII CN	AMCIII CN	S (mm)	Ia (mm)	Q	S* (mm)	AMCIII CN*	AMCII CN*
WK154	55.4	74.26	88.03	17.61	31.00	137.47	64.88	44.35
WK155	56.3	74.98	84.77	16.95	32.11	129.87	66.17	45.75
WK156	57.7	76.04	80.02	16.00	33.81	119.21	68.06	47.87
WK157	56.1	74.83	85.44	17.09	31.88	131.40	65.91	45.46
WK158	61.7	79.00	67.52	13.50	38.77	93.39	73.12	53.91
WK159	59.0	77.03	75.75	15.15	35.42	110.02	69.78	49.85
WK160	66.0	81.95	55.93	11.19	44.12	72.04	77.90	60.19
WK161	56.6	75.22	83.67	16.73	32.50	127.34	66.61	46.23
WK162	57.8	76.10	79.76	15.95	33.91	118.63	68.16	47.99
WK163	53.8	73.05	93.73	18.75	29.16	151.37	62.66	42.00
WK164	52.3	71.84	99.56	19.91	27.40	166.45	60.41	39.72
WK165	55.0	74.00	89.22	17.84	30.61	140.32	64.41	43.85
WK166	54.1	73.27	92.67	18.53	29.49	148.73	63.07	42.43
WK167	52.0	71.55	100.98	20.20	26.98	170.26	59.87	39.18
WK168	54.2	73.34	92.33	18.47	29.60	147.89	63.20	42.56
WK169	53.6	72.89	94.48	18.90	28.93	153.26	62.37	41.70

AMCII CN Values Determined From Tatham Engineering Limited CN Calculators

AMCII to AMCIII CN Conversion Based on MTO Design Chart 1.10

CN to CN* Conversion As Per Process Outlined In Visual OTTHYMO Reference Manual

117076 - Barrie Drainage Master Plan

AMCII to AMCIII CN and Modified CN Conversion Table

Watershed/Drainage Area:	**Bayshore, Royal Oak, Gray Lane**
Date Completed:	**11-Jun-2017**

City of Barrie:

Precipitation 87.6 mm/hr

Standard Ia 5 mm

Catchment	AMCII CN	AMCIII CN	S (mm)	Ia (mm)	Q	S* (mm)	AMCIII CN*	AMCII CN*
RY106	57.69	76.05	79.99	16.00	33.82	119.14	68.07	47.88
BY108	75.81	88.10	34.32	6.86	56.65	37.83	87.04	74.02
BY112	74.09	87.08	37.70	7.54	54.43	42.75	85.59	71.65
BY121	64.00	80.60	61.15	12.23	41.61	81.37	75.74	57.28
RY101	53.69	72.94	94.22	18.84	29.01	152.62	62.47	41.80
RY102	53.76	73.00	93.96	18.79	29.09	151.96	62.57	41.91
RY103	55.22	74.15	88.53	17.71	30.84	138.66	64.69	44.14
RY104	55.18	74.13	88.66	17.73	30.79	138.98	64.63	44.08
RY105	54.52	73.60	91.10	18.22	30.00	144.86	63.68	43.07
GL101	53.68	72.93	94.26	18.85	28.99	152.72	62.45	41.78
GL102	55.12	74.07	88.91	17.78	30.71	139.57	64.54	43.98
GL103	53.30	72.63	95.73	19.15	28.54	156.44	61.88	41.20
GL104	54.39	73.50	91.59	18.32	29.84	146.07	63.49	42.87
GL105	55.80	74.61	86.45	17.29	31.53	133.76	65.50	45.02
GL106	54.89	73.89	89.75	17.95	30.43	141.59	64.21	43.63
GL107	54.79	73.81	90.11	18.02	30.32	142.45	64.07	43.48
BY101	56.46	75.12	84.13	16.83	32.33	128.40	66.42	46.03
BY102	57.11	75.61	81.92	16.38	33.12	123.41	67.30	47.01
BY103	58.83	76.90	76.29	15.26	35.21	111.18	69.55	49.59
BY104	56.20	74.91	85.05	17.01	32.02	130.51	66.06	45.63
BY105	58.57	76.71	77.11	15.42	34.90	112.91	69.23	49.21
BY106	57.48	75.89	80.67	16.13	33.57	120.64	67.80	47.57
BY107	58.94	76.99	75.92	15.18	35.35	110.39	69.71	49.77
BY109	53.06	72.43	96.66	19.33	28.26	158.84	61.52	40.84
BY110	58.29	76.50	78.02	15.60	34.55	114.86	68.86	48.79
BY111	54.92	73.92	89.63	17.93	30.47	141.30	64.25	43.67
BY113	58.85	76.91	76.24	15.25	35.23	111.06	69.58	49.62
BY114	53.45	72.75	95.14	19.03	28.72	154.94	62.11	41.44
BY115	59.00	77.03	75.75	15.15	35.42	110.02	69.78	49.85
BY116	57.89	76.20	79.33	15.87	34.06	117.70	68.34	48.18
BY117	57.01	75.54	82.26	16.45	33.00	124.17	67.17	46.85
BY118	59.00	77.03	75.75	15.15	35.42	110.02	69.78	49.85
BY119	58.99	77.02	75.76	15.15	35.41	110.06	69.77	49.84
BY120	58.12	76.38	78.57	15.71	34.35	116.04	68.64	48.53

AMCII CN Values Determined From Tatham Engineering Limited CN Calculators

AMCII to AMCIII CN Conversion Based on MTO Design Chart 1.10

CN to CN* Conversion As Per Process Outlined In Visual OTTHYMO Reference Manual

117076 - Barrie Drainage Master Plan

AMCII to AMCIII CN and Modified CN Conversion Table

Watershed/Drainage Area:	**Lovers Creek**
Date Completed:	**7-Jun-2017**

City of Barrie:

Precipitation 87.6 mm/hr

Standard Ia 5 mm

Catchment	AMCII CN	AMCIII CN	S (mm)	Ia (mm)	Q	S* (mm)	AMCIII CN*	AMCII CN*
LV123	56.19	74.91	85.10	17.02	32.00	130.61	66.04	45.61
LV124	61.22	78.64	68.98	13.80	38.15	96.25	72.52	53.17
LV125	62.85	79.80	64.31	12.86	40.17	87.23	74.44	55.58
LV126	48.86	68.92	114.53	22.91	23.35	209.56	54.79	34.38
LV127	58.67	76.78	76.80	15.36	35.01	112.26	69.35	49.35
LV128	65.98	81.94	55.99	11.20	44.09	72.15	77.88	60.16
LV129	46.03	66.42	128.39	25.68	20.15	256.04	49.80	30.02
LV130	37.18	57.81	185.38	37.08	10.82	547.90	31.67	16.73
LV131	42.57	63.20	147.88	29.58	16.35	334.65	43.15	24.73
LV132	55.19	74.13	88.66	17.73	30.79	138.96	64.64	44.08
LV133	47.22	67.49	122.37	24.47	21.48	235.01	51.94	31.85
LV134	44.09	64.64	138.92	27.78	18.00	296.36	46.15	27.05
LV135	44.50	65.03	136.60	27.32	18.46	287.06	46.94	27.69
LV136	49.00	69.05	113.87	22.77	23.52	207.53	55.03	34.60
LV137	48.78	68.86	114.89	22.98	23.26	210.68	54.66	34.26
LV138	48.73	68.81	115.13	23.03	23.20	211.43	54.57	34.18
LV139	48.98	69.03	113.98	22.80	23.49	207.86	54.99	34.56
LV140	47.52	67.76	120.86	24.17	21.83	229.94	52.49	32.32
LV141	46.76	67.08	124.66	24.93	20.96	242.85	51.12	31.14
LV142	44.39	64.92	137.23	27.45	18.33	289.57	46.73	27.51
LV143	49.38	69.37	112.13	22.43	23.96	202.20	55.68	35.18
LV144	51.49	71.15	102.99	20.60	26.41	175.76	59.10	38.43
LV145	48.87	68.93	114.48	22.90	23.36	209.42	54.81	34.39
LV146	45.25	65.72	132.49	26.50	19.29	271.18	48.36	28.84
LV147	44.96	65.45	134.07	26.81	18.96	277.20	47.82	28.39
LV148	49.43	69.41	111.93	22.39	24.01	201.58	55.75	35.25
LV149	52.94	72.33	97.15	19.43	28.11	160.12	61.34	40.64
LV150	49.22	69.23	112.89	22.58	23.76	204.50	55.40	34.93
LV151	54.62	73.68	90.74	18.15	30.11	143.99	63.82	43.21
LV152	44.38	64.92	137.28	27.46	18.32	289.77	46.71	27.50
LV153	50.33	70.18	107.92	21.58	25.06	189.71	57.24	36.65
LV154	48.87	68.93	114.47	22.89	23.37	209.38	54.82	34.40
LV155	41.60	62.27	153.89	30.78	15.32	362.68	41.19	23.27
LV156	48.47	68.59	116.32	23.26	22.91	215.19	54.14	33.78
LV157	48.51	68.63	116.13	23.23	22.96	214.57	54.21	33.85
LV158	48.92	68.97	114.26	22.85	23.42	208.73	54.89	34.47
LV159	45.11	65.59	133.26	26.65	19.13	274.09	48.10	28.62
LV160	48.84	68.91	114.59	22.92	23.34	209.74	54.77	34.36
LV161	43.90	64.47	139.99	28.00	17.80	300.73	45.79	26.77
LV162	38.26	58.93	177.02	35.40	11.89	491.43	34.07	18.29
LV162_1	48.92	68.98	114.23	22.85	23.43	208.64	54.90	34.48
LV163	39.33	60.02	169.18	33.84	12.96	443.65	36.41	19.87
LV164	44.90	65.40	134.39	26.88	18.90	278.44	47.70	28.30
LV165	48.41	68.54	116.59	23.32	22.84	216.06	54.04	33.69
LV166	43.00	63.62	145.23	29.05	16.82	322.93	44.03	25.40
LV167	49.00	69.05	113.87	22.77	23.52	207.53	55.03	34.60
LV168	49.00	69.05	113.85	22.77	23.52	207.46	55.04	34.60
LV169	55.12	74.07	88.91	17.78	30.71	139.57	64.54	43.98
LV170	57.66	76.03	80.09	16.02	33.78	119.36	68.03	47.83
LV171	59.82	77.63	73.18	14.64	36.43	104.70	70.81	51.08
LV172	72.86	86.34	40.20	8.04	52.85	46.49	84.53	69.96
LV173	57.92	76.22	79.23	15.85	34.10	117.48	68.38	48.23
LV174	68.21	83.41	50.52	10.10	46.91	62.84	80.17	63.38

117076 - Barrie Drainage Master Plan

AMCII to AMCIII CN and Modified CN Conversion Table

Watershed/Drainage Area:	**Lovers Creek**
Date Completed:	**7-Jun-2017**

City of Barrie:

Precipitation 87.6 mm/hr

Standard Ia 5 mm

Catchment	AMCII CN	AMCIII CN	S (mm)	Ia (mm)	Q	S* (mm)	AMCIII CN*	AMCII CN*
LV175	65.80	81.82	56.44	11.29	43.87	72.93	77.69	59.90
LV176	56.77	75.35	83.10	16.62	32.70	126.05	66.83	46.48
LV177	61.21	78.64	68.99	13.80	38.14	96.27	72.52	53.16
LV178	47.71	67.92	119.98	24.00	22.04	227.01	52.81	32.60
LV179	52.76	72.19	97.83	19.57	27.91	161.88	61.08	40.38
LV180	53.19	72.54	96.14	19.23	28.42	157.51	61.72	41.04
LV181	54.46	73.55	91.32	18.26	29.92	145.41	63.59	42.97
LV182	48.07	68.24	118.22	23.64	22.45	221.26	53.44	33.17
LV183	49.65	69.61	110.91	22.18	24.27	198.50	56.13	35.60
LV184	50.00	69.90	109.39	21.88	24.67	194.01	56.70	36.13
LV185	48.07	68.24	118.24	23.65	22.45	221.33	53.44	33.16
LV186	45.42	65.87	131.61	26.32	19.47	267.86	48.67	29.09
LV187	49.00	69.05	113.87	22.77	23.52	207.53	55.03	34.60
LV188	45.29	65.75	132.33	26.47	19.32	270.56	48.42	28.88
LV189	48.77	68.84	114.95	22.99	23.25	210.88	54.64	34.24
LV190	49.03	69.07	113.72	22.74	23.56	207.05	55.09	34.65
LV191	49.00	69.05	113.87	22.77	23.52	207.53	55.03	34.60
LV192	41.69	62.36	153.28	30.66	15.42	359.75	41.38	23.41
LV193	49.13	69.16	113.28	22.66	23.67	205.69	55.25	34.80
LV194	49.37	69.37	112.18	22.44	23.94	202.34	55.66	35.17
LV195	49.40	69.39	112.07	22.41	23.97	202.00	55.70	35.21
LV196	48.04	68.22	118.35	23.67	22.42	221.70	53.40	33.12
LV197	57.05	75.57	82.12	16.42	33.05	123.85	67.22	46.92
LV198	50.98	70.73	105.12	21.02	25.82	181.68	58.30	37.65
LV199	52.03	71.60	100.77	20.15	27.04	169.70	59.95	39.26
LV200	53.90	73.11	93.43	18.69	29.25	150.64	62.77	42.12
LV201	57.93	76.23	79.20	15.84	34.11	117.42	68.39	48.24
LV202	58.56	76.70	77.14	15.43	34.89	112.98	69.21	49.20
LV203	59.00	77.03	75.75	15.15	35.42	110.02	69.78	49.85
LV204	59.00	77.03	75.75	15.15	35.42	110.02	69.78	49.85
LV205	58.59	76.72	77.06	15.41	34.92	112.81	69.25	49.23
LV206	57.10	75.60	81.97	16.39	33.10	123.51	67.28	46.99
LV207	58.85	76.92	76.21	15.24	35.24	111.01	69.59	49.63
LV208	58.57	76.71	77.10	15.42	34.90	112.90	69.23	49.21
LV209	63.48	80.24	62.56	12.51	40.96	83.97	75.15	56.51
LV210	58.66	76.78	76.82	15.36	35.01	112.30	69.34	49.35
LV211	58.00	76.28	78.97	15.79	34.20	116.91	68.48	48.35
LV212	64.14	80.69	60.79	12.16	41.78	80.70	75.89	57.47
LV213	60.72	78.29	70.45	14.09	37.54	99.16	71.92	52.43
LV214	58.66	76.78	76.82	15.36	35.01	112.29	69.34	49.35
LV215	57.36	75.80	81.09	16.22	33.42	121.56	67.63	47.38
LV216	58.22	76.45	78.26	15.65	34.46	115.37	68.77	48.68
LV217	56.68	75.28	83.39	16.68	32.59	126.72	66.72	46.35
LV218	59.11	77.11	75.39	15.08	35.56	109.27	69.92	50.02
LV219	58.82	76.90	76.32	15.26	35.20	111.23	69.55	49.58
LV220	60.09	77.83	72.35	14.47	36.76	102.99	71.15	51.49
LV221	58.12	76.37	78.59	15.72	34.34	116.08	68.63	48.52
LV222	57.76	76.11	79.75	15.95	33.91	118.60	68.17	47.99
LV223	58.39	76.58	77.70	15.54	34.67	114.17	68.99	48.94
LV224	52.28	71.80	99.76	19.95	27.34	167.00	60.33	39.64
LV225	56.56	75.19	83.81	16.76	32.45	127.66	66.55	46.17
LV226	54.42	73.52	91.48	18.30	29.87	145.79	63.53	42.91
LV227	57.03	75.55	82.19	16.44	33.02	124.02	67.19	46.89

117076 - Barrie Drainage Master Plan

AMCII to AMCIII CN and Modified CN Conversion Table

Watershed/Drainage Area:	**Lovers Creek**
Date Completed:	**7-Jun-2017**

City of Barrie:

Precipitation 87.6 mm/hr

Standard Ia 5 mm

Catchment	AMCII CN	AMCIII CN	S (mm)	Ia (mm)	Q	S* (mm)	AMCIII CN*	AMCII CN*
LV228	55.55	74.41	87.36	17.47	31.23	135.88	65.15	44.63
LV229	58.29	76.50	78.02	15.60	34.55	114.87	68.86	48.78
LV230	57.34	75.78	81.16	16.23	33.39	121.72	67.60	47.35
LV231	53.50	72.79	94.93	18.99	28.79	154.42	62.19	41.52
LV232	61.40	78.77	68.45	13.69	38.37	95.21	72.73	53.43
LV233	56.29	74.99	84.73	16.95	32.13	129.77	66.18	45.76
LV234	57.20	75.68	81.63	16.33	33.22	122.77	67.42	47.14
LV235	57.18	75.67	81.68	16.34	33.20	122.88	67.40	47.11
LV236	56.88	75.44	82.69	16.54	32.84	125.14	66.99	46.66
LV237	61.96	79.17	66.81	13.36	39.07	92.02	73.41	54.27
LV238	58.44	76.61	77.54	15.51	34.73	113.84	69.05	49.01
LV239	53.58	72.85	94.64	18.93	28.88	153.69	62.30	41.63
LV240	57.58	75.96	80.37	16.07	33.68	119.97	67.92	47.71
LV241	55.40	74.30	87.87	17.57	31.06	137.10	64.95	44.41
LV242	56.71	75.31	83.29	16.66	32.63	126.48	66.76	46.40
LV243	55.22	74.15	88.54	17.71	30.83	138.69	64.68	44.13
LV244	54.85	73.86	89.89	17.98	30.39	141.93	64.15	43.57
LV245	60.33	78.00	71.63	14.33	37.05	101.53	71.44	51.84
LV246	54.43	73.53	91.42	18.28	29.89	145.65	63.56	42.93

AMCII CN Values Determined From Tatham Engineering Limited CN Calculators

AMCII to AMCIII CN Conversion Based on MTO Design Chart 1.10

CN to CN* Conversion As Per Process Outlined In Visual OTTHYMO Reference Manual

117076 - Barrie Drainage Master Plan

AMCII to AMCIII CN and Modified CN Conversion Table

Watershed/Drainage Area:	**Hewitt's Creek**
Date Completed:	**7-Jun-2017**

City of Barrie:

Precipitation 87.6 mm/hr

Standard Ia 5 mm

Catchment	AMCII CN	AMCIII CN	S (mm)	Ia (mm)	Q	S* (mm)	AMCIII CN*	AMCII CN*
HW141_1	57.71	76.07	79.91	15.98	33.85	118.97	68.10	47.91
HW141_2	58.52	76.67	77.29	15.46	34.83	113.30	69.15	49.13
HW142	58.15	76.40	78.46	15.69	34.39	115.82	68.68	48.58
HW143	51.71	71.33	102.07	20.41	26.67	173.24	59.45	38.77
HW144	59.80	77.62	73.25	14.65	36.40	104.84	70.78	51.05
HW145	57.35	75.79	81.12	16.22	33.41	121.62	67.62	47.37
HW146	57.14	75.63	81.83	16.37	33.15	123.21	67.34	47.05
HW147_1	59.00	77.03	75.75	15.15	35.42	110.03	69.78	49.85
HW147_2	59.00	77.03	75.75	15.15	35.42	110.03	69.78	49.85
HW148	58.56	76.70	77.15	15.43	34.88	113.00	69.21	49.19
HW149	61.97	79.18	66.79	13.36	39.08	91.97	73.42	54.29
HW150	58.80	76.88	76.38	15.28	35.17	111.37	69.52	49.55
HW151_1	53.57	72.85	94.67	18.93	28.87	153.74	62.29	41.62
HW151_2	49.15	69.17	113.20	22.64	23.69	205.46	55.28	34.82
HW152	48.12	68.28	117.97	23.59	22.51	220.47	53.53	33.25
HW153	58.15	76.39	78.49	15.70	34.38	115.86	68.67	48.57
HW154_1	57.20	75.68	81.64	16.33	33.22	122.78	67.41	47.13
HW154_2	58.02	76.30	78.90	15.78	34.22	116.77	68.51	48.38
HW155	47.92	68.11	118.95	23.79	22.28	223.63	53.18	32.93
HW156	55.89	74.68	86.13	17.23	31.64	133.01	65.63	45.16
HW157	57.01	75.54	82.27	16.45	32.99	124.18	67.16	46.85
HW158	54.23	73.37	92.19	18.44	29.65	147.54	63.26	42.62
HW159	54.58	73.65	90.87	18.17	30.07	144.30	63.77	43.16
HW160	54.91	73.91	89.68	17.94	30.46	141.41	64.24	43.66
HW161_1	58.20	76.43	78.31	15.66	34.44	115.49	68.74	48.65
HW161_2	60.96	78.46	69.74	13.95	37.83	97.76	72.21	52.78
HW162_1	57.61	75.99	80.26	16.05	33.72	119.74	67.96	47.76
HW162_2	58.89	76.95	76.08	15.22	35.29	110.73	69.64	49.69
HW163	56.14	74.87	85.25	17.05	31.95	130.97	65.98	45.54
HW164	57.12	75.62	81.88	16.38	33.13	123.32	67.32	47.03
HW165	56.01	74.77	85.71	17.14	31.79	132.02	65.80	45.34
HW166	51.29	70.99	103.82	20.76	26.18	178.04	58.79	38.12
HW167	58.02	76.30	78.91	15.78	34.22	116.79	68.50	48.37

AMCII CN Values Determined From Tatham Engineering Limited CN Calculators

AMCII to AMCIII CN Conversion Based on MTO Design Chart 1.10

CN to CN* Conversion As Per Process Outlined In Visual OTTHYMO Reference Manual

117076 - Barrie Drainage Master Plan

Modified CN Conversion Table

Watershed/Drainage Area:	**Lovers Creek & Hewitt's Creek Annexation Lands**
Date Completed:	**21-Jun-2017**

City of Barrie:

Precipitation 87.6 mm/hr

Standard Ia 5 mm

Catchment	AMCII CN	AMCIII CN	Q	S (mm)	Ia (mm)	Q	S* (mm)	AMCIII CN*
29134	63.34	80.14	40.79	62.94	12.59	40.79	84.67	75.00
29130	69.06	83.96	47.99	48.54	9.71	47.99	59.58	81.00
29132	63.34	80.14	40.79	62.94	12.59	40.79	84.67	75.00
29135	68.04	83.30	46.70	50.92	10.18	46.70	63.50	80.00
261143	69.47	84.22	48.51	47.60	9.52	48.51	58.04	81.40
261141	58.86	76.93	35.25	76.19	15.24	35.25	110.94	69.60
261142	51.68	71.31	26.63	102.21	20.44	26.63	173.61	59.40
261192	63.34	80.14	40.79	62.94	12.59	40.79	84.67	75.00
261191	64.14	80.70	41.79	60.76	12.15	41.79	80.65	75.90
261212	66.28	82.14	44.47	55.23	11.05	44.47	70.81	78.20
261211	64.78	81.13	42.59	59.07	11.81	42.59	77.59	76.60
261225	51.49	71.15	26.41	102.99	20.60	26.41	175.78	59.10
261222	55.09	74.05	30.68	89.00	17.80	30.68	139.80	64.50
261223	49.70	69.64	24.32	110.72	22.14	24.32	197.96	56.20
261224	56.15	74.88	31.96	85.21	17.04	31.96	130.85	66.00
261221	58.71	76.81	35.06	76.68	15.34	35.06	111.99	69.40

AMCII CN Values Determined From Tatham Engineering Limited CN Calculators

AMCII to AMCIII CN Conversion Based on MTO Design Chart 1.10

CN to CN* Conversion As Per Process Outlined In Visual OTTHYMO Reference Manual

117076 - Barrie Drainage Master Plan	
AMCII to AMCIII CN and Modified CN Conversion Table	
Watershed/Drainage Area:	**Bear Creek and External**
Date Completed:	**7-Jun-2017**

City of Barrie:
Precipitation 87.6 mm/hr
Standard Ia 5 mm

Catchment	AMCII CN	AMCIII CN	S (mm)	Ia (mm)	Q	S* (mm)	AMCIII CN*	AMCII CN*
BR101	53.5	72.83	94.78	18.96	28.83	154.03	62.25	41.58
BR102	57.8	76.12	79.70	15.94	33.93	118.50	68.19	48.01
BR103	48.7	68.76	115.39	23.08	23.14	212.25	54.48	34.09
BR104	61.4	78.76	68.51	13.70	38.35	95.33	72.71	53.40
BR105	57.2	75.65	81.76	16.35	33.18	123.05	67.37	47.08
BR106	36.7	57.33	189.02	37.80	10.38	574.49	30.66	16.08
BR107	55.6	74.42	87.33	17.47	31.24	135.81	65.16	44.65
BR108	45.2	65.65	132.89	26.58	19.20	272.70	48.22	28.72
BR109	57.1	75.64	81.82	16.36	33.15	123.19	67.34	47.05
BR110	58.7	76.84	76.56	15.31	35.11	111.74	69.45	49.47
BR111	56.8	75.41	82.83	16.57	32.79	125.45	66.94	46.60
BR112	59.7	77.57	73.45	14.69	36.32	105.25	70.70	50.95
BR113	58.4	76.59	77.65	15.53	34.69	114.07	69.01	48.96
BR114	58.4	76.58	77.68	15.54	34.68	114.12	69.00	48.95
BR115	58.7	76.83	76.60	15.32	35.09	111.83	69.43	49.45
BR116	56.3	74.96	84.85	16.97	32.09	130.04	66.14	45.71
BR117	53.0	72.37	96.96	19.39	28.17	159.62	61.41	40.72
BR118	57.6	75.99	80.25	16.05	33.72	119.71	67.97	47.76
BR119	57.5	75.92	80.57	16.11	33.61	120.42	67.84	47.61
BR120	58.3	76.50	78.03	15.61	34.55	114.89	68.86	48.78
BR121	58.1	76.38	78.53	15.71	34.36	115.96	68.66	48.55
BR122	58.5	76.67	77.28	15.46	34.83	113.28	69.16	49.13
BR123	58.3	76.51	77.99	15.60	34.56	114.80	68.87	48.80
BR124	57.0	75.53	82.30	16.46	32.98	124.25	67.15	46.84
BR125	64.0	80.60	61.12	12.22	41.62	81.32	75.75	57.29
BR126	59.5	77.42	74.08	14.82	36.07	106.55	70.45	50.65
BR127	58.6	76.73	77.04	15.41	34.92	112.77	69.25	49.24
BR128	58.7	76.81	76.69	15.34	35.06	112.02	69.39	49.41
BR129	59.0	77.03	75.75	15.15	35.42	110.02	69.78	49.85
BR130	59.0	77.02	75.80	15.16	35.40	110.13	69.75	49.83
BR131	59.2	77.14	75.27	15.05	35.61	109.02	69.97	50.08
BR132	54.9	73.87	89.85	17.97	30.40	141.82	64.17	43.59
BR133	59.0	77.03	75.75	15.15	35.42	110.02	69.78	49.85
BR134	57.3	75.73	81.42	16.28	33.30	122.29	67.50	47.23
BR135	58.7	76.78	76.83	15.37	35.00	112.32	69.34	49.34
BR136	57.1	75.57	82.10	16.42	33.06	123.81	67.23	46.93
BR137	63.9	80.52	61.45	12.29	41.47	81.92	75.61	57.11
BR138	58.7	76.84	76.55	15.31	35.11	111.72	69.45	49.47
BR139	58.6	76.75	76.97	15.39	34.95	112.61	69.28	49.28
BR140	53.8	73.07	93.61	18.72	29.20	151.09	62.70	42.04
BR141	56.6	75.19	83.81	16.76	32.45	127.67	66.55	46.17
BR142	56.4	75.06	84.41	16.88	32.24	129.04	66.31	45.90
BR143	56.2	74.91	85.08	17.02	32.01	130.57	66.05	45.61
BR144	44.1	64.65	138.89	27.78	18.01	296.26	46.16	27.06
BR145	51.2	70.90	104.24	20.85	26.06	179.23	58.63	37.97
BR146	46.9	67.23	123.82	24.76	21.15	239.95	51.42	31.40
BR147	42.8	63.46	146.23	29.25	16.64	327.33	43.69	25.14
BR148	33.0	53.22	223.27	44.65	6.93	902.15	21.97	10.88
BR149	36.4	57.02	191.43	38.29	10.10	592.81	29.99	15.66
BR150	36.7	57.30	189.31	37.86	10.35	576.69	30.58	16.03
BR151	37.9	58.57	179.65	35.93	11.54	508.58	33.31	17.79
BR152	52.5	72.00	98.79	19.76	27.62	164.41	60.71	40.01
BR153	44.0	64.60	139.18	27.84	17.95	297.42	46.06	26.98
BR154	43.1	63.69	144.83	28.97	16.90	321.17	44.16	25.50
BR155	64.3	80.78	60.44	12.09	41.94	80.08	76.03	57.66
BR156	66.5	82.29	54.68	10.94	44.75	69.87	78.43	60.92
BR157	60.9	78.40	69.98	14.00	37.73	98.24	72.11	52.66

117076 - Barrie Drainage Master Plan

AMCII to AMCIII CN and Modified CN Conversion Table

Watershed/Drainage Area:	**Bear Creek and External**
Date Completed:	**7-Jun-2017**

City of Barrie:
Precipitation 87.6 mm/hr
Standard Ia 5 mm

Catchment	AMCII CN	AMCIII CN	S (mm)	Ia (mm)	Q	S* (mm)	AMCIII CN*	AMCII CN*
BR158	65.7	81.76	56.67	11.33	43.76	73.33	77.60	59.77
BR159	57.9	76.20	79.34	15.87	34.06	117.73	68.33	48.17
BR160	35.2	55.72	201.86	40.37	8.95	679.31	27.22	13.95
BR162	45.9	66.31	129.03	25.81	20.01	258.36	49.57	29.84
BR163	54.7	73.77	90.29	18.06	30.26	142.89	64.00	43.40
BR164	56.8	75.37	83.01	16.60	32.73	125.84	66.87	46.52
BR165	50.6	70.40	106.80	21.36	25.36	186.48	57.66	37.04
BR166	44.5	64.99	136.80	27.36	18.42	287.87	46.87	27.63
BR167	42.0	62.62	151.61	30.32	15.71	351.81	41.93	23.81
BR168	41.8	62.47	152.59	30.52	15.54	356.44	41.61	23.58
BR169	50.6	70.41	106.72	21.34	25.38	186.25	57.69	37.07
BR170	46.7	66.99	125.16	25.03	20.85	244.58	50.94	30.99
BR171	47.1	67.41	122.78	24.56	21.39	236.38	51.80	31.72
BR172	59.0	77.05	75.64	15.13	35.46	109.81	69.82	49.90
BR173	61.1	78.53	69.42	13.88	37.96	97.12	72.34	52.94
BR174	46.1	66.46	128.18	25.64	20.19	255.26	49.88	30.09
BR175	42.6	63.27	147.44	29.49	16.43	332.69	43.29	24.84
BR176	41.9	62.60	151.77	30.35	15.68	352.55	41.88	23.77
BR177	45.2	65.68	132.72	26.54	19.24	272.06	48.28	28.77
BR178	39.0	59.67	171.65	34.33	12.62	458.18	35.66	19.36
BR179	47.6	67.82	120.51	24.10	21.91	228.76	52.61	32.43
BR180	34.1	54.53	211.80	42.36	7.96	774.24	24.70	12.45
BR181	47.1	67.40	122.87	24.57	21.37	236.68	51.77	31.70
BR182	48.3	68.47	116.98	23.40	22.75	217.27	53.90	33.57
BR183	47.7	67.93	119.93	23.99	22.05	226.85	52.82	32.62
BR184	51.2	70.93	104.08	20.82	26.10	178.77	58.69	38.03
BR185	39.4	60.04	169.04	33.81	12.99	442.79	36.45	19.90
BR186	41.0	61.69	157.71	31.54	14.70	381.53	39.97	22.38
BR187	38.0	58.67	178.92	35.78	11.64	503.76	33.52	17.93
BR188	41.7	62.34	153.45	30.69	15.40	360.56	41.33	23.37
BR189	43.2	63.80	144.12	28.82	17.03	318.13	44.40	25.68
BR190	54.3	73.46	91.76	18.35	29.78	146.49	63.42	42.80
BR191	43.4	64.03	142.71	28.54	17.29	312.08	44.87	26.05
BR192	49.0	69.05	113.83	22.77	23.53	207.39	55.05	34.61
BR193	61.3	78.72	68.67	13.73	38.28	95.64	72.65	53.32
BR194	54.9	73.93	89.58	17.92	30.49	141.17	64.28	43.70
BR195	41.7	62.35	153.39	30.68	15.41	360.27	41.35	23.39
BR196	64.9	81.24	58.64	11.73	42.80	76.83	76.78	58.66
BR197	60.3	78.00	71.65	14.33	37.05	101.57	71.43	51.83
BR198	66.5	82.26	54.80	10.96	44.69	70.07	78.38	60.85
BR199	57.9	76.20	79.35	15.87	34.06	117.74	68.33	48.17
BR200	48.1	68.23	118.27	23.65	22.44	221.44	53.42	33.15
BR201	28.8	48.32	271.65	54.33	3.63	1796.80	12.39	5.78
BR202	47.9	68.05	119.28	23.86	22.20	224.71	53.06	32.83
BR203	16.1	30.69	573.54	114.71	1.34	4990.56	4.84	2.16
520	50.0	69.90	109.37	21.87	24.67	193.95	56.70	36.14
525	52.0	71.57	100.89	20.18	27.01	170.04	59.90	39.21
527	65.0	81.28	58.50	11.70	42.86	76.58	76.84	58.74
528	58.0	76.28	78.97	15.79	34.20	116.91	68.48	48.35
529	64.0	80.60	61.15	12.23	41.61	81.37	75.74	57.28
530	27.0	46.08	297.16	59.43	2.44	2714.96	8.56	3.90
532	24.0	42.18	348.19	69.64	0.88	7660.60	3.21	1.42
533	48.0	68.18	118.56	23.71	22.37	222.37	53.32	33.06
535	37.5	58.14	182.86	36.57	11.13	530.22	32.39	17.19
536	48.1	68.26	118.08	23.62	22.49	220.82	53.49	33.21
537	60.0	77.76	72.63	14.53	36.65	103.57	71.03	51.35
540	64.0	80.60	61.15	12.23	41.61	81.37	75.74	57.28

117076 - Barrie Drainage Master Plan

AMCII to AMCIII CN and Modified CN Conversion Table

Watershed/Drainage Area:	**Bear Creek and External**
Date Completed:	**7-Jun-2017**

City of Barrie:

Precipitation 87.6 mm/hr

Standard Ia 5 mm

Catchment	AMCII CN	AMCIII CN	S (mm)	Ia (mm)	Q	S* (mm)	AMCIII CN*	AMCII CN*
550	59.5	77.40	74.18	14.84	36.03	106.75	70.41	50.60
551	61.4	78.77	68.44	13.69	38.38	95.19	72.74	53.44
552	55.2	74.14	88.61	17.72	30.81	138.84	64.66	44.10
555	61.9	79.13	66.99	13.40	38.99	92.37	73.33	54.18
556	53.0	72.39	96.90	19.38	28.19	159.46	61.43	40.74
557	65.2	81.42	57.98	11.60	43.11	75.65	77.05	59.03
558	61.0	78.49	69.62	13.92	37.88	97.51	72.26	52.84
559	63.0	79.90	63.88	12.78	40.36	86.44	74.61	55.81
560	64.1	80.67	60.88	12.18	41.74	80.88	75.85	57.42
561	59.8	77.62	73.25	14.65	36.40	104.83	70.79	51.05

AMCII CN Values Determined From Tatham Engineering Limited CN Calculators

AMCII to AMCIII CN Conversion Based on MTO Design Chart 1.10

CN to CN* Conversion As Per Process Outlined In Visual OTTHYMO Reference Manual

117076 - Barrie Drainage Master Plan

AMCII to AMCIII CN and Modified CN Conversion Table

Watershed/Drainage Area:	**Georgian Creek**
Date Completed:	**7-Jun-2017**

City of Barrie:

Precipitation 87.6 mm/hr

Standard Ia 5 mm

Catchment	AMCII CN	AMCIII CN	S (mm)	Ia (mm)	Q	S* (mm)	AMCIII CN*	AMCII CN*
GR101	68.8	83.79	49.14	9.83	47.66	60.55	80.75	64.22
GR102	57.8	76.13	79.62	15.92	33.95	118.34	68.22	48.05
GR103	68.6	83.66	49.60	9.92	47.41	61.32	80.55	63.94
GR104	67.9	83.21	51.26	10.25	46.52	64.06	79.86	62.94
GR105	65.3	81.48	57.72	11.54	43.24	75.19	77.16	59.18
GR106	65.8	81.82	56.44	11.29	43.87	72.93	77.69	59.90
GR107	77.1	88.85	31.89	6.38	58.32	34.38	88.08	75.78
GR108	78.9	89.87	28.63	5.73	60.66	29.87	89.48	78.21
GR109	68.7	83.73	49.37	9.87	47.53	60.93	80.65	64.08
GR110	73.0	86.42	39.92	7.98	53.03	46.06	84.65	70.15
GR111	68.2	83.40	50.54	10.11	46.90	62.87	80.16	63.37
GR112	69.4	84.18	47.75	9.55	48.42	58.29	81.33	65.08
GR113	67.9	83.21	51.26	10.25	46.52	64.06	79.86	62.94
GR114	68.2	83.40	50.54	10.11	46.90	62.87	80.16	63.37
GR115	68.5	83.60	49.84	9.97	47.28	61.70	80.46	63.80
GR116	68.7	83.73	49.37	9.87	47.53	60.93	80.65	64.08
GR117	68.2	83.40	50.54	10.11	46.90	62.87	80.16	63.37
GR118	69.4	84.18	47.75	9.55	48.42	58.29	81.33	65.08
GR119	68.9	83.86	48.90	9.78	47.79	60.17	80.85	64.37
GR120	72.2	85.93	41.59	8.32	52.00	48.60	83.94	69.03
GR121	68.3	83.47	50.31	10.06	47.03	62.48	80.26	63.51
GR122	67.8	83.14	51.50	10.30	46.39	64.46	79.76	62.79
GR123	67.1	82.68	53.19	10.64	45.51	67.33	79.05	61.78
GR124	68.4	83.53	50.07	10.01	47.15	62.09	80.36	63.65
GR125	72.0	85.81	42.01	8.40	51.75	49.25	83.76	68.75

AMCII CN Values Determined From Tatham Engineering Limited CN Calculators

AMCII to AMCIII CN Conversion Based on MTO Design Chart 1.10

CN to CN* Conversion As Per Process Outlined In Visual OTTHYMO Reference Manual

117076 - Barrie Drainage Master Plan

AMCII to AMCIII CN and Modified CN Conversion Table

Watershed/Drainage Area:	**Little Lake**
Date Completed:	**7-Jun-2017**

City of Barrie:

Precipitation 87.6 mm/hr

Standard Ia 5 mm

Catchment	AMCII CN	AMCIII CN	S (mm)	Ia (mm)	Q	S* (mm)	AMCIII CN*	AMCII CN*
LT101	50.7	70.49	106.33	21.27	25.48	185.12	57.84	37.21
LT102	63.1	79.97	63.61	12.72	40.49	85.92	74.72	55.95
LT103	47.0	67.29	123.44	24.69	21.24	238.65	51.56	31.52
LT104	46.8	67.12	124.45	24.89	21.01	242.10	51.20	31.21
LT105	56.3	74.99	84.71	16.94	32.14	129.71	66.20	45.78
LT106	58.0	76.28	78.97	15.79	34.20	116.91	68.48	48.35
LT107	58.5	76.66	77.34	15.47	34.81	113.41	69.13	49.10
LT108	59.0	77.03	75.75	15.15	35.42	110.02	69.78	49.85
LT109	58.2	76.43	78.31	15.66	34.44	115.49	68.74	48.65
LT110	58.6	76.73	77.02	15.40	34.93	112.72	69.26	49.25
LT111	48.5	68.61	116.19	23.24	22.94	214.78	54.18	33.83
LT112	45.8	66.22	129.59	25.92	19.89	260.40	49.38	29.67
LT113	49.3	69.30	112.50	22.50	23.86	203.33	55.54	35.06
LT114	49.8	69.73	110.26	22.05	24.44	196.57	56.37	35.83
LT115	54.0	73.19	93.04	18.61	29.37	149.66	62.92	42.27
LT116	56.3	74.99	84.71	16.94	32.14	129.71	66.20	45.78
LT117	58.6	76.73	77.02	15.40	34.93	112.72	69.26	49.25
LT118	62.4	79.48	65.57	13.11	39.62	89.63	73.92	54.92
LT119	51.7	71.32	102.12	20.42	26.65	173.38	59.43	38.75
LT120	62.3	79.41	65.85	13.17	39.49	90.17	73.80	54.77
LT121	55.5	74.37	87.53	17.51	31.17	136.28	65.08	44.56
LT122	58.0	76.28	78.97	15.79	34.20	116.91	68.48	48.35
LT123	56.3	74.99	84.71	16.94	32.14	129.71	66.20	45.78
LT124	58.8	76.88	76.38	15.28	35.18	111.37	69.52	49.55
LT125	60.5	78.13	71.11	14.22	37.26	100.50	71.65	52.10
LT126	58.7	76.81	76.70	15.34	35.05	112.04	69.39	49.40
LT127	55.3	74.22	88.25	17.65	30.93	137.98	64.80	44.26
LT128	57.2	75.68	81.62	16.32	33.23	122.75	67.42	47.14
LT129	58.5	76.66	77.34	15.47	34.81	113.41	69.13	49.10
LT130	58.2	76.43	78.31	15.66	34.44	115.49	68.74	48.65
LT131	56.7	75.30	83.32	16.66	32.62	126.56	66.74	46.38
LT132	56.6	75.22	83.67	16.73	32.50	127.34	66.61	46.23
LT133	57.8	76.13	79.62	15.92	33.95	118.34	68.22	48.05
LT134	57.6	75.98	80.29	16.06	33.71	119.79	67.95	47.74
LT135	62.2	79.34	66.13	13.23	39.37	90.71	73.68	54.62
LT136	63.4	80.18	62.78	12.56	40.86	84.38	75.06	56.39
LT137	57.8	76.13	79.62	15.92	33.95	118.34	68.22	48.05
LT138	58.6	76.73	77.02	15.40	34.93	112.72	69.26	49.25
LT139	48.0	68.18	118.56	23.71	22.37	222.37	53.32	33.06
LT140	58.5	76.66	77.34	15.47	34.81	113.41	69.13	49.10
LT141	53.5	72.79	94.95	18.99	28.78	154.47	62.18	41.51
LT142	57.6	75.98	80.29	16.06	33.71	119.79	67.95	47.74
LT143	58.8	76.88	76.38	15.28	35.18	111.37	69.52	49.55
LT144	58.5	76.66	77.34	15.47	34.81	113.41	69.13	49.10
LT145	59.0	77.03	75.75	15.15	35.42	110.02	69.78	49.85
LT146	44.6	65.12	136.06	27.21	18.56	284.96	47.13	27.83

AMCII CN Values Determined From Tatham Engineering Limited CN Calculators

AMCII to AMCIII CN Conversion Based on MTO Design Chart 1.10

CN to CN* Conversion As Per Process Outlined In Visual OTTHYMO Reference Manual

Appendix E: Updated Visual OTTHYMO Model Results Summaries

BARRIE DRAINAGE MASTER PLAN
MODEL UPDATES - SCS CURVE NUMBER
MARCH 2018

BUNKERS CREEK FLOW COMPARISON

				Peak Flow (m^3/s)				Comparison of Tatham Engineering vs. MDP	
VO3	Location	BUNKERS CREEK		Tatham Engineering Existing		MDP Existing		Tatham Engineering Existing	
Hydrograph		River Reach	River Station	100 Year	Hazel	100 Year	Hazel	100 Year	Hazel
17917	Anne Street	5	365	20.88	22.97	16.03	13.01	130%	177%
17918		5	88	23.97	24.71				
17922		4	80	9.98	10.24				
17923	Milligan's Pond Main Branch	3	13	33.38	35.18	18.12	14.06	184%	250%
17920	Milligan's Pond via Boys Street	2	173	2.59	1.38	3.37	2.22	77%	62%
17924		1	814	35.41	36.79				
17932	Total Inflow to Milligan's Pond	1	612	34.95	37.04	25.43	19.14	137%	194%
17933	Innisfil Street	1	579	31.21	39.96	23.14	20.24	135%	197%
17934		1	422	31.29	40.26				
17935	Bradford Street	1	321	31.96	41.71	25.70	22.47	124%	186%
17936		1	176	31.22	41.77				
17937	Lakeshore Drive	1	67	31.41	42.63	29.05	25.12	108%	170%

1) Tatham Engineering Limited future flows are assumed to be 20% greater than existing flows as a contingency for future land use changes, climate change and a safety factor.

2) Hydrologic modelling assumes no inter-watershed spills.

3) The hydrologic modelling completed by Tatham Engineering Limited uses the SCS Curve Number infiltration approach.

BARRIE DRAINAGE MASTER PLAN
MODEL UPDATES - SCS CURVE NUMBER
MARCH 2018

DYMENTS CREEK FLOW COMPARISON

				Peak Flow (m^3/s)								Comparison of Tatham Engineering vs. MDP			
VO3 Hydrograph	Location	DYMENTS CREEK		Tatham Engineering Existing		Tatham Engineering Future		MDP Existing		MDP Future		Tatham Engineering Existing		Tatham Engineering Future	
		River Reach	River Station	100 Year	Hazel	100 Year	Hazel	100 Year	Hazel	100 Year	Hazel	100 Year	Hazel	100 Year	Hazel
18909		1	5093	4.69	16.02	5.63	16.02								
18910	Municipal Sanitation	1	4942	5.60	18.53	6.72	18.53	7.43	16.34	7.43	16.34	75%	113%	90%	113%
18911		1	4589	6.05	19.56	7.26	19.56								
18912	Edgehill Drive	1	4256	6.21	19.98	7.46	19.98	8.90	19.77	9.12	20.34	70%	101%	82%	98%
18913		1	4215	7.01	21.69	8.41	21.69								
18914		1	3785	7.03	21.83	8.44	21.83								
18915		1	3146	8.08	23.61	9.70	23.61								
18916	Between Ferndale & Dunlop	1	3107	8.13	23.85	9.75	23.85	13.19	32.44	13.08	32.99	62%	74%	75%	72%
18918	Ferndale Drive	1	2916	11.36	30.46	13.63	30.46	15.72	39.82	34.96	43.28	72%	76%	39%	70%
18919		1	2875	13.13	45.56	15.76	45.56								
18921	Sarjeant Drive	1	2595	15.16	45.13	18.19	45.13	20.71	42.59	38.38	46.79	73%	106%	47%	96%
18922		1	2380	17.27	46.21	20.72	46.21								
18923		1	2251	24.69	49.45	29.62	49.45								
18924	Highway 400	1	2085	24.68	49.94	29.61	49.94	25.61	45.19	43.55	50.19	96%	111%	68%	99%
18925		1	1961	25.40	50.53	30.47	50.53								
18926		1	1876	25.36	50.61	30.44	50.61								
18927	George Street	1	1685	25.91	51.49	31.09	51.49	27.83	46.41	45.54	51.56	93%	111%	68%	100%
18928		1	1637	27.06	52.63	32.47	52.63								
18001	Victoria Street	1	1442	26.41	52.63	31.69	52.63	29.13	47.90	45.46	53.17	91%	110%	70%	99%
18929		1	1389	26.58	52.92	31.89	52.92								
18930	Anne Street & John Street	1	1124	26.35	55.00	31.62	55.00	37.03	50.63	51.61	56.29	71%	109%	61%	98%
18931		1	970	26.33	55.17	31.59	55.17								
18932	Innisfil Street	1	718	26.14	55.75	31.37	55.75	36.99	51.61	52.17	57.49	71%	108%	60%	97%
18933		1	654	26.26	55.94	31.51	55.94								
18934		1	581	26.29	56.17	31.54	56.17								
18935	Bradford Street	1	461	26.73	56.99	32.08	56.99	38.26	52.57	52.58	58.60	70%	108%	61%	97%
18937		1	295	27.45	58.06	32.94	58.06								
18938	Lakeshore Drive	1	168	27.64	58.52	33.17	58.52	36.80	53.29	50.95	59.29	75%	110%	65%	99%

1) Tatham Engineering Limited future flows are assumed to be 20% greater than existing flows as a contingency for future land use changes, climate change and a safety factor.
2) Hydrologic modelling assumes no inter-watershed spills.
3) The hydrologic modelling completed by Tatham Engineering Limited uses the SCS Curve Number infiltration approach.

BARRIE DRAINAGE MASTER PLAN
MODEL UPDATES - SCS CURVE NUMBER
MARCH 2018

HOTCHKISS CREEK FLOW COMPARISON

				Peak Flow (m^3/s)				Comparison of Tatham Engineering vs. MDP	
VO3 Hydrograph	Location	HOTCHKISS CREEK		Tatham Engineering Existing		MDP Existing		Tatham Engineering Existing	
		River Reach	River Station	100 Year	Hazel	100 Year	Hazel	100 Year	Hazel
19901		6	821	1.07	0.72				
19902		6	701	1.29	0.88				
19903		6	555	1.29	1.13				
19904		6	362	2.10	1.92				
19906		7	290	1.16	0.84				
19905		3	839	3.76	3.48				
19907		3	438	8.43	7.67				
19929	Morrow Road	3	415	15.34	12.87	20.52	13.14	75%	98%
19909		3	107	15.92	13.73				
19121		5	260	1.14	0.57				
19914		4	480	6.63	7.03				
19913		4	260	6.69	7.57				
19928		4	201	6.84	7.63				
19912		4	67	7.09	7.86				
19911		2	533	9.10	8.98				
19910	Highway 400	1	1802	24.76	24.54	20.52	13.14	121%	187%
19917	Wood Street	1	1574	33.36	31.13	18.92	20.52	176%	152%
19918	BC Rail Tracks	1	1236	36.59	34.29	21.95	22.99	167%	149%
19919	Tiffin Street	1	1049	38.89	35.95	24.80	23.63	157%	152%
19920	Anne Street	1	969	55.10	46.38	32.66	31.04	169%	149%
19922	Innisfil Street	1	623	64.44	54.38	49.41	33.63	130%	162%
19923		1	462	64.61	54.90				
19924	Bradford Street	1	337	64.43	55.17	49.94	33.99	129%	162%
19925		1	182	66.50	56.96				
19926	Lakeshore Drive	1	129	66.18	57.18	58.23	39.74	114%	144%
19927		1	0	66.25	57.14				

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BARRIE DRAINAGE MASTER PLAN
MODEL UPDATES - SCS CURVE NUMBER
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KIDDS CREEK FLOW COMPARISON

				Peak Flow (m^3/s)				Comparison of Tatham Engineering vs. MDP	
VO3 Hydrograph	Location	KIDDS CREEK		Tatham Engineering Existing		MDP Existing		Tatham Engineering Existing	
		River Reach	River Station	100 Year	Hazel	100 Year	Hazel	100 Year	Hazel
16139		4	297	4.76	2.23				
16925		4	223	10.63	4.94				
16924		5	1514	15.20	24.81				
16905		5	1259	15.47	25.66				
16906	Cundles Road Inflow	5	1115	16.56	27.01	16.99	31.04	97%	87%
16907	Cundles Road West	5	906	19.50	31.09	20.88	36.33	93%	86%
16908		5	818	21.47	34.14				
16909		5	341	23.08	36.80				
16137		2	389	1.55	0.83				
16917		2	120	1.74	1.00				
16910		3	1152	29.09	43.62				
16911	Sunnidale Park Inflow	3	981	31.35	46.69	37.95	53.75	83%	87%
16912	Sunnidale Park Outflow	3	839	6.05	47.50	3.72	53.75	163%	88%
16913	Wellington Street	3	472	6.17	49.34	6.06	57.15	102%	86%
16914		3	319	6.18	49.42				
16915	Eccles Street	3	112	6.20	49.73	6.70	57.59	93%	86%
16916		1	1489	7.73	50.79				
16926	Donald Street	1	1406	8.83	51.45	9.82	59.74	90%	86%
16918		1	1230	9.57	51.94				
16919		1	1073	9.77	52.16				
16920	Dunlop Street	1	1051	11.56	53.11	12.08	61.34	96%	87%
16921		1	1000	12.36	53.47				
16921		1	814	12.36	53.47				
16921		1	518	12.36	53.47				
16922		1	495	13.36	53.93				
16923	Kempenfelt Bay	1	411	13.39	53.99	14.25	62.84	94%	86%

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SOPHIA CREEK FLOW COMPARISON

				Peak Flow (m^3/s)		
VO3 Hydrograph	Location	SOPHIA CREEK		Tatham Engineering	2002 MDP Existing	Comparison of Tatham Engineering vs. MDP
		River Reach	River Station	100 Year	100 Year	100 Year
15121	Duckworth to Howard	6	1124	12.34	8.3	149%
15908	Howard Crescent	6	1017	12.67	8.3	153%
15909	Lay Street	6	920	13.00	8.3	157%
15910	Lay to Grove	6	822	15.76	12.3	128%
15911		6	698	17.87		
15912	Grove Street	Trib. 1.1	645	17.85	12.3	145%
15913	Grove to St. Vincent	4	550	20.67	12.3	168%
15913	Grove to St. Vincent	3	389	20.67	12.3	168%
15914	St. Vincent Steet	3	355	20.30	19.5	104%
15915		3	321	29.75		
15916		3	79	29.28		
15905	Ottaway and Rose Street	2	389	15.95	17.1	93%
15906	Rose to Laurie	2	222	18.16	17.1	106%
15907	Laurie Crescent	2	203	18.30	17.1	107%
15917		1	1640	47.15		
15918	Bothwell Crescent	1	1597	47.45	37.3	127%
15919	Grove Street	1	1496	50.33	39.8	126%
15920	Parkdale Crescent	1	1239	50.34	40.3	125%
15921	Davidson and Gunn Street	1	1186	52.12	45	116%
15922	Gunn to Wellington	1	1105	53.23	45	118%
15923	Berczy and Wellington Street	1	1062	55.78	51	109%
15924	Berczy to Peel	1	920	58.40	51	115%
15957	Peel Street	1	680	58.48	51.4	114%
15925	Peel to Owen	1	671.2	59.85	51.4	116%
15926	Owen to Clapperton	1	559.7	60.00	56	107%
15927	Clapperton to Drury	1	464.6	61.78	56	110%
15928	Bayfield Street	1	403.8	62.47	58.4	107%
15929	Worsley to Ross	1	229	62.68	61.4	102%
15930	Collier to Dunlop	1	109	62.83	61.4	102%
15934	Dunlop to Simcoe	1	-21	64.78	61.4	106%
15935	Kempenfelt Bay	1	-237	64.93	61.4	106%

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BARRIE DRAINAGE MASTER PLAN
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WHISKEY CREEK FLOW COMPARISON

				Peak Flow (m^3/s)								Comparison of Tatham Engineering vs. MDP			
VO3	Location	WHISKEY CREEK		Tatham Engineering Existing		Tatham Engineering Future		MDP Existing		MDP Future		Tatham Engineering Existing		Tatham Engineering Future	
Hydrograph		River Reach	River Station	100 Year	Hazel	100 Year	Hazel	100 Year	Hazel	100 Year	Hazel	100 Year	Hazel	100 Year	Hazel
23111		7	494	2.96	2.41	3.55	2.41								
23906		7	125	3.52	4.16	4.23	4.16								
23902		6	432	14.17	11.43	17.01	11.43								
23905		4	2254	5.51	18.46	6.61	18.46								
23907	Harvie Road	4	2142	5.88	19.19	7.06	19.19	14.70	20.07	3.21	16.25	40%	96%	220%	118%
23908	Highway 400	4	2010	6.81	21.23	8.17	21.23	7.38	9.50	5.94	22.02	92%	223%	138%	96%
23909	Fairview Road	4	1709	7.18	22.00	8.61	22.00	7.69	10.27	8.27	23.20	93%	214%	104%	95%
23910	BCR Tracks	4	1481	8.14	23.68	9.77	23.68	10.66	12.21	13.28	25.31	76%	194%	74%	94%
23911	Bayview Drive	4	1160	8.37	24.39	10.04	24.39	11.94	13.32	15.76	26.39	70%	183%	64%	92%
23912		4	1100	8.62	24.75	10.35	24.75								
23913		5	389	4.00	4.54	4.80	4.54								
23914		5	101	6.24	5.52	7.48	5.52								
23915	West Tributary Convergence	3	1697	21.31	38.16	25.57	38.16	21.66	26.00	33.01	36.92	98%	147%	77%	103%
23916	Middle of Lackie's Bush	3	1351	20.58	39.65	24.70	39.65	21.50	28.77	30.91	39.94	96%	138%	80%	99%
23917		3	953	20.59	40.78	24.70	40.78								
23918		3	512	20.30	41.81	24.36	41.81								
23919	McConkey Place	3	352	20.54	42.34	24.65	42.34	20.19	32.04	29.21	43.60	102%	132%	84%	97%
23940		3	222	27.15	49.53	32.58	49.53								
23002	BCR Tracks	3	169	25.09	49.53	30.11	49.53	26.14	40.07	35.12	51.19	96%	124%	86%	97%
23920	Huronia Road	3	108	25.35	50.00	30.42	50.00	26.14	40.07	35.12	51.19	97%	125%	87%	98%
23922		2	1332	4.38	2.92	5.26	2.92								
23923		2	1059	7.24	4.82	8.68	4.82								
23924		2	864	7.27	5.56	8.72	5.56								
23925		2	683	11.95	9.22	14.34	9.22								
23926		2	601	14.69	11.35	17.63	11.35								
23927		2	383	14.77	11.53	17.73	11.53								
23921		2	110	34.29	63.01	41.14	63.01								
23928	Little Avenue	1	1549	29.31	63.39	35.18	63.39	35.72	55.33	47.61	65.88	82%	115%	74%	96%
23929		1	1515	29.23	63.31	35.07	63.31								
23930	Yonge Street	1	974	22.16	66.08	26.59	66.08	36.46	57.85	48.84	68.39	61%	114%	54%	97%
23931		1	929	22.17	66.18	26.60	66.18								
23932	BCR Tracks	1	663	22.76	67.72	27.31	67.72	38.17	61.03	50.70	71.32	60%	111%	54%	95%
23933		1	562	23.05	68.99	27.66	68.99								
23935	Tollendale Mill Road	1	495	23.09	69.27	27.70	69.27	39.07	62.67	52.03	72.99	59%	111%	53%	95%
23934		1	451	21.77	69.56	26.13	69.56								
23936	The Boulevard	1	243	21.77	69.62	26.13	69.62	39.24	63.07	52.25	73.32	55%	110%	50%	95%
23937		1	225	21.84	69.96	26.21	69.96								
23938	Brennan Avenue	1	180	21.84	70.07	26.20	70.07	39.43	63.44	52.50	73.66	55%	110%	50%	95%
23939	Outlet to Kempenfelt Bay	1	30	21.78	70.04	26.14	70.04	39.51	63.59	52.62	73.82	55%	110%	50%	95%

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LOVERS CREEK FLOW COMPARISON

					Peak Flow (m^3/s)								Comparison of Tatham Engineering vs. MDP			
VO3	Location	LOVERS CREEK			Tatham Engineering Existing		Tatham Engineering Future		MDP Existing		MDP Future		Tatham Engineering Existing		Tatham Engineering Future	
Hydrograph		River	River Reach	River Station	100 Year	Hazel	100 Year	Hazel	100 Year	Hazel	100 Year	Hazel	100 Year	Hazel	100 Year	Hazel
26101		LoversTrib12	Trib. 12	2022.191	7.35	17.02	8.82	17.02								
26102		Lovers	Main13	17068.83	23.76	46.99	28.51	46.99								
26902		Lovers	Main13	14591.37	29.16	62.25	34.99	62.25								
26901		Lovers	Main12	12805.08	30.74	74.76	36.89	74.76								
26105		LoversTrib11	Trib. 11	4142.068	12.80	29.74	15.36	29.74								
26903		LoversTrib11	Trib. 11	600.6452	13.97	36.02	16.76	36.02								
26904		Lovers	Main12	11880.01	44.95	121.19	53.94	121.19								
265000	Innisfil Beach Road	Lovers	Main11	11736.01	20.18	121.19	24.22	121.19	18.32	83.41	19.26	84.99	110%	145%	126%	143%
26109		LoversTrib10	Trib. 10	1030.103	15.98	21.04	19.18	21.04								
26905		Lovers	Main10	11268.73	21.41	123.35	25.69	123.35								
26103		LoversTrib9	Trib. 9	1813.445	6.86	16.00	8.23	16.00								
26905		Lovers	Main09	10933.77	21.41	123.35	25.69	123.35								
26108		LoversTrib8	Trib. 8	2104.788	9.18	20.43	11.02	20.43								
26906		Lovers	Main08	10585.7	24.11	137.82	28.93	137.82								
26907		Lovers	Main08	10326.75	25.92	140.10	31.10	140.10								
26908	9th Line	Lovers	Main08	9924.291	31.23	150.81	37.48	150.81	34.32	99.27	34.77	97.52	91%	152%	108%	155%
26115		LoversTrib7	Trib. 7	2400.669	20.09	40.44	24.11	40.44								
26909		Lovers	Main07	9560.6	48.02	181.20	57.62	181.20								
26113	Sideroad 10 1	LoversTrib6	Trib. 6	830.3067	9.03	17.54	10.84	17.54	8.34	17.18	28.63	21.53	108%	102%	38%	81%
26911		Lovers	Main06	9172.416	55.37	196.49	66.44	196.49								
261223		LoversTrib4.2	Lov7-1	709	0.58	1.48	0.69	1.48								
261141		LoversTrib5	Trib. 5	3511	2.51	6.79	3.01	6.79								
261141		LoversTrib5	Trib. 5	3406	2.51	6.79	3.01	6.79								
26992		LoversTrib5	Trib. 5	2578.718	5.10	16.21	6.12	16.21								
26993	Sideroad 10 2	LoversTrib5	Trib. 5	2047.039	7.72	22.50	9.26	22.50	7.29	19.86	32.67	29.88	106%	113%	28%	75%
26912	10th Line	Lovers	Main05	8706.571	61.76	213.99	74.11	213.99	62.53	172.24	72.11	179.93	99%	124%	103%	119%
26913		Lovers	Main05	8407.546	62.13	215.50	74.56	215.50								
26994	Sideroad 10 3	Lovers	Tri. 4.5	700	4.44	9.24	5.33	9.24	3.77	8.40	17.14	11.48	118%	110%	31%	81%
26914		Lovers	Main05	7691.346	67.37	230.45	80.84	230.45								
26926		LoversTrib4.1	Trib. 4.1.1	1904.3	3.81	9.78	4.57	9.78								
26991		LoversTrib4.1	Trib. 4.1.1	1746.581	6.05	11.02	7.26	11.02								
26919		LoversTrib4.1	Trib. 4.1.1	1704.249	17.64	20.61	21.17	20.61								
26920		LoversTrib4.1	Trib. 4.1.1	1479.158	10.45	21.25	12.54	21.25								
26006		LoversTrib4.1	Trib. 4.1.1	1287.58	9.96	N/A	11.95									
26921		LoversTrib4.1	Trib. 4.1.1	785.9333	11.08	26.00	13.30	26.00								
26918		LoversTrib4.1	Trib. 4.1.1	539.962	11.21	26.31	13.45	26.31								
261221		LoversTrib4	Trib. 4.2	3848	2.89	7.61	3.47	7.61								
26996		LoversTrib4	Trib. 4.2	2863.215	7.77	20.66	9.32	20.66								
26997		LoversTrib4	Trib. 4.2.1	2599.918	9.41	28.36	11.29	28.36								
26917	Sideroad 10 4	LoversTrib4	Trib. 4.1	322.0645	16.46	52.40	19.75	52.40	30.63	49.71	84.48	75.22	54%	105%	23%	70%
26916	Lockhart Road	Lovers	Main04	6658.264	80.55	270.89	96.66	270.89	74.20	229.62	164.19	260.60	109%	118%	59%	104%
26929		Lovers	Main04	6626.625	80.57	270.86	96.68	270.86								
26930		Lovers	Main04	6341.946	80.60	270.91	96.72	270.91								
26931		Lovers	Main04	5902.777	80.99	272.91	97.19	272.91								
26160		LoversTrib3	Trib. 3.2	2345	1.18	0.54	1.42	0.54								
26943		LoversTrib3	Trib. 3.2	2292	1.32	5.21	1.58	5.21								
26941		LoversTrib3	Trib. 3.2	2133	8.14	17.83	9.77	17.83								
26939	Welham Road	LoversTrib4	Trib. 3.2	1786	8.18	18.35	9.82	18.35	20.79	19.07	30.02	22.11	39%	96%	33%	83%
26938		LoversTrib3	Trib. 3.2	1678	8.21	18.46	9.85	18.46								
26937		LoversTrib3	Trib. 3.2	1519	8.52	19.62	10.22	19.62								
26012		LoversTrib3	Trib. 3.1	1500	1.86	N/A	2.23									
26936		LoversTrib3	Trib. 3.1	1393	2.10	2.60	2.52	2.60								

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LOVERS CREEK FLOW COMPARISON

					Peak Flow (m^3/s)								Comparison of Tatham Engineering vs. MDP			
VO3 Hydrograph	Location	LOVERS CREEK			Tatham Engineering Existing		Tatham Engineering Future		MDP Existing		MDP Future		Tatham Engineering Existing		Tatham Engineering Future	
		River	River Reach	River Station	100 Year	Hazel	100 Year	Hazel	100 Year	Hazel	100 Year	Hazel	100 Year	Hazel	100 Year	Hazel
26935		LoversTrib3	Trib. 3.1	1205	2.15	2.69	2.58	2.69								
26934		LoversTrib3	Trib. 3.0	561.1898	10.41	23.00	12.49	23.00								
26933	Huronia Road	LoversTrib3	Trib. 3.0	474.0832	11.09	25.22	13.31	25.22	21.82	21.68	31.39	25.26	51%	116%	42%	100%
26932		Lovers	Main03	5420.499	81.73	278.52	98.08	278.52								
26173		LoversTrib2	Trib. 2	1930.824	6.28	15.20	7.54	15.20								
26173		LoversTrib2	Trib. 2	1712.844	6.28	15.20	7.54	15.20								
26952		LoversTrib2	Trib. 2	303.7247	12.04	28.58	14.45	28.58								
26951		Lovers	Main02	4968.416	90.22	304.15	108.26	304.15								
26953	Mapleview Drive	Lovers	Main02	4535.809	90.15	304.38	108.18	304.38	84.65	262.86	170.52	318.18	106%	116%	63%	96%
26966		LoversTrib1	Trib. 1.4	3300	0.39	4.18	0.47	4.18								
26965		LoversTrib1	Trib. 1.4	2792	0.89	5.13	1.07	5.13								
26964		LoversTrib1	Trib. 1.4	2037	2.14	6.76	2.57	6.76								
26963		LoversTrib1	Trib. 1.4	1992	5.52	8.92	6.62	8.92								
26961		LoversTrib1	Trib. 1.4	1850	6.98	9.52	8.38	9.52								
26185		LoversTrib1	Trib. 1.3	1817	3.61	2.57	4.33	2.57								
26960		LoversTrib1	Trib. 1.3	1094	8.05	5.43	9.66	5.43								
26959		LoversTrib1	Trib. 1.2	1621	19.88	17.27	23.86	17.27								
26958		LoversTrib1	Trib. 1.2	1554.214	26.01	21.70	31.21	21.70								
26003		LoversTrib1	Trib. 1.1	1510	1.00	N/A	1.20									
26956		LoversTrib1	Trib. 1.2	1278.733	31.21	26.70	37.45	26.70								
26002		LoversTrib1	Trib. 1.0	1218.55	5.51	N/A	6.61									
26957	Huronia Road	LoversTrib1	Trib. 1.0	939.514	6.69	26.78	8.03	26.78	4.69	24.94	8.74	24.94	143%	107%	92%	107%
26955		LoversTrib1	Trib. 1.0	446.5532	7.21	29.23	8.65	29.23								
26970		Lovers	Main01	4159.121	95.87	321.48	115.04	321.48								
26971		Lovers	Main01	3586.156	96.82	324.76	116.18	324.76								
26974		Lovers	Main01	3327.937	98.49	333.34	118.19	333.34								
26975	Big Bay Point Road	Lovers	Main01	2734.631	98.55	335.23	118.26	335.23	92.37	291.31	176.86	357.32	107%	115%	67%	94%
26977		Lovers	Main01	2127.919	98.50	335.37	118.20	335.37								
26979		Lovers	Main01	2074.773	98.59	335.77	118.31	335.77								
26980		Lovers	Main01	1601.441	98.82	336.48	118.58	336.48								
26982		Lovers	Main01	1357.49	98.85	336.49	118.62	336.49								
26983		Lovers	Main01	1302.252	99.03	337.48	118.84	337.48								
26986		Lovers	Main01	1264.763	100.33	341.67	120.40	341.67								
26987		Lovers	Main01	1160.818	100.40	341.99	120.48	341.99								
26988		Lovers	Main01	1049.722	100.37	342.47	120.44	342.47								
26989	Tollendal Road	Lovers	Main01	545.2612	99.98	343.26	119.98	343.26	94.14	298.99	179.94	369.98	106%	115%	67%	93%
26990	Kempenfelt Bay	Lovers	Main01	17.79831	99.54	342.86	119.45	342.86								

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HEWITTS CREEK FLOW COMPARISON

				Peak Flow (m^3/s)								Comparison of Tatham Engineering vs. MDP			
VO3	Location	HEWITTS CREEK		Tatham Engineering Existing		Tatham Engineering Future		MDP Existing		MDP Future		Tatham Engineering Existing		Tatham Engineering Future	
Hydrograph		River Reach	River Station	100 Year	Hazel	100 Year	Hazel	100 Year	Hazel	100 Year	Hazel	100 Year	Hazel	100 Year	Hazel
29105		Main02	10601.45	9.90	25.54	11.88	25.54								
29901	9th Line	Main02	10048.05	11.72	29.64	14.06	29.64	10.97	28.76	10.97	28.76	107%	103%	128%	103%
29902		Main02	8422.349	17.85	42.94	21.42	42.94								
292000		Main02	8231.756	16.11	42.94	19.33	42.94								
29903	Convergence North of Victoria Street	Main02	7361.987	21.83	59.03	26.20	59.03	20.81	57.65	21.30	58.19	105%	102%	123%	101%
29904		Main02	5605.709	25.39	68.56	30.47	68.56								
29132		Hew2-1	845	2.88	6.72	3.46	6.72								
29905		Main02	5114.007	29.20	79.77	35.04	79.77								
29905		Main02	4974.487	29.20	79.77	35.04	79.77								
29135		Trib2	809.489	17.71	13.39	21.25	13.39								
29905		Main02	4844.722	29.20	79.77	35.04	79.77								
29906		Main02	3593.722	33.41	94.48	40.09	94.48								
291000		Main02	3445.696	33.28	94.48	39.94	94.48								
29907	Mapleview Drive	Main02	3408.654	33.48	95.37	40.18	95.37	31.95	90.15	47.31	85.43	105%	106%	85%	112%
29908		Main02	3129.259	33.84	96.79	40.61	96.79								
29144		Trib. 1	1258.764	0.52	2.15	0.62	2.15								
29909		Trib. 1	1051.061	22.27	17.39	26.72	17.39								
29008		Trib. 1	892.8565	7.27	17.39	8.72	17.39								
29910		Trib. 1	347.14	6.78	17.28	8.14	17.28								
29912		Main01	2743.481	37.27	106.63	44.72	106.63								
29913		Main01	2396.606	38.80	114.18	46.56	114.18								
29914		Main01	2291.371	40.08	120.99	48.10	120.99								
29915		Main01	1719.604	40.10	121.66	48.12	121.66								
29916	Big Bay Point Road	Main01	1460.708	40.32	123.11	48.38	123.11	37.81	111.79	58.51	116.95	107%	110%	83%	105%
29917		Main01	203.2475	41.01	127.56	49.21	127.56								
29918		Main01	106.3736	41.22	129.02	49.46	129.02								
29919	Kempenfelt Bay	Main01	46.29602	41.38	130.12	49.66	130.12	39.07	116.66	61.70	122.77	106%	112%	80%	106%
1237		Main02	4038.236	28.12	65.43	33.74	65.43								
1240		Main01	3363.75	43.36	119.09	52.03	119.09								
9245		Main01	2153.915	45.63	128.07	54.76	128.07								
9250		Main01	1781.572	48.23	133.75	57.88	133.75								
9255		Main01	11.93202	47.08	135.63	56.50	135.63								
210		Trib. 1.2	3023.37	3.96	11.08	4.76	11.08								
9212		Trib. 1.2	2344.297	11.03	26.29	13.24	26.29								
9205		Trib. 1.1	1522.978	19.38	44.76	23.26	44.76								
205		Trib. 1.1.1	776.1322	6.53	14.58	7.84	14.58								
230		Trib. 2	1521.429	7.42	16.54	8.90	16.54								
9237		Trib. 2	478.9501	13.64	32.99	16.37	32.99								
225		S4-1	409	4.06	8.70	4.88	8.70								
225		Lower	1456.073	4.06	8.70	4.88	8.70								
225		Lower-2	919	4.06	8.70	4.88	8.70								
9225		Lower-2	713.9764	10.03	22.83	12.04	22.83								
220		Upper	11000	3.49	7.93	4.18	7.93								
220		Upper	8000	3.49	7.93	4.18	7.93								
9284		Upper	5509.092	6.15	14.27	7.38	14.27								
9257		Main04	4645.049	14.50	32.44	17.40	32.44								

1) Tatham Engineering Limited future flows are assumed to be 20% greater than existing flows as a contingency for future land use changes, climate change and a safety factor.

2) The hydrologic modelling completed by Tatham Engineering Limited uses the SCS Curve Number infiltration approach.

BUNKERS CREEK
VISUAL OTTHYMO PEAK FLOW SUMMARY

PEAK FLOW COMPARISON
MARCH 2018 VERSUS FEBRUARY 2017 (SCS CURVE NUMBER)

			Δ Peak Flow (m^3/s)												
VO3	BUNKERS CREEK		Chicago 4 Hour Design Storms						SCS Design Storms						Hurricane Hazel
Hydrograph	River Reach	River Station	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	AMCII
17917	5	365	0.28	0.39	0.39	0.45	0.61	0.61	0.23	0.33	0.40	0.35	0.37	0.41	0.51
17918	5	366	0.65	0.79	0.85	1.11	1.32	1.32	0.49	0.78	0.91	0.94	1.02	1.36	0.24
17922	4	367	0.31	0.39	0.40	0.30	0.20	0.05	0.24	0.27	0.10	0.02	-0.22	-0.36	-0.03
17923	3	368	0.73	0.89	1.11	1.20	1.28	1.20	0.65	0.97	0.99	1.00	0.78	0.81	0.11
17920	2	369	0.10	0.14	0.15	0.17	0.22	0.22	0.08	0.12	0.16	0.17	0.18	0.24	0.04
17924	1	370	0.77	0.99	1.23	1.27	1.39	1.38	0.71	1.02	1.14	1.23	1.05	0.81	0.15
17932	1	371	0.79	1.01	1.22	1.21	1.33	1.33	0.74	1.00	1.09	1.17	0.97	0.82	0.15
17933	1	372	0.80	0.76	0.41	0.31	0.32	1.25	0.57	0.29	0.24	1.32	0.95	0.93	0.14
17934	1	373	0.80	0.75	0.40	0.29	0.31	1.28	0.56	0.32	0.24	1.32	0.91	0.82	0.12
17935	1	374	0.74	0.70	0.37	0.22	0.20	1.31	0.55	0.34	0.28	0.82	0.93	0.75	0.13
17936	1	375	0.71	0.78	0.47	0.29	0.26	1.23	0.63	0.34	0.24	1.05	0.83	0.82	0.13
17937	1	376	0.76	0.82	0.53	0.38	0.34	1.17	0.65	0.37	0.31	0.85	0.72	0.61	0.05

			% Change												
VO3	BUNKERS CREEK		Chicago 4 Hour Design Storms						SCS Design Storms						Hurricane Hazel
Hydrograph	River Reach	River Station	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	AMCII
17917	5	365	6%	5%	4%	4%	5%	4%	4%	4%	4%	2%	2%	2%	4%
17918	5	88	12%	10%	9%	9%	9%	8%	8%	8%	7%	6%	5%	6%	2%
17922	4	80	15%	12%	9%	5%	3%	1%	10%	7%	2%	0%	-2%	-4%	0%
17923	3	13	10%	8%	8%	7%	6%	5%	8%	7%	6%	4%	3%	2%	0%
17920	2	173	13%	13%	11%	11%	13%	11%	11%	10%	12%	9%	9%	10%	3%
17924	1	814	10%	9%	8%	7%	6%	5%	8%	7%	6%	5%	4%	2%	1%
17932	1	612	10%	9%	9%	7%	6%	5%	9%	7%	6%	5%	3%	2%	1%
17933	1	579	10%	6%	3%	2%	2%	6%	6%	2%	2%	8%	4%	3%	1%
17934	1	422	9%	6%	3%	2%	2%	6%	6%	2%	2%	8%	4%	3%	0%
17935	1	321	8%	6%	3%	1%	1%	6%	6%	2%	2%	4%	4%	2%	0%
17936	1	176	8%	6%	3%	2%	1%	6%	7%	2%	1%	6%	3%	3%	0%
17937	1	67	9%	7%	4%	2%	2%	6%	7%	3%	2%	5%	3%	2%	0%

DYMENTS CREEK
VISUAL OTTHYMO PEAK FLOW SUMMARY

PEAK FLOW COMPARISON
MARCH 2018 VERSUS FEBRUARY 2017 (SCS CURVE NUMBER)

			Δ Peak Flow (m^3/s)												
VO3	DYMENTS CREEK		Chicago 4 Hour Design Storms						SCS Design Storms						Hurricane Hazel
Hydrograph	River Reach	River Station	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	AMCII
18909	1	5093	-0.27	-0.22	-0.20	-0.22	-0.60	-0.92	-0.19	-0.15	-0.15	-0.77	-0.89	-0.95	-0.39
18910	1	4942	-0.27	-0.21	-0.18	-0.16	-0.51	-0.96	-0.17	-0.13	-0.09	-0.60	-0.90	-0.96	-0.36
18911	1	4589	-0.27	-0.21	-0.18	-0.17	-0.48	-0.96	-0.17	-0.13	-0.10	-0.51	-0.91	-1.00	-0.36
18912	1	4256	-0.27	-0.21	-0.18	-0.17	-0.48	-0.94	-0.18	-0.13	-0.10	-0.48	-0.91	-1.00	-0.36
18913	1	4215	-0.25	-0.17	-0.13	-0.09	-0.36	-0.81	-0.13	-0.06	0.00	-0.25	-0.75	-0.84	-0.24
18914	1	3785	-0.27	-0.18	-0.14	-0.10	-0.38	-0.80	-0.15	-0.08	-0.02	-0.30	-0.65	-0.78	-0.25
18915	1	3146	-0.27	-0.14	-0.07	-0.01	-0.28	-0.59	-0.11	0.01	0.08	-0.16	-0.38	-0.43	-0.12
18916	1	3107	-0.26	-0.13	-0.07	-0.02	-0.28	-0.59	-0.11	0.00	0.08	-0.17	-0.38	-0.43	-0.12
18918	1	2916	-0.13	-0.08	-0.11	-0.17	-0.50	-0.90	-0.08	-0.12	-0.18	-0.52	-0.75	-1.22	-0.41
18919	1	2875	-0.18	-0.23	-0.21	-0.20	-0.51	-0.86	-0.25	-0.18	-0.18	-0.33	-0.40	-0.64	-2.02
18921	1	2595	0.00	0.21	0.40	0.56	0.52	0.37	-0.12	0.28	0.63	0.97	1.08	1.01	-0.72
18922	1	2380	0.03	0.29	0.53	1.01	1.22	1.47	0.31	0.85	1.30	2.10	2.67	2.89	-0.73
18923	1	2251	0.43	0.81	1.02	1.60	1.86	2.39	0.65	1.37	2.19	3.20	3.86	4.65	-0.64
18924	1	2085	0.45	0.82	1.00	1.57	1.80	2.26	0.58	1.32	2.12	3.00	3.48	4.01	-0.66
18925	1	1961	0.42	0.87	0.98	1.51	1.77	2.19	0.57	1.26	2.04	2.82	3.40	4.06	-0.60
18926	1	1876	0.43	0.84	1.01	1.52	1.86	2.27	0.57	1.27	2.03	2.81	3.39	3.91	-0.43
18927	1	1685	0.42	0.84	1.14	1.69	2.05	2.50	0.53	1.31	2.04	2.78	3.43	4.07	-0.66
18928	1	1637	0.41	0.84	1.10	1.68	1.96	2.45	0.50	1.26	1.74	2.36	3.21	3.98	-0.81
18001	1	1442	-0.01	0.13	0.67	2.54	4.05	4.68	-0.01	1.00	2.54	3.33	4.11	4.19	-0.81
18929	1	1389	-0.02	0.13	0.63	2.52	4.04	4.55	-0.02	1.00	2.49	3.29	4.18	4.23	-0.83
18930	1	1124	0.00	0.19	0.48	2.00	3.25	4.23	-0.08	0.58	2.28	3.34	4.22	3.95	-0.79
18931	1	970	0.01	0.19	0.49	2.02	3.24	4.26	-0.08	0.60	2.30	3.33	4.17	3.95	-0.78
18932	1	718	0.00	0.19	0.48	1.91	3.07	4.09	-0.08	0.59	2.14	3.28	4.13	3.97	-0.83
18933	1	654	-0.06	0.20	0.49	1.92	3.10	4.09	-0.08	0.60	2.16	3.29	4.16	3.98	-0.80
18934	1	581	-0.13	0.19	0.49	1.91	3.08	4.08	-0.08	0.61	2.14	3.29	4.09	3.99	-0.74
18935	1	461	-0.41	0.21	0.52	1.98	3.19	4.10	-0.07	0.66	2.18	3.29	4.18	4.02	-0.78
18937	1	295	-0.69	0.14	0.55	2.01	3.14	4.13	-0.59	0.73	2.16	3.23	4.34	4.11	-1.36
18938	1	168	-0.53	0.22	0.57	2.05	3.22	4.15	-0.50	0.73	2.21	3.27	4.29	3.99	-1.40

			% Change												
VO3	DYMENTS CREEK		Chicago 4 Hour Design Storms						SCS Design Storms						Hurricane Hazel
Hydrograph	River Reach	River Station	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	AMCII
18909	1	5093	-14%	-10%	-9%	-8%	-19%	-24%	-9%	-6%	-6%	-21%	-19%	-17%	-4%
18910	1	4942	-13%	-9%	-7%	-5%	-14%	-21%	-8%	-5%	-3%	-14%	-17%	-15%	-3%
18911	1	4589	-13%	-8%	-6%	-5%	-12%	-20%	-7%	-4%	-3%	-11%	-16%	-14%	-3%
18912	1	4256	-13%	-8%	-6%	-5%	-12%	-19%	-8%	-4%	-3%	-10%	-15%	-14%	-3%
18913	1	4215	-12%	-6%	-4%	-2%	-8%	-15%	-5%	-2%	0%	-5%	-12%	-11%	-2%
18914	1	3785	-13%	-7%	-4%	-3%	-9%	-15%	-6%	-2%	-1%	-6%	-10%	-10%	-2%
18915	1	3146	-13%	-5%	-2%	0%	-6%	-10%	-4%	0%	2%	-3%	-5%	-5%	-1%
18916	1	3107	-13%	-5%	-2%	0%	-6%	-10%	-4%	0%	2%	-3%	-5%	-5%	-1%
18918	1	2916	-5%	-2%	-2%	-3%	-7%	-11%	-3%	-2%	-3%	-6%	-7%	-10%	-2%
18919	1	2875	-7%	-6%	-4%	-3%	-7%	-9%	-7%	-3%	-3%	-3%	-4%	-5%	-6%
18921	1	2595	0%	5%	8%	8%	6%	4%	-3%	5%	9%	10%	9%	7%	-2%
18922	1	2380	1%	6%	8%	13%	14%	15%	8%	13%	16%	20%	22%	20%	-2%
18923	1	2251	8%	11%	11%	14%	14%	16%	12%	16%	20%	22%	22%	23%	-2%
18924	1	2085	8%	10%	10%	13%	13%	15%	10%	14%	18%	20%	19%	19%	-2%
18925	1	1961	7%	11%	10%	12%	13%	14%	9%	13%	17%	18%	18%	19%	-2%
18926	1	1876	8%	10%	10%	12%	13%	14%	9%	13%	17%	18%	18%	18%	-1%
18927	1	1685	7%	10%	11%	14%	14%	15%	8%	14%	17%	17%	18%	19%	-2%
18928	1	1637	6%	9%	10%	12%	12%	14%	7%	12%	13%	14%	16%	17%	-2%
18001	1	1442	-1%	3%	10%	31%	41%	37%	0%	15%	27%	23%	23%	19%	-2%
18929	1	1389	-1%	3%	10%	30%	41%	36%	-1%	15%	26%	23%	23%	19%	-2%
18930	1	1124	0%	4%	7%	23%	32%	34%	-2%	8%	24%	24%	24%	18%	-2%
18931	1	970	0%	4%	7%	23%	32%	34%	-2%	9%	25%	24%	24%	18%	-2%
18932	1	718	0%	4%	7%	22%	30%	33%	-2%	9%	23%	24%	23%	18%	-2%
18933	1	654	-2%	4%	7%	22%	30%	32%	-2%	9%	23%	24%	24%	18%	-2%
18934	1	581	-5%	4%	7%	22%	29%	32%	-2%	9%	23%	24%	23%	18%	-2%
18935	1	461	-14%	4%	8%	22%	30%	32%	-2%	10%	23%	23%	23%	18%	-2%
18937	1	295	-20%	3%	8%	22%	29%	31%	-14%	10%	22%	22%	24%	18%	-3%
18938	1	168	-16%	4%	8%	22%	29%	31%	-12%	10%	22%	22%	23%	17%	-3%

HOTCHKISS CREEK
VISUAL OTTHYMO PEAK FLOW SUMMARY

PEAK FLOW COMPARISON
MARCH 2018 VERSUS FEBRUARY 2017 (SCS CURVE NUMBER)

			Δ Peak Flow (m^3/s)												
VO3	HOTCHKISS CREEK		Chicago 4 Hour Design Storms						SCS Design Storms						Hurricane Hazel
Hydrograph	River Reach	River Station	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	AMCII
19901	6	821	0.07	0.10	0.11	0.12	0.14	0.18	0.06	0.08	0.09	0.10	0.11	0.12	0.02
19902	6	701	0.08	0.10	0.12	0.13	0.16	0.19	0.06	0.08	0.08	0.10	0.11	0.12	0.02
19903	6	555	0.02	0.01	0.02	0.02	0.09	0.15	0.01	0.01	0.01	0.14	0.17	0.26	0.02
19904	6	362	0.06	0.07	0.08	0.12	0.12	0.12	0.05	0.07	0.08	0.10	0.24	0.35	0.04
19906	7	290	0.03	0.05	0.08	0.05	0.06	0.06	0.03	0.04	0.05	0.07	0.06	0.05	0.01
19905	3	839	0.17	0.24	0.33	0.37	0.40	0.44	0.17	0.23	0.26	0.35	0.38	0.46	0.10
19907	3	438	0.19	0.29	0.38	0.41	0.44	0.49	0.18	0.24	0.25	0.27	0.32	0.31	0.10
19929	3	415	0.37	0.60	0.66	0.76	0.82	0.89	0.34	0.46	0.58	0.62	0.65	0.65	0.16
19909	3	107	0.38	0.58	0.66	0.71	0.80	0.87	0.35	0.48	0.60	0.69	0.73	0.74	0.18
19121	5	260	0.05	0.06	0.07	0.10	0.09	0.10	0.04	0.08	0.06	0.07	0.10	0.08	0.01
19914	4	480	1.24	1.68	1.99	2.50	2.79	3.12	1.03	1.66	2.03	2.53	2.95	3.28	1.37
19913	4	260	1.24	1.63	1.94	2.40	2.67	3.02	1.03	1.61	1.95	2.40	2.77	3.15	0.25
19928	4	201	1.26	1.67	1.98	2.44	2.72	3.07	1.06	1.63	1.99	2.47	2.85	3.20	0.27
19912	4	67	1.26	1.68	1.95	2.46	2.70	3.05	1.06	1.64	1.99	2.46	2.89	3.20	0.28
19911	2	533	1.44	1.92	2.27	2.79	3.08	3.42	1.18	1.84	2.22	2.75	3.20	3.52	0.31
19910	1	1802	1.08	1.61	1.83	2.07	2.14	2.31	1.05	1.55	1.68	1.83	2.10	1.79	0.09
19917	1	1574	1.04	1.46	1.42	1.90	1.92	1.91	0.99	1.42	1.47	1.20	1.72	1.34	-0.15
19918	1	1236	1.02	1.45	1.35	1.79	1.78	1.78	0.98	1.34	1.36	1.10	1.50	1.18	-0.21
19919	1	1049	1.12	1.55	1.50	1.96	1.97	1.99	1.10	1.44	1.53	1.23	1.63	1.35	-0.17
19920	1	969	3.51	4.65	5.17	6.05	6.62	6.81	3.37	4.68	5.48	6.01	6.48	6.81	1.71
19922	1	623	3.79	5.11	5.47	6.25	7.16	7.33	3.62	4.99	5.82	6.39	6.94	7.52	1.74
19923	1	462	3.79	5.02	5.50	6.22	7.17	7.17	3.62	4.97	5.68	6.32	6.79	7.24	1.75
19924	1	337	4.24	5.03	5.43	6.16	7.08	7.21	4.72	4.90	5.59	6.15	6.76	7.23	1.77
19925	1	182	4.35	5.03	5.56	6.33	7.27	7.43	5.07	5.00	5.73	6.26	6.93	7.39	1.77
19926	1	129	4.38	4.98	5.59	6.20	7.23	7.24	5.02	4.84	5.57	6.17	6.85	7.32	1.78
19927	1	0	4.46	4.86	5.69	6.10	7.29	7.25	4.96	4.84	5.66	6.22	6.90	7.30	1.79

			% Change												
VO3	HOTCHKISS CREEK		Chicago 4 Hour Design Storms						SCS Design Storms						Hurricane Hazel
Hydrograph	River Reach	River Station	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	AMCII
19901	6	821	25%	25%	23%	21%	21%	25%	27%	21%	18%	14%	13%	13%	3%
19902	6	701	23%	21%	21%	19%	20%	21%	19%	17%	13%	12%	11%	10%	3%
19903	6	555	9%	6%	6%	8%	26%	31%	6%	5%	4%	28%	22%	25%	2%
19904	6	362	14%	13%	12%	14%	13%	11%	11%	10%	9%	9%	18%	20%	3%
19906	7	290	13%	13%	16%	7%	7%	6%	11%	7%	8%	9%	6%	5%	1%
19905	3	839	24%	22%	25%	22%	20%	19%	21%	17%	15%	15%	14%	14%	4%
19907	3	438	11%	12%	12%	10%	9%	9%	9%	7%	6%	5%	5%	4%	2%
19929	3	415	13%	14%	12%	11%	10%	9%	10%	8%	8%	6%	5%	4%	2%
19909	3	107	12%	12%	11%	9%	9%	8%	10%	8%	8%	7%	6%	5%	2%
19121	5	260	14%	12%	13%	15%	11%	11%	13%	17%	9%	9%	11%	8%	3%
19914	4	480	144%	139%	135%	136%	130%	129%	119%	120%	116%	109%	106%	98%	41%
19913	4	260	148%	136%	132%	128%	122%	123%	118%	112%	105%	98%	92%	89%	5%
19928	4	201	144%	135%	130%	125%	120%	120%	119%	110%	104%	99%	93%	88%	5%
19912	4	67	136%	130%	122%	119%	111%	111%	111%	106%	98%	92%	89%	82%	5%
19911	2	533	114%	106%	102%	95%	89%	85%	88%	83%	76%	71%	69%	63%	5%
19910	1	1802	23%	23%	20%	18%	16%	15%	20%	17%	14%	11%	11%	8%	1%
19917	1	1574	15%	14%	11%	11%	10%	9%	13%	11%	9%	5%	6%	4%	-1%
19918	1	1236	13%	13%	9%	10%	8%	7%	12%	10%	7%	4%	5%	3%	-1%
19919	1	1049	14%	13%	10%	10%	9%	8%	12%	10%	8%	5%	5%	4%	-1%
19920	1	969	34%	30%	26%	24%	22%	20%	29%	24%	22%	18%	16%	14%	5%
19922	1	623	31%	28%	24%	21%	20%	18%	27%	22%	20%	16%	14%	13%	4%
19923	1	462	31%	27%	24%	21%	20%	17%	27%	22%	19%	16%	14%	13%	4%
19924	1	337	38%	28%	23%	20%	20%	18%	38%	22%	19%	15%	14%	13%	4%
19925	1	182	38%	26%	23%	20%	20%	17%	40%	21%	19%	15%	14%	12%	4%
19926	1	129	38%	26%	23%	20%	20%	17%	39%	20%	18%	15%	14%	12%	4%
19927	1	0	39%	25%	23%	19%	20%	17%	39%	20%	18%	15%	14%	12%	4%

KIDD'S CREEK
VISUAL OTTHYMO PEAK FLOW SUMMARY

PEAK FLOW COMPARISON
MARCH 2018 VERSUS FEBRUARY 2017 (SCS CURVE NUMBER)

			Δ Peak Flow (m^3/s)												
VO3	KIDD'S CREEK		Chicago 4 Hour Design Storms						SCS Design Storms						Hurricane Hazel
Hydrograph	River Reach	River Station	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	AMCII
16139	4	297	-0.06	-0.09	-0.10	-0.12	-0.13	-0.15	-0.06	-0.08	-0.10	-0.16	-0.13	-0.15	-0.03
16925	4	223	-0.06	-0.08	-0.09	-0.10	-0.10	-0.02	-0.05	-0.06	-0.07	-0.12	-0.08	-0.08	-0.01
16924	5	1514	0.10	0.07	-0.05	-0.12	0.00	0.00	0.01	-0.04	-0.08	-0.28	1.04	2.20	2.04
16905	5	1259	0.06	-0.03	-0.05	-0.12	-0.03	-0.09	-0.03	-0.09	-0.13	-0.31	0.88	1.86	1.86
16906	5	1115	0.08	-0.02	-0.04	-0.11	-0.07	-0.14	-0.03	-0.10	-0.15	-0.37	0.65	1.69	1.60
16907	5	906	0.10	0.10	0.29	0.67	1.27	1.68	0.01	0.46	1.08	1.79	3.04	4.72	2.25
16908	5	818	0.10	0.11	0.11	0.32	1.34	1.98	0.01	0.10	0.71	1.97	2.98	4.55	2.39
16909	5	341	0.12	0.21	0.26	0.40	1.35	1.84	0.04	0.14	0.77	1.80	2.90	4.38	2.43
16137	2	389	0.07	0.09	0.11	0.13	0.20	0.16	0.05	0.09	0.10	0.12	0.13	0.18	0.06
16917	2	120	0.08	0.09	0.11	0.13	0.18	0.16	0.06	0.09	0.10	0.10	0.11	0.14	0.05
16910	3	1152	0.06	0.12	0.15	0.09	0.22	0.36	0.04	0.03	0.18	0.83	1.51	2.38	2.60
16911	3	981	0.07	0.13	0.15	0.09	0.15	0.30	0.04	0.01	0.14	0.75	1.37	2.27	2.57
16912	3	839	0.00	-0.01	0.00	-0.01	-0.01	-0.04	-0.01	-0.01	-0.01	0.00	-0.40	-0.29	1.23
16913	3	472	0.02	0.05	0.08	0.10	0.10	0.11	0.04	0.06	0.07	0.08	0.08	-0.29	1.21
16914	3	319	0.03	0.06	0.08	0.10	0.10	0.11	0.04	0.06	0.08	0.09	0.09	-0.28	1.20
16915	3	112	0.04	0.07	0.12	0.11	0.13	0.13	0.04	0.07	0.10	0.12	0.13	-0.29	1.19
16916	1	1489	0.05	0.12	0.23	0.27	0.35	0.29	0.12	0.16	0.19	0.21	0.23	0.27	1.24
16926	1	1406	0.05	0.13	0.22	0.25	0.35	0.33	0.11	0.17	0.20	0.23	0.25	0.29	1.25
16918	1	1230	0.07	0.17	0.25	0.37	0.44	0.40	0.14	0.23	0.26	0.30	0.33	0.37	1.26
16919	1	1073	0.07	0.18	0.26	0.38	0.47	0.46	0.14	0.23	0.30	0.34	0.40	0.44	1.27
16920	1	1051	0.09	0.26	0.32	0.42	0.57	0.51	0.20	0.32	0.37	0.40	0.44	0.49	1.24
16921	1	1000	0.17	0.29	0.33	0.45	0.58	0.59	0.21	0.34	0.40	0.41	0.48	0.51	1.28
16922	1	495	0.05	-0.01	-0.04	-0.04	-0.02	-0.11	-0.03	-0.15	-0.19	-0.36	-0.40	-0.49	0.94
16923	1	411	0.06	0.02	-0.02	0.00	0.02	-0.04	0.03	-0.03	-0.09	-0.29	-0.35	-0.46	0.86

			% Change												
VO3	KIDD'S CREEK		Chicago 4 Hour Design Storms						SCS Design Storms						Hurricane Hazel
Hydrograph	River Reach	River Station	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	AMCII
16139	4	297	-4%	-4%	-4%	-4%	-4%	-3%	-4%	-4%	-3%	-4%	-3%	-3%	-2%
16925	4	223	-2%	-2%	-1%	-1%	-1%	0%	-1%	-1%	-1%	-1%	-1%	-1%	0%
16924	5	1514	4%	2%	-1%	-2%	0%	0%	0%	-1%	-1%	-3%	9%	17%	14%
16905	5	1259	2%	-1%	-1%	-2%	0%	-1%	-1%	-2%	-2%	-3%	8%	14%	12%
16906	5	1115	3%	0%	-1%	-2%	-1%	-1%	-1%	-2%	-2%	-3%	5%	11%	10%
16907	5	906	3%	2%	5%	9%	14%	16%	0%	7%	13%	17%	24%	32%	12%
16908	5	818	2%	2%	1%	4%	13%	17%	0%	1%	7%	16%	20%	27%	11%
16909	5	341	2%	3%	3%	4%	12%	14%	1%	2%	7%	13%	18%	23%	11%
16137	2	389	16%	14%	15%	15%	20%	13%	14%	15%	13%	12%	12%	13%	8%
16917	2	120	15%	13%	13%	13%	16%	12%	12%	13%	11%	8%	9%	9%	5%
16910	3	1152	1%	1%	1%	1%	1%	2%	0%	0%	1%	4%	7%	9%	9%
16911	3	981	1%	1%	1%	1%	1%	1%	1%	0%	1%	4%	5%	8%	8%
16912	3	839	0%	0%	0%	0%	0%	-2%	-1%	0%	0%	0%	-9%	-5%	4%
16913	3	472	1%	2%	3%	3%	3%	3%	2%	2%	2%	2%	2%	-4%	4%
16914	3	319	1%	2%	3%	3%	3%	3%	2%	2%	2%	2%	2%	-4%	4%
16915	3	112	2%	3%	4%	3%	3%	3%	2%	2%	3%	3%	3%	-4%	4%
16916	1	1489	2%	4%	6%	6%	7%	5%	4%	4%	4%	4%	4%	4%	4%
16926	1	1406	2%	4%	6%	5%	6%	5%	4%	4%	4%	4%	3%	3%	4%
16918	1	1230	3%	5%	6%	7%	7%	6%	5%	5%	5%	4%	4%	4%	4%
16919	1	1073	3%	5%	6%	7%	8%	7%	5%	5%	5%	5%	5%	5%	4%
16920	1	1051	3%	7%	7%	7%	8%	6%	6%	6%	6%	5%	5%	4%	4%
16921	1	1000	6%	7%	7%	7%	8%	7%	6%	6%	6%	5%	5%	4%	4%
16922	1	495	2%	0%	-1%	-1%	0%	-1%	-1%	-2%	-3%	-4%	-4%	-4%	3%
16923	1	411	2%	0%	0%	0%	0%	0%	1%	0%	-1%	-3%	-3%	-4%	3%

SOPHIA CREEK
VISUAL OTTHYMO PEAK FLOW SUMMARY

PEAK FLOW COMPARISON
MARCH 2018 VERSUS FEBRUARY 2017 (SCS CURVE NUMBER)

			Δ Peak Flow (m^3/s)												
VO3	SOPHIA CREEK		Chicago 4 Hour Design Storms						SCS Design Storms						Hurricane Hazel
Hydrograph	River Reach	River Station	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	AMCII
15121	6	1124	1.45	1.45	1.51	1.64	1.62	1.30	0.68	0.71	0.65	0.95	0.36	0.17	-0.08
15908	6	1017	1.41	1.41	1.46	1.64	1.64	1.39	0.69	0.67	0.64	0.95	0.32	0.12	-0.09
15909	6	920	1.41	1.36	1.42	1.55	1.56	1.14	0.66	0.66	0.59	0.93	0.38	0.21	-0.07
15910	6	822	1.55	1.37	1.41	1.49	1.47	1.20	0.66	0.59	0.56	0.87	0.32	0.11	-0.10
15911	6	698	1.53	1.27	1.33	1.35	1.31	1.19	0.62	0.57	0.49	0.79	0.17	0.00	-0.11
15912	4	645	1.49	1.25	1.29	1.42	1.33	1.16	0.62	0.55	0.49	0.77	0.15	-0.06	-0.11
15913	4	550	1.62	1.25	1.33	1.36	1.23	1.00	0.66	0.62	0.48	0.77	0.06	-0.32	-0.14
15914	3	355	1.46	1.20	1.25	1.38	1.27	0.98	0.62	0.61	0.48	0.77	0.32	-0.01	-0.76
15915	3	321	-0.63	-1.92	-2.72	-3.54	-4.43	-5.88	-1.75	-3.44	-4.58	-5.61	-7.38	-8.94	-5.00
15916	3	79	2.14	1.76	1.83	2.34	2.50	1.93	1.06	1.14	1.43	2.08	1.05	0.70	-0.43
15905	2	389	4.94	6.84	8.40	10.26	10.43	12.55	5.36	8.29	9.37	11.48	12.84	13.76	6.62
15906	2	222	0.14	0.21	0.07	0.50	0.15	-0.15	0.03	-0.25	-0.21	-0.65	-0.97	-1.81	-1.65
15907	2	203	0.39	0.55	0.58	1.28	1.15	1.05	0.28	0.31	0.65	0.68	0.66	0.21	-0.26
15917	1	1640	-4.00	-6.57	-8.83	-11.34	-13.97	-16.86	-5.83	-10.30	-12.82	-17.42	-23.02	-28.14	-17.91
15918	1	1597	1.71	1.63	1.69	2.22	2.40	2.50	0.73	0.69	1.27	2.05	1.08	0.45	-0.79
15919	1	1496	1.21	0.76	0.67	0.91	1.08	0.88	-0.01	-0.38	0.03	0.23	-0.84	-2.02	-2.55
15920	1	1239	1.80	1.60	1.79	2.25	2.76	2.95	0.80	0.85	1.41	2.32	1.81	0.86	-0.89
15921	1	1186	1.41	1.16	1.17	1.54	1.86	1.73	0.36	0.13	0.57	1.05	0.26	-0.92	-1.91
15922	1	1105	1.53	1.30	1.36	1.82	2.20	2.19	0.50	0.36	0.81	1.56	0.90	-0.28	-1.37
15923	1	1062	1.30	0.88	0.83	1.10	1.41	1.27	0.12	-0.31	-0.11	0.59	-0.33	-1.85	-2.74
15924	1	920	1.45	1.06	0.97	1.12	1.44	1.37	0.23	-0.28	-0.23	0.61	-0.49	-2.00	-3.25
15957	1	680	2.10	1.86	1.97	2.27	2.76	3.01	0.88	0.60	0.83	2.22	1.58	0.48	-1.05
15925	1	671.2	1.88	1.54	1.56	1.73	2.06	2.24	0.61	0.14	0.23	1.31	0.43	-0.96	-1.99
15926	1	559.7	2.20	1.99	2.13	2.37	2.80	3.16	0.98	0.68	0.82	2.20	1.45	0.23	-0.86
15927	1	464.6	1.98	1.55	1.53	1.57	1.88	2.06	0.59	-0.04	-0.15	0.95	0.04	-1.64	-2.60
15928	1	403.8	2.25	1.83	1.89	2.04	2.38	2.71	0.84	0.33	0.20	1.54	0.79	-0.63	-1.69
15929	1	229	2.38	1.98	2.10	2.29	2.64	3.06	0.96	0.55	0.42	1.87	1.18	-0.15	-1.20
15930	1	109	2.43	2.03	2.13	2.31	2.67	3.09	1.00	0.57	0.42	1.88	1.19	-0.14	-1.18
15934	1	-21	2.04	1.34	1.25	1.17	1.47	1.63	0.48	-0.38	-0.79	0.40	-0.41	-2.13	-3.34
15935	1	-237	2.79	2.40	2.32	2.35	2.69	3.12	1.21	0.63	0.21	1.57	1.02	-0.34	-1.21

			% Change												
VO3	SOPHIA CREEK		Chicago 4 Hour Design Storms						SCS Design Storms						Hurricane Hazel
Hydrograph	River Reach	River Station	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	AMCII
15121	6	1124	95%	51%	40%	31%	25%	17%	29%	16%	11%	12%	4%	1%	-1%
15908	6	1017	89%	48%	37%	30%	25%	17%	28%	15%	10%	11%	3%	1%	-1%
15909	6	920	88%	45%	35%	27%	23%	14%	26%	14%	9%	11%	4%	2%	-1%
15910	6	822	79%	37%	28%	21%	17%	12%	21%	10%	7%	8%	2%	1%	-1%
15911	6	698	67%	29%	23%	16%	13%	10%	17%	8%	5%	7%	1%	0%	-1%
15912	4	645	65%	28%	22%	17%	14%	10%	17%	8%	5%	6%	1%	0%	-1%
15913	4	550	60%	24%	19%	14%	11%	7%	15%	8%	5%	5%	0%	-2%	-1%
15914	3	355	51%	23%	18%	14%	11%	7%	14%	8%	5%	5%	2%	0%	-6%
15915	3	321	-13%	-24%	-25%	-24%	-26%	-29%	-27%	-29%	-29%	-28%	-30%	-31%	-29%
15916	3	79	48%	23%	18%	17%	15%	10%	17%	10%	10%	11%	4%	2%	-2%
15905	2	389	485%	304%	255%	201%	148%	139%	323%	225%	155%	116%	103%	89%	61%
15906	2	222	11%	8%	2%	8%	2%	-1%	2%	-6%	-3%	-6%	-7%	-10%	-13%
15907	2	203	29%	21%	15%	22%	14%	10%	14%	7%	9%	6%	5%	1%	-2%
15917	1	1640	-69%	-67%	-66%	-61%	-60%	-59%	-72%	-69%	-63%	-59%	-60%	-61%	-59%
15918	1	1597	29%	16%	12%	12%	10%	9%	9%	5%	6%	7%	3%	1%	-3%
15919	1	1496	19%	7%	5%	4%	4%	3%	0%	-2%	0%	1%	-2%	-4%	-8%
15920	1	1239	27%	14%	12%	11%	11%	10%	9%	5%	6%	7%	4%	2%	-3%
15921	1	1186	21%	10%	7%	7%	7%	5%	4%	1%	2%	3%	1%	-2%	-5%
15922	1	1105	21%	11%	8%	8%	8%	7%	5%	2%	3%	5%	2%	-1%	-4%
15923	1	1062	17%	7%	5%	5%	5%	4%	1%	-2%	0%	2%	-1%	-3%	-7%
15924	1	920	18%	8%	5%	4%	5%	4%	2%	-1%	-1%	2%	-1%	-3%	-8%
15957	1	680	26%	13%	11%	9%	9%	8%	8%	3%	3%	6%	3%	1%	-3%
15925	1	671.2	23%	11%	8%	7%	7%	6%	5%	1%	1%	3%	1%	-2%	-5%
15926	1	559.7	27%	14%	11%	9%	9%	8%	8%	3%	3%	6%	3%	0%	-2%
15927	1	464.6	23%	10%	8%	6%	6%	5%	5%	0%	-1%	2%	0%	-3%	-6%
15928	1	403.8	26%	12%	10%	8%	7%	7%	7%	1%	1%	4%	2%	-1%	-4%
15929	1	229	27%	13%	10%	8%	8%	8%	8%	2%	1%	5%	2%	0%	-3%
15930	1	109	28%	13%	11%	8%	8%	8%	8%	3%	1%	5%	2%	0%	-3%
15934	1	-21	22%	8%	6%	4%	4%	4%	4%	-2%	-3%	1%	-1%	-3%	-7%
15935	1	-237	30%	15%	11%	8%	8%	8%	9%	3%	1%	4%	2%	-1%	-2%

WHISKEY CREEK
VISUAL OTTHYMO PEAK FLOW SUMMARY

PEAK FLOW COMPARISON
MARCH 2018 VERSUS FEBRUARY 2017 (SCS CURVE NUMBER)

			Δ Peak Flow (m^3/s)												
VO3	WHISKEY CREEK		Chicago 4 Hour Design Storms						SCS Design Storms						Hurricane Hazel
Hydrograph	River Reach	River Station	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	AMCII
23111	7	494	0.03	0.05	0.07	0.06	0.06	0.09	0.03	0.04	0.05	0.05	0.06	0.07	0.01
23906	7	125	0.04	0.06	0.11	0.12	0.14	0.19	0.06	0.09	0.13	0.18	0.21	0.25	0.06
23902	6	432	-0.04	-0.01	-0.13	0.12	0.16	0.25	0.01	0.18	0.19	0.26	0.40	0.50	0.22
23905	4	2254	0.06	0.11	0.16	0.20	0.24	0.33	0.08	0.16	0.23	0.31	0.39	0.46	0.54
23907	4	2142	0.08	0.12	0.18	0.22	0.28	0.36	0.10	0.18	0.26	0.35	0.44	0.51	0.54
23908	4	2010	0.06	0.12	0.19	0.24	0.29	0.39	0.09	0.18	0.26	0.38	0.47	0.58	0.50
23909	4	1709	0.01	0.03	0.06	0.09	0.13	0.20	0.03	0.11	0.18	0.26	0.36	0.44	0.53
23910	4	1481	-0.03	-0.03	-0.01	-0.02	0.04	0.06	0.01	0.09	0.16	0.27	0.45	0.55	0.81
23911	4	1160	-0.05	-0.05	-0.03	-0.06	-0.03	0.01	-0.01	0.06	0.12	0.24	0.37	0.47	0.82
23912	4	1100	-0.04	-0.03	-0.02	-0.04	-0.01	0.02	0.01	0.09	0.13	0.25	0.41	0.49	0.84
23913	5	389	-0.32	-0.46	-0.54	-0.68	-0.77	-0.94	-0.37	-0.60	-0.77	-0.99	-1.20	-1.40	-1.36
23914	5	101	-0.61	-0.87	-1.10	-1.11	-1.18	-1.35	-0.60	-0.93	-1.04	-1.28	-1.51	-1.75	-1.30
23915	3	1697	-3.59	-5.45	-6.79	-8.28	-9.56	-11.31	-4.33	-6.91	-8.83	-11.60	-13.87	-16.31	-16.64
23916	3	1351	-3.17	-4.56	-5.56	-6.82	-7.70	-9.35	-3.79	-5.85	-7.46	-9.52	-11.37	-13.32	-16.59
23917	3	953	-0.32	-0.29	-0.09	0.26	0.37	0.25	-0.13	0.28	0.44	0.84	1.38	1.51	0.88
23918	3	512	0.22	0.17	0.31	0.41	0.27	-0.05	0.27	0.54	0.37	0.44	0.86	0.92	0.81
23919	3	352	0.11	0.05	0.15	0.19	0.04	-0.33	0.19	0.41	0.23	0.21	0.57	0.60	1.12
23940	3	222	-1.84	-2.69	-3.23	-4.07	-4.84	-5.88	-1.88	-2.85	-3.81	-5.17	-5.82	-6.60	-4.44
23002	3	169	-1.50	-1.01	-0.16	1.32	2.45	-0.02	-1.02	0.64	2.35	1.35	-1.96	-3.98	-4.06
23920	3	108	-0.20	1.01	2.46	4.87	6.74	4.98	0.50	3.30	5.88	6.07	3.60	2.37	1.34
23922	2	1332	3.36	4.63	5.28	5.73	6.13	10.50	4.47	5.71	6.15	11.19	16.36	20.58	28.42
23923	2	1059	2.72	3.70	4.23	4.21	4.32	8.46	3.79	4.56	4.63	9.23	14.08	17.89	27.14
23924	2	864	-0.77	-1.11	-1.27	-1.80	-2.20	-2.58	-0.87	-1.41	-1.89	-2.62	-3.13	-3.81	-2.35
23925	2	683	-1.30	-1.61	-2.25	-2.87	-3.41	-3.97	-1.50	-2.41	-2.93	-4.16	-5.11	-6.00	-3.93
23926	2	601	-2.08	-2.77	-3.61	-4.59	-5.27	-6.07	-2.23	-3.61	-4.45	-6.16	-7.53	-8.96	-5.09
23927	2	383	-1.13	-1.34	-1.82	-2.28	-2.54	-2.93	-1.07	-1.75	-2.21	-2.94	-3.81	-4.46	-2.04
23921	2	110	-5.08	-6.82	-7.88	-9.04	-9.80	-10.67	-5.95	-8.07	-9.29	-10.85	-14.08	-18.90	-31.33
23928	1	1549	-2.78	-3.64	-3.85	-3.62	-3.61	-6.40	-3.28	-3.47	-3.39	-5.16	-9.78	-14.10	-30.96
23929	1	1515	1.55	2.42	3.11	4.35	5.03	3.02	2.16	3.83	4.95	4.55	4.88	5.79	1.73
23930	1	974	-0.52	-0.50	-0.52	-0.61	-0.76	-0.18	-0.30	-0.30	-0.41	0.78	0.85	1.54	-0.76
23931	1	929	-0.52	-0.51	-0.52	-0.61	-0.77	-0.21	-0.31	-0.30	-0.42	0.73	0.79	1.44	-0.81
23932	1	663	-0.43	-0.56	-0.47	-0.58	-0.91	-1.62	-0.33	-0.44	-0.57	-0.91	-3.83	-6.35	0.29
23933	1	562	-0.56	-0.71	-0.68	-0.85	-1.26	-1.95	-0.47	-0.66	-0.84	-1.24	-4.24	-6.93	-0.69
23935	1	495	-0.49	-0.60	-0.51	-0.60	-0.96	-1.61	-0.35	-0.46	-0.55	-0.87	-3.81	-6.42	0.34
23934	1	451	-0.38	-0.50	-0.36	-0.40	-0.73	-1.39	-0.23	-0.31	-0.35	-0.71	-3.64	-6.16	1.19
23936	1	243	-0.36	-0.49	-0.35	-0.38	-0.71	-1.35	-0.23	-0.30	-0.34	-0.66	-3.57	-6.00	1.36
23937	1	225	-0.38	-0.52	-0.40	-0.46	-0.82	-1.74	-0.25	-0.37	-0.45	-1.06	-4.40	-7.52	-1.56
23938	1	180	-0.38	-0.51	-0.39	-0.46	-0.82	-1.72	-0.24	-0.34	-0.45	-1.04	-4.37	-7.48	-1.61
23939	1	30	-0.34	-0.48	-0.33	-0.34	-0.73	-1.56	-0.20	-0.30	-0.40	-0.97	-4.06	-6.97	-1.49

			% Change												
VO3	WHISKEY CREEK		Chicago 4 Hour Design Storms						SCS Design Storms						Hurricane Hazel
Hydrograph	River Reach	River Station	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	AMCII
23111	7	494	5%	5%	6%	4%	4%	4%	5%	4%	3%	3%	2%	2%	1%
23906	7	125	7%	7%	9%	8%	7%	9%	8%	7%	8%	8%	8%	8%	2%
23902	6	432	-1%	0%	-2%	2%	2%	3%	0%	3%	3%	3%	3%	4%	2%
23905	4	2254	4%	5%	7%	7%	8%	9%	5%	6%	7%	8%	9%	9%	5%
23907	4	2142	5%	6%	7%	8%	8%	9%	5%	7%	8%	9%	9%	9%	5%
23908	4	2010	4%	5%	7%	7%	8%	9%	4%	6%	7%	8%	9%	9%	4%
23909	4	1709	1%	1%	2%	2%	3%	4%	2%	3%	5%	5%	6%	7%	4%
23910	4	1481	-2%	-1%	0%	0%	1%	1%	0%	3%	4%	5%	7%	7%	6%
23911	4	1160	-2%	-2%	-1%	-1%	-1%	0%	0%	2%	3%	4%	5%	6%	6%
23912	4	1100	-2%	-1%	-1%	-1%	0%	0%	0%	2%	3%	4%	6%	6%	6%
23913	5	389	-86%	-81%	-79%	-76%	-74%	-74%	-80%	-76%	-75%	-73%	-73%	-72%	-57%
23914	5	101	-55%	-54%	-54%	-44%	-42%	-41%	-52%	-50%	-44%	-42%	-42%	-42%	-40%
23915	3	1697	-81%	-82%	-82%	-79%	-79%	-79%	-82%	-82%	-81%	-80%	-80%	-80%	-82%
23916	3	1351	-72%	-71%	-70%	-68%	-67%	-67%	-72%	-71%	-70%	-68%	-68%	-68%	-79%
23917	3	953	-7%	-5%	-1%	3%	3%	2%	-2%	3%	4%	6%	8%	8%	4%
23918	3	512	6%	3%	4%	4%	2%	0%	6%	7%	4%	3%	5%	5%	4%
23919	3	352	3%	1%	2%	2%	0%	-2%	4%	5%	2%	1%	3%	3%	5%
23940	3	222	-35%	-33%	-31%	-30%	-30%	-30%	-29%	-26%	-26%	-26%	-25%	-25%	-15%
23002	3	169	-30%	-15%	-2%	16%	27%	0%	-18%	8%	28%	10%	-10%	-16%	-14%
23920	3	108	-4%	15%	33%	57%	74%	36%	9%	43%	69%	45%	18%	10%	5%
23922	2	1332	271%	268%	253%	213%	196%	297%	363%	296%	252%	341%	428%	456%	1132%
23923	2	1059	141%	135%	132%	98%	86%	148%	193%	145%	115%	175%	224%	240%	651%
23924	2	864	-40%	-40%	-39%	-41%	-42%	-43%	-43%	-43%	-44%	-45%	-46%	-46%	-48%
23925	2	683	-42%	-39%	-43%	-42%	-42%	-42%	-45%	-44%	-43%	-45%	-46%	-45%	-48%
23926	2	601	-55%	-54%	-55%	-54%	-54%	-54%	-55%	-55%	-53%	-55%	-55%	-55%	-51%
23927	2	383	-31%	-27%	-28%	-27%	-26%	-26%	-27%	-27%	-26%	-26%	-28%	-27%	-20%
23921	2	110	-62%	-61%	-59%	-55%	-53%	-51%	-63%	-58%	-55%	-51%	-53%	-56%	-76%
23928	1	1549	-48%	-46%	-41%	-33%	-29%	-38%	-48%	-37%	-31%	-33%	-44%	-49%	-76%
23929	1	1515	27%	30%	33%	40%	40%	18%	32%	41%	45%	29%	22%	20%	4%
23930	1	974	-9%	-6%	-5%	-5%	-6%	-1%	-4%	-3%	-4%	5%	4%	6%	-2%
23931	1	929	-9%	-6%	-5%	-5%	-6%	-1%	-4%	-3%	-4%	5%	4%	5%	-2%
23932	1	663	-7%	-7%	-5%	-5%	-7%	-9%	-5%	-5%	-5%	-6%	-17%	-22%	1%
23933	1	562	-9%	-8%	-7%	-7%	-9%	-11%	-6%	-7%	-7%	-8%	-19%	-24%	-2%
23935	1	495	-8%	-7%	-5%	-5%	-7%	-9%	-5%	-5%	-5%	-5%	-17%	-22%	1%
23934	1	451	-6%	-6%	-4%	-3%	-5%	-8%	-3%	-3%	-3%	-4%	-16%	-21%	3%
23936	1	243	-6%	-6%	-3%	-3%	-5%	-8%	-3%	-3%	-3%	-4%	-16%	-21%	3%
23937	1	225	-6%	-6%	-4%	-4%	-6%	-10%	-3%	-4%	-4%	-6%	-19%	-26%	-3%
23938	1	180	-6%	-6%	-4%	-4%	-6%	-10%	-3%	-3%	-4%	-6%	-19%	-26%	-3%
23939	1	30	-5%	-5%	-3%	-3%	-5%	-9%	-3%	-3%	-3%	-6%	-18%	-24%	-3%

LOVERS CREEK
VISUAL OTTHYMO PEAK FLOW SUMMARY

PEAK FLOW COMPARISON
MARCH 2018 VERSUS JANUARY 2017 (SCS CURVE NUMBER)

				Δ Peak Flow (m^3/s)												
VO3	LOVERS CREEK			Chicago 4 Hour Design Storms						SCS Design Storms						Hurricane Hazel
Hydrograph	River	River Reach	River Station	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	AMCII
26101	LoversTrib12	Trib. 12	2022.191	-0.15	-0.11	-0.07	0.02	0.08	0.15	-0.10	0.04	0.15	0.32	0.44	0.56	1.00
26102	Lovers	Main13	17068.83	-0.58	-0.57	-0.52	-0.38	-0.28	-0.14	-0.44	-0.14	0.10	0.42	0.67	0.93	1.68
26902	Lovers	Main13	14591.37	-0.67	-0.68	-0.59	-0.42	-0.29	-0.10	-0.56	-0.19	0.13	0.57	0.91	1.24	2.41
26901	Lovers	Main12	12805.08	-0.59	-0.55	-0.44	-0.26	-0.07	0.15	-0.53	-0.20	0.16	0.68	1.11	1.59	4.23
26105	LoversTrib11	Trib. 11	4142.068	-0.30	-0.28	-0.24	-0.17	-0.11	-0.03	-0.25	-0.10	0.02	0.21	0.34	0.47	1.07
26903	LoversTrib11	Trib. 11	600.6452	-0.22	-0.21	-0.16	-0.09	-0.02	0.06	-0.20	-0.09	0.03	0.21	0.35	0.51	1.18
26904	Lovers	Main12	11880.01	-0.76	-0.63	-0.45	-0.17	0.07	0.34	-0.58	-0.18	0.21	0.78	1.30	1.65	4.35
265000	Lovers	Main11	11736.01	-0.59	-0.50	-0.37	-0.03	0.02	0.09	-0.46	-0.02	0.06	0.21	0.34	0.45	4.17
26109	LoversTrib10	Trib. 10	1030.103	-0.20	-0.22	-0.21	-0.20	-0.18	-0.16	-0.13	-0.07	-0.03	0.02	0.06	0.10	0.15
26905	Lovers	Main10	11268.73	-0.53	-0.48	-0.37	-0.04	0.00	0.08	-0.44	-0.09	0.04	0.20	0.32	0.45	4.06
N/A	LoversTrib9	Trib. 9	1813.445	Flows for this tributary from Barrie DSWMMP.												
26905	Lovers	Main09	10933.77	-0.53	-0.48	-0.37	-0.04	0.00	0.08	-0.44	-0.09	0.04	0.20	0.32	0.45	4.06
26108	LoversTrib8	Trib. 8	2104.788	-0.07	0.01	0.08	0.17	0.26	0.33	0.00	0.18	0.30	0.46	0.58	0.69	5.71
26906	Lovers	Main08	10585.7	-0.53	-0.47	-0.31	0.02	0.13	0.24	-0.44	0.00	0.11	0.26	0.40	0.49	4.25
26907	Lovers	Main08	10326.75	-0.53	-0.48	-0.30	0.01	0.15	0.28	-0.44	0.01	0.12	0.25	0.40	0.51	4.28
26908	Lovers	Main08	9924.291	-0.51	-0.47	-0.28	0.10	0.25	0.42	-0.45	0.01	0.17	0.39	0.59	0.82	4.49
26115	LoversTrib7	Trib. 7	2400.669	-0.11	-0.04	0.02	0.10	0.16	0.23	-0.02	0.13	0.24	0.37	0.47	0.56	0.70
26909	Lovers	Main07	9560.6	-0.26	-0.17	-0.05	0.21	0.46	0.70	-0.43	0.00	0.27	0.68	0.92	1.19	2.69
26113	LoversTrib6	Trib. 6	830.3067	-0.13	-0.08	-0.02	0.07	0.14	0.22	-0.03	0.12	0.25	0.41	0.52	0.64	0.84
26911	Lovers	Main06	9172.416	-0.35	-0.16	0.04	0.36	0.61	0.87	-0.16	0.17	0.46	0.90	1.21	1.75	3.22
26114	LoversTrib5	Trib. 5	2578.718	-0.86	-1.62	-2.23	-3.10	-3.78	-4.51	-1.35	-2.50	-3.39	-4.64	-5.66	-6.72	-14.38
26912	Lovers	Main05	8706.571	-6.99	-13.29	-18.59	-26.49	-32.62	-39.03	-10.89	-20.72	-28.80	-40.01	-48.88	-58.13	-127.07
26913	Lovers	Main05	8407.546	-7.05	-13.40	-18.76	-26.63	-32.86	-39.29	-10.99	-20.90	-29.00	-40.32	-49.24	-58.50	-128.57
26914	Lovers	Main05	7691.346	-7.47	-14.16	-19.73	-27.91	-34.29	-41.03	-11.62	-21.88	-30.18	-41.89	-51.03	-60.64	-133.78
26926	LoversTrib4.1	Trib. 4.1.1	1904.3	-0.87	-0.68	-0.43	-0.03	0.35	0.76	-0.20	0.41	1.03	1.95	2.76	3.67	12.76
26991	LoversTrib4.1	Trib. 4.1.1	1746.581	4.40	10.14	15.26	22.81	28.87	35.06	8.70	18.17	26.09	37.23	45.99	55.48	131.91
26919	LoversTrib4.1	Trib. 4.1.1	1704.249	0.98	5.32	9.45	15.81	20.66	25.80	5.18	12.85	19.51	28.88	36.30	44.26	127.05
26920	LoversTrib4.1	Trib. 4.1.1	1479.158	-0.70	-1.34	-2.05	-2.81	-3.20	-3.82	-0.46	-1.66	-2.48	-3.45	-4.71	-6.27	-3.33
26006	LoversTrib4.1	Trib. 4.1.1	1287.58	5.51	12.16	17.35	25.04	31.37	37.93	10.06	20.06	27.96	39.45	48.12	57.17	140.56
26921	LoversTrib4.1	Trib. 4.1.1	785.9333	0.03	-0.49	-1.08	-2.03	-2.66	-3.48	-0.30	-1.35	-2.47	-3.81	-5.31	-7.01	-6.68
26918	LoversTrib4.1	Trib. 4.1.1	539.962	0.66	0.47	0.03	-0.66	-1.10	-1.71	0.32	-0.34	-1.23	-2.26	-3.46	-4.89	-6.01
26122	LoversTrib4	Trib. 4.2	2863.215	4.41	5.73	6.55	7.52	8.34	9.07	3.86	5.31	6.15	7.29	8.14	8.92	-4.42
26917	LoversTrib4	Trib. 4.1	322.0645	-1.07	-1.82	-2.28	-2.94	-3.70	-4.42	-1.73	-2.72	-3.48	-4.78	-5.24	-5.53	-17.35
26916	Lovers	Main04	6658.264	-8.12	-16.24	-22.15	-31.27	-38.74	-46.62	-13.38	-24.87	-34.09	-47.71	-58.35	-68.61	-165.30
26929	Lovers	Main04	6626.625	-7.75	-15.60	-21.87	-30.89	-38.18	-45.85	-12.61	-24.42	-33.78	-47.07	-57.41	-67.50	-162.05
26930	Lovers	Main04	6341.946	-7.68	-15.47	-21.77	-30.79	-38.08	-45.74	-12.55	-24.29	-33.73	-47.03	-57.31	-67.40	-161.84
26931	Lovers	Main04	5902.777	-9.25	-17.67	-24.40	-34.57	-42.66	-51.33	-14.44	-26.95	-37.25	-52.29	-64.41	-76.54	-177.26
26160	LoversTrib3	Trib. 3.2	2338	0.03	0.52	1.02	1.81	2.45	3.21	0.57	1.70	2.71	4.19	5.40	6.73	15.23
26943	LoversTrib3	Trib. 3.2	2278	0.10	0.71	1.33	2.35	3.31	4.22	0.59	1.89	3.31	5.04	6.56	8.24	20.05
26941	LoversTrib3	Trib. 3.2	2106	0.57	1.76	2.20	3.16	4.63	5.71	1.07	2.75	4.12	6.80	7.90	9.14	30.79
26939	LoversTrib4	Trib. 3.2	1786	7.18	15.50	21.65	31.49	39.73	48.36	12.44	24.85	34.94	50.34	61.98	73.19	179.53
26938	LoversTrib3	Trib. 3.2	1678	7.18	15.51	21.64	31.49	39.72	48.34	12.43	24.86	34.93	50.34	61.97	73.17	179.51
26937	LoversTrib3	Trib. 3.2	1519	6.82	14.89	21.52	31.32	39.55	48.15	12.00	24.74	34.79	50.17	61.79	72.96	178.83
26012	LoversTrib3	Trib. 3.1	1500	7.51	15.85	22.85	33.34	41.81	51.11	13.03	26.20	37.06	53.14	66.31	79.20	190.75
26936	LoversTrib3	Trib. 3.1	1393	-0.18	-0.22	-0.33	-0.50	-0.52	-0.56	-0.24	-0.41	-0.59	-0.70	-0.78	-0.86	-1.33
26935	LoversTrib3	Trib. 3.1	1205	-0.18	-0.22	-0.32	-0.49	-0.51	-0.56	-0.22	-0.37	-0.55	-0.64	-0.70	-0.76	-0.39
26934	LoversTrib3	Trib. 3.0	561.1898	-0.61	-0.72	-0.20	-0.75	-0.85	-0.87	-0.79	-0.35	-0.65	-0.73	-0.96	-1.32	-3.28
26933	LoversTrib3	Trib. 3.0	474.0832	-1.22	-1.57	-1.18	-1.48	-1.83	-1.45	-1.47	-1.63	-1.71	-1.97	-1.44	-1.91	-4.23
26932	Lovers	Main03	5240.499	-7.98	-16.56	-22.45	-31.89	-39.65	-47.36	-13.85	-25.71	-35.44	-49.34	-60.29	-71.62	-177.51
26173	LoversTrib2	Trib. 2	1712.844	0.87	0.83	0.99	0.97	0.82	1.36	0.59	0.40	0.40	0.57	1.43	2.24	0.63
26952	LoversTrib2	Trib. 2	303.7247	-0.45	-1.46	-2.17	-3.30	-4.24	-5.25	-1.23	-2.79	-3.97	-5.75	-7.11	-8.54	-20.76
26951	Lovers	Main02	4968.416	-8.91	-18.54	-26.01	-36.97	-46.10	-55.72	-15.44	-29.43	-40.67	-57.59	-71.25	-85.26	-207.36
26953	Lovers	Main02	4535.809	-8.82	-18.41	-25.91	-36.83	-45.91	-55.66	-15.39	-29.40	-40.63	-57.51	-71.18	-85.25	-207.80
26966	LoversTrib1	Trib. 1.4	3300	2.07	2.81	3.43	4.29	4.95	6.48	2.34	3.40	4.13	5.92	8.01	10.07	11.97
26965	LoversTrib1	Trib. 1.4	2792	2.81	4.04	4.92	5.97	6.80	7.68	3.20	4.83	5.96	7.52	8.77	10.27	12.69
26964	LoversTrib1	Trib. 1.4	2037	7.83	16.56	23.61	33.98	42.22	51.45	13.85	27.14	37.93	53.59	66.82	80.29	193.74
26963	LoversTrib1	Trib. 1.4	1992	0.46	0.92	1.28	1.79	2.18	2.62	0.79	1.51	2.04	2.82	3.47	4.15	5.79
26961	LoversTrib1	Trib. 1.4	1850	0.42	0.86	1.22	1.71	2.08	2.51	0.75	1.44	1.97	2.73	3.36	4.02	5.41
26185	LoversTrib1	Trib. 1.3	1817	0.53	1.63	2.50	3.73	4.65	5.64	1.57	3.30	4.61	6.34	7.61	8.93	21.88
26960	LoversTrib1	Trib. 1.3	1094	7.17	16.29	23.86	35.16	44.10	54.09	13.79	27.77	39.49	56.32	69.85	84.09	217.11
26959	LoversTrib1	Trib. 1.2	1621	4.95	13.16	20.12	30.55	38.94	48.14	11.68	24.41	35.29	51.11	63.95	77.28	209.97
26958	LoversTrib1	Trib. 1.2	1554.214	-4.76	-6.69	-8.07	-10.16	-11.71	-13.43	-4.73	-7.63	-9.74	-12.57	-15.09	-17.62	-11.25
26003	LoversTrib1	Trib. 1.1	1510	-0.32	-0.39	-0.38	-0.33	-0.30	-0.27	-0.24	-0.28	-0.24	-0.19	-0.16	-0.08	3.33
26956	LoversTrib1	Trib. 1.2	1278.733	-5.68	-8.03	-9.78	-12.30	-14.12	-16.15	-5.70	-9.15	-11.76	-15.03	-18.02	-20.75	-11.74
26002	LoversTrib1	Trib. 1.0	1218.55	-1.35	-1.02	-0.73	-0.42	-0.14	0.14	-1.41	-0.98	-0.65	-0.10	0.32	0.83	-9.84
26957	LoversTrib1	Trib. 1.0	939.514	-1.21	-0.68	-0.25	0.17	0.47	0.80	-1.22	-0.63	-0.22	0.28	0.72	1.21	-10.44
26955	LoversTrib1	Trib. 1.0	446.5532	-1.93	-2.21	-2.35	-2.50	-2.49	-2.61	-2.28	-2.57	-2.76	-2.98	-3.05	-3.07	-17.38
26970	Lovers	Main01	4159.121	-7.87	-17.11	-24.67	-36.87	-45.83	-55.59	-14.74	-28.51	-40.66	-57.80	-70.89	-84.21	-218.90
26971	Lovers	Main01	3586.156	-4.69	-12.54	-19.13	-29.85	-37.94	-46.36	-11.43	-23.30	-33.93	-49.27	-61.01	-73.13	-213.12
26974	Lovers	Main01	3327.937	-3.19	-10.56	-16.64	-26.57	-34.04	-42.12	-10.11	-21.17	-31.26	-45.93	-57.07	-68.34	-215.37
26975	Lovers	Main01	2734.631	-9.54	-19.82	-28.04	-40.95	-50.97	-61.27	-16.83	-32.16	-45.34	-64.04	-78.70	-93.54	-231.39
26977	Lovers	Main01	2127.919	-1.72	-8.27	-14.03	-22.92	-29.71	-37.79	-8.62	-18.79	-28.25	-42.24	-52.64	-63.18	-213.27
26979	Lovers	Main01	2074.773	-6.68	-16.65	-24.66	-37.09	-47.00	-57.19	-13.89	-28.88	-41.78	-60.38	-74.75	-88.98	-214.53
26980	Lovers	Main01	1601.441	-6.42	-16.31	-24.16	-36.48	-46.28	-56.33	-13.62	-28.50	-41.23	-59.41	-73.65	-87.98	-213.55
26982	Lovers	Main01	1357.49	-6.57	-16.25	-24.06	-36.20	-45.89	-55.84	-13.66	-28.34	-40.97	-59.17	-73.21	-87.50	-211.06
26983	Lovers	Main01	1302.252	-0.83	-1.09	0.66	0.61	0.51	0.96	-1.14	-0.10	0.23	-0.13	0.26	1.00	3.64
26986	Lovers	Main01	1264.763	-1.04	-1.17	0.27	0.19	0.16	0.41	-1.33	-0.48	-0.27	-0.78	-0.32	0.69	3.31
26987	Lovers	Main01	1160.818	-0.89	-0.79	0.48	0.52	0.61	0.89	-0.99	-0.06	0.53	0.20	0.91	2.25	10.62
26988	Lovers	Main01	1049.722	-0.91	-8.24	0.29	0.38	0.46	0.71	-0.95	0.00	0.62	0.38	0.95	2.21	11.36
26989	Lovers	Main01	545.2612	-0.87	-8.04	0.24	0.62	0.71	1.01	-0.93	0.01	0.88	0.54	1.36	2.92	11.85
26990	Lovers	Main01	17.79831	-0.83	-0.65	0.35	0.88	1.08	1.37	-0.86	0.11	1.09	0.90	1.87	3.31	13.02

LOVERS CREEK
VISUAL OTTHYMO PEAK FLOW SUMMARY

PEAK FLOW COMPARISON
MARCH 2018 VERSUS JANUARY 2017 (SCS CURVE NUMBER)

				% Change												
VO3	LOVERS CREEK			Chicago 4 Hour Design Storms						SCS Design Storms						Hurricane Hazel
Hydrograph	River	River Reach	River Station	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	AMCII
26101	LoversTrib12	Trib. 12	2022.191	-19%	-7%	-3%	1%	2%	3%	-8%	2%	4%	7%	8%	8%	8%
26102	Lovers	Main13	17068.83	-21%	-11%	-7%	-4%	-2%	-1%	-10%	-2%	1%	3%	3%	4%	4%
26902	Lovers	Main13	14591.37	-21%	-11%	-7%	-3%	-2%	-1%	-10%	-2%	1%	3%	4%	4%	5%
26901	Lovers	Main12	12805.08	-20%	-9%	-5%	-2%	0%	1%	-11%	-2%	1%	3%	5%	5%	7%
26105	LoversTrib11	Trib. 11	4142.068	-19%	-10%	-6%	-3%	-2%	0%	-10%	-2%	0%	2%	3%	4%	5%
26903	LoversTrib11	Trib. 11	600.6452	-15%	-7%	-4%	-2%	0%	1%	-9%	-2%	0%	2%	3%	4%	4%
26904	Lovers	Main11	11736.01	-17%	-7%	-3%	-1%	0%	1%	-8%	-1%	1%	3%	4%	4%	5%
265000	Lovers	Main11	11736.01	-15%	-6%	-3%	0%	0%	1%	-7%	0%	0%	1%	2%	2%	6%
26109	LoversTrib10	Trib. 10	1030.103	-10%	-6%	-4%	-3%	-2%	-2%	-4%	-1%	0%	0%	0%	1%	1%
26905	Lovers	Main10	11268.73	-15%	-6%	-3%	0%	0%	1%	-7%	-1%	0%	1%	2%	2%	6%
N/A	LoversTrib9	Trib. 9	1813.445	Flows for this tributary from Barrie DSWMMP.												
26905	Lovers	Main09	10933.77	-15%	-6%	-3%	0%	0%	1%	-7%	-1%	0%	1%	2%	2%	6%
26108	LoversTrib8	Trib. 8	2104.788	-6%	0%	3%	4%	5%	6%	0%	6%	7%	8%	8%	8%	49%
26906	Lovers	Main08	10585.7	-14%	-6%	-3%	0%	1%	1%	-6%	0%	1%	1%	2%	2%	6%
26907	Lovers	Main08	10326.75	-14%	-6%	-3%	0%	1%	2%	-6%	0%	1%	1%	2%	2%	6%
26908	Lovers	Main08	9924.291	-13%	-6%	-2%	1%	1%	2%	-6%	0%	1%	2%	2%	3%	6%
26115	LoversTrib7	Trib. 7	2400.669	-4%	-1%	0%	1%	1%	2%	0%	2%	2%	3%	3%	3%	2%
26909	Lovers	Main07	9560.6	-5%	-2%	0%	1%	2%	2%	-5%	0%	1%	2%	2%	3%	3%
26113	LoversTrib6	Trib. 6	830.3067	-13%	-4%	-1%	2%	3%	4%	-2%	4%	6%	7%	7%	8%	6%
26911	Lovers	Main06	9172.416	-6%	-1%	0%	1%	2%	2%	-2%	1%	2%	2%	3%	3%	3%
26114	LoversTrib5	Trib. 5	2578.718	-98%	-97%	-96%	-95%	-95%	-94%	-97%	-95%	-94%	-93%	-93%	-92%	-93%
26912	Lovers	Main05	8706.571	-98%	-97%	-97%	-97%	-97%	-96%	-97%	-96%	-96%	-96%	-96%	-96%	-96%
26913	Lovers	Main05	8407.546	-98%	-97%	-97%	-97%	-97%	-96%	-97%	-97%	-96%	-96%	-96%	-96%	-96%
26914	Lovers	Main05	7691.346	-97%	-95%	-95%	-94%	-94%	-94%	-96%	-94%	-93%	-93%	-93%	-92%	-92%
26926	LoversTrib4.1	Trib. 4.1.1	1904.3	-63%	-36%	-19%	-1%	11%	21%	-16%	21%	43%	64%	78%	91%	293%
26991	LoversTrib4.1	Trib. 4.1.1	1746.581	217%	353%	446%	537%	598%	640%	463%	614%	709%	794%	835%	883%	2817%
26919	LoversTrib4.1	Trib. 4.1.1	1704.249	18%	68%	101%	138%	156%	171%	94%	152%	185%	217%	234%	248%	1144%
26920	LoversTrib4.1	Trib. 4.1.1	1479.158	-68%	-64%	-64%	-63%	-60%	-60%	-40%	-53%	-54%	-54%	-56%	-59%	-31%
26006	LoversTrib4.1	Trib. 4.1.1	1287.58	402%	624%	598%	584%	613%	612%	724%	704%	644%	644%	599%	560%	1301%
26921	LoversTrib4.1	Trib. 4.1.1	785.9333	2%	-22%	-34%	-44%	-47%	-51%	-21%	-43%	-52%	-57%	-61%	-65%	-48%
26918	LoversTrib4.1	Trib. 4.1.1	539.962	54%	21%	1%	-14%	-19%	-25%	22%	-11%	-26%	-33%	-40%	-45%	-43%
26122	LoversTrib4	Trib. 4.2	2863.215	445%	298%	243%	198%	178%	161%	243%	175%	146%	124%	112%	102%	-22%
26917	LoversTrib4	Trib. 4.1	322.0645	-50%	-47%	-42%	-40%	-41%	-42%	-60%	-47%	-44%	-43%	-39%	-35%	-53%
26916	Lovers	Main04	6658.264	-85%	-90%	-89%	-88%	-88%	-89%	-91%	-90%	-89%	-89%	-88%	-87%	-92%
26929	Lovers	Main04	6626.625	-82%	-86%	-88%	-87%	-87%	-87%	-85%	-88%	-88%	-88%	-87%	-86%	-90%
26930	Lovers	Main04	6341.946	-81%	-85%	-87%	-87%	-87%	-87%	-85%	-88%	-88%	-88%	-87%	-86%	-90%
26931	Lovers	Main04	5902.777	-98%	-98%	-97%	-97%	-97%	-97%	-97%	-97%	-97%	-97%	-96%	-96%	-97%
26160	LoversTrib3	Trib. 3.2	2338	9%	102%	167%	245%	292%	341%	178%	333%	437%	537%	587%	647%	3310%
26943	LoversTrib3	Trib. 3.2	2278	28%	139%	215%	309%	385%	435%	174%	350%	494%	586%	650%	704%	1496%
26941	LoversTrib3	Trib. 3.2	2106	57%	141%	98%	97%	130%	132%	96%	130%	131%	171%	140%	125%	288%
26939	LoversTrib4	Trib. 3.2	1786	725%	1220%	954%	946%	1086%	1089%	1121%	1172%	1095%	1240%	1093%	994%	1596%
26938	LoversTrib3	Trib. 3.2	1678	725%	1221%	949%	946%	1082%	1084%	1110%	1173%	1092%	1237%	1091%	989%	1586%
26937	LoversTrib3	Trib. 3.2	1519	509%	801%	904%	905%	1038%	1040%	779%	1104%	1054%	1186%	1056%	955%	1480%
26012	LoversTrib3	Trib. 3.1	1500	1318%	2113%	2405%	2689%	3097%	3453%	2247%	2911%	3088%	3690%	4119%	4425%	11944%
26936	LoversTrib3	Trib. 3.1	1393	-31%	-27%	-32%	-37%	-35%	-34%	-39%	-41%	-45%	-44%	-43%	-42%	-73%
26935	LoversTrib3	Trib. 3.1	1205	-30%	-27%	-31%	-36%	-34%	-34%	-35%	-37%	-41%	-39%	-38%	-37%	-21%
26934	LoversTrib3	Trib. 3.0	561.1898	-34%	-31%	-7%	-18%	-18%	-15%	-39%	-12%	-16%	-14%	-13%	-14%	-23%
26933	LoversTrib3	Trib. 3.0	474.0832	-52%	-49%	-30%	-30%	-32%	-22%	-54%	-39%	-34%	-30%	-18%	-19%	-27%
26932	Lovers	Main03	5240.499	-88%	-91%	-89%	-90%	-91%	-90%	-92%	-91%	-91%	-91%	-90%	-90%	-94%
26173	LoversTrib2	Trib. 2	1712.844	123%	61%	52%	36%	25%	34%	49%	18%	13%	13%	27%	36%	5%
26952	LoversTrib2	Trib. 2	303.7247	-43%	-65%	-68%	-72%	-75%	-77%	-66%	-74%	-76%	-79%	-81%	-82%	-93%
26951	Lovers	Main02	4968.416	-93%	-96%	-96%	-96%	-97%	-97%	-96%	-97%	-97%	-97%	-97%	-98%	-99%
26953	Lovers	Main02	4535.809	-93%	-96%	-96%	-96%	-97%	-97%	-96%	-97%	-97%	-97%	-97%	-98%	-99%
26966	LoversTrib1	Trib. 1.4	3300	3450%	2810%	2287%	2145%	2152%	2492%	2925%	2125%	1967%	2193%	2670%	2962%	407%
26965	LoversTrib1	Trib. 1.4	2792	2555%	2244%	2050%	1658%	1545%	1449%	2000%	1610%	1419%	1297%	1253%	1252%	334%
26964	LoversTrib1	Trib. 1.4	2037	4606%	5520%	5621%	5570%	5629%	5654%	5130%	5322%	5268%	5359%	5477%	5576%	3906%
26963	LoversTrib1	Trib. 1.4	1992	184%	204%	203%	199%	196%	196%	193%	199%	191%	191%	193%	195%	95%
26961	LoversTrib1	Trib. 1.4	1850	145%	169%	177%	174%	172%	173%	167%	173%	173%	174%	176%	178%	83%
26185	LoversTrib1	Trib. 1.3	1817	64%	141%	177%	211%	229%	242%	194%	256%	281%	294%	293%	287%	1100%
26960	LoversTrib1	Trib. 1.3	1094	523%	840%	998%	1138%	1218%	1342%	951%	1177%	1282%	1360%	1375%	1372%	5219%
26959	LoversTrib1	Trib. 1.2	1621	140%	265%	333%	405%	450%	488%	332%	429%	489%	551%	582%	600%	1798%
26958	LoversTrib1	Trib. 1.2	1554.214	-99%	-98%	-98%	-98%	-98%	-98%	-98%	-97%	-97%	-98%	-98%	-98%	-77%
26003	LoversTrib1	Trib. 1.1	1510	-73%	-65%	-56%	-44%	-38%	-31%	-57%	-44%	-33%	-23%	-17%	-8%	438%
26956	LoversTrib1	Trib. 1.2	1278.733	-92%	-92%	-92%	-92%	-92%	-92%	-92%	-92%	-91%	-91%	-91%	-91%	-69%
26002	LoversTrib1	Trib. 1.0	1218.55	-45%	-31%	-21%	-11%	-3%	3%	-47%	-28%	-17%	-2%	7%	18%	-59%
26957	LoversTrib1	Trib. 1.0	939.514	-38%	-19%	-6%	4%	10%	16%	-37%	-16%	-5%	6%	14%	21%	-59%
26955	LoversTrib1	Trib. 1.0	446.5532	-65%	-61%	-58%	-54%	-49%	-47%	-70%	-62%	-58%	-54%	-50%	-46%	-89%
26970	Lovers	Main01	4159.121	-79%	-85%	-87%	-89%	-89%	-90%	-87%	-89%	-90%	-91%	-91%	-91%	-98%
26971	Lovers	Main01	3586.156	-47%	-62%	-67%	-72%	-74%	-75%	-67%	-72%	-75%	-77%	-78%	-79%	-94%
26974	Lovers	Main01	3327.937	-32%	-51%	-58%	-63%	-65%	-68%	-58%	-65%	-68%	-71%	-72%	-72%	-93%
26975	Lovers	Main01	2734.631	-95%	-97%	-97%	-98%	-98%	-99%	-97%	-98%	-98%	-99%	-99%	-99%	-100%
26977	Lovers	Main01	2127.919	-17%	-41%	-49%	-55%	-58%	-61%	-50%	-57%	-61%	-65%	-66%	-67%	-92%
26979	Lovers	Main01	2074.773	-67%	-82%	-86%	-90%	-91%	-92%	-80%	-88%	-91%	-93%	-94%	-94%	-92%
26980	Lovers	Main01	1601.441	-64%	-80%	-84%	-88%	-90%	-91%	-79%	-87%	-89%	-91%	-92%	-93%	-92%
26982	Lovers	Main01	1357.49	-66%	-80%	-84%	-88%	-89%	-90%	-79%	-86%	-89%	-91%	-92%	-92%	-91%
26983	Lovers	Main01	1302.252	-8%	-5%	2%	1%	1%	2%	-7%	0%	0%	0%	0%	1%	2%
26986	Lovers	Main01	1264.763	-10%	-6%	1%	0%	0%	1%	-8%	-1%	-1%	-1%	0%	1%	1%
26987	Lovers	Main01	1160.818	-9%	-4%	2%	1%	1%	1%	-6%	0%	1%	0%	1%	2%	4%
26988	Lovers	Main01	1049.722	-9%	-40%	1%	1%	1%	1%	-5%	0%	1%	1%	1%	2%	5%
26989	Lovers	Main01	545.2612	-9%	-39%	1%	1%	1%	2%	-5%	0%	2%	1%	2%	3%	5%
26990	Lovers	Main01	17.79831	-8%	-3%	1%	2%	2%	2%	-5%	0%	2%	1%	2%	3%	6%

HEWITT'S CREEK
VISUAL OTTHYMO PEAK FLOW SUMMARY

PEAK FLOW COMPARISON
MARCH 2018 VERSUS JANUARY 2017 (SCS CURVE NUMBER)

			Δ Peak Flow (m^3/s)												
VO3	HEWITTS CREEK		Chicago 4 Hour Design Storms						SCS Design Storms						Hurricane Hazel
Hydrograph	River Reach	River Station	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	AMCII
29105	Main02	10601.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29901	Main02	10048.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29902	Main02	8422.349	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29001	Main02	8231.756	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.30
29903	Main02	7361.987	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29904	Main02	5605.709	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.01	0.01	0.02
29905	Main02	4974.487	-3.76	-6.87	-9.72	-13.70	-16.72	-19.49	-5.59	-10.95	-15.09	-19.90	-23.06	-26.47	-58.91
29906	Main02	3593.722	-0.48	-0.83	-1.12	-1.58	-1.92	-2.40	-0.69	-1.19	-1.57	-2.41	-3.20	-4.08	-9.95
29009	Main02	3445.696	-0.48	-0.82	-1.11	-1.48	-1.72	-2.03	-0.69	-1.18	-1.47	-1.99	-3.05	-3.92	-9.94
29907	Main02	3408.654	-1.21	-3.85	-6.09	-8.71	-10.89	-12.14	-3.25	-6.85	-9.35	-12.04	-13.83	-15.86	-63.97
29908	Main02	3129.259	-0.59	-1.02	-1.37	-1.83	-2.14	-2.53	-0.84	-1.48	-1.85	-2.49	-3.72	-4.75	-12.17
29144	Trib. 1	1258.764	4.00	8.05	11.45	16.23	19.89	23.42	6.54	12.86	17.75	23.78	28.23	32.93	74.75
29909	Trib. 1	1051.061	3.00	6.48	9.02	12.66	15.36	17.81	5.43	10.91	14.57	18.83	22.31	25.75	66.44
29003	Trib. 1	892.8565	3.46	7.43	10.63	14.93	18.20	21.23	5.96	12.06	16.51	21.82	26.01	30.28	68.09
29910	Trib. 1	347.14	3.51	7.50	10.76	15.08	18.38	21.43	6.02	12.21	16.66	22.02	26.29	30.59	68.74
29912	Main01	2743.481	-4.70	-9.11	-12.75	-18.02	-21.97	-25.79	-7.50	-14.30	-19.63	-26.18	-31.57	-37.06	-85.35
29913	Main01	2396.606	-1.54	-4.41	-6.80	-9.90	-11.85	-13.12	-3.96	-7.87	-10.42	-12.62	-14.64	-16.62	-75.59
29914	Main01	2291.371	-4.40	-8.53	-11.75	-16.44	-19.92	-23.15	-7.13	-13.51	-18.23	-23.77	-28.34	-32.79	-82.10
29915	Main01	1719.604	-4.37	-8.49	-11.71	-16.40	-19.91	-23.21	-7.13	-13.48	-18.22	-23.94	-28.64	-33.32	-82.23
29916	Main01	1460.708	-0.31	-0.47	-0.42	-0.95	-1.21	-1.59	-0.57	-0.87	-1.33	-1.98	-2.40	-2.98	-9.19
29917	Main01	203.2475	-0.05	-0.15	-0.11	-0.85	-0.78	-1.04	-0.30	-0.54	-0.96	-1.57	-1.80	-2.29	-6.94
29918	Main01	106.3736	0.09	0.08	0.17	-0.56	-0.28	-0.38	-0.14	-0.23	-0.56	-1.00	-1.03	-1.27	-3.02
29919	Main01	46.29602	0.06	0.02	0.11	-0.72	-0.40	-0.51	-0.17	-0.28	-0.63	-1.05	-1.23	-1.43	-3.13

			% Change												
VO3	HEWITTS CREEK		Chicago 4 Hour Design Storms						SCS Design Storms						Hurricane Hazel
Hydrograph	River Reach	River Station	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	AMCII
29105	Main02	10601.45	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
29901	Main02	10048.05	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
29902	Main02	8422.349	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
29001	Main02	8231.756	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	46%
29903	Main02	7361.987	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
29904	Main02	5605.709	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
29905	Main02	4974.487	-96%	-94%	-94%	-93%	-93%	-92%	-94%	-92%	-92%	-91%	-91%	-90%	-92%
29906	Main02	3593.722	-12%	-10%	-10%	-10%	-10%	-10%	-10%	-9%	-9%	-10%	-11%	-12%	-13%
29009	Main02	3445.696	-12%	-10%	-10%	-9%	-9%	-9%	-10%	-9%	-8%	-8%	-11%	-12%	-13%
29907	Main02	3408.654	-29%	-47%	-52%	-53%	-54%	-52%	-48%	-52%	-52%	-50%	-48%	-47%	-84%
29908	Main02	3129.259	-14%	-12%	-12%	-11%	-11%	-11%	-12%	-11%	-10%	-10%	-13%	-14%	-16%
29144	Trib. 1	1258.764	10000%	8944%	9542%	9017%	9041%	8674%	7267%	7565%	7717%	7431%	7058%	6860%	14103%
29909	Trib. 1	1051.061	288%	390%	357%	347%	337%	323%	456%	517%	440%	380%	361%	342%	754%
29003	Trib. 1	892.8565	558%	965%	1085%	1051%	1028%	987%	828%	1160%	1131%	1049%	985%	946%	882%
29910	Trib. 1	347.14	548%	938%	1076%	1040%	1015%	974%	803%	1163%	1118%	1039%	981%	941%	866%
29912	Main01	2743.481	-99%	-99%	-99%	-99%	-99%	-99%	-99%	-99%	-99%	-99%	-99%	-99%	-99%
29913	Main01	2396.606	-30%	-46%	-51%	-53%	-52%	-49%	-50%	-52%	-51%	-46%	-44%	-43%	-84%
29914	Main01	2291.371	-83%	-86%	-86%	-86%	-85%	-84%	-87%	-87%	-86%	-85%	-83%	-82%	-88%
29915	Main01	1719.604	-83%	-86%	-86%	-85%	-85%	-84%	-87%	-87%	-86%	-85%	-84%	-83%	-88%
29916	Main01	1460.708	-6%	-5%	-3%	-5%	-5%	-6%	-7%	-6%	-6%	-6%	-7%	-7%	-10%
29917	Main01	203.2475	-1%	-1%	-1%	-4%	-3%	-4%	-4%	-3%	-4%	-5%	-5%	-6%	-7%
29918	Main01	106.3736	2%	1%	1%	-3%	-1%	-1%	-2%	-1%	-3%	-3%	-3%	-3%	-3%
29919	Main01	46.29602	1%	0%	1%	-4%	-2%	-2%	-2%	-2%	-3%	-4%	-3%	-3%	-3%

BEAR CREEK
VISUAL OTTHYMO PEAK FLOW SUMMARY

PEAK FLOW COMPARISON
MARCH 2018 VERSUS FEBRUARY 2017 (SCS CURVE NUMBER)

			Δ Peak Flow (m^3/s)												
VO3	BEAR CREEK		Chicago 4 Hour Design Storms						SCS Design Storms						Timmins
Hydrograph	River Reach	River Station	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	AMCII
32200	13	1942	0.05	0.09	0.14	0.19	0.25	0.31	0.09	0.18	0.25	0.37	0.45	0.54	0.42
32901	13	1093	0.14	0.26	0.33	0.20	0.21	0.30	0.33	0.53	0.57	0.53	0.63	0.77	1.80
32904	13	1045	0.15	0.28	0.36	0.24	0.21	0.30	0.26	0.54	0.55	0.52	0.60	0.76	1.83
32905	13	327	0.02	0.03	0.10	0.16	0.29	0.36	-0.01	0.00	0.04	0.15	0.27	0.42	1.99
32918	14	2730	0.05	0.05	0.06	0.11	0.25	0.43	0.06	0.10	0.25	0.59	0.86	1.02	3.85
32916	14	2552	0.25	0.39	0.44	0.63	0.66	0.73	0.27	0.48	0.65	0.75	0.79	0.99	3.75
32915	14	2513	0.28	0.42	0.53	0.71	0.79	0.83	0.31	0.54	0.70	0.86	0.89	1.02	3.76
32914	14	2333	0.25	0.35	0.41	0.59	0.68	0.81	0.24	0.44	0.65	0.74	0.86	1.11	3.79
32913	14	2167	0.22	0.31	0.35	0.49	0.57	0.68	0.21	0.34	0.61	0.71	0.95	1.33	3.94
32912	14	1896	0.29	0.51	0.79	1.13	1.39	1.84	0.48	0.90	1.27	1.71	2.12	2.41	5.20
32911	14	1744	0.31	0.54	0.82	1.25	1.44	1.92	0.48	0.94	1.30	1.71	2.16	2.67	5.43
32910	14	1430	0.55	0.99	1.36	2.02	2.39	2.97	0.68	1.29	1.96	2.67	3.31	4.03	5.73
32909	14	1199	0.56	1.01	1.36	2.01	2.38	2.95	0.69	1.26	1.98	2.60	3.13	4.00	5.86
32908	14	421	0.53	0.98	1.29	2.02	2.42	3.00	0.67	1.24	2.02	2.74	3.29	4.20	6.50
32906	12	431	0.58	0.78	0.94	1.16	1.92	2.95	0.57	0.68	0.91	2.75	3.23	3.27	8.92
32920	12	277	0.56	0.80	0.93	1.00	1.46	3.02	0.58	0.59	0.58	2.20	3.41	3.40	9.28
32001	12	195	0.56	0.79	0.92	1.00	1.45	2.96	0.58	0.62	0.57	2.22	2.90	7.22	9.87
32921	12	19	0.56	0.80	0.91	0.97	1.34	2.82	0.58	0.59	0.58	2.02	2.91	2.84	10.02
32148	6	290	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	0.00	0.00	-0.01
32147	5	135	0.00	-0.01	-0.01	-0.01	-0.01	-0.02	0.00	-0.02	-0.01	-0.02	-0.02	-0.02	-0.01
32926	4	327	0.00	-0.01	-0.01	-0.01	-0.01	-0.02	0.00	-0.01	-0.02	-0.02	-0.02	-0.02	-0.01
32149	3	716	0.00	0.00	0.00	-0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
32927	2	2458	0.00	0.02	0.02	0.03	0.03	0.04	0.01	0.03	0.03	0.04	0.05	0.07	0.06
32928	2	1250	0.01	0.03	0.04	0.05	0.07	0.08	0.02	0.05	0.06	0.11	0.12	0.15	0.13
32930	2	953	0.02	0.03	0.05	0.07	0.08	0.10	0.03	0.06	0.08	0.11	0.13	0.14	0.49
32936	8	2948	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.72
32935	8	1315	0.00	0.01	0.01	0.02	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.00	0.51
32941	11	1163	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.01	0.00
32942	11	949	0.01	0.00	0.00	0.02	0.02	0.03	0.01	0.00	0.02	0.02	0.03	0.22	0.90
32943	11	183	0.01	0.01	0.01	0.02	0.02	0.03	0.01	0.02	0.02	0.03	0.04	0.29	0.88
32944	11	126	0.01	0.01	0.01	0.02	0.02	0.03	0.01	0.02	0.02	0.03	0.04	0.29	0.88
32184	10	969	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
32945	10	574	0.03	0.03	0.04	0.05	0.05	0.05	0.03	0.05	0.06	0.13	0.10	0.12	0.00
32007	10	555	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50
32947	10	285	0.00	0.00	0.01	0.01	0.00	0.01	0.00	0.01	0.01	0.01	0.01	0.02	0.56
32946	10	254	0.00	0.00	0.00	0.00	0.00	-0.02	0.01	0.06	0.03	0.06	0.06	0.07	0.76
32948	9	2171	0.00	0.00	0.01	0.01	0.02	0.03	0.00	0.01	0.01	0.02	0.02	0.15	1.64
32949	9	1864	-0.01	0.00	0.01	0.01	0.02	0.03	0.00	0.00	0.01	0.02	0.03	0.17	1.63
32953	9	1642	0.00	0.00	0.00	-0.01	-0.02	-0.02	0.00	-0.02	-0.04	-0.06	-0.06	0.02	1.88
32954	9	1456	0.01	0.15	0.21	0.22	0.24	0.30	0.13	0.21	0.26	0.33	0.39	0.58	3.15
32340	9	1233	0.09	0.21	0.26	0.31	0.33	0.41	0.18	0.28	0.33	0.46	0.56	0.81	1.81
32932	7	187	0.06	0.15	0.25	0.27	0.23	0.30	0.13	0.22	0.30	0.31	0.36	0.47	1.62
32931	1	270	0.07	0.20	0.29	0.37	0.38	0.41	0.16	0.30	0.39	0.42	0.48	0.63	2.01
32933	1	233	0.13	0.30	0.44	0.57	0.56	0.69	0.24	0.44	0.58	0.68	0.81	1.00	2.13
32955	1	20	0.12	0.30	0.44	0.57	0.58	0.68	0.24	0.44	0.59	0.69	0.81	1.00	2.16
32201	15	2111.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00
32956	15	1290.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

BEAR CREEK
VISUAL OTTHYMO PEAK FLOW SUMMARY

PEAK FLOW COMPARISON
MARCH 2018 VERSUS FEBRUARY 2017 (SCS CURVE NUMBER)

			% Change												
VO3	BEAR CREEK		Chicago 4 Hour Design Storms						SCS Design Storms						Timmins
Hydrograph	River Reach	River Station	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	AMCII
32200	13	1942	48%	45%	46%	44%	46%	47%	52%	48%	48%	50%	50%	48%	30%
32901	13	1093	58%	55%	46%	15%	12%	13%	85%	62%	38%	22%	21%	20%	30%
32904	13	1045	58%	57%	49%	18%	12%	13%	55%	61%	36%	21%	19%	20%	30%
32905	13	327	2%	2%	5%	6%	10%	10%	-1%	0%	1%	4%	6%	8%	24%
32918	14	2730	17%	11%	11%	16%	33%	50%	20%	20%	38%	67%	73%	60%	76%
32916	14	2552	100%	103%	92%	103%	86%	76%	84%	86%	89%	71%	55%	51%	70%
32915	14	2513	108%	102%	104%	108%	101%	85%	94%	100%	104%	80%	62%	53%	70%
32914	14	2333	100%	83%	73%	82%	79%	79%	67%	72%	87%	64%	57%	55%	69%
32913	14	2167	73%	60%	49%	52%	50%	51%	44%	41%	59%	46%	49%	55%	67%
32912	14	1896	19%	22%	28%	30%	32%	37%	28%	30%	33%	31%	33%	32%	66%
32911	14	1744	16%	19%	23%	26%	26%	30%	22%	25%	27%	25%	27%	29%	64%
32910	14	1430	30%	35%	37%	41%	42%	45%	30%	33%	38%	37%	39%	41%	62%
32909	14	1199	30%	34%	35%	38%	39%	41%	29%	30%	36%	33%	34%	38%	61%
32908	14	421	21%	24%	25%	29%	30%	32%	21%	23%	28%	28%	28%	30%	59%
32906	12	431	28%	22%	21%	21%	30%	38%	19%	14%	15%	34%	30%	25%	46%
32920	12	277	25%	21%	19%	16%	20%	37%	19%	11%	8%	24%	31%	25%	47%
32001	12	195	25%	21%	19%	16%	20%	36%	19%	12%	8%	25%	26%	53%	51%
32921	12	19	25%	21%	18%	15%	18%	33%	18%	11%	8%	22%	26%	21%	51%
32148	6	290	15%	4%	-3%	-2%	0%	-1%	8%	-4%	-2%	-3%	0%	0%	-2%
32147	5	135	-30%	-25%	-27%	-18%	-16%	-26%	-15%	-30%	-17%	-21%	-19%	-17%	-8%
32926	4	327	0%	-14%	-10%	-7%	-5%	-8%	0%	-7%	-9%	-6%	-5%	-4%	-4%
32149	3	716	-30%	-20%	20%	-13%	13%	-7%	-10%	-5%	8%	-4%	-3%	-1%	2%
32927	2	2458	0%	7%	4%	4%	4%	4%	3%	5%	3%	3%	3%	4%	3%
32928	2	1250	5%	7%	6%	5%	6%	5%	5%	6%	5%	6%	5%	5%	4%
32930	2	953	4%	2%	3%	3%	2%	3%	3%	3%	3%	3%	2%	2%	7%
32936	8	2948	0%	3%	3%	2%	2%	2%	5%	0%	0%	0%	1%	0%	71%
32935	8	1315	0%	2%	1%	2%	1%	0%	3%	1%	1%	1%	1%	0%	22%
32941	11	1163	0%	0%	0%	4%	0%	0%	0%	4%	3%	0%	2%	1%	0%
32942	11	949	10%	0%	0%	5%	4%	5%	6%	0%	4%	2%	3%	17%	75%
32943	11	183	8%	4%	3%	4%	3%	4%	5%	5%	3%	3%	3%	19%	56%
32944	11	126	8%	4%	3%	4%	3%	4%	5%	5%	3%	3%	3%	19%	56%
32184	10	969	0%	-5%	-7%	0%	-2%	0%	0%	-3%	8%	9%	3%	2%	-6%
32945	10	574	5%	3%	3%	3%	3%	3%	5%	5%	4%	7%	5%	5%	0%
32007	10	555	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	68%
32947	10	285	0%	0%	2%	2%	0%	2%	0%	2%	2%	2%	1%	3%	63%
32946	10	254	0%	0%	0%	0%	0%	-1%	2%	7%	3%	4%	4%	4%	65%
32948	9	2171	0%	0%	1%	1%	1%	2%	0%	1%	1%	1%	1%	5%	56%
32949	9	1864	-2%	0%	1%	1%	1%	2%	0%	0%	1%	1%	1%	6%	54%
32953	9	1642	0%	0%	0%	-1%	-1%	-1%	0%	-1%	-2%	-2%	-2%	0%	47%
32954	9	1456	1%	13%	13%	9%	8%	8%	14%	11%	10%	8%	8%	9%	44%
32340	9	1233	9%	11%	10%	8%	7%	8%	12%	10%	8%	8%	8%	9%	13%
32932	7	187	5%	6%	7%	6%	4%	4%	7%	6%	6%	4%	4%	4%	9%
32931	1	270	5%	6%	6%	5%	4%	4%	7%	6%	5%	4%	4%	4%	8%
32933	1	233	8%	9%	9%	7%	6%	6%	9%	8%	7%	6%	6%	6%	7%
32955	1	20	7%	9%	9%	8%	6%	6%	9%	8%	7%	6%	6%	6%	7%
32201	15	2111.49	0%	-3%	3%	-1%	1%	1%	-1%	-3%	0%	2%	1%	0%	-1%
32956	15	1290.42	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

GEORGIAN CREEK
VISUAL OTTHYMO PEAK FLOW SUMMARY

PEAK FLOW COMPARISON
MARCH 2018 VERSUS FEBRUARY 2017 (SCS CURVE NUMBER)

			Δ Peak Flow (m^3/s)												
VO3	GEORGIAN CREEK		Chicago 4 Hour Design Storms						SCS Design Storms						Timmins
Hydrograph	River Reach	River Station	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	AMCII
30902	2	690	0.01	-0.06	-0.08	-0.10	-0.12	-0.17	-0.02	-0.12	-0.15	-0.22	-0.25	-0.28	-0.11
30905	2	618	0.01	-0.05	-0.07	-0.12	-0.15	-0.19	-0.02	-0.11	-0.15	-0.21	-0.24	-0.28	-0.11
30907	2	422	-0.01	-0.08	-0.11	-0.15	-0.17	-0.23	-0.04	-0.12	-0.15	-0.23	-0.23	-0.25	-0.12
30908	2	189	-0.02	-0.10	-0.12	-0.20	-0.20	-0.25	-0.04	-0.13	-0.16	-0.25	-0.25	-0.27	-0.13
30909	2	177	0.18	0.27	0.38	0.51	0.63	0.72	0.24	0.39	0.55	0.71	0.93	1.11	0.60
30911	2	159	0.06	0.06	0.09	0.13	0.19	0.21	0.08	0.10	0.17	0.20	0.35	0.45	0.20
30913	2	0	-0.53	-1.46	-2.42	-3.98	-5.06	-6.44	-0.96	-2.54	-4.11	-6.42	-8.43	-10.08	-0.01
30920	1	477	-0.33	-1.19	-1.96	-3.19	-4.05	-5.09	-0.76	-1.99	-3.09	-4.79	-6.24	-7.59	2.22
30922	1	227	-1.25	-2.60	-3.56	-5.19	-6.48	-8.00	-2.07	-3.87	-5.45	-7.99	-10.18	-12.26	2.13
30923	1	0	-1.29	-2.71	-3.68	-5.36	-6.68	-8.23	-2.18	-4.07	-5.71	-8.23	-10.35	-12.40	2.13

			% Change												
VO3	GEORGIAN CREEK		Chicago 4 Hour Design Storms						SCS Design Storms						Timmins
Hydrograph	River Reach	River Station	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	AMCII
30902	2	690	1%	-3%	-3%	-2%	-2%	-3%	-1%	-4%	-3%	-3%	-3%	-3%	-3%
30905	2	618	1%	-2%	-2%	-3%	-3%	-3%	-1%	-3%	-3%	-3%	-3%	-3%	-3%
30907	2	422	-1%	-3%	-3%	-3%	-3%	-3%	-2%	-3%	-3%	-3%	-2%	-2%	-2%
30908	2	189	-1%	-4%	-3%	-4%	-3%	-3%	-2%	-3%	-3%	-3%	-2%	-2%	-2%
30909	2	177	12%	10%	10%	9%	10%	9%	11%	10%	10%	9%	9%	9%	11%
30911	2	159	4%	2%	2%	2%	3%	2%	3%	2%	3%	2%	3%	4%	4%
30913	2	0	-33%	-52%	-62%	-71%	-75%	-78%	-43%	-63%	-72%	-78%	-82%	-82%	0%
30920	1	477	-12%	-26%	-32%	-38%	-41%	-44%	-21%	-32%	-36%	-42%	-44%	-46%	24%
30922	1	227	-45%	-56%	-58%	-63%	-66%	-69%	-56%	-61%	-65%	-70%	-73%	-74%	22%
30923	1	0	-46%	-57%	-58%	-63%	-66%	-68%	-57%	-62%	-66%	-70%	-72%	-73%	20%

LITTLE LAKE CREEK
VISUAL OTTHYMO PEAK FLOW SUMMARY

PEAK FLOW COMPARISON
MARCH 2018 VERSUS FEBRUARY 2017 (SCS CURVE NUMBER)

			Δ Peak Flow (m^3/s)												
VO3	LITTLE LAKE		Chicago 4 Hour Design Storms						SCS Design Storms						Timmins
Hydrograph	River Reach	River Station	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	AMCII
31919	1	776	-0.19	-0.01	-0.59	-0.41	-0.58	-0.35	-0.59	-1.01	-0.84	-0.62	-0.36	0.35	2.38
31920	1	330	-0.16	-0.04	-0.58	-0.41	-0.57	-0.36	-0.60	-0.98	-0.85	-0.64	-0.34	0.24	2.36
31924	1	263	-0.17	-0.04	-0.59	-0.41	-0.59	-0.36	-0.61	-0.99	-0.86	-0.64	-0.33	0.24	2.36
31927	1	22	-0.30	-0.13	-0.68	-0.82	-1.08	-0.83	-1.08	-1.69	-1.81	-1.59	-1.13	-0.34	2.59
31928	1	0	-0.30	-0.13	-0.68	-0.83	-1.09	-0.83	-1.08	-1.70	-1.81	-1.59	-1.11	-0.30	2.59

			% Change												
VO3	LITTLE LAKE		Chicago 4 Hour Design Storms						SCS Design Storms						Timmins
Hydrograph	River Reach	River Station	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	AMCII
31919	1	776	-11%	0%	-14%	-7%	-8%	-4%	-22%	-21%	-13%	-7%	-4%	3%	35%
31920	1	330	-9%	-1%	-13%	-7%	-8%	-4%	-22%	-20%	-13%	-8%	-3%	2%	34%
31924	1	263	-9%	-1%	-13%	-7%	-8%	-4%	-22%	-20%	-13%	-8%	-3%	2%	33%
31927	1	22	-11%	-3%	-10%	-9%	-9%	-6%	-25%	-21%	-17%	-11%	-7%	-2%	22%
31928	1	0	-11%	-3%	-10%	-9%	-9%	-6%	-25%	-21%	-17%	-11%	-6%	-2%	22%

Appendix F: Existing Condition HEC RAS Spill Analysis

Whiskey Creek Regional Spills Geometry Plan



Whiskey Creek Tributary Spills Geometry Plan



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TATHAM ENGINEERING

Project:	Barrie Drainage Master Plan	Date:	1-Aug-17
File No.:	117076	Designed:	DAM
Subject:	Whiskey Spills Analysis	Checked:	DRT

Reach	Spills	Spill Modelling Method	Details
Whiskey - Hwy 400 Spill 1	To Whiskey - Ditch to Hwy 400	Lateral Structures	Zero Height Weir Modelled Using Hager's Equation
Whiskey - Ditch to Hwy 400	To Whiskey Main Branch	Lateral Structure	Broad Crested Weir
Whiskey - Ditch to Hwy 400	To Whiskey - Hwy 400 Spill 4	Hand Calculation	HY-8 Analysis and Weir Calculation
Whiskey - Tributary	To Hotchkiss	Lateral Structure	Broad Crested Weir

Reach	Downstream Boundary Condition	Details
Whiskey - Hwy 400 Spill 1	Normal Depth	
Whiskey - Hwy 400 Spill 2	Junction	
Whiskey - Hwy 400 Spill 3	Normal Depth	
Whiskey - Hwy 400 Spill 4	Normal Depth	
Whiskey - Ditch to Hwy 400	Normal Depth	
Whiskey - Hwy 400 W Ditch	Normal Depth	
Whiskey - Tributary	Normal Depth	

HEC-RAS Plan: WKSpill Profile: Hazel

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)	
Hwy 400 Spill 2	491.11	Hazel	2.35	289.19	289.48	289.41	289.49	0.005681	0.46	5.62	46.73	0.42
Hwy 400 Spill 2	456.11	Hazel	2.35	289.08	289.29	289.29	289.33	0.003401	0.90	2.97	35.64	0.96
Hwy 400 Spill 2	416.11	Hazel	2.35	288.86	289.09	289.07	289.14	0.003942	1.08	2.96	23.44	1.06
Hwy 400 Spill 4	277.11	Hazel	1.27	287.91	288.17	288.17	288.24	0.006692	0.66	1.29	9.30	0.49
Hwy 400 Spill 4	258.11	Hazel	1.27	287.66	287.95	287.95	288.03	0.011200	0.89	1.16	8.83	0.64
Hwy 400 Spill 4	215.11	Hazel	2.97	287.22	287.57	287.57	287.67	0.005288	0.76	2.52	13.18	0.46
Hwy 400 Spill 4	172.11	Hazel	2.97	286.49	286.89	286.89	286.99	0.005896	0.81	2.47	12.82	0.49
Hwy 400 Spill 4	129.11	Hazel	2.97	285.67	286.01	286.01	286.10	0.004849	0.71	2.64	14.44	0.44
Hwy 400 Spill 4	86.11	Hazel	2.97	284.61	285.02	285.02	285.12	0.005019	0.73	2.47	13.27	0.45
Hwy 400 Spill 4	43.11	Hazel	2.97	283.49	283.83	283.83	283.91	0.002923	1.31	2.27	12.88	0.99
Hwy 400 Spill 4	0.11	Hazel	2.97	282.19	282.51	282.51	282.60	0.003101	1.34	2.22	12.66	1.02
Hwy 400 W Ditch	1000.11	Hazel	1.36	288.66	288.89	288.89	288.96	0.003377	1.14	1.32	10.10	1.01
Hwy 400 W Ditch	959.11	Hazel	1.36	288.43	288.71	288.67	288.75	0.005322	0.72	1.75	11.59	0.46
Hwy 400 W Ditch	919.11	Hazel	1.36	288.15	288.40	288.39	288.46	0.010117	0.89	1.36	10.13	0.62
Hwy 400 W Ditch	879.11	Hazel	1.36	287.47	287.52	287.52	287.56	0.087016	0.74	1.51	20.47	1.32
Hwy 400 W Ditch	837.11	Hazel	1.36	285.35	285.85	285.85	286.01	0.020324	1.79	0.84	3.03	0.93
Hwy 400 W Ditch	821.11	Hazel	1.36	284.83	285.29	285.29	285.45	0.002310	1.80	0.88	3.47	0.97
Hwy 400 Spill 3	376.11	Hazel	0.99	288.66	288.92	288.89	288.96	0.002359	0.41	1.48	10.19	0.29
Hwy 400 Spill 3	336.11	Hazel	0.99	288.45	288.74		288.77	0.009849	0.85	1.59	10.73	0.60
Hwy 400 Spill 3	296.11	Hazel	0.99	288.09	288.42	288.35	288.45	0.006945	0.76	1.72	11.04	0.52
Ditch to Hwy 400	667.11	Hazel	2.09	288.62	289.71		289.74	0.001440	0.96	3.78	6.07	0.30
Ditch to Hwy 400	628.11	Hazel	4.95	287.96	289.69		289.71	0.000589	0.86	11.42	12.20	0.21
Ditch to Hwy 400	589.11	Hazel	7.39	288.27	289.66		289.68	0.001050	0.98	15.59	20.55	0.27
Ditch to Hwy 400	588.11		Lat Struct									
Ditch to Hwy 400	550.11	Hazel	8.68	288.37	289.60		289.63	0.001483	1.09	18.37	33.24	0.32
Ditch to Hwy 400	511.11	Hazel	7.93	288.26	289.44	289.41	289.52	0.005375	1.95	12.23	42.77	0.59
Ditch to Hwy 400	471.11	Hazel	3.44	288.25	289.37		289.39	0.001098	0.88	9.61	24.87	0.27
Ditch to Hwy 400	443.11	Hazel	2.21	288.21	289.35		289.36	0.000628	0.65	7.59	19.01	0.20
Ditch to Hwy 400	418.11	Hazel	2.21	288.38	289.32	288.88	289.34	0.001200	0.79	4.90	14.23	0.27
Ditch to Hwy 400	394.11	Hazel	2.21	288.42	289.25		289.30	0.002425	1.01	3.03	7.32	0.37
Ditch to Hwy 400	371.11	Hazel	2.21	288.32	288.94	288.89	289.10	0.012630	1.82	1.41	3.64	0.79
Ditch to Hwy 400	332.11	Hazel	2.21	288.09	288.70		288.82	0.010708	1.55	1.54	3.98	0.71
Ditch to Hwy 400	293.11	Hazel	2.21	287.74	288.35		288.45	0.008235	1.44	1.74	4.57	0.64
Ditch to Hwy 400	254.11	Hazel	2.21	287.46	288.11		288.18	0.005388	1.19	2.11	4.71	0.52
Ditch to Hwy 400	235.11	Hazel	2.21	286.51	288.13	287.07	288.14	0.000181	0.45	8.65	9.74	0.11
Ditch to Hwy 400	217.11	Hazel	2.21	286.15	288.13	286.74	288.14	0.000080	0.34	12.28	11.41	0.08
Ditch to Hwy 400	174.11	Hazel	2.21	286.03	288.13	286.57	288.13	0.000043	0.26	19.81	25.83	0.06
Ditch to Hwy 400	164.11	Hazel	2.21	285.91	288.13	286.48	288.13	0.000006	0.10	50.55	44.76	0.02
Ditch to Hwy 400	147.11		Culvert									
Ditch to Hwy 400	133.11	Hazel	0.51	285.45	285.71	285.65	285.74	0.009254	0.85	0.61	4.52	0.59
Ditch to Hwy 400	112.11	Hazel	0.51	285.16	285.41	285.41	285.51	0.025048	1.39	0.39	2.29	0.96
Ditch to Hwy 400	91.11	Hazel	0.51	284.71	284.93	284.90	284.98	0.016260	1.03	0.50	2.87	0.76
Hwy 400 Spill 1	512.11	Hazel	11.51	290.41	290.64		290.66	0.002183	0.88	24.65	80.19	0.80
Hwy 400 Spill 1	511.11		Lat Struct									
Hwy 400 Spill 1	480.11	Hazel	9.41	290.25	290.51	290.44	290.57	0.003503	1.37	14.57	62.25	1.07
Hwy 400 Spill 1	479.11		Lat Struct									
Hwy 400 Spill 1	440.11	Hazel	6.56	290.12	290.37	290.37	290.46	0.002987	1.37	6.35	37.04	1.01
Hwy 400 Spill 1	439.11		Lat Struct									
Hwy 400 Spill 1	400.11	Hazel	4.12	289.90	290.15	290.15	290.22	0.003090	1.18	3.96	29.71	0.99
Hwy 400 Spill 1	399.11		Lat Struct									
Hwy 400 Spill 1	360.11	Hazel	2.76	289.61	289.90	289.90	289.95	0.003624	1.03	2.75	27.93	1.02
Hwy 400 Spill 1	359.11		Lat Struct									
Hwy 400 Spill 1	320.11	Hazel	2.37	289.42	289.64		289.66	0.002822	0.71	5.56	47.63	0.84
Hwy 400 Spill 1	280.11	Hazel	2.37	289.26	289.48	289.48	289.51	0.004792	0.90	3.74	45.49	1.09

HEC-RAS Plan: FutWKSpill Profile: Hazel

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)	
Hwy 400 Spill 2	491.11	Hazel	2.68	289.19	289.49	289.42	289.50	0.005267	0.48	6.25	47.51	0.42
Hwy 400 Spill 2	456.11	Hazel	2.68	289.08	289.30	289.30	289.34	0.003425	0.94	3.26	36.57	0.97
Hwy 400 Spill 2	416.11	Hazel	2.68	288.86	289.10	289.09	289.15	0.003553	1.08	3.34	24.96	1.02
Hwy 400 Spill 4	277.11	Hazel	1.20	287.91	288.16	288.16	288.23	0.007148	0.67	1.22	9.07	0.50
Hwy 400 Spill 4	258.11	Hazel	1.20	287.66	287.94	287.94	288.02	0.011994	0.90	1.10	8.60	0.66
Hwy 400 Spill 4	215.11	Hazel	2.80	287.22	287.56	287.56	287.66	0.005533	0.76	2.39	12.90	0.47
Hwy 400 Spill 4	172.11	Hazel	2.80	286.49	286.88	286.88	286.98	0.006169	0.81	2.34	12.51	0.50
Hwy 400 Spill 4	129.11	Hazel	2.80	285.67	286.00	286.00	286.09	0.004808	0.70	2.54	14.03	0.44
Hwy 400 Spill 4	86.11	Hazel	2.80	284.61	285.01	285.01	285.11	0.005035	0.73	2.37	13.01	0.45
Hwy 400 Spill 4	43.11	Hazel	2.80	283.49	283.82	283.82	283.90	0.002941	1.29	2.18	12.66	0.99
Hwy 400 Spill 4	0.11	Hazel	2.80	282.19	282.50	282.50	282.59	0.002911	1.29	2.17	12.52	0.99
Hwy 400 W Ditch	1000.11	Hazel	1.55	288.66	288.90	288.90	288.97	0.003312	1.18	1.45	10.42	1.02
Hwy 400 W Ditch	959.11	Hazel	1.55	288.43	288.73	288.68	288.77	0.004710	0.71	1.97	12.38	0.44
Hwy 400 W Ditch	919.11	Hazel	1.55	288.15	288.40	288.40	288.48	0.011929	0.98	1.41	10.45	0.67
Hwy 400 W Ditch	879.11	Hazel	1.55	287.47	287.54	287.54	287.57	0.059526	0.80	1.85	20.81	1.17
Hwy 400 W Ditch	837.11	Hazel	1.55	285.35	285.88	285.88	286.05	0.020126	1.87	0.93	3.22	0.94
Hwy 400 W Ditch	821.11	Hazel	1.55	284.83	285.31	285.31	285.49	0.002309	1.90	0.97	3.69	0.98
Hwy 400 Spill 3	376.11	Hazel	1.13	288.66	288.94	288.89	288.97	0.002348	0.42	1.63	10.81	0.30
Hwy 400 Spill 3	336.11	Hazel	1.13	288.45	288.76		288.79	0.009628	0.87	1.79	11.50	0.60
Hwy 400 Spill 3	296.11	Hazel	1.13	288.09	288.44	288.37	288.47	0.006934	0.79	1.93	11.77	0.52
Ditch to Hwy 400	667.11	Hazel	3.23	288.62	289.80		289.85	0.002471	1.33	4.31	6.49	0.40
Ditch to Hwy 400	628.11	Hazel	7.10	287.96	289.76		289.80	0.001005	1.15	12.32	12.70	0.28
Ditch to Hwy 400	589.11	Hazel	10.56	288.27	289.71		289.74	0.001807	1.32	16.59	20.97	0.36
Ditch to Hwy 400	588.11		Lat Struct									
Ditch to Hwy 400	550.11	Hazel	10.26	288.37	289.64		289.67	0.001730	1.20	19.61	33.57	0.34
Ditch to Hwy 400	511.11	Hazel	8.66	288.26	289.54		289.58	0.003017	1.54	16.43	44.92	0.45
Ditch to Hwy 400	471.11	Hazel	6.45	288.25	289.40		289.46	0.003213	1.52	10.36	25.37	0.46
Ditch to Hwy 400	443.11	Hazel	4.24	288.21	289.31		289.37	0.002876	1.37	6.89	18.35	0.43
Ditch to Hwy 400	418.11	Hazel	2.03	288.38	289.28	288.85	289.31	0.001239	0.78	4.43	13.43	0.27
Ditch to Hwy 400	394.11	Hazel	2.03	288.42	289.22		289.26	0.002400	0.98	2.81	6.56	0.36
Ditch to Hwy 400	371.11	Hazel	2.03	288.32	288.92	288.86	289.07	0.012274	1.75	1.34	3.54	0.77
Ditch to Hwy 400	332.11	Hazel	2.03	288.09	288.68		288.79	0.011268	1.52	1.42	3.86	0.72
Ditch to Hwy 400	293.11	Hazel	2.03	287.74	288.32		288.41	0.008445	1.40	1.62	4.41	0.64
Ditch to Hwy 400	254.11	Hazel	2.03	287.46	288.12		288.17	0.004448	1.09	2.13	4.72	0.47
Ditch to Hwy 400	235.11	Hazel	2.03	286.51	288.13	287.05	288.14	0.000153	0.41	8.65	9.74	0.10
Ditch to Hwy 400	217.11	Hazel	2.03	286.15	288.13	286.72	288.14	0.000067	0.31	12.27	11.41	0.07
Ditch to Hwy 400	174.11	Hazel	2.03	286.03	288.13	286.55	288.13	0.000036	0.24	19.82	25.83	0.05
Ditch to Hwy 400	164.11	Hazel	2.03	285.91	288.13	286.45	288.13	0.000005	0.10	50.55	44.76	0.02
Ditch to Hwy 400	147.11		Culvert									
Ditch to Hwy 400	133.11	Hazel	0.51	285.45	285.71	285.65	285.75	0.009244	0.85	0.61	4.53	0.59
Ditch to Hwy 400	112.11	Hazel	0.51	285.16	285.41	285.41	285.51	0.024990	1.39	0.39	2.29	0.96
Ditch to Hwy 400	91.11	Hazel	0.51	284.71	284.93	284.90	284.98	0.016258	1.03	0.50	2.87	0.76
Hwy 400 Spill 1	512.11	Hazel	15.69	290.41	290.69		290.71	0.002251	1.11	28.43	80.19	0.86
Hwy 400 Spill 1	511.11		Lat Struct									
Hwy 400 Spill 1	480.11	Hazel	12.41	290.25	290.55	290.46	290.63	0.003745	1.59	16.55	62.58	1.14
Hwy 400 Spill 1	479.11		Lat Struct									
Hwy 400 Spill 1	440.11	Hazel	8.58	290.12	290.41	290.41	290.51	0.002848	1.50	7.65	37.50	1.02
Hwy 400 Spill 1	439.11		Lat Struct									
Hwy 400 Spill 1	400.11	Hazel	5.17	289.90	290.17	290.17	290.25	0.002959	1.28	4.65	29.91	0.99
Hwy 400 Spill 1	399.11		Lat Struct									
Hwy 400 Spill 1	360.11	Hazel	3.27	289.61	289.91	289.91	289.97	0.003304	1.07	3.16	28.32	0.99
Hwy 400 Spill 1	359.11		Lat Struct									
Hwy 400 Spill 1	320.11	Hazel	2.67	289.42	289.65		289.67	0.002682	0.73	6.04	49.46	0.83
Hwy 400 Spill 1	280.11	Hazel	2.67	289.26	289.48	289.47	289.52	0.004955	0.95	3.95	45.69	1.12

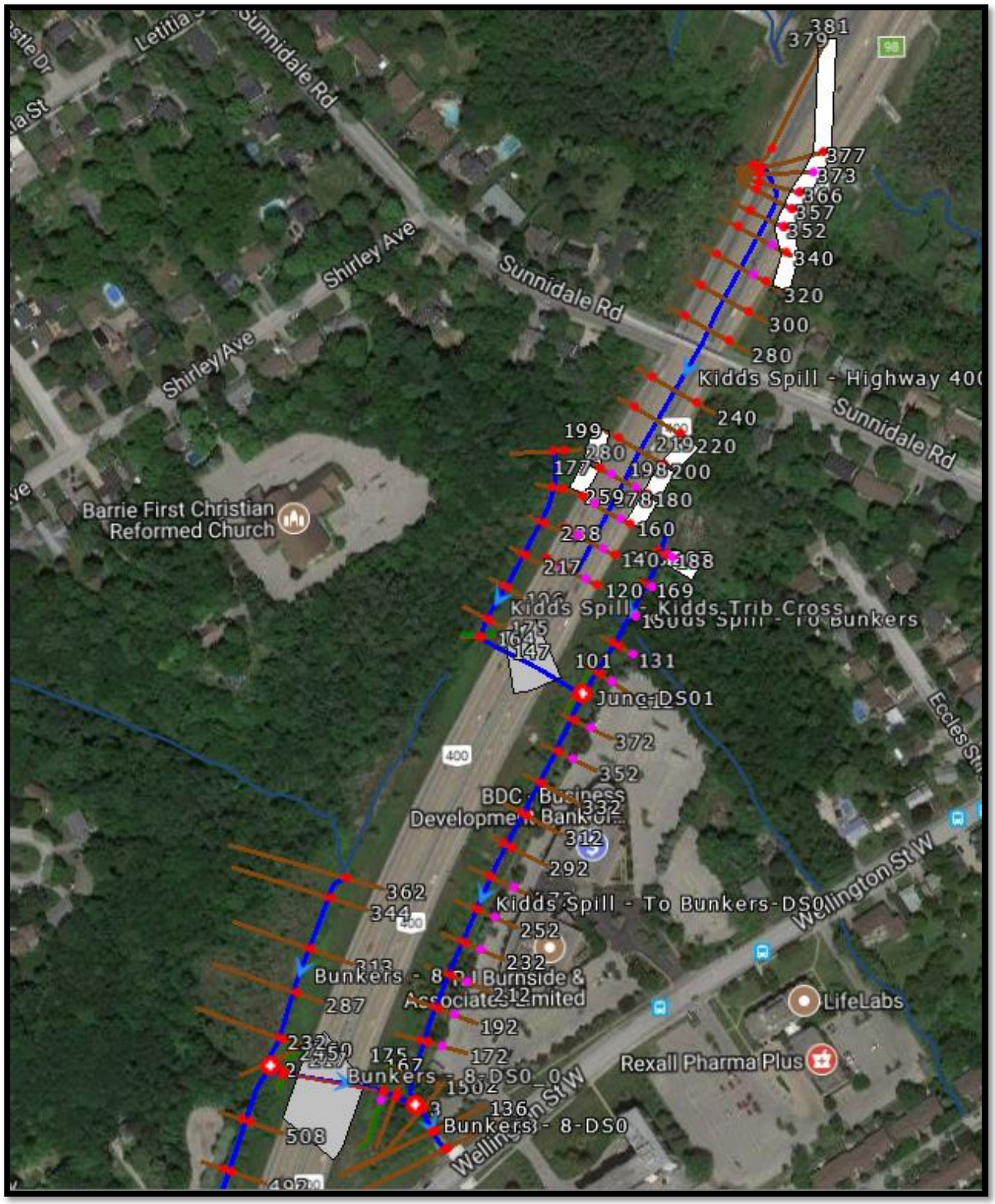
HEC-RAS Plan: WKTribSpill River: Whiskey Reach: Tributary

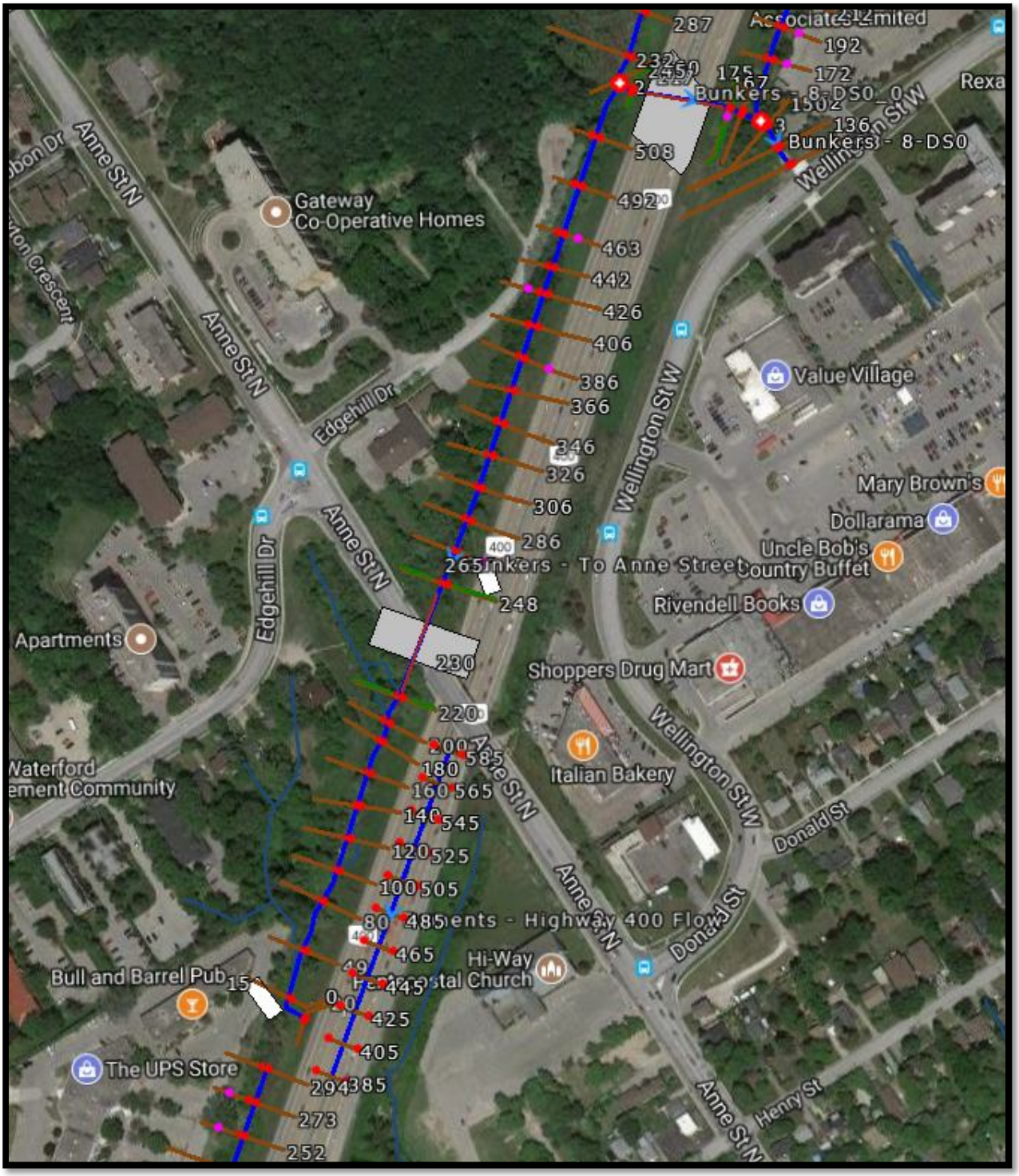
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Tributary	640	Hazel	1.41	288.10	288.38	288.38	288.46	0.019487	1.39	1.68	11.36	0.88
Tributary	640	100 Year	0.50	288.10	288.26	288.26	288.32	0.027123	1.08	0.57	6.58	0.94
Tributary	600	Hazel	1.41	286.85	287.12	287.12	287.21	0.025697	1.35	1.09	6.43	0.97
Tributary	600	100 Year	0.50	286.85	287.03	287.02	287.07	0.023032	0.88	0.57	5.17	0.84
Tributary	560	Hazel	1.41	285.90	286.12	286.12	286.19	0.025054	1.26	1.27	9.09	0.95
Tributary	560	100 Year	0.50	285.90	286.03	286.03	286.07	0.026965	0.86	0.59	6.93	0.89
Tributary	534	Hazel	1.41	285.52	285.82	285.73	285.84	0.005704	0.81	3.29	17.01	0.49
Tributary	534	100 Year	0.50	285.52	285.69	285.65	285.71	0.008252	0.65	1.28	13.58	0.53
Tributary	509	Hazel	2.77	285.29	285.53	285.40	285.57	0.021383	1.31	4.51	27.27	0.90
Tributary	509	100 Year	0.50	285.29	285.39	285.35	285.40	0.028710	0.72	1.25	17.52	0.87
Tributary	495	Hazel	2.77	284.91	284.97	284.97	285.03	0.152499	0.85	2.58	22.67	1.69
Tributary	495	100 Year	0.50	284.91	284.86	284.83	284.88	0.077127		0.91	10.38	0.00
Tributary	489		Lat Struct									
Tributary	479	Hazel	1.79	283.76	284.64	284.32	284.69	0.003065	1.05	1.95	3.75	0.39
Tributary	479	100 Year	0.50	283.76	284.04	284.04	284.15	0.031983	1.45	0.35	1.71	1.03
Tributary	454		Culvert									
Tributary	406	Hazel	1.79	283.21	283.70	283.70	283.89	0.018927	2.02	1.11	3.36	0.95
Tributary	406	100 Year	0.50	283.21	283.45	283.45	283.55	0.023711	1.35	0.40	2.36	0.94
Tributary	375	Hazel	1.79	281.90	282.53	282.53	282.72	0.017597	2.11	1.20	4.32	0.92
Tributary	375	100 Year	0.50	281.90	282.24	282.24	282.35	0.023981	1.47	0.38	2.01	0.94
Tributary	360	Hazel	1.79	281.54	282.01	282.01	282.14	0.021960	1.60	1.23	6.13	0.95
Tributary	360	100 Year	0.50	281.54	281.84	281.84	281.90	0.030952	1.15	0.43	3.16	1.00
Tributary	320	Hazel	1.79	280.52	280.80	280.80	280.89	0.023695	1.30	1.51	10.21	0.94
Tributary	320	100 Year	0.50	280.52	280.83		280.84	0.001152	0.31	1.80	10.98	0.21
Tributary	280	Hazel	2.82	279.72	280.78	280.17	280.78	0.000297	0.42	10.05	22.26	0.14
Tributary	280	100 Year	2.97	279.72	280.82	280.18	280.82	0.000282	0.42	10.58	22.86	0.13
Tributary	266		Culvert									
Tributary	240	Hazel	2.82	279.16	279.51	279.46	279.57	0.011988	1.13	2.84	14.69	0.70
Tributary	240	100 Year	2.97	279.16	279.51	279.47	279.58	0.012185	1.16	2.93	14.86	0.71
Tributary	200	Hazel	2.82	278.60	278.80	278.80	278.87	0.026724	1.24	2.47	17.45	0.97
Tributary	200	100 Year	2.97	278.60	278.80	278.80	278.88	0.026364	1.26	2.57	17.62	0.97
Tributary	160	Hazel	2.82	277.54	277.73	277.71	277.78	0.021397	1.08	2.74	18.90	0.86
Tributary	160	100 Year	2.97	277.54	277.73	277.72	277.79	0.021238	1.10	2.84	19.01	0.86
Tributary	120	Hazel	2.82	276.50	276.76	276.76	276.84	0.025740	1.29	2.27	14.54	0.96
Tributary	120	100 Year	2.97	276.50	276.77	276.77	276.85	0.025364	1.31	2.37	14.66	0.96
Tributary	80	Hazel	2.82	275.44	275.63	275.63	275.68	0.030185	1.03	2.83	27.08	0.97
Tributary	80	100 Year	2.97	275.44	275.64	275.63	275.69	0.026035	1.01	3.07	27.44	0.91
Tributary	40	Hazel	2.82	274.87	275.07		275.09	0.008529	0.75	5.48	36.83	0.56
Tributary	40	100 Year	2.97	274.87	275.07		275.09	0.009374	0.79	5.50	36.85	0.58
Tributary	0	Hazel	2.82	274.00	274.49	274.49	274.60	0.017258	1.68	2.47	14.67	0.88
Tributary	0	100 Year	2.97	274.00	274.50	274.50	274.61	0.015626	1.65	2.75	16.23	0.84

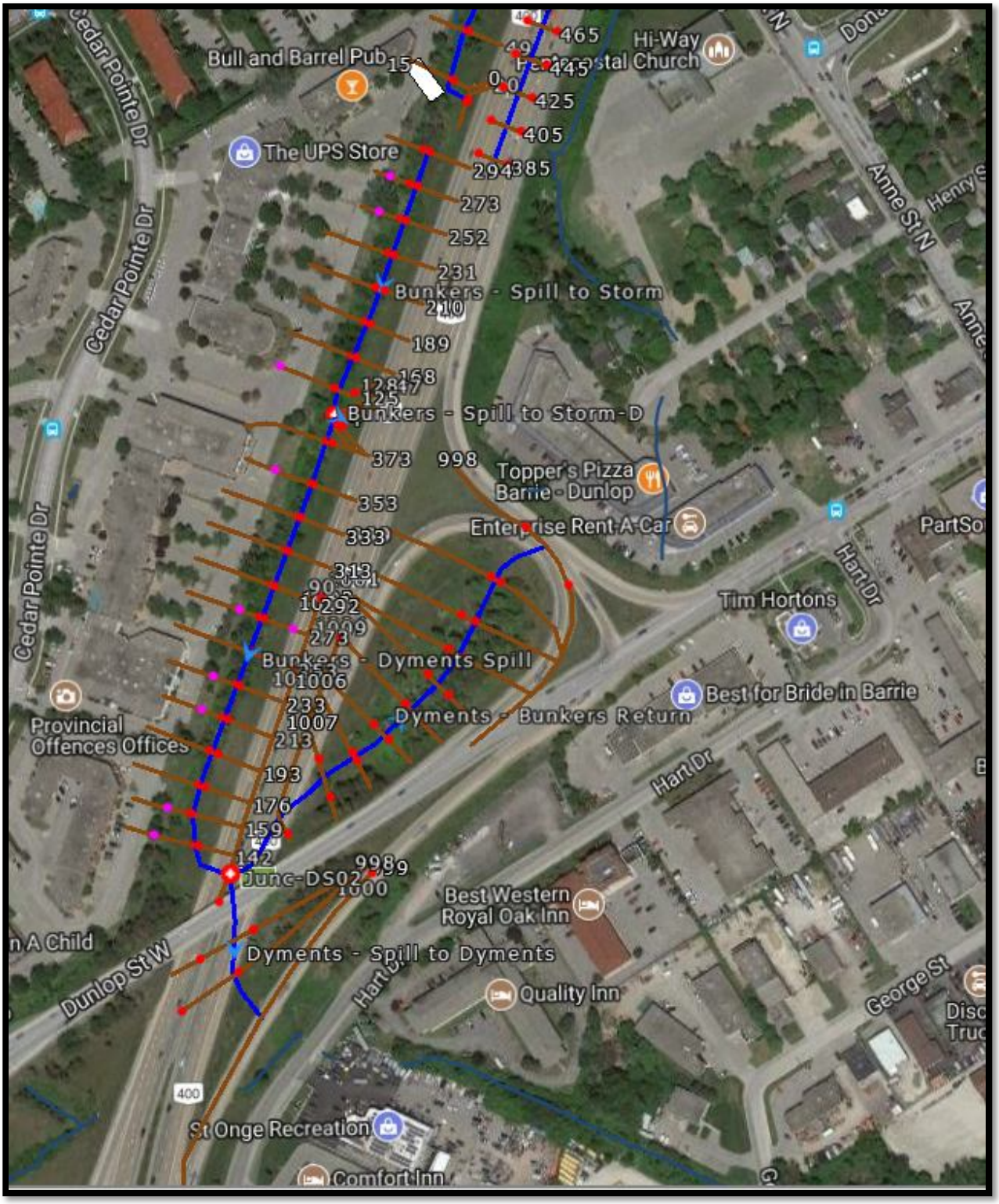
HEC-RAS Plan: FutSpillWK River: Whiskey Reach: Tributary

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	640	Hazel	1.69	288.10	288.40	288.40	288.49	0.020076	1.49	1.93	11.66	0.91
Tributary	640	100 Year	0.60	288.10	288.27	288.27	288.34	0.025877	1.14	0.68	7.68	0.94
Tributary	600	Hazel	1.69	286.85	287.15	287.14	287.25	0.024514	1.43	1.26	6.83	0.97
Tributary	600	100 Year	0.60	286.85	287.05	287.03	287.09	0.022468	0.93	0.65	5.49	0.84
Tributary	560	Hazel	1.69	285.90	286.13	286.13	286.23	0.026625	1.38	1.42	9.41	0.99
Tributary	560	100 Year	0.60	285.90	286.04	286.04	286.09	0.027508	0.93	0.67	7.25	0.91
Tributary	534	Hazel	1.69	285.52	285.84	285.76	285.87	0.005974	0.87	3.69	17.43	0.51
Tributary	534	100 Year	0.60	285.52	285.71	285.67	285.73	0.008088	0.68	1.50	14.22	0.53
Tributary	509	Hazel	3.18	285.29	285.55	285.40	285.59	0.022301	1.40	4.93	29.76	0.93
Tributary	509	100 Year	0.60	285.29	285.40	285.36	285.41	0.028596	0.78	1.42	18.79	0.89
Tributary	495	Hazel	3.18	284.91	284.99	284.99	285.05	0.136542	0.95	2.96	25.38	1.67
Tributary	495	100 Year	0.60	284.91	284.87	284.85	284.89	0.077431		1.03	10.71	0.00
Tributary	489		Lat Struct									
Tributary	479	Hazel	1.89	283.76	284.68	284.33	284.73	0.002823	1.05	2.11	9.65	0.38
Tributary	479	100 Year	0.60	283.76	284.08	284.08	284.19	0.029777	1.48	0.41	1.83	1.01
Tributary	454		Culvert									
Tributary	406	Hazel	1.89	283.21	283.72	283.72	283.91	0.018485	2.04	1.17	3.43	0.95
Tributary	406	100 Year	0.60	283.21	283.48	283.48	283.58	0.023403	1.44	0.46	2.46	0.95
Tributary	375	Hazel	1.89	281.90	282.57	282.57	282.74	0.014785	2.03	1.38	5.02	0.85
Tributary	375	100 Year	0.60	281.90	282.27	282.27	282.39	0.022614	1.54	0.44	2.16	0.93
Tributary	360	Hazel	1.89	281.54	282.02	282.02	282.15	0.022541	1.64	1.28	6.24	0.97
Tributary	360	100 Year	0.60	281.54	281.86	281.86	281.93	0.031061	1.20	0.50	3.44	1.01
Tributary	320	Hazel	1.89	280.52	280.82	280.81	280.90	0.020650	1.27	1.66	10.64	0.88
Tributary	320	100 Year	0.60	280.52	280.97		280.97	0.000275	0.21	3.69	17.06	0.11
Tributary	280	Hazel	2.92	279.72	280.80	280.17	280.81	0.000287	0.42	10.41	22.65	0.13
Tributary	280	100 Year	3.56	279.72	280.96	280.23	280.96	0.000239	0.42	12.54	25.41	0.13
Tributary	266		Culvert									
Tributary	240	Hazel	2.92	279.16	279.51	279.47	279.57	0.012110	1.15	2.90	14.81	0.71
Tributary	240	100 Year	3.56	279.16	279.54	279.49	279.61	0.012554	1.25	3.28	15.54	0.73
Tributary	200	Hazel	2.92	278.60	278.80	278.80	278.88	0.026432	1.25	2.54	17.56	0.97
Tributary	200	100 Year	3.56	278.60	278.82	278.82	278.91	0.025719	1.34	2.93	18.26	0.97
Tributary	160	Hazel	2.92	277.54	277.73	277.72	277.79	0.021720	1.10	2.79	18.96	0.87
Tributary	160	100 Year	3.56	277.54	277.75	277.74	277.82	0.021868	1.19	3.17	19.34	0.89
Tributary	120	Hazel	2.92	276.50	276.76	276.76	276.85	0.025460	1.30	2.34	14.63	0.96
Tributary	120	100 Year	3.56	276.50	276.79	276.79	276.89	0.024402	1.39	2.71	15.08	0.96
Tributary	80	Hazel	2.92	275.44	275.64	275.63	275.69	0.028132	1.03	2.97	27.28	0.94
Tributary	80	100 Year	3.56	275.44	275.65	275.65	275.71	0.025578	1.08	3.48	27.96	0.92
Tributary	40	Hazel	2.92	274.87	275.08		275.09	0.008909	0.77	5.53	36.89	0.57
Tributary	40	100 Year	3.56	274.87	275.09		275.12	0.009501	0.84	6.21	38.20	0.60
Tributary	0	Hazel	2.92	274.00	274.50	274.50	274.61	0.015779	1.65	2.70	15.97	0.85
Tributary	0	100 Year	3.56	274.00	274.56	274.56	274.66	0.013154	1.64	3.70	20.35	0.79

Kidd's, Bunkers and Dyments Creek Spills Geometry Plan




Anne St N
Gateway
Co-Operative Homes
Edgehill Dr
Wellington St W
Value Village
Mary Brown's
Dollarama
Uncle Bob's
Country Buffet
Rivendell Books
Shoppers Drug Mart
Italian Bakery
Apartments
Waterford
Community
Donald St
Hi-Way
Bull and Barrel Pub
The UPS Store
Henry St
Rexa
Bunkers - 8-DS0
Bunkers - To Anne Street
Bunkers - Highway 400 Flow
287
192
172
508
492
463
442
426
406
386
366
346
326
306
286
265
248
230
220
200
585
180
160
565
140
545
120
525
100
505
80
485
465
445
425
405
385
294
273
252


Bull and Barrel Pub
Hi-Way
The UPS Store
Cedar Pointe Dr
Anne St N
Bunkers - Spill to Storm
Bunkers - Spill to Storm-D
Topper's Pizza
Barrie - Dunlop
Enterprise Rent-A-Car
Tim Hortons
Hart Dr
Bunkers - Dyments Spill
Best for Bride in Barrie
Dyments - Bunkers Return
Provincial
Offences Offices
Junc-DS02
Best Western
Royal Oak Inn
Dyments - Spill to Dyments
Quality Inn
Dunlop St W
George St
St Onge Recreation
Comfort Inn
400

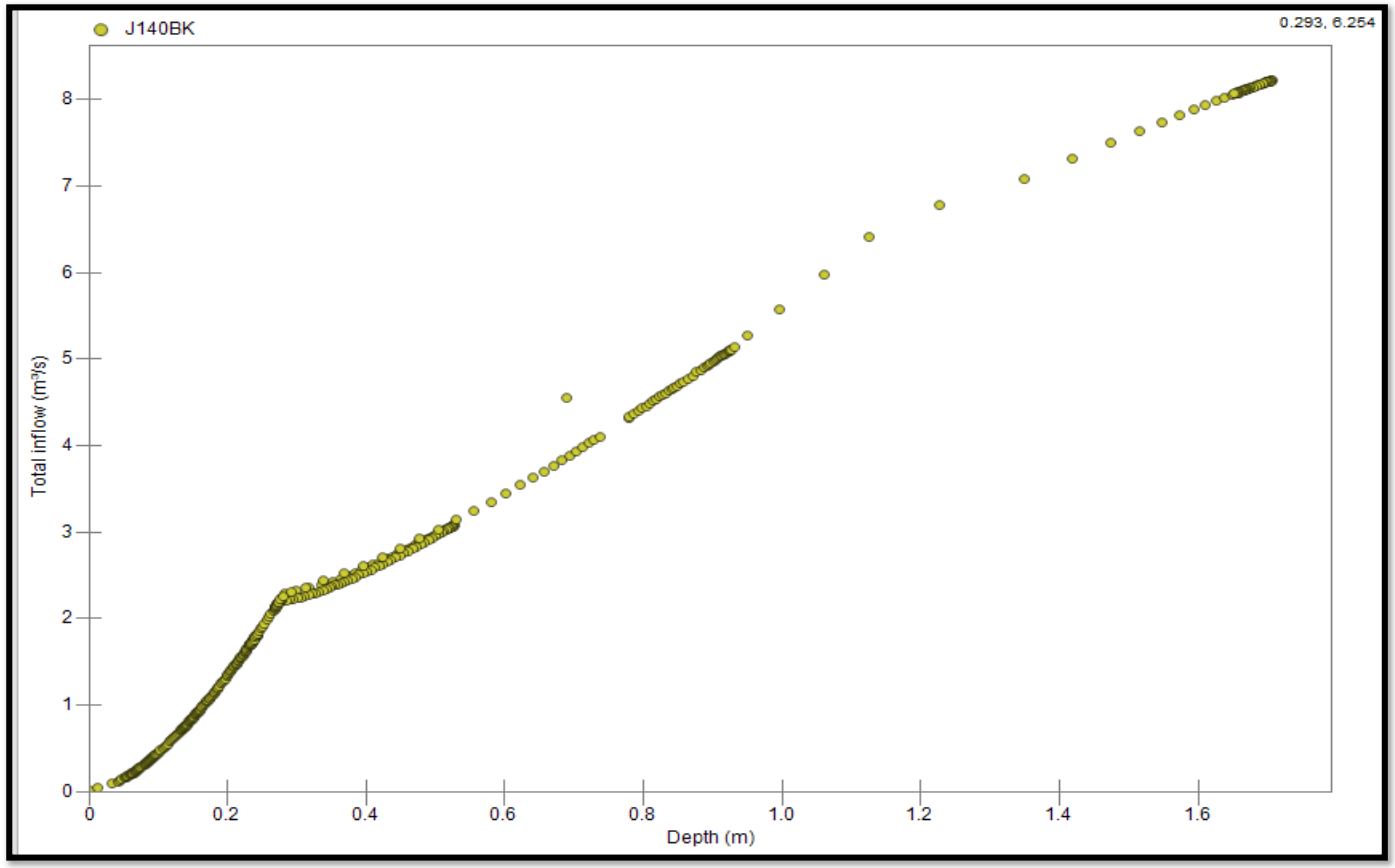
TATHAM ENGINEERING	Project: Barrie Drainage Master Plan	Date:	1-Aug-17
	File No.: 117076	Designed:	DAM
	Subject: Central Spills Analysis	Checked:	DRT

Reach	Spills	Spill Modelling Method	Details
Kidds Spill - Highway 400	To Kidds Creek Main Branch	Lateral Structure	Zero Height Weir Modelled Using Hager's Equation
Kidds Spill - Highway 400	To Kidds Creek Tributary Branch	Lateral Structures	Zero Height Weir Modelled Using Hager's Equation
Kidds Spill - Highway 400	To Kidds Spill - To Bunkers	Lateral Structures	Zero Height Weir Modelled Using Hager's Equation
Kidds Spill - Highway 400	To Bunkers - Minor Trib Cross	Lateral Structures	Zero Height Weir Modelled Using Hager's Equation
Kidds Spill - To Bunkers	To Kidds Creek Tributary Branch	Lateral Structures	Zero Height Weir Modelled Using Hager's Equation
Bunkers - North Trib	To Bunkers - To Anne Street	Split Junction	
Bunkers - To Anne Street	To Dyments - Highway 400 Flow	Lateral Structure	Broad Crested Weir
Bunkers - To Anne Street	To Bunkers - Spill to Storm	Lateral Structure	Broad Crested Weir
Bunkers - Spill to Storm	To Bunkers - Dyments Spill	Split Junction	
Bunkers - Dyments Spill	To Dyments - Spill to Dyments	Split Junction	

Reach	Downstream Boundary Condition	Details
Kidds Spill - Highway 400	Normal Depth	
Bunkers - Minor Trib Cross	Junction	
Kidds Spill - To Bunkers	Junction	
Bunkers - Trib Plus Kidds Spill	Junction	For future conditions there is still 0.38 cms within Kidds Spill - Highway 400 - this flow is added at this junction.
Bunkers - North Trib	Junction	
Bunkers - North Trib-Crossing	Junction	
Bunkers - North Trib-DS	Rating Curve	Rating Curve from PCSWMM.
Bunkers - To Anne Street	Rating Curve	Rating Curve from HY-8 analysis of crossing.
Bunkers - Spill to Storm	Junction	
Dyments - Highway 400 Flow	Normal Depth	
Bunkers -Spill to Storm-DS	Rating Curve	Rating Curve from HY-8 analysis of crossing.
Bunkers - Dyments Spill	Junction	
Dyments - Spill to Dyments	Known WS	Determined from Dyments Creek model for water surfaces downstream of Highway 400 Culvert Crossing.
Dyments - Bunkers Return	Critical Depth	Fills ponding area within Highway 400 exit ramp and spills over roadway at critical depth.

TATHAM ENGINEERING	Project: Barrie Drainage Master Plan	Date:	1-Aug-17
	File No.: 117076	Designed:	DAM
	Subject: Bunkers NE Rating Curve	Checked:	DRT

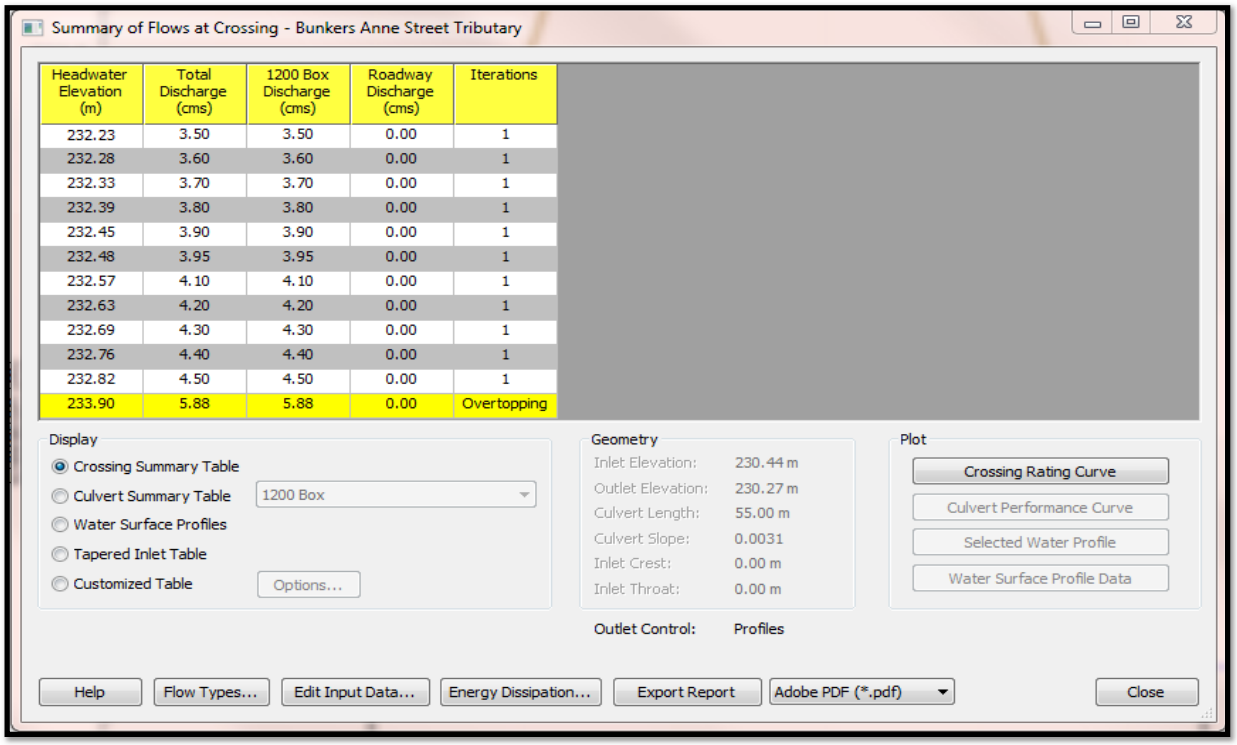
Bunkers Northeast Branch



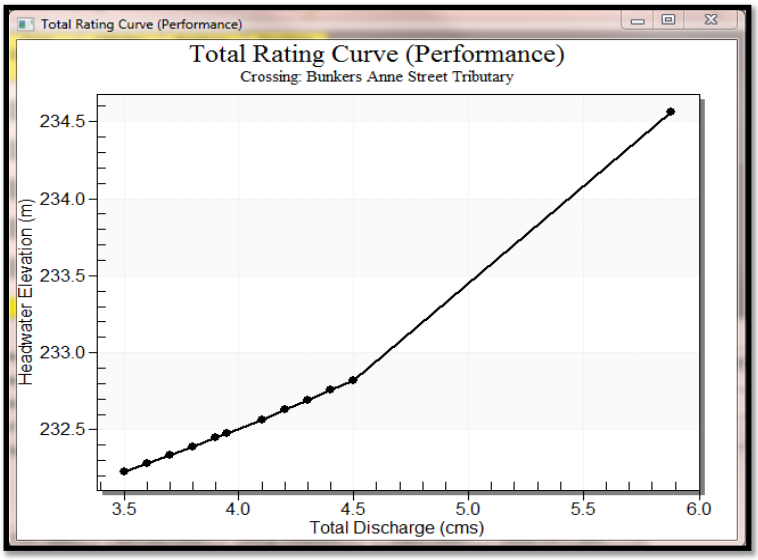
Depth (m)	Discharge (cms)
0	0
0.1	0.5
0.2	1.35
0.3	2.32
0.4	2.56
0.5	2.96
0.6	3.45
0.8	4.44
1	5.63
1.2	6.74

TATHAM ENGINEERING	Project: Barrie Drainage Master Plan	Date: 1-Aug-17
	File No.: 117076	Designed: DAM
	Subject: Bunkers Anne St. Rating Curve	Checked: DRT

Bunkers Central Branch



Headwater Elevation (m)	Total Discharge (cms)	1200 Box Discharge (cms)	Roadway Discharge (cms)	Iterations
232.23	3.50	3.50	0.00	1
232.28	3.60	3.60	0.00	1
232.33	3.70	3.70	0.00	1
232.39	3.80	3.80	0.00	1
232.45	3.90	3.90	0.00	1
232.48	3.95	3.95	0.00	1
232.57	4.10	4.10	0.00	1
232.63	4.20	4.20	0.00	1
232.69	4.30	4.30	0.00	1
232.76	4.40	4.40	0.00	1
232.82	4.50	4.50	0.00	1
233.90	5.88	5.88	0.00	Overtopping



TATHAM ENGINEERING	Project: Barrie Drainage Master Plan	Date: 1-Aug-17
	File No.: 117076	Designed: DAM
	Subject: Bunkers South Rating Curve	Checked: DRT

Bunkers South Branch

Summary of Flows at Crossing - Bunkers Trunk Spill to Dyments

Headwater Elevation (m)	Total Discharge (cms)	1200 Box Discharge (cms)	Roadway Discharge (cms)	Iterations
228.10	0.00	0.00	0.00	1
229.21	2.13	2.13	0.00	1
230.27	4.26	4.26	0.00	1
232.21	6.39	6.39	0.00	1
232.47	6.74	6.61	0.13	9
232.64	10.65	6.61	4.03	7
232.68	12.78	6.58	6.18	5
232.72	14.91	6.55	8.34	4
232.75	17.04	6.52	10.51	4
232.78	19.17	6.50	12.65	3
232.81	21.30	6.47	14.81	3
232.41	6.56	6.56	0.00	Overtopping

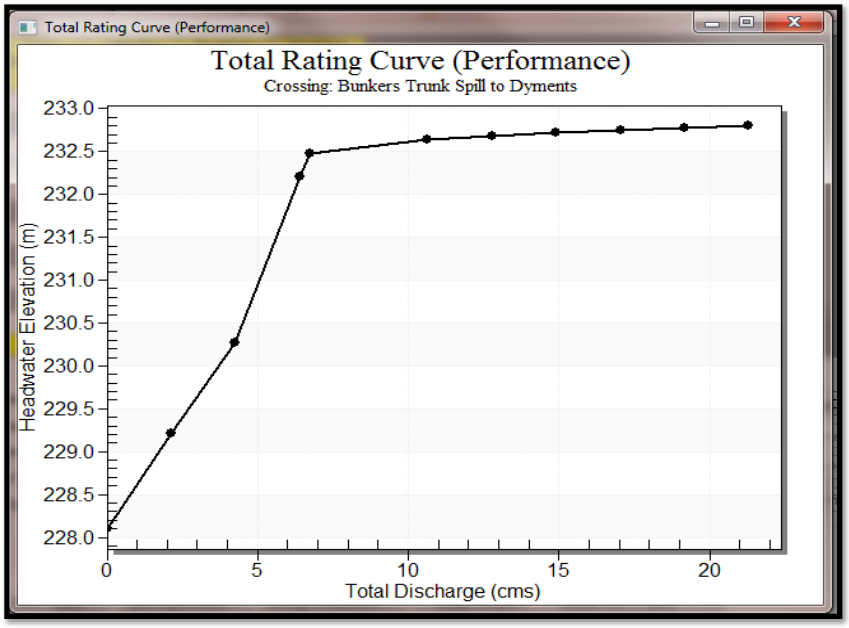
Display
- Crossing Summary Table
- Culvert Summary Table — 1200 Box
- Water Surface Profiles
- Tapered Inlet Table
- Customized Table — Options...

Geometry
- Inlet Elevation: 228.05 m
- Outlet Elevation: 227.14 m
- Culvert Length: 108.00 m
- Culvert Slope: 0.0084
- Inlet Crest: 0.00 m
- Inlet Throat: 0.00 m

Outlet Control: Profiles

Plot
- Crossing Rating Curve
- Culvert Performance Curve
- Selected Water Profile
- Water Surface Profile Data

Help | Flow Types... | Edit Input Data... | Energy Dissipation... | Export Report | Adobe PDF (*.pdf) | Close



HEC-RAS Plan: ExRegional Profile: Spill

River	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)	
Kidds Spill	To Bunkers	207	Spill	1.76	241.59	241.85	241.85	241.95	0.026383	1.48	1.37	6.99	1.01
Kidds Spill	To Bunkers	206		Lat Struct									
Kidds Spill	To Bunkers	188	Spill	0.06	240.19	240.28	240.28	240.30	0.040731	0.66	0.11	3.44	0.97
Kidds Spill	To Bunkers	169	Spill	0.06	239.41	239.54	239.53	239.57	0.021704	0.71	0.09	1.12	0.77
Kidds Spill	To Bunkers	150	Spill	0.06	238.96	239.05	239.05	239.07	0.030538	0.66	0.09	1.66	0.87
Kidds Spill	To Bunkers	131	Spill	0.06	238.67	238.75	238.73	238.75	0.010680	0.39	0.16	2.69	0.51
Kidds Spill	To Bunkers	112	Spill	0.06	238.28	238.34	238.34	238.37	0.053060	0.76	0.08	1.77	1.10
Kidds Spill	Highway 400	381	Spill	17.41	251.42	252.02	252.02	252.23	0.001998	2.16	14.33	44.27	0.98
Kidds Spill	Highway 400	379		Lat Struct									
Kidds Spill	Highway 400	377	Spill	17.10	251.25	251.74	251.74	251.88	0.002538	1.67	11.04	41.77	1.00
Kidds Spill	Highway 400	373	Spill	15.89	251.20	251.61	251.61	251.76	0.002515	1.72	9.39	33.35	1.00
Kidds Spill	Highway 400	366	Spill	13.36	251.01	251.43	251.43	251.59	0.002475	1.76	7.99	26.00	1.00
Kidds Spill	Highway 400	357	Spill	10.71	250.84	251.23	251.23	251.37	0.002609	1.66	6.78	25.18	1.01
Kidds Spill	Highway 400	352	Spill	7.73	250.61	250.95	250.95	251.07	0.002820	1.53	5.66	25.88	1.01
Kidds Spill	Highway 400	340	Spill	5.39	250.33	250.60	250.60	250.67	0.002964	1.17	4.88	34.28	0.97
Kidds Spill	Highway 400	320	Spill	5.39	249.94	250.19	250.19	250.25	0.002845	1.14	5.00	34.09	0.95
Kidds Spill	Highway 400	300	Spill	5.39	249.53	249.77	249.77	249.85	0.003469	1.24	4.39	31.12	1.05
Kidds Spill	Highway 400	280	Spill	5.39	249.08	249.37	249.37	249.44	0.003082	1.23	4.55	29.66	1.00
Kidds Spill	Highway 400	240	Spill	5.39	248.24	248.53	248.53	248.60	0.002451	1.14	4.90	30.46	0.90
Kidds Spill	Highway 400	220	Spill	5.39	247.80	248.07	248.07	248.15	0.003214	1.21	4.75	32.17	1.01
Kidds Spill	Highway 400	219		Lat Struct									
Kidds Spill	Highway 400	200	Spill	5.10	247.38	247.62	247.62	247.69	0.003240	1.19	4.74	33.65	1.01
Kidds Spill	Highway 400	199		Lat Struct									
Kidds Spill	Highway 400	198		Lat Struct									
Kidds Spill	Highway 400	180	Spill	1.90	246.95	247.13	247.13	247.17	0.004126	0.94	2.33	25.75	1.04
Kidds Spill	Highway 400	178		Lat Struct									
Kidds Spill	Highway 400	177		Lat Struct									
Kidds Spill	Highway 400	160	Spill	0.03	246.54	246.58	246.58	246.59	0.006205	0.43	0.07	3.98	1.00
Kidds Spill	Highway 400	140	Spill	0.03	246.07	246.14	246.14	246.16	0.007316	0.50	0.06	3.00	1.10
Kidds Spill	Highway 400	120	Spill	0.03	245.67	245.73	245.73	245.74	0.007118	0.46	0.07	3.61	1.07
Dyments	Spill to Dyments	1000	Spill	4.96	231.32	231.98		231.98	0.000013	0.19	31.45	61.07	0.08
Dyments	Spill to Dyments	999	Spill	4.96	231.09	231.98		231.98	0.000003	0.11	106.13	133.15	0.04
Dyments	Spill to Dyments	998	Spill	4.96	230.77	231.98	230.91	231.98	0.000000	0.02	211.15	304.69	0.01
Dyments	Bunkers Return	1009	Spill	9.58	231.63	231.91	231.91	231.98	0.003247	1.13	8.49	64.93	1.00
Dyments	Bunkers Return	1007	Spill	9.58	230.91	231.81		231.83	0.001162	0.63	15.84	35.34	0.25
Dyments	Bunkers Return	1006	Spill	9.58	230.49	231.81		231.81	0.000257	0.48	36.71	42.40	0.13
Dyments	Bunkers Return	1005	Spill	9.58	230.06	231.81		231.81	0.000040	0.22	66.05	50.16	0.05
Dyments	Bunkers Return	1004	Spill	9.58	229.79	231.81		231.81	0.000015	0.15	104.77	62.86	0.03
Dyments	Bunkers Return	1003	Spill	9.58	229.58	231.81		231.81	0.000006	0.10	138.83	72.05	0.02
Dyments	Bunkers Return	1002	Spill	9.58	229.45	231.81		231.81	0.000005	0.10	169.47	93.33	0.02
Dyments	Bunkers Return	1001	Spill	9.58	229.33	231.81		231.81	0.000004	0.09	199.36	108.41	0.02
Dyments	Bunkers Return	999	Spill	9.58	229.24	231.81		231.81	0.000004	0.10	183.53	95.90	0.02
Dyments	Bunkers Return	998	Spill	9.58	231.65	231.73	231.73	231.80	0.027775	1.60	8.61	77.42	2.43
Dyments	Highway 400 Flow	585	Spill	0.67	235.64	235.75	235.75	235.78	0.003164	0.68	0.99	15.98	0.87
Dyments	Highway 400 Flow	584.14		Lat Struct									
Dyments	Highway 400 Flow	565	Spill	0.66	235.39	235.49	235.49	235.55	0.009183	1.05	0.63	11.57	1.45
Dyments	Highway 400 Flow	545	Spill	0.64	235.14	235.26	235.26	235.30	0.005322	0.88	0.73	11.76	1.13
Dyments	Highway 400 Flow	525	Spill	0.55	234.86	235.02	235.02	235.05	0.004002	0.81	0.68	9.91	0.99
Dyments	Highway 400 Flow	505	Spill	0.52	234.70	234.83	234.83	234.86	0.006967	0.85	0.61	12.75	1.24
Dyments	Highway 400 Flow	485	Spill	0.44	234.49	234.62	234.62	234.65	0.004731	0.74	0.60	11.32	1.03
Dyments	Highway 400 Flow	465	Spill	0.38	234.29	234.41	234.41	234.43	0.004848	0.69	0.55	11.91	1.02
Dyments	Highway 400 Flow	445	Spill	0.37	234.10	234.21	234.21	234.23	0.003823	0.62	0.60	12.91	0.91
Dyments	Highway 400 Flow	425	Spill	0.35	233.85	233.96	233.96	233.99	0.004541	0.75	0.47	8.49	1.02
Dyments	Highway 400 Flow	405	Spill	0.35	233.57	233.71	233.71	233.74	0.004415	0.83	0.43	6.54	1.04
Dyments	Highway 400 Flow	385	Spill	0.35	233.40	233.52	233.52	233.55	0.004937	0.85	0.42	6.73	1.09
Bunkers	Spill to Storm	294	Spill	0.00	231.57	232.26		232.26	0.000000	0.00	7.69	18.05	0.00
Bunkers	Spill to Storm	273	Spill	6.37	231.43	232.22	231.88	232.24	0.001893	0.92	11.67	23.17	0.33
Bunkers	Spill to Storm	252	Spill	6.37	231.34	232.18	231.81	232.20	0.001966	0.96	11.92	21.68	0.34
Bunkers	Spill to Storm	231	Spill	6.37	231.07	232.16		232.18	0.000799	0.74	15.42	22.63	0.23
Bunkers	Spill to Storm	210	Spill	6.37	230.89	232.16		232.16	0.000288	0.49	21.12	29.27	0.14
Bunkers	Spill to Storm	189	Spill	6.37	230.57	232.15		232.16	0.000199	0.47	25.19	33.41	0.12
Bunkers	Spill to Storm	168	Spill	6.37	230.04	232.15		232.16	0.000115	0.42	35.44	45.63	0.10
Bunkers	Spill to Storm	147	Spill	20.49	230.76	232.12	231.38	232.14	0.000744	0.81	39.81	50.29	0.23
Bunkers	Dyments Spill	373	Spill	14.18	230.28	232.12		232.14	0.000451	0.79	41.02	58.68	0.19
Bunkers	Dyments Spill	353	Spill	14.18	229.68	232.12	230.70	232.13	0.000314	0.79	40.38	35.76	0.16
Bunkers	Dyments Spill	333	Spill	14.18	229.63	232.11		232.12	0.000296	0.78	45.45	59.36	0.16
Bunkers	Dyments Spill	313	Spill	14.18	229.73	232.10		232.11	0.000358	0.82	45.02	59.34	0.17
Bunkers	Dyments Spill	292	Spill	14.18	229.84	232.09		232.10	0.000447	0.90	43.03	62.92	0.19
Bunkers	Dyments Spill	273	Spill	14.18	229.99	232.08	230.90	232.09	0.000458	0.86	36.05	35.58	0.19
Bunkers	Dyments Spill	253	Spill	14.18	230.28	232.07		232.08	0.000654	0.93	41.27	59.48	0.22
Bunkers	Dyments Spill	233	Spill	14.18	230.20	232.05	231.07	232.07	0.000628	0.94	35.81	42.44	0.22
Bunkers	Dyments Spill	213	Spill	14.18	230.33	232.04	231.18	232.06	0.000719	0.95	33.73	42.15	0.23
Bunkers	Dyments Spill	193	Spill	14.18	230.39	232.03		232.04	0.000538	0.78	35.83	45.90	0.20
Bunkers	Dyments Spill	176	Spill	14.18	230.50	232.01		232.03	0.000749	0.90	34.44	48.36	0.23
Bunkers	Dyments Spill	159	Spill	14.18	230.56	232.00	231.46	232.01	0.001013	1.01	33.90	54.08	0.27
Bunkers	Dyments Spill	142	Spill	14.18	230.72	231.98	231.45	232.00	0.001196	0.98	34.02	56.63	0.28
Bunkers	Dyments Spill	90	Spill	14.18	231.47	231.98		231.98	0.000128	0.38	36.96	125.83	0.23
Bunkers	Minor Trib Cross	280	Spill	0.30	245.18	245.30	245.27	245.31	0.012838	0.56	0.55	6.81	0.60
Bunkers	Minor Trib Cross	259	Spill	0.89	244.54	244.74	244.74	244.81	0.031018	1.18	0.76	5.46	1.01
Bunkers	Minor Trib Cross	238	Spill	0.89	243.87	244.16	244.16	244.26	0.022411	1.47	0.73	4.06	0.94
Bunkers	Minor Trib Cross	217	Spill	0.89	243.23	243.53	243.53	243.64	0.020540	1.53	0.72	3.79	0.92
Bunkers	Minor Trib Cross	196	Spill	0.89	242.29	242.54	242.54	242.64	0.025305	1.46	0.71	3.90	0.99
Bunkers	Minor Trib Cross	175	Spill	0.89	241.18	241.50	241.50	241.62	0.022254	1.56	0.63	2.93	0.95
Bunkers	Minor Trib Cross	164	Spill	0.89	240.27	240.73	240.67	240.83	0.011310	1.50	0.76	2.69	0.73
Bunkers	Minor Trib Cross	147		Culvert									
Bunkers	Minor Trib Cross	101	Spill	0.89	238.45	238.78	238.78	238.90	0.028390	1.51	0.59	2.62	1.02
Bunkers	Trib Plus Kidds	372	Spill	0.95	237.63	238.03	237.94	238.08	0.007914	1.18	1.15	4.39	0.61
Bunkers	Trib Plus Kidds	352	Spill	0.95	237.43	237.75	237.73	237.84	0.018719	1.58	0.88	3.99	0.90
Bunkers	Trib Plus Kidds	332	Spill	0.95	237.12	237.47		237.54	0.012493	1.33	0.99	4.05	0.74
Bunkers	Trib Plus Kidds	312	Spill	0.95	236.99	237.32		237.36	0.005958	0.91	1.22	4.65	0.51

HEC-RAS Plan: ExRegional Profile: Spill (Continued)

River	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)	
Bunkers	Trib Plus Kidds	292	Spill	0.95	236.96	237.20		237.23	0.007188	0.79	1.37	8.48	0.53
Bunkers	Trib Plus Kidds	272	Spill	0.95	236.65	237.07	237.01	237.10	0.006102	1.01	1.93	10.66	0.52
Bunkers	Trib Plus Kidds	252	Spill	0.95	236.45	236.95	236.81	236.99	0.005194	1.07	1.39	4.90	0.50
Bunkers	Trib Plus Kidds	232	Spill	0.95	236.35	236.90	236.65	236.92	0.002102	0.74	1.65	4.41	0.33
Bunkers	Trib Plus Kidds	212	Spill	0.95	236.21	236.89	236.47	236.90	0.000402	0.38	4.25	11.02	0.15
Bunkers	Trib Plus Kidds	192	Spill	0.95	236.19	236.89	236.43	236.89	0.000258	0.31	5.28	14.74	0.12
Bunkers	Trib Plus Kidds	172	Spill	0.95	236.18	236.89	236.35	236.89	0.000093	0.19	7.78	15.76	0.07
Bunkers	Trib Plus Kidds	152	Spill	0.95	236.06	236.88		236.88	0.000292	0.37	4.55	10.32	0.13
Bunkers	North Trib	362	Spill	8.47	238.13	239.30	239.30	239.47	0.011653	2.72	7.89	23.02	0.84
Bunkers	North Trib	344	Spill	8.47	237.75	238.91	238.91	239.07	0.009860	2.37	7.91	23.49	0.76
Bunkers	North Trib	313	Spill	8.47	237.30	238.39	238.39	238.61	0.010317	2.51	6.29	15.06	0.79
Bunkers	North Trib	287	Spill	8.47	236.83	238.11		238.26	0.009473	2.64	8.39	21.54	0.77
Bunkers	North Trib	260	Spill	8.47	236.55	238.15		238.17	0.000718	0.77	22.91	37.92	0.21
Bunkers	North Trib	245	Spill	8.47	236.35	238.15		238.16	0.000307	0.61	26.59	26.48	0.15
Bunkers	North Trib-Cross	232	Spill	3.89	236.30	238.14	236.93	238.15	0.000273	0.61	8.57	14.56	0.14
Bunkers	North Trib-Cross	217		Culvert									
Bunkers	North Trib-Cross	175	Spill	3.89	235.98	236.82	236.78	237.01	0.012048	2.35	2.71	11.23	0.84
Bunkers	North Trib-Cross	167	Spill	3.89	235.97	236.84		236.85	0.000821	0.58	14.33	38.40	0.21
Bunkers	To Anne Street	508	Spill	4.58	236.65	238.13		238.15	0.000388	0.63	10.90	17.73	0.17
Bunkers	To Anne Street	492	Spill	4.58	236.69	238.12		238.14	0.000350	0.59	11.06	12.85	0.16
Bunkers	To Anne Street	463	Spill	4.58	236.79	238.11	237.26	238.12	0.000372	0.57	12.64	13.06	0.16
Bunkers	To Anne Street	442	Spill	4.58	237.01	238.04		238.10	0.002826	1.28	5.38	11.98	0.42
Bunkers	To Anne Street	426	Spill	4.58	237.04	238.01	237.62	238.06	0.002174	1.03	5.84	15.07	0.36
Bunkers	To Anne Street	406	Spill	4.58	237.12	237.95		238.01	0.003315	1.09	5.77	16.61	0.43
Bunkers	To Anne Street	386	Spill	4.58	236.98	237.89	237.62	237.94	0.002840	1.18	6.14	14.82	0.41
Bunkers	To Anne Street	366	Spill	4.58	236.78	237.60	237.60	237.82	0.012423	2.25	2.91	8.25	0.83
Bunkers	To Anne Street	346	Spill	4.58	236.63	237.28		237.41	0.011029	1.72	3.47	9.90	0.75
Bunkers	To Anne Street	326	Spill	4.58	236.26	237.10		237.23	0.007435	1.75	3.43	6.63	0.65
Bunkers	To Anne Street	306	Spill	4.58	236.08	236.98		237.10	0.005583	1.63	3.63	7.39	0.57
Bunkers	To Anne Street	286	Spill	4.58	235.95	236.93		237.01	0.003233	1.26	4.78	9.42	0.44
Bunkers	To Anne Street	266	Spill	4.58	236.11	236.87	236.65	236.93	0.003819	1.20	5.44	14.36	0.46
Bunkers	To Anne Street	265		Lat Struct									
Bunkers	To Anne Street	248	Spill	3.91	235.36	236.86	236.05	236.88	0.000423	0.62	9.58	36.92	0.17
Bunkers	To Anne Street	230		Culvert									
Bunkers	To Anne Street	220	Spill	3.91	234.41	235.08	235.08	235.31	0.016699	2.24	2.22	13.66	0.93
Bunkers	To Anne Street	200	Spill	10.32	233.72	234.90	234.90	235.12	0.008916	2.28	7.51	22.18	0.73
Bunkers	To Anne Street	180	Spill	10.32	233.42	234.76	234.76	234.95	0.007262	2.39	9.57	30.49	0.69
Bunkers	To Anne Street	160	Spill	10.32	233.12	234.52	234.52	234.68	0.006387	2.28	11.54	35.83	0.64
Bunkers	To Anne Street	140	Spill	10.32	232.77	233.98	233.98	234.19	0.008886	2.49	8.83	25.05	0.75
Bunkers	To Anne Street	120	Spill	10.32	232.09	233.39		233.44	0.002323	1.37	13.59	16.69	0.39
Bunkers	To Anne Street	100	Spill	10.32	231.65	233.22	232.91	233.36	0.005173	2.15	8.97	13.94	0.57
Bunkers	To Anne Street	80	Spill	10.32	231.52	232.81	232.81	233.18	0.014142	3.20	5.61	10.80	0.94
Bunkers	To Anne Street	49	Spill	10.32	230.96	232.52		232.60	0.003259	1.83	12.16	18.95	0.47
Bunkers	To Anne Street	20	Spill	10.32	230.66	232.49		232.53	0.001586	1.35	17.17	22.49	0.33
Bunkers	To Anne Street	15		Lat Struct									
Bunkers	To Anne Street	0	Spill	3.95	230.61	232.48	231.42	232.50	0.000470	0.80	10.04	14.07	0.19
Bunkers	North Trib-DS	150	Spill	4.84	235.76	236.61	236.61	236.79	0.014214	2.47	3.83	10.21	0.89
Bunkers	North Trib-DS	136	Spill	4.84	235.42	236.24	236.24	236.54	0.016329	2.57	2.39	4.58	0.95
Bunkers	North Trib-DS	133	Spill	4.84	234.25	235.43	235.12	235.55	0.004576	1.81	3.99	4.90	0.54
Bunkers	Spill to Storm-D	128	Spill	6.31	228.11	232.14		232.14	0.000008	0.17	77.30	44.58	0.03
Bunkers	Spill to Storm-D	125	Spill	6.31	227.91	232.13	228.72	232.14	0.000013	0.22	56.07	32.14	0.03

HEC-RAS Plan: ExFutReg Profile: Spill

River	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)	
Kidds Spill	To Bunkers	207	Spill	2.60	241.59	241.91	241.91	242.03	0.025337	1.70	1.80	7.24	1.03
Kidds Spill	To Bunkers	206		Lat Struct									
Kidds Spill	To Bunkers	188	Spill	0.20	240.19	240.33	240.32	240.36	0.039732	0.94	0.30	5.74	1.05
Kidds Spill	To Bunkers	169	Spill	0.20	239.41	239.62	239.62	239.68	0.031959	1.18	0.19	1.57	1.00
Kidds Spill	To Bunkers	150	Spill	0.20	238.96	239.16	239.11	239.18	0.011457	0.70	0.31	2.52	0.61
Kidds Spill	To Bunkers	131	Spill	0.20	238.67	238.77	238.77	238.81	0.038480	0.88	0.23	2.96	1.02
Kidds Spill	To Bunkers	112	Spill	0.20	238.28	238.53	238.40	238.54	0.002339	0.41	0.55	3.12	0.29
Kidds Spill	Highway 400	381	Spill	26.82	251.42	252.16	252.16	252.44	0.001893	2.49	21.20	51.78	0.99
Kidds Spill	Highway 400	379		Lat Struct									
Kidds Spill	Highway 400	377	Spill	25.40	251.25	251.82	251.82	252.00	0.002400	1.90	14.58	43.24	1.01
Kidds Spill	Highway 400	373	Spill	23.24	251.20	251.70	251.70	251.89	0.002225	1.93	12.47	34.51	0.98
Kidds Spill	Highway 400	366	Spill	19.30	251.01	251.52	251.52	251.72	0.002294	1.99	10.29	26.76	1.00
Kidds Spill	Highway 400	357	Spill	15.49	250.84	251.31	251.31	251.49	0.002389	1.87	8.77	25.45	1.00
Kidds Spill	Highway 400	352	Spill	11.37	250.61	251.02	251.02	251.17	0.002481	1.71	7.52	26.10	0.99
Kidds Spill	Highway 400	340	Spill	8.27	250.33	250.64	250.64	250.74	0.002947	1.39	6.37	34.52	1.01
Kidds Spill	Highway 400	320	Spill	8.27	249.94	250.23	250.23	250.32	0.003033	1.38	6.35	34.36	1.02
Kidds Spill	Highway 400	300	Spill	8.27	249.53	249.83	249.83	249.92	0.002826	1.38	6.06	31.41	0.99
Kidds Spill	Highway 400	280	Spill	8.27	249.08	249.41	249.41	249.52	0.002928	1.43	5.98	29.90	1.02
Kidds Spill	Highway 400	240	Spill	8.27	248.24	248.57	248.57	248.67	0.002830	1.41	6.08	30.70	1.00
Kidds Spill	Highway 400	220	Spill	8.27	247.80	248.12	248.12	248.22	0.002895	1.39	6.33	32.49	1.01
Kidds Spill	Highway 400	219		Lat Struct									
Kidds Spill	Highway 400	200	Spill	7.80	247.38	247.67	247.67	247.76	0.003046	1.38	6.24	33.75	1.02
Kidds Spill	Highway 400	199		Lat Struct									
Kidds Spill	Highway 400	198		Lat Struct									
Kidds Spill	Highway 400	180	Spill	3.53	246.95	247.16	247.16	247.21	0.004330	1.09	3.86	37.32	1.10
Kidds Spill	Highway 400	178		Lat Struct									
Kidds Spill	Highway 400	177		Lat Struct									
Kidds Spill	Highway 400	160	Spill	0.38	246.54	246.64	246.64	246.67	0.004490	0.69	0.54	10.99	1.00
Kidds Spill	Highway 400	140	Spill	0.38	246.07	246.22	246.22	246.24	0.004836	0.74	0.51	10.02	1.04
Kidds Spill	Highway 400	120	Spill	0.38	245.67	245.79	245.79	245.80	0.000952	0.31	1.56	20.37	0.46
Dyments	Spill to Dyments	1000	Spill	5.76	231.32	232.02		232.02	0.000014	0.20	33.89	61.28	0.08
Dyments	Spill to Dyments	999	Spill	5.76	231.09	232.02		232.02	0.000003	0.12	111.43	133.15	0.04
Dyments	Spill to Dyments	998	Spill	5.76	230.77	232.02	230.92	232.02	0.000000	0.03	223.32	304.69	0.01
Dyments	Bunkers Return	1009	Spill	12.99	231.63	231.95	231.95	232.02	0.003080	1.21	10.71	70.73	1.00
Dyments	Bunkers Return	1007	Spill	12.99	230.91	231.86		231.89	0.001514	0.76	17.87	39.95	0.29
Dyments	Bunkers Return	1006	Spill	12.99	230.49	231.86		231.87	0.000421	0.63	39.03	46.27	0.17
Dyments	Bunkers Return	1005	Spill	12.99	230.06	231.86		231.86	0.000067	0.30	68.80	52.40	0.07
Dyments	Bunkers Return	1004	Spill	12.99	229.79	231.86		231.86	0.000025	0.20	108.14	63.59	0.04
Dyments	Bunkers Return	1003	Spill	12.99	229.58	231.86		231.86	0.000010	0.14	142.68	72.69	0.03
Dyments	Bunkers Return	1002	Spill	12.99	229.45	231.86		231.86	0.000008	0.13	174.47	94.46	0.03
Dyments	Bunkers Return	1001	Spill	12.99	229.33	231.86		231.86	0.000006	0.11	205.13	108.74	0.02
Dyments	Bunkers Return	999	Spill	12.99	229.24	231.86		231.86	0.000007	0.13	188.64	97.91	0.03
Dyments	Bunkers Return	998	Spill	12.99	231.65	231.78	231.78	231.85	0.013847	1.78	12.82	84.79	1.93
Dyments	Highway 400 Flow	585	Spill	1.78	235.64	235.80	235.80	235.85	0.003606	1.00	1.78	17.61	1.00
Dyments	Highway 400 Flow	584.14		Lat Struct									
Dyments	Highway 400 Flow	565	Spill	1.39	235.39	235.54	235.54	235.59	0.004510	0.99	1.41	16.89	1.09
Dyments	Highway 400 Flow	545	Spill	1.02	235.14	235.29	235.29	235.33	0.003839	0.88	1.16	14.65	1.00
Dyments	Highway 400 Flow	525	Spill	0.71	234.86	235.04	235.04	235.07	0.004362	0.83	0.86	13.01	1.03
Dyments	Highway 400 Flow	505	Spill	0.65	234.70	234.83	234.83	234.88	0.009564	1.02	0.64	12.80	1.45
Dyments	Highway 400 Flow	485	Spill	0.55	234.49	234.62	234.62	234.66	0.005867	0.86	0.64	11.45	1.16
Dyments	Highway 400 Flow	465	Spill	0.47	234.29	234.41	234.41	234.45	0.005810	0.79	0.60	12.07	1.13
Dyments	Highway 400 Flow	445	Spill	0.45	234.10	234.22	234.22	234.24	0.003692	0.65	0.69	13.25	0.91
Dyments	Highway 400 Flow	425	Spill	0.43	233.85	233.97	233.97	234.00	0.005341	0.84	0.51	8.95	1.11
Dyments	Highway 400 Flow	405	Spill	0.43	233.57	233.72	233.72	233.75	0.003987	0.83	0.52	7.41	1.00
Dyments	Highway 400 Flow	385	Spill	0.43	233.40	233.53	233.53	233.56	0.004233	0.78	0.55	8.99	1.00
Bunkers	Spill to Storm	294	Spill	0.00	231.57	232.36		232.36	0.000000	0.00	9.60	20.59	0.00
Bunkers	Spill to Storm	273	Spill	7.80	231.43	232.32	231.93	232.34	0.001715	0.94	14.08	25.16	0.32
Bunkers	Spill to Storm	252	Spill	7.80	231.34	232.28	231.86	232.31	0.001797	1.00	14.22	23.01	0.33
Bunkers	Spill to Storm	231	Spill	7.80	231.07	232.26		232.28	0.000811	0.79	18.12	30.61	0.23
Bunkers	Spill to Storm	210	Spill	7.80	230.89	232.26		232.27	0.000316	0.54	24.39	35.85	0.15
Bunkers	Spill to Storm	189	Spill	7.80	230.57	232.25		232.26	0.000229	0.53	28.80	38.47	0.13
Bunkers	Spill to Storm	168	Spill	7.80	230.04	232.25		232.26	0.000128	0.46	40.26	48.85	0.10
Bunkers	Spill to Storm	147	Spill	24.74	230.76	232.22	231.43	232.25	0.000799	0.88	44.85	52.67	0.24
Bunkers	Dyments Spill	373	Spill	18.32	230.28	232.22		232.24	0.000548	0.90	46.79	60.41	0.21
Bunkers	Dyments Spill	353	Spill	18.32	229.68	232.21	230.82	232.22	0.000493	1.01	45.74	50.23	0.21
Bunkers	Dyments Spill	333	Spill	18.32	229.63	232.20		232.21	0.000392	0.92	51.02	62.14	0.18
Bunkers	Dyments Spill	313	Spill	18.32	229.73	232.19		232.20	0.000523	1.01	50.54	67.65	0.21
Bunkers	Dyments Spill	292	Spill	18.32	229.84	232.17		232.19	0.000606	1.07	48.59	69.97	0.23
Bunkers	Dyments Spill	273	Spill	18.32	229.99	232.16	231.00	232.18	0.000678	1.08	38.97	39.93	0.24
Bunkers	Dyments Spill	253	Spill	18.32	230.28	232.15		232.16	0.000802	1.06	46.15	69.06	0.25
Bunkers	Dyments Spill	233	Spill	18.32	230.20	232.12	231.16	232.14	0.000881	1.14	41.37	56.07	0.26
Bunkers	Dyments Spill	213	Spill	18.32	230.33	232.10	231.29	232.13	0.001045	1.17	38.50	55.77	0.28
Bunkers	Dyments Spill	193	Spill	18.32	230.39	232.08		232.11	0.000745	0.95	38.50	47.71	0.24
Bunkers	Dyments Spill	176	Spill	18.32	230.50	232.06		232.09	0.001031	1.08	37.01	50.72	0.28
Bunkers	Dyments Spill	159	Spill	18.32	230.56	232.04	231.44	232.07	0.001496	1.25	36.47	57.28	0.33
Bunkers	Dyments Spill	142	Spill	18.32	230.72	232.02	231.52	232.04	0.001662	1.18	36.16	57.04	0.34
Bunkers	Dyments Spill	90	Spill	18.32	231.47	232.02		232.03	0.000151	0.44	41.95	133.05	0.25
Bunkers	Minor Trib Cross	280	Spill	0.35	245.18	245.32		245.33	0.007727	0.51	0.72	7.69	0.49
Bunkers	Minor Trib Cross	259	Spill	1.57	244.54	244.80	244.80	244.90	0.027768	1.37	1.15	6.12	1.00
Bunkers	Minor Trib Cross	238	Spill	1.57	243.87	244.26	244.26	244.39	0.019766	1.73	1.18	5.00	0.94
Bunkers	Minor Trib Cross	217	Spill	1.57	243.23	243.64	243.64	243.78	0.018592	1.80	1.17	4.69	0.92
Bunkers	Minor Trib Cross	196	Spill	1.57	242.29	242.64	242.64	242.77	0.021897	1.73	1.12	4.59	0.97
Bunkers	Minor Trib Cross	175	Spill	1.57	241.18	241.62	241.62	241.78	0.019276	1.84	1.01	3.49	0.94
Bunkers	Minor Trib Cross	164	Spill	1.57	240.27	241.09	240.81	241.16	0.003384	1.23	1.75	4.80	0.44
Bunkers	Minor Trib Cross	147		Culvert									
Bunkers	Minor Trib Cross	101	Spill	1.57	238.45	238.91	238.91	239.04	0.025355	1.61	0.99	10.84	0.99
Bunkers	Trib Plus Kidds	372	Spill	2.15	237.63	238.20	238.11	238.30	0.009111	1.63	2.14	7.87	0.69
Bunkers	Trib Plus Kidds	352	Spill	2.15	237.43	237.92	237.91	238.05	0.016935	2.01	1.85	7.56	0.92
Bunkers	Trib Plus Kidds	332	Spill	2.15	237.12	237.65	237.58	237.76	0.012302	1.77	1.83	5.59	0.79
Bunkers	Trib Plus Kidds	312	Spill	2.15	236.99	237.45		237.54	0.009183	1.41	1.87	5.42	0.67

HEC-RAS Plan: ExFutReg Profile: Spill (Continued)

River	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)	
Bunkers	Trib Plus Kidds	292	Spill	2.15	236.96	237.35		237.39	0.005417	0.96	2.90	10.93	0.50
Bunkers	Trib Plus Kidds	272	Spill	2.15	236.65	237.28	237.11	237.30	0.003228	0.98	4.34	12.77	0.41
Bunkers	Trib Plus Kidds	252	Spill	2.15	236.45	237.13	236.99	237.20	0.007158	1.56	2.76	10.95	0.62
Bunkers	Trib Plus Kidds	232	Spill	2.15	236.35	237.00	236.83	237.08	0.005319	1.33	2.16	5.02	0.54
Bunkers	Trib Plus Kidds	212	Spill	2.15	236.21	237.01	236.63	237.02	0.001013	0.68	5.56	11.93	0.24
Bunkers	Trib Plus Kidds	192	Spill	2.15	236.19	236.99	236.57	237.00	0.000668	0.55	6.92	16.08	0.20
Bunkers	Trib Plus Kidds	172	Spill	2.15	236.18	236.99	236.45	236.99	0.000277	0.36	9.45	16.59	0.13
Bunkers	Trib Plus Kidds	152	Spill	2.15	236.06	236.97		236.98	0.000989	0.73	5.54	12.60	0.25
Bunkers	North Trib	362	Spill	10.16	238.13	239.36	239.36	239.52	0.011382	2.79	9.35	24.91	0.84
Bunkers	North Trib	344	Spill	10.16	237.75	238.95	238.95	239.12	0.011057	2.57	8.80	23.90	0.81
Bunkers	North Trib	313	Spill	10.16	237.30	238.46	238.46	238.68	0.010387	2.63	7.38	15.88	0.80
Bunkers	North Trib	287	Spill	10.16	236.83	238.27		238.36	0.005800	2.24	11.96	24.97	0.61
Bunkers	North Trib	260	Spill	10.16	236.55	238.28		238.29	0.000638	0.77	28.08	44.16	0.20
Bunkers	North Trib	245	Spill	10.16	236.35	238.27		238.28	0.000317	0.66	29.98	27.49	0.16
Bunkers	North Trib-Cross	232	Spill	4.18	236.30	238.26	236.95	238.28	0.000247	0.61	9.23	15.69	0.14
Bunkers	North Trib-Cross	217		Culvert									
Bunkers	North Trib-Cross	175	Spill	4.18	235.98	236.90	236.80	237.06	0.009134	2.18	3.17	12.66	0.74
Bunkers	North Trib-Cross	167	Spill	4.18	235.97	236.92		236.93	0.000531	0.50	17.60	41.01	0.17
Bunkers	To Anne Street	508	Spill	5.98	236.65	238.25		238.28	0.000454	0.72	13.20	19.49	0.18
Bunkers	To Anne Street	492	Spill	5.98	236.69	238.24		238.26	0.000467	0.71	12.75	18.64	0.18
Bunkers	To Anne Street	463	Spill	5.98	236.79	238.23	237.32	238.25	0.000458	0.67	14.22	13.66	0.18
Bunkers	To Anne Street	442	Spill	5.98	237.01	238.14		238.22	0.003102	1.44	6.90	16.92	0.45
Bunkers	To Anne Street	426	Spill	5.98	237.04	238.11	237.71	238.17	0.002217	1.13	7.52	16.46	0.37
Bunkers	To Anne Street	406	Spill	5.98	237.12	238.07		238.12	0.002817	1.12	7.78	17.97	0.40
Bunkers	To Anne Street	386	Spill	5.98	236.98	238.01	237.71	238.06	0.002713	1.26	8.08	17.91	0.41
Bunkers	To Anne Street	366	Spill	5.98	236.78	237.73	237.73	237.95	0.010725	2.33	4.17	12.15	0.80
Bunkers	To Anne Street	346	Spill	5.98	236.63	237.41		237.53	0.008164	1.71	4.87	11.83	0.67
Bunkers	To Anne Street	326	Spill	5.98	236.26	237.21		237.37	0.007665	1.95	4.23	7.95	0.67
Bunkers	To Anne Street	306	Spill	5.98	236.08	237.09		237.24	0.005970	1.83	4.49	9.01	0.60
Bunkers	To Anne Street	286	Spill	5.98	235.95	237.04		237.13	0.003430	1.41	6.09	16.64	0.46
Bunkers	To Anne Street	266	Spill	5.98	236.11	236.99	236.73	237.05	0.003370	1.25	7.72	20.80	0.45
Bunkers	To Anne Street	265		Lat Struct									
Bunkers	To Anne Street	248	Spill	4.18	235.36	236.98	236.08	237.00	0.000337	0.59	10.93	37.28	0.15
Bunkers	To Anne Street	230		Culvert									
Bunkers	To Anne Street	220	Spill	4.18	234.41	235.30	235.10	235.39	0.005140	1.53	4.13	24.08	0.54
Bunkers	To Anne Street	200	Spill	11.87	233.72	234.94	234.94	235.18	0.009537	2.43	8.46	24.10	0.76
Bunkers	To Anne Street	180	Spill	11.87	233.42	234.80	234.80	235.00	0.007223	2.44	11.09	33.18	0.69
Bunkers	To Anne Street	160	Spill	11.87	233.12	234.56	234.56	234.72	0.006896	2.41	12.71	36.89	0.67
Bunkers	To Anne Street	140	Spill	11.87	232.77	234.03	234.03	234.24	0.008879	2.56	10.08	26.37	0.76
Bunkers	To Anne Street	120	Spill	11.87	232.09	233.46		233.51	0.002493	1.46	14.72	17.40	0.41
Bunkers	To Anne Street	100	Spill	11.87	231.65	233.25		233.43	0.006194	2.39	9.42	14.51	0.63
Bunkers	To Anne Street	80	Spill	11.87	231.52	233.02	233.02	233.28	0.008630	2.79	8.83	19.43	0.75
Bunkers	To Anne Street	49	Spill	11.87	230.96	232.59		232.68	0.003346	1.91	13.57	20.01	0.48
Bunkers	To Anne Street	20	Spill	11.87	230.66	232.56		232.60	0.001679	1.43	18.78	23.42	0.34
Bunkers	To Anne Street	15		Lat Struct									
Bunkers	To Anne Street	0	Spill	4.07	230.61	232.55	231.44	232.57	0.000428	0.79	11.21	18.29	0.18
Bunkers	North Trib-DS	150	Spill	6.33	235.76	236.76	236.71	236.88	0.009348	2.25	6.26	27.69	0.75
Bunkers	North Trib-DS	136	Spill	6.33	235.42	236.38	236.38	236.71	0.015170	2.76	3.03	5.10	0.94
Bunkers	North Trib-DS	133	Spill	6.33	234.25	235.69	235.24	235.81	0.003641	1.85	5.32	5.51	0.50
Bunkers	Spill to Storm-D	128	Spill	6.42	228.11	232.24		232.24	0.000007	0.16	81.79	45.02	0.03
Bunkers	Spill to Storm-D	125	Spill	6.42	227.91	232.24	228.73	232.24	0.000012	0.21	59.34	33.15	0.03

HEC-RAS Plan: Ex10-100YrSpill

River	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)	
Dyments	Highway 400 Flow	585	100 Year Spill	0.51	235.64	235.74	235.74	235.76	0.004683	0.72	0.70	13.77	1.02
Dyments	Highway 400 Flow	585	50 Year Spill	0.03	235.64	235.66	235.66	235.67	0.009976	0.47	0.06	4.16	1.22
Dyments	Highway 400 Flow	585	25 Year Spill	0.00	235.64	235.66	235.66	235.66	0.000013	0.02	0.06	4.02	0.04
Dyments	Highway 400 Flow	585	10 Year Spill	0.00	235.64	235.66	235.66	235.66	0.000013	0.02	0.06	4.02	0.04
Dyments	Highway 400 Flow	584.14		Lat Struct									
Dyments	Highway 400 Flow	565	100 Year Spill	0.51	235.39	235.49	235.49	235.52	0.006354	0.86	0.59	11.28	1.20
Dyments	Highway 400 Flow	565	50 Year Spill	0.03	235.39	235.41	235.41	235.43	0.015869	0.59	0.05	3.44	1.53
Dyments	Highway 400 Flow	565	25 Year Spill	0.00	235.39	235.41	235.41	235.41	0.000018	0.02	0.05	3.44	0.05
Dyments	Highway 400 Flow	565	10 Year Spill	0.00	235.39	235.41	235.41	235.41	0.000018	0.02	0.05	3.44	0.05
Dyments	Highway 400 Flow	545	100 Year Spill	0.50	235.14	235.25	235.25	235.28	0.004575	0.77	0.65	11.55	1.03
Dyments	Highway 400 Flow	545	50 Year Spill	0.03	235.14	235.17	235.17	235.18	0.007201	0.46	0.07	3.52	1.07
Dyments	Highway 400 Flow	545	25 Year Spill	0.00	235.14	235.16	235.16	235.16	0.000303	0.06	0.02	2.10	0.19
Dyments	Highway 400 Flow	545	10 Year Spill	0.00	235.14	235.16	235.16	235.16	0.000303	0.06	0.02	2.10	0.19
Dyments	Highway 400 Flow	525	100 Year Spill	0.46	234.86	235.01	235.01	235.04	0.004517	0.83	0.55	8.65	1.04
Dyments	Highway 400 Flow	525	50 Year Spill	0.03	234.86	234.92	234.92	234.93	0.003151	0.39	0.08	2.81	0.76
Dyments	Highway 400 Flow	525	25 Year Spill	0.00	234.86	234.88	234.88	234.88	0.001175	0.12	0.01	0.81	0.39
Dyments	Highway 400 Flow	525	10 Year Spill	0.00	234.86	234.88	234.88	234.88	0.001175	0.12	0.01	0.81	0.39
Dyments	Highway 400 Flow	505	100 Year Spill	0.44	234.70	234.82	234.82	234.85	0.005673	0.75	0.59	12.70	1.11
Dyments	Highway 400 Flow	505	50 Year Spill	0.03	234.70	234.74	234.74	234.75	0.008274	0.53	0.06	2.72	1.17
Dyments	Highway 400 Flow	505	25 Year Spill	0.00	234.70	234.72	234.72	234.72	0.000388	0.07	0.01	1.62	0.22
Dyments	Highway 400 Flow	505	10 Year Spill	0.00	234.70	234.72	234.72	234.72	0.000388	0.07	0.01	1.62	0.22
Dyments	Highway 400 Flow	485	100 Year Spill	0.38	234.49	234.61	234.61	234.64	0.004441	0.69	0.55	11.17	0.99
Dyments	Highway 400 Flow	485	50 Year Spill	0.03	234.49	234.54	234.54	234.55	0.002686	0.36	0.08	2.98	0.70
Dyments	Highway 400 Flow	485	25 Year Spill	0.00	234.49	234.51	234.51	234.51	0.000370	0.08	0.01	1.11	0.23
Dyments	Highway 400 Flow	485	10 Year Spill	0.00	234.49	234.51	234.51	234.51	0.000370	0.08	0.01	1.11	0.23
Dyments	Highway 400 Flow	465	100 Year Spill	0.33	234.29	234.41	234.41	234.43	0.004650	0.65	0.51	11.82	0.99
Dyments	Highway 400 Flow	465	50 Year Spill	0.03	234.29	234.34	234.34	234.35	0.003693	0.39	0.08	3.10	0.80
Dyments	Highway 400 Flow	465	25 Year Spill	0.00	234.29	234.31	234.31	234.31	0.001089	0.11	0.01	1.07	0.37
Dyments	Highway 400 Flow	465	10 Year Spill	0.00	234.29	234.31	234.31	234.31	0.001089	0.11	0.01	1.07	0.37
Dyments	Highway 400 Flow	445	100 Year Spill	0.33	234.10	234.21	234.21	234.23	0.003370	0.57	0.58	12.83	0.85
Dyments	Highway 400 Flow	445	50 Year Spill	0.03	234.10	234.13	234.13	234.14	0.007054	0.48	0.06	3.14	1.07
Dyments	Highway 400 Flow	445	25 Year Spill	0.00	234.10	234.11	234.11	234.11	0.000149	0.05	0.02	2.08	0.14
Dyments	Highway 400 Flow	445	10 Year Spill	0.00	234.10	234.11	234.11	234.11	0.000149	0.05	0.02	2.08	0.14
Dyments	Highway 400 Flow	425	100 Year Spill	0.32	233.85	233.96	233.96	233.99	0.004378	0.73	0.44	8.15	1.00
Dyments	Highway 400 Flow	425	50 Year Spill	0.03	233.85	233.89	233.89	233.90	0.003590	0.38	0.08	3.28	0.79
Dyments	Highway 400 Flow	425	25 Year Spill	0.00	233.85	233.87	233.87	233.87	0.000732	0.09	0.01	1.27	0.30
Dyments	Highway 400 Flow	425	10 Year Spill	0.00	233.85	233.87	233.87	233.87	0.000732	0.09	0.01	1.27	0.30
Dyments	Highway 400 Flow	405	100 Year Spill	0.32	233.57	233.70	233.70	233.74	0.005104	0.86	0.37	6.01	1.10
Dyments	Highway 400 Flow	405	50 Year Spill	0.03	233.57	233.62	233.62	233.63	0.008461	0.61	0.05	1.96	1.22
Dyments	Highway 400 Flow	405	25 Year Spill	0.00	233.57	233.59	233.59	233.59	0.000264	0.07	0.01	1.04	0.19
Dyments	Highway 400 Flow	405	10 Year Spill	0.00	233.57	233.59	233.59	233.59	0.000264	0.07	0.01	1.04	0.19
Dyments	Highway 400 Flow	385	100 Year Spill	0.32	233.40	233.51	233.51	233.55	0.004295	0.79	0.41	6.59	1.01
Dyments	Highway 400 Flow	385	50 Year Spill	0.03	233.40	233.44	233.44	233.45	0.005728	0.48	0.06	2.57	1.00
Dyments	Highway 400 Flow	385	25 Year Spill	0.00	233.40	233.42	233.42	233.42	0.000091	0.04	0.02	1.71	0.11
Dyments	Highway 400 Flow	385	10 Year Spill	0.00	233.40	233.42	233.42	233.42	0.000091	0.04	0.02	1.71	0.11
Dyments	Spill to Dyments	1000	100 Year Spill	7.74	231.32	231.87		231.87	0.000072	0.38	24.59	60.53	0.18
Dyments	Spill to Dyments	1000	50 Year Spill	5.15	231.32	231.86		231.86	0.000034	0.26	24.12	60.49	0.12
Dyments	Spill to Dyments	1000	25 Year Spill	2.36	231.32	231.84		231.84	0.000008	0.12	22.99	60.40	0.06
Dyments	Spill to Dyments	1000	10 Year Spill	0.60	231.32	231.81		231.81	0.000001	0.03	21.19	60.26	0.02
Dyments	Spill to Dyments	999	100 Year Spill	7.74	231.09	231.87		231.87	0.000012	0.20	91.40	133.15	0.08
Dyments	Spill to Dyments	999	50 Year Spill	5.15	231.09	231.86		231.86	0.000005	0.13	90.16	133.15	0.05
Dyments	Spill to Dyments	999	25 Year Spill	2.36	231.09	231.84		231.84	0.000001	0.06	87.52	133.15	0.03
Dyments	Spill to Dyments	999	10 Year Spill	0.60	231.09	231.81		231.81	0.000000	0.02	83.51	133.15	0.01
Dyments	Spill to Dyments	998	100 Year Spill	7.74	230.77	231.87	230.95	231.87	0.000001	0.04	177.63	304.69	0.02
Dyments	Spill to Dyments	998	50 Year Spill	5.15	230.77	231.86	230.91	231.86	0.000000	0.03	174.65	304.69	0.01
Dyments	Spill to Dyments	998	25 Year Spill	2.36	230.77	231.84	230.88	231.84	0.000000	0.01	168.53	304.69	0.01
Dyments	Spill to Dyments	998	10 Year Spill	0.60	230.77	231.81	230.83	231.81	0.000000	0.00	159.33	304.69	0.00
Dyments	Bunkers Return	1009	100 Year Spill	3.56	231.63	231.84	231.84	231.88	0.003182	0.82	4.34	52.65	0.91
Dyments	Bunkers Return	1009	50 Year Spill	3.22	231.63	231.84	231.84	231.87	0.002883	0.80	4.04	47.50	0.87
Dyments	Bunkers Return	1009	25 Year Spill	2.81	231.63	231.81	231.81	231.86	0.005366	0.96	2.92	41.35	1.16
Dyments	Bunkers Return	1009	10 Year Spill	0.99	231.63	231.77	231.77	231.79	0.004369	0.70	1.41	27.44	0.99
Dyments	Bunkers Return	1007	100 Year Spill	3.56	230.91	231.71		231.72	0.000299	0.29	12.76	28.20	0.12
Dyments	Bunkers Return	1007	50 Year Spill	3.22	230.91	231.70		231.71	0.000255	0.26	12.58	27.55	0.11
Dyments	Bunkers Return	1007	25 Year Spill	2.81	230.91	231.69		231.70	0.000207	0.23	12.30	26.51	0.10
Dyments	Bunkers Return	1007	10 Year Spill	0.99	230.91	231.65		231.65	0.000034	0.09	11.20	24.00	0.04
Dyments	Bunkers Return	1006	100 Year Spill	3.56	230.49	231.71		231.71	0.000044	0.19	32.98	37.24	0.05
Dyments	Bunkers Return	1006	50 Year Spill	3.22	230.49	231.70		231.71	0.000037	0.17	32.73	37.08	0.05
Dyments	Bunkers Return	1006	25 Year Spill	2.81	230.49	231.69		231.70	0.000029	0.15	32.36	36.84	0.04
Dyments	Bunkers Return	1006	10 Year Spill	0.99	230.49	231.65		231.65	0.000004	0.06	30.72	35.97	0.02
Dyments	Bunkers Return	1005	100 Year Spill	3.56	230.06	231.71		231.71	0.000007	0.09	61.40	48.01	0.02
Dyments	Bunkers Return	1005	50 Year Spill	3.22	230.06	231.71		231.71	0.000006	0.08	61.08	47.93	0.02
Dyments	Bunkers Return	1005	25 Year Spill	2.81	230.06	231.69		231.70	0.000004	0.07	60.59	47.80	0.02

HEC-RAS Plan: Ex10-100YrSpill (Continued)

River	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)	
Dyments	Bunkers Return	1005	10 Year Spill	0.99	230.06	231.65		231.65	0.000001	0.03	58.44	47.19	0.01
Dyments	Bunkers Return	1004	100 Year Spill	3.56	229.79	231.71		231.71	0.000002	0.06	98.82	61.65	0.01
Dyments	Bunkers Return	1004	50 Year Spill	3.22	229.79	231.71		231.71	0.000002	0.05	98.40	61.58	0.01
Dyments	Bunkers Return	1004	25 Year Spill	2.81	229.79	231.69		231.70	0.000002	0.05	97.78	61.45	0.01
Dyments	Bunkers Return	1004	10 Year Spill	0.99	229.79	231.65		231.65	0.000000	0.02	95.01	60.97	0.00
Dyments	Bunkers Return	1003	100 Year Spill	3.56	229.58	231.71		231.71	0.000001	0.04	131.99	71.05	0.01
Dyments	Bunkers Return	1003	50 Year Spill	3.22	229.58	231.71		231.71	0.000001	0.04	131.51	71.01	0.01
Dyments	Bunkers Return	1003	25 Year Spill	2.81	229.58	231.69		231.69	0.000001	0.03	130.79	70.95	0.01
Dyments	Bunkers Return	1003	10 Year Spill	0.99	229.58	231.65		231.65	0.000000	0.01	127.59	70.66	0.00
Dyments	Bunkers Return	1002	100 Year Spill	3.56	229.45	231.71		231.71	0.000001	0.04	160.62	91.81	0.01
Dyments	Bunkers Return	1002	50 Year Spill	3.22	229.45	231.71		231.71	0.000001	0.03	160.01	91.72	0.01
Dyments	Bunkers Return	1002	25 Year Spill	2.81	229.45	231.69		231.69	0.000000	0.03	159.08	91.59	0.01
Dyments	Bunkers Return	1002	10 Year Spill	0.99	229.45	231.65		231.65	0.000000	0.01	154.94	91.12	0.00
Dyments	Bunkers Return	1001	100 Year Spill	3.56	229.33	231.71		231.71	0.000001	0.03	189.01	107.61	0.01
Dyments	Bunkers Return	1001	50 Year Spill	3.22	229.33	231.71		231.71	0.000000	0.03	188.29	107.55	0.01
Dyments	Bunkers Return	1001	25 Year Spill	2.81	229.33	231.69		231.69	0.000000	0.03	187.20	107.51	0.01
Dyments	Bunkers Return	1001	10 Year Spill	0.99	229.33	231.65		231.65	0.000000	0.01	182.35	106.93	0.00
Dyments	Bunkers Return	999	100 Year Spill	3.56	229.24	231.71		231.71	0.000001	0.04	174.40	95.13	0.01
Dyments	Bunkers Return	999	50 Year Spill	3.22	229.24	231.71		231.71	0.000001	0.03	173.77	95.09	0.01
Dyments	Bunkers Return	999	25 Year Spill	2.81	229.24	231.69		231.69	0.000000	0.03	172.80	95.02	0.01
Dyments	Bunkers Return	999	10 Year Spill	0.99	229.24	231.65		231.65	0.000000	0.01	168.51	94.76	0.00
Dyments	Bunkers Return	998	100 Year Spill	3.56	231.65	231.68	231.68	231.71	0.021157	0.74	5.08	66.10	1.81
Dyments	Bunkers Return	998	50 Year Spill	3.22	231.65	231.68	231.68	231.70	0.021054	0.65	4.78	65.20	1.75
Dyments	Bunkers Return	998	25 Year Spill	2.81	231.65	231.67	231.67	231.69	0.028194	0.73	3.98	59.68	2.01
Dyments	Bunkers Return	998	10 Year Spill	0.99	231.65	231.61	231.61	231.65	0.072034		1.26	34.11	0.00
Bunkers	Spill to Storm	294	100 Year Spill	0.00	231.57	232.24		232.24	0.000000	0.00	7.37	17.82	0.00
Bunkers	Spill to Storm	294	50 Year Spill	0.00	231.57	232.17		232.17	0.000000	0.00	6.13	17.08	0.00
Bunkers	Spill to Storm	294	25 Year Spill	0.00	231.57	232.07		232.07	0.000000	0.00	4.44	15.50	0.00
Bunkers	Spill to Storm	294	10 Year Spill	0.00	231.57	231.94		231.94	0.000000	0.00	2.59	12.39	0.00
Bunkers	Spill to Storm	273	100 Year Spill	7.50	231.43	232.17	231.92	232.21	0.003345	1.17	10.64	21.78	0.44
Bunkers	Spill to Storm	273	50 Year Spill	6.19	231.43	232.10	231.87	232.14	0.003414	1.10	9.19	20.56	0.43
Bunkers	Spill to Storm	273	25 Year Spill	4.35	231.43	232.01	231.80	232.04	0.003219	0.97	7.30	19.16	0.41
Bunkers	Spill to Storm	273	10 Year Spill	2.33	231.43	231.90	231.72	231.91	0.002310	0.71	5.25	17.56	0.34
Bunkers	Spill to Storm	252	100 Year Spill	7.50	231.34	232.09	231.85	232.13	0.004457	1.34	10.01	20.48	0.50
Bunkers	Spill to Storm	252	50 Year Spill	6.19	231.34	232.02	231.80	232.06	0.004706	1.28	8.56	19.47	0.51
Bunkers	Spill to Storm	252	25 Year Spill	4.35	231.34	231.93	231.74	231.96	0.004282	1.11	6.91	18.36	0.47
Bunkers	Spill to Storm	252	10 Year Spill	2.33	231.34	231.85	231.65	231.87	0.002290	0.73	5.52	17.02	0.34
Bunkers	Spill to Storm	231	100 Year Spill	7.50	231.07	232.04		232.07	0.001810	1.03	12.87	21.16	0.34
Bunkers	Spill to Storm	231	50 Year Spill	6.19	231.07	231.97		232.00	0.001730	0.95	11.39	20.40	0.32
Bunkers	Spill to Storm	231	25 Year Spill	4.35	231.07	231.90		231.91	0.001278	0.77	9.85	19.63	0.27
Bunkers	Spill to Storm	231	10 Year Spill	2.33	231.07	231.84		231.84	0.000515	0.46	8.71	19.04	0.17
Bunkers	Spill to Storm	210	100 Year Spill	7.50	230.89	232.04		232.05	0.000597	0.66	18.08	22.93	0.20
Bunkers	Spill to Storm	210	50 Year Spill	6.19	230.89	231.96		231.98	0.000522	0.59	16.49	22.09	0.18
Bunkers	Spill to Storm	210	25 Year Spill	4.35	230.89	231.89		231.90	0.000342	0.46	14.89	21.38	0.15
Bunkers	Spill to Storm	210	10 Year Spill	2.33	230.89	231.84		231.84	0.000124	0.27	13.71	20.96	0.09
Bunkers	Spill to Storm	189	100 Year Spill	7.50	230.57	232.03		232.04	0.000391	0.63	21.34	26.50	0.17
Bunkers	Spill to Storm	189	50 Year Spill	6.19	230.57	231.96		231.97	0.000330	0.56	19.63	23.17	0.15
Bunkers	Spill to Storm	189	25 Year Spill	4.35	230.57	231.89		231.89	0.000206	0.43	18.04	21.81	0.12
Bunkers	Spill to Storm	189	10 Year Spill	2.33	230.57	231.83		231.84	0.000071	0.24	16.90	21.42	0.07
Bunkers	Spill to Storm	168	100 Year Spill	7.50	230.04	232.02		232.03	0.000230	0.57	29.99	39.96	0.13
Bunkers	Spill to Storm	168	50 Year Spill	6.19	230.04	231.96		231.96	0.000164	0.47	27.50	33.46	0.11
Bunkers	Spill to Storm	168	25 Year Spill	4.35	230.04	231.89		231.89	0.000092	0.34	25.35	27.21	0.08
Bunkers	Spill to Storm	168	10 Year Spill	2.33	230.04	231.83		231.83	0.000030	0.19	24.02	24.17	0.05
Bunkers	Spill to Storm	147	100 Year Spill	17.15	230.76	232.00	231.32	232.02	0.000796	0.78	33.72	47.23	0.23
Bunkers	Spill to Storm	147	50 Year Spill	14.44	230.76	231.93	231.27	231.95	0.000715	0.72	30.73	45.64	0.22
Bunkers	Spill to Storm	147	25 Year Spill	11.19	230.76	231.87	231.21	231.88	0.000551	0.60	27.83	44.00	0.19
Bunkers	Spill to Storm	147	10 Year Spill	7.56	230.76	231.82	231.13	231.83	0.000299	0.43	25.94	42.36	0.14
Bunkers	Dyments Spill	373	100 Year Spill	10.98	230.28	232.00		232.01	0.000414	0.72	33.88	55.32	0.18
Bunkers	Dyments Spill	373	50 Year Spill	8.34	230.28	231.94		231.95	0.000294	0.60	30.75	53.59	0.15
Bunkers	Dyments Spill	373	25 Year Spill	5.17	230.28	231.88		231.88	0.000105	0.35	27.99	37.01	0.09
Bunkers	Dyments Spill	373	10 Year Spill	1.59	230.28	231.81		231.81	0.000012	0.11	25.84	31.88	0.03
Bunkers	Dyments Spill	353	100 Year Spill	10.98	229.68	231.99	230.60	232.00	0.000234	0.66	36.57	29.61	0.14
Bunkers	Dyments Spill	353	50 Year Spill	8.34	229.68	231.94	230.48	231.94	0.000150	0.52	34.96	28.53	0.11
Bunkers	Dyments Spill	353	25 Year Spill	5.17	229.68	231.87	230.36	231.88	0.000065	0.33	33.19	27.31	0.07
Bunkers	Dyments Spill	353	10 Year Spill	1.59	229.68	231.81	230.09	231.81	0.000007	0.11	31.56	26.59	0.02
Bunkers	Dyments Spill	333	100 Year Spill	10.98	229.63	231.99		232.00	0.000203	0.62	39.00	46.24	0.13
Bunkers	Dyments Spill	333	50 Year Spill	8.34	229.63	231.93		231.94	0.000130	0.49	36.68	40.94	0.10
Bunkers	Dyments Spill	333	25 Year Spill	5.17	229.63	231.87		231.88	0.000057	0.32	34.26	37.45	0.07
Bunkers	Dyments Spill	333	10 Year Spill	1.59	229.63	231.81		231.81	0.000006	0.10	32.26	28.01	0.02
Bunkers	Dyments Spill	313	100 Year Spill	10.98	229.73	231.98		231.99	0.000281	0.70	38.67	47.88	0.15
Bunkers	Dyments Spill	313	50 Year Spill	8.34	229.73	231.93		231.94	0.000162	0.52	36.33	44.27	0.11
Bunkers	Dyments Spill	313	25 Year Spill	5.17	229.73	231.87		231.87	0.000071	0.34	33.79	40.14	0.08

HEC-RAS Plan: Ex10-100YrSpill (Continued)

River	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)	
Bunkers	Dyments Spill	313	10 Year Spill	1.59	229.73	231.81		231.81	0.000008	0.11	31.63	34.52	0.02
Bunkers	Dyments Spill	292	100 Year Spill	10.98	229.84	231.98		231.99	0.000293	0.70	36.60	51.13	0.15
Bunkers	Dyments Spill	292	50 Year Spill	8.34	229.84	231.93		231.93	0.000189	0.55	34.21	45.65	0.12
Bunkers	Dyments Spill	292	25 Year Spill	5.17	229.84	231.87		231.87	0.000083	0.36	31.72	41.24	0.08
Bunkers	Dyments Spill	292	10 Year Spill	1.59	229.84	231.81		231.81	0.000009	0.12	29.55	35.99	0.03
Bunkers	Dyments Spill	273	100 Year Spill	10.98	229.99	231.97	230.81	231.98	0.000305	0.68	32.42	28.77	0.16
Bunkers	Dyments Spill	273	50 Year Spill	8.34	229.99	231.92	230.70	231.93	0.000195	0.54	31.09	28.15	0.12
Bunkers	Dyments Spill	273	25 Year Spill	5.17	229.99	231.87	230.56	231.87	0.000085	0.35	29.57	27.50	0.08
Bunkers	Dyments Spill	273	10 Year Spill	1.59	229.99	231.81	230.31	231.81	0.000009	0.11	28.07	26.86	0.03
Bunkers	Dyments Spill	253	100 Year Spill	10.98	230.28	231.96		231.97	0.000557	0.83	35.11	52.87	0.20
Bunkers	Dyments Spill	253	50 Year Spill	8.34	230.28	231.92		231.92	0.000328	0.62	32.89	49.67	0.16
Bunkers	Dyments Spill	253	25 Year Spill	5.17	230.28	231.87		231.87	0.000151	0.41	30.41	45.26	0.11
Bunkers	Dyments Spill	253	10 Year Spill	1.59	230.28	231.81		231.81	0.000017	0.14	28.11	42.33	0.04
Bunkers	Dyments Spill	233	100 Year Spill	10.98	230.20	231.95	230.98	231.96	0.000528	0.83	31.39	40.36	0.20
Bunkers	Dyments Spill	233	50 Year Spill	8.34	230.20	231.91	230.90	231.92	0.000330	0.64	29.91	37.78	0.16
Bunkers	Dyments Spill	233	25 Year Spill	5.17	230.20	231.86	230.73	231.87	0.000143	0.42	28.18	35.57	0.10
Bunkers	Dyments Spill	233	10 Year Spill	1.59	230.20	231.81	230.53	231.81	0.000014	0.13	26.51	31.41	0.03
Bunkers	Dyments Spill	213	100 Year Spill	10.98	230.33	231.93	231.10	231.95	0.000622	0.85	29.42	40.90	0.21
Bunkers	Dyments Spill	213	50 Year Spill	8.34	230.33	231.90	231.01	231.91	0.000408	0.68	28.07	40.64	0.17
Bunkers	Dyments Spill	213	25 Year Spill	5.17	230.33	231.86	230.88	231.86	0.000186	0.45	26.36	40.37	0.12
Bunkers	Dyments Spill	213	10 Year Spill	1.59	230.33	231.81	230.63	231.81	0.000020	0.14	24.57	37.33	0.04
Bunkers	Dyments Spill	193	100 Year Spill	10.98	230.39	231.92		231.94	0.000462	0.70	31.35	42.76	0.18
Bunkers	Dyments Spill	193	50 Year Spill	8.34	230.39	231.89		231.90	0.000298	0.55	30.08	42.54	0.15
Bunkers	Dyments Spill	193	25 Year Spill	5.17	230.39	231.86		231.86	0.000133	0.36	28.43	42.23	0.10
Bunkers	Dyments Spill	193	10 Year Spill	1.59	230.39	231.81		231.81	0.000015	0.12	26.61	41.89	0.03
Bunkers	Dyments Spill	176	100 Year Spill	10.98	230.50	231.91		231.93	0.000676	0.82	29.71	44.86	0.22
Bunkers	Dyments Spill	176	50 Year Spill	8.34	230.50	231.89		231.89	0.000435	0.65	28.59	44.66	0.18
Bunkers	Dyments Spill	176	25 Year Spill	5.17	230.50	231.85		231.86	0.000194	0.42	27.07	44.39	0.12
Bunkers	Dyments Spill	176	10 Year Spill	1.59	230.50	231.81		231.81	0.000022	0.14	25.30	43.99	0.04
Bunkers	Dyments Spill	159	100 Year Spill	10.98	230.56	231.90	231.38	231.91	0.000991	0.95	27.61	42.97	0.26
Bunkers	Dyments Spill	159	50 Year Spill	8.34	230.56	231.88	231.21	231.89	0.000631	0.75	26.73	42.85	0.21
Bunkers	Dyments Spill	159	25 Year Spill	5.17	230.56	231.85	231.11	231.85	0.000280	0.49	25.47	42.69	0.14
Bunkers	Dyments Spill	159	10 Year Spill	1.59	230.56	231.81	230.89	231.81	0.000032	0.16	23.90	42.49	0.05
Bunkers	Dyments Spill	142	100 Year Spill	10.98	230.72	231.88	231.35	231.89	0.001095	0.88	27.48	45.61	0.27
Bunkers	Dyments Spill	142	50 Year Spill	8.34	230.72	231.87	231.29	231.87	0.000669	0.68	26.87	45.10	0.21
Bunkers	Dyments Spill	142	25 Year Spill	5.17	230.72	231.84	231.18	231.85	0.000285	0.44	25.82	44.42	0.14
Bunkers	Dyments Spill	142	10 Year Spill	1.59	230.72	231.81	231.02	231.81	0.000032	0.14	24.38	43.87	0.05
Bunkers	Dyments Spill	90	100 Year Spill	10.98	231.47	231.87		231.88	0.000251	0.45	24.29	107.27	0.30
Bunkers	Dyments Spill	90	50 Year Spill	8.34	231.47	231.86		231.87	0.000165	0.36	23.27	105.87	0.24
Bunkers	Dyments Spill	90	25 Year Spill	5.17	231.47	231.84		231.84	0.000083	0.24	21.21	103.04	0.17
Bunkers	Dyments Spill	90	10 Year Spill	1.59	231.47	231.81		231.81	0.000012	0.09	18.28	95.21	0.06
Bunkers	North Trib	362	100 Year Spill	8.19	238.13	239.25	239.25	239.43	0.012751	2.75	6.93	17.71	0.87
Bunkers	North Trib	362	50 Year Spill	7.15	238.13	239.22	239.22	239.38	0.011712	2.59	6.41	17.18	0.83
Bunkers	North Trib	362	25 Year Spill	6.15	238.13	239.13	239.13	239.33	0.014602	2.72	5.04	14.75	0.91
Bunkers	North Trib	362	10 Year Spill	4.72	238.13	239.06	239.06	239.23	0.013331	2.46	4.09	12.53	0.86
Bunkers	North Trib	344	100 Year Spill	8.19	237.75	238.90	238.90	239.06	0.009810	2.34	7.70	23.39	0.75
Bunkers	North Trib	344	50 Year Spill	7.15	237.75	238.87	238.87	239.02	0.009472	2.25	6.92	23.05	0.74
Bunkers	North Trib	344	25 Year Spill	6.15	237.75	238.85	238.85	238.98	0.008129	2.06	6.46	22.85	0.68
Bunkers	North Trib	344	10 Year Spill	4.72	237.75	238.75	238.75	238.89	0.009379	2.05	4.31	18.93	0.72
Bunkers	North Trib	313	100 Year Spill	8.19	237.30	238.38	238.38	238.59	0.010248	2.48	6.12	14.93	0.78
Bunkers	North Trib	313	50 Year Spill	7.15	237.30	238.35	238.35	238.54	0.009031	2.29	5.73	14.65	0.73
Bunkers	North Trib	313	25 Year Spill	6.15	237.30	238.29	238.29	238.48	0.009385	2.24	4.87	14.11	0.74
Bunkers	North Trib	313	10 Year Spill	4.72	237.30	238.14	238.11	238.37	0.012981	2.34	2.99	8.23	0.85
Bunkers	North Trib	287	100 Year Spill	8.19	236.83	238.08	238.04	238.24	0.010213	2.70	7.79	19.95	0.79
Bunkers	North Trib	287	50 Year Spill	7.15	236.83	238.00	238.00	238.18	0.011969	2.79	6.31	16.58	0.85
Bunkers	North Trib	287	25 Year Spill	6.15	236.83	237.96	237.96	238.14	0.011470	2.66	5.66	16.03	0.83
Bunkers	North Trib	287	10 Year Spill	4.72	236.83	237.91	237.91	238.06	0.009497	2.35	4.89	15.26	0.75
Bunkers	North Trib	260	100 Year Spill	8.19	236.55	238.13		238.15	0.000735	0.77	22.08	36.73	0.21
Bunkers	North Trib	260	50 Year Spill	7.15	236.55	238.04		238.05	0.000842	0.79	18.87	33.05	0.22
Bunkers	North Trib	260	25 Year Spill	6.15	236.55	237.93		237.95	0.001040	0.83	15.65	29.76	0.24
Bunkers	North Trib	260	10 Year Spill	4.72	236.55	237.78		237.80	0.001448	0.89	11.28	27.78	0.28
Bunkers	North Trib	245	100 Year Spill	8.19	236.35	238.13		238.14	0.000306	0.61	26.01	26.37	0.15
Bunkers	North Trib	245	50 Year Spill	7.15	236.35	238.03		238.04	0.000307	0.59	23.60	25.92	0.15
Bunkers	North Trib	245	25 Year Spill	6.15	236.35	237.93		237.94	0.000312	0.56	20.94	24.82	0.15
Bunkers	North Trib	245	10 Year Spill	4.72	236.35	237.78		237.79	0.000278	0.50	17.53	21.81	0.14
Bunkers	Minor Trib Cross	581	100 Year Spill	0.19	245.18	245.26		245.28	0.030137	0.61	0.31	5.82	0.85
Bunkers	Minor Trib Cross	581	50 Year Spill	0.16	245.18	245.26		245.27	0.022977	0.53	0.30	5.78	0.74
Bunkers	Minor Trib Cross	581	25 Year Spill	0.13	245.18	245.25		245.26	0.024686	0.50	0.26	5.59	0.75
Bunkers	Minor Trib Cross	581	10 Year Spill	0.09	245.18	245.24		245.25	0.026713	0.46	0.20	5.18	0.76
Bunkers	Minor Trib Cross	560	100 Year Spill	0.19	244.54	244.64	244.63	244.66	0.029645	0.71	0.27	4.04	0.87
Bunkers	Minor Trib Cross	560	50 Year Spill	0.16	244.54	244.62	244.62	244.65	0.040843	0.75	0.21	3.77	1.00
Bunkers	Minor Trib Cross	560	25 Year Spill	0.13	244.54	244.62	244.61	244.64	0.037749	0.68	0.19	3.65	0.95

HEC-RAS Plan: Ex10-100YrSpill (Continued)

River	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)	
Bunkers	Minor Trib Cross	560	10 Year Spill	0.09	244.54	244.61	244.61	244.62	0.033716	0.58	0.16	3.45	0.87
Bunkers	Minor Trib Cross	539	100 Year Spill	0.19	243.87	244.01	244.00	244.05	0.029338	0.89	0.22	2.61	0.92
Bunkers	Minor Trib Cross	539	50 Year Spill	0.16	243.87	244.01	244.00	244.03	0.020530	0.75	0.22	2.61	0.77
Bunkers	Minor Trib Cross	539	25 Year Spill	0.13	243.87	243.99	243.99	244.02	0.024257	0.72	0.18	2.45	0.81
Bunkers	Minor Trib Cross	539	10 Year Spill	0.09	243.87	243.97	243.96	243.99	0.024032	0.63	0.14	2.27	0.78
Bunkers	Minor Trib Cross	518	100 Year Spill	0.19	243.23	243.35	243.35	243.40	0.032938	0.99	0.20	2.10	0.99
Bunkers	Minor Trib Cross	518	50 Year Spill	0.16	243.23	243.33	243.33	243.39	0.052745	1.07	0.15	1.93	1.20
Bunkers	Minor Trib Cross	518	25 Year Spill	0.13	243.23	243.33	243.33	243.37	0.042382	0.92	0.14	1.90	1.06
Bunkers	Minor Trib Cross	518	10 Year Spill	0.09	243.23	243.31	243.31	243.34	0.041156	0.80	0.11	1.80	1.02
Bunkers	Minor Trib Cross	497	100 Year Spill	0.19	242.29	242.40	242.40	242.44	0.036639	0.92	0.22	2.79	1.01
Bunkers	Minor Trib Cross	497	50 Year Spill	0.16	242.29	242.39	242.39	242.42	0.036206	0.87	0.20	2.72	0.99
Bunkers	Minor Trib Cross	497	25 Year Spill	0.13	242.29	242.37	242.37	242.41	0.047463	0.88	0.16	2.60	1.10
Bunkers	Minor Trib Cross	497	10 Year Spill	0.09	242.29	242.37	242.37	242.39	0.023934	0.62	0.15	2.59	0.78
Bunkers	Minor Trib Cross	476	100 Year Spill	0.19	241.18	241.32	241.32	241.37	0.035654	0.99	0.19	2.00	1.01
Bunkers	Minor Trib Cross	476	50 Year Spill	0.16	241.18	241.31	241.31	241.36	0.035800	0.93	0.17	1.92	1.00
Bunkers	Minor Trib Cross	476	25 Year Spill	0.13	241.18	241.29	241.29	241.34	0.050386	0.98	0.13	1.81	1.15
Bunkers	Minor Trib Cross	476	10 Year Spill	0.09	241.18	241.29	241.29	241.32	0.025651	0.69	0.13	1.80	0.82
Bunkers	Minor Trib Cross	465	100 Year Spill	0.19	240.27	240.43	240.43	240.50	0.028843	1.13	0.18	1.45	0.96
Bunkers	Minor Trib Cross	465	50 Year Spill	0.16	240.27	240.42	240.42	240.48	0.032807	1.10	0.15	1.39	1.00
Bunkers	Minor Trib Cross	465	25 Year Spill	0.13	240.27	240.40	240.40	240.45	0.032384	1.01	0.13	1.35	0.98
Bunkers	Minor Trib Cross	465	10 Year Spill	0.09	240.27	240.38	240.38	240.42	0.037620	0.92	0.10	1.26	1.01
Bunkers	Minor Trib Cross	448		Culvert									
Bunkers	Minor Trib Cross	402	100 Year Spill	0.19	238.45	238.61	238.61	238.66	0.032942	0.99	0.19	1.84	0.98
Bunkers	Minor Trib Cross	402	50 Year Spill	0.16	238.45	238.59	238.59	238.64	0.034834	0.96	0.17	1.75	0.99
Bunkers	Minor Trib Cross	402	25 Year Spill	0.13	238.45	238.58	238.58	238.62	0.037181	0.92	0.14	1.66	1.01
Bunkers	Minor Trib Cross	402	10 Year Spill	0.09	238.45	238.56	238.56	238.59	0.033604	0.79	0.11	1.55	0.94
Bunkers	Minor Trib Cross	372	100 Year Spill	0.19	237.63	237.80	237.76	237.82	0.007935	0.67	0.34	2.73	0.53
Bunkers	Minor Trib Cross	372	50 Year Spill	0.16	237.63	237.79	237.74	237.81	0.008289	0.64	0.30	2.58	0.53
Bunkers	Minor Trib Cross	372	25 Year Spill	0.13	237.63	237.77	237.73	237.78	0.009081	0.61	0.25	2.41	0.54
Bunkers	Minor Trib Cross	372	10 Year Spill	0.09	237.63	237.74	237.71	237.75	0.009625	0.54	0.19	2.21	0.54
Bunkers	Minor Trib Cross	352	100 Year Spill	0.19	237.43	237.58	237.56	237.61	0.015358	0.85	0.29	2.91	0.72
Bunkers	Minor Trib Cross	352	50 Year Spill	0.16	237.43	237.57	237.55	237.60	0.014507	0.79	0.26	2.78	0.69
Bunkers	Minor Trib Cross	352	25 Year Spill	0.13	237.43	237.57	237.54	237.59	0.011076	0.67	0.25	2.73	0.60
Bunkers	Minor Trib Cross	352	10 Year Spill	0.09	237.43	237.55	237.52	237.56	0.009580	0.56	0.20	2.50	0.54
Bunkers	Minor Trib Cross	332	100 Year Spill	0.19	237.12	237.27		237.30	0.015268	0.80	0.29	2.93	0.70
Bunkers	Minor Trib Cross	332	50 Year Spill	0.16	237.12	237.25		237.28	0.017238	0.78	0.25	2.82	0.73
Bunkers	Minor Trib Cross	332	25 Year Spill	0.13	237.12	237.23	237.22	237.26	0.024326	0.81	0.19	2.60	0.84
Bunkers	Minor Trib Cross	332	10 Year Spill	0.09	237.12	237.21	237.21	237.24	0.031629	0.77	0.13	2.31	0.91
Bunkers	Minor Trib Cross	312	100 Year Spill	0.19	236.99	237.15		237.15	0.003701	0.42	0.48	3.70	0.35
Bunkers	Minor Trib Cross	312	50 Year Spill	0.16	236.99	237.14		237.14	0.003233	0.38	0.45	3.64	0.33
Bunkers	Minor Trib Cross	312	25 Year Spill	0.13	236.99	237.13		237.13	0.002711	0.33	0.41	3.59	0.30
Bunkers	Minor Trib Cross	312	10 Year Spill	0.09	236.99	237.11		237.11	0.002471	0.28	0.34	3.46	0.27
Bunkers	Minor Trib Cross	292	100 Year Spill	0.19	236.96	237.08		237.08	0.004026	0.35	0.57	5.90	0.35
Bunkers	Minor Trib Cross	292	50 Year Spill	0.16	236.96	237.06		237.07	0.004840	0.35	0.48	5.77	0.37
Bunkers	Minor Trib Cross	292	25 Year Spill	0.13	236.96	237.05		237.05	0.004978	0.33	0.41	5.66	0.37
Bunkers	Minor Trib Cross	292	10 Year Spill	0.09	236.96	237.03		237.04	0.005329	0.29	0.32	5.49	0.37
Bunkers	Minor Trib Cross	272	100 Year Spill	0.19	236.65	236.84	236.84	236.90	0.029568	1.14	0.20	2.18	0.98
Bunkers	Minor Trib Cross	272	50 Year Spill	0.16	236.65	236.83	236.83	236.88	0.025852	1.03	0.18	2.00	0.90
Bunkers	Minor Trib Cross	272	25 Year Spill	0.13	236.65	236.81	236.81	236.86	0.029917	0.99	0.14	1.71	0.95
Bunkers	Minor Trib Cross	272	10 Year Spill	0.09	236.65	236.79	236.79	236.83	0.032099	0.88	0.11	1.50	0.95
Bunkers	Minor Trib Cross	252	100 Year Spill	0.19	236.45	236.81	236.62	236.82	0.000839	0.34	0.80	3.86	0.19
Bunkers	Minor Trib Cross	252	50 Year Spill	0.16	236.45	236.79	236.60	236.79	0.000793	0.31	0.72	3.68	0.18
Bunkers	Minor Trib Cross	252	25 Year Spill	0.13	236.45	236.77	236.59	236.77	0.000707	0.28	0.64	3.51	0.17
Bunkers	Minor Trib Cross	252	10 Year Spill	0.09	236.45	236.72	236.56	236.72	0.000702	0.25	0.48	3.12	0.16
Bunkers	Minor Trib Cross	232	100 Year Spill	0.19	236.35	236.81	236.47	236.81	0.000168	0.18	1.28	4.00	0.09
Bunkers	Minor Trib Cross	232	50 Year Spill	0.16	236.35	236.78	236.46	236.79	0.000145	0.16	1.19	3.90	0.08
Bunkers	Minor Trib Cross	232	25 Year Spill	0.13	236.35	236.76	236.45	236.76	0.000116	0.14	1.11	3.81	0.07
Bunkers	Minor Trib Cross	232	10 Year Spill	0.09	236.35	236.72	236.44	236.72	0.000090	0.11	0.94	3.61	0.06
Bunkers	Minor Trib Cross	212	100 Year Spill	0.19	236.21	236.81	236.31	236.81	0.000031	0.10	3.32	10.41	0.04
Bunkers	Minor Trib Cross	212	50 Year Spill	0.16	236.21	236.78	236.30	236.78	0.000026	0.09	3.09	10.26	0.04
Bunkers	Minor Trib Cross	212	25 Year Spill	0.13	236.21	236.76	236.29	236.76	0.000021	0.08	2.87	10.08	0.03
Bunkers	Minor Trib Cross	212	10 Year Spill	0.09	236.21	236.72	236.27	236.72	0.000015	0.06	2.41	9.64	0.03
Bunkers	Minor Trib Cross	192	100 Year Spill	0.19	236.19	236.81	236.28	236.81	0.000019	0.08	4.11	13.70	0.03
Bunkers	Minor Trib Cross	192	50 Year Spill	0.16	236.19	236.78	236.27	236.78	0.000016	0.07	3.81	13.42	0.03
Bunkers	Minor Trib Cross	192	25 Year Spill	0.13	236.19	236.76	236.26	236.76	0.000013	0.06	3.53	13.12	0.03
Bunkers	Minor Trib Cross	192	10 Year Spill	0.09	236.19	236.72	236.25	236.72	0.000009	0.05	2.96	11.73	0.02
Bunkers	Minor Trib Cross	172	100 Year Spill	0.19	236.18	236.81	236.24	236.81	0.000006	0.04	6.54	15.03	0.02
Bunkers	Minor Trib Cross	172	50 Year Spill	0.16	236.18	236.78	236.24	236.78	0.000005	0.04	6.21	14.81	0.02
Bunkers	Minor Trib Cross	172	25 Year Spill	0.13	236.18	236.76	236.23	236.76	0.000004	0.03	5.89	14.59	0.01
Bunkers	Minor Trib Cross	172	10 Year Spill	0.09	236.18	236.72	236.22	236.72	0.000003	0.03	5.22	14.13	0.01
Bunkers	Minor Trib Cross	152	100 Year Spill	0.19	236.06	236.81		236.81	0.000017	0.09	3.83	9.01	0.03

HEC-RAS Plan: Ex10-100YrSpill (Continued)

River	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)	
Bunkers	Minor Trib Cross	152	50 Year Spill	0.16	236.06	236.78		236.78	0.000014	0.07	3.64	8.64	0.03
Bunkers	Minor Trib Cross	152	25 Year Spill	0.13	236.06	236.76		236.76	0.000010	0.06	3.46	8.27	0.02
Bunkers	Minor Trib Cross	152	10 Year Spill	0.09	236.06	236.72		236.72	0.000006	0.05	3.09	7.51	0.02
Bunkers	North Trib-Cross	232	100 Year Spill	3.84	236.30	238.11	236.93	238.13	0.000278	0.61	8.45	14.40	0.15
Bunkers	North Trib-Cross	232	50 Year Spill	3.61	236.30	238.02	236.91	238.03	0.000297	0.61	7.97	13.73	0.15
Bunkers	North Trib-Cross	232	25 Year Spill	3.40	236.30	237.91	236.90	237.93	0.000333	0.62	7.42	12.95	0.16
Bunkers	North Trib-Cross	232	10 Year Spill	2.95	236.30	237.77	236.86	237.78	0.000356	0.60	6.65	11.92	0.16
Bunkers	North Trib-Cross	217		Culvert									
Bunkers	North Trib-Cross	175	100 Year Spill	3.84	235.98	236.77	236.77	237.00	0.015080	2.53	2.47	10.73	0.93
Bunkers	North Trib-Cross	175	50 Year Spill	3.61	235.98	236.75	236.75	236.97	0.015211	2.49	2.35	10.51	0.93
Bunkers	North Trib-Cross	175	25 Year Spill	3.40	235.98	236.74	236.74	236.94	0.014993	2.43	2.26	10.33	0.92
Bunkers	North Trib-Cross	175	10 Year Spill	2.95	235.98	236.69	236.69	236.89	0.014664	2.31	2.04	9.97	0.90
Bunkers	North Trib-Cross	167	100 Year Spill	3.84	235.97	236.79		236.80	0.001235	0.68	12.30	37.32	0.26
Bunkers	North Trib-Cross	167	50 Year Spill	3.61	235.97	236.77		236.78	0.001307	0.68	11.55	36.98	0.26
Bunkers	North Trib-Cross	167	25 Year Spill	3.40	235.97	236.75		236.76	0.001392	0.69	10.83	36.70	0.27
Bunkers	North Trib-Cross	167	10 Year Spill	2.95	235.97	236.70		236.71	0.001544	0.69	9.27	34.07	0.28
Bunkers	North Trib-DS	150	100 Year Spill	4.03	235.76	236.57	236.57	236.73	0.013528	2.32	3.38	9.86	0.86
Bunkers	North Trib-DS	150	50 Year Spill	3.77	235.76	236.55	236.55	236.71	0.013349	2.27	3.22	9.73	0.86
Bunkers	North Trib-DS	150	25 Year Spill	3.53	235.76	236.54	236.54	236.69	0.013105	2.22	3.08	9.60	0.84
Bunkers	North Trib-DS	150	10 Year Spill	3.04	235.76	236.50	236.50	236.65	0.012895	2.12	2.73	9.20	0.83
Bunkers	North Trib-DS	136	100 Year Spill	4.03	235.42	236.17	236.17	236.44	0.016864	2.43	2.05	4.29	0.95
Bunkers	North Trib-DS	136	50 Year Spill	3.77	235.42	236.14	236.14	236.40	0.017213	2.38	1.94	4.20	0.96
Bunkers	North Trib-DS	136	25 Year Spill	3.53	235.42	236.12	236.12	236.37	0.017185	2.33	1.85	4.13	0.95
Bunkers	North Trib-DS	136	10 Year Spill	3.04	235.42	236.07	236.07	236.30	0.017867	2.23	1.63	3.94	0.95
Bunkers	North Trib-DS	133	100 Year Spill	4.03	234.25	235.28	235.05	235.40	0.005473	1.80	3.27	4.72	0.58
Bunkers	North Trib-DS	133	50 Year Spill	3.77	234.25	235.22	235.03	235.35	0.005919	1.80	3.02	4.65	0.60
Bunkers	North Trib-DS	133	25 Year Spill	3.53	234.25	235.18	235.00	235.31	0.006381	1.81	2.80	4.59	0.61
Bunkers	North Trib-DS	133	10 Year Spill	3.04	234.25	235.08	234.90	235.21	0.007594	1.82	2.35	4.47	0.66
Bunkers	Spill to Storm-D	128	100 Year Spill	6.17	228.11	232.01		232.01	0.000009	0.18	71.74	43.80	0.03
Bunkers	Spill to Storm-D	128	50 Year Spill	6.10	228.11	231.94		231.94	0.000010	0.18	68.84	43.31	0.03
Bunkers	Spill to Storm-D	128	25 Year Spill	6.02	228.11	231.88		231.88	0.000010	0.19	65.92	42.67	0.03
Bunkers	Spill to Storm-D	128	10 Year Spill	5.97	228.11	231.83		231.83	0.000011	0.19	63.88	42.23	0.03
Bunkers	Spill to Storm-D	125	100 Year Spill	6.17	227.91	232.01	228.71	232.01	0.000014	0.23	52.10	30.96	0.04
Bunkers	Spill to Storm-D	125	50 Year Spill	6.10	227.91	231.94	228.70	231.94	0.000015	0.23	50.06	30.36	0.04
Bunkers	Spill to Storm-D	125	25 Year Spill	6.02	227.91	231.87	228.70	231.88	0.000017	0.24	48.01	29.75	0.04
Bunkers	Spill to Storm-D	125	10 Year Spill	5.97	227.91	231.83	228.70	231.83	0.000017	0.24	46.59	29.32	0.04
Bunkers	To Anne Street	508	100 Year Spill	4.35	236.65	238.11		238.13	0.000374	0.61	10.52	17.10	0.16
Bunkers	To Anne Street	508	50 Year Spill	3.54	236.65	238.02		238.03	0.000325	0.55	9.06	14.98	0.15
Bunkers	To Anne Street	508	25 Year Spill	2.75	236.65	237.92		237.93	0.000245	0.45	7.84	9.20	0.13
Bunkers	To Anne Street	508	10 Year Spill	1.77	236.65	237.77		237.78	0.000162	0.34	6.56	8.29	0.10
Bunkers	To Anne Street	492	100 Year Spill	4.35	236.69	238.10		238.11	0.000336	0.57	10.79	12.67	0.15
Bunkers	To Anne Street	492	50 Year Spill	3.54	236.69	238.01		238.02	0.000289	0.50	9.68	12.02	0.14
Bunkers	To Anne Street	492	25 Year Spill	2.75	236.69	237.91		237.92	0.000238	0.43	8.53	11.33	0.13
Bunkers	To Anne Street	492	10 Year Spill	1.77	236.69	237.77		237.77	0.000162	0.33	6.96	10.06	0.10
Bunkers	To Anne Street	463	100 Year Spill	4.35	236.79	238.09	237.25	238.10	0.000357	0.55	12.37	12.96	0.16
Bunkers	To Anne Street	463	50 Year Spill	3.54	236.79	238.01	237.20	238.01	0.000308	0.49	11.24	12.52	0.14
Bunkers	To Anne Street	463	25 Year Spill	2.75	236.79	237.91	237.16	237.91	0.000255	0.42	10.05	12.03	0.13
Bunkers	To Anne Street	463	10 Year Spill	1.77	236.79	237.76	237.09	237.77	0.000179	0.32	8.36	11.38	0.11
Bunkers	To Anne Street	442	100 Year Spill	4.35	237.01	238.02		238.08	0.002725	1.24	5.18	11.03	0.41
Bunkers	To Anne Street	442	50 Year Spill	3.54	237.01	237.95		238.00	0.002348	1.09	4.53	8.02	0.38
Bunkers	To Anne Street	442	25 Year Spill	2.75	237.01	237.86		237.90	0.002040	0.95	3.90	7.03	0.34
Bunkers	To Anne Street	442	10 Year Spill	1.77	237.01	237.73		237.76	0.001681	0.77	3.02	6.47	0.30
Bunkers	To Anne Street	426	100 Year Spill	4.35	237.04	237.99	237.61	238.04	0.002143	1.01	5.58	14.77	0.35
Bunkers	To Anne Street	426	50 Year Spill	3.54	237.04	237.92	237.55	237.96	0.001982	0.91	4.72	10.70	0.34
Bunkers	To Anne Street	426	25 Year Spill	2.75	237.04	237.83	237.49	237.87	0.001857	0.82	3.88	8.87	0.32
Bunkers	To Anne Street	426	10 Year Spill	1.77	237.04	237.71	237.41	237.73	0.001613	0.66	2.91	6.95	0.29
Bunkers	To Anne Street	406	100 Year Spill	4.35	237.12	237.93		237.99	0.003389	1.08	5.46	16.37	0.43
Bunkers	To Anne Street	406	50 Year Spill	3.54	237.12	237.85		237.90	0.003744	1.04	4.28	13.12	0.44
Bunkers	To Anne Street	406	25 Year Spill	2.75	237.12	237.76		237.81	0.004715	1.03	3.07	11.91	0.48
Bunkers	To Anne Street	406	10 Year Spill	1.77	237.12	237.63		237.67	0.006029	0.94	1.94	6.65	0.51
Bunkers	To Anne Street	386	100 Year Spill	4.35	236.98	237.87	237.60	237.92	0.002829	1.16	5.88	14.48	0.41
Bunkers	To Anne Street	386	50 Year Spill	3.54	236.98	237.79	237.51	237.84	0.002980	1.11	4.73	12.74	0.41
Bunkers	To Anne Street	386	25 Year Spill	2.75	236.98	237.68	237.44	237.73	0.003453	1.08	3.49	10.38	0.43
Bunkers	To Anne Street	386	10 Year Spill	1.77	236.98	237.52	237.34	237.57	0.004410	1.01	2.06	8.17	0.46
Bunkers	To Anne Street	366	100 Year Spill	4.35	236.78	237.57	237.57	237.80	0.013497	2.28	2.65	7.59	0.86
Bunkers	To Anne Street	366	50 Year Spill	3.54	236.78	237.45	237.45	237.70	0.018001	2.32	1.91	4.95	0.97
Bunkers	To Anne Street	366	25 Year Spill	2.75	236.78	237.39	237.37	237.59	0.016725	2.07	1.60	4.45	0.91
Bunkers	To Anne Street	366	10 Year Spill	1.77	236.78	237.31	237.25	237.43	0.012375	1.60	1.28	3.91	0.76
Bunkers	To Anne Street	346	100 Year Spill	4.35	236.63	237.26	237.21	237.39	0.011630	1.72	3.26	9.62	0.77
Bunkers	To Anne Street	346	50 Year Spill	3.54	236.63	237.19	237.16	237.32	0.013694	1.69	2.60	8.74	0.81
Bunkers	To Anne Street	346	25 Year Spill	2.75	236.63	237.12	237.10	237.24	0.016078	1.63	2.00	7.89	0.85
Bunkers	To Anne Street	346	10 Year Spill	1.77	236.63	237.02	237.01	237.13	0.018613	1.45	1.34	6.69	0.88

HEC-RAS Plan: Ex10-100YrSpill (Continued)

River	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)	
Bunkers	To Anne Street	326	100 Year Spill	4.35	236.26	237.08		237.21	0.007544	1.72	3.28	6.51	0.65
Bunkers	To Anne Street	326	50 Year Spill	3.54	236.26	236.99		237.11	0.008026	1.63	2.74	6.12	0.66
Bunkers	To Anne Street	326	25 Year Spill	2.75	236.26	236.91		237.01	0.008318	1.51	2.24	5.72	0.65
Bunkers	To Anne Street	326	10 Year Spill	1.77	236.26	236.78		236.86	0.009324	1.34	1.54	5.08	0.66
Bunkers	To Anne Street	306	100 Year Spill	4.35	236.08	236.96		237.08	0.005606	1.61	3.46	7.00	0.57
Bunkers	To Anne Street	306	50 Year Spill	3.54	236.08	236.87		236.98	0.005660	1.50	2.90	6.03	0.56
Bunkers	To Anne Street	306	25 Year Spill	2.75	236.08	236.80		236.88	0.004995	1.31	2.48	5.32	0.52
Bunkers	To Anne Street	306	10 Year Spill	1.77	236.08	236.68		236.74	0.004171	1.05	1.91	4.67	0.46
Bunkers	To Anne Street	286	100 Year Spill	4.35	235.95	236.91		236.98	0.003282	1.25	4.55	9.04	0.44
Bunkers	To Anne Street	286	50 Year Spill	3.54	235.95	236.82		236.88	0.003344	1.16	3.79	7.62	0.43
Bunkers	To Anne Street	286	25 Year Spill	2.75	235.95	236.75		236.80	0.002896	1.01	3.29	7.12	0.40
Bunkers	To Anne Street	286	10 Year Spill	1.77	235.95	236.64		236.67	0.002316	0.81	2.55	6.36	0.34
Bunkers	To Anne Street	266	100 Year Spill	4.35	236.11	236.84	236.64	236.90	0.004076	1.20	5.05	12.29	0.47
Bunkers	To Anne Street	266	50 Year Spill	3.54	236.11	236.71	236.59	236.79	0.006510	1.31	3.55	10.47	0.58
Bunkers	To Anne Street	266	25 Year Spill	2.75	236.11	236.53	236.53	236.67	0.019551	1.71	1.88	7.61	0.93
Bunkers	To Anne Street	266	10 Year Spill	1.77	236.11	236.45	236.45	236.56	0.021502	1.50	1.30	6.55	0.93
Bunkers	To Anne Street	265		Lat Struct									
Bunkers	To Anne Street	248	100 Year Spill	3.84	235.36	236.83	236.05	236.85	0.000449	0.63	9.25	36.81	0.17
Bunkers	To Anne Street	248	50 Year Spill	3.51	235.36	236.70	236.02	236.71	0.000592	0.67	7.82	36.40	0.20
Bunkers	To Anne Street	248	25 Year Spill	2.75	235.36	236.40	235.95	236.43	0.001227	0.80	4.91	11.16	0.27
Bunkers	To Anne Street	248	10 Year Spill	1.77	235.36	236.01	235.84	236.07	0.004836	1.09	1.83	4.89	0.49
Bunkers	To Anne Street	230		Culvert									
Bunkers	To Anne Street	220	100 Year Spill	3.84	234.41	235.31	235.08	235.39	0.004022	1.38	4.33	25.63	0.48
Bunkers	To Anne Street	220	50 Year Spill	3.51	234.41	235.18	235.04	235.30	0.006980	1.62	3.07	17.47	0.62
Bunkers	To Anne Street	220	25 Year Spill	2.75	234.41	235.00	234.97	235.16	0.013493	1.84	1.80	12.28	0.82
Bunkers	To Anne Street	220	10 Year Spill	1.77	234.41	235.01	234.85	235.07	0.005333	1.17	1.84	12.36	0.51
Bunkers	To Anne Street	200	100 Year Spill	11.53	233.72	234.92	234.92	235.17	0.009952	2.45	8.00	23.13	0.78
Bunkers	To Anne Street	200	50 Year Spill	10.14	233.72	234.90	234.90	235.11	0.008737	2.26	7.45	22.01	0.72
Bunkers	To Anne Street	200	25 Year Spill	8.14	233.72	234.89	234.69	235.03	0.005835	1.83	7.29	21.55	0.59
Bunkers	To Anne Street	200	10 Year Spill	5.79	233.72	234.63	234.55	234.83	0.011371	2.08	3.20	6.42	0.78
Bunkers	To Anne Street	180	100 Year Spill	11.53	233.42	234.83	234.83	235.00	0.006037	2.27	12.18	38.66	0.63
Bunkers	To Anne Street	180	50 Year Spill	10.14	233.42	234.78	234.78	234.95	0.006258	2.24	10.16	30.95	0.64
Bunkers	To Anne Street	180	25 Year Spill	8.14	233.42	234.44	234.41	234.88	0.019489	3.20	3.56	7.22	1.07
Bunkers	To Anne Street	180	10 Year Spill	5.79	233.42	234.56	234.32	234.72	0.006225	1.97	5.07	16.51	0.62
Bunkers	To Anne Street	160	100 Year Spill	11.53	233.12	234.55	234.55	234.71	0.006743	2.38	12.50	36.76	0.66
Bunkers	To Anne Street	160	50 Year Spill	10.14	233.12	234.52	234.52	234.67	0.006440	2.29	11.29	35.56	0.64
Bunkers	To Anne Street	160	25 Year Spill	8.14	233.12	234.43	234.43	234.59	0.006445	2.19	8.57	27.28	0.63
Bunkers	To Anne Street	160	10 Year Spill	5.79	233.12	234.05	234.05	234.49	0.021410	3.11	2.47	5.01	1.08
Bunkers	To Anne Street	140	100 Year Spill	11.53	232.77	234.01	234.01	234.23	0.009587	2.62	9.46	25.62	0.78
Bunkers	To Anne Street	140	50 Year Spill	10.14	232.77	233.99	233.99	234.18	0.008146	2.40	9.05	25.26	0.72
Bunkers	To Anne Street	140	25 Year Spill	8.14	232.77	233.93	233.93	234.11	0.007651	2.23	7.47	23.35	0.69
Bunkers	To Anne Street	140	10 Year Spill	5.79	232.77	233.63	233.63	233.94	0.017200	2.68	2.91	6.21	0.98
Bunkers	To Anne Street	120	100 Year Spill	11.53	232.09	233.48		233.53	0.002199	1.39	15.19	18.98	0.38
Bunkers	To Anne Street	120	50 Year Spill	10.14	232.09	233.38		233.42	0.002346	1.36	13.36	16.56	0.39
Bunkers	To Anne Street	120	25 Year Spill	8.14	232.09	233.24		233.28	0.002497	1.30	11.13	15.54	0.40
Bunkers	To Anne Street	120	10 Year Spill	5.79	232.09	233.06		233.10	0.002769	1.21	8.44	14.54	0.41
Bunkers	To Anne Street	100	100 Year Spill	11.53	231.65	233.27	233.02	233.45	0.006335	2.43	9.66	17.15	0.64
Bunkers	To Anne Street	100	50 Year Spill	10.14	231.65	233.21	232.89	233.35	0.005253	2.15	8.76	13.67	0.58
Bunkers	To Anne Street	100	25 Year Spill	8.14	231.65	233.05		233.20	0.005868	2.11	6.82	11.76	0.60
Bunkers	To Anne Street	100	10 Year Spill	5.79	231.65	232.90	232.66	233.02	0.005157	1.82	5.25	9.06	0.55
Bunkers	To Anne Street	80	100 Year Spill	11.53	231.52	232.90	232.90	233.26	0.012544	3.18	6.86	14.25	0.89
Bunkers	To Anne Street	80	50 Year Spill	10.14	231.52	232.80	232.80	233.17	0.013767	3.15	5.58	10.74	0.92
Bunkers	To Anne Street	80	25 Year Spill	8.14	231.52	232.74	232.74	233.03	0.011233	2.75	4.96	9.74	0.83
Bunkers	To Anne Street	80	10 Year Spill	5.79	231.52	232.53	232.53	232.84	0.014304	2.71	3.18	7.16	0.90
Bunkers	To Anne Street	49	100 Year Spill	11.53	230.96	232.57		232.66	0.003439	1.92	13.08	19.70	0.49
Bunkers	To Anne Street	49	50 Year Spill	10.14	230.96	232.52		232.60	0.003161	1.80	12.14	18.93	0.47
Bunkers	To Anne Street	49	25 Year Spill	8.14	230.96	232.42		232.49	0.002970	1.67	10.32	17.37	0.45
Bunkers	To Anne Street	49	10 Year Spill	5.79	230.96	232.24		232.32	0.003181	1.59	7.50	15.49	0.45
Bunkers	To Anne Street	20	100 Year Spill	11.53	230.66	232.53		232.57	0.001713	1.43	18.20	23.09	0.34
Bunkers	To Anne Street	20	50 Year Spill	10.14	230.66	232.49		232.52	0.001531	1.33	17.17	22.49	0.32
Bunkers	To Anne Street	20	25 Year Spill	8.14	230.66	232.39		232.42	0.001360	1.21	15.07	21.17	0.30
Bunkers	To Anne Street	20	10 Year Spill	5.79	230.66	232.22		232.25	0.001217	1.06	11.78	18.24	0.28
Bunkers	To Anne Street	15		Lat Struct									
Bunkers	To Anne Street	0	100 Year Spill	4.03	230.61	232.53	231.43	232.55	0.000442	0.79	10.77	16.62	0.18
Bunkers	To Anne Street	0	50 Year Spill	3.95	230.61	232.48	231.42	232.50	0.000471	0.80	10.03	14.05	0.19
Bunkers	To Anne Street	0	25 Year Spill	3.79	230.61	232.38	231.41	232.40	0.000512	0.81	8.84	10.14	0.19
Bunkers	To Anne Street	0	10 Year Spill	3.46	230.61	232.21	231.36	232.23	0.000645	0.85	7.30	8.45	0.22

HEC-RAS Plan: FutSpill10-100

River	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)	
Dyments	Highway 400 Flow	585	100 Year Spill	1.58	235.64	235.79	235.79	235.84	0.003624	0.95	1.65	17.61	0.99
Dyments	Highway 400 Flow	585	50 Year Spill	0.81	235.64	235.75	235.75	235.79	0.006018	0.90	0.90	15.25	1.19
Dyments	Highway 400 Flow	585	25 Year Spill	0.00	235.64	235.66	235.66	235.66	0.000013	0.02	0.06	4.02	0.04
Dyments	Highway 400 Flow	585	10 Year Spill	0.00	235.64	235.66	235.66	235.66	0.000013	0.02	0.06	4.02	0.04
Dyments	Highway 400 Flow	584.14		Lat Struct									
Dyments	Highway 400 Flow	565	100 Year Spill	1.26	235.39	235.54	235.54	235.58	0.004267	0.94	1.34	16.54	1.05
Dyments	Highway 400 Flow	565	50 Year Spill	0.81	235.39	235.49	235.49	235.57	0.012779	1.25	0.64	11.73	1.71
Dyments	Highway 400 Flow	565	25 Year Spill	0.00	235.39	235.41	235.41	235.41	0.000018	0.02	0.05	3.44	0.05
Dyments	Highway 400 Flow	565	10 Year Spill	0.00	235.39	235.41	235.41	235.41	0.000018	0.02	0.05	3.44	0.05
Dyments	Highway 400 Flow	545	100 Year Spill	0.96	235.14	235.28	235.28	235.33	0.004651	0.93	1.03	13.81	1.09
Dyments	Highway 400 Flow	545	50 Year Spill	0.75	235.14	235.27	235.27	235.31	0.004085	0.84	0.89	12.55	1.01
Dyments	Highway 400 Flow	545	25 Year Spill	0.00	235.14	235.16	235.16	235.16	0.000303	0.06	0.02	2.10	0.19
Dyments	Highway 400 Flow	545	10 Year Spill	0.00	235.14	235.16	235.16	235.16	0.000303	0.06	0.02	2.10	0.19
Dyments	Highway 400 Flow	525	100 Year Spill	0.70	234.86	235.04	235.04	235.07	0.004266	0.82	0.85	12.99	1.02
Dyments	Highway 400 Flow	525	50 Year Spill	0.60	234.86	235.03	235.03	235.06	0.003991	0.83	0.72	10.30	1.00
Dyments	Highway 400 Flow	525	25 Year Spill	0.00	234.86	234.88	234.88	234.88	0.001175	0.12	0.01	0.81	0.39
Dyments	Highway 400 Flow	525	10 Year Spill	0.00	234.86	234.88	234.88	234.88	0.001175	0.12	0.01	0.81	0.39
Dyments	Highway 400 Flow	505	100 Year Spill	0.63	234.70	234.83	234.83	234.88	0.009208	0.99	0.63	12.80	1.43
Dyments	Highway 400 Flow	505	50 Year Spill	0.56	234.70	234.83	234.83	234.87	0.007623	0.89	0.62	12.77	1.29
Dyments	Highway 400 Flow	505	25 Year Spill	0.00	234.70	234.72	234.72	234.72	0.000388	0.07	0.01	1.62	0.22
Dyments	Highway 400 Flow	505	10 Year Spill	0.00	234.70	234.72	234.72	234.72	0.000388	0.07	0.01	1.62	0.22
Dyments	Highway 400 Flow	485	100 Year Spill	0.54	234.49	234.62	234.62	234.66	0.005662	0.84	0.64	11.43	1.14
Dyments	Highway 400 Flow	485	50 Year Spill	0.47	234.49	234.62	234.62	234.65	0.004981	0.77	0.61	11.37	1.06
Dyments	Highway 400 Flow	485	25 Year Spill	0.00	234.49	234.51	234.51	234.51	0.000370	0.08	0.01	1.11	0.23
Dyments	Highway 400 Flow	485	10 Year Spill	0.00	234.49	234.51	234.51	234.51	0.000370	0.08	0.01	1.11	0.23
Dyments	Highway 400 Flow	465	100 Year Spill	0.45	234.29	234.41	234.41	234.44	0.005550	0.77	0.59	12.05	1.11
Dyments	Highway 400 Flow	465	50 Year Spill	0.40	234.29	234.41	234.41	234.44	0.004995	0.71	0.57	11.97	1.04
Dyments	Highway 400 Flow	465	25 Year Spill	0.00	234.29	234.31	234.31	234.31	0.001089	0.11	0.01	1.07	0.37
Dyments	Highway 400 Flow	465	10 Year Spill	0.00	234.29	234.31	234.31	234.31	0.001089	0.11	0.01	1.07	0.37
Dyments	Highway 400 Flow	445	100 Year Spill	0.44	234.10	234.22	234.22	234.24	0.003535	0.64	0.69	13.23	0.89
Dyments	Highway 400 Flow	445	50 Year Spill	0.39	234.10	234.21	234.21	234.23	0.003665	0.62	0.63	13.01	0.90
Dyments	Highway 400 Flow	445	25 Year Spill	0.00	234.10	234.11	234.11	234.11	0.000149	0.05	0.02	2.08	0.14
Dyments	Highway 400 Flow	445	10 Year Spill	0.00	234.10	234.11	234.11	234.11	0.000149	0.05	0.02	2.08	0.14
Dyments	Highway 400 Flow	425	100 Year Spill	0.42	233.85	233.97	233.97	234.00	0.005139	0.82	0.51	8.89	1.09
Dyments	Highway 400 Flow	425	50 Year Spill	0.37	233.85	233.96	233.96	233.99	0.004653	0.77	0.48	8.60	1.04
Dyments	Highway 400 Flow	425	25 Year Spill	0.00	233.85	233.87	233.87	233.87	0.000732	0.09	0.01	1.27	0.30
Dyments	Highway 400 Flow	425	10 Year Spill	0.00	233.85	233.87	233.87	233.87	0.000732	0.09	0.01	1.27	0.30
Dyments	Highway 400 Flow	405	100 Year Spill	0.42	233.57	233.72	233.72	233.75	0.003998	0.82	0.51	7.28	1.00
Dyments	Highway 400 Flow	405	50 Year Spill	0.37	233.57	233.71	233.71	233.74	0.004214	0.82	0.45	6.74	1.01
Dyments	Highway 400 Flow	405	25 Year Spill	0.00	233.57	233.59	233.59	233.59	0.000264	0.07	0.01	1.04	0.19
Dyments	Highway 400 Flow	405	10 Year Spill	0.00	233.57	233.59	233.59	233.59	0.000264	0.07	0.01	1.04	0.19
Dyments	Highway 400 Flow	385	100 Year Spill	0.42	233.40	233.53	233.53	233.56	0.004275	0.78	0.53	8.65	1.01
Dyments	Highway 400 Flow	385	50 Year Spill	0.37	233.40	233.52	233.52	233.56	0.004662	0.83	0.44	7.01	1.06
Dyments	Highway 400 Flow	385	25 Year Spill	0.00	233.40	233.42	233.42	233.42	0.000091	0.04	0.02	1.71	0.11
Dyments	Highway 400 Flow	385	10 Year Spill	0.00	233.40	233.42	233.42	233.42	0.000091	0.04	0.02	1.71	0.11
Dyments	Spill to Dyments	1000	100 Year Spill	9.96	231.32	231.89		231.90	0.000096	0.45	26.31	60.66	0.21
Dyments	Spill to Dyments	1000	50 Year Spill	7.95	231.32	231.88		231.88	0.000070	0.38	25.19	60.58	0.18
Dyments	Spill to Dyments	1000	25 Year Spill	4.82	231.32	231.86		231.86	0.000030	0.24	24.14	60.49	0.12
Dyments	Spill to Dyments	1000	10 Year Spill	1.87	231.32	231.82		231.82	0.000006	0.10	21.79	60.31	0.05
Dyments	Spill to Dyments	999	100 Year Spill	9.96	231.09	231.90		231.90	0.000017	0.24	95.36	133.15	0.09
Dyments	Spill to Dyments	999	50 Year Spill	7.95	231.09	231.88		231.88	0.000012	0.20	92.74	133.15	0.08
Dyments	Spill to Dyments	999	25 Year Spill	4.82	231.09	231.86		231.86	0.000005	0.12	90.16	133.15	0.05
Dyments	Spill to Dyments	999	10 Year Spill	1.87	231.09	231.82		231.82	0.000001	0.05	84.84	133.15	0.02
Dyments	Spill to Dyments	998	100 Year Spill	9.96	230.77	231.90	230.97	231.90	0.000001	0.05	186.82	304.69	0.02
Dyments	Spill to Dyments	998	50 Year Spill	7.95	230.77	231.88	230.96	231.88	0.000001	0.04	180.69	304.69	0.02
Dyments	Spill to Dyments	998	25 Year Spill	4.82	230.77	231.86	230.91	231.86	0.000000	0.03	174.65	304.69	0.01
Dyments	Spill to Dyments	998	10 Year Spill	1.87	230.77	231.82	230.85	231.82	0.000000	0.01	162.40	304.69	0.01
Dyments	Bunkers Return	1009	100 Year Spill	4.97	231.63	231.86	231.86	231.91	0.003201	0.92	5.38	54.95	0.94
Dyments	Bunkers Return	1009	50 Year Spill	3.96	231.63	231.85	231.85	231.89	0.003212	0.86	4.62	53.00	0.93
Dyments	Bunkers Return	1009	25 Year Spill	3.42	231.63	231.84	231.84	231.87	0.003192	0.81	4.23	52.51	0.91
Dyments	Bunkers Return	1009	10 Year Spill	1.99	231.63	231.80	231.80	231.83	0.003960	0.82	2.43	34.91	0.99
Dyments	Bunkers Return	1007	100 Year Spill	4.97	230.91	231.74		231.74	0.000497	0.38	13.50	31.62	0.16
Dyments	Bunkers Return	1007	50 Year Spill	3.96	230.91	231.72		231.72	0.000352	0.32	12.96	29.69	0.14
Dyments	Bunkers Return	1007	25 Year Spill	3.42	230.91	231.71		231.71	0.000280	0.28	12.69	27.84	0.12
Dyments	Bunkers Return	1007	10 Year Spill	1.99	230.91	231.68		231.68	0.000114	0.17	11.93	24.46	0.08
Dyments	Bunkers Return	1006	100 Year Spill	4.97	230.49	231.74		231.74	0.000080	0.26	33.90	37.81	0.07
Dyments	Bunkers Return	1006	50 Year Spill	3.96	230.49	231.72		231.72	0.000053	0.21	33.24	37.41	0.06
Dyments	Bunkers Return	1006	25 Year Spill	3.42	230.49	231.71		231.71	0.000041	0.18	32.89	37.18	0.05
Dyments	Bunkers Return	1006	10 Year Spill	1.99	230.49	231.68		231.68	0.000015	0.11	31.81	36.53	0.03
Dyments	Bunkers Return	1005	100 Year Spill	4.97	230.06	231.74		231.74	0.000012	0.12	62.59	48.32	0.03
Dyments	Bunkers Return	1005	50 Year Spill	3.96	230.06	231.72		231.72	0.000008	0.10	61.74	48.09	0.02
Dyments	Bunkers Return	1005	25 Year Spill	3.42	230.06	231.71		231.71	0.000006	0.09	61.28	47.98	0.02

HEC-RAS Plan: FutSpill10-100 (Continued)

River	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)	
Dyments	Bunkers Return	1005	10 Year Spill	1.99	230.06	231.68		231.68	0.000002	0.05	59.87	47.60	0.01
Dyments	Bunkers Return	1004	100 Year Spill	4.97	229.79	231.74		231.74	0.000005	0.08	100.34	61.95	0.02
Dyments	Bunkers Return	1004	50 Year Spill	3.96	229.79	231.72		231.72	0.000003	0.07	99.25	61.74	0.02
Dyments	Bunkers Return	1004	25 Year Spill	3.42	229.79	231.71		231.71	0.000002	0.06	98.66	61.62	0.01
Dyments	Bunkers Return	1004	10 Year Spill	1.99	229.79	231.68		231.68	0.000001	0.03	96.85	61.29	0.01
Dyments	Bunkers Return	1003	100 Year Spill	4.97	229.58	231.74		231.74	0.000002	0.06	133.74	71.29	0.01
Dyments	Bunkers Return	1003	50 Year Spill	3.96	229.58	231.72		231.72	0.000001	0.04	132.49	71.11	0.01
Dyments	Bunkers Return	1003	25 Year Spill	3.42	229.58	231.71		231.71	0.000001	0.04	131.81	71.04	0.01
Dyments	Bunkers Return	1003	10 Year Spill	1.99	229.58	231.68		231.68	0.000000	0.02	129.72	70.86	0.01
Dyments	Bunkers Return	1002	100 Year Spill	4.97	229.45	231.74		231.74	0.000001	0.05	162.89	92.13	0.01
Dyments	Bunkers Return	1002	50 Year Spill	3.96	229.45	231.72		231.72	0.000001	0.04	161.27	91.90	0.01
Dyments	Bunkers Return	1002	25 Year Spill	3.42	229.45	231.71		231.71	0.000001	0.04	160.39	91.78	0.01
Dyments	Bunkers Return	1002	10 Year Spill	1.99	229.45	231.68		231.68	0.000000	0.02	157.69	91.42	0.00
Dyments	Bunkers Return	1001	100 Year Spill	4.97	229.33	231.74		231.74	0.000001	0.05	191.68	108.12	0.01
Dyments	Bunkers Return	1001	50 Year Spill	3.96	229.33	231.72		231.72	0.000001	0.04	189.77	107.75	0.01
Dyments	Bunkers Return	1001	25 Year Spill	3.42	229.33	231.71		231.71	0.000001	0.03	188.74	107.57	0.01
Dyments	Bunkers Return	1001	10 Year Spill	1.99	229.33	231.68		231.68	0.000000	0.02	185.58	107.36	0.00
Dyments	Bunkers Return	999	100 Year Spill	4.97	229.24	231.74		231.74	0.000001	0.05	176.75	95.29	0.01
Dyments	Bunkers Return	999	50 Year Spill	3.96	229.24	231.72		231.72	0.000001	0.04	175.07	95.17	0.01
Dyments	Bunkers Return	999	25 Year Spill	3.42	229.24	231.71		231.71	0.000001	0.04	174.17	95.12	0.01
Dyments	Bunkers Return	999	10 Year Spill	1.99	229.24	231.68		231.68	0.000000	0.02	171.37	94.93	0.00
Dyments	Bunkers Return	998	100 Year Spill	4.97	231.65	231.69	231.69	231.73	0.030858	1.04	5.55	67.57	2.27
Dyments	Bunkers Return	998	50 Year Spill	3.96	231.65	231.69	231.69	231.72	0.022765	0.83	5.29	66.74	1.92
Dyments	Bunkers Return	998	25 Year Spill	3.42	231.65	231.68	231.68	231.71	0.020602	0.71	4.99	65.86	1.78
Dyments	Bunkers Return	998	10 Year Spill	1.99	231.65	231.64	231.64	231.68	0.077866		2.28	54.21	0.00
Bunkers	Spill to Storm	294	100 Year Spill	0.00	231.57	232.33		232.33	0.000000	0.00	9.03	19.92	0.00
Bunkers	Spill to Storm	294	50 Year Spill	0.00	231.57	232.26		232.26	0.000000	0.00	7.75	18.11	0.00
Bunkers	Spill to Storm	294	25 Year Spill	0.00	231.57	232.17		232.17	0.000000	0.00	6.13	17.08	0.00
Bunkers	Spill to Storm	294	10 Year Spill	0.00	231.57	232.02		232.02	0.000000	0.00	3.71	14.62	0.00
Bunkers	Spill to Storm	273	100 Year Spill	9.20	231.43	232.26	231.96	232.30	0.003203	1.23	12.62	24.15	0.44
Bunkers	Spill to Storm	273	50 Year Spill	7.84	231.43	232.19	231.93	232.24	0.003230	1.17	11.13	22.17	0.43
Bunkers	Spill to Storm	273	25 Year Spill	6.14	231.43	232.11	231.87	232.14	0.003331	1.09	9.22	20.58	0.43
Bunkers	Spill to Storm	273	10 Year Spill	3.57	231.43	231.97	231.78	231.99	0.003021	0.89	6.48	18.55	0.39
Bunkers	Spill to Storm	252	100 Year Spill	9.20	231.34	232.18	231.89	232.23	0.004057	1.39	11.97	21.71	0.49
Bunkers	Spill to Storm	252	50 Year Spill	7.84	231.34	232.12	231.86	232.16	0.004192	1.33	10.56	20.84	0.49
Bunkers	Spill to Storm	252	25 Year Spill	6.14	231.34	232.02	231.81	232.06	0.004464	1.26	8.68	19.55	0.50
Bunkers	Spill to Storm	252	10 Year Spill	3.57	231.34	231.90	231.71	231.92	0.003732	0.99	6.29	17.80	0.44
Bunkers	Spill to Storm	231	100 Year Spill	9.20	231.07	232.14		232.17	0.001827	1.10	14.91	22.31	0.34
Bunkers	Spill to Storm	231	50 Year Spill	7.84	231.07	232.07		232.10	0.001743	1.03	13.48	21.51	0.33
Bunkers	Spill to Storm	231	25 Year Spill	6.14	231.07	231.98		232.01	0.001633	0.93	11.56	20.49	0.32
Bunkers	Spill to Storm	231	10 Year Spill	3.57	231.07	231.87		231.88	0.001002	0.67	9.32	19.36	0.24
Bunkers	Spill to Storm	210	100 Year Spill	9.20	230.89	232.13		232.14	0.000659	0.73	20.30	27.22	0.21
Bunkers	Spill to Storm	210	50 Year Spill	7.84	230.89	232.06		232.08	0.000592	0.67	18.74	23.24	0.20
Bunkers	Spill to Storm	210	25 Year Spill	6.14	230.89	231.97		231.98	0.000498	0.58	16.69	22.20	0.18
Bunkers	Spill to Storm	210	10 Year Spill	3.57	230.89	231.87		231.87	0.000256	0.39	14.34	21.19	0.13
Bunkers	Spill to Storm	189	100 Year Spill	9.20	230.57	232.12		232.13	0.000455	0.71	24.08	32.52	0.18
Bunkers	Spill to Storm	189	50 Year Spill	7.84	230.57	232.06		232.07	0.000393	0.64	22.13	28.79	0.17
Bunkers	Spill to Storm	189	25 Year Spill	6.14	230.57	231.97		231.98	0.000316	0.55	19.84	23.54	0.15
Bunkers	Spill to Storm	189	10 Year Spill	3.57	230.57	231.86		231.87	0.000151	0.36	17.51	21.64	0.10
Bunkers	Spill to Storm	168	100 Year Spill	9.20	230.04	232.12		232.12	0.000267	0.63	33.82	44.11	0.14
Bunkers	Spill to Storm	168	50 Year Spill	7.84	230.04	232.05		232.06	0.000232	0.57	31.17	41.34	0.13
Bunkers	Spill to Storm	168	25 Year Spill	6.14	230.04	231.97		231.97	0.000160	0.46	27.80	34.39	0.11
Bunkers	Spill to Storm	168	10 Year Spill	3.57	230.04	231.86		231.86	0.000066	0.29	24.71	25.50	0.07
Bunkers	Spill to Storm	147	100 Year Spill	20.78	230.76	232.08	231.39	232.11	0.000865	0.86	37.94	49.37	0.24
Bunkers	Spill to Storm	147	50 Year Spill	17.74	230.76	232.03	231.32	232.05	0.000768	0.78	35.12	47.95	0.23
Bunkers	Spill to Storm	147	25 Year Spill	14.35	230.76	231.94	231.27	231.96	0.000680	0.70	31.18	45.89	0.21
Bunkers	Spill to Storm	147	10 Year Spill	9.85	230.76	231.85	231.18	231.86	0.000464	0.55	26.90	43.30	0.17
Bunkers	Dyments Spill	373	100 Year Spill	14.51	230.28	232.09		232.10	0.000530	0.85	39.01	57.92	0.20
Bunkers	Dyments Spill	373	50 Year Spill	11.54	230.28	232.02		232.03	0.000430	0.74	34.87	55.80	0.18
Bunkers	Dyments Spill	373	25 Year Spill	8.24	230.28	231.94		231.95	0.000232	0.53	30.70	51.90	0.13
Bunkers	Dyments Spill	373	10 Year Spill	3.85	230.28	231.84		231.84	0.000064	0.27	26.78	34.40	0.07
Bunkers	Dyments Spill	353	100 Year Spill	14.51	229.68	232.08	230.71	232.09	0.000348	0.82	39.23	31.46	0.17
Bunkers	Dyments Spill	353	50 Year Spill	11.54	229.68	232.01	230.62	232.02	0.000250	0.68	37.09	29.92	0.14
Bunkers	Dyments Spill	353	25 Year Spill	8.24	229.68	231.94	230.48	231.94	0.000147	0.51	34.91	28.49	0.11
Bunkers	Dyments Spill	353	10 Year Spill	3.85	229.68	231.84	230.29	231.84	0.000039	0.26	32.29	26.87	0.06
Bunkers	Dyments Spill	333	100 Year Spill	14.51	229.63	232.07		232.08	0.000341	0.83	43.31	57.33	0.17
Bunkers	Dyments Spill	333	50 Year Spill	11.54	229.63	232.01		232.01	0.000219	0.65	39.81	48.88	0.14
Bunkers	Dyments Spill	333	25 Year Spill	8.24	229.63	231.93		231.94	0.000127	0.49	36.61	40.85	0.10
Bunkers	Dyments Spill	333	10 Year Spill	3.85	229.63	231.84		231.84	0.000034	0.24	33.08	34.59	0.05
Bunkers	Dyments Spill	313	100 Year Spill	14.51	229.73	232.06		232.08	0.000411	0.87	42.85	56.47	0.18
Bunkers	Dyments Spill	313	50 Year Spill	11.54	229.73	232.00		232.01	0.000298	0.72	39.48	49.20	0.16
Bunkers	Dyments Spill	313	25 Year Spill	8.24	229.73	231.93		231.93	0.000159	0.52	36.25	44.07	0.11

HEC-RAS Plan: FutSpill10-100 (Continued)

River	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)	
Bunkers	Dyments Spill	313	10 Year Spill	3.85	229.73	231.84		231.84	0.000042	0.26	32.56	36.79	0.06
Bunkers	Dyments Spill	292	100 Year Spill	14.51	229.84	232.05		232.07	0.000459	0.90	40.79	57.39	0.19
Bunkers	Dyments Spill	292	50 Year Spill	11.54	229.84	231.99		232.00	0.000341	0.76	37.35	52.24	0.17
Bunkers	Dyments Spill	292	25 Year Spill	8.24	229.84	231.93		231.93	0.000185	0.55	34.13	45.53	0.12
Bunkers	Dyments Spill	292	10 Year Spill	3.85	229.84	231.84		231.84	0.000050	0.28	30.47	37.67	0.06
Bunkers	Dyments Spill	273	100 Year Spill	14.51	229.99	232.04	230.91	232.06	0.000510	0.90	34.73	33.74	0.20
Bunkers	Dyments Spill	273	50 Year Spill	11.54	229.99	231.98	230.83	232.00	0.000326	0.71	32.85	29.02	0.16
Bunkers	Dyments Spill	273	25 Year Spill	8.24	229.99	231.92	230.69	231.93	0.000191	0.53	31.05	28.13	0.12
Bunkers	Dyments Spill	273	10 Year Spill	3.85	229.99	231.84	230.49	231.84	0.000051	0.27	28.73	27.14	0.06
Bunkers	Dyments Spill	253	100 Year Spill	14.51	230.28	232.03		232.04	0.000781	1.01	38.92	57.15	0.24
Bunkers	Dyments Spill	253	50 Year Spill	11.54	230.28	231.98		231.99	0.000588	0.85	35.90	53.82	0.21
Bunkers	Dyments Spill	253	25 Year Spill	8.24	230.28	231.92		231.92	0.000322	0.62	32.82	49.53	0.15
Bunkers	Dyments Spill	253	10 Year Spill	3.85	230.28	231.84		231.84	0.000093	0.32	29.10	43.25	0.08
Bunkers	Dyments Spill	233	100 Year Spill	14.51	230.20	232.01	231.08	232.03	0.000753	1.01	33.98	41.64	0.24
Bunkers	Dyments Spill	233	50 Year Spill	11.54	230.20	231.96	231.00	231.97	0.000563	0.86	31.95	41.06	0.21
Bunkers	Dyments Spill	233	25 Year Spill	8.24	230.20	231.91	230.89	231.92	0.000324	0.64	29.87	37.72	0.16
Bunkers	Dyments Spill	233	10 Year Spill	3.85	230.20	231.83	230.67	231.84	0.000076	0.30	27.21	33.18	0.08
Bunkers	Dyments Spill	213	100 Year Spill	14.51	230.33	231.99	231.19	232.01	0.000880	1.03	31.77	41.38	0.26
Bunkers	Dyments Spill	213	50 Year Spill	11.54	230.33	231.95	231.12	231.96	0.000653	0.87	29.96	41.01	0.22
Bunkers	Dyments Spill	213	25 Year Spill	8.24	230.33	231.90	231.01	231.91	0.000400	0.67	28.02	40.63	0.17
Bunkers	Dyments Spill	213	10 Year Spill	3.85	230.33	231.83	230.81	231.83	0.000111	0.34	25.30	38.96	0.09
Bunkers	Dyments Spill	193	100 Year Spill	14.51	230.39	231.98		232.00	0.000667	0.86	33.62	43.13	0.22
Bunkers	Dyments Spill	193	50 Year Spill	11.54	230.39	231.94		231.95	0.000487	0.72	31.89	42.85	0.19
Bunkers	Dyments Spill	193	25 Year Spill	8.24	230.39	231.89		231.90	0.000292	0.54	30.04	42.53	0.14
Bunkers	Dyments Spill	193	10 Year Spill	3.85	230.39	231.83		231.83	0.000082	0.28	27.36	42.03	0.08
Bunkers	Dyments Spill	176	100 Year Spill	14.51	230.50	231.96		231.98	0.000972	1.00	31.85	46.56	0.26
Bunkers	Dyments Spill	176	50 Year Spill	11.54	230.50	231.92		231.94	0.000710	0.84	30.25	44.97	0.23
Bunkers	Dyments Spill	176	25 Year Spill	8.24	230.50	231.88		231.89	0.000426	0.64	28.55	44.66	0.17
Bunkers	Dyments Spill	176	10 Year Spill	3.85	230.50	231.83		231.83	0.000120	0.33	26.00	44.17	0.09
Bunkers	Dyments Spill	159	100 Year Spill	14.51	230.56	231.94	231.46	231.96	0.001434	1.16	29.38	43.20	0.32
Bunkers	Dyments Spill	159	50 Year Spill	11.54	230.56	231.91	231.40	231.92	0.001038	0.98	28.10	43.03	0.27
Bunkers	Dyments Spill	159	25 Year Spill	8.24	230.56	231.88	231.21	231.89	0.000617	0.74	26.71	42.85	0.21
Bunkers	Dyments Spill	159	10 Year Spill	3.85	230.56	231.83	231.05	231.83	0.000175	0.38	24.50	42.57	0.11
Bunkers	Dyments Spill	142	100 Year Spill	14.51	230.72	231.91	231.45	231.93	0.001789	1.15	30.11	55.49	0.34
Bunkers	Dyments Spill	142	50 Year Spill	11.54	230.72	231.89	231.36	231.90	0.001270	0.96	28.92	55.01	0.29
Bunkers	Dyments Spill	142	25 Year Spill	8.24	230.72	231.87	231.29	231.87	0.000654	0.68	26.85	45.09	0.21
Bunkers	Dyments Spill	142	10 Year Spill	3.85	230.72	231.82	231.13	231.82	0.000176	0.34	24.90	44.03	0.11
Bunkers	Dyments Spill	90	100 Year Spill	14.51	231.47	231.90		231.91	0.000308	0.53	27.53	112.34	0.34
Bunkers	Dyments Spill	90	50 Year Spill	11.54	231.47	231.88		231.89	0.000244	0.45	25.37	108.65	0.30
Bunkers	Dyments Spill	90	25 Year Spill	8.24	231.47	231.86		231.87	0.000161	0.35	23.25	105.84	0.24
Bunkers	Dyments Spill	90	10 Year Spill	3.85	231.47	231.82		231.82	0.000060	0.20	19.21	97.87	0.14
Bunkers	North Trib	362	100 Year Spill	9.83	238.13	239.35	239.35	239.51	0.011162	2.75	9.17	24.74	0.83
Bunkers	North Trib	362	50 Year Spill	8.58	238.13	239.30	239.30	239.47	0.011596	2.72	7.99	23.12	0.84
Bunkers	North Trib	362	25 Year Spill	7.38	238.13	239.21	239.21	239.39	0.012982	2.71	6.30	17.07	0.87
Bunkers	North Trib	362	10 Year Spill	5.66	238.13	239.10	239.10	239.30	0.014983	2.69	4.56	13.32	0.92
Bunkers	North Trib	344	100 Year Spill	9.83	237.75	238.95	238.95	239.11	0.010025	2.45	8.92	23.96	0.77
Bunkers	North Trib	344	50 Year Spill	8.58	237.75	238.91	238.91	239.07	0.009885	2.37	7.99	23.53	0.76
Bunkers	North Trib	344	25 Year Spill	7.38	237.75	238.87	238.87	239.03	0.009560	2.27	7.10	23.12	0.74
Bunkers	North Trib	344	10 Year Spill	5.66	237.75	238.81	238.81	238.96	0.008730	2.08	5.75	22.59	0.70
Bunkers	North Trib	313	100 Year Spill	9.83	237.30	238.44	238.44	238.67	0.010675	2.64	7.08	15.67	0.81
Bunkers	North Trib	313	50 Year Spill	8.58	237.30	238.39	238.39	238.61	0.010281	2.52	6.38	15.12	0.79
Bunkers	North Trib	313	25 Year Spill	7.38	237.30	238.36	238.36	238.55	0.008987	2.31	5.91	14.79	0.73
Bunkers	North Trib	313	10 Year Spill	5.66	237.30	238.27	238.27	238.45	0.009190	2.18	4.53	13.89	0.73
Bunkers	North Trib	287	100 Year Spill	9.83	236.83	238.24		238.34	0.006167	2.28	11.33	24.30	0.63
Bunkers	North Trib	287	50 Year Spill	8.58	236.83	238.13		238.26	0.008990	2.59	8.68	21.86	0.75
Bunkers	North Trib	287	25 Year Spill	7.38	236.83	238.00	237.99	238.19	0.012698	2.87	6.32	16.60	0.88
Bunkers	North Trib	287	10 Year Spill	5.66	236.83	237.96	237.96	238.11	0.009812	2.46	5.64	16.01	0.77
Bunkers	North Trib	260	100 Year Spill	9.83	236.55	238.26		238.27	0.000654	0.77	27.07	43.53	0.20
Bunkers	North Trib	260	50 Year Spill	8.58	236.55	238.16		238.18	0.000708	0.77	23.28	38.20	0.21
Bunkers	North Trib	260	25 Year Spill	7.38	236.55	238.06		238.07	0.000814	0.79	19.58	33.65	0.22
Bunkers	North Trib	260	10 Year Spill	5.66	236.55	237.88		237.90	0.001173	0.85	14.06	29.07	0.26
Bunkers	North Trib	245	100 Year Spill	9.83	236.35	238.25		238.26	0.000315	0.65	29.35	27.29	0.15
Bunkers	North Trib	245	50 Year Spill	8.58	236.35	238.16		238.17	0.000307	0.62	26.84	26.53	0.15
Bunkers	North Trib	245	25 Year Spill	7.38	236.35	238.06		238.06	0.000307	0.59	24.15	26.02	0.15
Bunkers	North Trib	245	10 Year Spill	5.66	236.35	237.88		237.89	0.000304	0.54	19.66	23.58	0.15
Bunkers	Minor Trib Cross	581	100 Year Spill	0.23	245.18	245.27	245.26	245.29	0.030122	0.66	0.35	5.96	0.86
Bunkers	Minor Trib Cross	581	50 Year Spill	0.19	245.18	245.26		245.28	0.030137	0.61	0.31	5.82	0.85
Bunkers	Minor Trib Cross	581	25 Year Spill	0.16	245.18	245.26		245.27	0.022977	0.53	0.30	5.78	0.74
Bunkers	Minor Trib Cross	581	10 Year Spill	0.11	245.18	245.24		245.26	0.026249	0.49	0.23	5.46	0.76
Bunkers	Minor Trib Cross	560	100 Year Spill	0.23	244.54	244.65	244.63	244.67	0.029253	0.75	0.31	4.23	0.88
Bunkers	Minor Trib Cross	560	50 Year Spill	0.19	244.54	244.64	244.63	244.66	0.029645	0.71	0.27	4.04	0.87
Bunkers	Minor Trib Cross	560	25 Year Spill	0.16	244.54	244.62	244.62	244.65	0.040843	0.75	0.21	3.77	1.00

HEC-RAS Plan: FutSpill10-100 (Continued)

River	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)	
Bunkers	Minor Trib Cross	560	10 Year Spill	0.11	244.54	244.61	244.60	244.63	0.034979	0.63	0.18	3.56	0.90
Bunkers	Minor Trib Cross	539	100 Year Spill	0.23	243.87	244.02	244.01	244.06	0.029032	0.95	0.25	2.72	0.93
Bunkers	Minor Trib Cross	539	50 Year Spill	0.19	243.87	244.01	244.00	244.05	0.029338	0.89	0.22	2.61	0.92
Bunkers	Minor Trib Cross	539	25 Year Spill	0.16	243.87	244.01	244.00	244.03	0.020530	0.75	0.22	2.61	0.77
Bunkers	Minor Trib Cross	539	10 Year Spill	0.11	243.87	243.98		244.01	0.026141	0.70	0.16	2.35	0.83
Bunkers	Minor Trib Cross	518	100 Year Spill	0.23	243.23	243.37	243.37	243.42	0.032859	1.07	0.22	2.21	1.00
Bunkers	Minor Trib Cross	518	50 Year Spill	0.19	243.23	243.35	243.35	243.40	0.032938	0.99	0.20	2.10	0.99
Bunkers	Minor Trib Cross	518	25 Year Spill	0.16	243.23	243.33	243.33	243.39	0.052745	1.07	0.15	1.93	1.20
Bunkers	Minor Trib Cross	518	10 Year Spill	0.11	243.23	243.32	243.32	243.36	0.038625	0.84	0.13	1.87	1.00
Bunkers	Minor Trib Cross	497	100 Year Spill	0.23	242.29	242.40	242.40	242.45	0.042197	1.03	0.24	2.84	1.10
Bunkers	Minor Trib Cross	497	50 Year Spill	0.19	242.29	242.40	242.40	242.44	0.036639	0.92	0.22	2.79	1.01
Bunkers	Minor Trib Cross	497	25 Year Spill	0.16	242.29	242.39	242.39	242.42	0.036206	0.87	0.20	2.72	0.99
Bunkers	Minor Trib Cross	497	10 Year Spill	0.11	242.29	242.38	242.38	242.40	0.027757	0.70	0.17	2.63	0.85
Bunkers	Minor Trib Cross	476	100 Year Spill	0.23	241.18	241.34	241.34	241.39	0.032945	1.04	0.22	2.07	0.99
Bunkers	Minor Trib Cross	476	50 Year Spill	0.19	241.18	241.32	241.32	241.37	0.035654	0.99	0.19	2.00	1.01
Bunkers	Minor Trib Cross	476	25 Year Spill	0.16	241.18	241.31	241.31	241.36	0.035800	0.93	0.17	1.92	1.00
Bunkers	Minor Trib Cross	476	10 Year Spill	0.11	241.18	241.30	241.30	241.33	0.027871	0.76	0.15	1.85	0.86
Bunkers	Minor Trib Cross	465	100 Year Spill	0.23	240.27	240.45	240.45	240.53	0.027936	1.21	0.20	1.51	0.97
Bunkers	Minor Trib Cross	465	50 Year Spill	0.19	240.27	240.43	240.43	240.50	0.028843	1.13	0.18	1.45	0.96
Bunkers	Minor Trib Cross	465	25 Year Spill	0.16	240.27	240.42	240.42	240.48	0.032807	1.10	0.15	1.39	1.00
Bunkers	Minor Trib Cross	465	10 Year Spill	0.11	240.27	240.39	240.39	240.44	0.032404	0.95	0.12	1.32	0.96
Bunkers	Minor Trib Cross	448		Culvert									
Bunkers	Minor Trib Cross	402	100 Year Spill	0.23	238.45	238.62	238.62	238.68	0.031971	1.04	0.22	1.93	0.98
Bunkers	Minor Trib Cross	402	50 Year Spill	0.19	238.45	238.61	238.61	238.66	0.032942	0.99	0.19	1.84	0.98
Bunkers	Minor Trib Cross	402	25 Year Spill	0.16	238.45	238.59	238.59	238.64	0.034834	0.96	0.17	1.75	0.99
Bunkers	Minor Trib Cross	402	10 Year Spill	0.11	238.45	238.57	238.57	238.61	0.036822	0.87	0.13	1.60	0.99
Bunkers	Minor Trib Cross	372	100 Year Spill	0.23	237.63	237.82	237.77	237.85	0.007809	0.72	0.40	2.94	0.53
Bunkers	Minor Trib Cross	372	50 Year Spill	0.19	237.63	237.80	237.76	237.82	0.007935	0.67	0.34	2.73	0.53
Bunkers	Minor Trib Cross	372	25 Year Spill	0.16	237.63	237.79	237.74	237.81	0.008289	0.64	0.30	2.58	0.53
Bunkers	Minor Trib Cross	372	10 Year Spill	0.11	237.63	237.75	237.72	237.77	0.009300	0.58	0.22	2.31	0.54
Bunkers	Minor Trib Cross	352	100 Year Spill	0.23	237.43	237.60	237.57	237.63	0.015666	0.92	0.33	3.02	0.73
Bunkers	Minor Trib Cross	352	50 Year Spill	0.19	237.43	237.58	237.56	237.61	0.015358	0.85	0.29	2.91	0.72
Bunkers	Minor Trib Cross	352	25 Year Spill	0.16	237.43	237.57	237.55	237.60	0.014507	0.79	0.26	2.78	0.69
Bunkers	Minor Trib Cross	352	10 Year Spill	0.11	237.43	237.56	237.53	237.57	0.010748	0.63	0.22	2.62	0.58
Bunkers	Minor Trib Cross	332	100 Year Spill	0.23	237.12	237.28		237.32	0.015168	0.86	0.33	3.05	0.71
Bunkers	Minor Trib Cross	332	50 Year Spill	0.19	237.12	237.27		237.30	0.015268	0.80	0.29	2.93	0.70
Bunkers	Minor Trib Cross	332	25 Year Spill	0.16	237.12	237.25		237.28	0.017238	0.78	0.25	2.82	0.73
Bunkers	Minor Trib Cross	332	10 Year Spill	0.11	237.12	237.22	237.21	237.25	0.025688	0.77	0.16	2.48	0.85
Bunkers	Minor Trib Cross	312	100 Year Spill	0.23	236.99	237.16		237.17	0.003747	0.46	0.54	3.80	0.36
Bunkers	Minor Trib Cross	312	50 Year Spill	0.19	236.99	237.15		237.15	0.003701	0.42	0.48	3.70	0.35
Bunkers	Minor Trib Cross	312	25 Year Spill	0.16	236.99	237.14		237.14	0.003233	0.38	0.45	3.64	0.33
Bunkers	Minor Trib Cross	312	10 Year Spill	0.11	236.99	237.12		237.12	0.002690	0.31	0.37	3.53	0.29
Bunkers	Minor Trib Cross	292	100 Year Spill	0.23	236.96	237.08		237.09	0.004784	0.40	0.61	5.95	0.38
Bunkers	Minor Trib Cross	292	50 Year Spill	0.19	236.96	237.08		237.08	0.004026	0.35	0.57	5.90	0.35
Bunkers	Minor Trib Cross	292	25 Year Spill	0.16	236.96	237.06		237.07	0.004840	0.35	0.48	5.77	0.37
Bunkers	Minor Trib Cross	292	10 Year Spill	0.11	236.96	237.04		237.05	0.005225	0.31	0.37	5.58	0.37
Bunkers	Minor Trib Cross	272	100 Year Spill	0.23	236.65	236.88	236.88	236.92	0.015032	0.97	0.35	5.13	0.73
Bunkers	Minor Trib Cross	272	50 Year Spill	0.19	236.65	236.84	236.84	236.90	0.029568	1.14	0.20	2.18	0.98
Bunkers	Minor Trib Cross	272	25 Year Spill	0.16	236.65	236.83	236.83	236.88	0.025852	1.03	0.18	2.00	0.90
Bunkers	Minor Trib Cross	272	10 Year Spill	0.11	236.65	236.80	236.80	236.84	0.029003	0.93	0.13	1.64	0.92
Bunkers	Minor Trib Cross	252	100 Year Spill	0.23	236.45	236.84	236.64	236.84	0.000883	0.37	0.91	4.04	0.20
Bunkers	Minor Trib Cross	252	50 Year Spill	0.19	236.45	236.82	236.62	236.82	0.000780	0.33	0.83	3.90	0.18
Bunkers	Minor Trib Cross	252	25 Year Spill	0.16	236.45	236.79	236.60	236.80	0.000750	0.31	0.73	3.71	0.18
Bunkers	Minor Trib Cross	252	10 Year Spill	0.11	236.45	236.75	236.58	236.75	0.000651	0.26	0.58	3.36	0.16
Bunkers	Minor Trib Cross	232	100 Year Spill	0.23	236.35	236.83	236.49	236.84	0.000196	0.21	1.39	4.12	0.10
Bunkers	Minor Trib Cross	232	50 Year Spill	0.19	236.35	236.81	236.47	236.81	0.000159	0.18	1.31	4.03	0.09
Bunkers	Minor Trib Cross	232	25 Year Spill	0.16	236.35	236.79	236.46	236.79	0.000139	0.16	1.21	3.93	0.08
Bunkers	Minor Trib Cross	232	10 Year Spill	0.11	236.35	236.75	236.45	236.75	0.000098	0.13	1.05	3.74	0.07
Bunkers	Minor Trib Cross	212	100 Year Spill	0.23	236.21	236.83	236.32	236.83	0.000036	0.11	3.60	10.60	0.04
Bunkers	Minor Trib Cross	212	50 Year Spill	0.19	236.21	236.81	236.31	236.81	0.000029	0.10	3.38	10.46	0.04
Bunkers	Minor Trib Cross	212	25 Year Spill	0.16	236.21	236.79	236.30	236.79	0.000025	0.09	3.13	10.29	0.04
Bunkers	Minor Trib Cross	212	10 Year Spill	0.11	236.21	236.75	236.28	236.75	0.000017	0.07	2.70	9.91	0.03
Bunkers	Minor Trib Cross	192	100 Year Spill	0.23	236.19	236.83	236.29	236.83	0.000023	0.09	4.49	14.05	0.04
Bunkers	Minor Trib Cross	192	50 Year Spill	0.19	236.19	236.81	236.28	236.81	0.000018	0.08	4.20	13.78	0.03
Bunkers	Minor Trib Cross	192	25 Year Spill	0.16	236.19	236.79	236.27	236.79	0.000016	0.07	3.87	13.48	0.03
Bunkers	Minor Trib Cross	192	10 Year Spill	0.11	236.19	236.75	236.26	236.75	0.000010	0.05	3.32	12.25	0.02
Bunkers	Minor Trib Cross	172	100 Year Spill	0.23	236.18	236.83	236.25	236.83	0.000007	0.05	6.95	15.29	0.02
Bunkers	Minor Trib Cross	172	50 Year Spill	0.19	236.18	236.81	236.24	236.81	0.000006	0.04	6.63	15.09	0.02
Bunkers	Minor Trib Cross	172	25 Year Spill	0.16	236.18	236.79	236.24	236.79	0.000005	0.04	6.27	14.86	0.02
Bunkers	Minor Trib Cross	172	10 Year Spill	0.11	236.18	236.75	236.23	236.75	0.000003	0.03	5.65	14.43	0.01
Bunkers	Minor Trib Cross	152	100 Year Spill	0.23	236.06	236.83		236.83	0.000022	0.10	4.08	9.47	0.04

HEC-RAS Plan: FutSpill10-100 (Continued)

River	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)	
Bunkers	Minor Trib Cross	152	50 Year Spill	0.19	236.06	236.81		236.81	0.000017	0.08	3.89	9.12	0.03
Bunkers	Minor Trib Cross	152	25 Year Spill	0.16	236.06	236.79		236.79	0.000014	0.07	3.68	8.72	0.03
Bunkers	Minor Trib Cross	152	10 Year Spill	0.11	236.06	236.75		236.75	0.000008	0.06	3.32	7.99	0.02
Bunkers	North Trib-Cross	232	100 Year Spill	4.13	236.30	238.24	236.95	238.25	0.000252	0.61	9.11	15.44	0.14
Bunkers	North Trib-Cross	232	50 Year Spill	3.91	236.30	238.14	236.93	238.16	0.000271	0.61	8.62	14.63	0.14
Bunkers	North Trib-Cross	232	25 Year Spill	3.66	236.30	238.04	236.92	238.05	0.000293	0.61	8.08	13.87	0.15
Bunkers	North Trib-Cross	232	10 Year Spill	3.24	236.30	237.86	236.88	237.88	0.000341	0.61	7.15	12.51	0.16
Bunkers	North Trib-Cross	217		Culvert									
Bunkers	North Trib-Cross	175	100 Year Spill	4.13	235.98	236.80	236.80	237.03	0.015147	2.59	2.60	11.00	0.93
Bunkers	North Trib-Cross	175	50 Year Spill	3.91	235.98	236.78	236.78	237.01	0.015559	2.57	2.47	10.74	0.94
Bunkers	North Trib-Cross	175	25 Year Spill	3.66	235.98	236.76	236.76	236.98	0.015004	2.49	2.39	10.57	0.92
Bunkers	North Trib-Cross	175	10 Year Spill	3.24	235.98	236.72	236.72	236.92	0.014748	2.38	2.19	10.20	0.91
Bunkers	North Trib-Cross	167	100 Year Spill	4.13	235.97	236.81		236.82	0.001182	0.67	13.15	37.73	0.25
Bunkers	North Trib-Cross	167	50 Year Spill	3.91	235.97	236.79		236.80	0.001239	0.68	12.46	37.40	0.26
Bunkers	North Trib-Cross	167	25 Year Spill	3.66	235.97	236.77		236.78	0.001295	0.68	11.71	37.04	0.26
Bunkers	North Trib-Cross	167	10 Year Spill	3.24	235.97	236.73		236.74	0.001458	0.69	10.28	36.50	0.27
Bunkers	North Trib-DS	150	100 Year Spill	4.36	235.76	236.59	236.59	236.75	0.013782	2.38	3.57	10.01	0.88
Bunkers	North Trib-DS	150	50 Year Spill	4.10	235.76	236.57	236.57	236.73	0.013624	2.34	3.42	9.90	0.87
Bunkers	North Trib-DS	150	25 Year Spill	3.82	235.76	236.56	236.56	236.71	0.013391	2.28	3.25	9.75	0.86
Bunkers	North Trib-DS	150	10 Year Spill	3.35	235.76	236.52	236.52	236.67	0.013083	2.19	2.95	9.47	0.84
Bunkers	North Trib-DS	136	100 Year Spill	4.36	235.42	236.20	236.20	236.48	0.016369	2.47	2.20	4.42	0.95
Bunkers	North Trib-DS	136	50 Year Spill	4.10	235.42	236.18	236.18	236.45	0.016758	2.44	2.09	4.33	0.95
Bunkers	North Trib-DS	136	25 Year Spill	3.82	235.42	236.15	236.15	236.41	0.017123	2.39	1.96	4.22	0.95
Bunkers	North Trib-DS	136	10 Year Spill	3.35	235.42	236.10	236.10	236.34	0.017555	2.30	1.76	4.05	0.95
Bunkers	North Trib-DS	133	100 Year Spill	4.36	234.25	235.34	235.08	235.47	0.004978	1.79	3.58	4.80	0.56
Bunkers	North Trib-DS	133	50 Year Spill	4.10	234.25	235.29	235.06	235.42	0.005353	1.79	3.34	4.73	0.57
Bunkers	North Trib-DS	133	25 Year Spill	3.82	234.25	235.24	235.04	235.37	0.005822	1.80	3.07	4.67	0.59
Bunkers	North Trib-DS	133	10 Year Spill	3.35	234.25	235.14	234.90	235.27	0.006794	1.81	2.63	4.55	0.63
Bunkers	Spill to Storm-D	128	100 Year Spill	6.27	228.11	232.10		232.10	0.000008	0.17	75.71	44.43	0.03
Bunkers	Spill to Storm-D	128	50 Year Spill	6.20	228.11	232.04		232.04	0.000009	0.17	73.03	44.00	0.03
Bunkers	Spill to Storm-D	128	25 Year Spill	6.11	228.11	231.95		231.95	0.000009	0.18	69.25	43.41	0.03
Bunkers	Spill to Storm-D	128	10 Year Spill	6.00	228.11	231.85		231.85	0.000011	0.19	64.94	42.46	0.03
Bunkers	Spill to Storm-D	125	100 Year Spill	6.27	227.91	232.10	228.72	232.10	0.000013	0.22	54.93	31.80	0.04
Bunkers	Spill to Storm-D	125	50 Year Spill	6.20	227.91	232.04	228.71	232.04	0.000014	0.22	53.02	31.23	0.04
Bunkers	Spill to Storm-D	125	25 Year Spill	6.11	227.91	231.95	228.71	231.95	0.000015	0.23	50.35	30.45	0.04
Bunkers	Spill to Storm-D	125	10 Year Spill	6.00	227.91	231.85	228.70	231.85	0.000017	0.24	47.33	29.54	0.04
Bunkers	To Anne Street	508	100 Year Spill	5.70	236.65	238.23		238.25	0.000442	0.70	12.76	19.18	0.18
Bunkers	To Anne Street	508	50 Year Spill	4.67	236.65	238.14		238.16	0.000393	0.64	11.06	17.99	0.17
Bunkers	To Anne Street	508	25 Year Spill	3.72	236.65	238.04		238.06	0.000337	0.56	9.40	15.64	0.15
Bunkers	To Anne Street	508	10 Year Spill	2.42	236.65	237.87		237.88	0.000218	0.41	7.44	8.91	0.12
Bunkers	To Anne Street	492	100 Year Spill	5.70	236.69	238.22		238.24	0.000416	0.67	12.39	15.88	0.17
Bunkers	To Anne Street	492	50 Year Spill	4.67	236.69	238.13		238.15	0.000355	0.59	11.17	12.92	0.16
Bunkers	To Anne Street	492	25 Year Spill	3.72	236.69	238.03		238.04	0.000299	0.52	9.95	12.15	0.14
Bunkers	To Anne Street	492	10 Year Spill	2.42	236.69	237.87		237.88	0.000214	0.40	8.04	11.00	0.12
Bunkers	To Anne Street	463	100 Year Spill	5.70	236.79	238.21	237.31	238.22	0.000441	0.65	13.93	13.57	0.18
Bunkers	To Anne Street	463	50 Year Spill	4.67	236.79	238.12	237.26	238.13	0.000377	0.57	12.76	13.11	0.16
Bunkers	To Anne Street	463	25 Year Spill	3.72	236.79	238.03	237.21	238.03	0.000318	0.50	11.52	12.62	0.15
Bunkers	To Anne Street	463	10 Year Spill	2.42	236.79	237.86	237.14	237.87	0.000231	0.39	9.52	11.81	0.12
Bunkers	To Anne Street	442	100 Year Spill	5.70	237.01	238.12		238.20	0.003068	1.41	6.58	16.23	0.44
Bunkers	To Anne Street	442	50 Year Spill	4.67	237.01	238.04		238.11	0.002852	1.29	5.47	12.45	0.42
Bunkers	To Anne Street	442	25 Year Spill	3.72	237.01	237.97		238.02	0.002388	1.12	4.68	8.29	0.38
Bunkers	To Anne Street	442	10 Year Spill	2.42	237.01	237.82		237.86	0.001927	0.89	3.62	6.86	0.33
Bunkers	To Anne Street	426	100 Year Spill	5.70	237.04	238.10	237.70	238.15	0.002204	1.11	7.20	16.22	0.37
Bunkers	To Anne Street	426	50 Year Spill	4.67	237.04	238.02	237.63	238.07	0.002173	1.04	5.95	15.19	0.36
Bunkers	To Anne Street	426	25 Year Spill	3.72	237.04	237.94	237.56	237.98	0.001975	0.93	4.93	10.97	0.34
Bunkers	To Anne Street	426	10 Year Spill	2.42	237.04	237.80	237.47	237.82	0.001770	0.77	3.56	7.83	0.31
Bunkers	To Anne Street	406	100 Year Spill	5.70	237.12	238.05		238.10	0.002868	1.11	7.42	17.75	0.41
Bunkers	To Anne Street	406	50 Year Spill	4.67	237.12	237.96		238.01	0.003254	1.09	5.92	16.72	0.42
Bunkers	To Anne Street	406	25 Year Spill	3.72	237.12	237.88		237.93	0.003548	1.04	4.59	13.97	0.43
Bunkers	To Anne Street	406	10 Year Spill	2.42	237.12	237.71		237.77	0.005234	1.02	2.58	11.21	0.50
Bunkers	To Anne Street	386	100 Year Spill	5.70	236.98	237.99	237.70	238.04	0.002740	1.25	7.71	17.59	0.41
Bunkers	To Anne Street	386	50 Year Spill	4.67	236.98	237.90	237.63	237.95	0.002812	1.18	6.28	15.03	0.41
Bunkers	To Anne Street	386	25 Year Spill	3.72	236.98	237.81	237.56	237.86	0.002799	1.10	5.09	13.21	0.40
Bunkers	To Anne Street	386	10 Year Spill	2.42	236.98	237.63	237.41	237.68	0.003750	1.07	2.99	9.54	0.44
Bunkers	To Anne Street	366	100 Year Spill	5.70	236.78	237.69	237.69	237.93	0.012217	2.39	3.66	10.04	0.84
Bunkers	To Anne Street	366	50 Year Spill	4.67	236.78	237.61	237.61	237.83	0.012741	2.28	2.93	8.29	0.84
Bunkers	To Anne Street	366	25 Year Spill	3.72	236.78	237.45	237.45	237.72	0.019733	2.43	1.91	4.96	1.01
Bunkers	To Anne Street	366	10 Year Spill	2.42	236.78	237.36	237.33	237.54	0.015372	1.92	1.50	4.24	0.87
Bunkers	To Anne Street	346	100 Year Spill	5.70	236.63	237.39		237.51	0.008559	1.71	4.59	11.43	0.68
Bunkers	To Anne Street	346	50 Year Spill	4.67	236.63	237.29		237.42	0.010805	1.72	3.55	10.00	0.75
Bunkers	To Anne Street	346	25 Year Spill	3.72	236.63	237.20	237.16	237.33	0.013230	1.70	2.74	8.93	0.80
Bunkers	To Anne Street	346	10 Year Spill	2.42	236.63	237.09	237.08	237.21	0.017121	1.59	1.77	7.51	0.87

HEC-RAS Plan: FutSpill10-100 (Continued)

River	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)	
Bunkers	To Anne Street	326	100 Year Spill	5.70	236.26	237.19		237.35	0.007576	1.90	4.08	7.69	0.67
Bunkers	To Anne Street	326	50 Year Spill	4.67	236.26	237.11		237.24	0.007403	1.76	3.49	6.68	0.65
Bunkers	To Anne Street	326	25 Year Spill	3.72	236.26	237.01		237.13	0.007911	1.65	2.86	6.21	0.65
Bunkers	To Anne Street	326	10 Year Spill	2.42	236.26	236.87		236.97	0.008503	1.45	2.02	5.54	0.65
Bunkers	To Anne Street	306	100 Year Spill	5.70	236.08	237.07		237.21	0.005827	1.79	4.35	8.75	0.59
Bunkers	To Anne Street	306	50 Year Spill	4.67	236.08	236.99		237.11	0.005572	1.64	3.69	7.53	0.57
Bunkers	To Anne Street	306	25 Year Spill	3.72	236.08	236.89		237.00	0.005646	1.52	3.02	6.21	0.56
Bunkers	To Anne Street	306	10 Year Spill	2.42	236.08	236.77		236.84	0.004655	1.22	2.31	5.07	0.50
Bunkers	To Anne Street	286	100 Year Spill	5.70	235.95	237.03		237.11	0.003340	1.38	5.84	15.12	0.45
Bunkers	To Anne Street	286	50 Year Spill	4.67	235.95	236.94		237.02	0.003214	1.27	4.88	9.54	0.44
Bunkers	To Anne Street	286	25 Year Spill	3.72	235.95	236.84		236.90	0.003312	1.18	3.96	7.80	0.43
Bunkers	To Anne Street	286	10 Year Spill	2.42	235.95	236.72		236.76	0.002663	0.94	3.08	6.93	0.38
Bunkers	To Anne Street	266	100 Year Spill	5.70	236.11	236.98	236.72	237.04	0.003408	1.24	7.35	20.44	0.45
Bunkers	To Anne Street	266	50 Year Spill	4.67	236.11	236.88	236.66	236.94	0.003729	1.20	5.61	15.18	0.46
Bunkers	To Anne Street	266	25 Year Spill	3.72	236.11	236.75	236.60	236.82	0.005482	1.26	3.95	10.97	0.54
Bunkers	To Anne Street	266	10 Year Spill	2.42	236.11	236.50	236.50	236.63	0.021007	1.67	1.66	7.28	0.95
Bunkers	To Anne Street	265		Lat Struct									
Bunkers	To Anne Street	248	100 Year Spill	4.14	235.36	236.97	236.08	236.98	0.000348	0.59	10.72	37.23	0.16
Bunkers	To Anne Street	248	50 Year Spill	3.94	235.36	236.87	236.06	236.89	0.000414	0.62	9.71	36.95	0.17
Bunkers	To Anne Street	248	25 Year Spill	3.61	235.36	236.73	236.02	236.75	0.000546	0.66	8.22	36.51	0.19
Bunkers	To Anne Street	248	10 Year Spill	2.42	235.36	236.28	235.91	236.31	0.001803	0.88	3.77	9.68	0.32
Bunkers	To Anne Street	230		Culvert									
Bunkers	To Anne Street	220	100 Year Spill	4.14	234.41	235.31	235.10	235.40	0.004804	1.50	4.28	25.55	0.53
Bunkers	To Anne Street	220	50 Year Spill	3.94	234.41	235.31	235.07	235.39	0.004303	1.42	4.30	25.57	0.50
Bunkers	To Anne Street	220	25 Year Spill	3.61	234.41	235.06	235.05	235.27	0.015589	2.13	2.13	13.38	0.89
Bunkers	To Anne Street	220	10 Year Spill	2.42	234.41	235.12	234.93	235.19	0.004900	1.27	2.53	15.33	0.51
Bunkers	To Anne Street	200	100 Year Spill	13.37	233.72	235.03	235.03	235.23	0.007680	2.30	11.03	31.35	0.69
Bunkers	To Anne Street	200	50 Year Spill	11.90	233.72	234.94	234.94	235.18	0.009428	2.42	8.54	24.41	0.76
Bunkers	To Anne Street	200	25 Year Spill	10.08	233.72	234.90	234.90	235.11	0.008713	2.25	7.41	21.89	0.72
Bunkers	To Anne Street	200	10 Year Spill	7.25	233.72	234.75	234.65	234.97	0.009815	2.15	4.63	17.63	0.75
Bunkers	To Anne Street	180	100 Year Spill	13.37	233.42	234.88	234.88	235.04	0.006279	2.36	13.84	39.32	0.65
Bunkers	To Anne Street	180	50 Year Spill	11.90	233.42	234.80	234.80	235.00	0.007247	2.45	11.10	33.19	0.69
Bunkers	To Anne Street	180	25 Year Spill	10.08	233.42	234.77	234.77	234.94	0.006284	2.24	10.07	30.90	0.64
Bunkers	To Anne Street	180	10 Year Spill	7.25	233.42	234.46	234.40	234.81	0.014528	2.82	3.77	9.23	0.93
Bunkers	To Anne Street	160	100 Year Spill	13.37	233.12	234.59	234.59	234.75	0.006963	2.47	14.09	37.76	0.67
Bunkers	To Anne Street	160	50 Year Spill	11.90	233.12	234.56	234.56	234.72	0.006905	2.41	12.73	36.90	0.67
Bunkers	To Anne Street	160	25 Year Spill	10.08	233.12	234.52	234.52	234.67	0.006458	2.29	11.21	35.46	0.64
Bunkers	To Anne Street	160	10 Year Spill	7.25	233.12	234.34	234.34	234.55	0.008492	2.38	6.31	21.31	0.72
Bunkers	To Anne Street	140	100 Year Spill	13.37	232.77	234.10	234.10	234.30	0.008319	2.57	12.12	32.31	0.74
Bunkers	To Anne Street	140	50 Year Spill	11.90	232.77	234.03	234.03	234.24	0.008857	2.56	10.11	26.70	0.76
Bunkers	To Anne Street	140	25 Year Spill	10.08	232.77	233.99	233.99	234.18	0.008097	2.39	9.02	25.23	0.72
Bunkers	To Anne Street	140	10 Year Spill	7.25	232.77	233.85	233.85	234.05	0.008648	2.26	5.86	19.93	0.73
Bunkers	To Anne Street	120	100 Year Spill	13.37	232.09	233.55		233.61	0.002513	1.54	16.61	20.83	0.41
Bunkers	To Anne Street	120	50 Year Spill	11.90	232.09	233.46		233.51	0.002496	1.47	14.74	17.42	0.41
Bunkers	To Anne Street	120	25 Year Spill	10.08	232.09	233.37		233.42	0.002358	1.36	13.27	16.51	0.39
Bunkers	To Anne Street	120	10 Year Spill	7.25	232.09	233.17		233.22	0.002579	1.27	10.15	15.18	0.40
Bunkers	To Anne Street	100	100 Year Spill	13.37	231.65	233.26	233.13	233.51	0.008744	2.85	9.52	16.86	0.75
Bunkers	To Anne Street	100	50 Year Spill	11.90	231.65	233.25		233.43	0.006210	2.39	9.43	14.52	0.63
Bunkers	To Anne Street	100	25 Year Spill	10.08	231.65	233.20	232.89	233.34	0.005305	2.16	8.66	13.55	0.58
Bunkers	To Anne Street	100	10 Year Spill	7.25	231.65	233.00		233.13	0.005786	2.03	6.16	10.87	0.59
Bunkers	To Anne Street	80	100 Year Spill	13.37	231.52	233.09	233.09	233.34	0.008213	2.81	10.35	22.27	0.74
Bunkers	To Anne Street	80	50 Year Spill	11.90	231.52	233.02	233.02	233.28	0.008615	2.79	8.86	19.47	0.75
Bunkers	To Anne Street	80	25 Year Spill	10.08	231.52	232.81	232.81	233.16	0.013414	3.12	5.62	10.83	0.91
Bunkers	To Anne Street	80	10 Year Spill	7.25	231.52	232.69	232.69	232.96	0.011302	2.67	4.44	9.13	0.82
Bunkers	To Anne Street	49	100 Year Spill	13.37	230.96	232.65		232.74	0.003461	1.99	14.78	20.77	0.49
Bunkers	To Anne Street	49	50 Year Spill	11.90	230.96	232.58		232.67	0.003456	1.94	13.41	19.91	0.49
Bunkers	To Anne Street	49	25 Year Spill	10.08	230.96	232.51		232.59	0.003204	1.81	12.00	18.81	0.47
Bunkers	To Anne Street	49	10 Year Spill	7.25	230.96	232.36		232.43	0.003031	1.64	9.29	16.62	0.45
Bunkers	To Anne Street	20	100 Year Spill	13.37	230.66	232.61		232.66	0.001793	1.51	20.20	26.57	0.35
Bunkers	To Anne Street	20	50 Year Spill	11.90	230.66	232.55		232.59	0.001736	1.45	18.56	23.30	0.34
Bunkers	To Anne Street	20	25 Year Spill	10.08	230.66	232.48		232.52	0.001552	1.33	17.00	22.39	0.32
Bunkers	To Anne Street	20	10 Year Spill	7.25	230.66	232.33		232.36	0.001322	1.16	13.83	20.18	0.29
Bunkers	To Anne Street	15		Lat Struct									
Bunkers	To Anne Street	0	100 Year Spill	4.17	230.61	232.61	231.45	232.63	0.000382	0.76	12.42	21.24	0.17
Bunkers	To Anne Street	0	50 Year Spill	4.06	230.61	232.54	231.44	232.56	0.000432	0.79	11.05	17.55	0.18
Bunkers	To Anne Street	0	25 Year Spill	3.94	230.61	232.47	231.42	232.49	0.000476	0.81	9.92	13.76	0.19
Bunkers	To Anne Street	0	10 Year Spill	3.68	230.61	232.32	231.39	232.34	0.000540	0.81	8.26	8.97	0.20

HEC-RAS Plan: Ex<10yrSpill

River	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)	
Bunkers	North Trib	362	5 Year Spill	3.64	238.13	239.01	239.01	239.16	0.011848	2.22	3.41	11.60	0.80
Bunkers	North Trib	362	2 Year Spill	2.31	238.13	238.84	238.84	239.03	0.017349	2.28	1.73	7.41	0.93
Bunkers	North Trib	344	5 Year Spill	3.64	237.75	238.62	238.62	238.80	0.013005	2.16	2.66	8.04	0.82
Bunkers	North Trib	344	2 Year Spill	2.31	237.75	238.47	238.47	238.65	0.014732	1.97	1.61	6.13	0.84
Bunkers	North Trib	313	5 Year Spill	3.64	237.30	238.08	238.04	238.26	0.010938	2.04	2.52	7.16	0.77
Bunkers	North Trib	313	2 Year Spill	2.31	237.30	237.98		238.10	0.008039	1.58	1.89	5.80	0.64
Bunkers	North Trib	287	5 Year Spill	3.64	236.83	237.85	237.85	237.99	0.008996	2.19	3.95	14.14	0.72
Bunkers	North Trib	287	2 Year Spill	2.31	236.83	237.69	237.69	237.85	0.011104	2.14	2.13	7.87	0.77
Bunkers	North Trib	260	5 Year Spill	3.64	236.55	237.65		237.67	0.002119	0.98	7.73	24.63	0.33
Bunkers	North Trib	260	2 Year Spill	2.31	236.55	237.40	237.25	237.48	0.006285	1.36	2.43	11.01	0.54
Bunkers	North Trib	245	5 Year Spill	3.64	236.35	237.65		237.66	0.000264	0.45	14.74	20.49	0.13
Bunkers	North Trib	245	2 Year Spill	2.31	236.35	237.44		237.44	0.000260	0.39	10.61	18.62	0.13
Bunkers	Minor Trib Cross	581	5 Year Spill	0.06	245.18	245.22		245.23	0.031949	0.44	0.14	4.34	0.80
Bunkers	Minor Trib Cross	581	2 Year Spill	0.03	245.18	245.22		245.22	0.022918	0.31	0.10	4.00	0.65
Bunkers	Minor Trib Cross	560	5 Year Spill	0.06	244.54	244.60	244.59	244.61	0.028917	0.48	0.12	3.22	0.79
Bunkers	Minor Trib Cross	560	2 Year Spill	0.03	244.54	244.58	244.57	244.59	0.043425	0.45	0.07	2.59	0.90
Bunkers	Minor Trib Cross	539	5 Year Spill	0.06	243.87	243.95	243.95	243.97	0.032298	0.61	0.10	1.95	0.87
Bunkers	Minor Trib Cross	539	2 Year Spill	0.03	243.87	243.94	243.93	243.95	0.022947	0.44	0.07	1.68	0.71
Bunkers	Minor Trib Cross	518	5 Year Spill	0.06	243.23	243.30	243.30	243.32	0.030470	0.63	0.10	1.72	0.86
Bunkers	Minor Trib Cross	518	2 Year Spill	0.03	243.23	243.27	243.27	243.29	0.045436	0.57	0.05	1.51	0.97
Bunkers	Minor Trib Cross	497	5 Year Spill	0.06	242.29	242.35	242.35	242.37	0.043433	0.65	0.10	2.38	0.99
Bunkers	Minor Trib Cross	497	2 Year Spill	0.03	242.29	242.33	242.32	242.34	0.045822	0.52	0.06	2.14	0.95
Bunkers	Minor Trib Cross	476	5 Year Spill	0.06	241.18	241.26	241.26	241.29	0.062408	0.81	0.07	1.59	1.19
Bunkers	Minor Trib Cross	476	2 Year Spill	0.03	241.18	241.24	241.24	241.26	0.058458	0.62	0.05	1.45	1.09
Bunkers	Minor Trib Cross	465	5 Year Spill	0.06	240.27	240.36	240.36	240.39	0.038656	0.79	0.08	1.21	0.98
Bunkers	Minor Trib Cross	465	2 Year Spill	0.03	240.27	240.33	240.33	240.35	0.047761	0.65	0.05	1.12	1.01
Bunkers	Minor Trib Cross	448		Culvert									
Bunkers	Minor Trib Cross	402	5 Year Spill	0.06	238.45	238.54	238.54	238.57	0.034583	0.71	0.08	1.41	0.92
Bunkers	Minor Trib Cross	402	2 Year Spill	0.03	238.45	238.51	238.51	238.53	0.054311	0.66	0.05	1.19	1.07
Bunkers	Minor Trib Cross	372	5 Year Spill	0.06	237.63	237.72	237.69	237.73	0.008947	0.45	0.15	2.06	0.50
Bunkers	Minor Trib Cross	372	2 Year Spill	0.03	237.63	237.69	237.67	237.69	0.013542	0.39	0.08	1.79	0.56
Bunkers	Minor Trib Cross	352	5 Year Spill	0.06	237.43	237.53	237.50	237.54	0.009717	0.49	0.15	2.22	0.52
Bunkers	Minor Trib Cross	352	2 Year Spill	0.03	237.43	237.50	237.48	237.51	0.007428	0.35	0.10	1.91	0.44
Bunkers	Minor Trib Cross	332	5 Year Spill	0.06	237.12	237.19	237.19	237.22	0.029155	0.64	0.10	2.11	0.85
Bunkers	Minor Trib Cross	332	2 Year Spill	0.03	237.12	237.17	237.17	237.19	0.057791	0.60	0.05	1.69	1.08
Bunkers	Minor Trib Cross	312	5 Year Spill	0.06	236.99	237.08		237.09	0.002493	0.24	0.26	3.34	0.26
Bunkers	Minor Trib Cross	312	2 Year Spill	0.03	236.99	237.06		237.06	0.001549	0.16	0.19	3.23	0.20
Bunkers	Minor Trib Cross	292	5 Year Spill	0.06	236.96	237.02		237.02	0.005447	0.25	0.25	5.33	0.36
Bunkers	Minor Trib Cross	292	2 Year Spill	0.03	236.96	237.00		237.00	0.005604	0.19	0.16	5.10	0.34
Bunkers	Minor Trib Cross	272	5 Year Spill	0.06	236.65	236.76	236.76	236.80	0.039445	0.80	0.08	1.27	1.00
Bunkers	Minor Trib Cross	272	2 Year Spill	0.03	236.65	236.74	236.74	236.76	0.045817	0.67	0.04	0.99	1.01
Bunkers	Minor Trib Cross	252	5 Year Spill	0.06	236.45	236.68	236.55	236.68	0.000683	0.21	0.35	2.74	0.16
Bunkers	Minor Trib Cross	252	2 Year Spill	0.03	236.45	236.61	236.52	236.61	0.000841	0.18	0.19	2.13	0.16
Bunkers	Minor Trib Cross	232	5 Year Spill	0.06	236.35	236.67	236.42	236.67	0.000064	0.09	0.79	3.40	0.05
Bunkers	Minor Trib Cross	232	2 Year Spill	0.03	236.35	236.61	236.40	236.61	0.000039	0.06	0.58	3.07	0.04
Bunkers	Minor Trib Cross	212	5 Year Spill	0.06	236.21	236.67	236.26	236.67	0.000009	0.04	2.01	8.66	0.02
Bunkers	Minor Trib Cross	212	2 Year Spill	0.03	236.21	236.61	236.25	236.61	0.000004	0.03	1.55	6.06	0.01
Bunkers	Minor Trib Cross	192	5 Year Spill	0.06	236.19	236.67	236.24	236.67	0.000006	0.04	2.47	11.00	0.02
Bunkers	Minor Trib Cross	192	2 Year Spill	0.03	236.19	236.61	236.22	236.61	0.000003	0.02	1.83	8.05	0.01
Bunkers	Minor Trib Cross	172	5 Year Spill	0.06	236.18	236.67	236.21	236.67	0.000002	0.02	4.63	13.67	0.01
Bunkers	Minor Trib Cross	172	2 Year Spill	0.03	236.18	236.61	236.20	236.61	0.000001	0.01	3.76	12.89	0.01
Bunkers	Minor Trib Cross	152	5 Year Spill	0.06	236.06	236.67		236.67	0.000004	0.03	2.78	7.05	0.01
Bunkers	Minor Trib Cross	152	2 Year Spill	0.03	236.06	236.61		236.61	0.000001	0.02	2.33	6.66	0.01
Bunkers	North Trib-Cross	232	5 Year Spill	2.56	236.30	237.63	236.82	237.65	0.000383	0.58	5.96	11.18	0.16
Bunkers	North Trib-Cross	232	2 Year Spill	1.98	236.30	237.42	236.72	237.43	0.000440	0.55	4.86	9.88	0.17
Bunkers	North Trib-Cross	217		Culvert									
Bunkers	North Trib-Cross	175	5 Year Spill	2.56	235.98	236.66	236.62	236.83	0.013725	2.16	1.88	8.47	0.86
Bunkers	North Trib-Cross	175	2 Year Spill	1.98	235.98	236.62	236.55	236.74	0.010808	1.83	1.66	6.03	0.75
Bunkers	North Trib-Cross	167	5 Year Spill	2.56	235.97	236.67		236.68	0.001717	0.70	8.01	32.26	0.29
Bunkers	North Trib-Cross	167	2 Year Spill	1.98	235.97	236.61		236.62	0.001985	0.70	6.22	30.71	0.31

HEC-RAS Plan: Ex<10yrSpill (Continued)

River	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)	
Bunkers	North Trib-DS	150	5 Year Spill	2.62	235.76	236.45	236.45	236.60	0.013980	2.10	2.30	8.50	0.85
Bunkers	North Trib-DS	150	2 Year Spill	2.06	235.76	236.37	236.37	236.53	0.016584	2.09	1.67	7.21	0.91
Bunkers	North Trib-DS	136	5 Year Spill	2.62	235.42	236.02	236.02	236.23	0.018744	2.14	1.43	3.78	0.96
Bunkers	North Trib-DS	136	2 Year Spill	2.06	235.42	235.95	235.95	236.14	0.019053	1.97	1.20	3.54	0.95
Bunkers	North Trib-DS	133	5 Year Spill	2.62	234.25	234.98	234.88	235.13	0.009730	1.88	1.90	4.29	0.72
Bunkers	North Trib-DS	133	2 Year Spill	2.06	234.25	234.83	234.80	235.00	0.013993	1.93	1.37	3.53	0.84
Bunkers	To Anne Street	508	5 Year Spill	1.08	236.65	237.64		237.64	0.000096	0.24	5.50	7.66	0.08
Bunkers	To Anne Street	508	2 Year Spill	0.33	236.65	237.43		237.43	0.000021	0.09	3.99	6.68	0.03
Bunkers	To Anne Street	492	5 Year Spill	1.08	236.69	237.64		237.64	0.000096	0.23	5.76	8.53	0.08
Bunkers	To Anne Street	492	2 Year Spill	0.33	236.69	237.43		237.43	0.000022	0.09	4.13	7.34	0.04
Bunkers	To Anne Street	463	5 Year Spill	1.08	236.79	237.63	237.03	237.64	0.000115	0.23	6.93	10.88	0.08
Bunkers	To Anne Street	463	2 Year Spill	0.33	236.79	237.43	236.94	237.43	0.000032	0.10	4.76	10.09	0.04
Bunkers	To Anne Street	442	5 Year Spill	1.08	237.01	237.61		237.63	0.001313	0.59	2.29	5.97	0.26
Bunkers	To Anne Street	442	2 Year Spill	0.33	237.01	237.42		237.43	0.000634	0.31	1.23	4.91	0.17
Bunkers	To Anne Street	426	5 Year Spill	1.08	237.04	237.59	237.32	237.61	0.001344	0.52	2.18	6.07	0.25
Bunkers	To Anne Street	426	2 Year Spill	0.33	237.04	237.41	237.20	237.42	0.000811	0.28	1.18	4.85	0.18
Bunkers	To Anne Street	406	5 Year Spill	1.08	237.12	237.52		237.55	0.008331	0.86	1.26	5.53	0.57
Bunkers	To Anne Street	406	2 Year Spill	0.33	237.12	237.35		237.37	0.010676	0.67	0.49	3.64	0.59
Bunkers	To Anne Street	386	5 Year Spill	1.08	236.98	237.40	237.26	237.43	0.004687	0.86	1.36	4.82	0.45
Bunkers	To Anne Street	386	2 Year Spill	0.33	236.98	237.20	237.12	237.22	0.005646	0.57	0.57	3.34	0.44
Bunkers	To Anne Street	366	5 Year Spill	1.08	236.78	237.22		237.30	0.009667	1.23	0.97	3.45	0.65
Bunkers	To Anne Street	366	2 Year Spill	0.33	236.78	237.05		237.08	0.008953	0.76	0.44	2.55	0.56
Bunkers	To Anne Street	346	5 Year Spill	1.08	236.63	236.95	236.93	237.03	0.020891	1.25	0.88	5.29	0.88
Bunkers	To Anne Street	346	2 Year Spill	0.33	236.63	236.85		236.88	0.012446	0.71	0.46	3.61	0.63
Bunkers	To Anne Street	326	5 Year Spill	1.08	236.26	236.66		236.73	0.011247	1.18	0.99	4.24	0.69
Bunkers	To Anne Street	326	2 Year Spill	0.33	236.26	236.47	236.46	236.52	0.027554	1.01	0.32	2.67	0.92
Bunkers	To Anne Street	306	5 Year Spill	1.08	236.08	236.57		236.61	0.003459	0.82	1.43	4.16	0.40
Bunkers	To Anne Street	306	2 Year Spill	0.33	236.08	236.38		236.39	0.002482	0.47	0.71	3.34	0.31
Bunkers	To Anne Street	286	5 Year Spill	1.08	235.95	236.54		236.56	0.001763	0.62	1.94	5.59	0.29
Bunkers	To Anne Street	286	2 Year Spill	0.33	235.95	236.36		236.37	0.000843	0.31	1.08	4.05	0.19
Bunkers	To Anne Street	266	5 Year Spill	1.08	236.11	236.37	236.37	236.46	0.027652	1.34	0.83	5.40	1.00
Bunkers	To Anne Street	266	2 Year Spill	0.33	236.11	236.27	236.27	236.31	0.033088	0.93	0.35	3.84	0.97
Bunkers	To Anne Street	248	5 Year Spill	1.08	235.36	235.74	235.74	235.85	0.025202	1.50	0.72	3.25	0.98
Bunkers	To Anne Street	248	2 Year Spill	0.33	235.36	235.58	235.58	235.65	0.033023	1.14	0.29	2.25	1.01
Bunkers	To Anne Street	230		Culvert									
Bunkers	To Anne Street	220	5 Year Spill	1.08	234.41	234.93	234.75	234.97	0.003455	0.85	1.46	11.31	0.40
Bunkers	To Anne Street	220	2 Year Spill	0.33	234.41	234.73	234.59	234.74	0.002743	0.50	0.67	8.58	0.32
Bunkers	To Anne Street	200	5 Year Spill	4.22	233.72	234.43	234.42	234.66	0.018481	2.15	2.08	4.99	0.95
Bunkers	To Anne Street	200	2 Year Spill	2.19	233.72	234.24	234.24	234.40	0.023545	1.79	1.23	3.95	0.99
Bunkers	To Anne Street	180	5 Year Spill	4.22	233.42	234.34		234.50	0.007930	1.89	2.93	5.66	0.67
Bunkers	To Anne Street	180	2 Year Spill	2.19	233.42	234.09		234.20	0.008302	1.52	1.72	4.28	0.64
Bunkers	To Anne Street	160	5 Year Spill	4.22	233.12	234.01	234.01	234.28	0.014272	2.44	2.24	4.69	0.88
Bunkers	To Anne Street	160	2 Year Spill	2.19	233.12	233.73	233.73	233.94	0.019410	2.12	1.17	3.08	0.95
Bunkers	To Anne Street	140	5 Year Spill	4.22	232.77	233.53	233.53	233.77	0.015171	2.31	2.37	5.61	0.90
Bunkers	To Anne Street	140	2 Year Spill	2.19	232.77	233.31	233.31	233.50	0.019120	1.97	1.27	4.02	0.95
Bunkers	To Anne Street	120	5 Year Spill	4.22	232.09	232.89		232.94	0.003722	1.23	6.07	13.75	0.45
Bunkers	To Anne Street	120	2 Year Spill	2.19	232.09	232.63		232.70	0.008725	1.41	2.63	12.42	0.65
Bunkers	To Anne Street	100	5 Year Spill	4.22	231.65	232.74	232.55	232.84	0.005280	1.66	3.98	7.07	0.54
Bunkers	To Anne Street	100	2 Year Spill	2.19	231.65	232.48	232.36	232.56	0.006047	1.42	2.23	6.08	0.55
Bunkers	To Anne Street	80	5 Year Spill	4.22	231.52	232.43	232.43	232.68	0.012409	2.34	2.52	6.30	0.82
Bunkers	To Anne Street	80	2 Year Spill	2.19	231.52	232.14	232.14	232.35	0.018686	2.12	1.18	3.20	0.94
Bunkers	To Anne Street	49	5 Year Spill	4.22	230.96	232.10		232.18	0.003220	1.47	5.57	12.45	0.45
Bunkers	To Anne Street	49	2 Year Spill	2.19	230.96	231.77		231.86	0.005090	1.46	2.26	6.45	0.53
Bunkers	To Anne Street	20	5 Year Spill	4.22	230.66	232.09		232.11	0.001117	0.96	9.38	16.64	0.26
Bunkers	To Anne Street	20	2 Year Spill	2.19	230.66	231.72		231.76	0.001813	0.99	4.09	12.28	0.32
Bunkers	To Anne Street	15		Lat Struct									
Bunkers	To Anne Street	0	5 Year Spill	3.17	230.61	232.06	231.33	232.09	0.000825	0.90	6.12	7.69	0.24
Bunkers	To Anne Street	0	2 Year Spill	2.19	230.61	231.69	231.18	231.73	0.001415	0.96	3.60	5.90	0.30
Bunkers	Spill to Storm	294	5 Year Spill	0.00	231.57	231.78		231.78	0.000000	0.00	0.99	8.20	0.00

HEC-RAS Plan: Ex<10yrSpill (Continued)

River	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)	
Bunkers	Spill to Storm	294	2 Year Spill	0.00	231.57	231.59	231.59	231.59	0.000953	0.05	0.02	1.45	0.12
Bunkers	Spill to Storm	273	5 Year Spill	1.05	231.43	231.73	231.62	231.74	0.003383	0.63	2.52	14.45	0.38
Bunkers	Spill to Storm	273	2 Year Spill	0.00	231.43	231.44	231.44	231.44	0.001385	0.04	0.02	2.48	0.14
Bunkers	Spill to Storm	252	5 Year Spill	1.05	231.34	231.62	231.58	231.64	0.008250	0.89	1.95	12.92	0.57
Bunkers	Spill to Storm	252	2 Year Spill	0.00	231.34	231.35	231.35	231.35	0.105983	0.27	0.00	0.62	1.11
Bunkers	Spill to Storm	231	5 Year Spill	1.05	231.07	231.29	231.29	231.36	0.024174	1.30	1.04	7.87	0.94
Bunkers	Spill to Storm	231	2 Year Spill	0.00	231.07	231.09	231.09	231.09	0.000428	0.03	0.04	2.64	0.08
Bunkers	Spill to Storm	210	5 Year Spill	1.05	230.89	231.21		231.22	0.002195	0.53	2.59	13.11	0.31
Bunkers	Spill to Storm	210	2 Year Spill	0.00	230.89	231.06		231.06	0.000000	0.00	1.11	8.24	0.00
Bunkers	Spill to Storm	189	5 Year Spill	1.05	230.57	231.20		231.20	0.000310	0.32	5.31	14.66	0.13
Bunkers	Spill to Storm	189	2 Year Spill	0.00	230.57	231.06		231.06	0.000000	0.00	3.46	12.11	0.00
Bunkers	Spill to Storm	168	5 Year Spill	1.05	230.04	231.20		231.20	0.000054	0.18	10.72	18.27	0.06
Bunkers	Spill to Storm	168	2 Year Spill	0.00	230.04	231.06		231.06	0.000000	0.00	8.34	16.58	0.00
Bunkers	Spill to Storm	147	5 Year Spill	5.11	230.76	231.07	231.07	231.17	0.022233	1.46	4.17	20.80	0.94
Bunkers	Spill to Storm	147	2 Year Spill	2.50	230.76	230.98	230.98	231.05	0.026923	1.19	2.40	18.74	0.96
Bunkers	Spill to Storm	128	5 Year Spill	5.11	228.11	231.05		231.05	0.000031	0.27	34.39	31.74	0.05
Bunkers	Spill to Storm	128	2 Year Spill	2.50	228.11	229.40		229.40	0.000207	0.39	7.60	7.90	0.11
Bunkers	Spill to Storm	125	5 Year Spill	5.11	227.91	231.04	228.64	231.05	0.000042	0.32	26.48	21.99	0.06
Bunkers	Spill to Storm	125	2 Year Spill	2.50	227.91	229.39	228.41	229.40	0.000245	0.44	6.38	6.40	0.12

HEC-RAS Plan: FutSpill<10

River	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)	
Bunkers	North Trib	362	5 Year Spill	4.37	238.13	239.05	239.05	239.21	0.012783	2.38	3.89	12.25	0.84
Bunkers	North Trib	362	2 Year Spill	2.77	238.13	238.95	238.95	239.08	0.010844	2.01	2.76	10.73	0.76
Bunkers	North Trib	344	5 Year Spill	4.37	237.75	238.71	238.71	238.87	0.010073	2.07	3.73	16.76	0.74
Bunkers	North Trib	344	2 Year Spill	2.77	237.75	238.55	238.55	238.71	0.012292	1.96	2.12	7.41	0.78
Bunkers	North Trib	313	5 Year Spill	4.37	237.30	238.13	238.11	238.34	0.011886	2.22	2.89	7.98	0.81
Bunkers	North Trib	313	2 Year Spill	2.77	237.30	238.01	237.94	238.15	0.009769	1.80	2.05	6.13	0.71
Bunkers	North Trib	287	5 Year Spill	4.37	236.83	237.89	237.89	238.04	0.009948	2.36	4.46	14.75	0.76
Bunkers	North Trib	287	2 Year Spill	2.77	236.83	237.76	237.76	237.90	0.009273	2.08	2.86	10.95	0.72
Bunkers	North Trib	260	5 Year Spill	4.37	236.55	237.74		237.76	0.001564	0.90	10.14	25.83	0.29
Bunkers	North Trib	260	2 Year Spill	2.77	236.55	237.49		237.55	0.004561	1.27	4.07	22.31	0.47
Bunkers	North Trib	245	5 Year Spill	4.37	236.35	237.74		237.75	0.000274	0.48	16.64	21.33	0.14
Bunkers	North Trib	245	2 Year Spill	2.77	236.35	237.52		237.52	0.000260	0.41	12.12	19.26	0.13
Bunkers	Minor Trib Cross	581	5 Year Spill	0.07	245.18	245.22	245.22	245.24	0.044857	0.52	0.13	4.34	0.95
Bunkers	Minor Trib Cross	581	2 Year Spill	0.04	245.18	245.22		245.23	0.023821	0.35	0.11	4.19	0.68
Bunkers	Minor Trib Cross	560	5 Year Spill	0.07	244.54	244.60	244.60	244.62	0.021276	0.46	0.15	3.44	0.69
Bunkers	Minor Trib Cross	560	2 Year Spill	0.04	244.54	244.58	244.58	244.59	0.038441	0.47	0.08	2.80	0.87
Bunkers	Minor Trib Cross	539	5 Year Spill	0.07	243.87	243.96		243.98	0.026120	0.59	0.12	2.11	0.80
Bunkers	Minor Trib Cross	539	2 Year Spill	0.04	243.87	243.94	243.93	243.96	0.025083	0.50	0.08	1.80	0.75
Bunkers	Minor Trib Cross	518	5 Year Spill	0.07	243.23	243.30	243.30	243.33	0.038570	0.72	0.10	1.73	0.97
Bunkers	Minor Trib Cross	518	2 Year Spill	0.04	243.23	243.28	243.28	243.30	0.041364	0.61	0.07	1.58	0.95
Bunkers	Minor Trib Cross	497	5 Year Spill	0.07	242.29	242.35	242.35	242.38	0.054716	0.74	0.10	2.39	1.11
Bunkers	Minor Trib Cross	497	2 Year Spill	0.04	242.29	242.34	242.34	242.35	0.050294	0.59	0.07	2.22	1.02
Bunkers	Minor Trib Cross	476	5 Year Spill	0.07	241.18	241.29	241.29	241.31	0.015517	0.54	0.13	1.80	0.64
Bunkers	Minor Trib Cross	476	2 Year Spill	0.04	241.18	241.25	241.25	241.27	0.045591	0.63	0.06	1.54	1.00
Bunkers	Minor Trib Cross	465	5 Year Spill	0.07	240.27	240.37	240.37	240.40	0.036757	0.82	0.09	1.23	0.97
Bunkers	Minor Trib Cross	465	2 Year Spill	0.04	240.27	240.34	240.34	240.37	0.038977	0.68	0.06	1.16	0.95
Bunkers	Minor Trib Cross	448		Culvert									
Bunkers	Minor Trib Cross	402	5 Year Spill	0.07	238.45	238.54	238.54	238.58	0.040391	0.78	0.09	1.44	1.00
Bunkers	Minor Trib Cross	402	2 Year Spill	0.04	238.45	238.53	238.53	238.55	0.032050	0.61	0.07	1.31	0.86
Bunkers	Minor Trib Cross	372	5 Year Spill	0.07	237.63	237.73	237.70	237.74	0.009702	0.49	0.16	2.10	0.53
Bunkers	Minor Trib Cross	372	2 Year Spill	0.04	237.63	237.71	237.68	237.71	0.007546	0.37	0.12	1.96	0.44
Bunkers	Minor Trib Cross	352	5 Year Spill	0.07	237.43	237.54	237.51	237.55	0.008879	0.50	0.17	2.35	0.51
Bunkers	Minor Trib Cross	352	2 Year Spill	0.04	237.43	237.50	237.49	237.51	0.013648	0.47	0.10	1.90	0.59
Bunkers	Minor Trib Cross	332	5 Year Spill	0.07	237.12	237.20	237.19	237.22	0.035359	0.72	0.10	2.14	0.94
Bunkers	Minor Trib Cross	332	2 Year Spill	0.04	237.12	237.19	237.19	237.20	0.017958	0.47	0.09	2.04	0.65
Bunkers	Minor Trib Cross	312	5 Year Spill	0.07	236.99	237.09		237.09	0.002432	0.25	0.29	3.39	0.26
Bunkers	Minor Trib Cross	312	2 Year Spill	0.04	236.99	237.07		237.07	0.002076	0.19	0.21	3.27	0.23
Bunkers	Minor Trib Cross	292	5 Year Spill	0.07	236.96	237.02		237.03	0.005470	0.26	0.27	5.39	0.36
Bunkers	Minor Trib Cross	292	2 Year Spill	0.04	236.96	237.01		237.01	0.005507	0.21	0.19	5.19	0.34
Bunkers	Minor Trib Cross	272	5 Year Spill	0.07	236.65	236.77	236.77	236.81	0.034535	0.82	0.09	1.36	0.95
Bunkers	Minor Trib Cross	272	2 Year Spill	0.04	236.65	236.74	236.74	236.77	0.046854	0.74	0.05	1.09	1.04
Bunkers	Minor Trib Cross	252	5 Year Spill	0.07	236.45	236.70	236.55	236.71	0.000552	0.21	0.43	2.98	0.14
Bunkers	Minor Trib Cross	252	2 Year Spill	0.04	236.45	236.63	236.53	236.64	0.000756	0.19	0.25	2.38	0.16
Bunkers	Minor Trib Cross	232	5 Year Spill	0.07	236.35	236.70	236.43	236.70	0.000063	0.09	0.88	3.54	0.05
Bunkers	Minor Trib Cross	232	2 Year Spill	0.04	236.35	236.63	236.41	236.63	0.000048	0.07	0.65	3.20	0.04
Bunkers	Minor Trib Cross	212	5 Year Spill	0.07	236.21	236.70	236.27	236.70	0.000011	0.05	2.27	9.50	0.02
Bunkers	Minor Trib Cross	212	2 Year Spill	0.04	236.21	236.63	236.25	236.63	0.000006	0.03	1.70	6.32	0.02
Bunkers	Minor Trib Cross	192	5 Year Spill	0.07	236.19	236.70	236.24	236.70	0.000006	0.04	2.79	11.53	0.02
Bunkers	Minor Trib Cross	192	2 Year Spill	0.04	236.19	236.63	236.23	236.63	0.000004	0.03	2.05	10.26	0.01
Bunkers	Minor Trib Cross	172	5 Year Spill	0.07	236.18	236.70	236.22	236.70	0.000002	0.02	5.01	13.97	0.01
Bunkers	Minor Trib Cross	172	2 Year Spill	0.04	236.18	236.63	236.21	236.63	0.000001	0.01	4.09	13.20	0.01
Bunkers	Minor Trib Cross	152	5 Year Spill	0.07	236.06	236.70		236.70	0.000004	0.04	2.98	7.28	0.02
Bunkers	Minor Trib Cross	152	2 Year Spill	0.04	236.06	236.63		236.63	0.000002	0.03	2.50	6.81	0.01
Bunkers	North Trib-Cross	232	5 Year Spill	2.83	236.30	237.72	236.85	237.74	0.000364	0.59	6.44	11.69	0.16
Bunkers	North Trib-Cross	232	2 Year Spill	2.20	236.30	237.50	236.79	237.51	0.000416	0.57	5.27	10.42	0.17
Bunkers	North Trib-Cross	217		Culvert									
Bunkers	North Trib-Cross	175	5 Year Spill	2.83	235.98	236.68	236.68	236.87	0.014462	2.27	1.99	9.88	0.89
Bunkers	North Trib-Cross	175	2 Year Spill	2.20	235.98	236.63	236.57	236.78	0.011834	1.95	1.75	6.71	0.79
Bunkers	North Trib-Cross	167	5 Year Spill	2.83	235.97	236.69		236.70	0.001607	0.70	8.84	33.08	0.29
Bunkers	North Trib-Cross	167	2 Year Spill	2.20	235.97	236.63		236.64	0.001841	0.70	6.93	31.24	0.30

HEC-RAS Plan: FutSpill<10 (Continued)

River	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)	
Bunkers	North Trib-DS	150	5 Year Spill	2.90	235.76	236.49	236.49	236.63	0.013107	2.11	2.60	9.01	0.83
Bunkers	North Trib-DS	150	2 Year Spill	2.24	235.76	236.38	236.38	236.56	0.017809	2.19	1.74	7.44	0.94
Bunkers	North Trib-DS	136	5 Year Spill	2.90	235.42	236.05	236.05	236.28	0.018030	2.20	1.57	3.89	0.95
Bunkers	North Trib-DS	136	2 Year Spill	2.24	235.42	235.97	235.97	236.17	0.018890	2.03	1.27	3.62	0.95
Bunkers	North Trib-DS	133	5 Year Spill	2.90	234.25	235.04	234.89	235.19	0.008140	1.83	2.20	4.43	0.67
Bunkers	North Trib-DS	133	2 Year Spill	2.24	234.25	234.85	234.83	235.03	0.014547	2.01	1.43	3.55	0.86
Bunkers	To Anne Street	508	5 Year Spill	1.54	236.65	237.73		237.74	0.000141	0.31	6.22	8.10	0.10
Bunkers	To Anne Street	508	2 Year Spill	0.57	236.65	237.51		237.52	0.000045	0.15	4.58	7.07	0.05
Bunkers	To Anne Street	492	5 Year Spill	1.54	236.69	237.73		237.73	0.000142	0.30	6.57	9.55	0.09
Bunkers	To Anne Street	492	2 Year Spill	0.57	236.69	237.51		237.51	0.000046	0.14	4.76	7.70	0.05
Bunkers	To Anne Street	463	5 Year Spill	1.54	236.79	237.72	237.08	237.73	0.000160	0.29	7.91	11.22	0.10
Bunkers	To Anne Street	463	2 Year Spill	0.57	236.79	237.51	236.98	237.51	0.000061	0.15	5.62	10.41	0.06
Bunkers	To Anne Street	442	5 Year Spill	1.54	237.01	237.70		237.72	0.001581	0.72	2.79	6.31	0.29
Bunkers	To Anne Street	442	2 Year Spill	0.57	237.01	237.50		237.51	0.000918	0.42	1.64	5.50	0.21
Bunkers	To Anne Street	426	5 Year Spill	1.54	237.04	237.67	237.38	237.69	0.001547	0.62	2.67	6.64	0.28
Bunkers	To Anne Street	426	2 Year Spill	0.57	237.04	237.49	237.25	237.49	0.001032	0.37	1.56	5.33	0.21
Bunkers	To Anne Street	406	5 Year Spill	1.54	237.12	237.59		237.63	0.006677	0.92	1.71	6.29	0.53
Bunkers	To Anne Street	406	2 Year Spill	0.57	237.12	237.41		237.44	0.009976	0.77	0.75	4.37	0.59
Bunkers	To Anne Street	386	5 Year Spill	1.54	236.98	237.49	237.32	237.53	0.004400	0.96	1.82	5.55	0.46
Bunkers	To Anne Street	386	2 Year Spill	0.57	236.98	237.28	237.18	237.30	0.005072	0.69	0.85	3.89	0.44
Bunkers	To Anne Street	366	5 Year Spill	1.54	236.78	237.29		237.39	0.011251	1.48	1.19	3.79	0.72
Bunkers	To Anne Street	366	2 Year Spill	0.57	236.78	237.12		237.16	0.008973	0.95	0.64	2.92	0.59
Bunkers	To Anne Street	346	5 Year Spill	1.54	236.63	237.00	236.99	237.10	0.020348	1.42	1.17	6.23	0.90
Bunkers	To Anne Street	346	2 Year Spill	0.57	236.63	236.89		236.94	0.017068	0.92	0.62	4.09	0.76
Bunkers	To Anne Street	326	5 Year Spill	1.54	236.26	236.74		236.82	0.009763	1.29	1.37	4.87	0.67
Bunkers	To Anne Street	326	2 Year Spill	0.57	236.26	236.55		236.60	0.016563	1.04	0.56	3.35	0.77
Bunkers	To Anne Street	306	5 Year Spill	1.54	236.08	236.65		236.70	0.003959	0.98	1.76	4.51	0.44
Bunkers	To Anne Street	306	2 Year Spill	0.57	236.08	236.46		236.48	0.002819	0.61	0.99	3.67	0.34
Bunkers	To Anne Street	286	5 Year Spill	1.54	235.95	236.61		236.64	0.002156	0.75	2.36	6.14	0.33
Bunkers	To Anne Street	286	2 Year Spill	0.57	235.95	236.43		236.44	0.001226	0.43	1.40	4.77	0.23
Bunkers	To Anne Street	266	5 Year Spill	1.54	236.11	236.43	236.43	236.53	0.021714	1.42	1.17	6.27	0.93
Bunkers	To Anne Street	266	2 Year Spill	0.57	236.11	236.31	236.31	236.37	0.032598	1.10	0.52	4.43	1.01
Bunkers	To Anne Street	248	5 Year Spill	1.54	235.36	235.90	235.81	235.98	0.008983	1.26	1.32	4.20	0.64
Bunkers	To Anne Street	248	2 Year Spill	0.57	235.36	235.64	235.64	235.73	0.030906	1.31	0.44	2.64	1.02
Bunkers	To Anne Street	230		Culvert									
Bunkers	To Anne Street	220	5 Year Spill	1.54	234.41	234.97	234.82	235.03	0.005280	1.11	1.65	11.85	0.51
Bunkers	To Anne Street	220	2 Year Spill	0.57	234.41	234.80	234.65	234.82	0.003562	0.68	0.90	9.43	0.39
Bunkers	To Anne Street	200	5 Year Spill	5.31	233.72	234.59	234.52	234.79	0.011820	2.04	2.94	6.18	0.79
Bunkers	To Anne Street	200	2 Year Spill	2.80	233.72	234.30	234.30	234.49	0.021965	1.93	1.48	4.32	0.98
Bunkers	To Anne Street	180	5 Year Spill	5.31	233.42	234.48	234.29	234.67	0.007517	2.05	3.97	12.10	0.67
Bunkers	To Anne Street	180	2 Year Spill	2.80	233.42	234.18		234.30	0.007827	1.63	2.13	4.67	0.64
Bunkers	To Anne Street	160	5 Year Spill	5.31	233.12	234.04	234.04	234.42	0.019347	2.92	2.40	4.92	1.03
Bunkers	To Anne Street	160	2 Year Spill	2.80	233.12	233.81	233.81	234.06	0.018430	2.29	1.44	3.47	0.95
Bunkers	To Anne Street	140	5 Year Spill	5.31	232.77	233.63	233.63	233.89	0.013983	2.43	2.96	6.28	0.89
Bunkers	To Anne Street	140	2 Year Spill	2.80	232.77	233.39	233.39	233.59	0.016820	2.07	1.63	4.72	0.91
Bunkers	To Anne Street	120	5 Year Spill	5.31	232.09	233.01		233.05	0.003034	1.22	7.69	14.28	0.42
Bunkers	To Anne Street	120	2 Year Spill	2.80	232.09	232.72		232.78	0.005995	1.31	3.76	12.97	0.55
Bunkers	To Anne Street	100	5 Year Spill	5.31	231.65	232.85	232.63	232.96	0.005340	1.79	4.79	8.16	0.56
Bunkers	To Anne Street	100	2 Year Spill	2.80	231.65	232.57	232.42	232.66	0.005687	1.50	2.80	6.41	0.54
Bunkers	To Anne Street	80	5 Year Spill	5.31	231.52	232.52	232.52	232.79	0.012734	2.53	3.10	7.06	0.85
Bunkers	To Anne Street	80	2 Year Spill	2.80	231.52	232.24	232.24	232.47	0.015803	2.20	1.54	3.80	0.89
Bunkers	To Anne Street	49	5 Year Spill	5.31	230.96	232.34		232.38	0.001736	1.23	9.04	16.46	0.34
Bunkers	To Anne Street	49	2 Year Spill	2.80	230.96	231.92		232.00	0.003865	1.43	3.44	9.91	0.47
Bunkers	To Anne Street	20	5 Year Spill	5.31	230.66	232.33		232.34	0.000717	0.85	13.78	20.14	0.22
Bunkers	To Anne Street	20	2 Year Spill	2.80	230.66	231.90		231.93	0.001143	0.88	6.51	14.62	0.26
Bunkers	To Anne Street	15		Lat Struct									
Bunkers	To Anne Street	0	5 Year Spill	3.66	230.61	232.31	231.39	232.33	0.000548	0.81	8.18	8.93	0.20
Bunkers	To Anne Street	0	2 Year Spill	2.69	230.61	231.87	231.26	231.90	0.001096	0.94	4.73	6.68	0.27
Bunkers	Spill to Storm	294	5 Year Spill	0.00	231.57	232.31		232.31	0.000000	0.00	8.68	19.54	0.00

HEC-RAS Plan: FutSpill<10 (Continued)

River	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)	
Bunkers	Spill to Storm	294	2 Year Spill	0.00	231.57	231.60		231.60	0.000284	0.03	0.03	1.67	0.07
Bunkers	Spill to Storm	273	5 Year Spill	1.65	231.43	232.31	231.67	232.31	0.000079	0.20	13.92	25.03	0.07
Bunkers	Spill to Storm	273	2 Year Spill	0.12	231.43	231.54	231.49	231.55	0.002412	0.26	0.50	7.20	0.27
Bunkers	Spill to Storm	252	5 Year Spill	1.65	231.34	232.31	231.61	232.31	0.000071	0.20	14.85	23.30	0.07
Bunkers	Spill to Storm	252	2 Year Spill	0.12	231.34	231.46	231.43	231.47	0.006819	0.43	0.31	4.82	0.44
Bunkers	Spill to Storm	231	5 Year Spill	1.65	231.07	232.31		232.31	0.000031	0.16	19.58	34.12	0.05
Bunkers	Spill to Storm	231	2 Year Spill	0.12	231.07	231.13	231.13	231.16	0.052166	0.76	0.17	3.59	1.10
Bunkers	Spill to Storm	210	5 Year Spill	1.65	230.89	232.31		232.31	0.000012	0.11	26.31	41.15	0.03
Bunkers	Spill to Storm	210	2 Year Spill	0.12	230.89	231.10		231.10	0.000133	0.10	1.41	8.97	0.07
Bunkers	Spill to Storm	189	5 Year Spill	1.65	230.57	232.31		232.31	0.000009	0.11	31.00	41.34	0.03
Bunkers	Spill to Storm	189	2 Year Spill	0.12	230.57	231.10		231.10	0.000008	0.05	3.90	12.94	0.02
Bunkers	Spill to Storm	168	5 Year Spill	1.65	230.04	232.31		232.31	0.000005	0.09	43.00	50.14	0.02
Bunkers	Spill to Storm	168	2 Year Spill	0.12	230.04	231.10		231.10	0.000001	0.02	8.93	17.01	0.01
Bunkers	Spill to Storm	147	5 Year Spill	6.52	230.76	232.31	231.10	232.31	0.000043	0.21	49.55	54.80	0.06
Bunkers	Spill to Storm	147	2 Year Spill	3.12	230.76	231.00	231.00	231.08	0.025595	1.27	2.83	19.33	0.96
Bunkers	Spill to Storm	128	5 Year Spill	6.52	228.11	232.31		232.31	0.000006	0.16	85.01	45.35	0.02
Bunkers	Spill to Storm	128	2 Year Spill	3.12	228.11	229.70		229.71	0.000144	0.38	10.28	9.69	0.10
Bunkers	Spill to Storm	125	5 Year Spill	6.52	227.91	232.31	228.73	232.31	0.000011	0.21	61.73	33.92	0.03
Bunkers	Spill to Storm	125	2 Year Spill	3.12	227.91	229.70	228.47	229.71	0.000177	0.43	8.53	7.84	0.11

Appendix G: Existing Condition PCSWMM Spill Analysis

TATHAM ENGINEERING	Project: Barrie Drainage Master Plan	Date: 1-Aug-17
	File No.: 117076	Designed: DAM
	Subject: PCSWMM Verification Modelling	Checked: DRT

Existing Regional Flows
Kidd's Creek, Dyments Creek and Bunkers Creek Spills

Model	1 - Kidd's Creek Main Branch (m3/s)	2 - Kidd's Creek Tributary Branch (m3/s)	3 - Kidd's Creek Downstream of Tributary Connection (m3/s)
VO No Spill	47.5	0.83	50.79
HEC-RAS Plus Spill	42.11	5.57	50.79
PCSWMM Plus Spill	38.02	5.90	50.79

Model	4 - Bunkers Creek Northeast Branch (m3/s)	5 - Bunkers Creek Central Branch (m3/s)	6 - Bunkers Creek South Branch (m3/s)	7 - Dyments Creek Main Branch (m3/s)
VO No Spill	8.77	6.41	14.12	49.91
HEC-RAS Plus Spill	4.84	4.26	15.89	54.87
PCSWMM Plus Spill	4.60	3.73	13.97	52.93

Whiskey Creek and Hotchkiss Creek Spills

Storm	1 - Whiskey Creek Main Branch (m3/s)	2 - Whiskey Creek Tributary Branch (m3/s)	3 - To Hotchkiss Creek (m3/s)
VO No Spill	21.23	2.44	0
HEC-RAS Plus Spill	16.79	3.33	+ 3.94
PCSWMM Plus Spill	18.196	2.67	+ 1.12

Existing 100-Year Flows
Kidd's Creek, Dyments Creek and Bunkers Creek Spills

Model	4 - Bunkers Creek Northeast Branch (m3/s)	5 - Bunkers Creek Central Branch (m3/s)	6 - Bunkers Creek South Branch (m3/s)	7 - Dyments Creek Main Branch (m3/s)
VO No Spill	8.38	7.69	9.65	24.68
HEC-RAS Plus Spill	4.03	4.22	9.73	32.42
PCSWMM Plus Spill	4.59	3.79	11.89	31.79

Appendix H: Existing Condition Discrete Calculation Spill Analysis

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0 cfs

Design Flow: 176.573 cfs

Maximum Flow: 325.954 cfs

Table 4 - Summary of Culvert Flows at Crossing: Bunkers Northeast Branch

Headwater Elevation (m)	Total Discharge (cms)	1200 Box Discharge (cms)	Roadway Discharge (cms)	Iterations
236.29	0.00	0.00	0.00	1
236.89	0.92	0.92	0.00	1
237.25	1.85	1.85	0.00	1
237.57	2.77	2.77	0.00	1
237.93	3.69	3.69	0.00	1
238.38	4.62	4.62	0.00	1
238.60	5.00	5.00	0.00	1
239.33	6.46	6.10	0.35	15
239.37	7.38	6.16	1.22	6
239.40	8.31	6.20	2.10	5
239.43	9.23	6.23	2.99	4
239.30	6.06	6.06	0.00	Overtopping

Rating Curve Plot for Crossing: Bunkers Northeast Branch

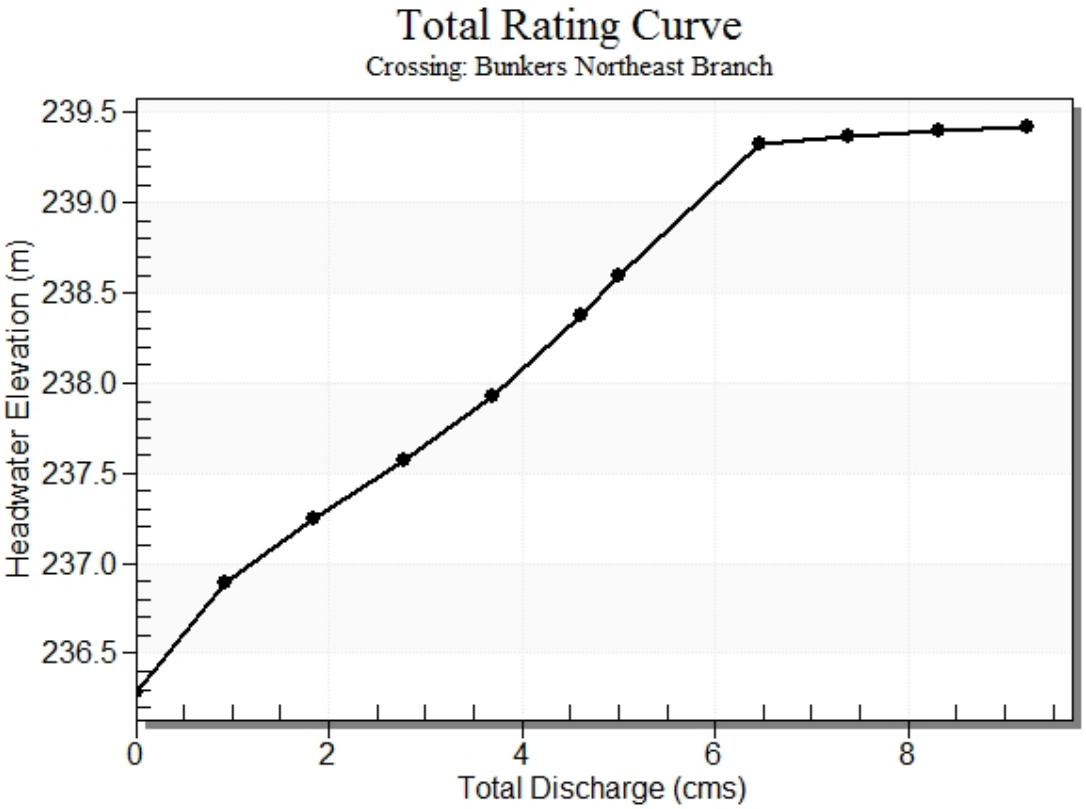


Table 5 - Culvert Summary Table: 1200 Box

Total Discharge (cms)	Culvert Discharge (cms)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)	Tailwater Velocity (m/s)
0.00	0.00	236.29	0.000	0.000	0-NF	0.000	0.000	0.080	0.000	0.000	0.000
0.92	0.92	236.89	0.599	0.251	1-JS1t	0.330	0.392	0.574	0.589	1.341	0.670
1.85	1.85	237.25	0.958	0.563	1-JS1t	0.544	0.622	0.745	0.767	2.064	0.539
2.77	2.77	237.57	1.280	0.903	5-S2n	0.739	0.816	0.739	0.862	3.122	0.516
3.69	3.69	237.93	1.641	1.477	5-S2n	0.925	0.988	0.925	0.935	3.325	0.509
4.62	4.62	238.38	2.089	1.996	7-M2c	1.200	1.146	1.146	0.994	3.354	0.505
5.00	5.00	238.60	2.307	2.212	6-FFc	1.200	1.200	1.200	1.015	3.472	0.506
6.46	6.10	239.33	3.041	2.889	6-FFc	1.200	1.200	1.200	1.086	4.239	0.515
7.38	6.16	239.37	3.080	2.925	6-FFc	1.200	1.200	1.200	1.130	4.276	0.509
8.31	6.20	239.40	3.110	2.953	6-FFc	1.200	1.200	1.200	1.161	4.304	0.520
9.23	6.23	239.43	3.136	2.977	6-FFc	1.200	1.200	1.200	1.190	4.328	0.532

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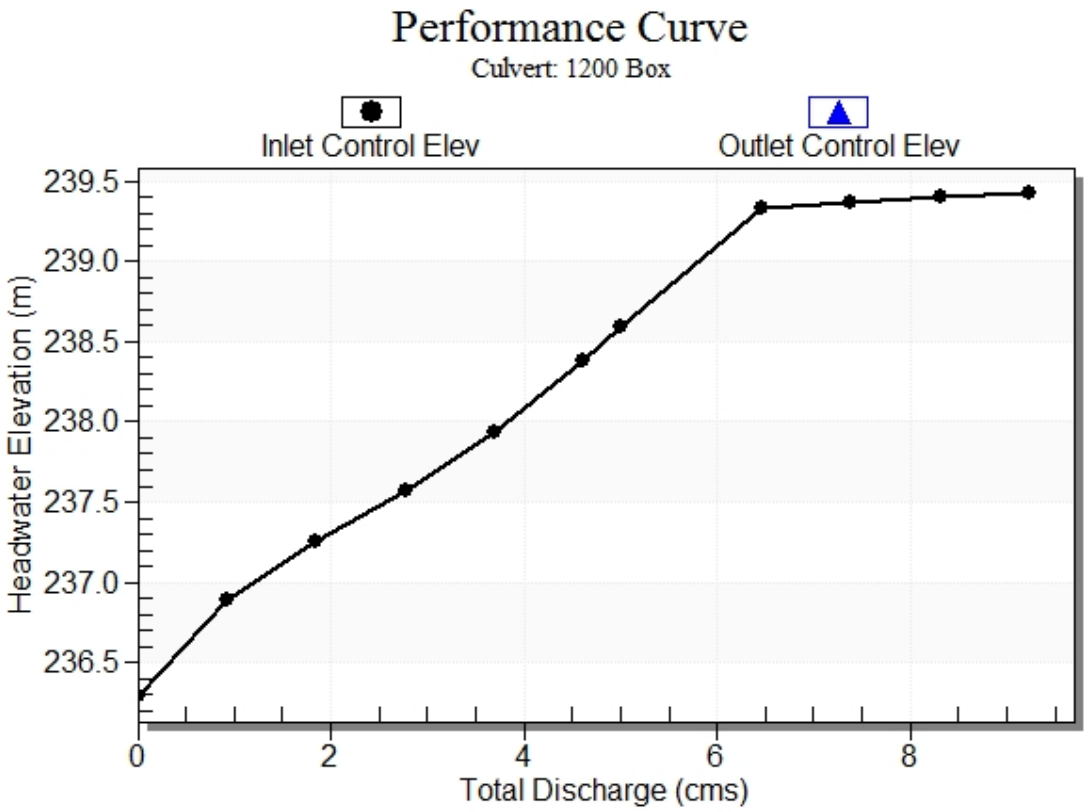
Straight Culvert

Inlet Elevation (invert): 236.29 m, Outlet Elevation (invert): 235.92 m

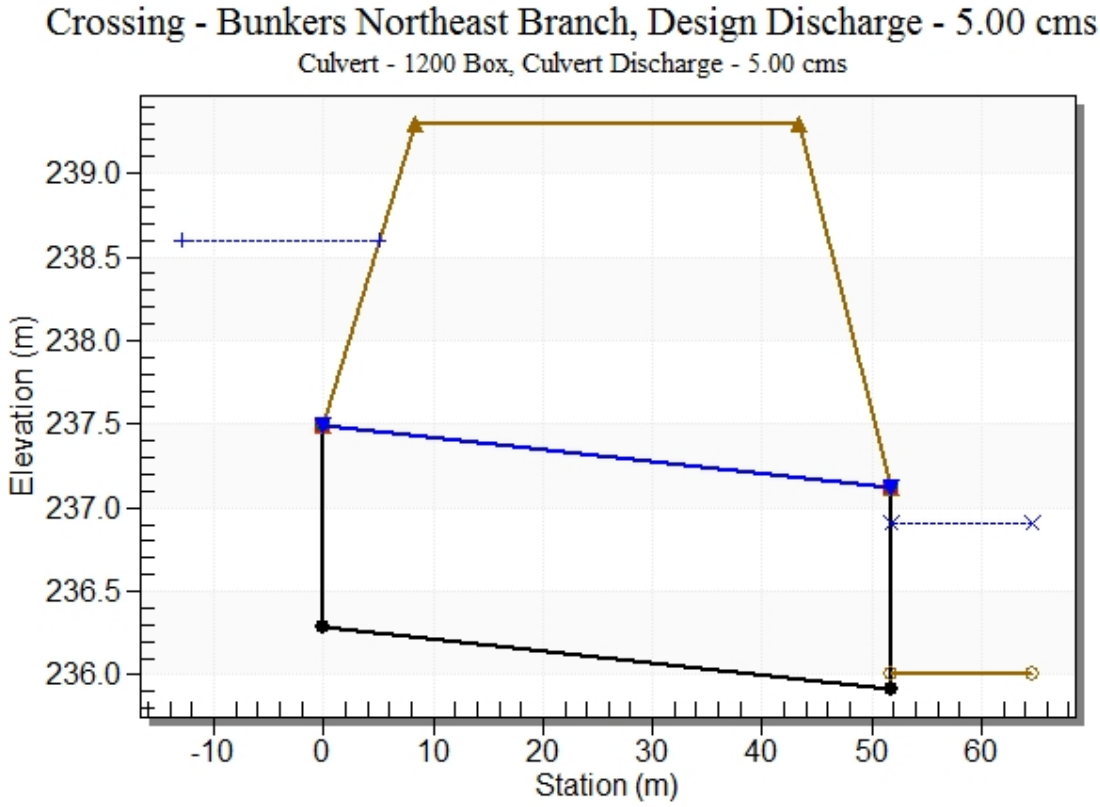
Culvert Length: 51.71 m, Culvert Slope: 0.0072

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Culvert Performance Curve Plot: 1200 Box



Water Surface Profile Plot for Culvert: 1200 Box



Site Data - 1200 Box

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 m

Inlet Elevation: 236.29 m

Outlet Station: 51.71 m

Outlet Elevation: 235.92 m

Number of Barrels: 1

Culvert Data Summary - 1200 Box

Barrel Shape: Concrete Box

Barrel Span: 1200.00 mm

Barrel Rise: 1200.00 mm

Barrel Material: Concrete

Embedment: 0.00 mm

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge (30-75º flare) Wingwall

Inlet Depression: NONE

Table 6 - Downstream Channel Rating Curve (Crossing: Bunkers Northeast Branch)

Flow (cms)	Water Surface Elev (m)	Depth (m)	Velocity (m/s)	Shear (Pa)	Froude Number
0.00	236.00	0.00	0.00	0.00	0.00
0.92	236.49	0.49	0.93	31.94	0.56
1.85	236.67	0.67	0.91	43.03	0.63
2.77	236.77	0.77	0.80	49.79	0.58
3.69	236.84	0.84	0.77	54.10	0.53
4.62	236.89	0.89	0.76	57.59	0.50
5.00	236.91	0.91	0.76	58.92	0.49
6.46	236.98	0.98	0.75	63.28	0.47
7.38	237.01	1.01	0.75	65.58	0.46
8.31	237.05	1.05	0.76	67.64	0.45
9.23	237.07	1.07	0.76	69.53	0.44

Tailwater Channel Data - Bunkers Northeast Branch

Tailwater Channel Option: Irregular Channel

Roadway Data for Crossing: Bunkers Northeast Branch

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 40.00 m

Crest Elevation: 239.30 m

Roadway Surface: Paved

Roadway Top Width: 35.00 m

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 123.601 cfs

Design Flow: 139.493 cfs

Maximum Flow: 158.916 cfs

Table 7 - Summary of Culvert Flows at Crossing: Bunkers Central Branch

Headwater Elevation (m)	Total Discharge (cms)	1200 Box Discharge (cms)	Roadway Discharge (cms)	Iterations
232.23	3.50	3.50	0.00	1
232.28	3.60	3.60	0.00	1
232.33	3.70	3.70	0.00	1
232.39	3.80	3.80	0.00	1
232.45	3.90	3.90	0.00	1
232.48	3.95	3.95	0.00	1
232.57	4.10	4.10	0.00	1
232.63	4.20	4.20	0.00	1
232.69	4.30	4.30	0.00	1
232.76	4.40	4.40	0.00	1
232.82	4.50	4.50	0.00	1
233.90	5.88	5.88	0.00	Overtopping

Rating Curve Plot for Crossing: Bunkers Central Branch

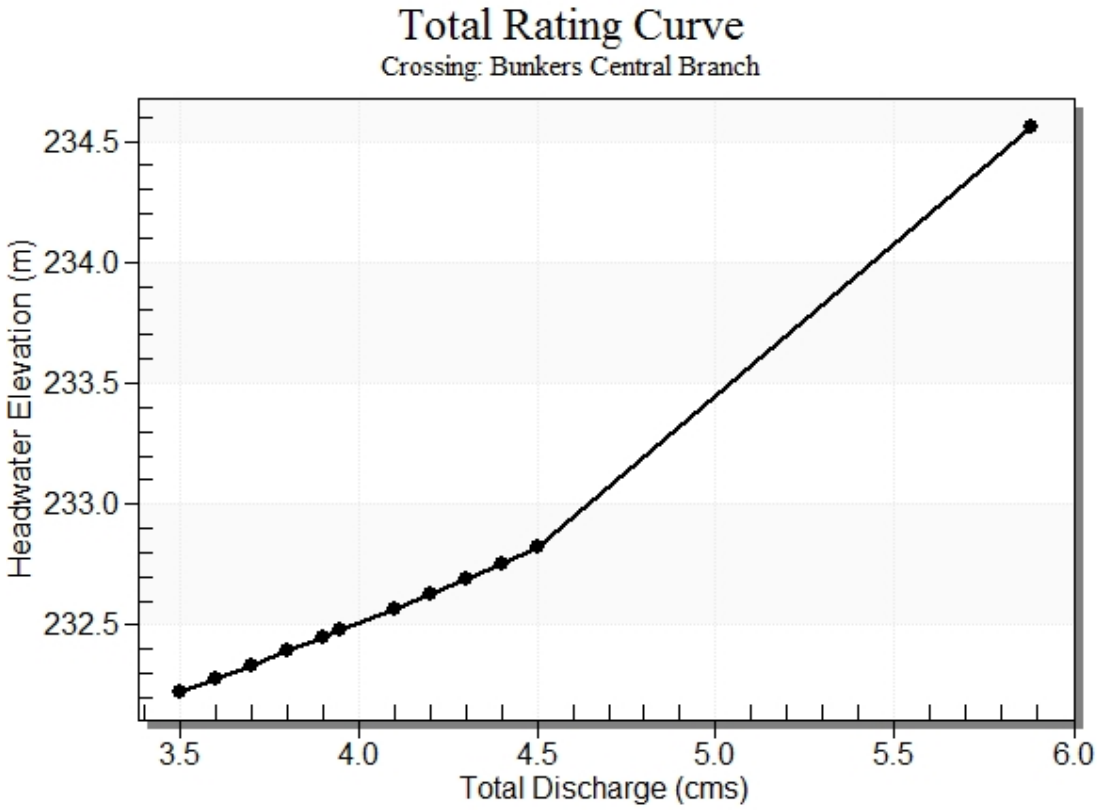


Table 8 - Culvert Summary Table: 1200 Box

Total Discharge (cms)	Culvert Discharge (cms)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)	Tailwater Velocity (m/s)
3.50	3.50	232.23	1.786	1.709	7-M2c	1.200	0.953	0.953	0.864	3.059	0.418
3.60	3.60	232.28	1.839	1.745	7-M2c	1.200	0.972	0.972	0.868	3.088	0.419
3.70	3.70	232.33	1.894	1.811	7-M2c	1.200	0.989	0.989	0.873	3.116	0.420
3.80	3.80	232.39	1.950	1.875	7-M2c	1.200	1.007	1.007	0.877	3.144	0.421
3.90	3.90	232.45	2.007	1.942	7-M2c	1.200	1.025	1.025	0.883	3.171	0.415
3.95	3.95	232.48	2.037	1.972	7-M2c	1.200	1.034	1.034	0.885	3.185	0.415
4.10	4.10	232.57	2.126	2.064	7-M2c	1.200	1.060	1.060	0.890	3.225	0.418
4.20	4.20	232.63	2.188	2.126	7-M2c	1.200	1.077	1.077	0.894	3.251	0.419
4.30	4.30	232.69	2.251	2.188	7-M2c	1.200	1.094	1.094	0.897	3.276	0.421
4.40	4.40	232.76	2.316	2.252	7-M2c	1.200	1.111	1.111	0.900	3.302	0.422
4.50	4.50	232.82	2.382	2.314	7-M2c	1.200	1.127	1.127	0.904	3.326	0.424

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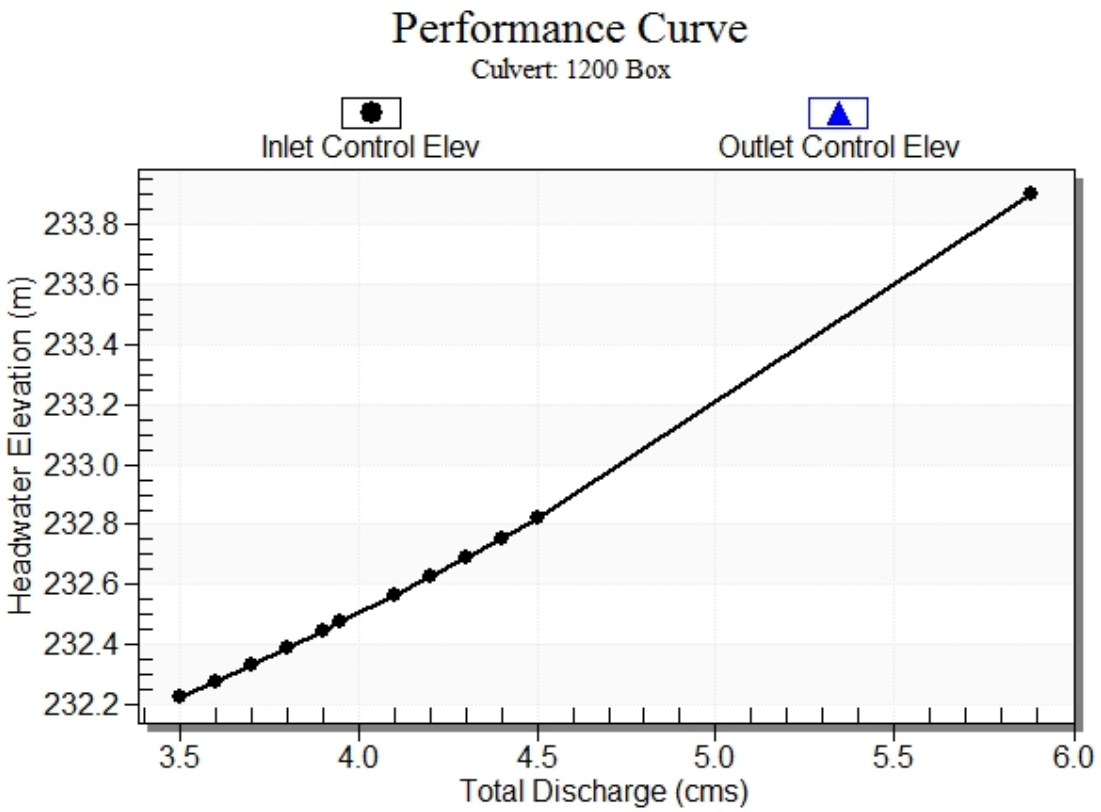
Straight Culvert

Inlet Elevation (invert): 230.44 m, Outlet Elevation (invert): 230.27 m

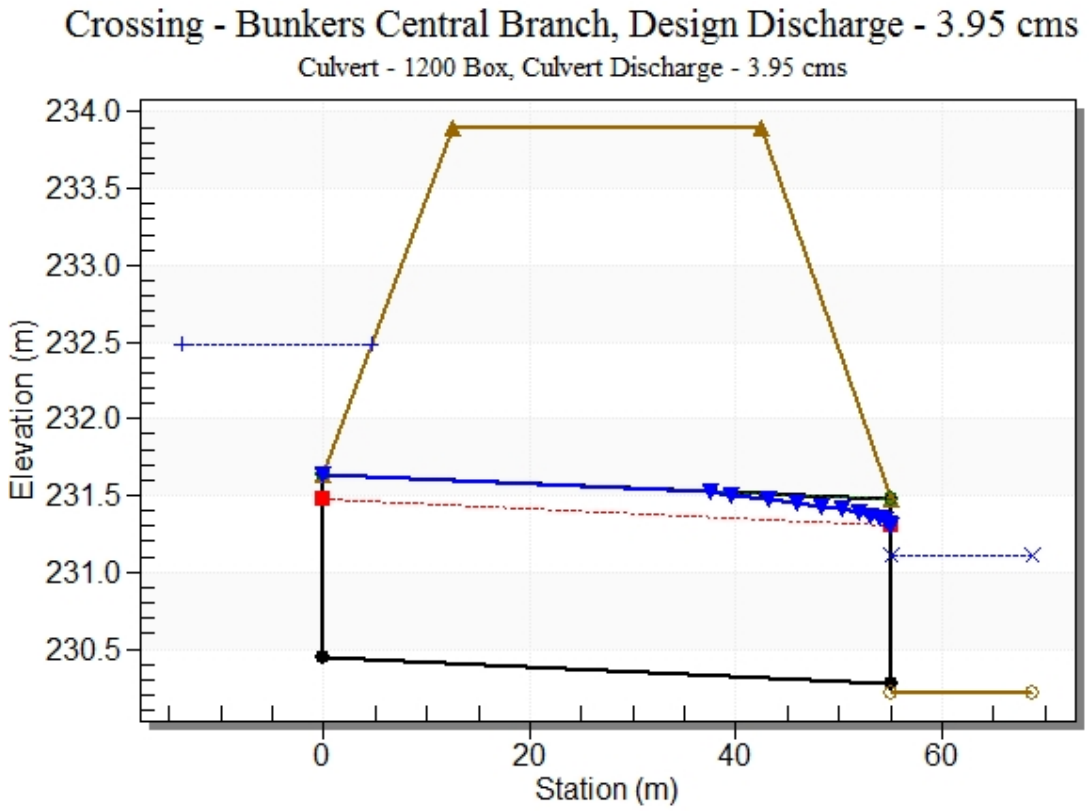
Culvert Length: 55.00 m, Culvert Slope: 0.0031

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Culvert Performance Curve Plot: 1200 Box



Water Surface Profile Plot for Culvert: 1200 Box



Site Data - 1200 Box

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 m

Inlet Elevation: 230.44 m

Outlet Station: 55.00 m

Outlet Elevation: 230.27 m

Number of Barrels: 1

Culvert Data Summary - 1200 Box

Barrel Shape: Concrete Box

Barrel Span: 1200.00 mm

Barrel Rise: 1200.00 mm

Barrel Material: Concrete

Embedment: 0.00 mm

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge (0º flare) Wingwall

Inlet Depression: NONE

Table 9 - Downstream Channel Rating Curve (Crossing: Bunkers Central Branch)

Flow (cms)	Water Surface Elev (m)	Depth (m)	Velocity (m/s)	Shear (Pa)	Froude Number
3.50	231.08	0.86	0.42	33.89	0.34
3.60	231.09	0.87	0.42	34.05	0.33
3.70	231.09	0.87	0.42	34.21	0.33
3.80	231.09	0.88	0.42	34.37	0.33
3.90	231.10	0.88	0.41	34.63	0.33
3.95	231.10	0.89	0.42	34.70	0.33
4.10	231.11	0.89	0.42	34.91	0.33
4.20	231.11	0.89	0.42	35.04	0.33
4.30	231.12	0.90	0.42	35.18	0.32
4.40	231.12	0.90	0.42	35.31	0.32
4.50	231.12	0.90	0.42	35.43	0.32

Tailwater Channel Data - Bunkers Central Branch

Tailwater Channel Option: Irregular Channel

Roadway Data for Crossing: Bunkers Central Branch

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 20.00 m

Crest Elevation: 233.90 m

Roadway Surface: Paved

Roadway Top Width: 30.00 m

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0 cfs

Design Flow: 238.021 cfs

Maximum Flow: 752.202 cfs

Table 1 - Summary of Culvert Flows at Crossing: Bunkers South Branch Spill to Dyments

Headwater Elevation (m)	Total Discharge (cms)	1200 Box Discharge (cms)	Roadway Discharge (cms)	Iterations
228.10	0.00	0.00	0.00	1
229.21	2.13	2.13	0.00	1
230.27	4.26	4.26	0.00	1
232.00	6.39	6.39	0.00	1
232.47	6.74	6.61	0.13	21
232.64	10.65	6.61	4.03	7
232.68	12.78	6.58	6.18	5
232.72	14.91	6.55	8.34	4
232.75	17.04	6.52	10.51	4
232.78	19.17	6.49	12.65	3
232.81	21.30	6.46	14.83	3
232.41	6.55	6.55	0.00	Overtopping

Rating Curve Plot for Crossing: Bunkers South Branch Spill to Dyments

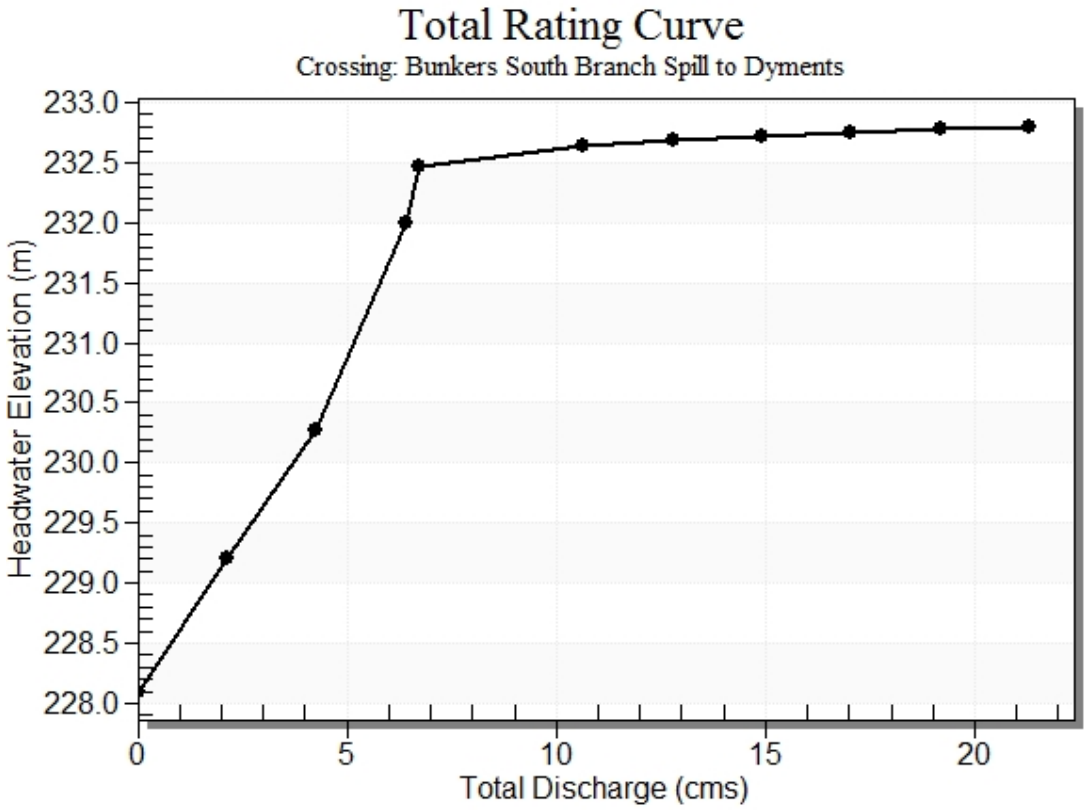


Table 2 - Culvert Summary Table: 1200 Box

Total Discharge (cms)	Culvert Discharge (cms)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)	Tailwater Velocity (m/s)
0.00	0.00	228.10	0.000	0.050	0-NF	0.000	0.000	0.960	0.000	0.000	0.000
2.13	2.13	229.21	1.157	0.803	1-JS1f	0.569	0.685	1.200	0.366	1.479	2.055
4.26	4.26	230.27	2.222	2.112	5-JS1f	0.972	1.087	1.200	0.514	2.958	2.544
6.39	6.39	232.00	3.954	4.163	4-FFf	1.200	1.200	1.200	0.628	4.437	2.847
6.74	6.61	232.47	4.187	4.421	4-FFf	1.200	1.200	1.200	0.645	4.589	2.888
10.65	6.61	232.64	4.192	4.592	4-FFf	1.200	1.200	1.200	0.810	4.592	3.255
12.78	6.58	232.68	4.159	4.634	4-FFf	1.200	1.200	1.200	0.887	4.571	3.408
14.91	6.55	232.72	4.124	4.669	4-FFf	1.200	1.200	1.200	0.958	4.549	3.538
17.04	6.52	232.75	4.091	4.701	4-FFf	1.200	1.200	1.200	1.024	4.527	3.654
19.17	6.49	232.78	4.059	4.729	4-FFf	1.200	1.200	1.200	1.085	4.506	3.760
21.30	6.46	232.81	4.029	4.755	4-FFf	1.200	1.200	1.200	1.143	4.486	3.855

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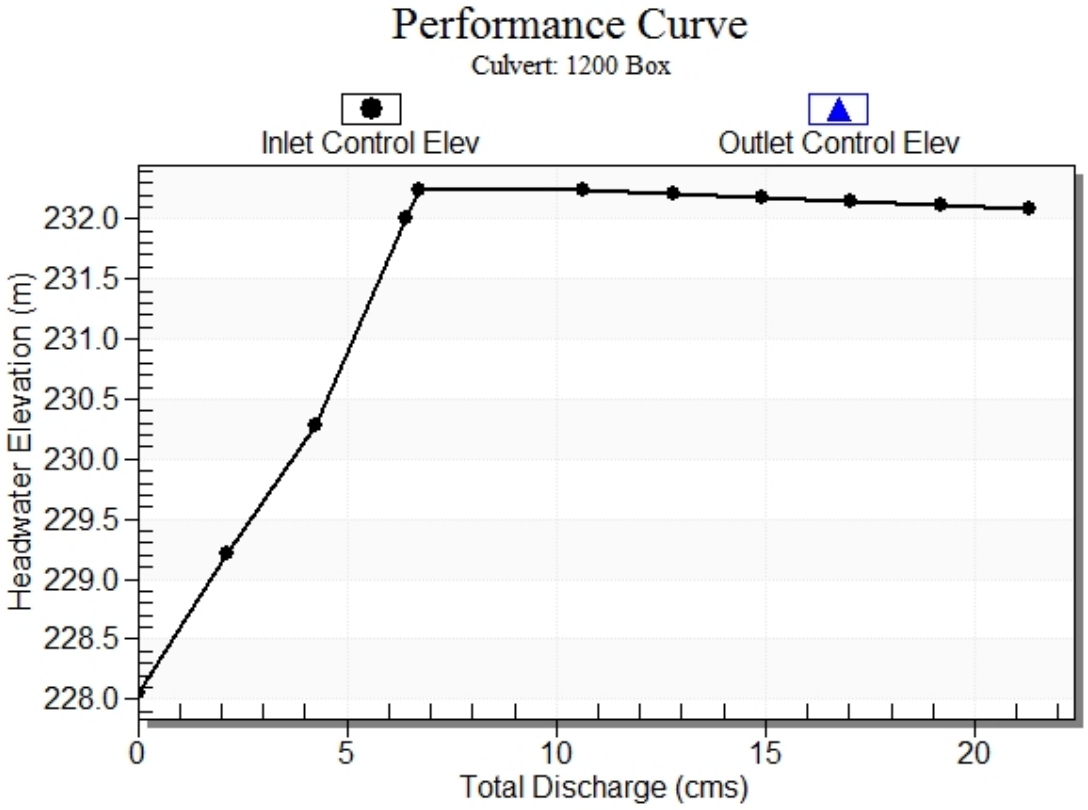
Straight Culvert

Inlet Elevation (invert): 228.05 m, Outlet Elevation (invert): 227.14 m

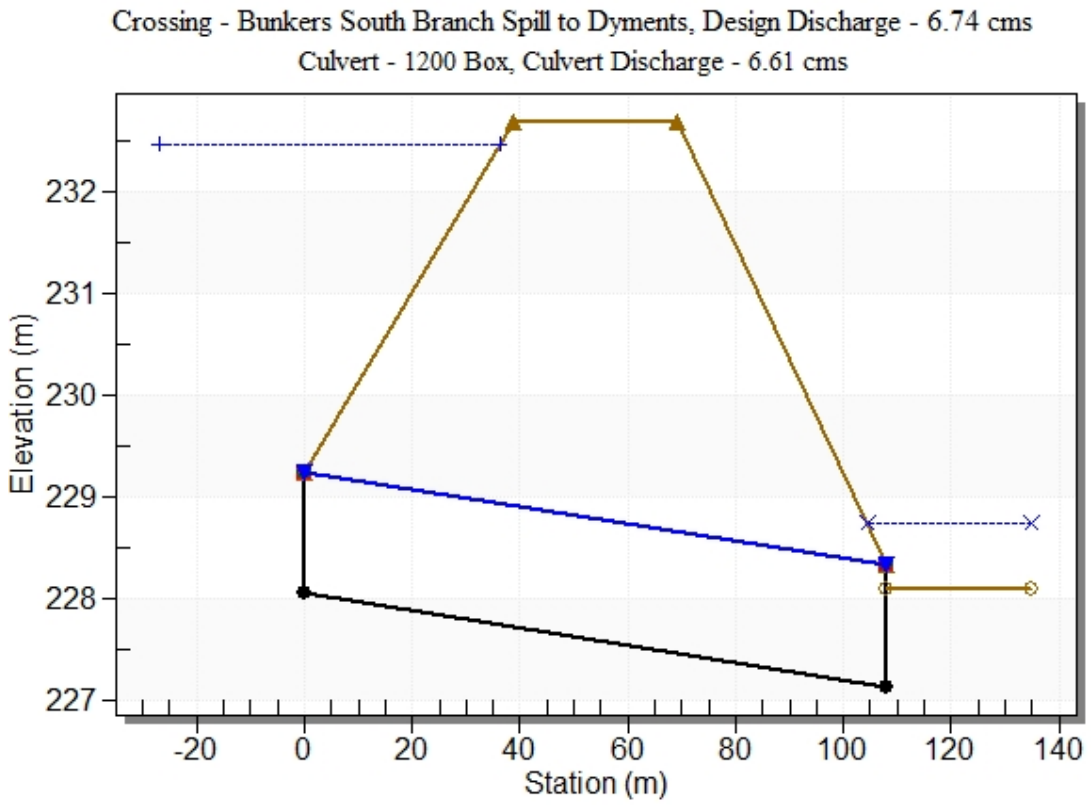
Culvert Length: 108.00 m, Culvert Slope: 0.0084

****

Culvert Performance Curve Plot: 1200 Box



Water Surface Profile Plot for Culvert: 1200 Box



Site Data - 1200 Box

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 m

Inlet Elevation: 228.05 m

Outlet Station: 108.00 m

Outlet Elevation: 227.14 m

Number of Barrels: 1

Culvert Data Summary - 1200 Box

Barrel Shape: Concrete Box

Barrel Span: 1200.00 mm

Barrel Rise: 1200.00 mm

Barrel Material: Concrete

Embedment: 0.00 mm

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge (0º flare) Wingwall

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: Bunkers South Branch Spill to Dyments)

Flow (cms)	Water Surface Elev (m)	Depth (m)	Velocity (m/s)	Shear (Pa)	Froude Number
0.00	228.10	0.00	0.00	0.00	0.00
2.13	228.47	0.37	2.06	132.73	1.28
4.26	228.61	0.51	2.54	186.25	1.36
6.39	228.73	0.63	2.85	227.85	1.39
6.74	228.75	0.65	2.89	233.97	1.39
10.65	228.91	0.81	3.26	293.77	1.41
12.78	228.99	0.89	3.41	321.75	1.42
14.91	229.06	0.96	3.54	347.48	1.42
17.04	229.12	1.02	3.65	371.32	1.43
19.17	229.19	1.09	3.76	393.58	1.43
21.30	229.24	1.14	3.86	414.65	1.43

Tailwater Channel Data - Bunkers South Branch Spill to Dyments

Tailwater Channel Option: Irregular Channel

Channel Slope: 0.0370

Roadway Data for Crossing: Bunkers South Branch Spill to Dyments

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (m)	Elevation (m)
0	30.20	232.70
1	44.82	232.63
2	52.65	232.60
3	75.41	232.50
4	97.14	232.41

Roadway Surface: Paved

Roadway Top Width: 30.50 m

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 10.5944 cfs

Design Flow: 17.3042 cfs

Maximum Flow: 35.3147 cfs

Table 10 - Summary of Culvert Flows at Crossing: Whiskey Spill Service Road Crossing

Headwater Elevation (m)	Total Discharge (cms)	450 CSP Discharge (cms)	Roadway Discharge (cms)	Iterations
287.37	0.30	0.30	0.00	1
287.67	0.37	0.33	0.04	4
287.70	0.44	0.33	0.11	13
287.71	0.49	0.33	0.15	10
287.73	0.58	0.33	0.24	9
287.75	0.65	0.34	0.31	8
287.76	0.72	0.34	0.38	7
287.77	0.79	0.34	0.45	6
287.78	0.86	0.34	0.52	6
287.79	0.93	0.34	0.59	5
287.80	1.00	0.34	0.66	5
288.00	0.36	0.36	0.00	Overtopping

Rating Curve Plot for Crossing: Whiskey Spill Service Road Crossing

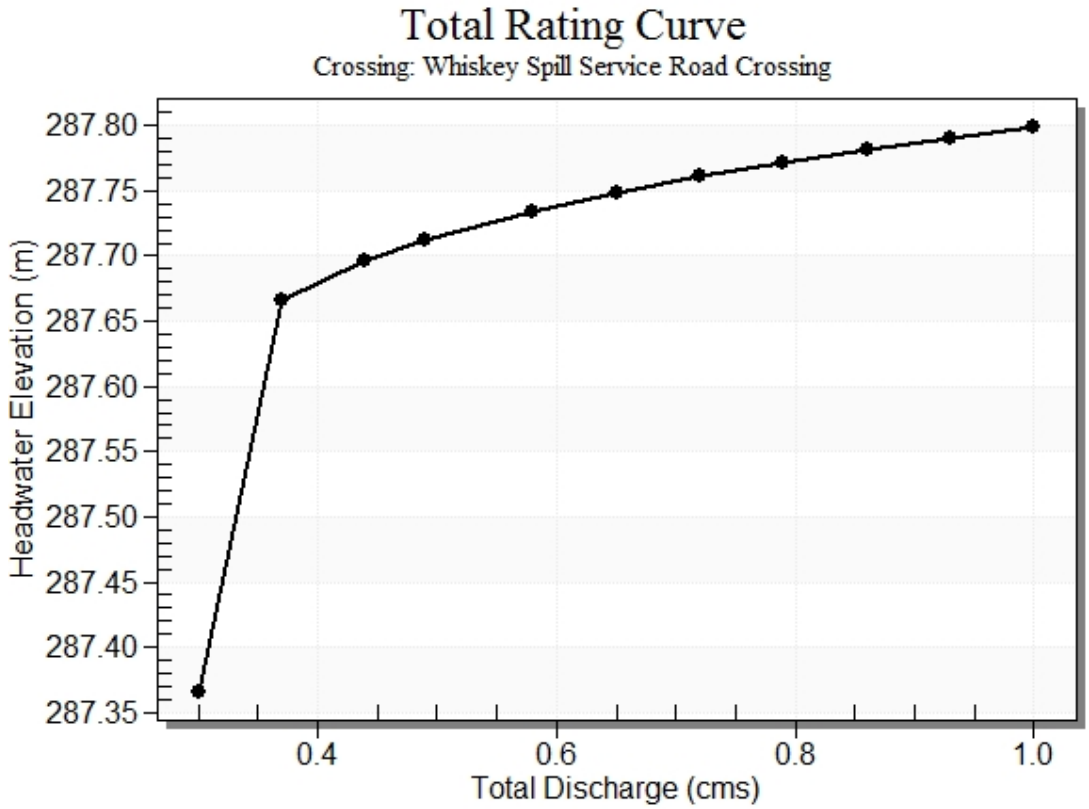


Table 11 - Culvert Summary Table: 450 CSP

Total Discharge (cms)	Culvert Discharge (cms)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)	Tailwater Velocity (m/s)
0.30	0.30	287.37	0.909	1.456	7-M2c	0.450	0.381	0.381	0.136	2.088	0.785
0.37	0.33	287.67	1.035	1.756	7-M2c	0.450	0.395	0.395	0.152	2.221	0.836
0.44	0.33	287.70	1.048	1.787	7-M2c	0.450	0.396	0.396	0.167	2.234	0.880
0.49	0.33	287.71	1.055	1.803	7-M2c	0.450	0.397	0.397	0.176	2.242	0.908
0.58	0.33	287.73	1.064	1.825	7-M2c	0.450	0.397	0.397	0.193	2.251	0.953
0.65	0.34	287.75	1.070	1.839	7-M2c	0.450	0.398	0.398	0.204	2.257	0.985
0.72	0.34	287.76	1.076	1.851	7-M2c	0.450	0.398	0.398	0.216	2.263	1.014
0.79	0.34	287.77	1.080	1.862	7-M2c	0.450	0.399	0.399	0.226	2.267	1.041
0.86	0.34	287.78	1.085	1.872	7-M2c	0.450	0.399	0.399	0.236	2.272	1.066
0.93	0.34	287.79	1.089	1.881	7-M2c	0.450	0.400	0.400	0.246	2.276	1.090
1.00	0.34	287.80	1.093	1.890	7-M2c	0.450	0.400	0.400	0.255	2.280	1.112

****

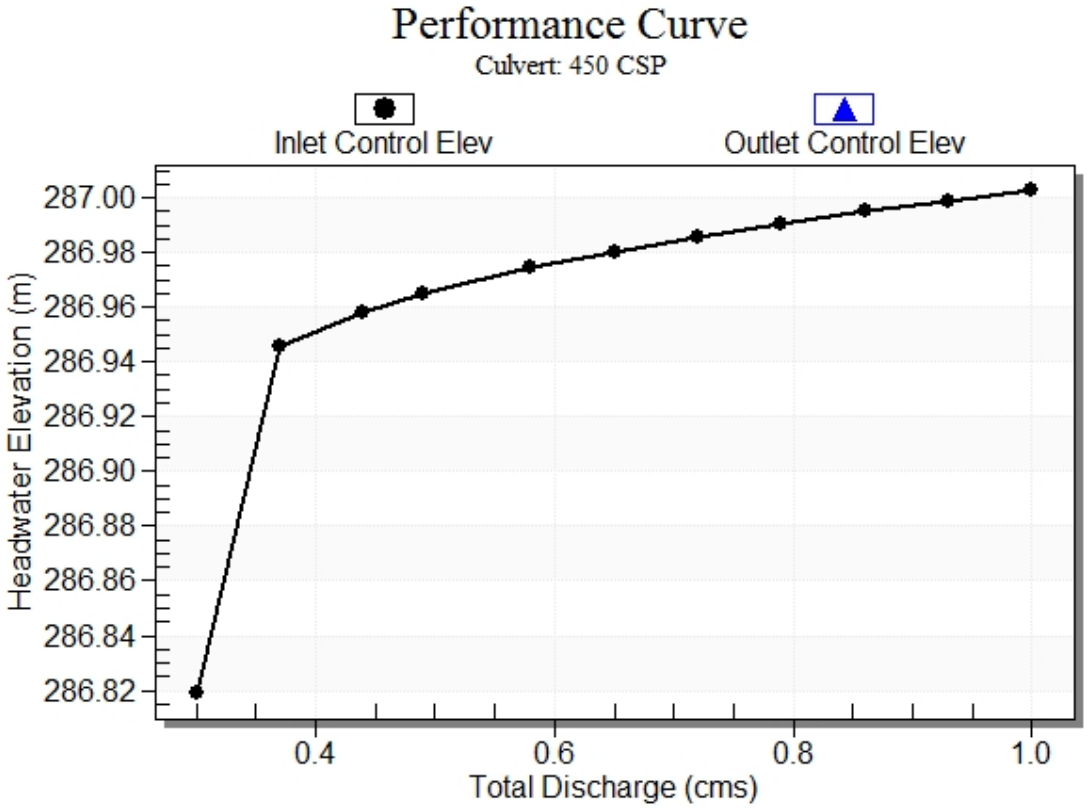
Straight Culvert

Inlet Elevation (invert): 285.91 m, Outlet Elevation (invert): 285.49 m

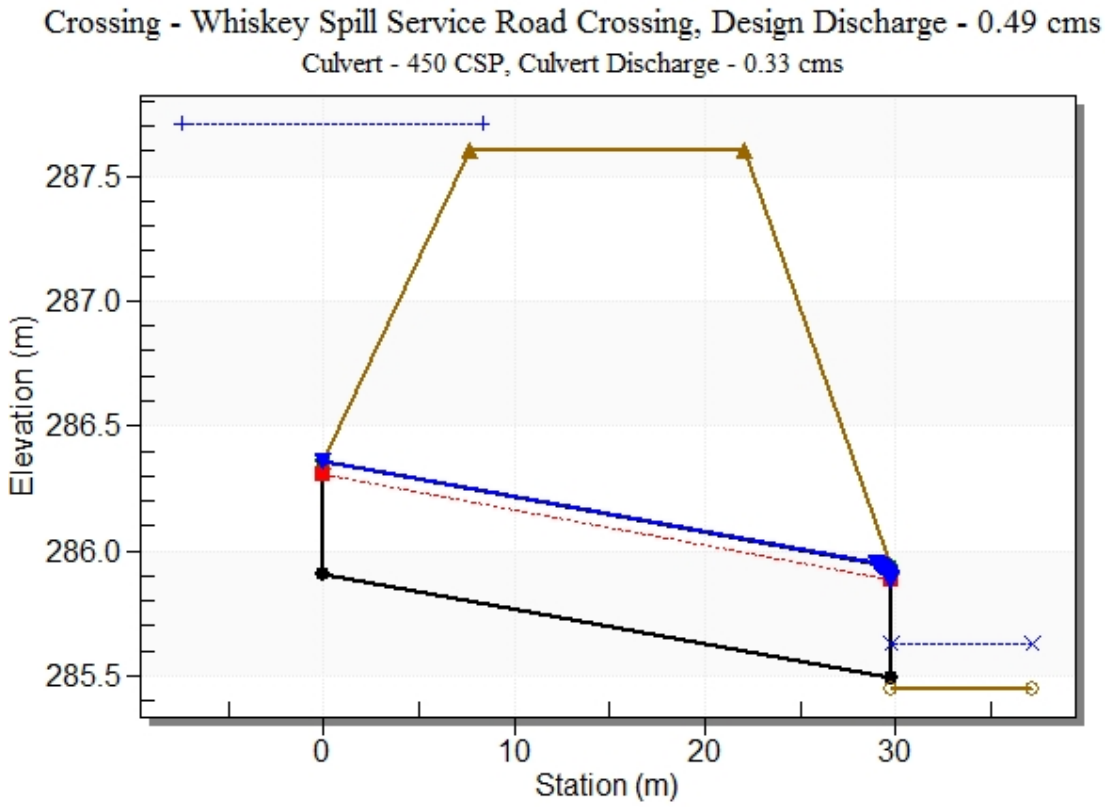
Culvert Length: 29.73 m, Culvert Slope: 0.0141

****

Culvert Performance Curve Plot: 450 CSP



Water Surface Profile Plot for Culvert: 450 CSP



Site Data - 450 CSP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 m

Inlet Elevation: 285.91 m

Outlet Station: 29.73 m

Outlet Elevation: 285.49 m

Number of Barrels: 1

Culvert Data Summary - 450 CSP

Barrel Shape: Circular

Barrel Diameter: 450.00 mm

Barrel Material: Corrugated Steel

Embedment: 0.00 mm

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Thin Edge Projecting

Inlet Depression: NONE

Table 12 - Downstream Channel Rating Curve (Crossing: Whiskey Spill Service Road Crossing)

Flow (cms)	Water Surface Elev (m)	Depth (m)	Velocity (m/s)	Shear (Pa)	Froude Number
0.30	285.59	0.14	0.79	26.61	0.77
0.37	285.60	0.15	0.84	29.80	0.78
0.44	285.62	0.17	0.88	32.67	0.79
0.49	285.63	0.18	0.91	34.59	0.80
0.58	285.64	0.19	0.95	37.79	0.81
0.65	285.65	0.20	0.99	40.09	0.82
0.72	285.67	0.22	1.01	42.27	0.82
0.79	285.68	0.23	1.04	44.33	0.83
0.86	285.69	0.24	1.07	46.28	0.83
0.93	285.70	0.25	1.09	48.16	0.84
1.00	285.70	0.25	1.11	49.96	0.84

Tailwater Channel Data - Whiskey Spill Service Road Crossing

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 2.00 m

Side Slope (H:V): 6.00 (_:1)

Channel Slope: 0.0200

Channel Manning's n: 0.0400

Channel Invert Elevation: 285.45 m

Roadway Data for Crossing: Whiskey Spill Service Road Crossing

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (m)	Elevation (m)
0	3.80	287.60
1	29.00	288.00
2	44.00	288.25

Roadway Surface: Paved

Roadway Top Width: 14.40 m

TATHAM ENGINEERING	Project: Barrie Drainage Master Plan	Date:	1-Aug-17
	File No.: 117076	Designed:	DAM
	Subject: Service Road Weir Analysis	Checked:	DRT

Existing Conditions:

Upstream Flow	2.21 cms
Upstream Water Surface	287.72 m
Culvert Discharge	0.51 cms

Trapezoidal Broad Crested Weir

Source: Hydraulic Structures, C.D.Smith, University of Saskatchewan

Trapezoidal Weir

The trapezoidal weir is a combination of the rectangular weir and the triangular weir

Enter

W	Weir Bottom Width (m)	0.3
H	Head (m)	0.4
L	Weir Downstream Length	10
S	Side Slope (horizontal):1	15

Rectangular Weir

$$Q = CWH^{3/2}$$

H/L	0.04
C	1.48873

Result

Q Rectangular Weir	Flow (m^3/s)	**0.11299**

Triangular Weir

$$Q = CH^{5/2}\tan(\theta/2)$$

Notch Angle (one side)	86.18592517	degrees
Notch Angle (one side)	1.504228163	radians
$\tan(\theta/2)$	15.000000	

Triangular H/L	0.04
C	1.0500E+00

out of range

Result

Q Triangular Weir	Flow (m^3/s)	**1.5938**

Total Rectangular + Triangular Weir

Q Total	**Flow (m^3/s)**	**1.7068**

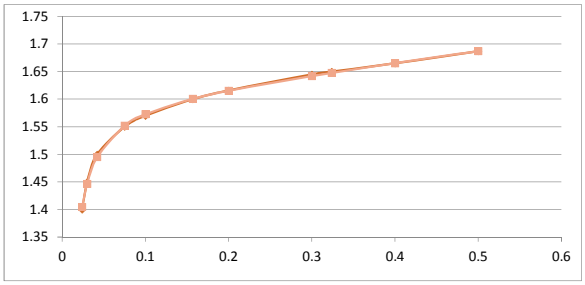
Rectangular Weir Coefficient

H/W	C Graph	C Equation
0.024	1.4	1.40468
0.03	1.45	1.44635
0.042	1.5	1.49489
0.075	1.55	1.55183
0.1	1.57	1.57258
0.157	1.6	1.60064
0.2	1.616	1.61522
0.3	1.645	1.64203
0.324	1.65	1.64779
0.4	1.665	1.66522
0.5	1.687	1.68723

Rectangular C Equation

y=(a+bx)/(1+cx+dx^2)

a	-1.04E+04
b	3.42E+06
c	2.13E+06
d	-2.35E+05



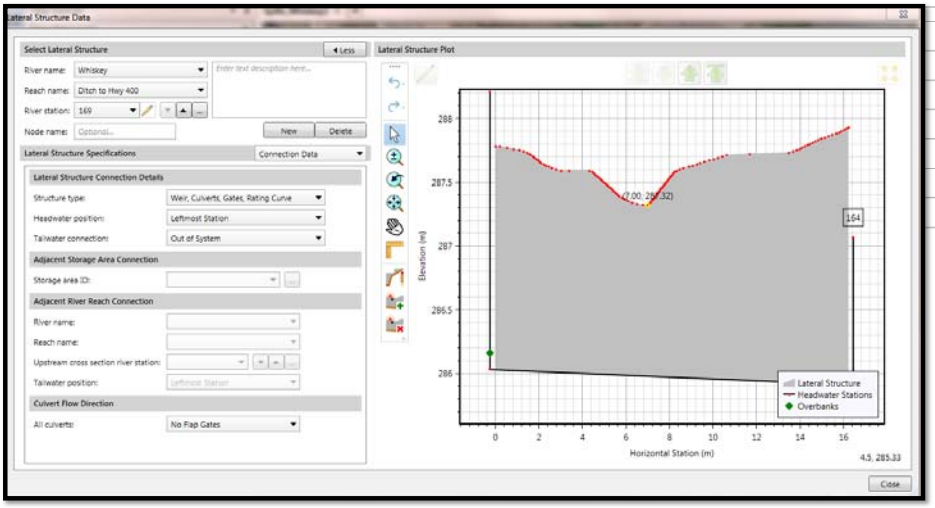
Triangular Weir Coefficient

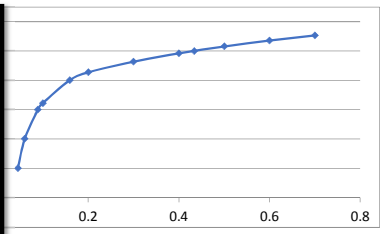
H/L	C Graph	C Equation
0.045	1.05	1.0519
0.06	1.1	1.0971
0.089	1.15	1.1459
0.1	1.161	1.1578
0.159	1.2	1.1963
0.2	1.2135	1.2113
0.3	1.232	1.2336
0.4	1.246	1.2476
0.434	1.25	1.2515
0.5	1.258	1.2583
0.6	1.268	1.2673
0.7	1.2765	1.2754

Triangular C Equation

y=(a+bx)/(1+cx+dx^2)

a	-1.01E-05
b	1.44E+02
c	1.15E+02
d	-4.77E+00





TATHAM ENGINEERING	Project: Barrie Drainage Master Plan	Date: 1-Aug-17
	File No.: 117076	Designed: DAM
	Subject: Service Road Weir Analysis	Checked: DRT

Future Conditions:

Upstream Flow	2.03	cms
Upstream Water Surface	287.72	m
Culvert Discharge	0.51	cms

Trapezoidal Broad Crested Weir

Source: Hydraulic Structures, C.D.Smith, University of Saskatchewan

Trapezoidal Weir

The trapezoidal weir is a combination of the rectangular weir and the triangular weir

Enter

W	Weir Bottom Width (m)	0.3
H	Head (m)	0.39
L	Weir Downstream Length	10
S	Side Slope (horizontal):1	15

Rectangular Weir $Q = CWH^{3/2}$

H/L	0.039
C	1.48543

Result

Q Rectangular Weir	Flow (m^3/s)	**0.10853**

Triangular Weir $Q = CH^{5/2}\tan(\theta/2)$

Notch Angle (one side)	86.18592517	degrees
Notch Angle (one side)	1.504228163	radians
$\tan(\theta/2)$	15.000000	

Triangular H/L	0.039
C	1.0500E+00

out of range

Result

Q Triangular Weir	Flow (m^3/s)	**1.4960**

Total Rectangular + Triangular Weir

Q Total	**Flow (m^3/s)**	**1.6046**

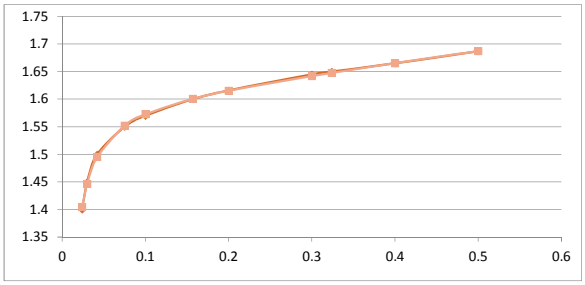
Rectangular Weir Coefficient

H/W	C Graph	C Equation
0.024	1.4	1.40468
0.03	1.45	1.44635
0.042	1.5	1.49489
0.075	1.55	1.55183
0.1	1.57	1.57258
0.157	1.6	1.60064
0.2	1.616	1.61522
0.3	1.645	1.64203
0.324	1.65	1.64779
0.4	1.665	1.66522
0.5	1.687	1.68723

Rectangular C Equation

y=(a+bx)/(1+cx+dx^2)

a	-1.04E+04
b	3.42E+06
c	2.13E+06
d	-2.35E+05



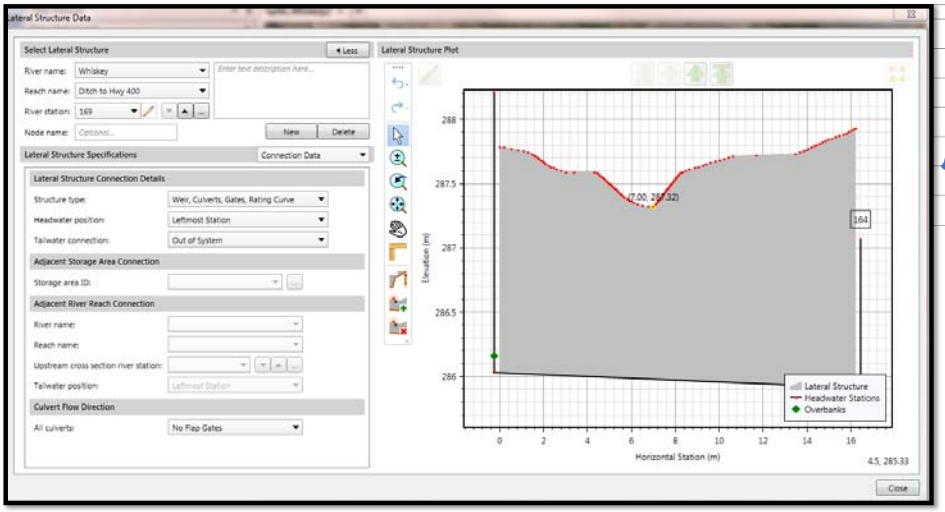
Triangular Weir Coefficient

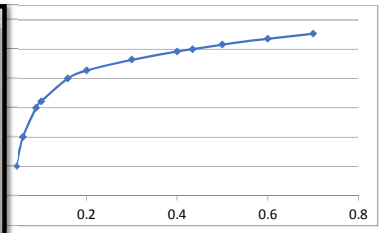
H/L	C Graph	C Equation
0.045	1.05	1.0519
0.06	1.1	1.0971
0.089	1.15	1.1459
0.1	1.161	1.1578
0.159	1.2	1.1963
0.2	1.2135	1.2113
0.3	1.232	1.2336
0.4	1.246	1.2476
0.434	1.25	1.2515
0.5	1.258	1.2583
0.6	1.268	1.2673
0.7	1.2765	1.2754

Triangular C Equation

y=(a+bx)/(1+cx+dx^2)

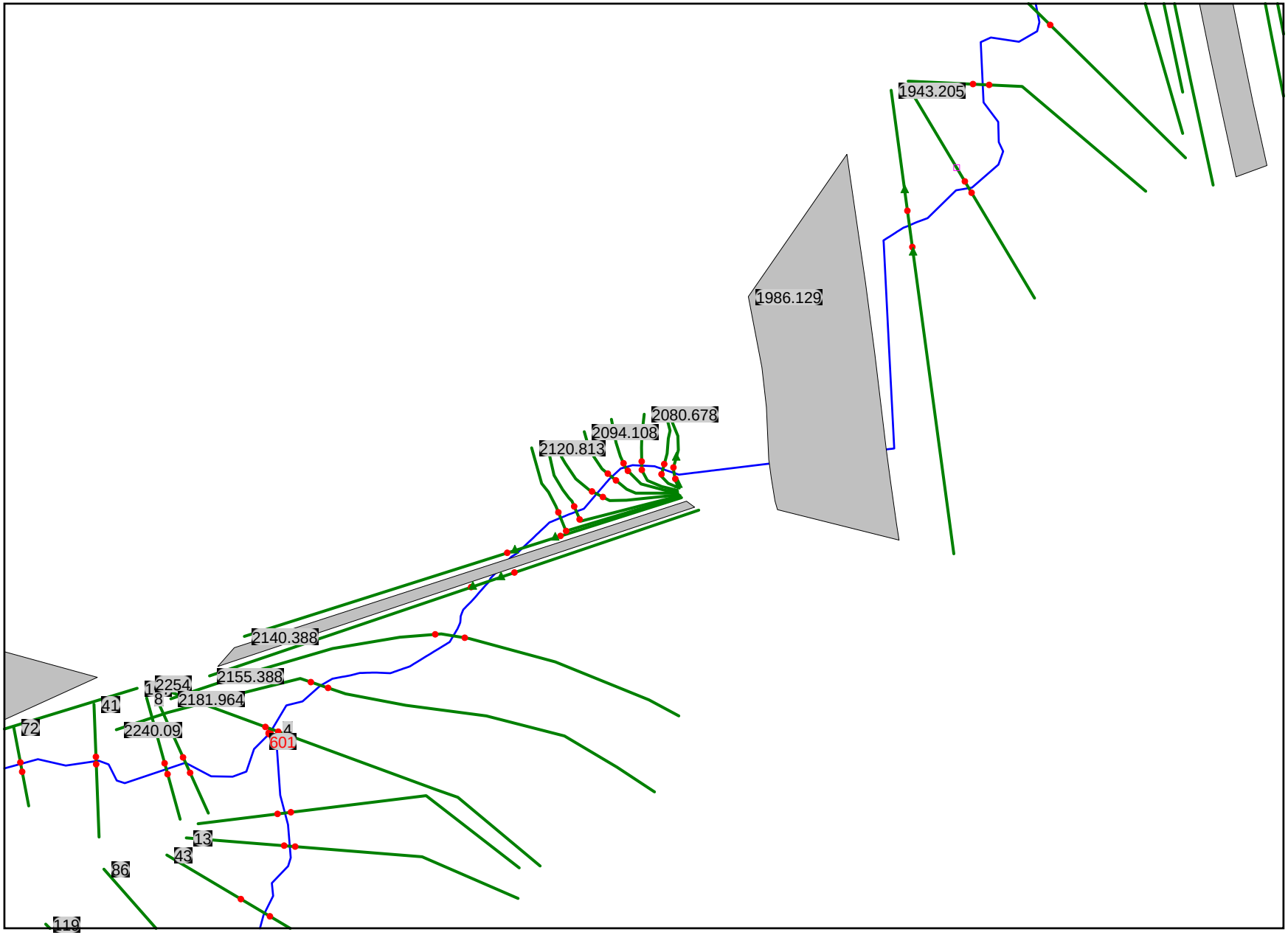
a	-1.01E-05
b	1.44E+02
c	1.15E+02
d	-4.77E+00





Appendix I: MTO Improvements HEC RAS Spill Analysis

Whiskey Creek Highway 400 Crossing Geometry Plan



Whiskey Creek Tributary Highway 400 Crossing Geometry Plan



TATHAM ENGINEERING	Project: Barrie Drainage Master Plan	Date:	16-Feb-18
	File No.: 117076	Designed:	DAM
	Subject: Whiskey Spills Analysis	Checked:	DRT

Reach	Spills	Spill Modelling Method	Details
Whiskey - Hwy 400 Spill	None	None	All cross-sections contain flow
Whiskey - Tributary	None	None	All cross-sections contain flow

Reach	Downstream Boundary Condition	Details
Whiskey - Hwy 400 Spill	Normal Depth	
Whiskey - Tributary	Normal Depth	

HEC-RAS Plan: Ex+Spill River: Whiskey Reach: 4 Profile: Regional

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)	
4	2254	Regional	18.46	286.50	288.76		288.76	0.000079	0.36	97.78	95.54	0.08
4	2240.09	Regional	18.46	285.67	288.76		288.76	0.000011	0.17	164.59	117.55	0.03
4	2181.964	Regional	18.46	284.83	288.76		288.76	0.000003	0.12	238.00	121.86	0.02
4	2155.388	Regional	19.19	284.67	288.76	285.69	288.76	0.000003	0.11	276.68	165.57	0.02
4	2146.129		Culvert									
4	2140.388	Regional	19.19	283.73	288.76	285.48	288.76	0.000004	0.10	252.76	155.23	0.02
4	2120.813	Regional	19.19	284.12	288.75		288.76	0.000044	0.37	81.25	58.87	0.07
4	2114.087	Regional	19.19	284.04	288.75		288.76	0.000066	0.46	67.43	50.69	0.08
4	2103.116	Regional	19.19	283.98	288.75		288.75	0.000034	0.39	77.42	45.57	0.06
4	2094.108	Regional	19.19	283.94	288.75		288.75	0.000046	0.47	66.39	35.34	0.07
4	2087.324	Regional	19.19	283.89	288.74		288.75	0.000081	0.64	50.94	27.43	0.10
4	2080.678	Regional	19.19	283.85	288.74		288.75	0.000096	0.65	46.33	24.43	0.10
4	2072.108	Regional	19.19	283.83	288.74		288.75	0.000075	0.54	47.76	22.54	0.09
4	2067.436	Regional	21.23	283.78	288.72	285.66	288.74	0.000130	0.68	34.21	19.47	0.11
4	1986.129		Culvert									
4	1943.205	Regional	21.23	281.42	284.18	282.87	284.21	0.000583	0.83	28.77	40.97	0.20
4	1886	Regional	21.23	281.30	284.11	282.76	284.18	0.000799	1.28	21.72	14.39	0.26
4	1836	Regional	21.23	280.40	284.15		284.15	0.000035	0.34	137.15	62.07	0.06
4	1786	Regional	21.23	280.05	284.15		284.15	0.000009	0.19	216.33	90.71	0.03
4	1734	Regional	21.23	279.75	284.15		284.15	0.000009	0.20	237.45	90.68	0.03
4	1713	Regional	21.23	279.60	284.15		284.15	0.000008	0.19	273.08	101.79	0.03
4	1709	Regional	22.00	278.99	284.15	280.41	284.15	0.000006	0.18	277.82	100.79	0.03
4	1690		Culvert									
4	1673	Regional	22.00	278.36	280.68	279.93	281.02	0.003626	2.56	8.58	35.82	0.55
4	1668	Regional	22.00	278.36	280.73		280.77	0.000581	1.04	40.19	38.32	0.22
4	1652	Regional	22.00	278.16	280.74		280.76	0.000339	0.85	54.22	45.87	0.17
4	1619	Regional	22.00	277.66	280.73		280.75	0.000293	0.88	60.61	53.83	0.16
4	1580	Regional	22.00	277.46	280.73		280.74	0.000116	0.58	84.54	55.60	0.10
4	1545	Regional	22.00	277.06	280.73		280.74	0.000114	0.61	80.87	44.15	0.10
4	1514	Regional	22.00	277.16	280.73		280.73	0.000042	0.37	124.52	57.26	0.06
4	1487	Regional	22.00	276.96	280.73		280.73	0.000026	0.31	127.77	56.91	0.05
4	1481	Regional	23.66	276.96	280.73	278.15	280.73	0.000048	0.41	131.17	77.31	0.07
4	1470		Culvert									
4	1459	Regional	23.66	276.78	277.89	277.89	278.45	0.015146	3.30	7.18	31.52	1.00
4	1452	Regional	23.66	276.68	277.55	277.51	277.91	0.014574	2.71	9.17	11.66	0.94
4	1427	Regional	23.66	276.39	277.44		277.61	0.005369	1.86	12.89	12.85	0.59
4	1403	Regional	23.66	275.99	276.99	276.99	277.39	0.015067	2.91	9.74	13.81	0.97
4	1367	Regional	23.66	275.68	276.41		276.62	0.010257	2.03	12.55	19.80	0.76
4	1303	Regional	23.66	274.70	275.54	275.54	275.82	0.014940	2.70	13.32	24.56	0.95
4	1252	Regional	23.66	273.80	274.37	274.37	274.64	0.019468	2.39	11.02	21.41	1.01
4	1220	Regional	23.66	273.30	274.32		274.38	0.002318	1.22	24.31	27.47	0.39
4	1173	Regional	23.66	272.40	274.32		274.33	0.000430	0.76	52.37	44.52	0.18
4	1160	Regional	24.39	272.40	274.30	273.50	274.33	0.000581	0.85	53.13	61.73	0.21
4	1129		Culvert									
4	1100	Regional	24.75	271.20	272.56	272.56	273.22	0.014329	3.60	6.87	39.47	1.00
4	1094	Regional	24.75	271.00	271.85	271.83	272.04	0.021379	2.91	16.68	35.80	1.09
4	1039	Regional	24.75	270.10	270.90	270.90	271.05	0.014787	2.40	21.83	62.15	0.91
4	1011	Regional	24.75	269.10	270.48	270.48	270.63	0.007265	2.34	27.09	82.06	0.69
4	959	Regional	24.75	268.80	269.36	269.36	269.54	0.023101	2.37	16.93	54.15	1.08
4	906	Regional	24.75	267.80	268.78		268.81	0.001564	0.93	40.64	66.70	0.31
4	858	Regional	24.75	267.20	268.78		268.79	0.000161	0.43	86.56	73.50	0.11
4	827	Regional	24.75	267.20	268.78		268.78	0.000040	0.21	134.74	147.51	0.05
4	786	Regional	24.75	267.06	268.78	268.29	268.78	0.000035	0.21	111.45	87.58	0.05
4	737	Regional	24.75	267.30	268.77	268.30	268.78	0.000132	0.36	67.49	64.63	0.10
4	683	Regional	24.75	267.30	268.31	268.31	268.72	0.014498	2.92	9.27	11.95	0.95
4	635	Regional	24.75	267.10	268.49	268.10	268.50	0.000101	0.30	71.14	61.77	0.08
4	590	Regional	24.75	267.00	268.49	268.10	268.49	0.000075	0.27	82.36	72.13	0.07
4	562	Regional	24.75	266.80	268.49	267.93	268.49	0.000090	0.32	81.18	79.09	0.08
4	521	Regional	24.75	266.70	268.44	267.87	268.48	0.000900	1.05	31.04	39.44	0.26
4	482	Regional	24.75	266.70	268.42	267.72	268.45	0.000749	0.96	32.98	39.66	0.24
4	447	Regional	24.75	266.58	268.39	267.58	268.43	0.000678	0.94	33.74	40.16	0.23
4	408	Regional	24.75	266.49	268.32		268.39	0.001436	1.34	25.21	39.48	0.33
4	372	Regional	24.75	266.25	268.27		268.34	0.001259	1.37	26.23	38.26	0.31
4	321	Regional	24.75	266.10	267.93		268.20	0.004900	2.45	13.48	15.50	0.60
4	285	Regional	24.75	266.30	268.02		268.06	0.001068	1.12	51.62	78.86	0.28
4	249	Regional	24.75	266.10	267.40	267.40	267.91	0.014908	3.22	8.27	9.03	0.97
4	210	Regional	24.75	264.50	265.92	265.92	266.45	0.013498	3.34	8.81	9.63	0.95
4	181	Regional	24.75	263.10	264.50	264.50	265.09	0.014384	3.53	8.30	8.43	0.98
4	145	Regional	24.75	262.90	263.69	263.69	263.97	0.016638	2.41	11.46	22.84	0.96
4	95	Regional	24.75	261.70	262.29	262.29	262.47	0.016947	2.11	16.72	47.76	0.93
4	64	Regional	24.75	260.20	260.92	260.92	261.21	0.019016	2.38	10.47	19.22	1.00
4	0	Regional	24.75	259.35	260.52		260.57	0.001540	1.03	27.44	31.02	0.32

HEC-RAS Plan: Fut+Spill River: Whiskey Reach: 4 Profile: Regional

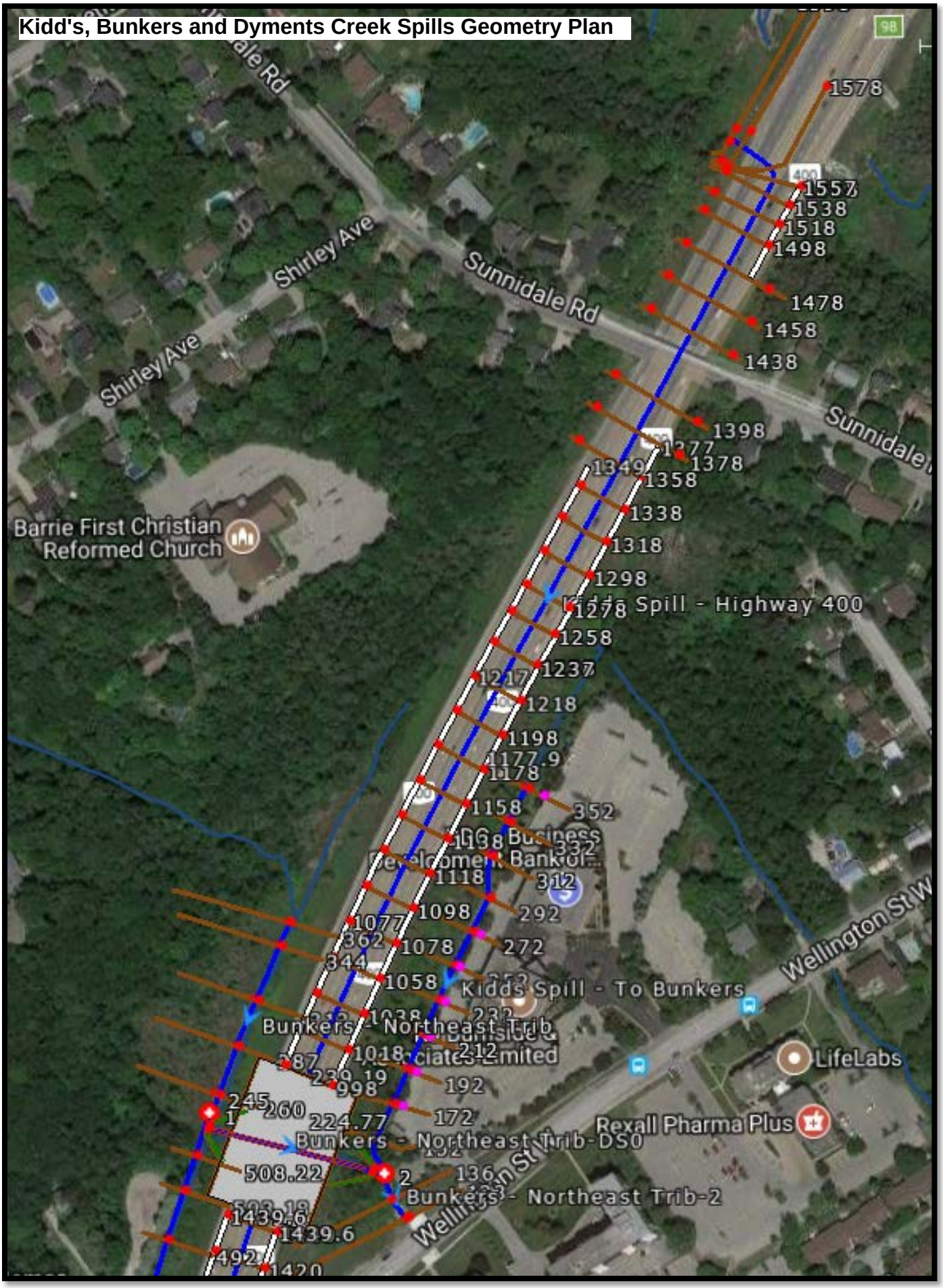
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
4	2254	Regional	22.15	286.50	290.54		290.54	0.000004	0.13	318.76	141.12	0.02
4	2240.09	Regional	22.15	285.67	290.54		290.54	0.000001	0.08	448.29	190.65	0.01
4	2181.964	Regional	22.15	284.83	290.54		290.54	0.000001	0.07	498.49	180.29	0.01
4	2155.388	Regional	23.03	284.67	290.54	285.77	290.54	0.000000	0.06	597.14	198.65	0.01
4	2146.129		Culvert									
4	2140.388	Regional	23.03	283.73	290.54	285.65	290.54	0.000001	0.05	531.77	158.11	0.01
4	2120.813	Regional	23.03	284.12	290.54		290.54	0.000005	0.18	186.87	59.21	0.03
4	2114.087	Regional	23.03	284.04	290.54		290.54	0.000008	0.21	158.55	51.02	0.03
4	2103.116	Regional	23.03	283.98	290.54		290.54	0.000007	0.22	159.15	45.74	0.03
4	2094.108	Regional	23.03	283.94	290.54		290.54	0.000010	0.28	129.91	35.56	0.04
4	2087.324	Regional	23.03	283.89	290.54		290.54	0.000016	0.36	100.40	27.63	0.05
4	2080.678	Regional	23.03	283.85	290.54		290.54	0.000022	0.39	90.41	24.61	0.05
4	2072.108	Regional	23.03	283.83	290.54		290.54	0.000021	0.36	88.45	22.76	0.05
4	2067.436	Regional	25.48	283.78	290.52	285.83	290.54	0.000045	0.51	54.91	19.86	0.07
4	1986.129		Culvert									
4	1943.205	Regional	25.48	281.42	284.24	283.00	284.29	0.000735	0.96	30.40	42.72	0.23
4	1886	Regional	25.48	281.30	284.14	282.90	284.24	0.001092	1.51	22.24	14.82	0.30
4	1836	Regional	25.48	280.40	284.20		284.20	0.000047	0.40	140.44	62.50	0.07
4	1786	Regional	25.48	280.05	284.20		284.20	0.000013	0.22	221.16	91.71	0.04
4	1734	Regional	25.48	279.75	284.20		284.20	0.000013	0.23	242.26	91.22	0.04
4	1713	Regional	25.48	279.60	284.20		284.20	0.000011	0.23	278.48	102.52	0.03
4	1709	Regional	26.40	278.99	284.20	280.58	284.20	0.000009	0.21	283.16	102.09	0.03
4	1690		Culvert									
4	1673	Regional	26.40	278.36	280.75	280.13	281.21	0.004706	2.98	8.85	36.84	0.63
4	1668	Regional	26.40	278.36	280.83		280.87	0.000700	1.17	43.79	40.71	0.24
4	1652	Regional	26.40	278.16	280.83		280.86	0.000434	0.98	58.60	52.77	0.19
4	1619	Regional	26.40	277.66	280.82		280.85	0.000365	1.00	65.67	58.33	0.18
4	1580	Regional	26.40	277.46	280.82		280.83	0.000146	0.66	89.63	57.13	0.12
4	1545	Regional	26.40	277.06	280.82		280.83	0.000145	0.70	84.84	44.95	0.12
4	1514	Regional	26.40	277.16	280.82		280.82	0.000054	0.43	129.72	58.53	0.07
4	1487	Regional	26.40	276.96	280.82		280.82	0.000034	0.36	132.90	57.72	0.06
4	1481	Regional	28.39	276.96	280.82	278.30	280.82	0.000062	0.47	138.10	78.32	0.08
4	1470		Culvert									
4	1459	Regional	28.39	276.78	278.04	278.04	278.66	0.014516	3.50	8.11	32.72	1.00
4	1452	Regional	28.39	276.68	277.66	277.65	278.06	0.013752	2.86	10.95	21.63	0.93
4	1427	Regional	28.39	276.39	277.55		277.76	0.005397	2.01	14.40	13.13	0.60
4	1403	Regional	28.39	275.99	277.11	277.11	277.54	0.014014	3.04	11.44	14.66	0.95
4	1367	Regional	28.39	275.68	276.49		276.73	0.010385	2.18	14.10	20.30	0.78
4	1303	Regional	28.39	274.70	275.62	275.62	275.92	0.014983	2.87	15.22	25.30	0.96
4	1252	Regional	28.39	273.80	274.44	274.44	274.74	0.018693	2.53	12.57	21.93	1.01
4	1220	Regional	28.39	273.30	274.39		274.47	0.002631	1.36	26.33	28.06	0.42
4	1173	Regional	28.39	272.40	274.39		274.41	0.000529	0.86	55.67	46.15	0.20
4	1160	Regional	29.27	272.40	274.38	273.61	274.40	0.000686	0.94	57.72	65.89	0.23
4	1129		Culvert									
4	1100	Regional	29.70	271.20	272.73	272.73	273.48	0.013782	3.83	7.76	47.32	1.00
4	1094	Regional	29.70	271.00	271.91	271.89	272.12	0.021181	3.06	18.91	36.39	1.10
4	1039	Regional	29.70	270.10	270.94	270.94	271.10	0.015491	2.55	24.52	63.21	0.94
4	1011	Regional	29.70	269.10	270.52	270.52	270.68	0.008141	2.53	30.42	83.84	0.73
4	959	Regional	29.70	268.80	269.42	269.42	269.60	0.021713	2.47	20.17	61.11	1.06
4	906	Regional	29.70	267.80	268.67		268.74	0.003856	1.34	33.37	64.78	0.48
4	858	Regional	29.70	267.20	268.68		268.69	0.000304	0.56	78.89	72.80	0.15
4	827	Regional	29.70	267.20	268.68		268.68	0.000078	0.28	120.33	130.96	0.08
4	786	Regional	29.70	267.06	268.67	268.44	268.68	0.000067	0.28	102.15	87.30	0.07
4	737	Regional	29.70	267.30	268.66	268.30	268.67	0.000278	0.50	60.16	64.37	0.14
4	683	Regional	29.70	267.30	268.63	268.43	268.65	0.000460	0.63	51.37	63.36	0.18
4	635	Regional	29.70	267.10	268.63	268.10	268.64	0.000099	0.32	80.00	62.07	0.08
4	590	Regional	29.70	267.00	268.63	268.10	268.64	0.000073	0.29	92.72	72.45	0.07
4	562	Regional	29.70	266.80	268.63	268.04	268.63	0.000085	0.32	92.54	79.35	0.08
4	521	Regional	29.70	266.70	268.58	268.00	268.62	0.000771	1.02	36.82	39.81	0.24
4	482	Regional	29.70	266.70	268.57	267.88	268.60	0.000653	0.95	38.91	40.31	0.22
4	447	Regional	29.70	266.58	268.54	267.69	268.58	0.000599	0.94	39.90	41.11	0.22
4	408	Regional	29.70	266.49	268.49		268.54	0.001114	1.26	32.04	41.25	0.29
4	372	Regional	29.70	266.25	268.44		268.51	0.001028	1.31	33.44	45.88	0.29
4	321	Regional	29.70	266.10	268.07		268.38	0.005082	2.63	15.82	17.05	0.62
4	285	Regional	29.70	266.30	268.21		268.24	0.000778	1.03	66.63	80.63	0.24
4	249	Regional	29.70	266.10	267.54	267.54	268.11	0.014013	3.38	9.63	9.60	0.96
4	210	Regional	29.70	264.50	266.07	266.07	266.65	0.012849	3.51	10.33	10.36	0.94
4	181	Regional	29.70	263.10	264.67	264.67	265.32	0.013474	3.71	9.87	10.03	0.97
4	145	Regional	29.70	262.90	263.77	263.77	264.08	0.015818	2.54	13.33	24.09	0.95
4	95	Regional	29.70	261.70	262.34	262.34	262.54	0.017184	2.25	18.99	48.22	0.95
4	64	Regional	29.70	260.20	261.00	261.00	261.32	0.018056	2.51	11.96	19.97	1.00
4	0	Regional	29.70	259.35	260.62		260.68	0.001625	1.12	30.86	34.59	0.33

HEC-RAS Plan: Pr400Ex River: Whiskey Reach: Tributary Profile: Hazel

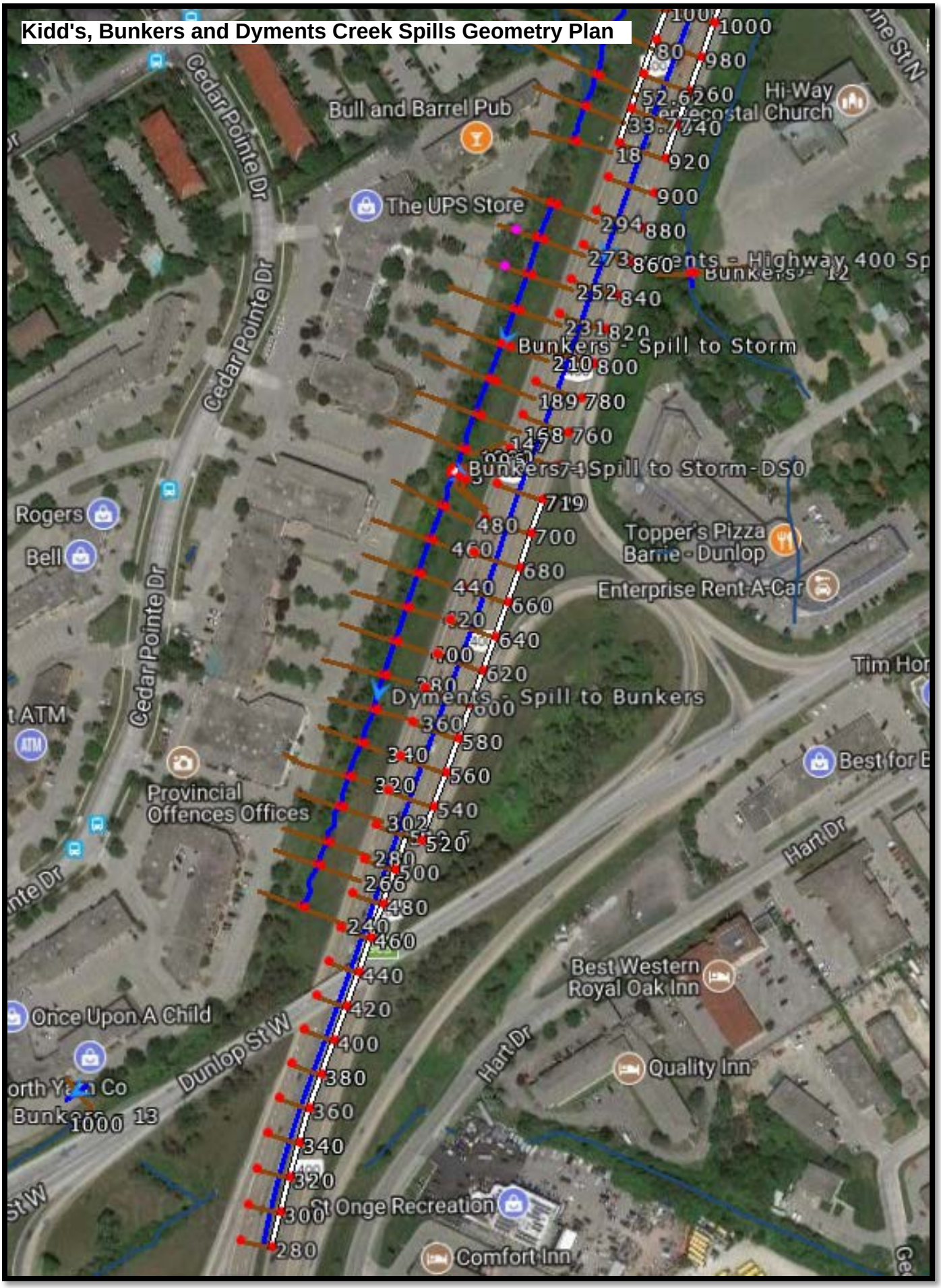
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)	
Tributary	640	Hazel	1.41	288.10	288.36	288.36	288.44	0.021028	1.42	1.67	11.52	0.91
Tributary	600	Hazel	1.41	286.85	287.11	287.10	287.19	0.023720	1.32	1.17	7.22	0.94
Tributary	560	Hazel	1.41	285.90	286.12	286.12	286.20	0.025726	1.27	1.25	8.94	0.96
Tributary	534	Hazel	1.41	285.54	285.81	285.73	285.84	0.006610	0.83	3.20	16.94	0.52
Tributary	512	Hazel	1.41	285.37	285.55	285.55	285.60	0.024389	1.17	2.39	25.45	0.92
Tributary	496	Hazel	1.41	283.85	284.75	284.14	284.76	0.000441	0.49	3.57	8.05	0.16
Tributary	463		Culvert									
Tributary	385	Hazel	1.41	282.74	283.11	283.11	283.23	0.019043	1.69	1.19	5.74	0.92
Tributary	375	Hazel	1.41	282.17	282.57	282.57	282.71	0.020374	1.70	0.98	4.34	0.94
Tributary	360	Hazel	1.41	281.67	282.01	282.01	282.11	0.019514	1.52	1.17	6.26	0.90
Tributary	320	Hazel	1.41	280.54	280.76	280.76	280.83	0.026348	1.22	1.27	9.69	0.96
Tributary	280	Hazel	2.44	279.73	280.68	280.11	280.69	0.000283	0.39	9.36	21.91	0.13
Tributary	266		Culvert									
Tributary	240	Hazel	2.44	279.17	279.47	279.42	279.52	0.011115	1.04	2.67	14.71	0.67
Tributary	200	Hazel	2.44	278.60	278.77	278.77	278.84	0.027264	1.17	2.26	17.59	0.96
Tributary	160	Hazel	2.44	277.55	277.71	277.69	277.76	0.021702	1.02	2.53	19.36	0.85
Tributary	120	Hazel	2.44	276.49	276.72	276.72	276.79	0.026857	1.23	2.07	14.54	0.97
Tributary	80	Hazel	2.44	275.45	275.64	275.61	275.67	0.017521	0.82	3.19	28.72	0.74
Tributary	40	Hazel	2.44	274.87	275.04		275.07	0.012761	0.81	4.40	36.18	0.66
Tributary	0	Hazel	2.44	273.93	274.39	274.39	274.50	0.015208	1.60	2.12	12.69	0.83

HEC-RAS Plan: Pr400Fut River: Whiskey Reach: Tributary Profile: Hazel

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	640	Hazel	1.69	288.10	288.38	288.38	288.47	0.020824	1.50	1.95	12.18	0.92
Tributary	600	Hazel	1.69	286.85	287.13	287.13	287.23	0.024180	1.42	1.32	7.55	0.96
Tributary	560	Hazel	1.69	285.90	286.14	286.14	286.23	0.024639	1.34	1.45	9.33	0.96
Tributary	534	Hazel	1.69	285.54	285.84	285.74	285.86	0.006697	0.89	3.63	17.48	0.53
Tributary	512	Hazel	1.69	285.37	285.56	285.56	285.61	0.026329	1.27	2.68	26.08	0.97
Tributary	496	Hazel	1.69	283.85	284.86	284.17	284.88	0.000419	0.52	4.05	10.97	0.16
Tributary	463		Culvert									
Tributary	385	Hazel	1.69	282.74	283.15	283.15	283.27	0.018114	1.76	1.39	6.09	0.91
Tributary	375	Hazel	1.69	282.17	282.61	282.61	282.76	0.018415	1.75	1.19	4.88	0.91
Tributary	360	Hazel	1.69	281.67	282.03	282.03	282.15	0.020088	1.63	1.34	6.62	0.93
Tributary	320	Hazel	1.69	280.54	280.82		280.87	0.012363	1.03	1.92	11.47	0.69
Tributary	280	Hazel	2.93	279.73	280.81	280.15	280.81	0.000241	0.39	11.10	24.23	0.12
Tributary	266		Culvert									
Tributary	240	Hazel	2.93	279.17	279.49	279.45	279.55	0.011383	1.12	3.01	15.56	0.69
Tributary	200	Hazel	2.93	278.60	278.79	278.79	278.87	0.026624	1.25	2.58	17.97	0.97
Tributary	160	Hazel	2.93	277.55	277.72	277.71	277.78	0.022182	1.10	2.83	19.69	0.88
Tributary	120	Hazel	2.93	276.49	276.74	276.74	276.82	0.025666	1.30	2.38	15.18	0.97
Tributary	80	Hazel	2.93	275.45	275.65	275.64	275.69	0.017166	0.87	3.62	29.69	0.75
Tributary	40	Hazel	2.93	274.87	275.06		275.08	0.013089	0.87	4.92	36.59	0.68
Tributary	0	Hazel	2.93	273.93	274.43	274.43	274.54	0.013628	1.63	2.71	14.82	0.80


Kidd's, Bunkers and Dyments Creek Spills Geometry Plan
Shirley Ave
Sunnidale Rd
Barrie First Christian Reformed Church
Kidds Spill - Highway 400
Kidds Spill - To Bunkers
Bunkers - Northeast Trib
Bunkers - Northeast Trib-DS0
Bunkers - Northeast Trib-2
Wellington St W
LifeLabs
Rexall Pharma Plus
1578
1557
1538
1518
1498
1478
1458
1438
1398
1378
1358
1338
1318
1298
1278
1258
1237
1218
1198
1178
1158
352
332
312
292
272
1098
1078
1058
362
344
212
192
172
998
508.22
1439.6
1420


Kidd's, Bunkers and Dyments Creek Spills Geometry Plan
Anne St N
Gateway Co-Operative Homes
Edgehill Dr
Value Village
Wellington St W
Mary Brov
Dollarama
Uncle Bob's Country Buffet
Rivendell Books
Bunkers - Central Trib
Bunkers - Northeast Tri
Bunkers - Nort
Shoppers Drug Mart
Italian Bakery
Donald St
Hi-Way Pentecostal Church
The UPS Store
Henry St
Esso
Bunkers - Highway 400 Spil
Bunkers - Spill to Storm
Community
ull and Barrel Pub
245
260
224.77
508.22
1439.6
1420
1400
1380
1360
1340
1320
1300
1280
1260
1240
1220
1200
1180
1160
1140
1120
1100
1079
1060
1040
1020
1000
980
960
940
920
900
880
860
840
820
800
492
463
442
426
406
386
366
346
326
306
286
266
248
230
200
180
160
140
120
100
80
52.6
33.7
18
294
273
252
231
210
192
172
136
2


Kidd's, Bunkers and Dyments Creek Spills Geometry Plan
Cedar Pointe Dr
Bull and Barrel Pub
The UPS Store
Hi-Way Pentecostal Church
Bunkers - Highway 400 Sp
Bunkers - Spill to Storm
Bunkers - Spill to Storm-DS0
Dyments - Spill to Bunkers
Rogers
Bell
Topper's Pizza Barrie - Dunlop
Enterprise Rent-A-Car
Provincial Offences Offices
Hart Dr
Best Western Royal Oak Inn
Quality Inn
Once Upon A Child
Dunlop St W
St Onge Recreation
Comfort Inn
1000
980
960
940
920
900
880
860
840
820
800
780
760
740
720
700
680
660
640
620
600
580
560
540
520
500
480
460
440
420
400
380
360
340
320
300
280

TATHAM ENGINEERING

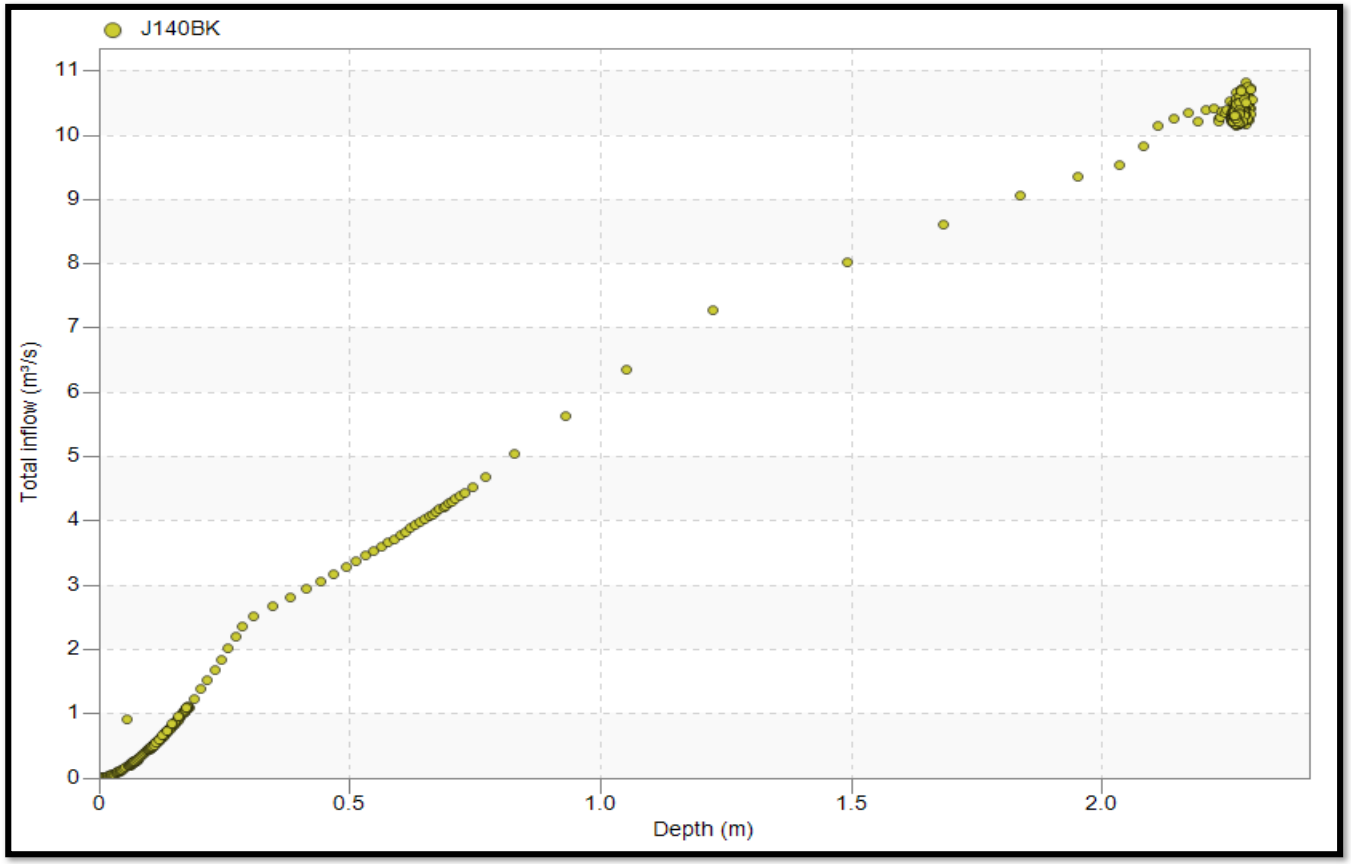
Project: Barrie Drainage Master Plan		Date:	5-Feb-18
File No.: 117076		Designed:	DAM
Subject: Central Spills Analysis		Checked:	DRT

Reach	Spills	Spill Modelling Method	Details
Kidds Spill - Highway 400	To: Kidds Creek Main Branch	Lateral Structure 1557	Zero Height Weir Modelled Using Hager's Equation
Kidds Spill - Highway 400	To: Kidds Creek Tributary Branch	Lateral Structure 1377	Zero Height Weir Modelled Using Hager's Equation
Kidds Spill - Highway 400	To: Kidds Spill - To Bunkers (Upstream of 400 Crossing - HY-8 analysis to confirm crossing capacity)	Lateral Structure 1349	Zero Height Weir Modelled Using Hager's Equation
Kidds Spill - Highway 400	To: Kidds Spill - To Bunkers	Lateral Structures 1237, 1177	Zero Height Weir Modelled Using Hager's Equation
Kidds Spill - Highway 400	To: Bunkers - Northeast Trib	Lateral Structures 1217, 1077	Zero Height Weir Modelled Using Hager's Equation
Bunkers - Northeast Trib	To Bunkers - Central Trib	Split Junction	
Kidds Spill - Highway 400 2	To: Bunkers - Central Trib (Upstream of 400 Crossing)	Lateral Structures 1439.6, 1099	Zero Height Weir Modelled Using Hager's Equation
Kidds Spill - Highway 400 2	To: Bunkers - Central Trib (Downstream of 400 Crossing)	Lateral Structures 1439, 1079	Zero Height Weir Modelled Using Hager's Equation
Kidds Spill - Highway 400 2	To: Bunkers - Central Trib	Lateral Structure 1038	Zero Height Weir Modelled Using Hager's Equation
Bunkers - Central Trib	To Bunkers - Spill to Storm	Lateral Structure 33	Broad Crested Weir
Kidds Spill - Highway 400 2	To Bunkers - Spill to Storm	Lateral Structure 719	Zero Height Weir Modelled Using Hager's Equation
Bunkers - Spill to Storm	To Dyments - Spill From Bunkers	Split Junction	
Kidds Spill - Highway 400 2	To Dyments	Lateral Structure 519.5	Zero Height Weir Modelled Using Hager's Equation
Kidds Spill - Highway 400 2	To Dyments	Downstream Total	

Reach	Upstream Flow	Downstream Boundary Condition	Details
Kidds Spill - Highway 400	Flow overtopping Highway 400	Normal Depth	
Kidds Spill - To Bunkers	0.295 cms for Existing Regional Storm plus LS 1349		
Bunkers - Northeast Trib	8.47 cms for Existing Regional Storm	Junction	
Bunkers - Northeast Trib-DSO	Split flow analysis of "Bunkers - Northeast Trib"	Junction	
Bunkers - Northeast Trib-2	Confluence of "Bunkers - Northeast Trib-DSO" and "Kidds Spill - To Bunkers"	Rating Curve	Rating Curve from PCSWMM.
Kidds Spill - Highway 400 2	Downstream flow from "Kidds Spill - Highway 400"	Normal Depth	
Bunkers - Central Trib	Split flow analysis of "Bunkers - Northeast Trib"		
Bunkers - Central Trib	Additional 6.41 cms for Existing Regional Storm at XS 200	Rating Curve	Rating Curve from HY-8 Analysis
Bunkers - Spill to Storm	Additional 14.12 cms for Existing Regional Storm at XS 147.	Junction	
Bunkers -Spill to Storm-DS	Split flow analysis of "Bunkers - Spill to Storm"	Rating Curve	Rating Curve from PCSWMM and HY-8 Analysis.
Dyments - Spill From Bunkers	Split flow analysis of "Bunkers - Spill to Storm"	Rating Curve	Rating Curve from Weir Analysis

TATHAM ENGINEERING	Project: Barrie Drainage Master Plan	Date:	6-Feb-18
	File No.: 117076	Designed:	DAM
	Subject: Bunkers NE Rating Curve	Checked:	DRT

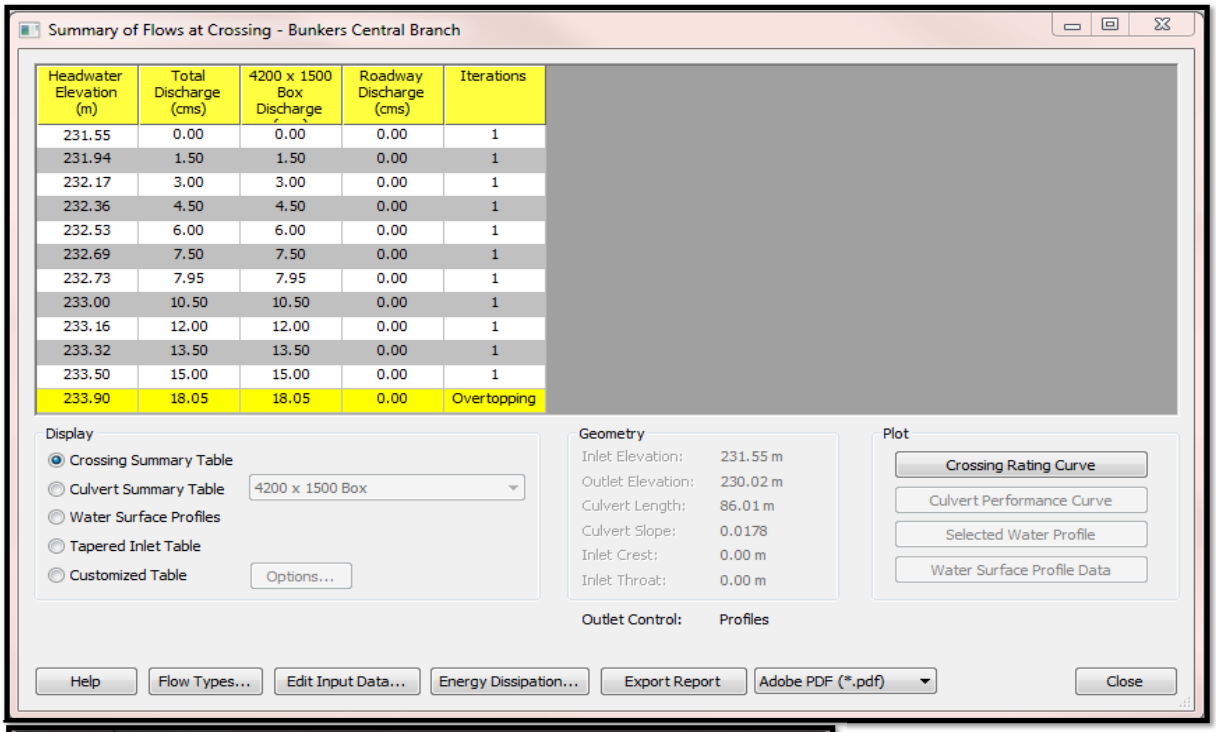
Bunkers Northeast Branch



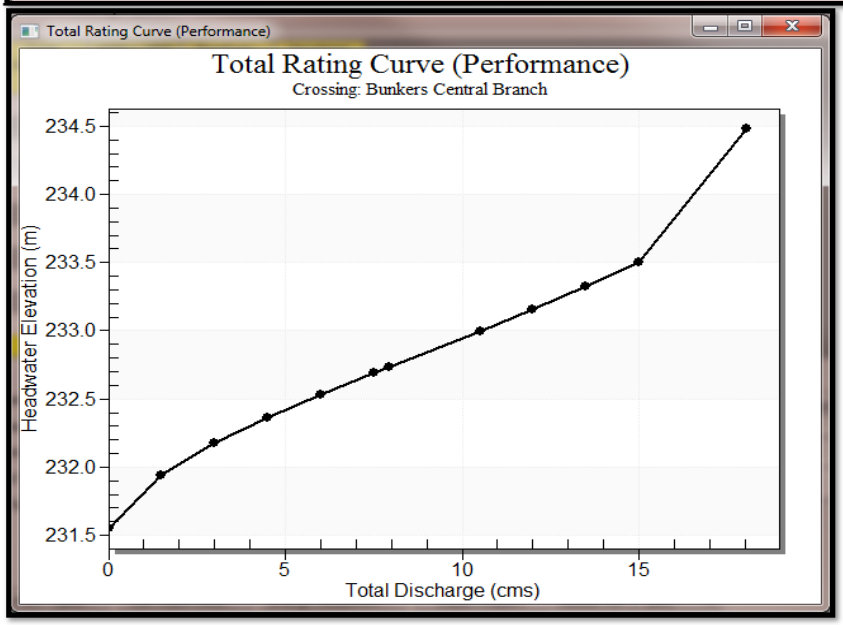
Depth (m)	Discharge (cms)
0	0
0.2	1.38
0.29	2.48
0.4	2.94
0.6	3.79
0.8	4.94
1	5.98
1.2	7.22
1.4	7.65
1.6	8.44
1.8	8.99
2	9.48
2.2	10.32

TATHAM ENGINEERING	Project: Barrie Drainage Master Plan	Date: 7-Feb-18
	File No.: 117076	Designed: DAM
	Subject: Bunkers Central Rating Curve	Checked: DRT

Bunkers Central Branch



Headwater Elevation (m)	Total Discharge (cms)	4200 x 1500 Box Discharge	Roadway Discharge (cms)	Iterations
231.55	0.00	0.00	0.00	1
231.94	1.50	1.50	0.00	1
232.17	3.00	3.00	0.00	1
232.36	4.50	4.50	0.00	1
232.53	6.00	6.00	0.00	1
232.69	7.50	7.50	0.00	1
232.73	7.95	7.95	0.00	1
233.00	10.50	10.50	0.00	1
233.16	12.00	12.00	0.00	1
233.32	13.50	13.50	0.00	1
233.50	15.00	15.00	0.00	1
233.90	18.05	18.05	0.00	Overtopping

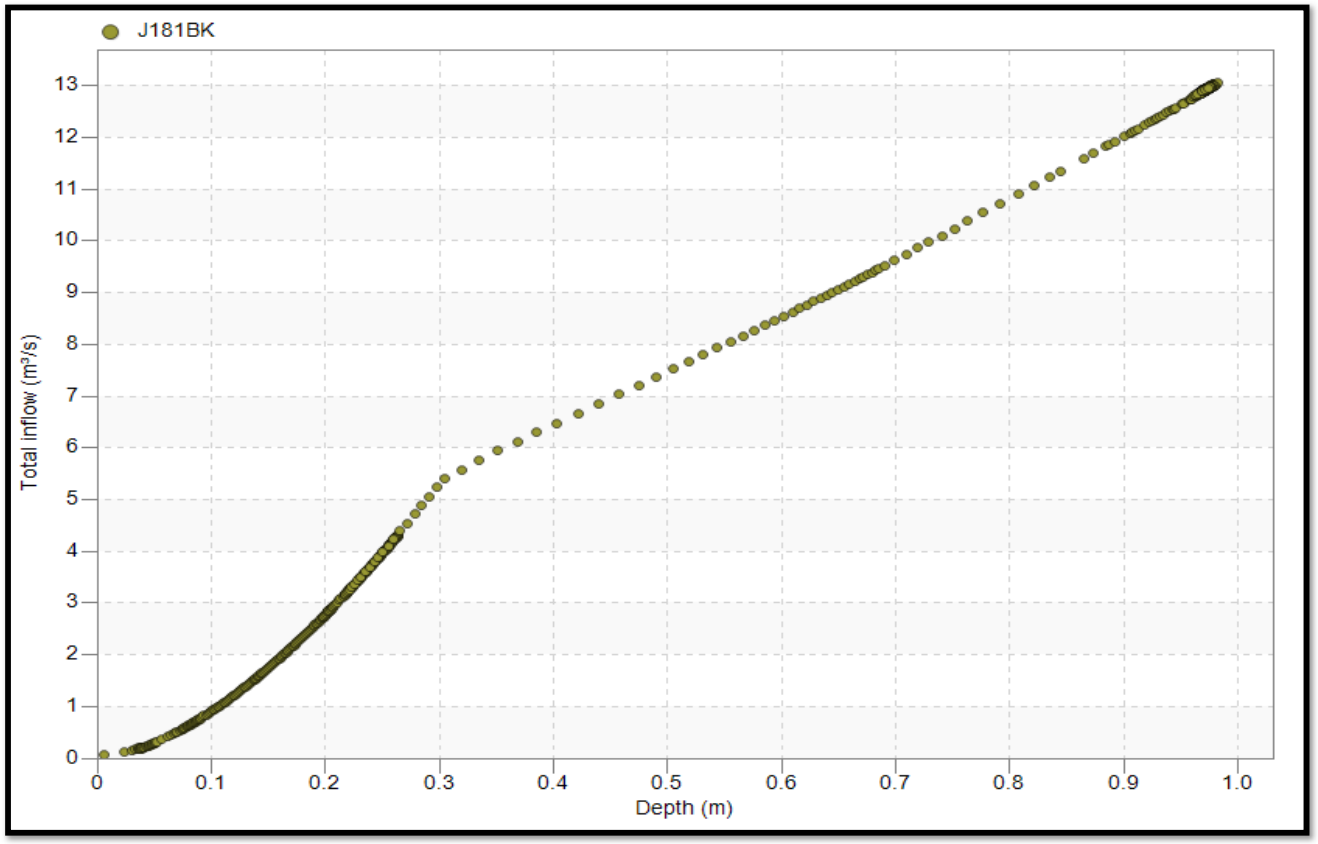


Governing Rating Curve

Elevation (m)	Discharge (cms)
231.55	0
231.94	1.5
232.17	3
232.36	4.5
232.53	6
232.69	7.5
232.73	7.95
233	10.5
233.16	12
233.32	13.5
233.5	15

TATHAM ENGINEERING	Project: Barrie Drainage Master Plan	Date: 7-Feb-18
	File No.: 117076	Designed: DAM
	Subject: Bunkers Central Rating Curve	Checked: DRT

Bunkers Central Branch



Depth (m)	Discharge (cms)
0	0
0.1	0.95
0.2	2.76
0.3	5.34
0.32	5.58
0.4	6.48
0.5	7.46
0.6	8.55
0.7	9.62
0.8	10.84
0.9	12.03
1.00	13.24

PCSWMM Rating Curve

Elevation (m)	Discharge (cms)
231.65	0.95
231.75	2.76
231.85	5.34
231.87	5.58
231.95	6.48
232.05	7.46
232.15	8.55
232.25	9.62
232.35	10.84
232.45	12.03
232.55	13.24

TATHAM ENGINEERING	Project: Barrie Drainage Master Plan	Date: 7-Feb-18
	File No.: 117076	Designed: DAM
	Subject: Bunkers South Rating Curve	Checked: DRT

Bunkers South Branch

Summary of Flows at Crossing - Bunkers South Branch Spill to Dyments

Headwater Elevation (m)	Total Discharge (cms)	Twin 1800 x 1200 Box Discharge	Roadway Discharge (cms)	Iterations
228.05	0.00	0.00	0.00	1
228.51	1.60	1.60	0.00	1
228.77	3.20	3.20	0.00	1
228.99	4.80	4.80	0.00	1
229.21	6.40	6.40	0.00	1
229.43	8.00	8.00	0.00	1
229.68	9.60	9.60	0.00	1
229.96	11.20	11.20	0.00	1
230.28	12.80	12.80	0.00	1
230.29	12.87	12.87	0.00	1
231.04	16.00	16.00	0.00	1
233.10	22.08	22.08	0.00	Overtopping

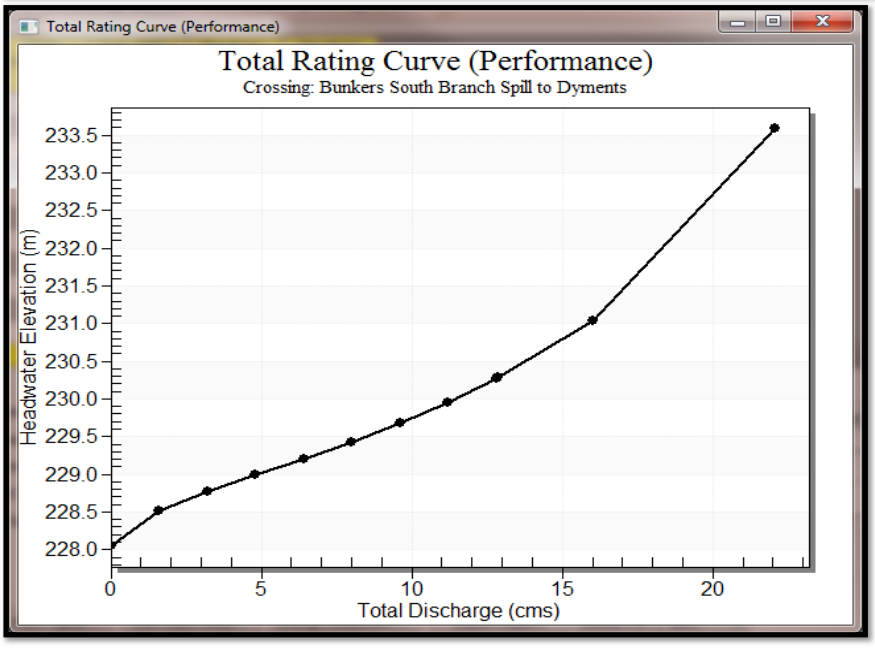
Display
- Crossing Summary Table
- Culvert Summary Table — Twin 1800 x 1200 Box
- Water Surface Profiles
- Tapered Inlet Table
- Customized Table — Options...

Geometry
- Inlet Elevation: 228.05 m
- Outlet Elevation: 227.14 m
- Culvert Length: 97.00 m
- Culvert Slope: 0.0094
- Inlet Crest: 0.00 m
- Inlet Throat: 0.00 m

Outlet Control: Profiles

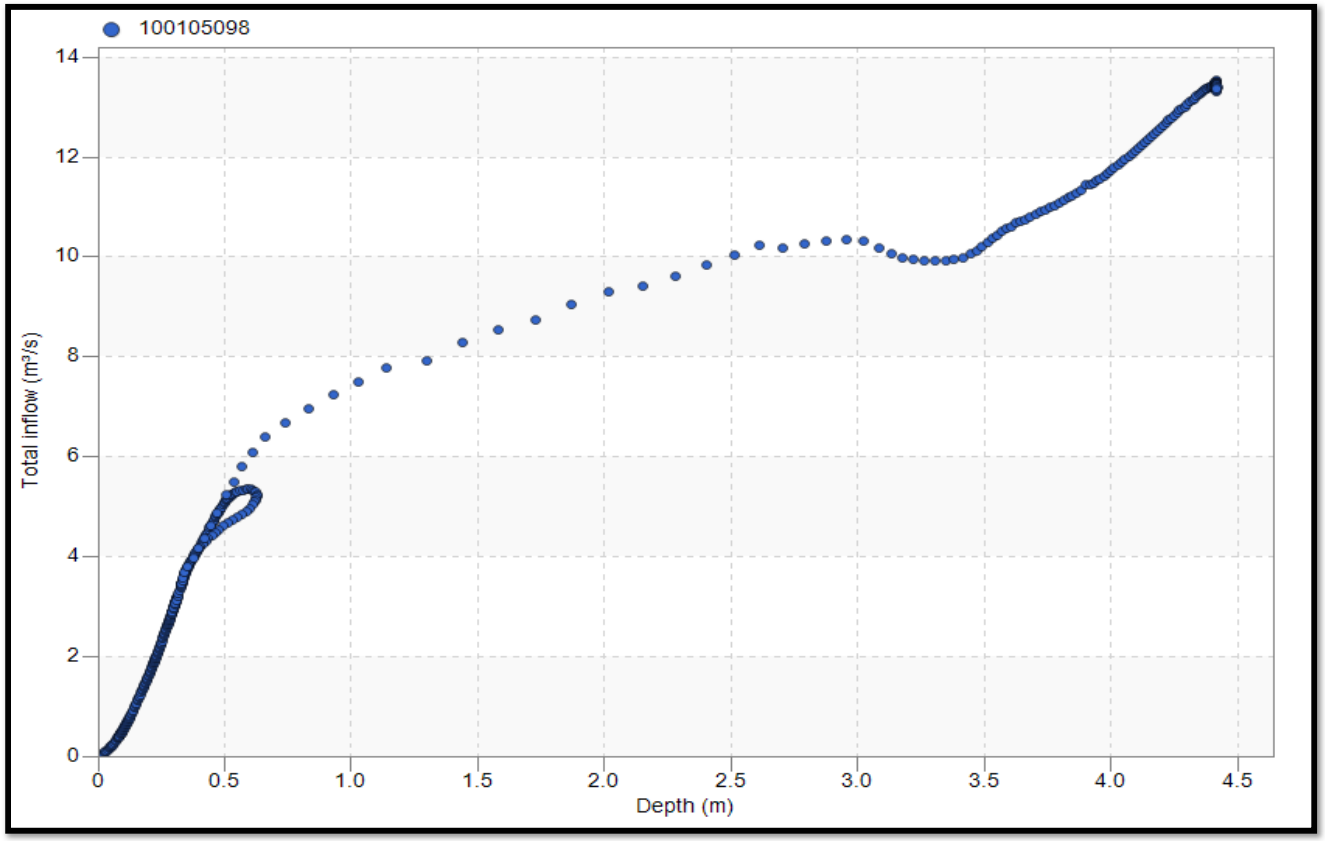
Plot
- Crossing Rating Curve
- Culvert Performance Curve
- Selected Water Profile
- Water Surface Profile Data

Help | Flow Types... | Edit Input Data... | Energy Dissipation... | Export Report | Adobe PDF (*.pdf) | Close



TATHAM ENGINEERING	Project: Barrie Drainage Master Plan	Date: 7-Feb-18
	File No.: 117076	Designed: DAM
	Subject: Bunkers South Rating Curve	Checked: DRT

Bunkers South Branch



Depth (m)	Discharge (cms)
0	0
0.14	0.96
0.38	4.03
0.5	5.24
0.61	6.10
1	7.34
1.5	8.36
2	9.18
2.5	10
3	10.31
3.59	10.57
4	11.78
4.4	13.44

Governing Rating Curve

Elevation (m)	Discharge (cms)
228.05	0
228.51	1.6
228.77	3.2
228.99	4.8
229.21	6.4
229.43	8
229.55	8.36
230.05	9.18
230.55	10
231.05	10.31
231.64	10.57
232.05	11.78
232.45	13.44

TATHAM ENGINEERING	Project: Barrie Drainage Master Plan	Date:	10-Feb-18
	File No.: 117076	Designed:	DAM
	Subject: Dyments Spill Rating Curve	Checked:	DRT

Trapezoidal Broad Crested Weir

Source: Hydraulic Structures, C.D.Smith, University of Saskatchewan

Trapezoidal Weir

The trapezoidal weir is a combination of the rectangular weir and the triangular weir

Enter

W	Weir Bottom Width (m)	6.3
H	Head (m)	0.7
L	Weir Downstream Length	7
S	Side Slope (horizontal):1	10

Rectangular Weir $Q = CWH^{3/2}$

H/L	0.1
C	1.57258

Result

Q Rectangular Weir	Flow (m^3/s)	**5.802303**

Triangular Weir $Q = CH^{5/2}\tan(\theta/2)$

Notch Angle (one side)	84.28940686	degrees
Notch Angle (one side)	1.471127674	radians
$\tan(\theta/2)$	10.000000	

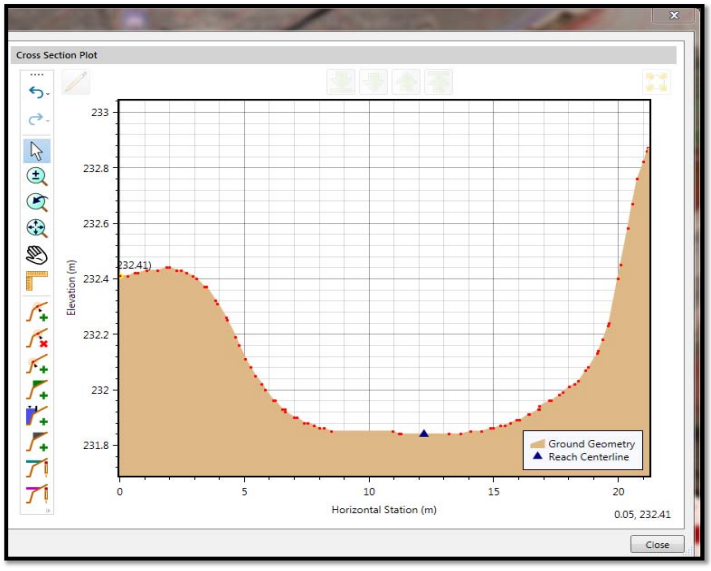
Triangular H/L	0.1
C	1.1578E+00

Result

Q Triangular Weir	Flow (m^3/s)	**4.7465**

Total Rectangular + Triangular Weir

Q Total	**Flow (m^3/s)**	**10.5488**



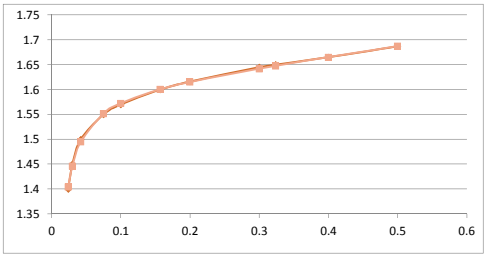
Rectangular Weir Coefficient

H/W	C Graph	C Equation
0.024	1.4	1.404683
0.03	1.45	1.446349
0.042	1.5	1.494886
0.075	1.55	1.551834
0.1	1.57	1.57258
0.157	1.6	1.600637
0.2	1.616	1.615218
0.3	1.645	1.642033
0.324	1.65	1.647787
0.4	1.665	1.66522
0.5	1.687	1.687229

Rectangular C Equation

y=(a+bx)/(1+cx+dx^2)

a	-1.04E+04
b	3.42E+06
c	2.13E+06
d	-2.35E+05



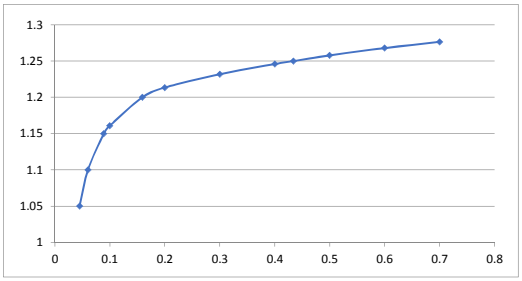
Triangular Weir Coefficient

H/L	C Graph	C Equation
0.045	1.05	1.0519
0.06	1.1	1.0971
0.089	1.15	1.1459
0.1	1.161	1.1578
0.159	1.2	1.1963
0.2	1.2135	1.2113
0.3	1.232	1.2336
0.4	1.246	1.2476
0.434	1.25	1.2515
0.5	1.258	1.2583
0.6	1.268	1.2673
0.7	1.2765	1.2754

Triangular C Equation

y=(a+bx)/(1+cx+dx^2)

a	-1.01E-05
b	1.44E+02
c	1.15E+02
d	-4.77E+00



Spill Rating Curve

Elevation (m)	Discharge (cms)
231.84	0.0000
231.89	0.1045
231.94	0.3121
231.99	0.6039
232.04	0.9981
232.09	1.4884
232.14	2.0677
232.19	2.7512
232.24	3.5389
232.29	4.4303
232.34	5.4285
232.39	6.5365
232.44	7.7572
232.49	9.0937
232.54	10.5488

HEC-RAS Plan: ExReg Profile: Spill

River	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)	
Kidds Spill	To Bunkers	352	Spill	1.92	237.11	237.77	237.77	237.91	0.015766	2.37	1.62	4.43	0.93
Kidds Spill	To Bunkers	332	Spill	2.42	236.50	237.64		237.67	0.001877	1.18	4.49	7.36	0.35
Kidds Spill	To Bunkers	312	Spill	2.57	236.44	237.60		237.63	0.001957	1.22	4.64	7.48	0.36
Kidds Spill	To Bunkers	292	Spill	2.70	236.37	237.56		237.59	0.001902	1.23	4.88	7.67	0.36
Kidds Spill	To Bunkers	272	Spill	2.81	236.30	237.53	237.03	237.56	0.001823	1.22	5.11	7.82	0.35
Kidds Spill	To Bunkers	252.00*	Spill	2.92	236.23	237.49		237.52	0.001742	1.22	5.36	8.01	0.35
Kidds Spill	To Bunkers	232.00*	Spill	3.02	236.17	237.46		237.49	0.001642	1.20	5.64	8.23	0.34
Kidds Spill	To Bunkers	212.00*	Spill	3.20	236.10	237.43		237.45	0.001628	1.22	5.92	8.44	0.34
Kidds Spill	To Bunkers	192.00*	Spill	3.25	236.04	237.40	236.81	237.42	0.001467	1.18	6.24	8.67	0.32
Kidds Spill	To Bunkers	172	Spill	3.28	235.97	237.37	236.74	237.39	0.001302	1.13	6.60	8.92	0.30
Kidds Spill	To Bunkers	152	Spill	3.29	235.90	237.35		237.37	0.001058	1.04	8.74	16.74	0.28
Kidds Spill	Highway 400 - 2	1440	Spill	5.68	239.63	240.06	240.06	240.14	0.003002	1.27	4.47	27.00	1.00
Kidds Spill	Highway 400 - 2	1439.6		Lat Struct									
Kidds Spill	Highway 400 - 2	1439		Lat Struct									
Kidds Spill	Highway 400 - 2	1420	Spill	5.64	239.41	239.84	239.84	239.92	0.003021	1.27	4.44	26.88	1.00
Kidds Spill	Highway 400 - 2	1400	Spill	5.63	239.19	239.62	239.62	239.70	0.003049	1.27	4.43	27.00	1.00
Kidds Spill	Highway 400 - 2	1380	Spill	5.62	238.97	239.40	239.40	239.49	0.003038	1.27	4.43	27.00	1.00
Kidds Spill	Highway 400 - 2	1360	Spill	5.61	238.75	239.18	239.18	239.27	0.003045	1.27	4.42	27.00	1.00
Kidds Spill	Highway 400 - 2	1340	Spill	5.60	238.53	238.96	238.96	239.05	0.003038	1.27	4.42	27.00	1.00
Kidds Spill	Highway 400 - 2	1320	Spill	5.59	238.31	238.74	238.74	238.83	0.003055	1.27	4.41	27.00	1.00
Kidds Spill	Highway 400 - 2	1300	Spill	5.59	238.10	238.52	238.52	238.61	0.003063	1.27	4.40	26.90	1.00
Kidds Spill	Highway 400 - 2	1280	Spill	5.59	237.88	238.30	238.30	238.39	0.003080	1.27	4.40	27.00	1.01
Kidds Spill	Highway 400 - 2	1260	Spill	5.59	237.62	238.05	238.05	238.13	0.003067	1.27	4.40	27.00	1.00
Kidds Spill	Highway 400 - 2	1240	Spill	5.59	237.36	237.79	237.79	237.87	0.003030	1.27	4.41	26.83	1.00
Kidds Spill	Highway 400 - 2	1220	Spill	5.59	237.09	237.52	237.52	237.61	0.003049	1.27	4.41	27.00	1.00
Kidds Spill	Highway 400 - 2	1200	Spill	5.59	236.83	237.26	237.26	237.34	0.002972	1.27	4.40	26.43	0.99
Kidds Spill	Highway 400 - 2	1180	Spill	5.59	236.57	237.00	237.00	237.08	0.003058	1.27	4.41	27.00	1.00
Kidds Spill	Highway 400 - 2	1160	Spill	5.59	236.28	236.70	236.70	236.79	0.003069	1.27	4.40	27.00	1.00
Kidds Spill	Highway 400 - 2	1140	Spill	5.59	235.98	236.40	236.40	236.49	0.003037	1.27	4.39	26.64	1.00
Kidds Spill	Highway 400 - 2	1120	Spill	5.59	235.68	236.10	236.10	236.19	0.003038	1.27	4.40	26.79	1.00
Kidds Spill	Highway 400 - 2	1100	Spill	5.59	235.38	235.80	235.80	235.89	0.003046	1.27	4.39	26.76	1.00
Kidds Spill	Highway 400 - 2	1099		Lat Struct									
Kidds Spill	Highway 400 - 2	1080	Spill	5.57	235.08	235.50	235.50	235.59	0.003056	1.27	4.39	26.90	1.00
Kidds Spill	Highway 400 - 2	1079		Lat Struct									
Kidds Spill	Highway 400 - 2	1060	Spill	5.51	234.83	235.26	235.26	235.34	0.003038	1.27	4.34	26.47	1.00
Kidds Spill	Highway 400 - 2	1040	Spill	5.50	234.60	235.03	235.03	235.11	0.003054	1.27	4.35	26.74	1.00
Kidds Spill	Highway 400 - 2	1020	Spill	5.50	234.37	234.79	234.79	234.88	0.003030	1.27	4.33	26.40	1.00
Kidds Spill	Highway 400 - 2	1000	Spill	5.50	234.14	234.57	234.57	234.65	0.003028	1.27	4.34	26.46	1.00
Kidds Spill	Highway 400 - 2	980	Spill	5.49	233.91	234.33	234.33	234.42	0.003039	1.27	4.32	26.37	1.00
Kidds Spill	Highway 400 - 2	960	Spill	5.40	233.78	234.20	234.20	234.29	0.003055	1.26	4.28	26.36	1.00
Kidds Spill	Highway 400 - 2	940	Spill	5.40	233.69	234.11	234.11	234.19	0.003006	1.26	4.28	26.03	1.00
Kidds Spill	Highway 400 - 2	920	Spill	5.40	233.59	234.02	234.02	234.10	0.003008	1.26	4.28	26.10	1.00
Kidds Spill	Highway 400 - 2	900	Spill	5.40	233.50	233.92	233.92	234.00	0.003100	1.26	4.28	26.64	1.01
Kidds Spill	Highway 400 - 2	880	Spill	5.40	233.40	233.83	233.83	233.91	0.002976	1.26	4.29	26.00	0.99
Kidds Spill	Highway 400 - 2	860	Spill	5.40	233.32	233.74	233.74	233.83	0.003026	1.26	4.28	26.18	1.00
Kidds Spill	Highway 400 - 2	840	Spill	5.40	233.24	233.66	233.66	233.75	0.003026	1.27	4.27	26.08	1.00
Kidds Spill	Highway 400 - 2	820	Spill	5.40	233.16	233.58	233.58	233.67	0.003046	1.26	4.27	26.27	1.00
Kidds Spill	Highway 400 - 2	800	Spill	5.40	233.08	233.50	233.50	233.59	0.003036	1.26	4.29	26.41	1.00
Kidds Spill	Highway 400 - 2	780	Spill	5.40	233.00	233.42	233.42	233.51	0.003047	1.26	4.28	26.37	1.00
Kidds Spill	Highway 400 - 2	760	Spill	5.40	232.92	233.34	233.34	233.43	0.003013	1.27	4.27	26.02	1.00
Kidds Spill	Highway 400 - 2	740	Spill	5.40	232.84	233.26	233.26	233.35	0.003037	1.27	4.26	26.03	1.00
Kidds Spill	Highway 400 - 2	720	Spill	5.40	232.76	233.18	233.18	233.27	0.003027	1.27	4.25	25.79	1.00
Kidds Spill	Highway 400 - 2	719		Lat Struct									
Kidds Spill	Highway 400 - 2	700	Spill	5.40	232.68	233.10	233.10	233.19	0.003034	1.27	4.27	26.08	1.00
Kidds Spill	Highway 400 - 2	680	Spill	5.40	232.60	233.02	233.02	233.11	0.003030	1.26	4.28	26.28	1.00
Kidds Spill	Highway 400 - 2	660	Spill	5.40	232.52	232.95	232.95	233.03	0.003001	1.26	4.28	26.08	0.99
Kidds Spill	Highway 400 - 2	640	Spill	5.40	232.44	232.87	232.87	232.95	0.002980	1.26	4.29	26.08	0.99
Kidds Spill	Highway 400 - 2	620	Spill	5.40	232.37	232.79	232.79	232.87	0.003005	1.27	4.27	25.89	1.00
Kidds Spill	Highway 400 - 2	600	Spill	5.40	232.29	232.71	232.71	232.79	0.003086	1.26	4.27	26.49	1.01
Kidds Spill	Highway 400 - 2	580	Spill	5.40	232.21	232.63	232.63	232.72	0.003038	1.26	4.29	26.40	1.00
Kidds Spill	Highway 400 - 2	560	Spill	5.39	232.13	232.53	232.53	232.62	0.003077	1.27	4.23	25.87	1.01
Kidds Spill	Highway 400 - 2	540	Spill	5.28	232.02	232.41	232.41	232.51	0.003692	1.35	3.90	24.88	1.09
Kidds Spill	Highway 400 - 2	520	Spill	4.74	231.91	232.33		232.39	0.001923	1.07	4.45	24.90	0.80
Kidds Spill	Highway 400 - 2	519.5		Lat Struct									
Kidds Spill	Highway 400 - 2	500	Spill	4.27	231.82	232.24	232.24	232.34	0.002883	1.37	3.11	16.10	1.00
Kidds Spill	Highway 400 - 2	480	Spill	3.97	231.71	232.15	232.15	232.24	0.002868	1.34	2.96	15.82	0.99
Kidds Spill	Highway 400 - 2	460	Spill	3.84	231.60	232.05	232.05	232.15	0.002998	1.36	2.82	15.20	1.01
Kidds Spill	Highway 400 - 2	440	Spill	3.81	231.50	231.96	231.96	232.06	0.003300	1.40	2.71	15.01	1.06
Kidds Spill	Highway 400 - 2	420	Spill	3.81	231.39	231.88	231.88	231.98	0.002962	1.38	2.76	14.45	1.01
Kidds Spill	Highway 400 - 2	400	Spill	3.81	231.30	231.80	231.80	231.90	0.002877	1.38	2.76	14.05	1.00
Kidds Spill	Highway 400 - 2	380	Spill	3.80	231.19	231.76		231.83	0.001863	1.20	3.18	14.48	0.82
Kidds Spill	Highway 400 - 2	360	Spill	3.76	231.14	231.73		231.79	0.001527	1.12	3.35	14.42	0.74
Kidds Spill	Highway 400 - 2	340	Spill	3.72	231.12	231.70		231.76	0.001342	1.07	3.48	14.80	0.70
Kidds Spill	Highway 400 - 2	320	Spill	3.67	231.08	231.68		231.73	0.001190	1.01	3.63	15.17	0.66
Kidds Spill	Highway 400 - 2	300	Spill	3.61	231.05	231.65		231.71	0.001260	1.03	3.51	14.97	0.68
Kidds Spill	Highway 400 - 2	280	Spill	3.57	231.03	231.62	231.50	231.68	0.001377	1.06	3.38	14.79	0.71
Kidds Spill	Highway 400	1618	Spill	11.04	251.08	252.94		252.94	0.000063	0.33	72.25	75.16	0.08
Kidds Spill	Highway 400	1598	Spill	11.04	251.33	252.93		252.94	0.000095	0.31	50.05	68.62	0.09
Kidds Spill	Highway 400	1578	Spill	11.04	251.49	251.71	251.71	252.82	0.575026	3.97	2.43	20.32	4.52
Kidds Spill	Highway 400	1558	Spill	11.04	251.41	251.73	251.73	252.04	0.017128	2.59	5.01	32.13	2.29
Kidds Spill	Highway 400	1557		Lat Struct									
Kidds Spill	Highway 400	1538	Spill	11.04	251.23	251.68	251.68	251.80	0.004050	1.55	8.01	41.36	1.17
Kidds Spill	Highway 400	1518	Spill	11.01	250.97	251.43	251.43	251.54	0.003623	1.50	8.20	41.36	1.11
Kidds Spill	Highway 400	1498	Spill	10.97	250.72	251.18	251.18	251.29	0.003699	1.50	8.17	41.72	1.12
Kidds Spill	Highway 400	1478	Spill	10.95	250.29	250.72	250.72	250.80	0.003928	1.35	10.05	58.03	1.12

HEC-RAS Plan: ExReg Profile: Spill (Continued)

River	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)	
Kidds Spill	Highway 400	1458	Spill	10.95	249.85	250.29	250.29	250.37	0.003870	1.34	9.98	57.77	1.11
Kidds Spill	Highway 400	1438	Spill	10.95	249.44	249.88	249.88	249.96	0.003694	1.34	9.81	55.95	1.09
Kidds Spill	Highway 400	1398	Spill	10.95	248.61	249.04	249.04	249.13	0.003924	1.35	10.02	58.06	1.12
Kidds Spill	Highway 400	1378	Spill	10.95	248.19	248.63	248.63	248.71	0.003958	1.35	10.13	62.37	1.12
Kidds Spill	Highway 400	1377		Lat Struct									
Kidds Spill	Highway 400	1358	Spill	10.80	247.78	248.24	248.24	248.35	0.003706	1.51	7.96	40.85	1.12
Kidds Spill	Highway 400	1349		Lat Struct									
Kidds Spill	Highway 400	1338	Spill	10.29	247.37	247.84	247.84	248.01	0.004216	1.80	5.73	26.42	1.23
Kidds Spill	Highway 400	1318	Spill	9.56	246.95	247.43	247.43	247.58	0.004083	1.72	5.56	26.70	1.20
Kidds Spill	Highway 400	1298	Spill	8.94	246.54	247.01	247.01	247.15	0.003722	1.62	5.50	26.90	1.15
Kidds Spill	Highway 400	1278	Spill	8.40	246.13	246.60	246.60	246.73	0.003521	1.59	5.28	25.54	1.12
Kidds Spill	Highway 400	1258	Spill	8.05	245.80	246.26	246.26	246.38	0.003264	1.53	5.26	25.54	1.08
Kidds Spill	Highway 400	1238	Spill	7.74	245.41	245.87	245.87	245.99	0.003220	1.50	5.16	25.54	1.06
Kidds Spill	Highway 400	1237		Lat Struct									
Kidds Spill	Highway 400	1218	Spill	7.42	244.99	245.45	245.45	245.55	0.003039	1.42	5.24	27.00	1.03
Kidds Spill	Highway 400	1217		Lat Struct									
Kidds Spill	Highway 400	1198	Spill	7.14	244.56	245.01	245.01	245.11	0.003003	1.39	5.13	27.00	1.02
Kidds Spill	Highway 400	1178	Spill	6.92	244.13	244.58	244.58	244.68	0.002973	1.37	5.05	27.00	1.01
Kidds Spill	Highway 400	1177		Lat Struct									
Kidds Spill	Highway 400	1158	Spill	6.71	243.70	244.15	244.15	244.24	0.002957	1.35	4.97	27.00	1.01
Kidds Spill	Highway 400	1138	Spill	6.50	243.28	243.72	243.72	243.81	0.002908	1.33	4.90	27.00	0.99
Kidds Spill	Highway 400	1118	Spill	6.35	242.86	243.30	243.30	243.39	0.002917	1.32	4.82	27.00	0.99
Kidds Spill	Highway 400	1098	Spill	6.21	242.44	242.88	242.88	242.97	0.002935	1.31	4.75	27.00	0.99
Kidds Spill	Highway 400	1078	Spill	6.09	242.02	242.46	242.46	242.55	0.002948	1.30	4.69	27.00	1.00
Kidds Spill	Highway 400	1077		Lat Struct									
Kidds Spill	Highway 400	1058	Spill	5.99	241.60	242.04	242.04	242.13	0.002960	1.29	4.64	27.00	1.00
Kidds Spill	Highway 400	1038	Spill	5.76	241.26	241.69	241.69	241.78	0.003004	1.28	4.51	27.00	1.00
Kidds Spill	Highway 400	1018	Spill	5.71	240.97	241.40	241.40	241.49	0.003023	1.28	4.48	27.00	1.00
Kidds Spill	Highway 400	998	Spill	5.68	240.68	241.11	241.11	241.20	0.003040	1.27	4.46	27.00	1.00
Dyments	Spill From Bunke	460	Spill	4.12	230.09	232.28		232.28	0.000104	0.40	24.58	40.28	0.09
Dyments	Spill From Bunke	440	Spill	4.12	230.03	232.28		232.28	0.000071	0.34	32.67	58.96	0.07
Dyments	Spill From Bunke	420	Spill	4.12	230.04	232.28		232.28	0.000061	0.31	35.38	60.79	0.07
Dyments	Spill From Bunke	400	Spill	4.12	230.01	232.28		232.28	0.000059	0.31	35.08	58.00	0.07
Dyments	Spill From Bunke	380	Spill	4.12	230.06	232.27		232.28	0.000081	0.37	29.34	53.82	0.08
Dyments	Spill From Bunke	360	Spill	4.12	230.30	232.27	230.80	232.27	0.000064	0.30	36.26	59.56	0.07
Bunkers	Northeast Trib	362	Spill	8.47	238.35	239.44	239.44	239.60	0.010641	2.53	7.84	21.40	0.81
Bunkers	Northeast Trib	344	Spill	8.92	238.24	239.13		239.22	0.009622	2.07	9.26	23.12	0.74
Bunkers	Northeast Trib	328.50*	Spill	8.95	238.04	238.93		239.05	0.011284	2.24	8.19	20.44	0.80
Bunkers	Northeast Trib	313	Spill	8.97	237.83	238.72		238.87	0.012360	2.31	7.13	15.89	0.84
Bunkers	Northeast Trib	300.00*	Spill	8.97	237.67	238.55		238.69	0.014358	2.51	7.50	18.88	0.90
Bunkers	Northeast Trib	287	Spill	8.97	237.50	238.33	237.99	238.47	0.021017	2.86	7.05	19.35	1.06
Bunkers	Northeast Trib	273.50*	Spill	8.97	237.42	238.08	237.91	238.21	0.016840	2.37	7.62	21.68	0.95
Bunkers	Northeast Trib	260	Spill	8.97	237.34	237.77	237.76	237.91	0.028693	2.38	6.60	22.13	1.17
Bunkers	Spill to Storm	294	Spill	0.01	231.59	232.35		232.35	0.000000	0.00	5.31	11.87	0.00
Bunkers	Spill to Storm	273	Spill	2.65	231.43	232.34		232.35	0.000687	0.60	7.38	15.11	0.20
Bunkers	Spill to Storm	252	Spill	2.65	231.36	232.32		232.33	0.000725	0.65	7.31	12.76	0.21
Bunkers	Spill to Storm	231	Spill	2.65	231.07	232.31		232.32	0.000400	0.57	10.16	25.50	0.16
Bunkers	Spill to Storm	210	Spill	2.65	230.90	232.31		232.31	0.000193	0.43	13.15	25.63	0.12
Bunkers	Spill to Storm	189	Spill	2.65	230.66	232.31		232.31	0.000149	0.41	15.54	31.53	0.10
Bunkers	Spill to Storm	168	Spill	2.65	230.34	232.31		232.31	0.000063	0.30	23.89	39.66	0.07
Bunkers	Spill to Storm	147	Spill	16.76	230.30	232.26		232.29	0.001581	1.25	30.68	43.44	0.31
Bunkers	Northeast Trib-D	245	Spill	7.73	236.02	237.69	236.95	237.79	0.001787	1.49	6.84	10.04	0.37
Bunkers	Northeast Trib-D	239.19		Culvert									
Bunkers	Northeast Trib-D	224.77	Spill	7.73	235.81	237.36	236.70	237.43	0.001629	1.31	7.85	27.57	0.34
Bunkers	Spill to Storm-D	1000	Spill	12.64	228.11	232.28		232.28	0.000020	0.29	96.65	47.06	0.05
Bunkers	Spill to Storm-D	996	Spill	12.64	228.03	232.26	229.08	232.27	0.000091	0.61	24.00	37.88	0.10
Bunkers	Northeast Trib-2	136	Spill	11.02	235.54	236.79	236.79	237.16	0.012689	3.09	5.80	13.89	0.91
Bunkers	Northeast Trib-2	133	Spill	11.02	234.37	236.93	235.58	236.99	0.000888	1.36	21.76	53.81	0.27
Bunkers	Central Trib	508.22	Spill	1.24	236.86	237.77		237.79	0.001532	0.83	2.97	7.38	0.29
Bunkers	Central Trib	503.18	Spill	1.24	236.82	237.74		237.76	0.001217	0.77	3.12	6.74	0.27
Bunkers	Central Trib	492	Spill	1.27	236.71	237.73		237.74	0.000491	0.55	4.55	7.83	0.18
Bunkers	Central Trib	463	Spill	1.28	236.84	237.73		237.73	0.000120	0.25	7.71	11.15	0.09
Bunkers	Central Trib	442	Spill	1.28	237.05	237.70		237.72	0.001594	0.73	2.72	6.79	0.29
Bunkers	Central Trib	426	Spill	1.29	237.03	237.68	237.37	237.70	0.001252	0.63	2.86	6.86	0.26
Bunkers	Central Trib	406	Spill	1.30	237.17	237.60		237.65	0.006276	1.06	1.63	6.00	0.54
Bunkers	Central Trib	386	Spill	1.30	236.99	237.52		237.55	0.003528	0.95	2.12	6.46	0.42
Bunkers	Central Trib	366	Spill	1.30	236.88	237.31	237.24	237.42	0.015044	1.70	1.16	4.35	0.84
Bunkers	Central Trib	346	Spill	1.30	236.66	237.03	236.98	237.11	0.015382	1.55	1.28	5.44	0.83
Bunkers	Central Trib	326	Spill	1.30	236.34	236.76		236.84	0.012133	1.50	1.29	4.73	0.75
Bunkers	Central Trib	306	Spill	1.30	236.10	236.65		236.69	0.004596	1.05	1.60	4.81	0.48
Bunkers	Central Trib	286	Spill	1.30	236.00	236.60		236.62	0.002430	0.82	2.13	5.87	0.35
Bunkers	Central Trib	266	Spill	1.30	236.11	236.40	236.40	236.51	0.023852	1.56	1.05	5.63	0.98
Bunkers	Central Trib	248	Spill	1.30	235.48	235.87	235.87	235.98	0.017323	1.67	1.07	4.36	0.89
Bunkers	Central Trib	230		Culvert									
Bunkers	Central Trib	220	Spill	1.30	234.47	235.19	234.85	235.21	0.001389	0.72	3.01	18.84	0.28
Bunkers	Central Trib	200	Spill	7.73	233.78	234.65	234.65	234.92	0.014196	2.57	4.28	8.93	0.91
Bunkers	Central Trib	180	Spill	7.75	233.43	234.58		234.74	0.005902	2.07	6.84	15.27	0.62
Bunkers	Central Trib	160	Spill	7.77	233.09	234.08	234.08	234.51	0.019367	3.29	3.66	7.59	1.09
Bunkers	Central Trib	140	Spill	7.78	232.73	233.74	233.74	234.04	0.013897	2.82	4.73	13.96	0.92
Bunkers	Central Trib	120	Spill	7.78	232.14	233.25		233.36	0.006397	1.98	6.95	11.55	0.62
Bunkers	Central Trib	100	Spill	7.78	231.95	232.91	232.88	233.15	0.017302	2.96	4.76	9.13	1.01
Bunkers	Central Trib	80	Spill	7.82	231.52	232.56	232.56	232.85	0.012208	2.71	4.49	8.45	0.87
Bunkers	Central Trib	52.62	Spill	7.84	231.27	232.52		232.58	0.003075	1.51	9.75	15.62	0.45
Bunkers	Central Trib	33.77	Spill	7.84	231.02	232.41		232.51	0.004309	1.99	8.15	12.49	0.55
Bunkers	Central Trib	33		Lat Struct									

HEC-RAS Plan: ExReg Profile: Spill (Continued)

River	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)	
Bunkers	Central Trib	13.12	Spill	5.20	230.67	232.44	231.45	232.46	0.000480	0.79	14.48	20.50	0.19

HEC-RAS Plan: FutReg Profile: Spill

River	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)	
Kidds Spill	To Bunkers	352	Spill	3.00	237.11	238.19		238.24	0.003768	1.62	4.05	6.99	0.50
Kidds Spill	To Bunkers	332	Spill	4.41	236.50	238.18		238.20	0.000961	1.10	9.34	10.60	0.27
Kidds Spill	To Bunkers	312	Spill	4.85	236.44	238.16		238.18	0.001042	1.16	9.75	10.83	0.28
Kidds Spill	To Bunkers	292	Spill	5.27	236.37	238.14		238.16	0.001073	1.20	10.27	11.11	0.29
Kidds Spill	To Bunkers	272	Spill	5.65	236.30	238.12	237.32	238.14	0.001097	1.23	10.73	11.32	0.29
Kidds Spill	To Bunkers	252.00*	Spill	6.03	236.23	238.09		238.12	0.001125	1.27	11.26	11.80	0.30
Kidds Spill	To Bunkers	232.00*	Spill	6.39	236.17	238.07		238.09	0.001141	1.30	11.79	12.28	0.30
Kidds Spill	To Bunkers	212.00*	Spill	6.86	236.10	238.04		238.07	0.001198	1.35	12.30	12.72	0.31
Kidds Spill	To Bunkers	192.00*	Spill	7.13	236.04	238.02	237.12	238.05	0.001173	1.35	12.82	13.09	0.31
Kidds Spill	To Bunkers	172	Spill	7.37	235.97	238.00	237.08	238.02	0.001060	1.30	13.39	12.69	0.29
Kidds Spill	To Bunkers	152	Spill	7.39	235.90	238.00		238.01	0.000374	0.79	26.04	29.77	0.17
Kidds Spill	Highway 400 - 2	1440	Spill	7.47	239.63	240.09	240.09	240.19	0.003093	1.43	5.23	27.00	1.04
Kidds Spill	Highway 400 - 2	1439.6		Lat Struct									
Kidds Spill	Highway 400 - 2	1439		Lat Struct									
Kidds Spill	Highway 400 - 2	1420	Spill	7.13	239.41	239.86	239.86	239.96	0.003018	1.39	5.12	27.00	1.02
Kidds Spill	Highway 400 - 2	1400	Spill	6.88	239.19	239.64	239.64	239.74	0.002990	1.37	5.03	27.00	1.01
Kidds Spill	Highway 400 - 2	1380	Spill	6.71	238.97	239.42	239.42	239.52	0.002987	1.35	4.95	27.00	1.01
Kidds Spill	Highway 400 - 2	1360	Spill	6.56	238.75	239.20	239.20	239.29	0.002967	1.34	4.90	27.00	1.00
Kidds Spill	Highway 400 - 2	1340	Spill	6.44	238.53	238.98	238.98	239.07	0.002964	1.33	4.84	27.00	1.00
Kidds Spill	Highway 400 - 2	1320	Spill	6.33	238.31	238.76	238.76	238.85	0.002952	1.32	4.80	27.00	1.00
Kidds Spill	Highway 400 - 2	1300	Spill	6.25	238.10	238.54	238.54	238.63	0.002903	1.31	4.78	27.00	0.99
Kidds Spill	Highway 400 - 2	1280	Spill	6.18	237.88	238.32	238.32	238.40	0.002909	1.30	4.75	27.00	0.99
Kidds Spill	Highway 400 - 2	1260	Spill	6.15	237.62	238.06	238.06	238.15	0.002942	1.30	4.72	27.00	0.99
Kidds Spill	Highway 400 - 2	1240	Spill	6.15	237.36	237.80	237.80	237.89	0.002920	1.30	4.73	27.00	0.99
Kidds Spill	Highway 400 - 2	1220	Spill	6.46	237.09	237.54	237.54	237.63	0.002962	1.33	4.85	27.00	1.00
Kidds Spill	Highway 400 - 2	1200	Spill	6.77	236.83	237.28	237.28	237.37	0.002963	1.36	4.99	27.00	1.01
Kidds Spill	Highway 400 - 2	1180	Spill	6.92	236.57	237.02	237.02	237.11	0.002946	1.37	5.07	27.00	1.01
Kidds Spill	Highway 400 - 2	1160	Spill	6.92	236.28	236.73	236.73	236.82	0.002940	1.37	5.07	27.00	1.01
Kidds Spill	Highway 400 - 2	1140	Spill	6.92	235.98	236.43	236.43	236.52	0.002935	1.36	5.08	27.00	1.00
Kidds Spill	Highway 400 - 2	1120	Spill	6.92	235.68	236.13	236.13	236.22	0.002944	1.37	5.07	27.00	1.01
Kidds Spill	Highway 400 - 2	1100	Spill	6.92	235.38	235.83	235.83	235.92	0.002938	1.36	5.07	27.00	1.01
Kidds Spill	Highway 400 - 2	1099		Lat Struct									
Kidds Spill	Highway 400 - 2	1080	Spill	6.77	235.08	235.53	235.53	235.62	0.002923	1.35	5.01	27.00	1.00
Kidds Spill	Highway 400 - 2	1079		Lat Struct									
Kidds Spill	Highway 400 - 2	1060	Spill	6.47	234.83	235.28	235.28	235.36	0.002919	1.33	4.88	27.00	1.00
Kidds Spill	Highway 400 - 2	1040	Spill	6.32	234.60	235.04	235.04	235.13	0.002914	1.31	4.81	27.00	0.99
Kidds Spill	Highway 400 - 2	1020	Spill	6.21	234.37	234.81	234.81	234.90	0.002925	1.31	4.76	27.00	0.99
Kidds Spill	Highway 400 - 2	1000	Spill	6.13	234.14	234.58	234.58	234.67	0.002928	1.30	4.72	27.00	0.99
Kidds Spill	Highway 400 - 2	980	Spill	6.03	233.91	234.35	234.35	234.43	0.002948	1.29	4.66	27.00	0.99
Kidds Spill	Highway 400 - 2	960	Spill	5.83	233.78	234.21	234.21	234.30	0.002983	1.28	4.55	27.00	1.00
Kidds Spill	Highway 400 - 2	940	Spill	5.81	233.69	234.12	234.12	234.20	0.002970	1.28	4.55	27.00	0.99
Kidds Spill	Highway 400 - 2	920	Spill	5.78	233.59	234.03	234.03	234.11	0.002994	1.28	4.53	27.00	1.00
Kidds Spill	Highway 400 - 2	900	Spill	5.78	233.50	233.93	233.93	234.01	0.002986	1.28	4.53	27.00	1.00
Kidds Spill	Highway 400 - 2	880	Spill	5.78	233.40	233.84	233.84	233.92	0.002992	1.28	4.53	27.00	1.00
Kidds Spill	Highway 400 - 2	860	Spill	5.78	233.32	233.75	233.75	233.84	0.002993	1.28	4.53	27.00	1.00
Kidds Spill	Highway 400 - 2	840	Spill	5.78	233.24	233.67	233.67	233.76	0.003004	1.28	4.52	27.00	1.00
Kidds Spill	Highway 400 - 2	820	Spill	5.78	233.16	233.59	233.59	233.68	0.002995	1.28	4.52	27.00	1.00
Kidds Spill	Highway 400 - 2	800	Spill	5.78	233.08	233.51	233.51	233.60	0.002983	1.28	4.53	27.00	0.99
Kidds Spill	Highway 400 - 2	780	Spill	5.78	233.00	233.43	233.43	233.52	0.002989	1.28	4.53	27.00	1.00
Kidds Spill	Highway 400 - 2	760	Spill	5.78	232.92	233.35	233.35	233.44	0.003003	1.28	4.52	27.00	1.00
Kidds Spill	Highway 400 - 2	740	Spill	5.78	232.84	233.27	233.27	233.36	0.002976	1.28	4.51	26.61	1.00
Kidds Spill	Highway 400 - 2	720	Spill	5.78	232.76	233.19	233.19	233.28	0.002953	1.29	4.49	26.21	0.99
Kidds Spill	Highway 400 - 2	719		Lat Struct									
Kidds Spill	Highway 400 - 2	700	Spill	5.77	232.68	233.11	233.11	233.20	0.002968	1.28	4.50	26.56	0.99
Kidds Spill	Highway 400 - 2	680	Spill	5.76	232.60	233.03	233.03	233.12	0.002993	1.28	4.51	26.99	1.00
Kidds Spill	Highway 400 - 2	660	Spill	5.74	232.52	232.95	232.95	233.04	0.003009	1.28	4.50	27.00	1.00
Kidds Spill	Highway 400 - 2	640	Spill	5.72	232.44	232.88	232.88	232.96	0.003001	1.27	4.49	27.00	1.00
Kidds Spill	Highway 400 - 2	620	Spill	5.72	232.37	232.80	232.80	232.88	0.003004	1.27	4.49	26.95	1.00
Kidds Spill	Highway 400 - 2	600	Spill	5.71	232.29	232.72	232.72	232.80	0.002993	1.27	4.48	26.84	1.00
Kidds Spill	Highway 400 - 2	580	Spill	5.71	232.21	232.64	232.64	232.72	0.003019	1.27	4.48	27.00	1.00
Kidds Spill	Highway 400 - 2	560	Spill	5.69	232.13	232.54	232.54	232.62	0.003114	1.31	4.36	25.95	1.02
Kidds Spill	Highway 400 - 2	540	Spill	5.52	232.02	232.42	232.42	232.51	0.003384	1.34	4.13	25.14	1.05
Kidds Spill	Highway 400 - 2	520	Spill	4.91	231.91	232.34		232.40	0.001924	1.08	4.55	24.95	0.81
Kidds Spill	Highway 400 - 2	519.5		Lat Struct									
Kidds Spill	Highway 400 - 2	500	Spill	4.39	231.82	232.25	232.25	232.35	0.002834	1.38	3.18	16.15	0.99
Kidds Spill	Highway 400 - 2	480	Spill	4.06	231.71	232.15	232.15	232.24	0.002864	1.35	3.01	15.86	0.99
Kidds Spill	Highway 400 - 2	460	Spill	3.92	231.60	232.05	232.05	232.15	0.003028	1.37	2.85	15.23	1.02
Kidds Spill	Highway 400 - 2	440	Spill	3.88	231.50	231.96	231.96	232.07	0.003334	1.42	2.73	15.02	1.06
Kidds Spill	Highway 400 - 2	420	Spill	3.88	231.39	231.88	231.88	231.98	0.002986	1.39	2.79	14.51	1.01
Kidds Spill	Highway 400 - 2	400	Spill	3.88	231.30	231.81	231.81	231.90	0.002869	1.39	2.79	14.11	1.00
Kidds Spill	Highway 400 - 2	380	Spill	3.87	231.19	231.76		231.83	0.001866	1.21	3.21	14.49	0.82
Kidds Spill	Highway 400 - 2	360	Spill	3.82	231.14	231.73		231.79	0.001527	1.13	3.38	14.45	0.74
Kidds Spill	Highway 400 - 2	340	Spill	3.77	231.12	231.70		231.76	0.001327	1.07	3.53	14.85	0.70
Kidds Spill	Highway 400 - 2	320	Spill	3.71	231.08	231.68		231.73	0.001154	1.01	3.69	15.22	0.65
Kidds Spill	Highway 400 - 2	300	Spill	3.63	231.05	231.66		231.71	0.001165	1.00	3.61	15.03	0.65
Kidds Spill	Highway 400 - 2	280	Spill	3.57	231.03	231.62	231.55	231.68	0.001376	1.06	3.38	14.79	0.71
Kidds Spill	Highway 400	1618	Spill	20.45	251.08	252.35		252.38	0.001227	1.12	35.52	50.40	0.33
Kidds Spill	Highway 400	1598	Spill	20.45	251.33	252.19	252.12	252.35	0.010904	1.79	12.18	33.07	0.83
Kidds Spill	Highway 400	1578	Spill	20.45	251.49	252.12	251.96	252.17	0.005521	1.03	20.27	55.62	0.57
Kidds Spill	Highway 400	1558	Spill	20.45	251.41	251.87	251.74	252.11	0.005942	2.21	10.38	41.38	1.48
Kidds Spill	Highway 400	1557		Lat Struct									
Kidds Spill	Highway 400	1538	Spill	20.43	251.23	251.70	251.70	252.03	0.009920	2.60	8.81	41.37	1.87
Kidds Spill	Highway 400	1518	Spill	20.33	250.97	251.45	251.45	251.75	0.008245	2.45	9.21	41.36	1.72
Kidds Spill	Highway 400	1498	Spill	20.20	250.72	251.20	251.20	251.50	0.008553	2.46	9.11	41.73	1.74
Kidds Spill	Highway 400	1478	Spill	20.05	250.29	250.75	250.75	250.95	0.006956	2.05	11.98	58.15	1.54

HEC-RAS Plan: FutReg Profile: Spill (Continued)

River	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)	
Kidds Spill	Highway 400	1458	Spill	20.05	249.85	250.32	250.32	250.52	0.006777	2.03	11.94	57.77	1.52
Kidds Spill	Highway 400	1438	Spill	20.05	249.44	249.91	249.91	250.11	0.006438	2.02	11.76	55.95	1.49
Kidds Spill	Highway 400	1398	Spill	20.05	248.61	249.08	249.08	249.27	0.006943	2.05	11.95	58.21	1.54
Kidds Spill	Highway 400	1378	Spill	20.05	248.19	248.65	248.65	248.87	0.008145	2.14	11.70	63.53	1.65
Kidds Spill	Highway 400	1377		Lat Struct									
Kidds Spill	Highway 400	1358	Spill	19.67	247.78	248.28	248.26	248.54	0.006617	2.28	9.51	40.87	1.55
Kidds Spill	Highway 400	1349		Lat Struct									
Kidds Spill	Highway 400	1338	Spill	18.82	247.37	247.86	247.86	248.34	0.011296	3.07	6.13	26.42	2.04
Kidds Spill	Highway 400	1318	Spill	17.87	246.95	247.45	247.45	247.90	0.011051	2.98	6.00	26.70	2.01
Kidds Spill	Highway 400	1298	Spill	16.98	246.54	247.03	247.03	247.44	0.009993	2.82	6.02	26.90	1.91
Kidds Spill	Highway 400	1278	Spill	16.15	246.13	246.62	246.62	247.01	0.009447	2.78	5.82	25.54	1.86
Kidds Spill	Highway 400	1258	Spill	15.52	245.80	246.29	246.29	246.64	0.008363	2.63	5.89	25.54	1.75
Kidds Spill	Highway 400	1238	Spill	14.89	245.41	245.90	245.90	246.23	0.008023	2.56	5.82	25.54	1.71
Kidds Spill	Highway 400	1237		Lat Struct									
Kidds Spill	Highway 400	1218	Spill	14.16	244.99	245.47	245.47	245.76	0.006928	2.35	6.03	27.00	1.59
Kidds Spill	Highway 400	1217		Lat Struct									
Kidds Spill	Highway 400	1198	Spill	13.40	244.56	245.04	245.04	245.30	0.006461	2.25	5.96	27.00	1.53
Kidds Spill	Highway 400	1178	Spill	12.71	244.13	244.61	244.61	244.85	0.005945	2.15	5.92	27.00	1.47
Kidds Spill	Highway 400	1177		Lat Struct									
Kidds Spill	Highway 400	1158	Spill	12.01	243.70	244.18	244.18	244.40	0.005499	2.05	5.86	27.00	1.41
Kidds Spill	Highway 400	1138	Spill	11.28	243.28	243.76	243.76	243.95	0.004927	1.94	5.83	27.00	1.33
Kidds Spill	Highway 400	1118	Spill	10.63	242.86	243.34	243.34	243.51	0.004570	1.85	5.75	27.00	1.28
Kidds Spill	Highway 400	1098	Spill	9.99	242.44	242.92	242.92	243.08	0.004251	1.76	5.66	27.00	1.23
Kidds Spill	Highway 400	1078	Spill	9.43	242.02	242.50	242.50	242.64	0.003985	1.69	5.58	27.00	1.19
Kidds Spill	Highway 400	1077		Lat Struct									
Kidds Spill	Highway 400	1058	Spill	8.92	241.60	242.07	242.07	242.21	0.003775	1.63	5.48	27.00	1.15
Kidds Spill	Highway 400	1038	Spill	8.18	241.26	241.73	241.73	241.84	0.003371	1.52	5.38	27.00	1.09
Kidds Spill	Highway 400	1018	Spill	7.79	240.97	241.43	241.43	241.54	0.003219	1.47	5.30	27.00	1.06
Kidds Spill	Highway 400	998	Spill	7.47	240.68	241.14	241.14	241.25	0.003121	1.43	5.22	27.00	1.04
Dyments	Spill From Bunke	460	Spill	8.82	230.09	232.49		232.50	0.000225	0.64	33.42	42.11	0.13
Dyments	Spill From Bunke	440	Spill	8.82	230.03	232.49		232.50	0.000148	0.52	46.58	69.92	0.11
Dyments	Spill From Bunke	420	Spill	8.82	230.04	232.49		232.49	0.000131	0.48	49.66	71.60	0.10
Dyments	Spill From Bunke	400	Spill	8.82	230.01	232.49		232.49	0.000134	0.50	48.98	71.64	0.10
Dyments	Spill From Bunke	380	Spill	8.82	230.06	232.48		232.49	0.000187	0.60	41.78	66.09	0.12
Dyments	Spill From Bunke	360	Spill	8.82	230.30	232.48	231.12	232.48	0.000142	0.49	50.04	73.05	0.11
Bunkers	Northeast Trib	362	Spill	10.16	238.35	239.49	239.49	239.66	0.011370	2.69	8.84	21.99	0.84
Bunkers	Northeast Trib	344	Spill	12.27	238.24	239.24		239.33	0.008787	2.16	12.01	24.64	0.72
Bunkers	Northeast Trib	328.50*	Spill	12.44	238.04	239.09		239.20	0.008421	2.19	11.76	23.30	0.72
Bunkers	Northeast Trib	313	Spill	12.59	237.83	238.84	238.33	239.03	0.014160	2.71	9.14	19.64	0.92
Bunkers	Northeast Trib	300.00*	Spill	12.67	237.67	238.67	238.16	238.83	0.014751	2.78	9.82	21.86	0.94
Bunkers	Northeast Trib	287	Spill	12.74	237.50	238.45	237.99	238.60	0.020574	3.12	9.55	23.69	1.07
Bunkers	Northeast Trib	273.50*	Spill	12.78	237.42	238.39		238.44	0.005228	1.72	15.28	28.12	0.57
Bunkers	Northeast Trib	260	Spill	12.78	237.34	238.38		238.40	0.001632	1.03	25.60	42.49	0.32
Bunkers	Spill to Storm	294	Spill	0.01	231.59	232.60		232.60	0.000000	0.00	8.78	15.73	0.00
Bunkers	Spill to Storm	273	Spill	5.43	231.43	232.57		232.59	0.001009	0.86	11.80	24.47	0.26
Bunkers	Spill to Storm	252	Spill	5.43	231.36	232.55		232.57	0.001279	0.99	11.64	26.01	0.29
Bunkers	Spill to Storm	231	Spill	5.43	231.07	232.54		232.55	0.000651	0.81	16.73	31.38	0.22
Bunkers	Spill to Storm	210	Spill	5.43	230.90	232.53		232.54	0.000433	0.71	19.92	41.09	0.18
Bunkers	Spill to Storm	189	Spill	5.43	230.66	232.52		232.53	0.000267	0.59	24.22	44.87	0.14
Bunkers	Spill to Storm	168	Spill	5.43	230.34	232.52		232.52	0.000120	0.45	32.75	42.79	0.10
Bunkers	Spill to Storm	147	Spill	22.36	230.30	232.48		232.51	0.001270	1.22	40.56	46.13	0.28
Bunkers	Northeast Trib-D	245	Spill	8.11	236.02	238.32	236.98	238.37	0.000627	1.09	9.85	16.58	0.23
Bunkers	Northeast Trib-D	239.19		Culvert									
Bunkers	Northeast Trib-D	224.77	Spill	8.11	235.81	238.00	236.70	238.03	0.000501	0.92	11.66	33.53	0.20
Bunkers	Spill to Storm-D	1000	Spill	13.54	228.11	232.50		232.50	0.000018	0.28	107.33	52.32	0.04
Bunkers	Spill to Storm-D	996	Spill	13.54	228.03	232.47	229.12	232.49	0.000087	0.62	25.31	42.34	0.10
Bunkers	Northeast Trib-2	136	Spill	15.51	235.54	238.00		238.00	0.000135	0.51	77.72	75.47	0.11
Bunkers	Northeast Trib-2	133	Spill	15.51	234.37	238.00	235.84	238.00	0.000057	0.44	99.90	77.22	0.07
Bunkers	Central Trib	508.22	Spill	4.66	236.86	238.34		238.37	0.001486	1.16	9.79	17.42	0.31
Bunkers	Central Trib	503.18	Spill	4.66	236.82	238.30		238.34	0.001631	1.25	7.98	10.73	0.33
Bunkers	Central Trib	492	Spill	4.90	236.71	238.28		238.30	0.001026	1.07	9.79	11.30	0.27
Bunkers	Central Trib	463	Spill	5.06	236.84	238.27		238.28	0.000316	0.56	14.20	12.85	0.15
Bunkers	Central Trib	442	Spill	5.14	237.05	238.22		238.26	0.002095	1.25	7.43	11.31	0.37
Bunkers	Central Trib	426	Spill	5.20	237.03	238.18	237.73	238.23	0.001979	1.19	7.01	9.98	0.36
Bunkers	Central Trib	406	Spill	5.28	237.17	238.08		238.17	0.004533	1.54	5.29	9.11	0.52
Bunkers	Central Trib	386	Spill	5.33	236.99	238.02		238.08	0.003666	1.52	6.12	9.72	0.48
Bunkers	Central Trib	366	Spill	5.38	236.88	237.66	237.66	237.92	0.020293	2.96	3.28	7.69	1.08
Bunkers	Central Trib	346	Spill	5.40	236.66	237.47		237.60	0.009817	2.13	4.49	9.08	0.76
Bunkers	Central Trib	326	Spill	5.41	236.34	237.32		237.44	0.006330	1.94	4.93	8.36	0.63
Bunkers	Central Trib	306	Spill	5.41	236.10	237.25		237.34	0.003359	1.53	5.59	8.56	0.47
Bunkers	Central Trib	305		Lat Struct									
Bunkers	Central Trib	286	Spill	5.26	236.00	237.23		237.28	0.001969	1.23	7.43	13.14	0.36
Bunkers	Central Trib	266	Spill	4.95	236.11	237.22		237.24	0.001206	0.91	10.56	21.71	0.28
Bunkers	Central Trib	248	Spill	4.64	235.48	237.21	236.20	237.22	0.000309	0.63	13.77	26.51	0.15
Bunkers	Central Trib	230		Culvert									
Bunkers	Central Trib	220	Spill	4.64	234.47	235.25	235.23	235.42	0.011524	2.19	3.59	23.69	0.81
Bunkers	Central Trib	200	Spill	12.36	233.78	234.94	234.94	235.20	0.010050	2.65	8.53	20.68	0.81
Bunkers	Central Trib	180	Spill	12.47	233.43	234.58	234.44	234.98	0.015085	3.31	6.88	15.36	1.00
Bunkers	Central Trib	160	Spill	12.59	233.09	234.51	234.51	234.72	0.007745	2.67	11.28	29.18	0.73
Bunkers	Central Trib	140	Spill	12.67	232.73	234.05	234.05	234.24	0.008139	2.60	11.36	28.99	0.74
Bunkers	Central Trib	120	Spill	12.73	232.14	233.50		233.66	0.007458	2.47	10.19	15.94	0.70
Bunkers	Central Trib	100	Spill	12.78	231.95	233.21	233.09	233.45	0.013245	3.15	7.93	12.20	0.93
Bunkers	Central Trib	80	Spill	12.89	231.52	232.80	232.80	233.17	0.012984	3.22	6.83	12.96	0.93
Bunkers	Central Trib	52.62	Spill	12.95	231.27	232.78		232.87	0.003345	1.80	15.19	26.16	0.48
Bunkers	Central Trib	33.77	Spill	12.96	231.02	232.64		232.78	0.005401	2.47	11.30	15.01	0.63

HEC-RAS Plan: FutReg Profile: Spill (Continued)

River	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)	
Bunkers	Central Trib	33		Lat Struct									
Bunkers	Central Trib	13.12	Spill	7.54	230.67	232.69	231.59	232.71	0.000479	0.86	20.46	25.86	0.19

HEC-RAS Plan: ExDsgnStm50-100

River	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)	
Kidds Spill	To Bunkers	352	100 Year Spill	0.19	237.11	237.30	237.30	237.37	0.029447	1.41	0.20	1.63	1.04
Kidds Spill	To Bunkers	352	50 Year Spill	0.16	237.11	237.26	237.26	237.36	0.049055	1.57	0.14	1.41	1.29
Kidds Spill	To Bunkers	332	100 Year Spill	0.19	236.50	237.10		237.10	0.000230	0.27	1.38	4.10	0.11
Kidds Spill	To Bunkers	332	50 Year Spill	0.16	236.50	237.03		237.03	0.000296	0.28	1.09	3.65	0.12
Kidds Spill	To Bunkers	312	100 Year Spill	0.19	236.44	237.10		237.10	0.000153	0.23	1.62	4.44	0.09
Kidds Spill	To Bunkers	312	50 Year Spill	0.16	236.44	237.02		237.02	0.000189	0.24	1.30	3.98	0.10
Kidds Spill	To Bunkers	292	100 Year Spill	0.19	236.37	237.09		237.10	0.000098	0.20	1.94	4.85	0.07
Kidds Spill	To Bunkers	292	50 Year Spill	0.16	236.37	237.02		237.02	0.000115	0.20	1.59	4.39	0.08
Kidds Spill	To Bunkers	272	100 Year Spill	0.19	236.30	237.09	236.50	237.09	0.000065	0.17	2.27	5.23	0.06
Kidds Spill	To Bunkers	272	50 Year Spill	0.16	236.30	237.02	236.48	237.02	0.000074	0.17	1.89	4.77	0.06
Kidds Spill	To Bunkers	252.00*	100 Year Spill	0.19	236.23	237.09		237.09	0.000045	0.15	2.63	5.62	0.05
Kidds Spill	To Bunkers	252.00*	50 Year Spill	0.16	236.23	237.02		237.02	0.000049	0.15	2.21	5.17	0.05
Kidds Spill	To Bunkers	232.00*	100 Year Spill	0.19	236.17	237.09		237.09	0.000032	0.13	3.01	6.03	0.04
Kidds Spill	To Bunkers	232.00*	50 Year Spill	0.16	236.17	237.01		237.02	0.000034	0.13	2.57	5.57	0.05
Kidds Spill	To Bunkers	212.00*	100 Year Spill	0.19	236.10	237.09		237.09	0.000023	0.12	3.43	6.43	0.04
Kidds Spill	To Bunkers	212.00*	50 Year Spill	0.16	236.10	237.01		237.01	0.000024	0.12	2.95	5.97	0.04
Kidds Spill	To Bunkers	192.00*	100 Year Spill	0.19	236.04	237.09	236.24	237.09	0.000017	0.11	3.87	6.83	0.03
Kidds Spill	To Bunkers	192.00*	50 Year Spill	0.16	236.04	237.01	236.22	237.01	0.000017	0.10	3.36	6.37	0.03
Kidds Spill	To Bunkers	172	100 Year Spill	0.19	235.97	237.09	236.16	237.09	0.000013	0.10	4.33	7.23	0.03
Kidds Spill	To Bunkers	172	50 Year Spill	0.16	235.97	237.01	236.15	237.01	0.000013	0.09	3.79	6.77	0.03
Kidds Spill	To Bunkers	152	100 Year Spill	0.19	235.90	237.09		237.09	0.000012	0.10	5.00	11.81	0.03
Kidds Spill	To Bunkers	152	50 Year Spill	0.16	235.90	237.01		237.01	0.000010	0.09	4.30	7.90	0.03
Dyments	Spill From Bunke	460	100 Year Spill	1.00	230.09	232.04		232.04	0.000012	0.13	16.09	26.60	0.03
Dyments	Spill From Bunke	460	50 Year Spill	0.01	230.09	231.62		231.62	0.000000	0.00	8.94	13.46	0.00
Dyments	Spill From Bunke	440	100 Year Spill	1.00	230.03	232.04		232.04	0.000009	0.11	20.29	45.02	0.03
Dyments	Spill From Bunke	440	50 Year Spill	0.01	230.03	231.62		231.62	0.000000	0.00	10.15	14.46	0.00
Dyments	Spill From Bunke	420	100 Year Spill	1.00	230.04	232.04		232.04	0.000008	0.11	23.08	42.35	0.02
Dyments	Spill From Bunke	420	50 Year Spill	0.01	230.04	231.62		231.62	0.000000	0.00	11.38	18.01	0.00
Dyments	Spill From Bunke	400	100 Year Spill	1.00	230.01	232.04		232.04	0.000008	0.10	23.36	39.82	0.02
Dyments	Spill From Bunke	400	50 Year Spill	0.01	230.01	231.62		231.62	0.000000	0.00	10.98	18.93	0.00
Dyments	Spill From Bunke	380	100 Year Spill	1.00	230.06	232.04		232.04	0.000009	0.11	19.02	35.36	0.03
Dyments	Spill From Bunke	380	50 Year Spill	0.01	230.06	231.62		231.62	0.000000	0.00	10.33	14.63	0.00
Dyments	Spill From Bunke	360	100 Year Spill	1.00	230.30	232.04	230.55	232.04	0.000007	0.09	25.00	39.04	0.02
Dyments	Spill From Bunke	360	50 Year Spill	0.01	230.30	231.62	230.38	231.62	0.000000	0.00	11.28	22.75	0.00
Bunkers	Northeast Trib	362	100 Year Spill	8.19	238.35	239.44	239.44	239.59	0.010423	2.49	7.69	21.30	0.80
Bunkers	Northeast Trib	362	50 Year Spill	7.15	238.35	239.40	239.40	239.55	0.009932	2.38	6.99	20.66	0.77
Bunkers	Northeast Trib	344	100 Year Spill	8.19	238.24	239.10		239.19	0.009570	2.02	8.72	22.77	0.73
Bunkers	Northeast Trib	344	50 Year Spill	7.15	238.24	239.05		239.14	0.011011	2.07	7.49	21.82	0.78
Bunkers	Northeast Trib	313	100 Year Spill	8.19	237.83	238.68		238.83	0.013576	2.33	6.41	15.26	0.87
Bunkers	Northeast Trib	313	50 Year Spill	7.15	237.83	238.65		238.78	0.012309	2.16	5.98	14.71	0.82
Bunkers	Northeast Trib	287	100 Year Spill	8.19	237.50	238.36	237.97	238.46	0.013498	2.36	7.78	20.14	0.85
Bunkers	Northeast Trib	287	50 Year Spill	7.15	237.50	238.30	237.97	238.41	0.016162	2.45	6.56	18.83	0.92
Bunkers	Northeast Trib	260	100 Year Spill	8.19	237.34	237.73	237.73	237.88	0.035753	2.48	5.71	20.93	1.28
Bunkers	Northeast Trib	260	50 Year Spill	7.15	237.34	237.73	237.73	237.85	0.027423	2.17	5.69	20.91	1.12
Bunkers	Spill to Storm	294	100 Year Spill	0.01	231.59	232.21		232.21	0.000000	0.00	3.85	9.34	0.00
Bunkers	Spill to Storm	294	50 Year Spill	0.01	231.59	232.07		232.07	0.000000	0.01	2.59	7.80	0.00
Bunkers	Spill to Storm	273	100 Year Spill	3.01	231.43	232.17		232.20	0.002044	0.91	5.14	11.39	0.34
Bunkers	Spill to Storm	273	50 Year Spill	2.31	231.43	232.00		232.04	0.003236	0.96	3.47	9.06	0.41
Bunkers	Spill to Storm	252	100 Year Spill	3.01	231.36	232.12		232.15	0.002475	1.02	4.98	10.44	0.38
Bunkers	Spill to Storm	252	50 Year Spill	2.31	231.36	231.89		231.95	0.006046	1.26	2.90	8.27	0.56
Bunkers	Spill to Storm	231	100 Year Spill	3.01	231.07	232.09		232.11	0.001339	0.91	6.34	12.15	0.29
Bunkers	Spill to Storm	231	50 Year Spill	2.31	231.07	231.81		231.85	0.003478	1.18	3.42	8.71	0.44
Bunkers	Spill to Storm	210	100 Year Spill	3.01	230.90	232.08		232.09	0.000582	0.66	8.50	13.44	0.20
Bunkers	Spill to Storm	210	50 Year Spill	2.31	230.90	231.78		231.80	0.001265	0.80	5.01	10.36	0.28
Bunkers	Spill to Storm	189	100 Year Spill	3.01	230.66	232.07		232.08	0.000406	0.60	9.55	19.52	0.17
Bunkers	Spill to Storm	189	50 Year Spill	2.31	230.66	231.77		231.78	0.000750	0.69	5.75	10.11	0.22
Bunkers	Spill to Storm	168	100 Year Spill	3.01	230.34	232.07		232.07	0.000213	0.51	15.25	31.39	0.13
Bunkers	Spill to Storm	168	50 Year Spill	2.31	230.34	231.76		231.77	0.000293	0.52	8.89	12.87	0.14

HEC-RAS Plan: ExDsgnStm50-100 (Continued)

River	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)	
Bunkers	Spill to Storm	147	100 Year Spill	12.65	230.30	232.01		232.05	0.002493	1.41	20.22	34.80	0.38
Bunkers	Spill to Storm	147	50 Year Spill	10.55	230.30	231.50		231.68	0.014689	2.56	7.18	13.82	0.85
Bunkers	Northeast Trib-D	245	100 Year Spill	7.42	236.02	237.54	236.93	237.64	0.002356	1.60	6.09	8.52	0.42
Bunkers	Northeast Trib-D	245	50 Year Spill	6.69	236.02	237.43	236.87	237.54	0.002495	1.57	5.59	7.43	0.42
Bunkers	Northeast Trib-D	239.19		Culvert									
Bunkers	Northeast Trib-D	224.77	100 Year Spill	7.42	235.81	237.07	236.65	237.17	0.003319	1.62	6.12	24.77	0.47
Bunkers	Northeast Trib-D	224.77	50 Year Spill	6.69	235.81	237.00	236.62	237.10	0.003341	1.57	5.71	24.18	0.47
Bunkers	Spill to Storm-D	1000	100 Year Spill	11.66	228.11	232.03		232.03	0.000024	0.30	85.18	44.83	0.05
Bunkers	Spill to Storm-D	1000	50 Year Spill	10.55	228.11	231.62		231.63	0.000037	0.35	67.63	41.36	0.06
Bunkers	Spill to Storm-D	996	100 Year Spill	11.66	228.03	232.01	229.03	232.02	0.000095	0.60	22.51	35.73	0.10
Bunkers	Spill to Storm-D	996	50 Year Spill	10.55	228.03	231.60	228.97	231.62	0.000114	0.61	20.06	32.24	0.10
Bunkers	Northeast Trib-2	136	100 Year Spill	7.61	235.54	236.55	236.55	236.90	0.015200	2.90	3.76	6.81	0.96
Bunkers	Northeast Trib-2	136	50 Year Spill	6.85	235.54	236.49	236.49	236.83	0.015630	2.82	3.39	6.28	0.96
Bunkers	Northeast Trib-2	133	100 Year Spill	7.61	234.37	235.94	235.38	236.06	0.003102	1.84	6.63	6.26	0.47
Bunkers	Northeast Trib-2	133	50 Year Spill	6.85	234.37	235.70	235.32	235.85	0.004762	2.04	5.19	5.62	0.57
Bunkers	Central Trib	508.22	100 Year Spill	0.77	236.86	237.63		237.64	0.001385	0.70	2.07	5.97	0.27
Bunkers	Central Trib	508.22	50 Year Spill	0.47	236.86	237.53		237.54	0.001102	0.56	1.50	4.88	0.23
Bunkers	Central Trib	503.18	100 Year Spill	0.77	236.82	237.61		237.62	0.001012	0.63	2.29	5.78	0.24
Bunkers	Central Trib	503.18	50 Year Spill	0.47	236.82	237.51		237.52	0.000731	0.49	1.75	5.00	0.20
Bunkers	Central Trib	492	100 Year Spill	0.77	236.71	237.60		237.60	0.000333	0.42	3.60	7.05	0.14
Bunkers	Central Trib	492	50 Year Spill	0.47	236.71	237.50		237.51	0.000207	0.30	2.96	6.36	0.11
Bunkers	Central Trib	463	100 Year Spill	0.77	236.84	237.60		237.60	0.000079	0.18	6.30	10.83	0.07
Bunkers	Central Trib	463	50 Year Spill	0.47	236.84	237.50		237.50	0.000050	0.13	5.29	10.50	0.05
Bunkers	Central Trib	442	100 Year Spill	0.77	237.05	237.58		237.59	0.001356	0.58	1.95	5.97	0.26
Bunkers	Central Trib	442	50 Year Spill	0.47	237.05	237.49		237.50	0.001113	0.46	1.44	5.28	0.23
Bunkers	Central Trib	426	100 Year Spill	0.77	237.03	237.56	237.29	237.57	0.001020	0.50	2.10	6.21	0.23
Bunkers	Central Trib	426	50 Year Spill	0.47	237.03	237.48	237.23	237.48	0.000805	0.39	1.58	5.61	0.19
Bunkers	Central Trib	406	100 Year Spill	0.77	237.17	237.49		237.53	0.007792	0.94	1.01	5.07	0.57
Bunkers	Central Trib	406	50 Year Spill	0.47	237.17	237.41		237.45	0.009771	0.85	0.65	4.31	0.60
Bunkers	Central Trib	386	100 Year Spill	0.77	236.99	237.40		237.43	0.003363	0.78	1.43	5.39	0.40
Bunkers	Central Trib	386	50 Year Spill	0.47	236.99	237.31		237.33	0.003509	0.67	0.97	4.64	0.39
Bunkers	Central Trib	366	100 Year Spill	0.77	236.88	237.21	237.19	237.29	0.014886	1.42	0.78	3.74	0.80
Bunkers	Central Trib	366	50 Year Spill	0.47	236.88	237.15		237.21	0.013861	1.17	0.55	3.24	0.75
Bunkers	Central Trib	346	100 Year Spill	0.77	236.66	236.95		237.01	0.013641	1.25	0.90	4.70	0.75
Bunkers	Central Trib	346	50 Year Spill	0.47	236.66	236.90		236.94	0.012253	1.02	0.65	4.33	0.69
Bunkers	Central Trib	326	100 Year Spill	0.77	236.34	236.65		236.72	0.015443	1.36	0.80	4.07	0.81
Bunkers	Central Trib	326	50 Year Spill	0.47	236.34	236.57	236.55	236.63	0.019960	1.25	0.50	3.33	0.87
Bunkers	Central Trib	306	100 Year Spill	0.77	236.10	236.53		236.56	0.004267	0.84	1.09	4.05	0.44
Bunkers	Central Trib	306	50 Year Spill	0.47	236.10	236.45		236.47	0.003905	0.69	0.79	3.50	0.40
Bunkers	Central Trib	286	100 Year Spill	0.77	236.00	236.49		236.50	0.001985	0.64	1.53	5.16	0.31
Bunkers	Central Trib	286	50 Year Spill	0.47	236.00	236.41		236.42	0.001503	0.49	1.17	4.60	0.26
Bunkers	Central Trib	266	100 Year Spill	0.77	236.11	236.38	236.38	236.42	0.011494	1.02	0.93	5.45	0.67
Bunkers	Central Trib	266	50 Year Spill	0.47	236.11	236.29	236.28	236.35	0.021743	1.05	0.51	4.44	0.86
Bunkers	Central Trib	248	100 Year Spill	0.77	235.48	235.77	235.77	235.86	0.019384	1.45	0.69	3.73	0.89
Bunkers	Central Trib	248	50 Year Spill	0.47	235.48	235.68	235.68	235.78	0.034439	1.46	0.38	2.84	1.11
Bunkers	Central Trib	230		Culvert									
Bunkers	Central Trib	220	100 Year Spill	0.77	234.47	235.26	234.77	235.26	0.000303	0.36	3.66	23.81	0.13
Bunkers	Central Trib	220	50 Year Spill	0.47	234.47	235.15	234.69	235.16	0.000231	0.28	2.72	17.24	0.11
Bunkers	Central Trib	200	100 Year Spill	8.46	233.78	234.67	234.67	234.98	0.015077	2.70	4.52	9.49	0.94
Bunkers	Central Trib	200	50 Year Spill	7.09	233.78	234.59	234.59	234.87	0.015552	2.57	3.82	8.18	0.94
Bunkers	Central Trib	180	100 Year Spill	8.46	233.43	234.67	234.34	234.80	0.004819	1.97	8.35	18.78	0.57
Bunkers	Central Trib	180	50 Year Spill	7.09	233.43	234.50	234.27	234.67	0.006855	2.12	5.71	12.35	0.66
Bunkers	Central Trib	160	100 Year Spill	8.46	233.09	234.10	234.10	234.59	0.021360	3.50	3.83	8.42	1.14
Bunkers	Central Trib	160	50 Year Spill	7.09	233.09	234.06	234.06	234.44	0.017756	3.09	3.48	6.98	1.03
Bunkers	Central Trib	140	100 Year Spill	8.46	232.73	233.73	233.73	234.10	0.017321	3.12	4.57	12.97	1.03
Bunkers	Central Trib	140	50 Year Spill	7.09	232.73	233.66	233.66	234.00	0.017023	2.94	3.84	8.99	1.01

HEC-RAS Plan: ExDsgnStm50-100 (Continued)

River	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)	
Bunkers	Central Trib	120	100 Year Spill	8.46	232.14	233.29		233.40	0.006369	2.02	7.43	11.88	0.63
Bunkers	Central Trib	120	50 Year Spill	7.09	232.14	233.20		233.31	0.006478	1.93	6.44	11.19	0.62
Bunkers	Central Trib	100	100 Year Spill	8.46	231.95	232.94	232.92	233.19	0.017363	3.04	5.07	9.42	1.02
Bunkers	Central Trib	100	50 Year Spill	7.09	231.95	232.87	232.84	233.10	0.016749	2.84	4.48	8.85	0.98
Bunkers	Central Trib	80	100 Year Spill	8.46	231.52	232.60	232.60	232.89	0.012129	2.76	4.81	8.67	0.87
Bunkers	Central Trib	80	50 Year Spill	7.09	231.52	232.50	232.50	232.79	0.013026	2.69	4.02	8.08	0.89
Bunkers	Central Trib	52.62	100 Year Spill	8.46	231.27	232.55		232.62	0.003162	1.56	10.26	16.04	0.45
Bunkers	Central Trib	52.62	50 Year Spill	7.09	231.27	232.47		232.53	0.003080	1.47	8.99	15.04	0.44
Bunkers	Central Trib	33.77	100 Year Spill	8.46	231.02	232.43		232.54	0.004616	2.08	8.44	12.75	0.57
Bunkers	Central Trib	33.77	50 Year Spill	7.09	231.02	232.36		232.46	0.004156	1.91	7.60	12.02	0.53
Bunkers	Central Trib	33		Lat Struct									
Bunkers	Central Trib	13.12	100 Year Spill	5.46	230.67	232.47	231.47	232.49	0.000487	0.80	15.09	21.25	0.19
Bunkers	Central Trib	13.12	50 Year Spill	4.79	230.67	232.39	231.38	232.41	0.000455	0.75	13.57	18.89	0.18

HEC-RAS Plan: FutDesSpills50-100

River	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)	
Kidds Spill	To Bunkers	352	100 Year Spill	0.23	237.11	237.33	237.33	237.40	0.024755	1.42	0.25	1.80	0.97
Kidds Spill	To Bunkers	352	50 Year Spill	0.19	237.11	237.30	237.30	237.37	0.029447	1.41	0.20	1.63	1.04
Kidds Spill	To Bunkers	332	100 Year Spill	0.23	236.50	237.17		237.17	0.000204	0.27	1.68	4.52	0.11
Kidds Spill	To Bunkers	332	50 Year Spill	0.19	236.50	237.11		237.11	0.000209	0.26	1.43	4.18	0.11
Kidds Spill	To Bunkers	312	100 Year Spill	0.23	236.44	237.17		237.17	0.000141	0.24	1.95	4.87	0.09
Kidds Spill	To Bunkers	312	50 Year Spill	0.19	236.44	237.11		237.11	0.000140	0.23	1.68	4.52	0.09
Kidds Spill	To Bunkers	292	100 Year Spill	0.23	236.37	237.17		237.17	0.000093	0.21	2.30	5.27	0.07
Kidds Spill	To Bunkers	292	50 Year Spill	0.19	236.37	237.11		237.11	0.000090	0.19	2.00	4.93	0.07
Kidds Spill	To Bunkers	272	100 Year Spill	0.23	236.30	237.16	236.51	237.17	0.000064	0.18	2.66	5.65	0.06
Kidds Spill	To Bunkers	272	50 Year Spill	0.19	236.30	237.11	236.50	237.11	0.000060	0.17	2.34	5.31	0.06
Kidds Spill	To Bunkers	252.00*	100 Year Spill	0.23	236.23	237.16		237.16	0.000046	0.16	3.04	6.05	0.05
Kidds Spill	To Bunkers	252.00*	50 Year Spill	0.19	236.23	237.11		237.11	0.000042	0.15	2.71	5.71	0.05
Kidds Spill	To Bunkers	232.00*	100 Year Spill	0.23	236.17	237.16		237.16	0.000033	0.14	3.46	6.45	0.05
Kidds Spill	To Bunkers	232.00*	50 Year Spill	0.19	236.17	237.11		237.11	0.000030	0.13	3.10	6.11	0.04
Kidds Spill	To Bunkers	212.00*	100 Year Spill	0.23	236.10	237.16		237.16	0.000024	0.13	3.90	6.85	0.04
Kidds Spill	To Bunkers	212.00*	50 Year Spill	0.19	236.10	237.10		237.11	0.000022	0.12	3.51	6.51	0.04
Kidds Spill	To Bunkers	192.00*	100 Year Spill	0.23	236.04	237.16	236.24	237.16	0.000018	0.12	4.37	7.26	0.03
Kidds Spill	To Bunkers	192.00*	50 Year Spill	0.19	236.04	237.10	236.24	237.10	0.000016	0.10	3.96	6.91	0.03
Kidds Spill	To Bunkers	172	100 Year Spill	0.23	235.97	237.16	236.18	237.16	0.000014	0.10	4.86	7.66	0.03
Kidds Spill	To Bunkers	172	50 Year Spill	0.19	235.97	237.10	236.16	237.10	0.000012	0.09	4.43	7.32	0.03
Kidds Spill	To Bunkers	152	100 Year Spill	0.23	235.90	237.16		237.16	0.000013	0.10	5.88	13.12	0.03
Kidds Spill	To Bunkers	152	50 Year Spill	0.19	235.90	237.10		237.10	0.000012	0.10	5.16	12.05	0.03
Dyments	Spill From Bunke	460	100 Year Spill	3.37	230.09	232.23		232.24	0.000083	0.36	22.76	39.91	0.08
Dyments	Spill From Bunke	460	50 Year Spill	1.32	230.09	232.07		232.08	0.000019	0.16	17.01	29.10	0.04
Dyments	Spill From Bunke	440	100 Year Spill	3.37	230.03	232.23		232.23	0.000057	0.30	30.06	56.40	0.07
Dyments	Spill From Bunke	440	50 Year Spill	1.32	230.03	232.07		232.07	0.000016	0.15	21.81	47.60	0.04
Dyments	Spill From Bunke	420	100 Year Spill	3.37	230.04	232.23		232.23	0.000048	0.27	32.71	57.77	0.06
Dyments	Spill From Bunke	420	50 Year Spill	1.32	230.04	232.07		232.07	0.000013	0.13	24.53	46.02	0.03
Dyments	Spill From Bunke	400	100 Year Spill	3.37	230.01	232.23		232.23	0.000046	0.27	32.55	54.81	0.06
Dyments	Spill From Bunke	400	50 Year Spill	1.32	230.01	232.07		232.07	0.000012	0.13	24.70	44.28	0.03
Dyments	Spill From Bunke	380	100 Year Spill	3.37	230.06	232.23		232.23	0.000054	0.30	27.04	50.11	0.07
Dyments	Spill From Bunke	380	50 Year Spill	1.32	230.06	232.07		232.07	0.000013	0.14	20.22	38.32	0.03
Dyments	Spill From Bunke	360	100 Year Spill	3.37	230.30	232.23	230.78	232.23	0.000041	0.24	33.74	56.21	0.06
Dyments	Spill From Bunke	360	50 Year Spill	1.32	230.30	232.07	230.61	232.07	0.000011	0.12	26.28	39.35	0.03
Bunkers	Northeast Trib	362	100 Year Spill	9.83	238.35	239.48	239.48	239.65	0.011261	2.66	8.65	21.88	0.83
Bunkers	Northeast Trib	362	50 Year Spill	8.58	238.35	239.45	239.45	239.61	0.010708	2.54	7.91	21.44	0.81
Bunkers	Northeast Trib	344	100 Year Spill	9.83	238.24	239.16		239.25	0.009060	2.07	10.14	23.59	0.72
Bunkers	Northeast Trib	344	50 Year Spill	8.58	238.24	239.11		239.20	0.009644	2.05	9.00	22.98	0.74
Bunkers	Northeast Trib	313	100 Year Spill	9.83	237.83	238.74		238.90	0.013293	2.44	7.47	16.41	0.87
Bunkers	Northeast Trib	313	50 Year Spill	8.58	237.83	238.69		238.85	0.013436	2.35	6.67	15.49	0.87
Bunkers	Northeast Trib	287	100 Year Spill	9.83	237.50	238.40	237.99	238.51	0.015477	2.61	8.50	21.07	0.92
Bunkers	Northeast Trib	287	50 Year Spill	8.58	237.50	238.37	237.98	238.47	0.014303	2.45	7.89	20.31	0.88
Bunkers	Northeast Trib	260	100 Year Spill	9.83	237.34	237.79	237.79	237.94	0.029471	2.47	6.97	22.46	1.19
Bunkers	Northeast Trib	260	50 Year Spill	8.58	237.34	237.75	237.75	237.90	0.032884	2.45	6.07	21.31	1.24
Bunkers	Spill to Storm	294	100 Year Spill	0.01	231.59	232.39		232.39	0.000000	0.00	5.69	12.39	0.00
Bunkers	Spill to Storm	294	50 Year Spill	0.01	231.59	232.25		232.25	0.000000	0.00	4.17	9.75	0.00
Bunkers	Spill to Storm	273	100 Year Spill	4.21	231.43	232.34		232.37	0.001701	0.95	7.44	15.19	0.32
Bunkers	Spill to Storm	273	50 Year Spill	3.21	231.43	232.20		232.23	0.001954	0.91	5.54	12.16	0.34
Bunkers	Spill to Storm	252	100 Year Spill	4.21	231.36	232.30		232.33	0.002012	1.07	7.04	12.47	0.35
Bunkers	Spill to Storm	252	50 Year Spill	3.21	231.36	232.16		232.19	0.002303	1.02	5.38	10.80	0.37
Bunkers	Spill to Storm	231	100 Year Spill	4.21	231.07	232.27		232.30	0.001176	0.96	9.24	22.34	0.28
Bunkers	Spill to Storm	231	50 Year Spill	3.21	231.07	232.13		232.15	0.001282	0.91	6.83	12.74	0.29
Bunkers	Spill to Storm	210	100 Year Spill	4.21	230.90	232.26		232.28	0.000570	0.72	12.05	23.80	0.20
Bunkers	Spill to Storm	210	50 Year Spill	3.21	230.90	232.12		232.13	0.000568	0.67	9.05	15.44	0.19
Bunkers	Spill to Storm	189	100 Year Spill	4.21	230.66	232.26		232.27	0.000421	0.67	13.99	28.68	0.17
Bunkers	Spill to Storm	189	50 Year Spill	3.21	230.66	232.11		232.12	0.000404	0.61	10.37	21.67	0.17
Bunkers	Spill to Storm	168	100 Year Spill	4.21	230.34	232.25		232.26	0.000195	0.52	21.88	38.43	0.12
Bunkers	Spill to Storm	168	50 Year Spill	3.21	230.34	232.11		232.11	0.000206	0.51	16.53	33.12	0.12

HEC-RAS Plan: FutDesSpills50-100 (Continued)

River	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)	
Bunkers	Spill to Storm	147	100 Year Spill	15.78	230.30	232.21		232.24	0.001734	1.29	27.94	40.77	0.32
Bunkers	Spill to Storm	147	50 Year Spill	13.10	230.30	232.05		232.09	0.002205	1.35	21.86	36.17	0.36
Bunkers	Northeast Trib-D	245	100 Year Spill	8.50	236.02	237.69	237.02	237.80	0.002195	1.65	6.81	9.97	0.41
Bunkers	Northeast Trib-D	245	50 Year Spill	7.69	236.02	237.57	236.97	237.68	0.002312	1.61	6.27	8.89	0.41
Bunkers	Northeast Trib-D	239.19		Culvert									
Bunkers	Northeast Trib-D	224.77	100 Year Spill	8.50	235.81	237.13	236.72	237.25	0.003642	1.75	6.47	25.36	0.50
Bunkers	Northeast Trib-D	224.77	50 Year Spill	7.69	235.81	237.08	236.69	237.19	0.003442	1.66	6.18	24.87	0.48
Bunkers	Spill to Storm-D	1000	100 Year Spill	12.42	228.11	232.23		232.23	0.000021	0.29	94.20	46.48	0.05
Bunkers	Spill to Storm-D	1000	50 Year Spill	11.79	228.11	232.07		232.08	0.000023	0.30	87.14	45.18	0.05
Bunkers	Spill to Storm-D	996	100 Year Spill	12.42	228.03	232.20	229.09	232.22	0.000092	0.61	23.69	37.41	0.10
Bunkers	Spill to Storm-D	996	50 Year Spill	11.79	228.03	232.05	229.04	232.07	0.000094	0.60	22.77	36.08	0.10
Bunkers	Northeast Trib-2	136	100 Year Spill	8.73	235.54	236.66	236.66	236.99	0.013104	2.89	4.53	7.85	0.91
Bunkers	Northeast Trib-2	136	50 Year Spill	7.88	235.54	236.58	236.58	236.92	0.014382	2.88	3.97	7.10	0.94
Bunkers	Northeast Trib-2	133	100 Year Spill	8.73	234.37	236.26	235.46	236.36	0.002001	1.68	8.83	7.50	0.39
Bunkers	Northeast Trib-2	133	50 Year Spill	7.88	234.37	236.02	235.40	236.13	0.002779	1.80	7.11	6.50	0.45
Bunkers	Central Trib	508.22	100 Year Spill	1.33	236.86	237.78		237.80	0.001670	0.88	3.05	7.55	0.30
Bunkers	Central Trib	508.22	50 Year Spill	0.89	236.86	237.67		237.68	0.001462	0.75	2.29	6.33	0.28
Bunkers	Central Trib	503.18	100 Year Spill	1.33	236.82	237.75		237.77	0.001346	0.82	3.18	6.79	0.28
Bunkers	Central Trib	503.18	50 Year Spill	0.89	236.82	237.64		237.66	0.001105	0.68	2.49	6.06	0.25
Bunkers	Central Trib	492	100 Year Spill	1.33	236.71	237.74		237.74	0.000524	0.57	4.61	7.88	0.18
Bunkers	Central Trib	492	50 Year Spill	0.89	236.71	237.63		237.64	0.000379	0.45	3.84	7.25	0.15
Bunkers	Central Trib	463	100 Year Spill	1.33	236.84	237.73		237.74	0.000126	0.26	7.79	11.17	0.09
Bunkers	Central Trib	463	50 Year Spill	0.89	236.84	237.63		237.63	0.000090	0.20	6.67	10.91	0.07
Bunkers	Central Trib	442	100 Year Spill	1.33	237.05	237.71		237.73	0.001656	0.75	2.76	6.85	0.30
Bunkers	Central Trib	442	50 Year Spill	0.89	237.05	237.61		237.63	0.001432	0.62	2.14	6.19	0.27
Bunkers	Central Trib	426	100 Year Spill	1.33	237.03	237.69	237.36	237.70	0.001294	0.65	2.90	6.89	0.26
Bunkers	Central Trib	426	50 Year Spill	0.89	237.03	237.59	237.30	237.61	0.001091	0.54	2.29	6.41	0.24
Bunkers	Central Trib	406	100 Year Spill	1.33	237.17	237.61		237.65	0.006269	1.07	1.67	6.03	0.54
Bunkers	Central Trib	406	50 Year Spill	0.89	237.17	237.52		237.56	0.007350	0.98	1.16	5.35	0.56
Bunkers	Central Trib	386	100 Year Spill	1.33	236.99	237.53		237.56	0.003537	0.96	2.15	6.49	0.42
Bunkers	Central Trib	386	50 Year Spill	0.89	236.99	237.43		237.46	0.003449	0.83	1.59	5.64	0.41
Bunkers	Central Trib	366	100 Year Spill	1.33	236.88	237.38	237.38	237.45	0.008103	1.39	1.51	4.95	0.64
Bunkers	Central Trib	366	50 Year Spill	0.89	236.88	237.24		237.32	0.014851	1.49	0.87	3.88	0.81
Bunkers	Central Trib	346	100 Year Spill	1.33	236.66	237.03		237.12	0.014547	1.54	1.33	5.52	0.81
Bunkers	Central Trib	346	50 Year Spill	0.89	236.66	236.97		237.03	0.014151	1.33	0.99	4.83	0.78
Bunkers	Central Trib	326	100 Year Spill	1.33	236.34	236.76		236.85	0.012041	1.51	1.32	4.76	0.75
Bunkers	Central Trib	326	50 Year Spill	0.89	236.34	236.68		236.75	0.014381	1.40	0.92	4.27	0.79
Bunkers	Central Trib	306	100 Year Spill	1.33	236.10	236.65		236.70	0.004629	1.06	1.62	4.84	0.48
Bunkers	Central Trib	306	50 Year Spill	0.89	236.10	236.56		236.60	0.004383	0.90	1.21	4.22	0.45
Bunkers	Central Trib	286	100 Year Spill	1.33	236.00	236.60		236.63	0.002465	0.83	2.16	5.90	0.36
Bunkers	Central Trib	286	50 Year Spill	0.89	236.00	236.51		236.53	0.002141	0.69	1.67	5.36	0.32
Bunkers	Central Trib	266	100 Year Spill	1.33	236.11	236.40	236.40	236.51	0.023242	1.56	1.08	5.68	0.97
Bunkers	Central Trib	266	50 Year Spill	0.89	236.11	236.38	236.38	236.44	0.015502	1.19	0.93	5.45	0.78
Bunkers	Central Trib	248	100 Year Spill	1.33	235.48	235.87	235.87	235.99	0.018101	1.71	1.07	4.36	0.91
Bunkers	Central Trib	248	50 Year Spill	0.89	235.48	235.81	235.81	235.90	0.016383	1.44	0.82	3.98	0.84
Bunkers	Central Trib	230		Culvert									
Bunkers	Central Trib	220	100 Year Spill	1.33	234.47	235.48	234.85	235.48	0.000257	0.39	6.21	30.07	0.13
Bunkers	Central Trib	220	50 Year Spill	0.89	234.47	235.30	234.79	235.30	0.000337	0.39	4.06	25.60	0.14
Bunkers	Central Trib	200	100 Year Spill	10.56	233.78	234.73	234.73	235.15	0.018770	3.16	5.18	12.95	1.07
Bunkers	Central Trib	200	50 Year Spill	8.85	233.78	234.68	234.68	235.01	0.015785	2.79	4.62	9.70	0.97
Bunkers	Central Trib	180	100 Year Spill	10.56	233.43	234.52	234.43	234.88	0.014037	3.07	5.98	13.20	0.95
Bunkers	Central Trib	180	50 Year Spill	8.85	233.43	234.72	234.37	234.84	0.004352	1.92	9.33	21.69	0.55
Bunkers	Central Trib	160	100 Year Spill	10.56	233.09	234.44	234.44	234.63	0.007208	2.49	9.40	22.32	0.70
Bunkers	Central Trib	160	50 Year Spill	8.85	233.09	234.11	234.11	234.64	0.022390	3.62	3.93	8.85	1.17
Bunkers	Central Trib	140	100 Year Spill	10.56	232.73	233.95	233.95	234.16	0.008681	2.55	9.01	23.35	0.75
Bunkers	Central Trib	140	50 Year Spill	8.85	232.73	233.76	233.76	234.12	0.016448	3.11	5.01	15.63	1.01

HEC-RAS Plan: FutDesSpills50-100 (Continued)

River	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)	
Bunkers	Central Trib	120	100 Year Spill	10.56	232.14	233.39		233.52	0.006664	2.21	8.73	12.98	0.65
Bunkers	Central Trib	120	50 Year Spill	8.85	232.14	233.31		233.43	0.006386	2.05	7.68	12.04	0.63
Bunkers	Central Trib	100	100 Year Spill	10.56	231.95	233.07	233.02	233.32	0.014996	3.09	6.41	10.62	0.97
Bunkers	Central Trib	100	50 Year Spill	8.85	231.95	232.96	232.94	233.22	0.016971	3.06	5.31	9.65	1.01
Bunkers	Central Trib	80	100 Year Spill	10.56	231.52	232.70	232.70	233.03	0.012597	3.00	5.73	9.47	0.90
Bunkers	Central Trib	80	50 Year Spill	8.85	231.52	232.62	232.62	232.92	0.012198	2.81	4.99	8.79	0.88
Bunkers	Central Trib	52.62	100 Year Spill	10.56	231.27	232.66		232.74	0.003442	1.72	12.27	21.03	0.48
Bunkers	Central Trib	52.62	50 Year Spill	8.85	231.27	232.57		232.64	0.003169	1.58	10.66	17.29	0.46
Bunkers	Central Trib	33.77	100 Year Spill	10.56	231.02	232.52		232.65	0.005283	2.32	9.61	13.73	0.61
Bunkers	Central Trib	33.77	50 Year Spill	8.85	231.02	232.45		232.57	0.004744	2.13	8.69	13.08	0.58
Bunkers	Central Trib	33		Lat Struct									
Bunkers	Central Trib	13.12	100 Year Spill	6.36	230.67	232.57	231.52	232.59	0.000498	0.84	17.34	23.77	0.20
Bunkers	Central Trib	13.12	50 Year Spill	5.65	230.67	232.49	231.48	232.51	0.000490	0.81	15.57	21.75	0.19

HEC-RAS Plan: ExDesSpill10-25

River	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)	
Kidds Spill	To Bunkers	352	25 Year Spill	0.13	237.11	237.29	237.29	237.33	0.017181	1.04	0.18	1.57	0.79
Kidds Spill	To Bunkers	352	10 Year Spill	0.09	237.11	237.23	237.23	237.29	0.033197	1.13	0.11	1.25	1.03
Kidds Spill	To Bunkers	332	25 Year Spill	0.13	236.50	236.95		236.95	0.000387	0.29	0.83	3.19	0.14
Kidds Spill	To Bunkers	332	10 Year Spill	0.09	236.50	236.83		236.83	0.000715	0.32	0.48	2.46	0.18
Kidds Spill	To Bunkers	312	25 Year Spill	0.13	236.44	236.94		236.95	0.000234	0.24	1.01	3.52	0.11
Kidds Spill	To Bunkers	312	10 Year Spill	0.09	236.44	236.82		236.82	0.000390	0.26	0.62	2.77	0.13
Kidds Spill	To Bunkers	292	25 Year Spill	0.13	236.37	236.94		236.94	0.000135	0.20	1.26	3.92	0.08
Kidds Spill	To Bunkers	292	10 Year Spill	0.09	236.37	236.81		236.81	0.000197	0.20	0.81	3.16	0.10
Kidds Spill	To Bunkers	272	25 Year Spill	0.13	236.30	236.94	236.46	236.94	0.000082	0.17	1.54	4.31	0.07
Kidds Spill	To Bunkers	272	10 Year Spill	0.09	236.30	236.81	236.43	236.81	0.000107	0.16	1.03	3.54	0.07
Kidds Spill	To Bunkers	252.00*	25 Year Spill	0.13	236.23	236.94		236.94	0.000053	0.14	1.83	4.70	0.05
Kidds Spill	To Bunkers	252.00*	10 Year Spill	0.09	236.23	236.81		236.81	0.000063	0.14	1.27	3.93	0.06
Kidds Spill	To Bunkers	232.00*	25 Year Spill	0.13	236.17	236.94		236.94	0.000035	0.12	2.15	5.10	0.05
Kidds Spill	To Bunkers	232.00*	10 Year Spill	0.09	236.17	236.81		236.81	0.000039	0.12	1.55	4.33	0.05
Kidds Spill	To Bunkers	212.00*	25 Year Spill	0.13	236.10	236.94		236.94	0.000024	0.11	2.50	5.50	0.04
Kidds Spill	To Bunkers	212.00*	10 Year Spill	0.09	236.10	236.81		236.81	0.000025	0.10	1.84	4.73	0.04
Kidds Spill	To Bunkers	192.00*	25 Year Spill	0.13	236.04	236.94	236.21	236.94	0.000017	0.10	2.88	5.90	0.03
Kidds Spill	To Bunkers	192.00*	10 Year Spill	0.09	236.04	236.81	236.17	236.81	0.000016	0.09	2.17	5.13	0.03
Kidds Spill	To Bunkers	172	25 Year Spill	0.13	235.97	236.94	236.12	236.94	0.000012	0.08	3.28	6.30	0.03
Kidds Spill	To Bunkers	172	10 Year Spill	0.09	235.97	236.81	236.10	236.81	0.000011	0.07	2.52	5.53	0.03
Kidds Spill	To Bunkers	152	25 Year Spill	0.13	235.90	236.94		236.94	0.000009	0.08	3.73	6.80	0.02
Kidds Spill	To Bunkers	152	10 Year Spill	0.09	235.90	236.81		236.81	0.000008	0.07	2.91	5.89	0.02
Bunkers	Northeast Trib	362	25 Year Spill	6.15	238.35	239.35	239.35	239.51	0.010427	2.35	5.99	19.66	0.79
Bunkers	Northeast Trib	362	10 Year Spill	4.72	238.35	239.23	239.23	239.41	0.012576	2.35	4.00	12.39	0.84
Bunkers	Northeast Trib	344	25 Year Spill	6.15	238.24	239.00		239.10	0.011963	2.06	6.46	20.74	0.80
Bunkers	Northeast Trib	344	10 Year Spill	4.72	238.24	238.91	238.72	239.03	0.015969	2.17	4.71	19.15	0.90
Bunkers	Northeast Trib	313	25 Year Spill	6.15	237.83	238.60		238.73	0.011999	2.04	5.37	13.98	0.80
Bunkers	Northeast Trib	313	10 Year Spill	4.72	237.83	238.56		238.65	0.009631	1.74	4.73	13.05	0.71
Bunkers	Northeast Trib	287	25 Year Spill	6.15	237.50	238.27	237.93	238.37	0.015759	2.34	5.90	17.91	0.90
Bunkers	Northeast Trib	287	10 Year Spill	4.72	237.50	238.18	237.91	238.29	0.020425	2.42	4.37	15.96	1.00
Bunkers	Northeast Trib	260	25 Year Spill	6.15	237.34	237.70	237.70	237.81	0.026845	2.04	5.15	20.12	1.10
Bunkers	Northeast Trib	260	10 Year Spill	4.72	237.34	237.69	237.69	237.76	0.017685	1.63	4.95	19.92	0.89
Bunkers	Northeast Trib-D	245	25 Year Spill	5.94	236.02	237.32	236.82	237.42	0.002672	1.54	5.05	6.21	0.43
Bunkers	Northeast Trib-D	245	10 Year Spill	4.73	236.02	237.13	236.70	237.22	0.003048	1.48	4.13	5.21	0.45
Bunkers	Northeast Trib-D	239.19		Culvert									
Bunkers	Northeast Trib-D	224.77	25 Year Spill	5.94	235.81	236.92	236.56	237.01	0.003465	1.52	5.23	23.40	0.47
Bunkers	Northeast Trib-D	224.77	10 Year Spill	4.73	235.81	236.78	236.53	236.87	0.003785	1.44	4.39	22.05	0.48
Bunkers	Central Trib	508.22	25 Year Spill	0.22	236.86	237.41		237.41	0.000666	0.38	0.97	3.89	0.17
Bunkers	Central Trib	508.22	10 Year Spill	0.00	236.86	237.23		237.23	0.000000	0.00	0.43	2.48	0.00
Bunkers	Central Trib	503.18	25 Year Spill	0.22	236.82	237.40		237.40	0.000383	0.31	1.23	4.24	0.14
Bunkers	Central Trib	503.18	10 Year Spill	0.00	236.82	237.23		237.23	0.000000	0.00	0.63	3.01	0.00
Bunkers	Central Trib	492	25 Year Spill	0.22	236.71	237.40		237.40	0.000086	0.18	2.30	5.65	0.07
Bunkers	Central Trib	492	10 Year Spill	0.00	236.71	237.23		237.23	0.000000	0.00	1.46	4.68	0.00
Bunkers	Central Trib	463	25 Year Spill	0.22	236.84	237.39		237.39	0.000022	0.08	4.17	10.00	0.03
Bunkers	Central Trib	463	10 Year Spill	0.00	236.84	237.23		237.23	0.000000	0.00	2.62	9.20	0.00
Bunkers	Central Trib	442	25 Year Spill	0.22	237.05	237.39		237.39	0.000719	0.31	0.95	4.40	0.18
Bunkers	Central Trib	442	10 Year Spill	0.00	237.05	237.23		237.23	0.000000	0.00	0.36	3.07	0.00
Bunkers	Central Trib	426	25 Year Spill	0.22	237.03	237.38	237.16	237.38	0.000482	0.25	1.08	4.72	0.14
Bunkers	Central Trib	426	10 Year Spill	0.00	237.03	237.23	237.04	237.23	0.000000	0.00	0.46	3.31	0.00
Bunkers	Central Trib	406	25 Year Spill	0.22	237.17	237.33		237.35	0.013705	0.71	0.33	3.32	0.65
Bunkers	Central Trib	406	10 Year Spill	0.00	237.17	237.23	237.23	237.23	0.000002	0.00	0.07	1.96	0.01
Bunkers	Central Trib	386	25 Year Spill	0.22	236.99	237.21		237.22	0.003552	0.52	0.55	3.67	0.36
Bunkers	Central Trib	386	10 Year Spill	0.00	236.99	237.06	237.06	237.06	0.000001	0.00	0.09	2.04	0.01
Bunkers	Central Trib	366	25 Year Spill	0.22	236.88	237.07		237.10	0.012688	0.87	0.32	2.50	0.67
Bunkers	Central Trib	366	10 Year Spill	0.00	236.88	236.96	236.96	236.96	0.000001	0.00	0.09	1.68	0.01
Bunkers	Central Trib	346	25 Year Spill	0.22	236.66	236.82		236.85	0.013184	0.81	0.35	3.52	0.67
Bunkers	Central Trib	346	10 Year Spill	0.00	236.66	236.67		236.67	0.012430	0.08	0.00	0.76	0.37
Bunkers	Central Trib	326	25 Year Spill	0.22	236.34	236.50	236.50	236.54	0.019035	0.94	0.29	2.79	0.79
Bunkers	Central Trib	326	10 Year Spill	0.00	236.34	236.35		236.35	0.021687	0.11	0.00	0.61	0.48
Bunkers	Central Trib	306	25 Year Spill	0.22	236.10	236.35		236.36	0.003656	0.51	0.47	2.93	0.36

HEC-RAS Plan: ExDesSpill10-25 (Continued)

River	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)	
Bunkers	Central Trib	306	10 Year Spill	0.00	236.10	236.11		236.11	0.007132	0.07	0.00	0.69	0.29
Bunkers	Central Trib	286	25 Year Spill	0.22	236.00	236.32		236.33	0.000914	0.32	0.80	3.86	0.19
Bunkers	Central Trib	286	10 Year Spill	0.00	236.00	236.11		236.11	0.000000	0.00	0.16	2.12	0.00
Bunkers	Central Trib	266	25 Year Spill	0.22	236.11	236.24	236.24	236.27	0.018134	0.75	0.31	3.69	0.74
Bunkers	Central Trib	266	10 Year Spill	0.00	236.11	236.11		236.11	0.022130	0.09	0.00	0.87	0.47
Bunkers	Central Trib	248	25 Year Spill	0.22	235.48	235.61	235.61	235.68	0.045182	1.19	0.20	2.29	1.17
Bunkers	Central Trib	248	10 Year Spill	0.00	235.48	235.49	235.49	235.49	0.046567	0.14	0.00	0.49	0.70
Bunkers	Central Trib	230		Culvert									
Bunkers	Central Trib	220	25 Year Spill	0.22	234.47	235.04	234.62	235.04	0.000107	0.17	1.90	13.38	0.07
Bunkers	Central Trib	220	10 Year Spill	0.00	234.47	235.01	234.48	235.01	0.000000	0.00	1.70	12.63	0.00
Bunkers	Central Trib	200	25 Year Spill	5.60	233.78	234.49	234.49	234.75	0.016929	2.43	3.04	7.31	0.96
Bunkers	Central Trib	200	10 Year Spill	4.01	233.78	234.29	234.29	234.63	0.034480	2.71	1.77	5.51	1.29
Bunkers	Central Trib	180	25 Year Spill	5.60	233.43	234.36		234.50	0.006830	1.92	4.40	7.83	0.65
Bunkers	Central Trib	180	10 Year Spill	4.01	233.43	234.20		234.32	0.007207	1.74	3.29	6.59	0.64
Bunkers	Central Trib	160	25 Year Spill	5.60	233.09	233.98	233.98	234.28	0.015590	2.73	2.98	6.00	0.95
Bunkers	Central Trib	160	10 Year Spill	4.01	233.09	233.83	233.83	234.09	0.017108	2.50	2.17	4.77	0.97
Bunkers	Central Trib	140	25 Year Spill	5.60	232.73	233.57	233.57	233.85	0.015997	2.65	3.15	7.09	0.96
Bunkers	Central Trib	140	10 Year Spill	4.01	232.73	233.44	233.44	233.68	0.016782	2.41	2.32	5.81	0.95
Bunkers	Central Trib	120	25 Year Spill	5.60	232.14	233.10		233.20	0.006331	1.78	5.41	10.37	0.61
Bunkers	Central Trib	120	10 Year Spill	4.01	232.14	232.99		233.07	0.006183	1.60	4.24	9.57	0.58
Bunkers	Central Trib	100	25 Year Spill	5.60	231.95	232.77	232.77	232.99	0.018099	2.71	3.62	8.09	1.00
Bunkers	Central Trib	100	10 Year Spill	4.01	231.95	232.65	232.65	232.85	0.020391	2.55	2.67	7.14	1.03
Bunkers	Central Trib	80	25 Year Spill	5.60	231.52	232.38	232.37	232.66	0.014225	2.56	3.12	6.60	0.91
Bunkers	Central Trib	80	10 Year Spill	4.01	231.52	232.29	232.22	232.49	0.011758	2.14	2.54	5.63	0.81
Bunkers	Central Trib	52.62	25 Year Spill	5.60	231.27	232.37		232.43	0.003043	1.37	7.52	14.22	0.43
Bunkers	Central Trib	52.62	10 Year Spill	4.01	231.27	232.23		232.29	0.003183	1.27	5.68	13.26	0.43
Bunkers	Central Trib	33.77	25 Year Spill	5.60	231.02	232.28		232.36	0.003518	1.68	6.67	11.12	0.48
Bunkers	Central Trib	33.77	10 Year Spill	4.01	231.02	232.17		232.23	0.002831	1.42	5.50	9.96	0.43
Bunkers	Central Trib	33		Lat Struct									
Bunkers	Central Trib	13.12	25 Year Spill	4.10	230.67	232.31	231.35	232.32	0.000358	0.64	12.14	14.45	0.16
Bunkers	Central Trib	13.12	10 Year Spill	3.16	230.67	232.19	231.29	232.20	0.000295	0.56	10.52	13.04	0.15
Bunkers	Northeast Trib-2	136	25 Year Spill	6.07	235.54	236.44	236.44	236.75	0.015557	2.70	3.07	5.87	0.95
Bunkers	Northeast Trib-2	136	10 Year Spill	4.82	235.54	236.35	236.35	236.62	0.015271	2.48	2.57	5.32	0.92
Bunkers	Northeast Trib-2	133	25 Year Spill	6.07	234.37	235.57	235.26	235.73	0.005469	2.04	4.50	5.33	0.60
Bunkers	Northeast Trib-2	133	10 Year Spill	4.82	234.37	235.34	235.14	235.51	0.007967	2.12	3.31	4.82	0.70
Bunkers	Spill to Storm	294	25 Year Spill	0.01	231.59	231.95		231.95	0.000000	0.01	1.73	6.75	0.00
Bunkers	Spill to Storm	294	10 Year Spill	0.01	231.59	231.83		231.83	0.000002	0.01	0.98	5.56	0.01
Bunkers	Spill to Storm	273	25 Year Spill	1.51	231.43	231.89		231.92	0.003225	0.83	2.53	7.93	0.40
Bunkers	Spill to Storm	273	10 Year Spill	0.86	231.43	231.78		231.79	0.003194	0.67	1.67	6.74	0.37
Bunkers	Spill to Storm	252	25 Year Spill	1.51	231.36	231.78		231.82	0.006990	1.15	2.00	7.10	0.57
Bunkers	Spill to Storm	252	10 Year Spill	0.86	231.36	231.64		231.69	0.010291	1.07	1.14	5.79	0.65
Bunkers	Spill to Storm	231	25 Year Spill	1.51	231.07	231.69		231.73	0.003211	1.00	2.49	7.27	0.41
Bunkers	Spill to Storm	231	10 Year Spill	0.86	231.07	231.55		231.57	0.003093	0.82	1.57	5.58	0.39
Bunkers	Spill to Storm	210	25 Year Spill	1.51	230.90	231.67		231.68	0.001014	0.65	3.89	9.25	0.24
Bunkers	Spill to Storm	210	10 Year Spill	0.86	230.90	231.53		231.54	0.000772	0.49	2.72	7.64	0.20
Bunkers	Spill to Storm	189	25 Year Spill	1.51	230.66	231.66		231.67	0.000524	0.54	4.71	9.16	0.18
Bunkers	Spill to Storm	189	10 Year Spill	0.86	230.66	231.52		231.53	0.000328	0.38	3.56	7.86	0.14
Bunkers	Spill to Storm	168	25 Year Spill	1.51	230.34	231.66		231.66	0.000183	0.39	7.58	11.58	0.11
Bunkers	Spill to Storm	168	10 Year Spill	0.86	230.34	231.52		231.53	0.000097	0.26	6.13	10.19	0.08
Bunkers	Spill to Storm	147	25 Year Spill	8.34	230.30	231.36	231.36	231.57	0.019857	2.66	5.34	12.26	0.96
Bunkers	Spill to Storm	147	10 Year Spill	6.08	230.30	231.28	231.28	231.45	0.018468	2.37	4.32	11.45	0.91
Bunkers	Spill to Storm	100	25 Year Spill	8.34	228.11	229.62		229.65	0.000912	0.99	14.09	13.21	0.26
Bunkers	Spill to Storm	100	10 Year Spill	6.08	228.11	229.25		229.28	0.001440	1.03	9.50	11.36	0.31
Bunkers	Spill to Storm	96	25 Year Spill	8.34	228.03	229.54	228.86	229.62	0.001609	1.25	7.73	8.56	0.34
Bunkers	Spill to Storm	96	10 Year Spill	6.08	228.03	229.17	228.74	229.24	0.002598	1.29	5.45	7.13	0.41

HEC-RAS Plan: FutDesSpill10-25

River	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)	
Kidds Spill	To Bunkers	352	25 Year Spill	0.16	237.11	237.26	237.26	237.36	0.049055	1.57	0.14	1.41	1.29
Kidds Spill	To Bunkers	352	10 Year Spill	0.11	237.11	237.24	237.24	237.31	0.040487	1.30	0.12	1.29	1.14
Kidds Spill	To Bunkers	332	25 Year Spill	0.16	236.50	237.04		237.04	0.000267	0.27	1.13	3.72	0.12
Kidds Spill	To Bunkers	332	10 Year Spill	0.11	236.50	236.91		236.91	0.000430	0.28	0.70	2.93	0.14
Kidds Spill	To Bunkers	312	25 Year Spill	0.16	236.44	237.03		237.03	0.000172	0.23	1.35	4.06	0.10
Kidds Spill	To Bunkers	312	10 Year Spill	0.11	236.44	236.90		236.90	0.000250	0.24	0.86	3.26	0.11
Kidds Spill	To Bunkers	292	25 Year Spill	0.16	236.37	237.03		237.03	0.000105	0.19	1.64	4.47	0.08
Kidds Spill	To Bunkers	292	10 Year Spill	0.11	236.37	236.90		236.90	0.000138	0.19	1.10	3.66	0.08
Kidds Spill	To Bunkers	272	25 Year Spill	0.16	236.30	237.03	236.48	237.03	0.000068	0.17	1.95	4.85	0.06
Kidds Spill	To Bunkers	272	10 Year Spill	0.11	236.30	236.89	236.44	236.90	0.000081	0.16	1.35	4.04	0.07
Kidds Spill	To Bunkers	252.00*	25 Year Spill	0.16	236.23	237.03		237.03	0.000046	0.15	2.28	5.24	0.05
Kidds Spill	To Bunkers	252.00*	10 Year Spill	0.11	236.23	236.89		236.89	0.000051	0.13	1.63	4.44	0.05
Kidds Spill	To Bunkers	232.00*	25 Year Spill	0.16	236.17	237.03		237.03	0.000032	0.13	2.64	5.64	0.04
Kidds Spill	To Bunkers	232.00*	10 Year Spill	0.11	236.17	236.89		236.89	0.000033	0.12	1.93	4.84	0.04
Kidds Spill	To Bunkers	212.00*	25 Year Spill	0.16	236.10	237.03		237.03	0.000022	0.11	3.03	6.05	0.04
Kidds Spill	To Bunkers	212.00*	10 Year Spill	0.11	236.10	236.89		236.89	0.000022	0.10	2.27	5.24	0.04
Kidds Spill	To Bunkers	192.00*	25 Year Spill	0.16	236.04	237.03	236.22	237.03	0.000016	0.10	3.44	6.45	0.03
Kidds Spill	To Bunkers	192.00*	10 Year Spill	0.11	236.04	236.89	236.18	236.89	0.000015	0.09	2.63	5.64	0.03
Kidds Spill	To Bunkers	172	25 Year Spill	0.16	235.97	237.03	236.15	237.03	0.000012	0.09	3.88	6.85	0.03
Kidds Spill	To Bunkers	172	10 Year Spill	0.11	235.97	236.89	236.10	236.89	0.000011	0.08	3.01	6.04	0.03
Kidds Spill	To Bunkers	152	25 Year Spill	0.16	235.90	237.03		237.03	0.000010	0.08	4.40	8.14	0.03
Kidds Spill	To Bunkers	152	10 Year Spill	0.11	235.90	236.89		236.89	0.000008	0.07	3.44	6.46	0.02
Bunkers	Northeast Trib	362	25 Year Spill	7.38	238.35	239.41	239.41	239.56	0.009867	2.39	7.21	20.87	0.77
Bunkers	Northeast Trib	362	10 Year Spill	5.66	238.35	239.34	239.34	239.48	0.009641	2.24	5.75	19.30	0.75
Bunkers	Northeast Trib	344	25 Year Spill	7.38	238.24	239.06		239.15	0.010473	2.04	7.81	22.10	0.76
Bunkers	Northeast Trib	344	10 Year Spill	5.66	238.24	238.97		239.07	0.012778	2.07	5.91	20.23	0.82
Bunkers	Northeast Trib	313	25 Year Spill	7.38	237.83	238.64	238.32	238.79	0.013939	2.27	5.84	14.55	0.87
Bunkers	Northeast Trib	313	10 Year Spill	5.66	237.83	238.58		238.70	0.011606	1.97	5.09	13.62	0.79
Bunkers	Northeast Trib	287	25 Year Spill	7.38	237.50	238.36	237.91	238.44	0.011398	2.16	7.66	20.01	0.78
Bunkers	Northeast Trib	287	10 Year Spill	5.66	237.50	238.24	237.91	238.34	0.016159	2.31	5.49	17.44	0.91
Bunkers	Northeast Trib	260	25 Year Spill	7.38	237.34	237.68	237.68	237.86	0.046915	2.61	4.79	19.50	1.44
Bunkers	Northeast Trib	260	10 Year Spill	5.66	237.34	237.69	237.69	237.79	0.025430	1.95	4.95	19.92	1.06
Bunkers	Northeast Trib-D	245	25 Year Spill	6.85	236.02	237.46	236.91	237.56	0.002461	1.58	5.70	7.69	0.42
Bunkers	Northeast Trib-D	245	10 Year Spill	5.52	236.02	237.25	236.80	237.35	0.002792	1.52	4.74	5.54	0.44
Bunkers	Northeast Trib-D	239.19		Culvert									
Bunkers	Northeast Trib-D	224.77	25 Year Spill	6.85	235.81	237.01	236.63	237.11	0.003392	1.59	5.77	24.27	0.47
Bunkers	Northeast Trib-D	224.77	10 Year Spill	5.52	235.81	236.87	236.56	236.96	0.003608	1.50	4.93	22.90	0.48
Bunkers	Central Trib	508.22	25 Year Spill	0.54	236.86	237.55		237.56	0.001181	0.60	1.63	5.15	0.24
Bunkers	Central Trib	508.22	10 Year Spill	0.15	236.86	237.36		237.36	0.000466	0.29	0.80	3.46	0.14
Bunkers	Central Trib	503.18	25 Year Spill	0.54	236.82	237.53		237.54	0.000801	0.52	1.88	5.17	0.21
Bunkers	Central Trib	503.18	10 Year Spill	0.15	236.82	237.35		237.35	0.000252	0.24	1.04	3.94	0.11
Bunkers	Central Trib	492	25 Year Spill	0.54	236.71	237.53		237.53	0.000236	0.33	3.11	6.53	0.12
Bunkers	Central Trib	492	10 Year Spill	0.15	236.71	237.35		237.35	0.000051	0.13	2.05	5.38	0.05
Bunkers	Central Trib	463	25 Year Spill	0.54	236.84	237.53		237.53	0.000057	0.14	5.53	10.59	0.06
Bunkers	Central Trib	463	10 Year Spill	0.15	236.84	237.35		237.35	0.000013	0.06	3.73	9.76	0.03
Bunkers	Central Trib	442	25 Year Spill	0.54	237.05	237.51		237.52	0.001182	0.49	1.56	5.50	0.24
Bunkers	Central Trib	442	10 Year Spill	0.15	237.05	237.35		237.35	0.000549	0.24	0.77	4.09	0.15
Bunkers	Central Trib	426	25 Year Spill	0.54	237.03	237.50	237.24	237.51	0.000864	0.42	1.70	5.81	0.20
Bunkers	Central Trib	426	10 Year Spill	0.15	237.03	237.34	237.14	237.34	0.000354	0.20	0.89	4.48	0.12
Bunkers	Central Trib	406	25 Year Spill	0.54	237.17	237.43		237.47	0.009192	0.87	0.73	4.49	0.59
Bunkers	Central Trib	406	10 Year Spill	0.15	237.17	237.29		237.32	0.019311	0.67	0.22	2.94	0.73
Bunkers	Central Trib	386	25 Year Spill	0.54	236.99	237.33		237.35	0.003487	0.70	1.08	4.84	0.39
Bunkers	Central Trib	386	10 Year Spill	0.15	236.99	237.17		237.18	0.003537	0.45	0.41	3.34	0.35
Bunkers	Central Trib	366	25 Year Spill	0.54	236.88	237.16		237.23	0.014693	1.25	0.59	3.35	0.77
Bunkers	Central Trib	366	10 Year Spill	0.15	236.88	237.02	237.01	237.05	0.015583	0.80	0.22	2.20	0.71
Bunkers	Central Trib	346	25 Year Spill	0.54	236.66	236.91		236.96	0.012325	1.07	0.72	4.43	0.70
Bunkers	Central Trib	346	10 Year Spill	0.15	236.66	236.80		236.82	0.009615	0.63	0.29	3.18	0.56
Bunkers	Central Trib	326	25 Year Spill	0.54	236.34	236.58	236.56	236.65	0.018898	1.29	0.56	3.51	0.86
Bunkers	Central Trib	326	10 Year Spill	0.15	236.34	236.45	236.43	236.50	0.031096	0.94	0.18	2.31	0.96
Bunkers	Central Trib	306	25 Year Spill	0.54	236.10	236.47		236.50	0.003845	0.72	0.87	3.64	0.41

HEC-RAS Plan: FutDesSpill10-25 (Continued)

River	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)	
Bunkers	Central Trib	306	10 Year Spill	0.15	236.10	236.30		236.31	0.004069	0.45	0.34	2.64	0.37
Bunkers	Central Trib	286	25 Year Spill	0.54	236.00	236.44		236.45	0.001541	0.52	1.28	4.76	0.27
Bunkers	Central Trib	286	10 Year Spill	0.15	236.00	236.28		236.28	0.000743	0.25	0.64	3.50	0.17
Bunkers	Central Trib	266	25 Year Spill	0.54	236.11	236.29	236.29	236.36	0.028644	1.21	0.51	4.43	0.99
Bunkers	Central Trib	266	10 Year Spill	0.15	236.11	236.22		236.24	0.018465	0.64	0.23	3.25	0.71
Bunkers	Central Trib	248	25 Year Spill	0.54	235.48	235.72	235.72	235.80	0.023074	1.35	0.49	3.20	0.93
Bunkers	Central Trib	248	10 Year Spill	0.15	235.48	235.58	235.58	235.64	0.053167	1.07	0.14	2.07	1.21
Bunkers	Central Trib	230		Culvert									
Bunkers	Central Trib	220	25 Year Spill	0.54	234.47	235.14	234.70	235.14	0.000331	0.33	2.58	16.34	0.13
Bunkers	Central Trib	220	10 Year Spill	0.15	234.47	234.97	234.59	234.97	0.000079	0.13	1.53	12.12	0.06
Bunkers	Central Trib	200	25 Year Spill	7.00	233.78	234.60	234.60	234.86	0.014737	2.51	3.86	8.22	0.92
Bunkers	Central Trib	200	10 Year Spill	4.97	233.78	234.46	234.46	234.69	0.016241	2.30	2.80	6.90	0.93
Bunkers	Central Trib	180	25 Year Spill	7.00	233.43	234.49	234.26	234.65	0.006731	2.09	5.58	11.16	0.66
Bunkers	Central Trib	180	10 Year Spill	4.97	233.43	234.32		234.45	0.006156	1.78	4.15	7.49	0.61
Bunkers	Central Trib	160	25 Year Spill	7.00	233.09	234.05	234.05	234.43	0.017838	3.08	3.42	6.76	1.04
Bunkers	Central Trib	160	10 Year Spill	4.97	233.09	233.87	233.87	234.22	0.020404	2.85	2.40	5.15	1.07
Bunkers	Central Trib	140	25 Year Spill	7.00	232.73	233.65	233.65	233.99	0.017030	2.93	3.79	8.89	1.01
Bunkers	Central Trib	140	10 Year Spill	4.97	232.73	233.52	233.52	233.79	0.015838	2.54	2.84	6.50	0.94
Bunkers	Central Trib	120	25 Year Spill	7.00	232.14	233.19		233.30	0.006507	1.93	6.36	11.15	0.62
Bunkers	Central Trib	120	10 Year Spill	4.97	232.14	233.06		233.15	0.006330	1.72	4.94	10.06	0.60
Bunkers	Central Trib	100	25 Year Spill	7.00	231.95	232.87	232.84	233.09	0.016582	2.82	4.45	8.82	0.98
Bunkers	Central Trib	100	10 Year Spill	4.97	231.95	232.73	232.73	232.94	0.018626	2.64	3.26	7.72	1.01
Bunkers	Central Trib	80	25 Year Spill	7.00	231.52	232.50	232.50	232.79	0.013206	2.69	3.95	7.99	0.89
Bunkers	Central Trib	80	10 Year Spill	4.97	231.52	232.34	232.29	232.59	0.013703	2.42	2.86	6.16	0.88
Bunkers	Central Trib	52.62	25 Year Spill	7.00	231.27	232.46		232.52	0.003089	1.46	8.88	14.96	0.44
Bunkers	Central Trib	52.62	10 Year Spill	4.97	231.27	232.31		232.37	0.003176	1.35	6.73	13.82	0.44
Bunkers	Central Trib	33.77	25 Year Spill	7.00	231.02	232.36		232.45	0.004151	1.90	7.52	11.94	0.53
Bunkers	Central Trib	33.77	10 Year Spill	4.97	231.02	232.23		232.31	0.003350	1.60	6.14	10.55	0.47
Bunkers	Central Trib	33		Lat Struct									
Bunkers	Central Trib	13.12	25 Year Spill	4.73	230.67	232.39	231.38	232.40	0.000449	0.74	13.45	18.57	0.18
Bunkers	Central Trib	13.12	10 Year Spill	3.69	230.67	232.26	231.33	232.27	0.000334	0.61	11.42	13.85	0.16
Bunkers	Northeast Trib-2	136	25 Year Spill	7.01	235.54	236.51	236.51	236.85	0.015235	2.82	3.50	6.40	0.95
Bunkers	Northeast Trib-2	136	10 Year Spill	5.63	235.54	236.41	236.41	236.71	0.015258	2.62	2.91	5.67	0.93
Bunkers	Northeast Trib-2	133	25 Year Spill	7.01	234.37	235.73	235.33	235.88	0.004632	2.04	5.34	5.69	0.57
Bunkers	Northeast Trib-2	133	10 Year Spill	5.63	234.37	235.49	235.22	235.65	0.006157	2.07	4.08	5.15	0.63
Bunkers	Spill to Storm	294	25 Year Spill	0.01	231.59	232.06		232.06	0.000000	0.01	2.55	7.77	0.00
Bunkers	Spill to Storm	294	10 Year Spill	0.01	231.59	231.91		231.91	0.000001	0.01	1.47	6.30	0.01
Bunkers	Spill to Storm	273	25 Year Spill	2.27	231.43	232.00		232.03	0.003218	0.95	3.43	9.01	0.41
Bunkers	Spill to Storm	273	10 Year Spill	1.28	231.43	231.86		231.88	0.003190	0.77	2.24	7.46	0.39
Bunkers	Spill to Storm	252	25 Year Spill	2.27	231.36	231.89		231.94	0.005982	1.25	2.88	8.24	0.55
Bunkers	Spill to Storm	252	10 Year Spill	1.28	231.36	231.74		231.78	0.007685	1.12	1.71	6.74	0.59
Bunkers	Spill to Storm	231	25 Year Spill	2.27	231.07	231.81		231.85	0.003384	1.16	3.42	8.71	0.44
Bunkers	Spill to Storm	231	10 Year Spill	1.28	231.07	231.65		231.68	0.003193	0.95	2.18	6.80	0.41
Bunkers	Spill to Storm	210	25 Year Spill	2.27	230.90	231.78		231.80	0.001225	0.79	5.01	10.37	0.27
Bunkers	Spill to Storm	210	10 Year Spill	1.28	230.90	231.63		231.64	0.000938	0.60	3.51	8.73	0.23
Bunkers	Spill to Storm	189	25 Year Spill	2.27	230.66	231.77		231.78	0.000725	0.68	5.76	10.12	0.21
Bunkers	Spill to Storm	189	10 Year Spill	1.28	230.66	231.62		231.63	0.000461	0.49	4.33	8.80	0.17
Bunkers	Spill to Storm	168	25 Year Spill	2.27	230.34	231.77		231.77	0.000284	0.51	8.90	12.88	0.14
Bunkers	Spill to Storm	168	10 Year Spill	1.28	230.34	231.62		231.62	0.000153	0.35	7.11	11.17	0.10
Bunkers	Spill to Storm	147	25 Year Spill	10.47	230.30	231.44	231.44	231.67	0.019984	2.85	6.35	13.16	0.98
Bunkers	Spill to Storm	147	10 Year Spill	7.55	230.30	231.32	231.32	231.53	0.020661	2.63	4.88	11.90	0.98
Bunkers	Spill to Storm	100	25 Year Spill	10.47	228.11	231.45		231.45	0.000049	0.39	60.51	39.62	0.07
Bunkers	Spill to Storm	100	10 Year Spill	7.55	228.11	229.45		229.48	0.001174	1.04	11.94	12.33	0.29
Bunkers	Spill to Storm	96	25 Year Spill	10.47	228.03	231.42	228.97	231.44	0.000135	0.64	19.00	30.77	0.11
Bunkers	Spill to Storm	96	10 Year Spill	7.55	228.03	229.37	228.84	229.45	0.002114	1.31	6.67	7.66	0.38

HEC-RAS Plan: ExDesSpill2-5

River	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)	
Bunkers	Spill to Storm	294	5 Year Spill	0.01	231.59	231.75		231.75	0.000009	0.02	0.58	4.84	0.02
Bunkers	Spill to Storm	294	2 Year Spill	0.01	231.59	231.61		231.62	0.039198	0.28	0.04	2.71	0.77
Bunkers	Spill to Storm	273	5 Year Spill	0.50	231.43	231.71		231.72	0.002631	0.52	1.23	6.13	0.33
Bunkers	Spill to Storm	273	2 Year Spill	0.11	231.43	231.57		231.57	0.001840	0.26	0.49	4.78	0.24
Bunkers	Spill to Storm	252	5 Year Spill	0.50	231.36	231.55		231.60	0.018029	1.06	0.63	4.87	0.80
Bunkers	Spill to Storm	252	2 Year Spill	0.11	231.36	231.43	231.43	231.46	0.038772	0.79	0.16	3.20	0.99
Bunkers	Spill to Storm	231	5 Year Spill	0.50	231.07	231.44		231.46	0.003040	0.68	1.03	4.54	0.37
Bunkers	Spill to Storm	231	2 Year Spill	0.11	231.07	231.26		231.27	0.002246	0.36	0.36	2.99	0.28
Bunkers	Spill to Storm	210	5 Year Spill	0.50	230.90	231.43		231.43	0.000565	0.37	2.00	6.47	0.17
Bunkers	Spill to Storm	210	2 Year Spill	0.11	230.90	231.26		231.26	0.000137	0.14	1.05	4.75	0.08
Bunkers	Spill to Storm	189	5 Year Spill	0.50	230.66	231.42		231.43	0.000198	0.27	2.82	6.95	0.10
Bunkers	Spill to Storm	189	2 Year Spill	0.11	230.66	231.26		231.26	0.000029	0.09	1.79	5.47	0.04
Bunkers	Spill to Storm	168	5 Year Spill	0.50	230.34	231.42		231.42	0.000051	0.18	5.16	9.36	0.06
Bunkers	Spill to Storm	168	2 Year Spill	0.11	230.34	231.26		231.26	0.000005	0.05	3.74	7.87	0.02
Bunkers	Spill to Storm	147	5 Year Spill	4.55	230.30	231.18	231.18	231.36	0.020666	2.28	3.31	10.51	0.94
Bunkers	Spill to Storm	147	2 Year Spill	2.60	230.30	231.07	231.07	231.21	0.020355	1.96	2.12	9.34	0.90
Bunkers	Spill to Storm	100	5 Year Spill	4.55	228.11	229.04		229.06	0.001770	0.99	7.21	10.37	0.33
Bunkers	Spill to Storm	100	2 Year Spill	2.60	228.11	228.75		228.77	0.002447	0.91	4.40	9.22	0.37
Bunkers	Spill to Storm	96	5 Year Spill	4.55	228.03	228.96	228.62	229.03	0.003305	1.25	4.19	6.52	0.44
Bunkers	Spill to Storm	96	2 Year Spill	2.60	228.03	228.67	228.49	228.74	0.004988	1.15	2.51	5.64	0.51
Bunkers	Central Trib	508.22	5 Year Spill	0.01	236.86	237.24		237.24	0.000009	0.03	0.44	2.49	0.02
Bunkers	Central Trib	508.22	2 Year Spill	0.01	236.86	237.24		237.24	0.000009	0.03	0.44	2.49	0.02
Bunkers	Central Trib	503.18	5 Year Spill	0.01	236.82	237.24		237.24	0.000004	0.02	0.64	3.03	0.01
Bunkers	Central Trib	503.18	2 Year Spill	0.01	236.82	237.24		237.24	0.000004	0.02	0.64	3.03	0.01
Bunkers	Central Trib	492	5 Year Spill	0.01	236.71	237.24		237.24	0.000001	0.01	1.47	4.69	0.01
Bunkers	Central Trib	492	2 Year Spill	0.01	236.71	237.24		237.24	0.000001	0.01	1.47	4.69	0.01
Bunkers	Central Trib	463	5 Year Spill	0.01	236.84	237.24		237.24	0.000000	0.01	2.64	9.21	0.00
Bunkers	Central Trib	463	2 Year Spill	0.01	236.84	237.24		237.24	0.000000	0.01	2.64	9.21	0.00
Bunkers	Central Trib	442	5 Year Spill	0.01	237.05	237.23		237.24	0.000018	0.03	0.36	3.09	0.03
Bunkers	Central Trib	442	2 Year Spill	0.01	237.05	237.23		237.24	0.000018	0.03	0.36	3.09	0.03
Bunkers	Central Trib	426	5 Year Spill	0.01	237.03	237.23	237.06	237.23	0.000010	0.02	0.46	3.32	0.02
Bunkers	Central Trib	426	2 Year Spill	0.01	237.03	237.23	237.06	237.23	0.000010	0.02	0.46	3.32	0.02
Bunkers	Central Trib	406	5 Year Spill	0.01	237.17	237.23	237.23	237.23	0.002529	0.14	0.07	1.96	0.23
Bunkers	Central Trib	406	2 Year Spill	0.01	237.17	237.23	237.23	237.23	0.002529	0.14	0.07	1.96	0.23
Bunkers	Central Trib	386	5 Year Spill	0.01	236.99	237.06	237.06	237.06	0.001093	0.11	0.09	2.04	0.16
Bunkers	Central Trib	386	2 Year Spill	0.01	236.99	237.06	237.06	237.06	0.001093	0.11	0.09	2.04	0.16
Bunkers	Central Trib	366	5 Year Spill	0.01	236.88	236.96	236.96	236.96	0.001035	0.12	0.09	1.68	0.16
Bunkers	Central Trib	366	2 Year Spill	0.01	236.88	236.96	236.96	236.96	0.001035	0.12	0.09	1.68	0.16
Bunkers	Central Trib	346	5 Year Spill	0.01	236.66	236.69		236.70	0.015772	0.27	0.04	1.61	0.54
Bunkers	Central Trib	346	2 Year Spill	0.01	236.66	236.69		236.70	0.015772	0.27	0.04	1.61	0.54
Bunkers	Central Trib	326	5 Year Spill	0.01	236.34	236.38		236.38	0.015657	0.29	0.03	1.26	0.55
Bunkers	Central Trib	326	2 Year Spill	0.01	236.34	236.38		236.38	0.015657	0.29	0.03	1.26	0.55
Bunkers	Central Trib	306	5 Year Spill	0.01	236.10	236.15		236.16	0.008573	0.24	0.04	1.19	0.42
Bunkers	Central Trib	306	2 Year Spill	0.01	236.10	236.15		236.16	0.008573	0.24	0.04	1.19	0.42
Bunkers	Central Trib	286	5 Year Spill	0.01	236.00	236.15		236.15	0.000061	0.04	0.24	2.53	0.04
Bunkers	Central Trib	286	2 Year Spill	0.01	236.00	236.15		236.15	0.000061	0.04	0.24	2.53	0.04
Bunkers	Central Trib	266	5 Year Spill	0.01	236.11	236.14		236.15	0.019970	0.29	0.04	1.52	0.60
Bunkers	Central Trib	266	2 Year Spill	0.01	236.11	236.14		236.15	0.019970	0.29	0.04	1.52	0.60
Bunkers	Central Trib	248	5 Year Spill	0.01	235.48	235.51	235.51	235.52	0.054286	0.43	0.02	1.17	0.97
Bunkers	Central Trib	248	2 Year Spill	0.01	235.48	235.51	235.51	235.52	0.054286	0.43	0.02	1.17	0.97
Bunkers	Central Trib	230		Culvert									
Bunkers	Central Trib	220	5 Year Spill	0.01	234.47	234.84	234.50	234.84	0.000001	0.01	0.93	10.08	0.01
Bunkers	Central Trib	220	2 Year Spill	0.01	234.47	234.73	234.50	234.73	0.000006	0.02	0.52	8.53	0.02
Bunkers	Central Trib	200	5 Year Spill	3.14	233.78	234.27	234.27	234.51	0.024882	2.24	1.67	5.40	1.09
Bunkers	Central Trib	200	2 Year Spill	1.86	233.78	234.14	234.14	234.34	0.032365	2.00	1.02	4.42	1.17
Bunkers	Central Trib	180	5 Year Spill	3.14	233.43	234.11		234.21	0.007267	1.60	2.71	5.99	0.63

HEC-RAS Plan: ExDesSpill2-5 (Continued)

River	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)	
Bunkers	Central Trib	180	2 Year Spill	1.86	233.43	233.94		234.02	0.007746	1.35	1.79	5.10	0.62
Bunkers	Central Trib	160	5 Year Spill	3.14	233.09	233.73	233.72	233.98	0.019243	2.38	1.71	4.31	1.00
Bunkers	Central Trib	160	2 Year Spill	1.86	233.09	233.57	233.57	233.77	0.021232	2.04	1.10	3.65	1.00
Bunkers	Central Trib	140	5 Year Spill	3.14	232.73	233.33	233.33	233.58	0.020793	2.37	1.74	4.91	1.03
Bunkers	Central Trib	140	2 Year Spill	1.86	232.73	233.22	233.22	233.38	0.016961	1.85	1.25	4.16	0.89
Bunkers	Central Trib	120	5 Year Spill	3.14	232.14	232.92		232.99	0.005717	1.45	3.62	9.14	0.55
Bunkers	Central Trib	120	2 Year Spill	1.86	232.14	232.74		232.81	0.007881	1.40	2.11	7.69	0.62
Bunkers	Central Trib	100	5 Year Spill	3.14	231.95	232.55	232.55	232.77	0.025431	2.55	2.03	6.38	1.12
Bunkers	Central Trib	100	2 Year Spill	1.86	231.95	232.50	232.50	232.61	0.013770	1.75	1.72	6.02	0.81
Bunkers	Central Trib	80	5 Year Spill	3.14	231.52	232.23		232.38	0.010106	1.87	2.21	5.13	0.74
Bunkers	Central Trib	80	2 Year Spill	1.86	231.52	232.11		232.20	0.007665	1.42	1.64	4.44	0.62
Bunkers	Central Trib	52.62	5 Year Spill	3.14	231.27	232.15		232.20	0.003252	1.21	4.60	12.62	0.43
Bunkers	Central Trib	52.62	2 Year Spill	1.86	231.27	232.00		232.05	0.003427	1.08	2.77	11.67	0.43
Bunkers	Central Trib	33.77	5 Year Spill	3.14	231.02	232.10		232.15	0.002366	1.24	4.83	9.28	0.39
Bunkers	Central Trib	33.77	2 Year Spill	1.86	231.02	231.97		232.00	0.001566	0.92	3.70	8.16	0.31
Bunkers	Central Trib	33		Lat Struct									
Bunkers	Central Trib	13.12	5 Year Spill	2.65	230.67	232.12	231.29	232.12	0.000258	0.50	9.57	12.29	0.14
Bunkers	Central Trib	13.12	2 Year Spill	1.76	230.67	231.98	231.16	231.98	0.000177	0.39	7.98	11.04	0.11

HEC-RAS Plan: FutDesSpill2-5

River	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)	
Bunkers	Spill to Storm	294	5 Year Spill	0.01	231.59	231.81		231.81	0.000003	0.01	0.88	5.39	0.01
Bunkers	Spill to Storm	294	2 Year Spill	0.01	231.59	231.66		231.66	0.000294	0.06	0.18	3.69	0.08
Bunkers	Spill to Storm	273	5 Year Spill	0.76	231.43	231.76		231.77	0.003032	0.63	1.56	6.59	0.36
Bunkers	Spill to Storm	273	2 Year Spill	0.20	231.43	231.61		231.62	0.002228	0.35	0.69	5.17	0.28
Bunkers	Spill to Storm	252	5 Year Spill	0.76	231.36	231.62		231.66	0.011836	1.07	0.99	5.54	0.69
Bunkers	Spill to Storm	252	2 Year Spill	0.20	231.36	231.48	231.48	231.51	0.015787	0.74	0.34	4.02	0.70
Bunkers	Spill to Storm	231	5 Year Spill	0.76	231.07	231.52		231.54	0.003192	0.80	1.41	5.28	0.39
Bunkers	Spill to Storm	231	2 Year Spill	0.20	231.07	231.34		231.34	0.001959	0.43	0.61	3.59	0.28
Bunkers	Spill to Storm	210	5 Year Spill	0.76	230.90	231.50		231.51	0.000742	0.47	2.49	7.25	0.20
Bunkers	Spill to Storm	210	2 Year Spill	0.20	230.90	231.33		231.33	0.000215	0.20	1.42	5.38	0.10
Bunkers	Spill to Storm	189	5 Year Spill	0.76	230.66	231.49		231.50	0.000301	0.36	3.33	7.57	0.13
Bunkers	Spill to Storm	189	2 Year Spill	0.20	230.66	231.33		231.33	0.000059	0.13	2.20	6.06	0.06
Bunkers	Spill to Storm	168	5 Year Spill	0.76	230.34	231.49		231.50	0.000086	0.24	5.83	9.94	0.07
Bunkers	Spill to Storm	168	2 Year Spill	0.20	230.34	231.33		231.33	0.000013	0.08	4.32	8.44	0.03
Bunkers	Spill to Storm	147	5 Year Spill	5.62	230.30	231.26	231.26	231.42	0.018157	2.31	4.09	11.26	0.90
Bunkers	Spill to Storm	147	2 Year Spill	3.19	230.30	231.08	231.08	231.27	0.026324	2.27	2.27	9.52	1.03
Bunkers	Spill to Storm	100	5 Year Spill	5.62	228.11	229.18		229.21	0.001526	1.02	8.79	10.99	0.31
Bunkers	Spill to Storm	100	2 Year Spill	3.19	228.11	228.85		228.87	0.002127	0.93	5.31	9.59	0.35
Bunkers	Spill to Storm	96	5 Year Spill	5.62	228.03	229.10	228.73	229.18	0.002784	1.28	5.07	6.96	0.42
Bunkers	Spill to Storm	96	2 Year Spill	3.19	228.03	228.77	228.54	228.83	0.004166	1.17	3.07	5.98	0.47
Bunkers	Central Trib	508.22	5 Year Spill	0.01	236.86	237.24		237.24	0.000009	0.03	0.44	2.49	0.02
Bunkers	Central Trib	508.22	2 Year Spill	0.01	236.86	237.24		237.24	0.000009	0.03	0.44	2.49	0.02
Bunkers	Central Trib	503.18	5 Year Spill	0.01	236.82	237.24		237.24	0.000004	0.02	0.64	3.03	0.01
Bunkers	Central Trib	503.18	2 Year Spill	0.01	236.82	237.24		237.24	0.000004	0.02	0.64	3.03	0.01
Bunkers	Central Trib	492	5 Year Spill	0.01	236.71	237.24		237.24	0.000001	0.01	1.47	4.69	0.01
Bunkers	Central Trib	492	2 Year Spill	0.01	236.71	237.24		237.24	0.000001	0.01	1.47	4.69	0.01
Bunkers	Central Trib	463	5 Year Spill	0.01	236.84	237.24		237.24	0.000000	0.01	2.64	9.21	0.00
Bunkers	Central Trib	463	2 Year Spill	0.01	236.84	237.24		237.24	0.000000	0.01	2.64	9.21	0.00
Bunkers	Central Trib	442	5 Year Spill	0.01	237.05	237.23		237.24	0.000018	0.03	0.36	3.09	0.03
Bunkers	Central Trib	442	2 Year Spill	0.01	237.05	237.23		237.24	0.000018	0.03	0.36	3.09	0.03
Bunkers	Central Trib	426	5 Year Spill	0.01	237.03	237.23	237.06	237.23	0.000010	0.02	0.46	3.32	0.02
Bunkers	Central Trib	426	2 Year Spill	0.01	237.03	237.23	237.06	237.23	0.000010	0.02	0.46	3.32	0.02
Bunkers	Central Trib	406	5 Year Spill	0.01	237.17	237.23	237.23	237.23	0.002529	0.14	0.07	1.96	0.23
Bunkers	Central Trib	406	2 Year Spill	0.01	237.17	237.23	237.23	237.23	0.002529	0.14	0.07	1.96	0.23
Bunkers	Central Trib	386	5 Year Spill	0.01	236.99	237.06	237.06	237.06	0.001093	0.11	0.09	2.04	0.16
Bunkers	Central Trib	386	2 Year Spill	0.01	236.99	237.06	237.06	237.06	0.001093	0.11	0.09	2.04	0.16
Bunkers	Central Trib	366	5 Year Spill	0.01	236.88	236.96	236.96	236.96	0.001035	0.12	0.09	1.68	0.16
Bunkers	Central Trib	366	2 Year Spill	0.01	236.88	236.96	236.96	236.96	0.001035	0.12	0.09	1.68	0.16
Bunkers	Central Trib	346	5 Year Spill	0.01	236.66	236.69		236.70	0.015772	0.27	0.04	1.61	0.54
Bunkers	Central Trib	346	2 Year Spill	0.01	236.66	236.69		236.70	0.015772	0.27	0.04	1.61	0.54
Bunkers	Central Trib	326	5 Year Spill	0.01	236.34	236.38		236.38	0.015657	0.29	0.03	1.26	0.55
Bunkers	Central Trib	326	2 Year Spill	0.01	236.34	236.38		236.38	0.015657	0.29	0.03	1.26	0.55
Bunkers	Central Trib	306	5 Year Spill	0.01	236.10	236.15		236.16	0.008573	0.24	0.04	1.19	0.42
Bunkers	Central Trib	306	2 Year Spill	0.01	236.10	236.15		236.16	0.008573	0.24	0.04	1.19	0.42
Bunkers	Central Trib	286	5 Year Spill	0.01	236.00	236.15		236.15	0.000061	0.04	0.24	2.53	0.04
Bunkers	Central Trib	286	2 Year Spill	0.01	236.00	236.15		236.15	0.000061	0.04	0.24	2.53	0.04
Bunkers	Central Trib	266	5 Year Spill	0.01	236.11	236.14		236.15	0.019970	0.29	0.04	1.52	0.60
Bunkers	Central Trib	266	2 Year Spill	0.01	236.11	236.14		236.15	0.019970	0.29	0.04	1.52	0.60
Bunkers	Central Trib	248	5 Year Spill	0.01	235.48	235.51	235.51	235.52	0.054286	0.43	0.02	1.17	0.97
Bunkers	Central Trib	248	2 Year Spill	0.01	235.48	235.51	235.51	235.52	0.054286	0.43	0.02	1.17	0.97
Bunkers	Central Trib	230		Culvert									
Bunkers	Central Trib	220	5 Year Spill	0.01	234.47	234.96	234.50	234.96	0.000000	0.01	1.44	11.85	0.00
Bunkers	Central Trib	220	2 Year Spill	0.01	234.47	234.71	234.50	234.71	0.000008	0.02	0.46	8.25	0.02
Bunkers	Central Trib	200	5 Year Spill	3.77	233.78	234.29	234.29	234.60	0.031539	2.58	1.75	5.48	1.23
Bunkers	Central Trib	200	2 Year Spill	2.23	233.78	234.21	234.21	234.38	0.020782	1.86	1.38	4.92	0.97
Bunkers	Central Trib	180	5 Year Spill	3.77	233.43	234.17		234.29	0.007505	1.72	3.08	6.38	0.65

HEC-RAS Plan: FutDesSpill2-5 (Continued)

River	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)	
Bunkers	Central Trib	180	2 Year Spill	2.23	233.43	233.98		234.07	0.008290	1.48	1.99	5.30	0.65
Bunkers	Central Trib	160	5 Year Spill	3.77	233.09	233.81	233.81	234.06	0.016432	2.41	2.09	4.68	0.94
Bunkers	Central Trib	160	2 Year Spill	2.23	233.09	233.64	233.64	233.83	0.017516	2.05	1.36	3.95	0.93
Bunkers	Central Trib	140	5 Year Spill	3.77	232.73	233.42	233.42	233.66	0.016497	2.35	2.22	5.69	0.94
Bunkers	Central Trib	140	2 Year Spill	2.23	232.73	233.26	233.26	233.44	0.018084	2.01	1.40	4.35	0.94
Bunkers	Central Trib	120	5 Year Spill	3.77	232.14	232.99		233.06	0.005281	1.49	4.29	9.61	0.54
Bunkers	Central Trib	120	2 Year Spill	2.23	232.14	232.79		232.87	0.007250	1.43	2.52	8.06	0.60
Bunkers	Central Trib	100	5 Year Spill	3.77	231.95	232.58	232.57	232.84	0.029426	2.84	2.21	6.57	1.22
Bunkers	Central Trib	100	2 Year Spill	2.23	231.95	232.53	232.53	232.66	0.016167	1.96	1.86	6.19	0.89
Bunkers	Central Trib	80	5 Year Spill	3.77	231.52	232.27	232.21	232.46	0.011301	2.07	2.46	5.51	0.79
Bunkers	Central Trib	80	2 Year Spill	2.23	231.52	232.15		232.26	0.008377	1.56	1.82	4.66	0.66
Bunkers	Central Trib	52.62	5 Year Spill	3.77	231.27	232.21		232.27	0.003175	1.25	5.40	13.08	0.43
Bunkers	Central Trib	52.62	2 Year Spill	2.23	231.27	232.05		232.10	0.003386	1.12	3.33	11.95	0.43
Bunkers	Central Trib	33.77	5 Year Spill	3.77	231.02	232.16		232.21	0.002683	1.36	5.34	9.79	0.42
Bunkers	Central Trib	33.77	2 Year Spill	2.23	231.02	232.01		232.05	0.001825	1.03	4.04	8.49	0.34
Bunkers	Central Trib	33		Lat Struct									
Bunkers	Central Trib	13.12	5 Year Spill	3.02	230.67	232.17	231.28	232.18	0.000284	0.54	10.29	12.86	0.14
Bunkers	Central Trib	13.12	2 Year Spill	2.04	230.67	232.02	231.15	232.03	0.000206	0.43	8.46	11.45	0.12

Appendix J:
MTO Improvements PCSWMM Spill Analysis

TATHAM ENGINEERING	Project: Barrie Drainage Master Plan	Date: 8-Feb-18
	File No.: 117076	Designed: DAM
	Subject: PCSWMM Verification Modelling	Checked: DRT

Existing Regional Flows
Kidd's Creek, Dyments Creek and Bunkers Creek Spills

Model	1 - Kidd's Creek Main Branch (m3/s)	2 - Kidd's Creek Tributary Branch (m3/s)	3 - Sum of Branches Immediately Downstream of Highway (m3/s)
VO No Spill	47.5	0.83	48.33
HEC-RAS Plus Spill	36.55	2.60	39.15
PCSWMM Plus Spill	34.16	4.75	38.91

Model	4 - Bunkers Creek Northeast Branch (m3/s)	5 - Bunkers Creek Central Branch (m3/s)	6 - Bunkers Creek South Branch (m3/s)	7 - Dyments Creek Main Branch (m3/s)
VO No Spill	8.77	6.41	14.12	49.91
HEC-RAS Plus Spill	11.02	5.29	13.30	58.77
PCSWMM Plus Spill	8.66	11.77	13.16	55.09

Existing 100-Year Flows
Kidd's Creek, Dyments Creek and Bunkers Creek Spills

Model	4 - Bunkers Creek Northeast Branch (m3/s)	5 - Bunkers Creek Central Branch (m3/s)	6 - Bunkers Creek South Branch (m3/s)	7 - Dyments Creek Main Branch (m3/s)
VO No Spill	8.39	7.69	9.65	24.68
HEC-RAS Plus Spill	7.61	5.46	11.66	25.68
PCSWMM Plus Spill	4.71	10.65	10.42	24.64

Appendix K: MTO Improvements Discrete Calculations Spill Analysis

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0 cfs

Design Flow: 105.944 cfs

Maximum Flow: 176.573 cfs

Table 1 - Summary of Culvert Flows at Crossing: Bunkers Northmost Branch

Headwater Elevation (m)	Total Discharge (cms)	1200 x 900 Box Discharge (cms)	Roadway Discharge (cms)	Iterations
240.09	0.00	0.00	0.00	1
240.48	0.50	0.50	0.00	1
240.72	1.00	1.00	0.00	1
240.92	1.50	1.50	0.00	1
241.13	2.00	2.00	0.00	1
241.37	2.50	2.50	0.00	1
241.65	3.00	3.00	0.00	1
241.99	3.50	3.50	0.00	1
242.39	4.00	4.00	0.00	1
242.86	4.50	4.50	0.00	1
243.40	5.00	5.00	0.00	1
245.00	6.24	6.24	0.00	Overtopping

Rating Curve Plot for Crossing: Bunkers Northmost Branch

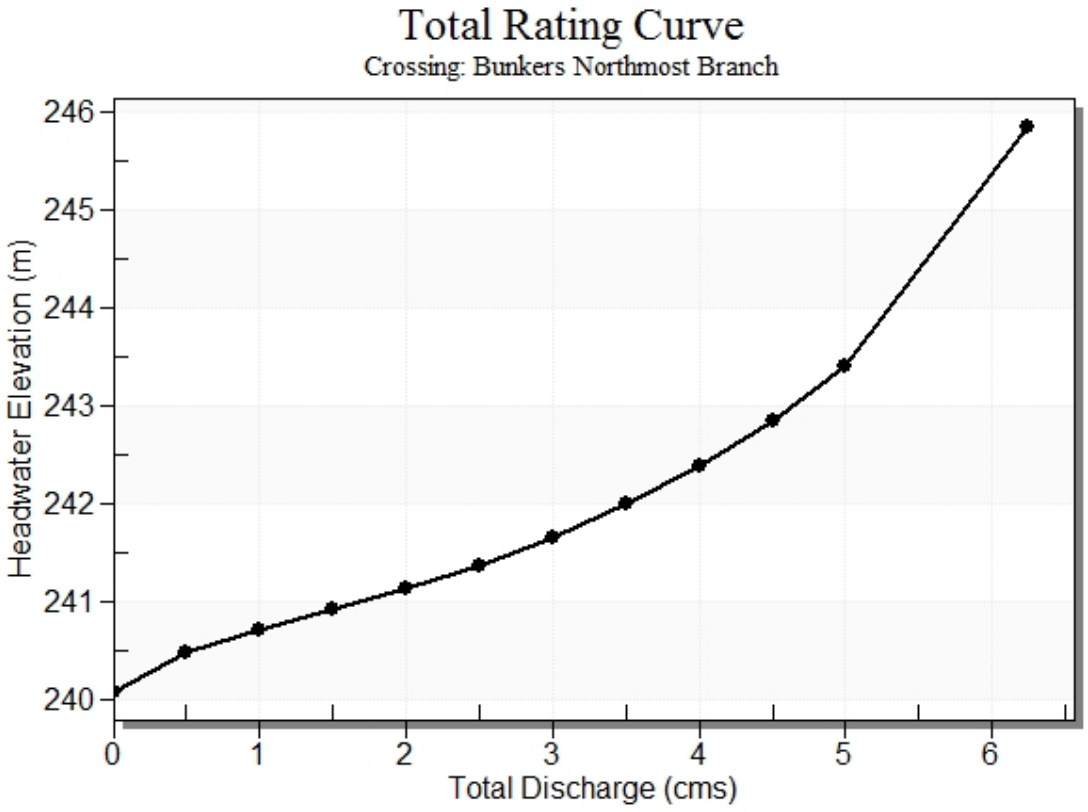


Table 2 - Culvert Summary Table: 1200 x 900 Box

Total Discharge (cms)	Culvert Discharge (cms)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)	Tailwater Velocity (m/s)
0.00	0.00	240.09	0.000	0.000	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
0.50	0.50	240.48	0.393	0.0*	1-S2n	0.153	0.261	0.153	0.367	2.729	0.851
1.00	1.00	240.72	0.630	0.0*	1-S2n	0.244	0.414	0.244	0.506	3.413	0.979
1.50	1.50	240.92	0.833	0.0*	1-S2n	0.323	0.542	0.323	0.607	3.875	1.064
2.00	2.00	241.13	1.039	0.0*	5-S2n	0.395	0.657	0.395	0.690	4.219	1.129
2.50	2.50	241.37	1.277	0.0*	5-S2n	0.464	0.762	0.464	0.761	4.491	1.182
3.00	3.00	241.65	1.562	0.360	5-S2n	0.530	0.860	0.540	0.823	4.629	1.228
3.50	3.50	241.99	1.904	0.828	5-S2n	0.595	0.900	0.608	0.880	4.800	1.268
4.00	4.00	242.39	2.305	1.345	5-S2n	0.658	0.900	0.671	0.931	4.968	1.304
4.50	4.50	242.86	2.766	1.931	5-S2n	0.720	0.900	0.733	0.979	5.117	1.337
5.00	5.00	243.40	3.310	2.585	5-S2n	0.781	0.900	0.793	1.024	5.253	1.367

* Full Flow Headwater elevation is below inlet invert.

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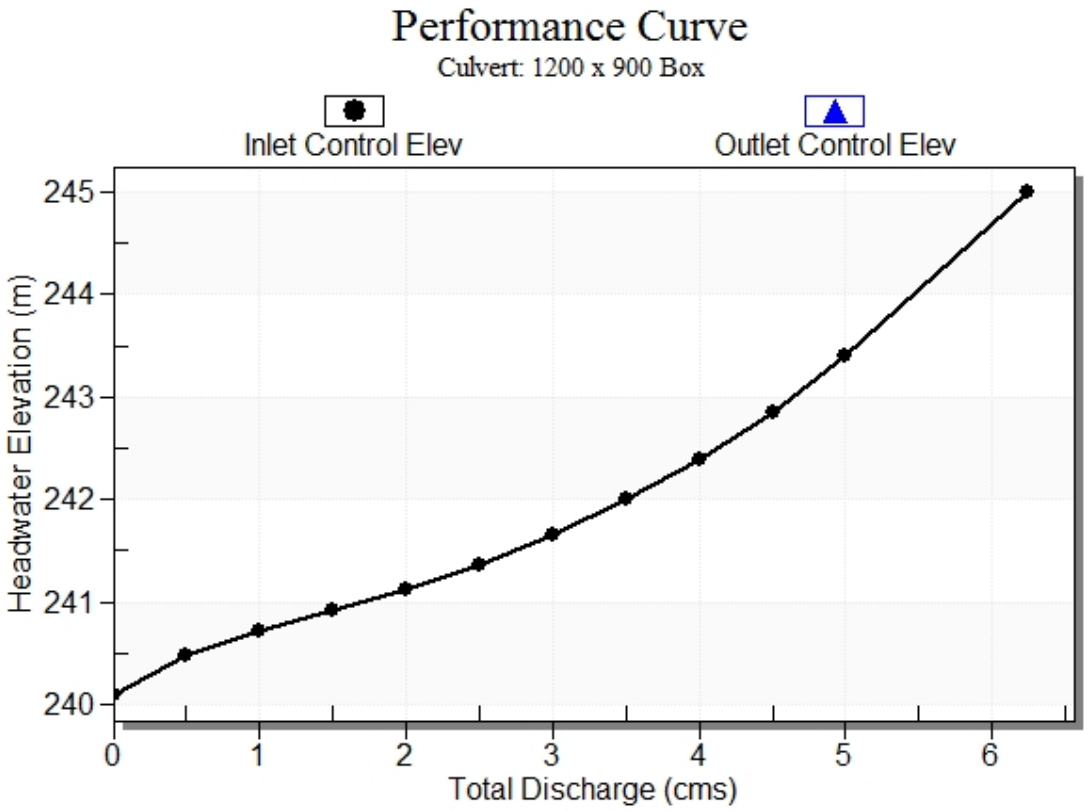
Straight Culvert

Inlet Elevation (invert): 240.09 m, Outlet Elevation (invert): 238.33 m

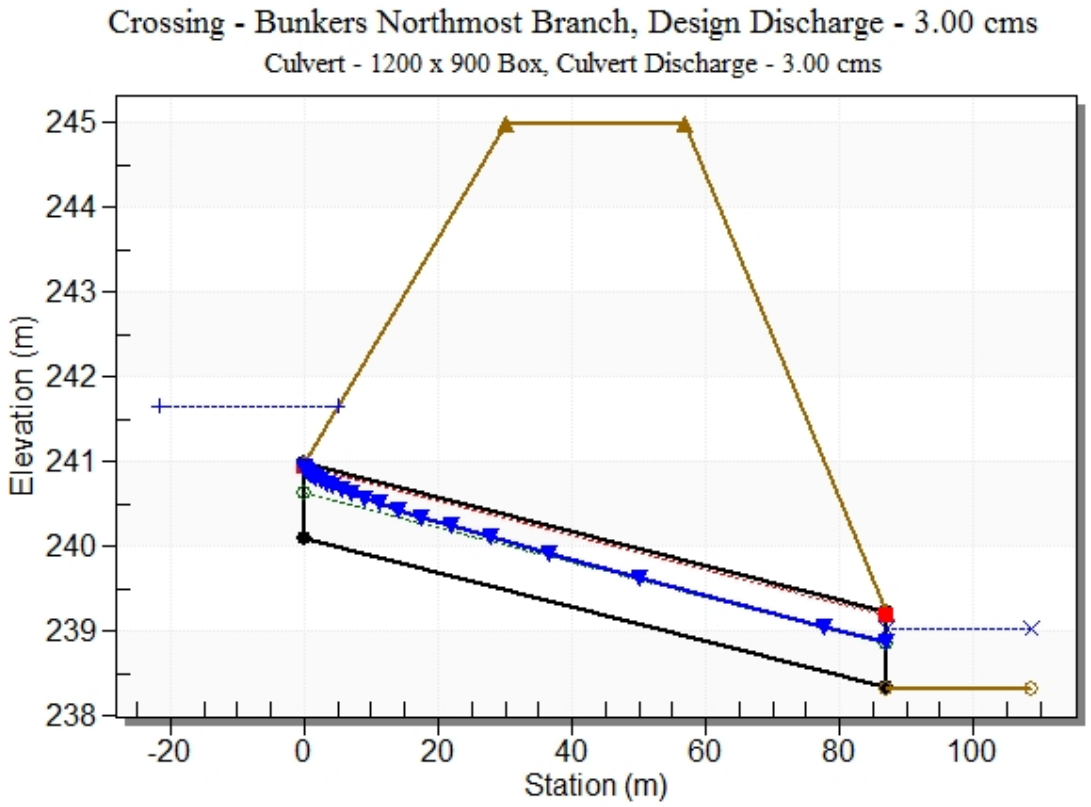
Culvert Length: 87.02 m, Culvert Slope: 0.0202

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Culvert Performance Curve Plot: 1200 x 900 Box



Water Surface Profile Plot for Culvert: 1200 x 900 Box



Site Data - 1200 x 900 Box

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 m

Inlet Elevation: 240.09 m

Outlet Station: 87.00 m

Outlet Elevation: 238.33 m

Number of Barrels: 1

Culvert Data Summary - 1200 x 900 Box

Barrel Shape: Concrete Box

Barrel Span: 1200.00 mm

Barrel Rise: 900.00 mm

Barrel Material: Concrete

Embedment: 0.00 mm

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge (30-75º flare) Wingwall

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: Bunkers Northmost Branch)

Flow (cms)	Water Surface Elev (m)	Depth (m)	Velocity (m/s)	Shear (Pa)	Froude Number
0.00	238.33	0.00	0.00	0.00	0.00
0.50	238.63	0.30	1.17	89.33	0.87
1.00	238.75	0.42	1.34	124.02	0.86
1.50	238.84	0.51	1.46	149.42	0.86
2.00	238.91	0.58	1.55	170.14	0.86
2.50	238.97	0.64	1.62	187.93	0.87
3.00	239.02	0.69	1.68	203.68	0.87
3.50	239.07	0.74	1.73	217.90	0.87
4.00	239.12	0.79	1.78	230.94	0.87
4.50	239.16	0.83	1.83	243.02	0.87
5.00	239.19	0.86	1.87	254.30	0.87

Tailwater Channel Data - Bunkers Northmost Branch

Tailwater Channel Option: Irregular Channel

Roadway Data for Crossing: Bunkers Northmost Branch

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 40.00 m

Crest Elevation: 245.00 m

Roadway Surface: Paved

Roadway Top Width: 27.00 m

Crossing Notes: Bunkers Northeast Branch

No spill from branch crossing up to water surface of 237.00 m. High flow capacity governed by downstream system backwater. Analysis confirms culvert capacity prior to backwater conditions and that culvert capacity is greater than downstream capacity for high flows.

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0 cfs

Design Flow: 262.035 cfs

Maximum Flow: 529.72 cfs

Table 4 - Summary of Culvert Flows at Crossing: Bunkers Northeast Branch

Headwater Elevation (m)	Total Discharge (cms)	2400 x 1830 Box Discharge (cms)	Roadway Discharge (cms)	Iterations
236.02	0.00	0.00	0.00	1
236.54	1.50	1.50	0.00	1
236.85	3.00	3.00	0.00	1
237.11	4.50	4.50	0.00	1
237.34	6.00	6.00	0.00	1
237.55	7.42	7.42	0.00	1
237.77	9.00	9.00	0.00	1
237.98	10.50	10.50	0.00	1
238.21	12.00	12.00	0.00	1
238.45	13.50	13.50	0.00	1
238.72	15.00	15.00	0.00	1
240.20	21.40	21.40	0.00	Overtopping

Rating Curve Plot for Crossing: Bunkers Northeast Branch

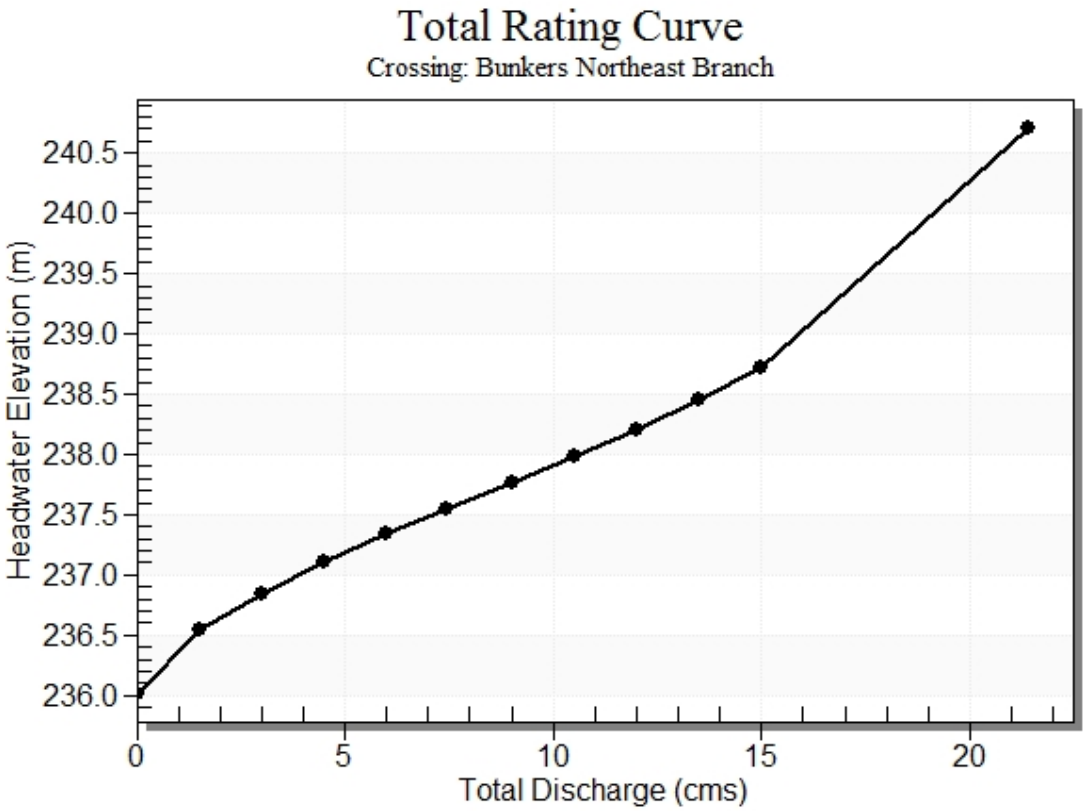


Table 5 - Culvert Summary Table: 2400 x 1830 Box

Total Discharge (cms)	Culvert Discharge (cms)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)	Tailwater Velocity (m/s)
0.00	0.00	236.02	0.000	0.000	0-NF	0.000	0.000	0.280	0.000	0.000	0.000
1.50	1.50	236.54	0.522	0.214	1-JS1t	0.278	0.341	0.672	0.392	0.930	1.233
3.00	3.00	236.85	0.828	0.383	1-JS1t	0.446	0.542	0.805	0.525	1.553	1.362
4.50	4.50	237.11	1.091	0.527	1-JS1t	0.590	0.710	0.888	0.608	2.112	1.470
6.00	6.00	237.34	1.325	0.674	1-S2n	0.722	0.860	0.730	0.670	3.426	1.569
7.42	7.42	237.55	1.529	0.823	1-S2n	0.842	0.991	0.851	0.716	3.633	1.669
9.00	9.00	237.77	1.749	1.094	1-S2n	0.968	1.127	0.968	0.763	3.876	1.760
10.50	10.50	237.98	1.963	1.373	5-S2n	1.084	1.249	1.095	0.804	3.995	1.833
12.00	12.00	238.21	2.189	1.672	5-S2n	1.197	1.366	1.209	0.841	4.135	1.898
13.50	13.50	238.45	2.434	2.166	5-S2n	1.309	1.477	1.321	0.878	4.259	1.947
15.00	15.00	238.72	2.702	2.450	5-S2n	1.418	1.585	1.430	0.911	4.371	1.996

****

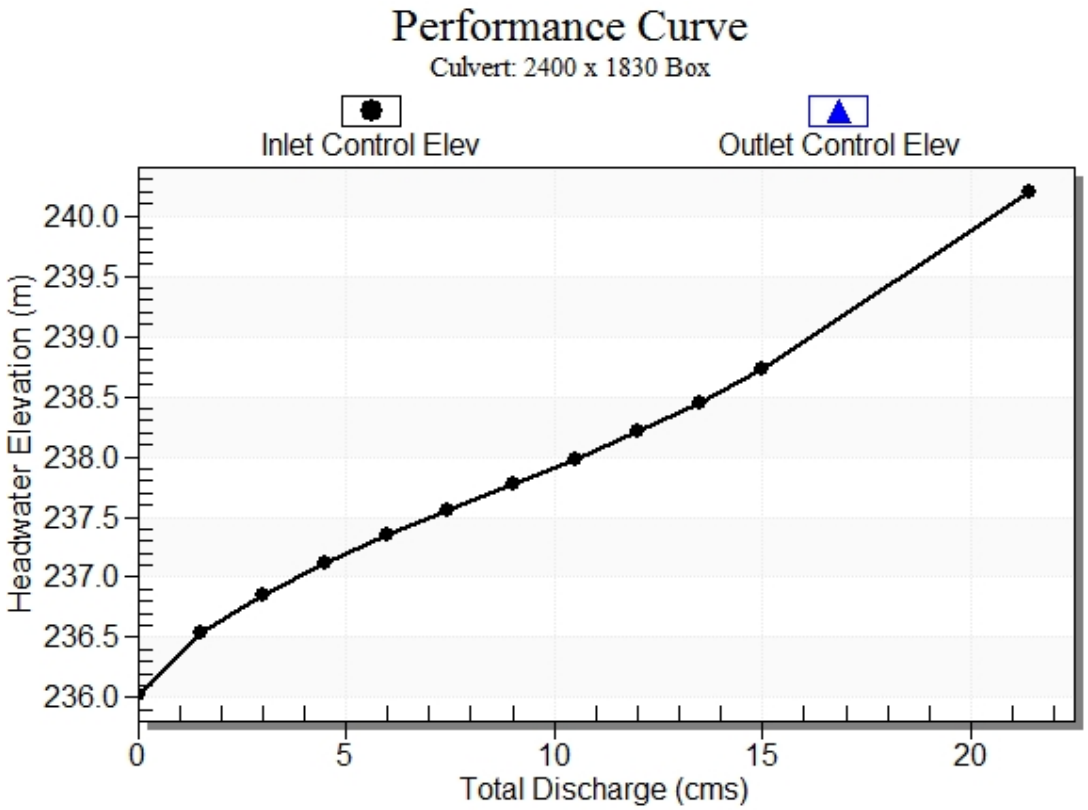
Straight Culvert

Inlet Elevation (invert): 236.02 m, Outlet Elevation (invert): 235.55 m

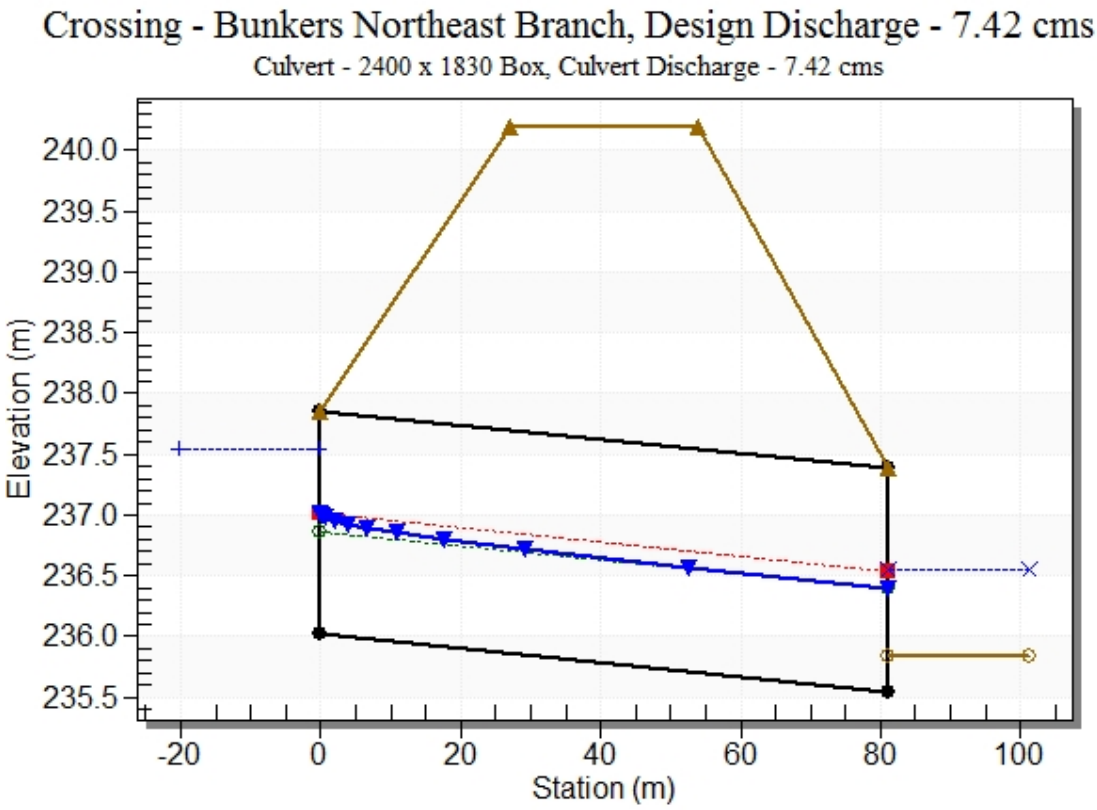
Culvert Length: 81.00 m, Culvert Slope: 0.0058

****

Culvert Performance Curve Plot: 2400 x 1830 Box



Water Surface Profile Plot for Culvert: 2400 x 1830 Box



Site Data - 2400 x 1830 Box

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 m

Inlet Elevation: 236.02 m

Outlet Station: 81.00 m

Outlet Elevation: 235.55 m

Number of Barrels: 1

Culvert Data Summary - 2400 x 1830 Box

Barrel Shape: Concrete Box

Barrel Span: 2400.00 mm

Barrel Rise: 1830.00 mm

Barrel Material: Concrete

Embedment: 0.00 mm

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge (30-75º flare) Wingwall

Inlet Depression: NONE

Table 6 - Downstream Channel Rating Curve (Crossing: Bunkers Northeast Branch)

Flow (cms)	Water Surface Elev (m)	Depth (m)	Velocity (m/s)	Shear (Pa)	Froude Number
0.00	235.83	0.00	0.00	0.00	0.00
1.50	236.22	0.39	1.23	80.75	0.87
3.00	236.35	0.52	1.36	108.00	0.89
4.50	236.44	0.61	1.47	125.13	0.91
6.00	236.50	0.67	1.57	137.91	0.93
7.42	236.55	0.72	1.67	147.37	0.94
9.00	236.59	0.76	1.76	157.01	0.95
10.50	236.63	0.80	1.83	165.42	0.96
12.00	236.67	0.84	1.90	173.11	0.97
13.50	236.71	0.88	1.95	180.64	0.98
15.00	236.74	0.91	2.00	187.45	0.98

Tailwater Channel Data - Bunkers Northeast Branch

Tailwater Channel Option: Irregular Channel

Channel Slope: 0.0210

Roadway Data for Crossing: Bunkers Northeast Branch

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 40.00 m

Crest Elevation: 240.20 m

Roadway Surface: Paved

Roadway Top Width: 27.00 m

Crossing Notes: Bunkers Central Branch

Spill limited due to backwater from downstream south branch. Culvert capacity governed by headwater elevation – downstream conditions are not limiting.

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0 cfs

Design Flow: 476.395 cfs

Maximum Flow: 529.72 cfs

Table 7 - Summary of Culvert Flows at Crossing: Bunkers Central Branch

Headwater Elevation (m)	Total Discharge (cms)	4200 x 1500 Box Discharge (cms)	Roadway Discharge (cms)	Iterations
231.55	0.00	0.00	0.00	1
231.94	1.50	1.50	0.00	1
232.17	3.00	3.00	0.00	1
232.36	4.50	4.50	0.00	1
232.53	6.00	6.00	0.00	1
232.69	7.50	7.50	0.00	1
232.84	9.00	9.00	0.00	1
233.00	10.50	10.50	0.00	1
233.16	12.00	12.00	0.00	1
233.32	13.49	13.49	0.00	1
233.50	15.00	15.00	0.00	1
233.90	18.05	18.05	0.00	Overtopping

Rating Curve Plot for Crossing: Bunkers Central Branch

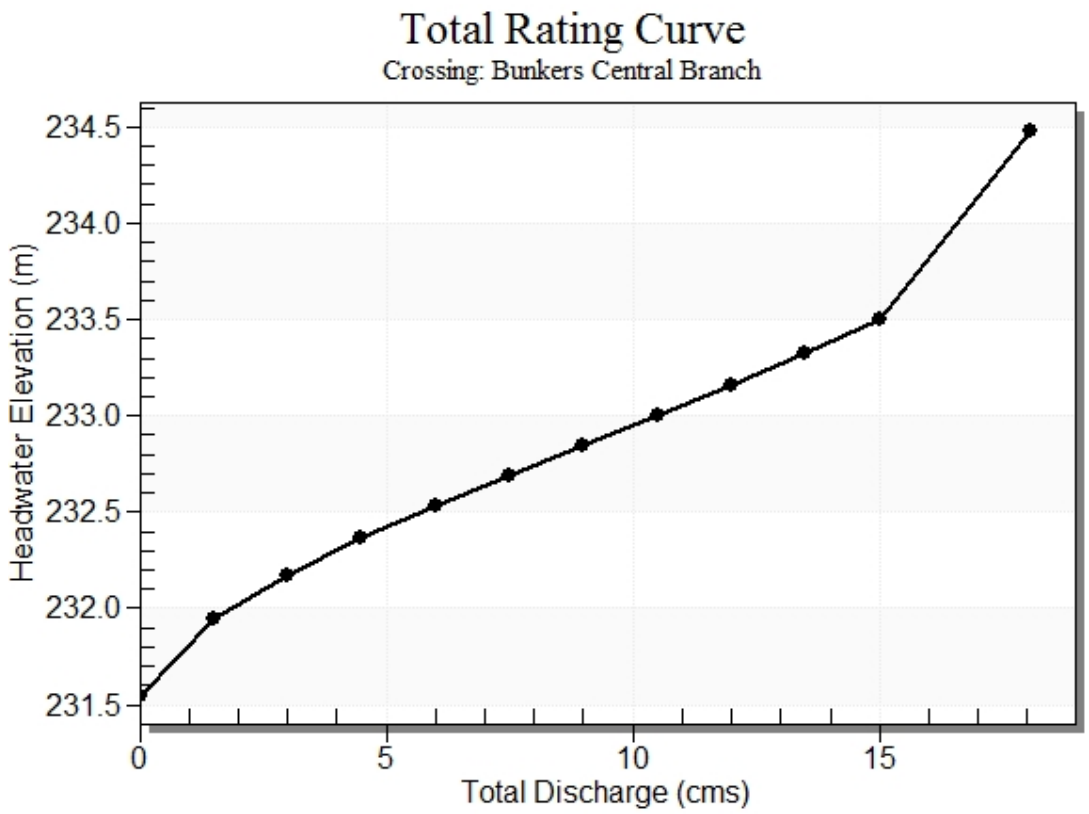


Table 8 - Culvert Summary Table: 4200 x 1500 Box

Total Discharge (cms)	Culvert Discharge (cms)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)	Tailwater Velocity (m/s)
0.00	0.00	231.55	0.000	0.000	0-NF	0.000	0.000	0.020	0.000	0.000	0.000
1.50	1.50	231.94	0.392	0.0*	1-S2n	0.137	0.235	0.137	0.373	2.616	1.474
3.00	3.00	232.17	0.623	0.0*	1-S2n	0.203	0.373	0.212	0.520	3.376	1.756
4.50	4.50	232.36	0.813	0.0*	1-S2n	0.270	0.489	0.270	0.633	3.971	1.943
6.00	6.00	232.53	0.979	0.0*	1-S2n	0.321	0.592	0.333	0.727	4.293	2.095
7.50	7.50	232.69	1.138	0.0*	1-S2n	0.371	0.687	0.383	0.809	4.667	2.221
9.00	9.00	232.84	1.292	0.0*	1-S2n	0.419	0.776	0.436	0.886	4.911	2.320
10.50	10.50	233.00	1.448	0.0*	1-S2n	0.461	0.860	0.486	0.955	5.145	2.407
12.00	12.00	233.16	1.607	0.0*	5-S2n	0.504	0.940	0.534	1.021	5.346	2.478
13.49	13.49	233.32	1.772	0.114	5-S2n	0.546	1.017	0.582	1.081	5.520	2.543
15.00	15.00	233.50	1.950	0.303	5-S2n	0.584	1.091	0.629	1.141	5.678	2.589

* Full Flow Headwater elevation is below inlet invert.

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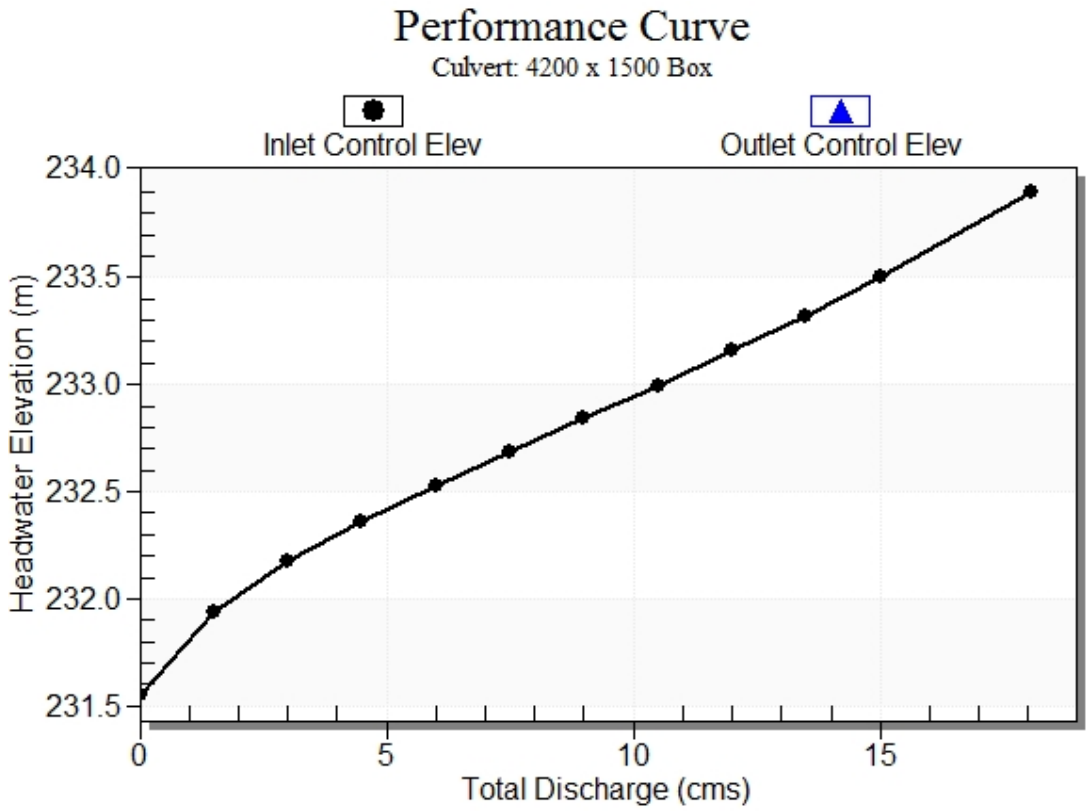
Straight Culvert

Inlet Elevation (invert): 231.55 m, Outlet Elevation (invert): 230.02 m

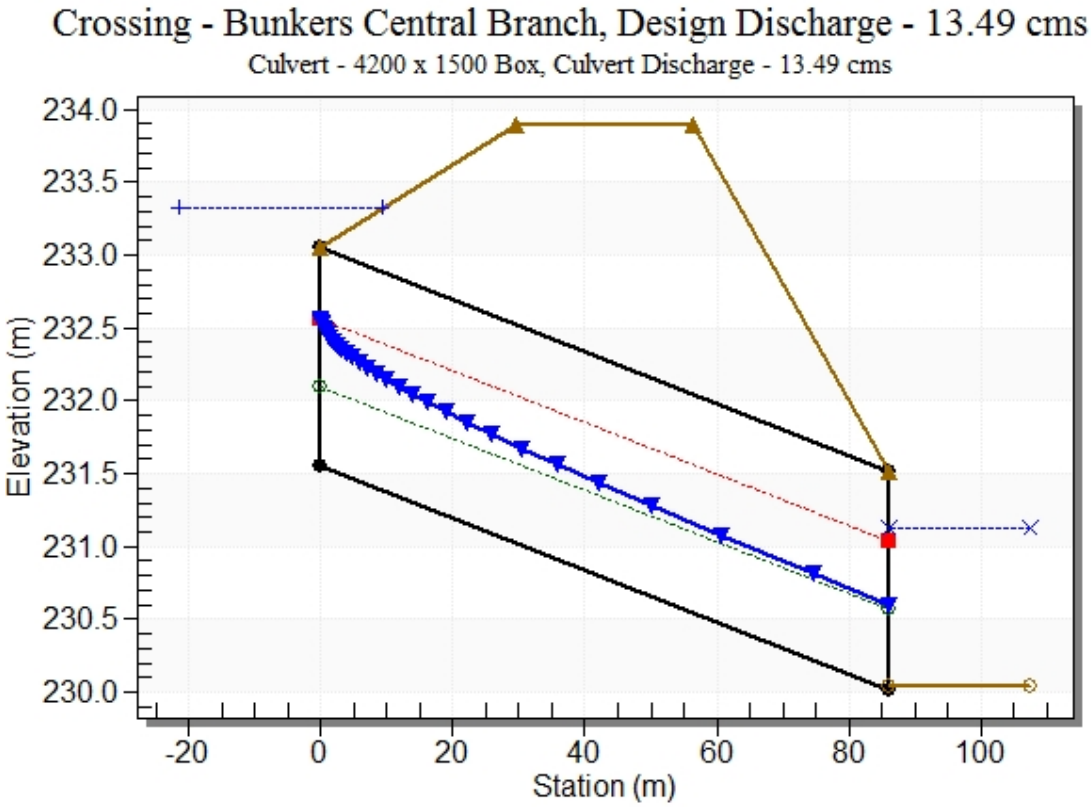
Culvert Length: 86.01 m, Culvert Slope: 0.0178

****

Culvert Performance Curve Plot: 4200 x 1500 Box



Water Surface Profile Plot for Culvert: 4200 x 1500 Box



Site Data - 4200 x 1500 Box

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 m

Inlet Elevation: 231.55 m

Outlet Station: 86.00 m

Outlet Elevation: 230.02 m

Number of Barrels: 1

Culvert Data Summary - 4200 x 1500 Box

Barrel Shape: Concrete Box

Barrel Span: 4200.00 mm

Barrel Rise: 1500.00 mm

Barrel Material: Concrete

Embedment: 0.00 mm

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge (0º flare) Wingwall

Inlet Depression: NONE

Table 9 - Downstream Channel Rating Curve (Crossing: Bunkers Central Branch)

Flow (cms)	Water Surface Elev (m)	Depth (m)	Velocity (m/s)	Shear (Pa)	Froude Number
0.00	230.04	0.00	0.00	0.00	0.00
1.50	230.41	0.37	1.47	98.74	0.97
3.00	230.56	0.52	1.76	137.71	0.97
4.50	230.67	0.63	1.94	167.55	0.97
6.00	230.77	0.73	2.09	192.31	0.97
7.50	230.85	0.81	2.22	214.17	0.97
9.00	230.93	0.89	2.32	234.40	0.98
10.50	231.00	0.96	2.41	252.78	0.98
12.00	231.06	1.02	2.48	270.16	0.99
13.49	231.12	1.08	2.54	286.08	0.99
15.00	231.18	1.14	2.59	302.03	0.99

Tailwater Channel Data - Bunkers Central Branch

Tailwater Channel Option: Irregular Channel

Channel Slope: 0.0270

Roadway Data for Crossing: Bunkers Central Branch

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 40.00 m

Crest Elevation: 233.90 m

Roadway Surface: Paved

Roadway Top Width: 27.00 m

Crossing Notes: Bunkers South Branch Spill

Spill governed by weir controlling spill to Dyments Creek watershed. High flow capacity governed by downstream system backwater. Governing rating curve is conservative combination of HY-8 and PCSWMM analysis for culvert capacity.

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 0 cfs

Design Flow: 454.5 cfs

Maximum Flow: 565.035 cfs

Table 10 - Summary of Culvert Flows at Crossing: Bunkers South Branch Spill

Headwater Elevation (m)	Total Discharge (cms)	Twin 1800 x 1200 Box Discharge (cms)	Roadway Discharge (cms)	Iterations
228.05	0.00	0.00	0.00	1
228.51	1.60	1.60	0.00	1
228.77	3.20	3.20	0.00	1
228.99	4.80	4.80	0.00	1
229.21	6.40	6.40	0.00	1
229.43	8.00	8.00	0.00	1
229.68	9.60	9.60	0.00	1
229.96	11.20	11.20	0.00	1
230.28	12.80	12.80	0.00	1
230.29	12.87	12.87	0.00	1
231.04	16.00	16.00	0.00	1
233.10	22.08	22.08	0.00	Overtopping

Rating Curve Plot for Crossing: Bunkers South Branch Spill

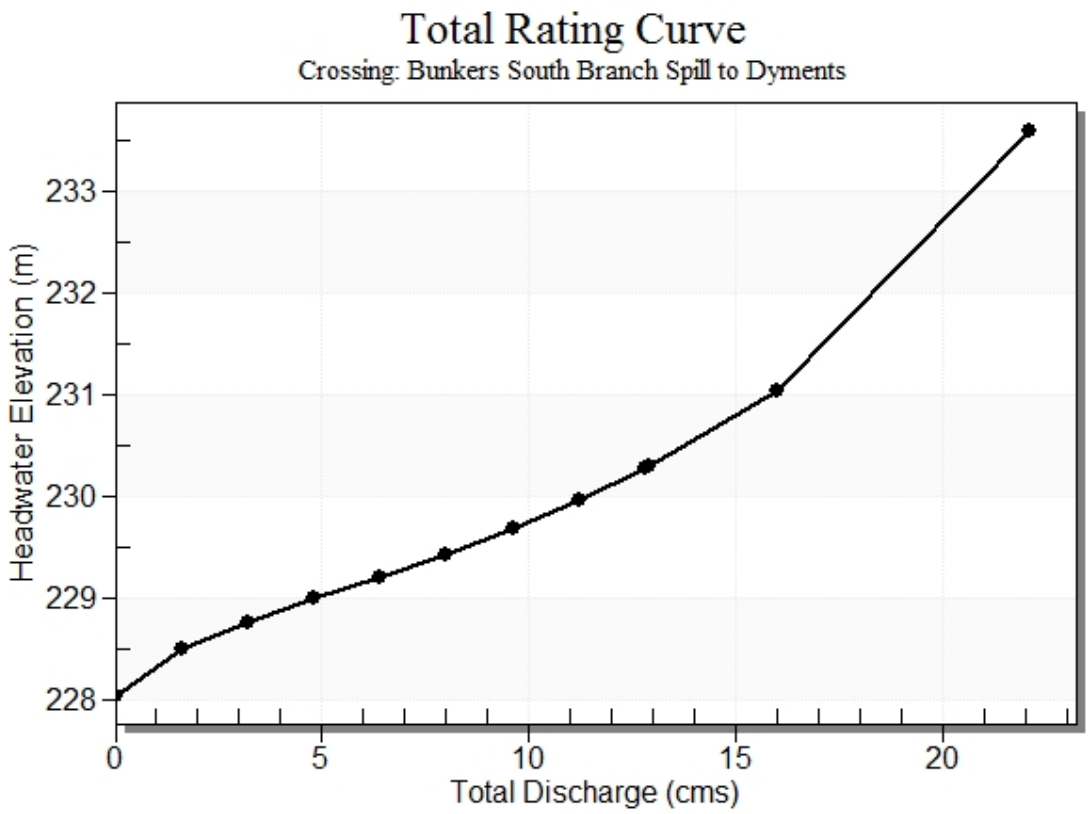


Table 11 - Culvert Summary Table: Twin 1800 x 1200 Box

Total Discharge (cms)	Culvert Discharge (cms)	Headwater Elevation (m)	Inlet Control Depth (m)	Outlet Control Depth (m)	Flow Type	Normal Depth (m)	Critical Depth (m)	Outlet Depth (m)	Tailwater Depth (m)	Outlet Velocity (m/s)	Tailwater Velocity (m/s)
0.00	0.00	228.05	0.000	0.000	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
1.60	1.60	228.51	0.458	0.0*	1-S2n	0.197	0.272	0.197	0.366	2.258	2.283
3.20	3.20	228.77	0.720	0.0*	1-S2n	0.313	0.432	0.316	0.511	2.813	2.851
4.80	4.80	228.99	0.942	0.0*	1-S2n	0.413	0.566	0.413	0.626	3.229	3.216
6.40	6.40	229.21	1.158	0.105	1-S2n	0.504	0.685	0.511	0.725	3.482	3.489
8.00	8.00	229.43	1.383	0.401	5-S2n	0.591	0.795	0.591	0.812	3.761	3.707
9.60	9.60	229.68	1.630	0.730	5-S2n	0.674	0.898	0.684	0.892	3.900	3.886
11.20	11.20	229.96	1.909	1.198	5-S2n	0.754	0.995	0.765	0.966	4.067	4.038
12.80	12.80	230.28	2.226	1.553	5-S2n	0.832	1.088	0.844	1.035	4.215	4.172
12.87	12.87	230.29	2.241	1.570	5-S2n	0.836	1.092	0.847	1.038	4.219	4.177
16.00	16.00	231.04	2.991	2.351	5-S2n	0.984	1.200	0.999	1.161	4.450	4.399

* Full Flow Headwater elevation is below inlet invert.

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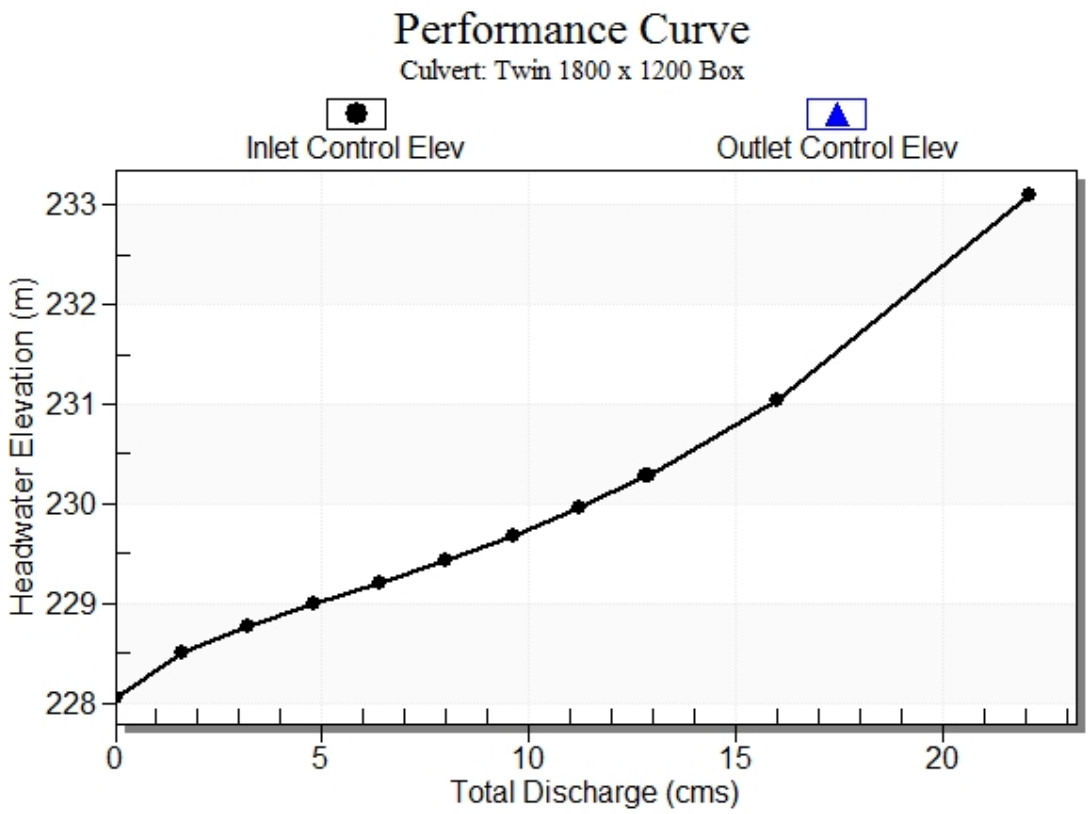
Straight Culvert

Inlet Elevation (invert): 228.05 m, Outlet Elevation (invert): 227.14 m

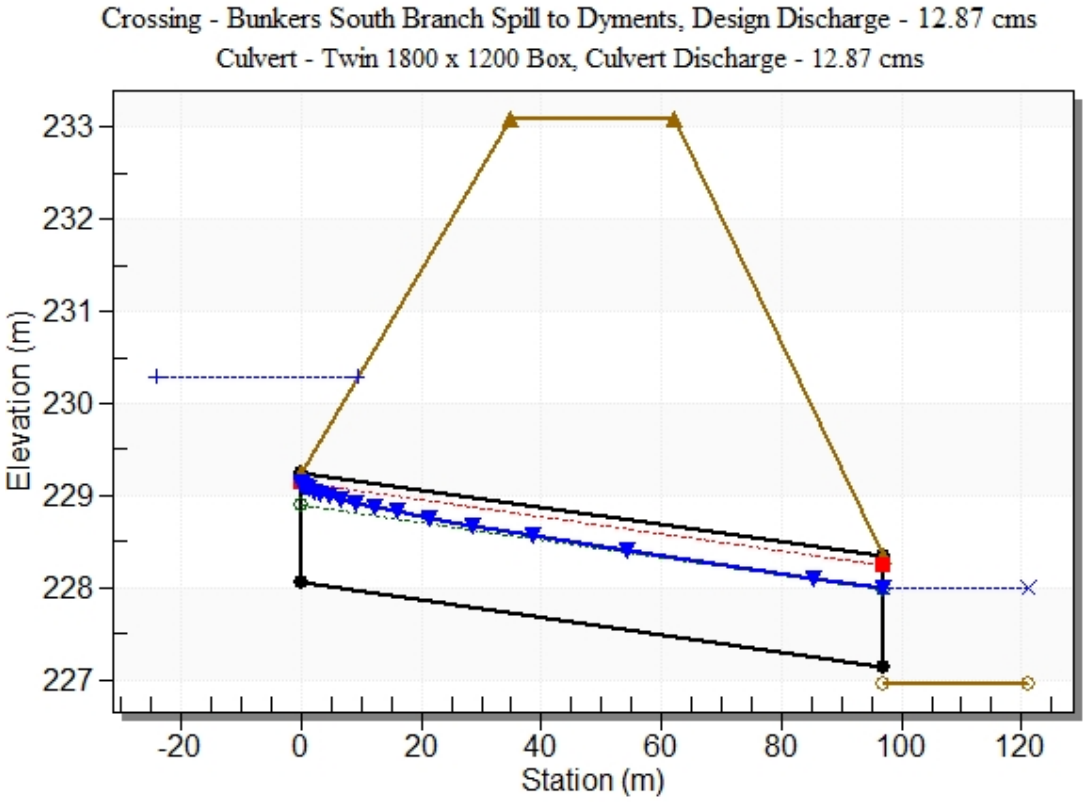
Culvert Length: 97.00 m, Culvert Slope: 0.0094

****

Culvert Performance Curve Plot: Twin 1800 x 1200 Box



Water Surface Profile Plot for Culvert: Twin 1800 x 1200 Box



Site Data - Twin 1800 x 1200 Box

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 m

Inlet Elevation: 228.05 m

Outlet Station: 97.00 m

Outlet Elevation: 227.14 m

Number of Barrels: 2

Culvert Data Summary - Twin 1800 x 1200 Box

Barrel Shape: Concrete Box

Barrel Span: 1800.00 mm

Barrel Rise: 1200.00 mm

Barrel Material: Concrete

Embedment: 0.00 mm

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge (0º flare) Wingwall

Inlet Depression: NONE

Table 12 -Downstream Channel Rating Curve (Crossing: Bunkers South Branch Spill)

Flow (cms)	Water Surface Elev (m)	Depth (m)	Velocity (m/s)	Shear (Pa)	Froude Number
0.00	226.96	0.00	0.00	0.00	0.00
1.60	227.33	0.37	2.28	132.69	1.43
3.20	227.47	0.51	2.85	185.38	1.51
4.80	227.59	0.63	3.22	227.02	1.54
6.40	227.68	0.72	3.49	262.77	1.56
8.00	227.77	0.81	3.71	294.64	1.57
9.60	227.85	0.89	3.89	323.68	1.58
11.20	227.93	0.97	4.04	350.49	1.59
12.80	228.00	1.04	4.17	375.45	1.59
12.87	228.00	1.04	4.18	376.50	1.59
16.00	228.12	1.16	4.40	421.20	1.59

Tailwater Channel Data - Bunkers South Branch Spill to Dyments

Tailwater Channel Option: Irregular Channel

Channel Slope: 0.0370

Roadway Data for Crossing: Bunkers South Branch Spill to Dyments

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 40.00 m

Crest Elevation: 233.10 m

Roadway Surface: Paved

Roadway Top Width: 27.00 m

TATHAM ENGINEERING	Project: Barrie Drainage Master Plan	Date:	10-Feb-18
	File No.: 117076	Designed:	DAM
	Subject: Dyments Spill Rating Curve	Checked:	DRT

Trapezoidal Broad Crested Weir

Source: Hydraulic Structures, C.D.Smith, University of Saskatchewan

Trapezoidal Weir

The trapezoidal weir is a combination of the rectangular weir and the triangular weir

Enter

W	Weir Bottom Width (m)	6.3
H	Head (m)	0.7
L	Weir Downstream Length	7
S	Side Slope (horizontal):1	10

Rectangular Weir $Q = CWH^{3/2}$

H/L	0.1
C	1.57258

Result

Q Rectangular Weir	Flow (m^3/s)	**5.802303**

Triangular Weir $Q = CH^{5/2}\tan(\theta/2)$

Notch Angle (one side)	84.28940686	degrees
Notch Angle (one side)	1.471127674	radians
$\tan(\theta/2)$	10.000000	

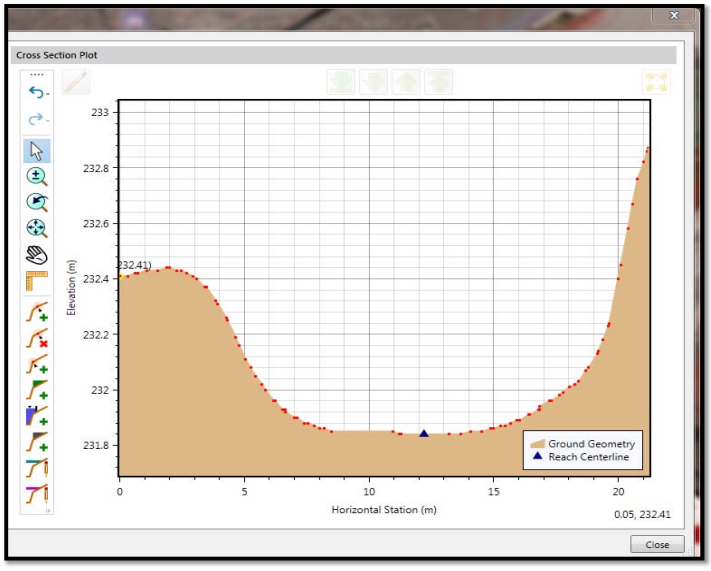
Triangular H/L	0.1
C	1.1578E+00

Result

Q Triangular Weir	Flow (m^3/s)	**4.7465**

Total Rectangular + Triangular Weir

Q Total	**Flow (m^3/s)**	**10.5488**



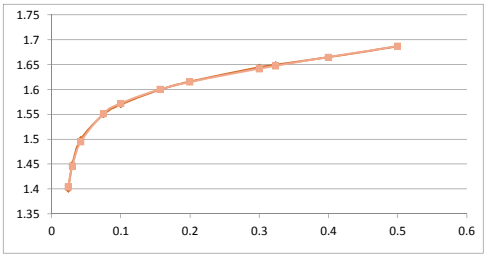
Rectangular Weir Coefficient

H/W	C Graph	C Equation
0.024	1.4	1.404683
0.03	1.45	1.446349
0.042	1.5	1.494886
0.075	1.55	1.551834
0.1	1.57	1.57258
0.157	1.6	1.600637
0.2	1.616	1.615218
0.3	1.645	1.642033
0.324	1.65	1.647787
0.4	1.665	1.66522
0.5	1.687	1.687229

Rectangular C Equation

y=(a+bx)/(1+cx+dx^2)

a	-1.04E+04
b	3.42E+06
c	2.13E+06
d	-2.35E+05



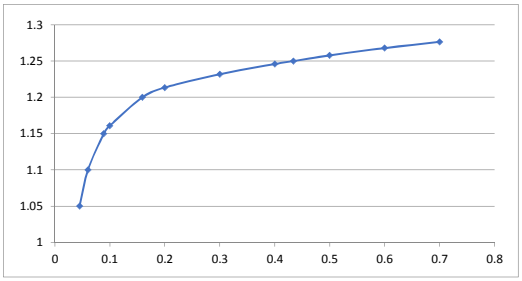
Triangular Weir Coefficient

H/L	C Graph	C Equation
0.045	1.05	1.0519
0.06	1.1	1.0971
0.089	1.15	1.1459
0.1	1.161	1.1578
0.159	1.2	1.1963
0.2	1.2135	1.2113
0.3	1.232	1.2336
0.4	1.246	1.2476
0.434	1.25	1.2515
0.5	1.258	1.2583
0.6	1.268	1.2673
0.7	1.2765	1.2754

Triangular C Equation

y=(a+bx)/(1+cx+dx^2)

a	-1.01E-05
b	1.44E+02
c	1.15E+02
d	-4.77E+00



Spill Rating Curve

Elevation (m)	Discharge (cms)
231.84	0.0000
231.89	0.1045
231.94	0.3121
231.99	0.6039
232.04	0.9981
232.09	1.4884
232.14	2.0677
232.19	2.7512
232.24	3.5389
232.29	4.4303
232.34	5.4285
232.39	6.5365
232.44	7.7572
232.49	9.0937
232.54	10.5488

Appendix L:
Existing Crossings Summary

Table 1: Kidd's Creek Existing Condition / Flows Culvert Capacity Summary

Culvert ID	Location	Size	Capacity (m^3/s)	Level of Service	Design Criteria
13	Cundles Road West	2200 mm Dia. CSP	15.7	1:50 Year	1:100 Year
14	Highway 400	2440 mm × 1520 mm Conc. Box Culvert	7.3	1:100 Year	1:100 Year
15	Wellington Street / Ross Street	3000 mm × 1800 mm Conc. Box Culvert	7.4	1:100 Year	1:100 Year
16	Thomson Street	1850 mm × 1050 mm Conc. Box Culvert	5.8	1:50 Year	1:100 Year
17	Eccles Street	3000 mm × 1500 mm Conc. Box Culvert	3.9	1:10 Year	1:100 Year
18	Wellington Street	600 mm Dia. CSP	0.7	1:2 Year	1:100 Year
19	Parkview Gardens	900 mm Dia. Conc. Pipe	2.1	1:100 Year	1:100 Year
20	Donald Street	6.75 m Open Bottom Span Structure	10.6	1:100 Year	1:100 Year
21	Eccles Street	Twin 2400 mm × 1200 mm Conc. Box Culverts	11.5	1:100 Year	1:100 Year

Table 2: Kidd's Creek Existing Condition / Flows Road/Rail Crossing Summary

Crossing ID	Location	Regulatory Flow (m^3/s)	Weir Flow (m^3/s)	Max. Depth of Weir Flow (m)	Velocity of Weir Flow (m/s)
13	Cundles Road West	31.1	13.1	0.47	0.94
14	Highway 400	47.5	17.1	0.56	1.11
15	Wellington Street / Ross Street	49.3	28.3	0.92	1.33
16	Thomson Street	49.4	43.1	0.89	1.26
17	Eccles Street	49.7	46.2	0.63	1.00
18	Wellington Street	5.5	4.9	0.24	0.67
19	Parkview Gardens	5.6	3.3	0.39	0.63
20	Donald Street	51.5	35.5	0.65	1.19
21	Eccles Street	51.9	41.8	0.77	1.27

Table 3: Bunkers Existing Condition / Flows Culvert Capacity Summary

Culvert ID	Location	Size	Capacity (m^3/s)	Level of Service	Design Criteria
22	Innisfil Street	Twin 1520 mm Dia. CSP	<9.2	<1:2 Year	1:100 Year
23	Commercial Plaza Entrance Road	Twin 2400 mm × 1550 mm CSPA Culverts	<7.0	<1:2 Year	1:100 Year
24	Bradford Street	Twin 2440 mm × 1730 mm CSPA Culverts	<8.9	<1:2 Year	1:100 Year
25	Lakeshore Drive	15.27 m Open Bottom Span Structure	31.3	1:100 Year	1:100 Year

Table 4: Bunkers Creek Existing Condition / Flows Road/Rail Crossing Summary

Crossing ID	Location	Regulatory Flow (m^3/s)	Weir Flow (m^3/s)	Max. Depth of Weir Flow (m)	Velocity of Weir Flow (m/s)
22	Innisfil Street	40.0	34.1	0.50	0.95
23	Commercial Plaza Entrance Road	40.3	32.8	0.73	1.09
24	Bradford Street	41.7	32.6	0.59	0.93
25	Lakeshore Drive	42.6	11.7	0.26	0.61

Table 5: Dyments Creek Existing Condition / Flows Culvert Capacity Summary

Culvert ID	Location	Size	Capacity (m^3/s)	Level of Service	Design Criteria
26	Edgehill Drive	Twin 3000 mm × 1500 mm Conc. Box Culvert	7.5	1:100 Year	1:50 Year
27	Sproule Drive	4 - 1800 mm × 900 mm Conc. Box Culvert & 1 – 450mm Dia. CSP Culvert	8.4	1:100 Year	1:50 Year
28	Dunlop Street West	2235 mm × 1625 mm CSPA Culvert	<1.4	<1:2 Year	1:100 Year
29	Ferndale Drive North	2125 mm × 1525 mm CSPA Culvert	3.7	1:2 Year	1:100 Year
30	Sarjeant Drive	2000 mm × 1500 mm CSPA Culvert	8.0	1:10 Year	1:100 Year
31	Dunlop Street / Highway 400 On-Ramp	1800 mm × 1400 mm Conc. Box Culvert	<0.5	<1:2 Year	1:100 Year
33	Highway 400	1200 mm × 1000 mm Conc. Box Culvert	<4.1	<1:2 Year	1:100 Year
32	Hart Drive	1500 mm Dia. CSP	<3.7	<1:2 Year	1:100 Year
-	Parking Lot	3 - 1800 mm Dia. Conc. Pipes	14.2	1:10 Year	-
34	George Street	2690 mm × 1730 mm Conc. Ellipse	6.8	1:2 Year	1:100 Year
35	Victoria Street	450 mm Dia. CSP	<0.3	<1:2 Year	1:100 Year
36	John Street	2460 mm × 1720 mm CSPA Culvert	13.9	1:10 Year	1:100 Year
37	Innisfil Street	2000 mm × 1000 mm Conc. Box Culvert	4.2	1:2 Year	1:100 Year
38	Sanford Street	1350 mm Dia. CSP	9.0	1:5 Year	1:100 Year
39	Bradford Street	5400 mm × 1800 mm CSPA Culvert	21.5	1:25 Year	Regional
40	Lakeshore Drive	12 m Open Bottom Span Structure	39.1	1:100 Year	Regional
137	Ferndale Landfill Access Road	3000 mm × 1500 mm Conc. Box Culvert	6.7	1:100 Year	1:50 year

Table 6: Dyments Creek Existing Condition / Flows Road/Rail Crossing Summary

Crossing ID	Location	Regulatory Flow (m^3/s)	Weir Flow (m^3/s)	Max. Depth of Weir Flow (m)	Velocity of Weir Flow (m/s)
26	Edgehill Drive	39.0	20.0	0.20	0.58
27	Sproule Drive	21.8	0.00	0.00	0.00
28	Dunlop Street West	23.6	21.1	0.60	0.85
29	Ferndale Drive North	30.5	30.3	0.73	0.21
30	Sarjeant Drive	45.1	40.7	0.49	0.80
31	Dunlop Street / Highway 400 On-Ramp	49.5	48.1	0.83	0.52
33	Highway 400	50.0	47.5	0.59	0.97
32	Hart Drive	54.9	51.5	0.70	1.13
-	Parking Lot	48.4	45.2	0.97	1.05
34	George Street	55.9	48.0	0.70	1.05
35	Victoria Street	55.1	54.7	0.72	1.10
36	John Street	59.3	47.8	0.83	1.13
37	Innisfil Street	59.9	55.5	1.01	1.28
38	Sanford Street	60.3	53.3	0.78	1.13
39	Bradford Street	61.1	41.0	0.86	1.08
40	Lakeshore Drive	62.6	5.1	0.18	0.28
137	Ferndale Landfill Access Road	18.5	3.3	0.28	0.65

Table 7: Hotchkiss Creek Existing Condition / Flows Culvert Capacity Summary

Culvert ID	Location	Size	Capacity (m^3/s)	Level of Service	Design Criteria
41	Mayfair Drive	600 mm Dia. CSP	0.7	1:10 Year	1:50 Year
42	Ardagh Road	Inline Structure	<0.6	<1:2 Year	1:100 Year
43	Morrow Road	4572 mm x 1219 mm Conc. Box Culvert	6.0	1:25 Year	1:50 Year
44	Essa Road	900 mm × 900 mm Conc. Box Culvert	<2.0	<1:2 Year	1:100 Year
45	Essa Road / Highway 400 On-Ramp	1200 mm × 1200 mm Conc. Box Culvert	>8.6	Regional	1:100 Year
46	Highway 400	1070 mm Dia. Conc. Pipe & 2100 mm Dia. Conc. Pipe	18.0	1:25 Year	1:50 Year
47	Wood Street	1200 mm Dia. CSP	<1.1	<1:2 Year	1:100 Year
48	Tiffin Street	1500 mm Dia. Conc. Pipe	<0.6	<1:2 Year	1:100 Year
49	Anne Street South	1900 mm Dia. Conc. Pipe	<8.1	<1:2 Year	1:100 Year
50	Innisfil Street	1500 mm Dia. CSP	<9.2	<1:2 Year	1:100 Year
51	Bradford Street	9754 mm × 2040 mm Conc. Box Culvert	35.2	1:10 Year	Regional
52	Lakeshore Drive	1220 mm × 1500 mm Conc. Box Culvert	47.6	1:25 Year	Regional
135	Rail Crossing	1200 mm Dia. Conc. Pipe	<5.0	<1:2 Year	1:100 Year

Table 8: Hotchkiss Creek Existing Condition / Flows Road/Rail Crossing Summary

Crossing ID	Location	Regulatory Flow (m^3/s)	Weir Flow (m^3/s)	Max. Depth of Weir Flow (m)	Velocity of Weir Flow (m/s)
41	Mayfair Drive	1.3	0.5	0.20	0.48
42	Ardagh Road	2.1	2.1	0.15	0.48
43	Morrow Road	8.4	7.7	0.97	0.14
44	Essa Road	8.3	5.1	0.52	0.90
45	Essa Road / Highway 400 On-Ramp	8.6	0.0	0.00	0.00
46	Highway 400	25.0	3.8	0.16	0.50
47	Wood Street	34.3	33.4	0.66	0.97
48	Tiffin Street	39.0	37.9	0.98	0.63
49	Anne Street South	55.1	41.7	0.85	1.09
50	Innisfil Street	64.4	48.3	0.98	1.15
51	Bradford Street	64.4	27.9	0.72	1.14
52	Lakeshore Drive	66.2	24.5	0.53	0.86
135	Rail Crossing	37.3	32.4	0.75	0.87

Table 9: Whiskey Creek Existing Condition / Flows Culvert Capacity Summary

Culvert ID	Location	Size	Capacity (m^3/s)	Level of Service	Design Criteria
53	Harvie Road	600 mm Dia. CSP	<0.7	<1:2 Year	1:100 Year
54	Harvie Road	1200 mm Dia. CSP	3.4	1:10 Year	1:100 Year
55	Highway 400	1200 mm × 1200 mm Conc. Box Culvert	8.2	1:100 Year	1:100 Year
56	Fairview Road	1200 mm × 1200 mm Conc. Box Culvert	7.4	1:100 Year	1:100 Year
57	Bayview Drive	Twin 1650 mm × 1050 mm CSP Ellipse Culverts	6.1	1:25 Year	1:100 Year
58	Bayview Drive	1400 mm Dia. CSP	6.1	1:100 Year	1:50 Year
59	McConkey Place	3650 mm × 1800 mm Conc. Box Culvert	10.9	1:10 Year	1:100 Year
60	Huronia Road	Twin 1800 mm Dia. Conc. Culverts	4.5	1:10 Year	1:100 Year
61	Herrell Avenue	1650 mm Dia. Conc. Pipe	10.1	1:50 Year	1:50 Year
62	Little Avenue	6000 mm × 1200 mm Conc. Box Culvert	16.3	1:25 Year	1:100 Year
63	Yonge Street	2400 mm × 1800 mm Conc. Box Culvert	18.5	1:50 Year	1:100 Year
64	Hurst Drive	1200 mm Dia. CSP & 1800 mm Dia. CSP	19.2	1:50 Year	1:100 Year
65	The Boulevard	1790 mm × 1000 mm CSPA Culvert	<3.0	<1:2 Year	1:100 Year
66	Brennan Avenue	3650 mm × 1800 mm Conc. Box Culvert	9.8	1.5 Year	1:100 Year
138	Rail Crossing	1600 mm Dia. CSP	11.3	1:10 Year	1:100 Year
139	Highway 400	1200 mm × 900 mm Conc. Box Culvert	>2.6	Regional	1:100 Year
140	Fairview Road	1900 mm × 1900 mm Conc. Box Culvert	>3.4	Regional	1:100 Year
144	Rail Crossing	Twin 1500 mm Dia. CSP Culverts	9.8	1:100 Year	1:100 Year
147	Rail Crossing	1350 mm × 1200 mm Conc. Ellipse	7.6	1:5 Year	1:100 Year

Table 10: Whiskey Creek Existing Condition / Flows Road/Rail Crossing Summary

Crossing ID	Location	Regulatory Flow (m^3/s)	Weir Flow (m^3/s)	Max. Depth of Weir Flow (m)	Velocity of Weir Flow (m/s)
53	Harvie Road	4.2	3.33	0.25	0.65
54	Harvie Road	19.2	19.1	4.23	0.04
55	Highway 400	21.2	11.51	0.41	0.72
56	Fairview Road	22.0	13.63	0.35	0.78
57	Bayview Drive	24.4	16.92	0.70	0.98
58	Bayview Drive	6.6	0.1	0.80	0.00
59	McConkey Place	42.3	23.3	0.76	1.10
60	Huronia Road	45.3	40.6	0.76	1.09
61	Herrell Avenue	12.0	0.7	0.11	0.39
62	Little Avenue	63.4	41.7	0.83	0.97
63	Yonge Street	66.0	46.2	0.52	0.87
64	Hurst Drive	69.2	46.8	0.84	1.23
65	The Boulevard	69.6	65.7	1.44	1.49
66	Brennan Avenue	70.1	67.3	1.41	0.35
138	Rail Crossing	67.7	59.5	0.89	1.09
139	Highway 400	2.6	0.0	0.00	0.00
140	Fairview Road	3.4	0.0	0.00	0.00
144	Rail Crossing	23.7	7.2	0.44	0.75
147	Rail Crossing	49.5	41.6	0.50	0.87

Table 11: Hewitts Creek Existing Condition / Flows Culvert Capacity Summary

Culvert ID	Location	Size	Capacity (m^3/s)	Level of Service	Design Criteria
83	Mapleview Drive East	1650 × 4800 mm Conc. Box	23.8	1:25 Year	1:100 Year
84	Prince William Way	1200 × 1800 mm Conc. Box	3.8	1:25 Year	1:50 Year
85	Consort Drive	1600 x 3600 mm CSPA	8.1	1:100 Year	1:50 Year
86	Big Bay Point Road	3670 mm Dia Conc. 3670 mm Dia. CSP 3050 mm Dia. CSP 3340 x 3750 mm CSPA	>123.1	Regional	1:100 Year

Table 12: Hewitts Creek Existing Condition / Flows Road/Rail Crossing Summary

Crossing ID	Location	Regulatory Flow (m^3/s)	Weir Flow (m^3/s)	Max. Depth of Weir Flow (m)	Velocity of Weir Flow (m/s)
83	Mapleview Drive East	94.5	88.6	0.79	1.07
84	Prince William Way	15.5	6.5	0.26	0.47
85	Consort Drive	17.3	5.8	0.29	0.68
86	Big Bay Point Road	123.1	0.0	0.00	0.00

Table 13: Lovers Creek Existing Condition / Flows Culvert Capacity Summary

Culvert ID	Location	Size	Capacity (m^3/s)	Level of Service	Design Criteria
87	Saunders Road	2 - 1260 x 1840 mm CSPA	> 11.0	Regional	1:50 Year
88	Bayview Drive	1350 mm Dia. CSP	5.4	1:10 Year	1:50 Year
89	Lockhart Road	2 - 650 x 3800 mm Conc. Box	4.0	1:5 Year	1:100 Year
91	Lockhart Road	2400 x 6100 mm Conc. Box	38.1	1:10 Year	1:100 Year
92	Huronia Road	1200 mm Dia. CSP	<3.0	< 1:2 Year	1:100 Year
94	Welham Road	1880 x 2590 mm CSPA	4.7	1:25 Year	1:50 Year
95	Mapleview Drive East	1830 mm x 2330 mm Conc. Box	4.7	1:25 Year	1:100 Year
96	Mapleview Drive East	12 - 1500 x 3000 mm Conc. Box Culverts & 10 m Open Bottom Span Structure	108.2	1:100 Year	1:100 Year
97	Huronia Road	1400 mm Dia. CSP	3.7	1:2 Year	1:100 Year
98	Welham Road	2 - 2000 mm Dia. Conc.	17.7	1:10 Year	1:50 Year
99	Ellis Drive	2 - 1350 mm Dia. Conc.	5.3	1:10 Year	1:50 Year
100	Bayview Drive	1400 x 2130 mm CSPA	>6.8	Regional	1:50 Year
101	Highway 400	1200 x 1200 mm Conc. Box	1.1	1:100 Year	1:100 Year
102	Big Bay Point Road	40 m Span Bridge	>335.2	Regional	1:100 Year
103	Yonge Street	35 m Span Bridge	>335.4	Regional	1:100 Year
104	Hurst Drive	76 m Span Bridge	>342.0	Regional	1:100 Year
105	Tollendal Mill Road	4150 mm Dia. CSP	34.0	1:5 Year	1:100 Year
106	Rail Crossing	52 m Span Bridge	>337.5	Regional	1:100 Year
121	Rail Crossing	2250 mm Dia. Conc. 1200 mm Dia. Conc. 800 mm Dia. Conc.	27.2	1:50 Year	1:50 Year
123	Rail Crossing	1050 x 900 mm. Conc. Elliptical	5.8	1:25 Year	1:50 Year
124	Rail Crossing	700 x 900 mm CSPE	>2.6	Regional	1:50 Year
126	Rail Crossing	1200 mm Dia. CSP	6.7	1:25 Year	1:50 Year

Table 14: Lovers Creek Existing Condition / Flows Road/Rail Crossing Summary

Crossing ID	Location	Regulatory Flow (m^3/s)	Weir Flow (m^3/s)	Depth of Weir Flow (m)	Velocity of Weir Flow (m/s)
87	Saunders Road	11.0	0.0	0.00	0.00
88	Bayview Drive	21.3	18.1	0.34	0.77
89	Lockhart Road	19.3	12.2	0.64	0.85
91	Lockhart Road	270.9	259.7	1.55	1.20
92	Huronia Road	25.2	24.9	0.42	0.82
94	Welham Road	18.4	17.7	1.77	0.12
95	Mapleview Drive East	18.5	18.2	3.09	0.05
96	Mapleview Drive East	304.4	199.6	0.92	1.21
97	Huronia Road	26.7	21.6	0.68	0.90
98	Welham Road	26.0	5.1	0.25	0.61
99	Ellis Drive	64.4	59.5	0.90	1.11
100	Bayview Drive	6.8	0.0	0.00	0.00
101	Highway 400	5.1	1.0	0.14	0.44
102	Big Bay Point Road	335.2	0.0	0.00	0.00
103	Yonge Street	335.4	0.0	0.00	0.00
104	Hurst Drive	342.0	0.0	0.00	0.00
105	Tollendal Mill Road	343.3	293.7	2.39	2.01
106	Rail Crossing	337.5	0.0	0.00	0.00
121	Rail Crossing	31.2	3.6	0.19	0.53
123	Rail Crossing	19.5	12.7	0.39	0.75
124	Rail Crossing	2.6	0.0	0.00	0.00
126	Rail Crossing	26.4	19.1	0.35	0.69

Table 15: Existing Condition, Existing Flows Culvert Capacity Summary for Bear Creek

Culvert ID	Location	Size	Capacity (m^3/s)	Level of Service	Design Criteria
67	Essa Road	1200 mm × 2400 mm Conc. Box	5.5	1:100 Year	1:100 Year
68	Lougheed Road	1550 mm Dia. CSP	7.0	1:100 Year	1:50 Year
69	Essa Road	800 mm × 2150 mm Conc. Box	4.5	1:100 Year	1:100 Year
70	Mapleview Drive West	1525 mm × 3000 mm Conc. Box	>13.9	Regional	1:100 Year
71	Redfern Avenue	1500 mm × 2400 mm Conc. Box	>15.0	Regional	1:50 Year
72	Lougheed Road	2650 mm × 3800 mm CSPA 1500 mm Dia. CSP	>8.1	Regional	1:50 Year
73	County Road 27	2000 mm Dia. CSP	20.7	1:100 Year	1:50 Year
74	County Road 27	1400 mm Dia. CSP	>5.7	Regional	1:50 Year
75	Ardagh Road	965 mm × 1800 mm Conc. Elliptical Twin 1200 mm × 1800 mm Conc. Box	>7.8	Regional	1:100 Year
76	Ardagh Road	1200 mm × 2400 mm Conc. Box	>2.9	Regional	1:100 Year
77	Ardagh Road	1350 mm Dia. Conc.	>2.4	Regional	1:100 Year
78	Ardagh Road	750 mm Dia. Conc.	>1.9	Regional	1:100 Year
79	Summerset Road	950 mm Dia. Conc.	2.6	1:50 Year	1:50 Year
80	County Road 27	500 mm Dia. Conc.	<0.3	< 1:2 Year	1:50 Year
113	County Road 27	1400 mm Dia. CSP	>2.3	Regional	1:50 Year
133	Mapleview Church Access Road	1220 mm × 4000 mm Conc. Box	3.5	1:100 Year	1:50 Year
134	Rail Crossing	500 mm Dia. CSP	< 0.02	< 1:2 Year	1:50 Year

Table 16: Existing Condition, Existing Flows Road/Rail Crossing Summary for Bear Creek

Culvert ID	Location	Regulatory Flow (m^3/s)	Weir Flow (m^3/s)	Max. Depth of Weir Flow (m)	Velocity of Weir Flow (m/s)
67	Essa Road	7.7	1.9	0.06	0.34
68	Lougheed Road	10.3	1.3	0.14	0.46
69	Essa Road	10.0	2.4	0.10	0.41
70	Mapleview Drive West	13.9	0.0	0.00	0.00
71	Redfern Avenue	15.0	0.0	0.00	0.00
72	Lougheed Road	17.6	0.0	0.00	0.00
73	County Road 27	28.9	6.3	0.18	0.57
74	County Road 27	5.7	0.0	0.00	0.00
75	Ardagh Road	7.8	0.0	0.00	0.00
76	Ardagh Road	2.9	0.0	0.00	0.00
77	Ardagh Road	2.4	0.0	0.00	0.00
78	Ardagh Road	1.9	0.0	0.00	0.00
79	Summerset Road	4.6	1.4	0.16	0.51
80	County Road 27	31.2	30.8	0.29	0.58
113	County Road 27	2.3	0.0	0.00	0.00
133	Mapleview Church Access Road	9.1	8.3	0.52	0.19
134	Rail Crossing	27.8	27.8	0.57	0.32

Table 17: Little Lake Creek Existing Condition / Flows Culvert Capacity Summary

Culvert ID	Location	Size	Capacity (m^3/s)	Level of Service	Design Criteria
81	Livingstone Street East	Inline Structure	11.5	1:100 Year	1:50 Year

Table 18: Little Lake Creek Existing Condition / Flows Road/Rail Crossing Summary

Culvert ID	Location	Regulatory Flow (m^3/s)	Weir Flow (m^3/s)	Max. Depth of Weir Flow (m)	Velocity of Weir Flow (m/s)
81	Livingstone Street East	11.4	0.0	0.00	0.00

Table 19: Georgian Creek Existing Condition / Flows Culvert Capacity Summary

Culvert ID	Location	Size	Capacity (m^3/s)	Level of Service	Design Criteria
82	Penetanguishene Road	1000 mm Dia. Conc.	1.9	1:2 Year	1:100 Year

Table 20: Georgian Creek Existing Condition / Flows Road/Rail Crossing Summary

Culvert ID	Location	Regulatory Flow (m^3/s)	Weir Flow (m^3/s)	Max. Depth of Weir Flow (m)	Velocity of Weir Flow (m/s)
82	Penetanguishene Road	11.9	9.1	0.48	0.84

Table 21: Kidd's Creek Existing Condition / Future Flows Culvert Capacity Summary

Culvert ID	Location	Size	Capacity (m^3/s)	Level of Service	Design Criteria
13	Cundles Road West	2200 mm Dia. CSP	15.7	1:25 Year	1:100 Year
14	Highway 400	2440 mm × 1520 mm Conc. Box Culvert	7.3	1:100 Year	1:100 Year
15	Wellington Street / Ross Street	3000 mm × 1800 mm Conc. Box Culvert	7.4	1:100 Year	1:100 Year
16	Thomson Street	1850 mm × 1050 mm Conc. Box Culvert	5.8	1:50 Year	1:100 Year
17	Eccles Street	3000 mm × 1500 mm Conc. Box Culvert	3.9	1:5 Year	1:100 Year
18	Wellington Street	600 mm Dia. CSP	0.7	1:2 Year	1:100 Year
19	Parkview Gardens	900 mm Dia. Conc. Pipe	2.1	1:100 Year	1:100 Year
20	Donald Street	6.75 m Open Bottom Span Structure	10.6	1:100 Year	1:100 Year
21	Eccles Street	Twin 2400 mm × 1200 mm Conc. Box Culverts	11.5	1:100 Year	1:100 Year

Table 22: Kidd's Creek Existing Condition / Future Flows Road/Rail Crossing Summary

Crossing ID	Location	Regulatory Flow (m^3/s)	Weir Flow (m^3/s)	Max. Depth of Weir Flow (m)	Velocity of Weir Flow (m/s)
13	Cundles Road West	31.1	13.1	0.47	0.94
14	Highway 400	47.5	17.1	0.56	1.11
15	Wellington Street / Ross Street	49.3	28.3	0.92	1.33
16	Thomson Street	49.4	43.1	0.89	1.26
17	Eccles Street	49.7	46.2	0.63	1.00
18	Wellington Street	5.5	4.9	0.24	0.67
19	Parkview Gardens	5.6	3.3	0.39	0.63
20	Donald Street	51.5	35.5	0.65	1.19
21	Eccles Street	51.9	41.8	0.77	1.27

Table 23: Bunkers Creek Existing Condition / Future Flows Culvert Capacity Summary

Culvert ID	Location	Size	Capacity (m^3/s)	Level of Service	Design Criteria
22	Innisfil Street	1520 mm Dia. CSP	<9.2	<1:2 Year	1:100 Year
23	Commercial Plaza Entrance Road	Twin 2400 mm × 1550 mm CSPA Culverts	<7.0	<1:2 Year	1:100 Year
24	Bradford Street	Twin 2440 mm × 1730 mm CSPA Culverts	<8.9	<1:2 Year	1:100 Year
25	Lakeshore Drive	15.27 m Open Bottom Span Structure	31.3	1:50 Year	1:100 Year

Table 24: Bunkers Creek Existing Condition / Future Flows Road/Rail Crossing Summary

Crossing ID	Location	Regulatory Flow (m^3/s)	Weir Flow (m^3/s)	Max. Depth of Weir Flow (m)	Velocity of Weir Flow (m/s)
22	Innisfil Street	40.0	34.1	0.50	0.95
23	Commercial Plaza Entrance Road	40.3	32.8	0.73	1.09
24	Bradford Street	41.7	32.6	0.59	0.93
25	Lakeshore Drive	42.6	11.7	0.26	0.61

Table 25: Dyments Creek Existing Condition / Future Flows Culvert Capacity Summary

Culvert ID	Location	Size	Capacity (m^3/s)	Level of Service	Design Criteria
26	Edgehill Drive	Twin 3000 mm × 1500 mm Conc. Box Culvert	7.5	1:100 Year	1:50 Year
27	Sproule Drive	4 - 1800 mm × 900 mm Conc. Box Culvert & 1 – 450mm Dia. CSP Culvert	8.4	1:100 Year	1:50 Year
28	Dunlop Street West	2235 mm × 1625 mm CSPA Culvert	<1.4	<1:2 Year	1:100 Year
29	Ferndale Drive North	2125 mm × 1525 mm CSPA Culvert	3.7	1:2 Year	1:100 Year
30	Sarjeant Drive	2000 mm × 1500 mm CSPA Culvert	8.0	1:5 Year	1:100 Year
31	Dunlop Street / Highway 400 On-Ramp	1800 mm × 1400 mm Conc. Box Culvert	<0.5	<1:2 Year	1:100 Year
33	Highway 400	1200 mm × 1000 mm Conc. Box Culvert	<4.1	<1:2 Year	1:100 Year
32	Hart Drive	1500 mm Dia. CSP	<3.7	<1:2 Year	1:100 Year
-	Parking Lot	3 - 1800 mm Dia. Conc. Pipe	14.2	1:5 Year	-
34	George Street	2690 mm × 1730 mm Conc. Ellipse	<7.9	<1:2 Year	1:100 Year
35	Victoria Street	450 mm Dia. CSP	<0.3	<1:2 Year	1:100 Year
36	John Street	2460 mm × 1720 mm CSPA Culvert	13.9	1:10 Year	1:100 Year
37	Innisfil Street	2000 mm × 1000 mm Conc. Box Culvert	4.2	1:2 Year	1:100 Year
38	Sandford Street	1350 mm Dia. CSP	9.0	1:5 Year	1:100 Year
39	Bradford Street	5400 mm × 1800 mm CSPA Culvert	21.5	1:10 Year	Regional
40	Lakeshore Drive	12 m Open Bottom Span Structure	39.1	1:100 Year	Regional
137	Ferndale Landfill Access Road	3000 mm × 1500 mm Conc. Box Culvert	6.7	1:100 Year	1:50 Year

Table 26: Dyments Creek Existing Condition / Future Flows Road/Rail Crossing Summary

Crossing ID	Location	Regulatory Flow (m^3/s)	Weir Flow (m^3/s)	Max. Depth of Weir Flow (m)	Velocity of Weir Flow (m/s)
26	Edgehill Drive	39.0	20.0	0.20	0.58
27	Sproule Drive	21.8	0.00	0.00	0.00
28	Dunlop Street West	23.6	21.1	0.60	0.85
29	Ferndale Drive North	30.5	30.3	0.73	0.21
30	Sarjeant Drive	45.1	40.7	0.49	0.80
31	Dunlop Street / Highway 400 On-Ramp	49.5	48.1	0.83	0.52
33	Highway 400	50.0	47.5	0.59	0.97
32	Hart Drive	54.9	51.5	0.70	1.13
-	Parking Lot	48.4	45.2	0.97	1.05
34	George Street	55.9	48.0	0.70	1.05
35	Victoria Street	55.1	54.7	0.72	1.10
36	John Street	59.3	47.8	0.83	1.13
37	Innisfil Street	59.9	55.5	1.01	1.28
38	Sanford Street	60.3	53.3	0.78	1.13
39	Bradford Street	61.1	41.0	0.86	1.08
40	Lakeshore Drive	62.6	5.1	0.18	0.28
137	Ferndale Landfill Access Road	18.5	3.3	0.28	0.65

Table 27: Hotchkiss Creek Existing Condition / Future Flows Culvert Capacity Summary

Culvert ID	Location	Size	Capacity (m^3/s)	Level of Service	Design Criteria
41	Mayfair Drive	600 mm Dia. CSP	0.7	1:5 Year	1:50 Year
42	Ardagh Road	Inline Structure	<0.6	<1:2 Year	1:100 Year
43	Morrow Road	4572 mm x 1219 mm Conc. Box Culvert	6.0	1:10 Year	1:50 Year
44	Essa Road	900 mm × 900 mm Conc. Box Culvert	<2.0	<1:2 Year	1:100 Year
45	Essa Road / Highway 400 On-Ramp	1200 mm × 1200 mm Conc. Box Culvert	>8.6	Regional	1:100 Year
46	Highway 400	1070 mm Dia. Conc. Pipe & 2100 mm Dia. Conc. Pipe	18.0	1:10 Year	1:100 Year
47	Wood Street	1200 mm Dia. CSP	<1.1	<1:2 Year	1:100 Year
48	Tiffin Street	1500 mm Dia. Conc. Pipe	<0.6	<1:2 Year	1:100 Year
49	Anne Street South	1900 mm Dia. Conc. Pipe	<8.1	<1:2 Year	1:100 Year
50	Innisfil Street	1500 mm Dia. CSP	<9.2	<1:2 Year	1:100 Year
51	Bradford Street	9754 mm × 2040 mm Conc. Box Culvert	35.2	1:5 Year	Regional
52	Lakeshore Drive	1220 mm × 1500 mm Conc. Box Culvert	47.6	1:10 Year	Regional
135	Rail Crossing	1200 mm Dia. Conc. Pipe	<5.0	<1:2 Year	1:100 Year

Table 28: Hotchkiss Creek Existing Condition / Future Flows Road/Rail Crossing Summary

Crossing ID	Location	Regulatory Flow (m^3/s)	Weir Flow (m^3/s)	Max. Depth of Weir Flow (m)	Velocity of Weir Flow (m/s)
41	Mayfair Drive	1.6	0.8	0.24	0.52
42	Ardagh Road	2.5	2.5	0.18	0.51
43	Morrow Road	10.1	9.0	1.05	0.14
44	Essa Road	8.3	5.1	0.52	0.90
45	Essa Road / Highway 400 On-Ramp	8.6	0.0	0.00	0.00
46	Highway 400	13.7	8.5	0.23	0.60
47	Wood Street	40.0	39.2	0.71	1.01
48	Tiffin Street	46.7	45.9	1.12	0.59
49	Anne Street South	66.1	58.5	0.93	1.15
50	Innisfil Street	77.3	68.4	1.11	1.19
51	Bradford Street	77.3	39.2	0.87	1.25
52	Lakeshore Drive	79.4	39.7	0.65	0.98
135	Rail Crossing	44.0	39.2	0.80	0.91

Table 29: Whiskey Creek Existing Condition / Future Flows Culvert Capacity Summary

Culvert ID	Location	Size	Capacity (m^3/s)	Level of Service	Design Criteria
53	Harvie Road	600 mm Dia. CSP	<0.7	<1:2 Year	1:100 Year
54	Harvie Road	1200 mm Dia. CSP	3.4	1:5 Year	1:100 Year
55	Highway 400	1200 mm × 1200 mm Conc. Box Culvert	8.2	1:100 Year	1:100 Year
56	Fairview Road	1200 mm × 1200 mm Conc. Box Culvert	7.4	1:50 Year	1:100 Year
57	Bayview Drive	Twin 1650 mm × 1050 mm Conc. Ellipse Culverts	6.1	1:10 Year	1:100 Year
58	Bayview Drive	1400 mm Dia. CSP	6.1	1:50 Year	1:50 Year
59	McConkey Place	3650 mm × 1800 mm Conc. Box Culvert	10.9	1:5 Year	1:100 Year
60	Huronia Road	Twin 1800 mm Dia. Conc. Culverts	4.5	1:5 Year	1:100 Year
61	Herrell Avenue	1650 mm Dia. Conc. Pipe	10.1	1:25 Year	1:50 Year
62	Little Avenue	6000 mm × 1200 mm Conc. Box Culvert	16.3	1:10 Year	1:100 Year
63	Yonge Street	2400 mm × 1800 mm Conc. Box Culvert	18.5	1:25 Year	1:100 Year
64	Hurst Drive	1200 mm Dia. CSP & 1800 mm Dia. CSP	19.2	1:25 Year	1:100 Year
65	The Boulevard	1790 mm × 1000 mm CSPA Culvert	<3.0	<1:2 Year	1:100 Year
66	Brennan Avenue	3650 mm × 1800 mm Conc. Box Culvert	9.8	1:2 Year	1:100 Year
138	Rail Crossing	1600 mm Dia. CSP	11.3	1:2 Year	1:100 Year
139	Highway 400	1200 mm × 900 mm Conc. Box Culvert	>2.6	Regional	1:100 Year
140	Fairview Road	1900 mm × 1900 mm Conc. Box Culvert	>3.8	Regional	1:100 Year
144	Rail Crossing	Twin 1500 mm Dia. CSP Culverts	9.8	1:100 Year	1:100 Year
147	Rail Crossing	1350 mm × 1200 mm Conc. Ellipse	7.6	1:2 Year	1:100 Year

Table 30: Whiskey Creek Existing Condition / Future Flows Road/Rail Crossing Summary

Crossing ID	Location	Regulatory Flow (m^3/s)	Weir Flow (m^3/s)	Max. Depth of Weir Flow (m)	Velocity of Weir Flow (m/s)
53	Harvie Road	4.3	3.4	0.26	0.66
54	Harvie Road	19.2	19.1	4.23	0.04
55	Highway 400	21.2	11.5	0.41	0.72
56	Fairview Road	22.0	13.6	0.35	0.78
57	Bayview Drive	24.4	16.9	0.70	0.98
58	Bayview Drive	7.5	1.1	0.80	0.01
59	McConkey Place	42.3	23.3	0.76	1.10
60	Huronia Road	45.3	40.6	0.76	1.09
61	Herrell Avenue	14.3	3.0	0.23	0.59
62	Little Avenue	63.4	41.7	0.83	0.97
63	Yonge Street	66.0	46.2	0.52	0.87
64	Hurst Drive	54.3	46.8	0.84	1.23
65	The Boulevard	69.6	65.7	1.44	1.49
66	Brennan Avenue	70.1	67.3	1.41	0.35
138	Rail Crossing	67.8	59.5	0.89	1.09
139	Highway 400	2.6	0.0	0.00	0.00
140	Fairview Road	3.4	0.0	0.00	0.00
144	Rail Crossing	23.7	7.2	0.44	0.75
147	Rail Crossing	49.5	41.6	0.50	0.87

Table 31: Hewitts Creek Existing Condition / Future Flows Culvert Capacity Summary

Culvert ID	Location	Size	Capacity (m^3/s)	Level of Service	Design Criteria
83	Mapleview Drive East	1650 × 4800 mm Conc. Box	23.8	1:10 Year	1:100 Year
84	Prince William Way	1200 × 1800 mm Conc. Box	3.8	1:10 Year	1:50 Year
85	Consort Drive	1600 x 3600 mm CSPA	8.1	1:100 Year	1:50 Year
86	Big Bay Point Road	3670 mm Dia. Conc. 3670 mm Dia. CSP 3050 mm Dia. CSP 3340 x 3750 mm CSPA	>123.1	Regional	1:100 Year

Table 32: Hewitts Creek Existing Condition / Future Flows Road/Rail Crossing Summary

Crossing ID	Location	Regulatory Flow (m^3/s)	Weir Flow (m^3/s)	Max. Depth of Weir Flow (m)	Velocity of Weir Flow (m/s)
83	Mapleview Drive East	94.5	88.6	0.79	1.07
84	Prince William Way	15.5	6.5	0.26	0.47
85	Consort Drive	17.3	5.8	0.29	0.68
86	Big Bay Point Road	123.1	0.0	0.00	0.00

Table 33: Lovers Creek Existing Condition / Future Flows Culvert Capacity Summary

Culvert ID	Location	Size	Capacity (m^3/s)	Level of Service	Design Criteria
87	Saunders Road	2 - 1260 x 1840 mm CSPA	> 11.0	Regional	1:50 Year
88	Bayview Drive	1350 mm Dia. CSP	5.4	1:10 Year	1:50 Year
89	Lockhart Road	2 x 650 x 3800 mm Conc. Box	4.0	1:5 Year	1:100 Year
91	Lockhart Road	2400 x 6100 mm Conc. Box	38.1	1:10 Year	1:100 Year
92	Huronia Road	1200 mm Dia. CSP	<3.0	< 1:2 Year	1:100 Year
94	Welham Road	1880 x 2590 mm CSPA	4.7	1:10 Year	1:50 Year
95	Mapleview Drive East	1830 mm × 2330 mm Conc. Box	4.7	1:25 Year	1:100 Year
96	Mapleview Drive East	12 - 1500 x 3000 mm Conc. Box Culverts & 10 m Open Bottom Span Structure	108.2	1:100 Year	1:100 Year
97	Huronia Road	1400 mm Dia. CSP	<4.4	<1:2 Year	1:100 Year
98	Welham Road	2 - 2000 mm Dia. Conc.	17.7	1:10 Year	1:50 Year
99	Ellis Drive	2 - 1350 mm Dia. Conc.	5.3	1:10 Year	1:50 Year
100	Bayview Drive	1400 x 2130 mm CSPA	>6.8	Regional	1:50 Year
101	Highway 400	1200 x 1200 mm Conc. Box	1.1	1:100 Year	1:100 Year
102	Big Bay Point Road	40 m Span Bridge	>335.2	Regional	1:100 Year
103	Yonge Street	35 m Span Bridge	>335.4	Regional	1:100 Year
104	Hurst Drive	76 m Span Bridge	>342.0	Regional	1:100 Year
105	Tollendal Mill Road	4150 mm Dia. CSP	34.0	1:2 Year	1:100 Year
106	Rail Crossing	52 m Span Bridge	>337.5	Regional	1:100 Year
121	Rail Crossing	2250 mm Dia. Conc. 1200 mm Dia. Conc. 800 mm Dia. Conc.	27.2	1:25 Year	1:50 Year
123	Rail Crossing	1050 x 900 mm. Conc. Elliptical	5.8	1:25 Year	1:50 Year
124	Rail Crossing	700 x 900 mm CSPE	>2.6	Regional	1:50 Year
126	Rail Crossing	1200 mm Dia. CSP	6.7	1:10 Year	1:50 Year

Table 34: Lovers Creek Existing Condition / Future Flows Road/Rail Crossing Summary

Crossing ID	Location	Regulatory Flow (m^3/s)	Weir Flow (m^3/s)	Max. Depth of Weir Flow (m)	Velocity of Weir Flow (m/s)
87	Saunders Road	11.0	0.0	0.00	0.00
88	Bayview Drive	21.2	18.1	0.34	0.77
89	Lockhart Road	20.9	15.6	0.64	0.85
90	Huronia Road	52.5	51.4	0.76	0.96
91	Lockhart Road	270.9	259.7	1.55	1.20
92	Huronia Road	25.2	24.9	0.42	0.82
94	Welham Road	18.4	17.7	1.77	0.12
95	Mapleview Drive East	18.5	18.2	3.09	0.05
96	Mapleview Drive East	304.4	199.6	0.92	1.21
97	Huronia Road	26.7	21.5	0.68	0.89
98	Welham Road	31.2	9.1	0.32	0.69
99	Ellis Drive	64.4	59.5	0.90	1.11
100	Bayview Drive	6.8	0.0	0.00	0.00
101	Highway 400	5.1	1.0	0.14	0.44
102	Big Bay Point Road	335.2	0.0	0.00	0.00
103	Yonge Street	335.4	0.0	0.00	0.00
104	Hurst Drive	342.0	0.0	0.00	0.00
105	Tollendal Mill Road	343.3	293.7	2.39	2.01
106	Rail Crossing	337.5	0.0	0.00	0.00
121	Rail Crossing	37.5	9.3	0.30	0.68
123	Rail Crossing	19.5	12.7	0.39	0.75
124	Rail Crossing	2.6	0.0	0.00	0.00
126	Rail Crossing	26.4	19.1	0.35	0.69

Table 35: Bear Creek Existing Condition / Future Flows Culvert Capacity Summary

Culvert ID	Location	Size	Capacity (m^3/s)	Level of Service	Design Criteria
67	Essa Road	1200 mm × 2400 mm Conc. Box	5.5	1:100 Year	1:100 Year
68	Lougheed Road	1550 mm Dia. CSP	7.0	1:100 Year	1:50 Year
69	Essa Road	800 mm × 2150 mm Conc. Box	4.5	1:100 Year	1:100 Year
70	Mapleview Drive West	1525 mm × 3000 mm Conc. Box	>13.9	Regional	1:100 Year
71	Redfern Avenue	1500 mm × 2400 mm Conc. Box	>15.0	Regional	1:50 Year
72	Lougheed Road	2650 mm × 3800 mm CSPA 1500 mm Dia. CSP	>8.1	Regional	1:50 Year
73	County Road 27	2000 mm Dia. CSP	20.7	1:100 Year	1:50 Year
74	County Road 27	1400 mm Dia. CSP	>5.7	Regional	1:50 Year
75	Ardagh Road	965 mm × 1800 mm Conc. Elliptical Twin 1200 mm × 1800 mm Conc. Box	>7.8	Regional	1:100 Year
76	Ardagh Road	1200 mm × 2400 mm Conc. Box	>2.9	Regional	1:100 Year
77	Ardagh Road	1350 mm Dia. Conc.	>2.4	Regional	1:100 Year
78	Ardagh Road	750 mm Dia. Conc.	2.0	1:50 Year	1:100 Year
79	Summerset Road	950 mm Dia. Conc.	2.6	1:25 Year	1:50 Year
80	County Road 27	500 mm Dia. Conc.	<0.3	<1:2 Year	1:50 Year
113	County Road 27	1400 mm Dia. CSP	>2.3	Regional	1:100 Year
133	Mapleview Church Access Road	1220 mm × 4000 mm Conc. Box	3.5	1:100 Year	1:50 Year
134	Rail Crossing	500 mm Dia. CSP	<0.02	<1:2 Year	1:50 Year

Table 36: Bear Creek Existing Condition / Future Flows Road/Rail Crossing Summary

Culvert ID	Location	Regulatory Flow (m^3/s)	Weir Flow (m^3/s)	Depth of Weir Flow (m)	Velocity of Weir Flow (m/s)
67	Essa Road	7.7	1.9	0.06	0.34
68	Lougheed Road	10.3	1.3	0.14	0.46
69	Essa Road	10.0	2.4	0.10	0.41
70	Mapleview Drive West	13.9	0.0	0.00	0.00
71	Redfern Avenue	15.0	0.0	0.00	0.00
72	Lougheed Road	17.6	0.0	0.00	0.00
73	County Road 27	28.9	6.3	0.18	0.57
74	County Road 27	5.7	0.0	0.0	0.07
75	Ardagh Road	7.8	0.0	0.00	0.00
76	Ardagh Road	2.9	0.0	0.00	0.00
77	Ardagh Road	2.4	0.0	0.00	0.00
78	Ardagh Road	2.3	0.1	0.09	0.33
79	Summerset Road	4.6	1.4	0.16	0.51
80	County Road 27	31.2	30.8	0.29	0.58
113	County Road 27	2.3	0.0	0.00	0.00
133	Mapleview Church Access Road	9.1	8.3	0.52	0.19
134	Rail Crossing	27.8	27.8	0.57	0.32

Table 37: Little Lake Creek Existing Condition / Future Flows Culvert Capacity Summary

Culvert ID	Location	Size	Capacity (m^3/s)	Level of Service	Design Criteria
81	Livingstone Street East	Inline Structure	11.5	1:50 Year	1:50 Year

Table 38: Little Lake Creek Existing Condition / Future Flows Road/Rail Crossing Summary

Culvert ID	Location	Regulatory Flow (m^3/s)	Weir Flow (m^3/s)	Max. Depth of Weir Flow (m)	Velocity of Weir Flow (m/s)
81	Livingstone Street East	13.6	0.9	0.05	0.32

Table 39: Georgian Creek Existing Condition / Future Flows Culvert Capacity Summary

Culvert ID	Location	Size	Capacity (m^3/s)	Level of Service	Design Criteria
82	Penetanguishene Road	1000 mm Dia. Conc.	1.9	1:2 Year	1:100 Year

Table 40: Georgian Creek Existing Condition / Future Flows Road/Rail Crossing Summary

Culvert ID	Location	Regulatory Flow (m^3/s)	Weir Flow (m^3/s)	Max. Depth of Weir Flow (m)	Velocity of Weir Flow (m/s)
82	Penetanguishene Road	11.9	9.1	0.48	0.84

Appendix M:
Overland Flow Route Deficiencies

BARRIE CREEKS DRAINAGE STUDY AREA
EXISTING CONDITIONS MAJOR OVERLAND FLOW ROUTE DEFICIENCY SUMMARY
OCTOBER 2017

Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101300068-S	27.751	2.190	0.776	1.698	Yes	Yes	Yes
101300069-S	0.000	0.000	1.034	0.000	-	Yes	-
101300072-S	10.214	0.900	1.363	1.227	-	Yes	Yes
101300135-S	7.507	3.030	0.259	0.783	Yes	-	Yes
101300146-S	0.000	0.000	0.376	0.000	-	Yes	-
101300147-S	0.000	0.000	0.376	0.000	-	Yes	-
101301725-S	2.830	2.490	0.165	0.410	Yes	-	Yes
101301726-S	3.074	2.760	0.165	0.454	Yes	-	Yes
101301736-S	0.975	0.170	0.611	0.104	-	Yes	-
101301738-S	6.796	0.920	0.494	0.454	-	Yes	Yes
101301740-S	5.881	2.350	0.212	0.497	Yes	-	Yes
101301752-S	2.036	1.710	0.165	0.281	Yes	-	-
101301753-S	10.524	1.580	0.470	0.743	-	Yes	Yes
101301754-S	7.769	2.090	0.329	0.688	Yes	Yes	Yes
101301757-S	7.062	2.580	0.282	0.728	Yes	-	Yes
101301773-S	0.000	0.000	0.447	0.000	-	Yes	-
101301775-S	2.637	0.730	0.329	0.240	-	Yes	-
101301796-S	1.740	3.180	0.094	0.299	Yes	-	-
101301869-S	0.000	0.000	0.776	0.000	-	Yes	-
101301925-S	0.687	0.080	0.635	0.051	-	Yes	-
101302005-S	1.583	2.230	0.118	0.262	Yes	-	-
101302006-S	1.631	1.950	0.141	0.275	Yes	-	-
101302037-S	0.000	0.000	0.776	0.000	-	Yes	-
101302308-S	1.497	2.040	0.118	0.240	Yes	-	-
101302309-S	1.800	2.310	0.141	0.326	Yes	-	-
101302316-S	3.260	1.440	0.282	0.406	-	-	Yes
101302317-S	3.840	0.750	0.517	0.388	-	Yes	-
101302324-S	4.164	1.490	0.282	0.420	-	-	Yes
101302353-S	25.635	2.280	0.705	1.607	Yes	Yes	Yes
101302354-S	24.645	2.000	0.752	1.504	Yes	Yes	Yes
101302355-S	29.835	1.720	1.011	1.738	Yes	Yes	Yes
101302356-S	27.114	1.220	1.246	1.520	-	Yes	Yes
101302357-S	21.861	1.280	0.987	1.263	-	Yes	Yes
101302361-S	0.855	1.940	0.094	0.182	Yes	-	-
101302363-S	2.361	2.070	0.165	0.341	Yes	-	-
101302364-S	4.030	1.590	0.259	0.411	-	-	Yes
101302365-S	4.226	1.550	0.376	0.583	-	Yes	Yes
101302378-S	0.695	0.280	0.329	0.092	-	Yes	-

BARRIE CREEKS DRAINAGE STUDY AREA
EXISTING CONDITIONS MAJOR OVERLAND FLOW ROUTE DEFICIENCY SUMMARY
OCTOBER 2017

Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101302380-S	1.616	1.980	0.141	0.279	Yes	-	-
101302390-S	6.083	1.160	0.400	0.463	-	Yes	Yes
101302391-S	5.659	1.840	0.282	0.519	Yes	-	Yes
101302398-S	0.962	1.730	0.094	0.163	Yes	-	-
101302422-S	0.000	0.000	0.329	0.000	-	Yes	-
101302435-S	0.538	2.080	0.071	0.147	Yes	-	-
101302447-S	1.195	0.260	0.611	0.159	-	Yes	-
101302451-S	3.066	1.130	0.306	0.345	-	Yes	-
101302452-S	3.354	0.760	0.400	0.304	-	Yes	-
101302456-S	1.370	0.920	0.306	0.281	-	Yes	-
101302488-S	0.955	1.730	0.118	0.203	Yes	-	-
101302491-S	20.362	1.780	1.387	2.468	Yes	Yes	Yes
101302492-S	7.406	0.750	1.481	1.110	-	Yes	Yes
101302494-S	1.230	1.740	0.118	0.204	Yes	-	-
101302500-S	0.000	0.000	0.423	0.000	-	Yes	-
101302531-S	1.846	1.910	0.141	0.269	Yes	-	-
101302532-S	2.450	1.820	0.188	0.342	Yes	-	-
101302533-S	3.778	2.060	0.212	0.436	Yes	-	Yes
101302534-S	4.774	2.900	0.212	0.613	Yes	-	Yes
101302535-S	16.668	1.160	1.128	1.308	-	Yes	Yes
101302536-S	14.801	1.050	0.870	0.913	-	Yes	Yes
101302548-S	0.000	0.000	0.517	0.000	-	Yes	-
101302549-S	5.414	0.590	0.611	0.360	-	Yes	-
101302598-S	1.048	1.740	0.118	0.204	Yes	-	-
101302599-S	2.191	1.000	0.353	0.353	-	Yes	-
101302600-S	10.992	4.720	0.235	1.109	Yes	-	Yes
101302604-S	0.984	1.790	0.094	0.168	Yes	-	-
101302606-S	1.356	2.020	0.118	0.237	Yes	-	-
101302609-S	10.518	3.150	0.282	0.888	Yes	-	Yes
101302610-S	13.006	2.760	0.329	0.908	Yes	Yes	Yes
101302611-S	10.561	4.370	0.235	1.027	Yes	-	Yes
101302612-S	12.094	4.850	0.235	1.140	Yes	-	Yes
101302614-S	0.816	1.860	0.094	0.175	Yes	-	-
101302619-S	1.643	1.790	0.141	0.252	Yes	-	-
101302622-S	2.098	1.720	0.165	0.283	Yes	-	-
101302633-S	0.390	2.060	0.071	0.145	Yes	-	-
101302666-S	4.511	0.850	0.400	0.340	-	Yes	-
101302693-S	4.002	1.760	0.259	0.455	Yes	-	Yes

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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101302694-S	4.879	0.780	0.447	0.348	-	Yes	-
101302711-S	0.789	3.080	0.071	0.217	Yes	-	-
101302742-S	1.495	2.630	0.118	0.309	Yes	-	-
101302743-S	1.162	1.880	0.118	0.221	Yes	-	-
101302744-S	1.035	2.550	0.094	0.240	Yes	-	-
101302750-S	2.950	2.840	0.165	0.467	Yes	-	Yes
101302751-S	2.277	2.500	0.141	0.353	Yes	-	-
101302757-S	0.684	0.320	0.517	0.165	-	Yes	-
101302760-S	6.646	0.980	0.470	0.461	-	Yes	Yes
101302763-S	4.529	1.170	0.329	0.385	-	Yes	-
101302765-S	4.169	2.130	0.235	0.501	Yes	-	Yes
101302766-S	2.638	0.260	0.776	0.202	-	Yes	-
101302767-S	2.327	0.530	0.682	0.361	-	Yes	-
101302768-S	0.702	0.340	0.893	0.304	-	Yes	-
101302773-S	4.202	0.590	0.517	0.305	-	Yes	-
101302774-S	3.937	1.020	0.329	0.336	-	Yes	-
101302775-S	1.999	0.250	0.635	0.159	-	Yes	-
101302791-S	7.655	1.230	0.470	0.578	-	Yes	Yes
101302795-S	2.104	0.630	0.541	0.341	-	Yes	-
101302796-S	3.143	0.750	0.400	0.300	-	Yes	-
101302798-S	0.525	0.280	0.353	0.099	-	Yes	-
101302810-S	1.211	0.430	0.917	0.394	-	Yes	-
101302811-S	1.820	1.090	0.752	0.820	-	Yes	Yes
101302823-S	0.629	2.010	0.071	0.142	Yes	-	-
101302830-S	4.812	2.490	0.235	0.585	Yes	-	Yes
101302831-S	4.833	2.560	0.235	0.602	Yes	-	Yes
101302833-S	1.067	3.310	0.071	0.233	Yes	-	-
101302834-S	1.476	2.360	0.118	0.277	Yes	-	-
101302840-S	3.476	2.410	0.212	0.510	Yes	-	Yes
101302855-S	11.520	1.120	0.447	0.500	-	Yes	Yes
101302856-S	4.785	0.660	0.376	0.248	-	Yes	-
101302926-S	1.343	2.230	0.118	0.262	Yes	-	-
101302930-S	4.577	0.820	0.423	0.347	-	Yes	-
101302933-S	1.870	0.800	0.987	0.790	-	Yes	Yes
101302956-S	3.801	0.860	0.376	0.323	-	Yes	-
101303008-S	4.941	0.970	0.423	0.410	-	Yes	Yes
101303017-S	0.575	0.250	0.306	0.076	-	Yes	-
101303018-S	0.934	0.780	0.376	0.293	-	Yes	-

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101303019-S	1.344	1.110	0.447	0.496	-	Yes	Yes
101303022-S	10.344	0.330	2.350	0.776	-	Yes	Yes
101303023-S	0.000	0.000	1.175	0.000	-	Yes	-
101303028-S	5.863	1.780	0.635	1.129	Yes	Yes	Yes
101303029-S	37.020	2.280	1.363	3.108	Yes	Yes	Yes
101303030-S	4.629	1.800	0.447	0.804	Yes	Yes	Yes
101303031-S	7.096	3.100	0.259	0.801	Yes	-	Yes
101303045-S	1.305	2.270	0.118	0.267	Yes	-	-
101303046-S	1.983	1.160	0.306	0.354	-	Yes	-
101303048-S	1.344	2.140	0.118	0.251	Yes	-	-
101303049-S	1.186	1.960	0.118	0.230	Yes	-	-
101303052-S	1.571	2.050	0.141	0.289	Yes	-	-
101303054-S	0.228	0.070	0.306	0.021	-	Yes	-
101303065-S	0.565	1.910	0.071	0.135	Yes	-	-
101303066-S	0.630	1.960	0.071	0.138	Yes	-	-
101303067-S	0.716	1.960	0.094	0.184	Yes	-	-
101303068-S	0.932	2.360	0.094	0.222	Yes	-	-
101303071-S	0.000	0.000	0.400	0.000	-	Yes	-
101303081-S	0.165	1.070	0.376	0.402	-	Yes	Yes
101303083-S	6.473	1.010	0.541	0.546	-	Yes	Yes
101303094-S	1.806	2.650	0.118	0.311	Yes	-	-
101303103-S	0.445	1.790	0.071	0.126	Yes	-	-
101303106-S	0.892	2.370	0.094	0.223	Yes	-	-
101303107-S	0.000	0.000	0.400	0.000	-	Yes	-
101303108-S	1.267	0.530	0.729	0.386	-	Yes	-
101303109-S	0.227	0.210	0.353	0.074	-	Yes	-
101303138-S	2.752	0.850	0.329	0.280	-	Yes	-
101303154-S	2.968	2.980	0.165	0.490	Yes	-	Yes
101303155-S	1.726	2.080	0.141	0.293	Yes	-	-
101303166-S	0.378	0.140	0.400	0.056	-	Yes	-
101303167-S	0.000	0.000	0.423	0.000	-	Yes	-
101303168-S	0.863	0.140	0.964	0.135	-	Yes	-
101303169-S	0.789	0.190	0.611	0.116	-	Yes	-
101303180-S	1.092	2.180	0.094	0.205	Yes	-	-
101303181-S	0.962	2.120	0.094	0.199	Yes	-	-
101303188-S	1.426	2.150	0.118	0.253	Yes	-	-
101303189-S	0.804	2.220	0.094	0.209	Yes	-	-
101303190-S	0.951	2.020	0.094	0.190	Yes	-	-

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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101303196-S	2.343	0.830	0.306	0.254	-	Yes	-
101303202-S	3.014	0.800	0.353	0.282	-	Yes	-
101303214-S	0.000	0.000	0.400	0.000	-	Yes	-
101303231-S	9.084	1.240	0.541	0.670	-	Yes	Yes
101303235-S	0.000	0.000	0.306	0.000	-	Yes	-
101303275-S	5.082	3.150	0.165	0.518	Yes	-	Yes
101303276-S	5.499	2.780	0.188	0.523	Yes	-	Yes
101303401-S	5.029	4.060	0.165	0.668	Yes	-	Yes
101303405-S	3.697	2.640	0.188	0.496	Yes	-	Yes
101303491-S	0.000	0.000	0.376	0.000	-	Yes	-
101303622-S	0.000	0.000	0.329	0.000	-	Yes	-
101303628-S	36.117	1.890	1.175	2.221	Yes	Yes	Yes
101303629-S	0.000	0.000	0.353	0.000	-	Yes	-
101303633-S	0.629	0.030	1.222	0.037	-	Yes	-
101303634-S	0.501	0.060	0.964	0.058	-	Yes	-
101303821-S	0.000	0.000	0.376	0.000	-	Yes	-
101304106-S	0.000	0.000	0.376	0.000	-	Yes	-
101304219-S	2.954	2.180	0.165	0.359	Yes	-	-
101304222-S	5.497	2.390	0.259	0.618	Yes	-	Yes
101304227-S	2.581	2.830	0.141	0.399	Yes	-	-
101304231-S	5.784	0.900	0.494	0.444	-	Yes	Yes
101304259-S	0.000	0.000	0.517	0.000	-	Yes	-
101304270-S	4.120	3.450	0.165	0.568	Yes	-	Yes
101304272-S	3.743	2.340	0.188	0.440	Yes	-	Yes
101304274-S	4.125	2.380	0.188	0.447	Yes	-	Yes
101304275-S	4.513	2.530	0.212	0.535	Yes	-	Yes
101304277-S	5.055	3.580	0.165	0.589	Yes	-	Yes
101304284-S	5.005	0.630	0.470	0.296	-	Yes	-
101304298-S	1.407	0.530	2.350	1.246	-	Yes	Yes
101304299-S	5.285	2.210	0.306	0.675	Yes	Yes	Yes
101304301-S	0.453	0.170	0.494	0.084	-	Yes	-
101304302-S	1.509	2.230	0.118	0.262	Yes	-	-
101304306-S	1.039	0.270	0.494	0.133	-	Yes	-
101304307-S	3.317	3.060	0.165	0.503	Yes	-	Yes
101304308-S	3.263	3.790	0.141	0.534	Yes	-	Yes
101304309-S	3.248	3.650	0.141	0.515	Yes	-	Yes
101304311-S	1.519	2.550	0.118	0.300	Yes	-	-
101304312-S	1.267	2.430	0.094	0.228	Yes	-	-

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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101304313-S	0.752	1.950	0.094	0.183	Yes	-	-
101304317-S	0.000	0.000	0.400	0.000	-	Yes	-
101304326-S	3.651	1.030	0.306	0.315	-	Yes	-
101304327-S	0.780	2.090	0.094	0.196	Yes	-	-
101304335-S	1.389	2.160	0.118	0.254	Yes	-	-
101304336-S	0.089	2.050	0.024	0.048	Yes	-	-
101304351-S	1.498	1.990	0.118	0.234	Yes	-	-
101304352-S	1.532	2.120	0.118	0.249	Yes	-	-
101304945-S	0.000	0.000	0.541	0.000	-	Yes	-
101305037-S	0.000	0.000	0.776	0.000	-	Yes	-
101305062-S	0.000	0.000	0.423	0.000	-	Yes	-
101305080-S	0.382	0.120	0.635	0.076	-	Yes	-
101305204-S	0.154	0.070	0.306	0.021	-	Yes	-
101305264-S	0.132	0.060	0.423	0.025	-	Yes	-
101305414-S	3.415	2.490	0.165	0.410	Yes	-	Yes
101305426-S	2.030	0.840	0.494	0.415	-	Yes	Yes
101305448-S	0.000	0.000	0.964	0.000	-	Yes	-
101305450-S	0.000	0.000	0.823	0.000	-	Yes	-
101305576-S	10.492	1.030	0.987	1.017	-	Yes	Yes
101305686-S	8.824	1.420	0.447	0.634	-	Yes	Yes
101305688-S	4.603	0.940	0.376	0.353	-	Yes	-
101305805-S	0.000	0.000	0.494	0.000	-	Yes	-
101305806-S	10.166	0.610	0.964	0.588	-	Yes	Yes
101305880-S	3.425	2.350	0.188	0.442	Yes	-	Yes
101305890-S	0.000	0.000	0.353	0.000	-	Yes	-
101305981-S	0.418	2.660	0.047	0.125	Yes	-	-
101306008-S	3.176	0.810	0.329	0.266	-	Yes	-
101306611-S	2.144	2.510	0.400	1.003	Yes	Yes	Yes
101306631-S	1.461	3.130	0.165	0.515	Yes	-	Yes
101306638_1-S	3.971	1.750	0.235	0.411	Yes	-	Yes
101306687-S	2.624	1.790	0.188	0.337	Yes	-	-
101306763-S	2.880	0.340	0.494	0.168	-	Yes	-
101306764-S	11.947	1.480	0.494	0.730	-	Yes	Yes
101306765-S	2.179	0.690	0.423	0.292	-	Yes	-
101306770-S	0.009	0.000	0.329	0.000	-	Yes	-
101306779-S	0.462	1.810	0.071	0.128	Yes	-	-
101306780-S	0.488	1.860	0.071	0.131	Yes	-	-
101306784-S	0.970	2.200	0.094	0.207	Yes	-	-

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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101306790-S	1.035	1.980	0.094	0.186	Yes	-	-
101306791-S	1.319	2.080	0.118	0.244	Yes	-	-
101306792-S	1.334	1.950	0.118	0.229	Yes	-	-
101306907_1-S	13.105	2.670	0.306	0.816	Yes	Yes	Yes
101306908-S	3.873	1.310	0.423	0.554	-	Yes	Yes
101306912-S	0.238	0.170	0.635	0.108	-	Yes	-
101306913-S	0.239	0.140	0.306	0.043	-	Yes	-
101307318-S	1.132	1.820	0.118	0.214	Yes	-	-
101307319-S	1.394	1.860	0.118	0.219	Yes	-	-
101307599-S	0.094	0.100	0.376	0.038	-	Yes	-
101307600-S	0.591	0.430	0.494	0.212	-	Yes	-
101307631-S	4.084	0.560	0.517	0.290	-	Yes	-
101307633-S	2.550	1.970	0.188	0.370	Yes	-	-
101307634-S	2.844	2.160	0.188	0.406	Yes	-	Yes
101307636-S	2.690	2.250	0.494	1.110	Yes	Yes	Yes
101307641-S	2.784	0.680	0.470	0.320	-	Yes	-
101307658-S	4.717	0.260	1.434	0.373	-	Yes	-
101307659-S	0.368	0.140	0.846	0.118	-	Yes	-
101307697-S	5.271	0.830	0.353	0.293	-	Yes	-
101307698-S	4.980	0.790	0.329	0.260	-	Yes	-
101307699-S	3.518	2.520	0.165	0.415	Yes	-	Yes
101307707_1-S	22.404	2.020	0.682	1.377	Yes	Yes	Yes
101307710-S	16.793	2.900	0.447	1.295	Yes	Yes	Yes
101307712_1-S	22.750	2.960	0.517	1.530	Yes	Yes	Yes
101307714-S	0.845	0.110	0.564	0.062	-	Yes	-
101307715-S	0.782	0.150	0.447	0.067	-	Yes	-
101307720-S	0.864	1.870	0.094	0.176	Yes	-	-
101307724-S	1.074	1.710	0.118	0.201	Yes	-	-
101307768-S	0.811	1.980	0.094	0.186	Yes	-	-
101307774-S	1.360	0.490	0.729	0.357	-	Yes	-
101307775-S	1.847	0.510	0.752	0.384	-	Yes	-
101307776-S	2.435	0.740	0.705	0.522	-	Yes	Yes
101307777-S	21.964	2.580	0.470	1.213	Yes	Yes	Yes
101307778-S	2.861	1.150	0.635	0.730	-	Yes	Yes
101307779-S	15.905	1.420	0.987	1.402	-	Yes	Yes
101307877-S	0.000	0.000	0.306	0.000	-	Yes	-
101307944-S	0.000	0.000	0.376	0.000	-	Yes	-
101308045-S	3.850	1.010	0.306	0.309	-	Yes	-

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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101308163-S	1.350	0.480	0.353	0.169	-	Yes	-
101308216-S	2.446	1.730	0.165	0.285	Yes	-	-
101308222-S	2.526	1.820	0.165	0.299	Yes	-	-
101308231-S	1.097	0.820	0.376	0.308	-	Yes	-
101308232-S	0.882	0.670	0.329	0.220	-	Yes	-
101308233-S	2.564	0.600	0.940	0.564	-	Yes	Yes
101308437-S	4.567	0.950	0.376	0.357	-	Yes	-
101308444-S	0.024	0.000	0.447	0.000	-	Yes	-
101308481-S	15.507	0.510	1.105	0.563	-	Yes	Yes
101308488-S	36.608	1.390	0.823	1.143	-	Yes	Yes
101308493-S	0.160	0.010	1.199	0.012	-	Yes	-
101308498-S	2.242	0.450	0.306	0.137	-	Yes	-
101308552-S	1.146	1.900	0.118	0.223	Yes	-	-
101308553-S	1.393	2.290	0.118	0.269	Yes	-	-
101308554-S	1.461	2.230	0.118	0.262	Yes	-	-
101308587-S	0.000	0.000	0.306	0.000	-	Yes	-
101308639-S	0.000	0.000	0.752	0.000	-	Yes	-
101308690-S	0.000	0.000	0.376	0.000	-	Yes	-
101308691-S	0.000	0.000	0.823	0.000	-	Yes	-
101308713-S	1.336	0.290	0.470	0.136	-	Yes	-
101308715-S	1.876	0.740	0.400	0.296	-	Yes	-
101308717-S	6.025	3.400	0.188	0.639	Yes	-	Yes
101308718-S	5.875	2.560	0.235	0.602	Yes	-	Yes
101308720-S	6.445	2.210	0.259	0.571	Yes	-	Yes
101308721-S	3.760	3.000	0.188	0.564	Yes	-	Yes
101308722-S	3.727	3.230	0.165	0.531	Yes	-	Yes
101308723-S	3.765	2.950	0.188	0.555	Yes	-	Yes
101308724-S	18.272	0.660	1.105	0.729	-	Yes	Yes
101308725-S	18.615	1.590	0.893	1.420	-	Yes	Yes
101308733-S	0.736	1.720	0.094	0.162	Yes	-	-
101308735-S	1.107	2.180	0.094	0.205	Yes	-	-
101308739-S	2.985	3.390	0.141	0.478	Yes	-	Yes
101308740-S	3.061	3.210	0.141	0.453	Yes	-	Yes
101308742-S	1.810	2.260	0.141	0.319	Yes	-	-
101308768-S	4.020	1.770	0.259	0.458	Yes	-	Yes
101308769-S	5.187	1.790	0.282	0.505	Yes	-	Yes
101308770-S	4.075	2.590	0.212	0.548	Yes	-	Yes
101308773-S	4.593	0.780	0.423	0.330	-	Yes	-

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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101308776-S	1.754	0.260	0.470	0.122	-	Yes	-
101308777-S	1.214	0.840	0.423	0.355	-	Yes	-
101308781-S	5.223	2.240	0.259	0.579	Yes	-	Yes
101308782-S	4.466	2.250	0.235	0.529	Yes	-	Yes
101308783-S	4.077	4.330	0.141	0.611	Yes	-	Yes
101308785-S	6.333	1.020	0.517	0.527	-	Yes	Yes
101308787-S	0.000	0.000	1.175	0.000	-	Yes	-
101308803-S	4.771	1.110	0.353	0.391	-	Yes	-
101308820-S	1.560	2.160	0.118	0.254	Yes	-	-
101308821-S	0.996	2.090	0.094	0.196	Yes	-	-
101308822-S	1.236	1.800	0.118	0.212	Yes	-	-
101308833-S	2.672	2.620	0.165	0.431	Yes	-	Yes
101308834-S	2.538	2.290	0.165	0.377	Yes	-	-
101308845-S	0.747	0.360	0.329	0.118	-	Yes	-
101308915-S	1.407	0.440	0.353	0.155	-	Yes	-
101308918-S	0.000	0.000	0.564	0.000	-	Yes	-
101308927-S	3.343	2.770	0.165	0.456	Yes	-	Yes
101309086-S	1.653	2.120	0.141	0.299	Yes	-	-
101309087-S	2.467	2.600	0.141	0.367	Yes	-	-
101309089-S	2.269	2.120	0.141	0.299	Yes	-	-
101309090-S	2.495	2.160	0.141	0.305	Yes	-	-
101309094-S	4.075	0.620	0.470	0.291	-	Yes	-
101309433-S	4.535	1.290	0.306	0.394	-	Yes	-
101309435-S	5.011	2.120	0.259	0.548	Yes	-	Yes
101309436-S	5.612	2.150	0.282	0.606	Yes	-	Yes
101309437-S	8.396	1.330	0.447	0.594	-	Yes	Yes
101309438-S	8.260	1.670	0.376	0.628	-	Yes	Yes
101309440-S	5.096	3.440	0.188	0.647	Yes	-	Yes
101310000-S	1.963	2.410	0.141	0.340	Yes	-	-
101310008-2-S	10.177	1.270	0.541	0.686	-	Yes	Yes
101310008-S	0.917	0.400	0.400	0.160	-	Yes	-
101310017-S	0.000	0.000	0.400	0.000	-	Yes	-
101310031-S	2.272	1.730	0.188	0.325	Yes	-	-
101310039-S	2.438	3.400	0.259	0.879	Yes	-	Yes
101310044-S	2.623	2.200	0.165	0.362	Yes	-	-
101310045-S	2.403	2.690	0.141	0.379	Yes	-	-
101310047-S	2.190	1.940	0.165	0.319	Yes	-	-
101310060-S	1.471	0.450	0.306	0.137	-	Yes	-

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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101310062-S	1.289	0.470	0.306	0.144	-	Yes	-
101310069-S	0.658	0.540	0.376	0.203	-	Yes	-
101310139-S	3.442	2.900	0.141	0.409	Yes	-	Yes
101310140-S	3.472	2.920	0.141	0.412	Yes	-	Yes
101310141-S	3.394	3.060	0.141	0.431	Yes	-	Yes
101310143-S	3.247	2.920	0.141	0.412	Yes	-	Yes
101310144-S	4.781	3.530	0.165	0.581	Yes	-	Yes
101310146-S	0.000	0.000	0.470	0.000	-	Yes	-
101310151-S	0.850	0.110	0.799	0.088	-	Yes	-
101310152-S	0.409	0.130	0.376	0.049	-	Yes	-
101310160_1-S	0.000	0.000	1.175	0.000	-	Yes	-
101310167-S	2.820	0.860	0.329	0.283	-	Yes	-
101310172-S	2.503	1.980	0.188	0.372	Yes	-	-
101310193-S	8.991	1.870	0.423	0.791	Yes	Yes	Yes
101310194-S	0.635	0.100	0.470	0.047	-	Yes	-
101310195-S	4.993	0.410	0.870	0.356	-	Yes	-
101310196-S	7.752	1.240	0.447	0.554	-	Yes	Yes
101310220_3-S	5.748	2.010	0.353	0.709	Yes	Yes	Yes
101310221-S	4.371	1.040	0.353	0.367	-	Yes	-
101310227_1-S	6.706	1.370	0.400	0.547	-	Yes	Yes
101310262-S	3.036	0.890	0.306	0.272	-	Yes	-
101310333-S	1.379	1.730	0.141	0.244	Yes	-	-
101310370-S	1.300	0.580	0.447	0.259	-	Yes	-
101310379-S	3.508	2.660	0.188	0.500	Yes	-	Yes
101310380-S	3.074	2.390	0.188	0.449	Yes	-	Yes
101310381-S	3.884	2.520	0.212	0.533	Yes	-	Yes
101310382-S	1.543	3.530	0.094	0.332	Yes	-	-
101310384-S	4.117	0.960	0.353	0.338	-	Yes	-
101310385-S	1.008	2.000	0.094	0.188	Yes	-	-
101310386-S	1.196	2.130	0.118	0.250	Yes	-	-
101310387-S	2.046	2.460	0.141	0.347	Yes	-	-
101310388-S	1.863	2.120	0.141	0.299	Yes	-	-
101310389-S	6.580	1.010	0.470	0.475	-	Yes	Yes
101310390-S	1.153	1.740	0.118	0.204	Yes	-	-
101310391-S	0.000	0.000	0.353	0.000	-	Yes	-
101310392-S	8.358	1.360	0.447	0.607	-	Yes	Yes
101310393-S	2.941	0.810	0.635	0.514	-	Yes	Yes
101310394-S	1.798	1.120	0.329	0.368	-	Yes	-

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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101310395-S	5.661	0.650	0.588	0.382	-	Yes	-
101310396-S	4.646	3.810	0.165	0.627	Yes	-	Yes
101310397-S	4.488	2.960	0.188	0.556	Yes	-	Yes
101310398-S	1.245	1.930	0.141	0.272	Yes	-	-
101310406-S	0.293	0.090	0.376	0.034	-	Yes	-
101310428-S	2.523	0.580	0.353	0.204	-	Yes	-
101310471-S	0.015	0.010	0.376	0.004	-	Yes	-
101310473-S	0.000	0.000	0.541	0.000	-	Yes	-
101310475-S	2.448	2.570	0.141	0.362	Yes	-	-
101310493-S	0.524	0.090	0.470	0.042	-	Yes	-
101310495-S	0.000	0.000	0.447	0.000	-	Yes	-
101310525-S	0.000	0.000	0.917	0.000	-	Yes	-
101310528-S	0.776	0.370	0.329	0.122	-	Yes	-
101310529-S	3.301	1.790	0.423	0.757	Yes	Yes	Yes
101310530-S	2.514	2.490	0.165	0.410	Yes	-	Yes
101310544-S	0.126	1.900	0.094	0.179	Yes	-	-
101310551-S	0.000	0.000	0.423	0.000	-	Yes	-
101310591-S	0.408	2.600	0.047	0.122	Yes	-	-
101310592-S	1.191	1.780	0.118	0.209	Yes	-	-
101310615-S	1.234	2.400	0.094	0.226	Yes	-	-
101310617-S	1.727	2.130	0.141	0.300	Yes	-	-
101310619-S	1.659	1.610	0.259	0.416	-	-	Yes
101310643_1-S	45.593	1.910	1.387	2.648	Yes	Yes	Yes
101310644_1-S	23.825	2.130	0.705	1.502	Yes	Yes	Yes
101310645_1-S	29.901	2.820	0.752	2.121	Yes	Yes	Yes
101310655-S	1.209	1.870	0.118	0.220	Yes	-	-
101310656-S	1.839	1.960	0.141	0.276	Yes	-	-
101310657-S	2.532	2.050	0.188	0.385	Yes	-	-
101310658-S	2.327	2.150	0.165	0.354	Yes	-	-
101310679-S	1.472	1.870	0.141	0.264	Yes	-	-
101310680-S	1.844	1.930	0.141	0.272	Yes	-	-
101310682-S	2.156	0.920	0.423	0.389	-	Yes	-
101310690_1-S	6.536	3.020	0.235	0.710	Yes	-	Yes
101310699-S	0.909	2.090	0.094	0.196	Yes	-	-
101310700-S	0.657	1.980	0.094	0.186	Yes	-	-
101310701-S	1.130	2.210	0.094	0.208	Yes	-	-
101310739-S	8.567	1.280	0.541	0.692	-	Yes	Yes
101310772-S	0.570	1.340	0.893	1.197	-	Yes	Yes

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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101310860-S	0.939	2.380	0.094	0.224	Yes	-	-
101310866-S	1.618	2.740	0.118	0.322	Yes	-	-
101310877-S	15.593	1.580	0.635	1.003	-	Yes	Yes
101310888-S	0.825	1.770	0.094	0.166	Yes	-	-
101310896_1-S	5.731	1.190	0.376	0.447	-	Yes	Yes
101310925-S	1.186	1.950	0.118	0.229	Yes	-	-
101311083-S	1.835	2.330	0.141	0.329	Yes	-	-
101311144-S	0.000	0.000	0.329	0.000	-	Yes	-
101311145-S	2.740	3.230	0.141	0.455	Yes	-	Yes
101311146-S	2.154	3.270	0.118	0.384	Yes	-	-
101311147-S	4.301	3.450	0.188	0.649	Yes	-	Yes
101311148-S	6.229	0.500	0.752	0.376	-	Yes	-
101311164-S	5.408	3.390	0.188	0.637	Yes	-	Yes
101311174-S	3.362	3.210	0.141	0.453	Yes	-	Yes
101311175-S	3.953	3.340	0.165	0.549	Yes	-	Yes
101311177-S	10.932	1.420	0.517	0.734	-	Yes	Yes
101311178-S	3.549	3.370	0.141	0.475	Yes	-	Yes
101311179-S	3.870	3.490	0.141	0.492	Yes	-	Yes
101311180-S	0.651	1.980	0.071	0.140	Yes	-	-
101311191-S	12.398	0.990	0.541	0.535	-	Yes	Yes
101311192-S	14.195	1.570	0.541	0.849	-	Yes	Yes
101311193-S	10.044	0.940	0.658	0.619	-	Yes	Yes
101311203-S	0.368	0.460	0.306	0.141	-	Yes	-
101311243-S	0.340	1.850	0.047	0.087	Yes	-	-
101311253-S	1.612	1.750	0.141	0.247	Yes	-	-
101311254-S	1.270	2.160	0.118	0.254	Yes	-	-
101311258-S	4.340	2.250	0.212	0.476	Yes	-	Yes
101311259-S	4.246	2.520	0.188	0.474	Yes	-	Yes
101311263-S	2.719	1.900	0.188	0.357	Yes	-	-
101311264-S	6.893	3.420	0.212	0.723	Yes	-	Yes
101311265-S	6.498	3.180	0.235	0.747	Yes	-	Yes
101311266-S	10.830	4.140	0.235	0.973	Yes	-	Yes
101311267-S	10.628	4.290	0.235	1.008	Yes	-	Yes
101311274-S	17.097	0.690	1.293	0.892	-	Yes	Yes
101311284-S	3.486	0.220	0.752	0.165	-	Yes	-
101311285-S	4.892	0.320	1.034	0.331	-	Yes	-
101311286-S	6.559	1.510	0.658	0.994	-	Yes	Yes
101311287-S	2.230	1.950	0.165	0.321	Yes	-	-

BARRIE CREEKS DRAINAGE STUDY AREA
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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101311289-S	0.452	0.260	0.353	0.092	-	Yes	-
101311290-S	2.474	2.070	0.165	0.341	Yes	-	-
101311291-S	3.179	1.790	0.259	0.463	Yes	-	Yes
101311297-S	3.872	0.810	0.329	0.266	-	Yes	-
101311301-S	0.000	0.000	0.682	0.000	-	Yes	-
101311306-S	1.343	2.260	0.118	0.266	Yes	-	-
101311307-S	1.408	2.360	0.118	0.277	Yes	-	-
101311452-S	2.414	2.060	0.141	0.290	Yes	-	-
101311453-S	2.435	1.870	0.165	0.308	Yes	-	-
101311462-S	4.774	1.340	0.306	0.409	-	Yes	Yes
101311655-S	0.381	0.270	0.306	0.082	-	Yes	-
101311781-S	1.668	0.480	0.306	0.147	-	Yes	-
101408031-S	0.580	2.210	0.071	0.156	Yes	-	-
101412839-S	0.901	1.950	0.094	0.183	Yes	-	-
1044_2-S	2.607	1.840	0.588	1.081	Yes	Yes	Yes
1052-S	0.531	3.360	0.047	0.158	Yes	-	-
1081-S	0.441	1.710	0.071	0.121	Yes	-	-
1102-S	18.333	3.980	0.376	1.496	Yes	Yes	Yes
1103-S	22.173	3.370	0.470	1.584	Yes	Yes	Yes
1104_1-S	26.330	3.050	0.564	1.720	Yes	Yes	Yes
120003746_2-S	81.368	2.780	1.598	4.442	Yes	Yes	Yes
120003752-S	3.135	0.140	1.340	0.188	-	Yes	-
120075704-S	0.000	0.000	1.175	0.000	-	Yes	-
120075784-S	0.000	0.000	0.494	0.000	-	Yes	-
120075785-S	0.000	0.000	0.494	0.000	-	Yes	-
120080577-S	1.060	1.880	0.118	0.221	Yes	-	-
120080582-S	0.844	1.870	0.094	0.176	Yes	-	-
120080583-S	1.098	1.800	0.118	0.212	Yes	-	-
120080979-S	1.874	2.870	0.118	0.337	Yes	-	-
120080980-S	1.914	2.730	0.118	0.321	Yes	-	-
120080982-S	5.230	2.540	0.517	1.313	Yes	Yes	Yes

LOVERS CREEK, HEWITTS CREEK AND SANDY COVE DRAINAGE STUDY AREA
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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101303835-S	2.722	0.240	0.729	0.175	-	Yes	-
101303846-S	8.985	1.250	0.517	0.646	-	Yes	Yes
101304174-S	3.480	1.710	0.212	0.362	Yes	-	-
101304175-S	2.005	2.090	0.141	0.295	Yes	-	-
101304191-S	3.809	1.050	0.306	0.321	-	Yes	-
101304369-S	1.102	0.580	0.400	0.232	-	Yes	-
101304371-S	4.402	0.870	0.306	0.266	-	Yes	-
101304394-S	2.028	1.720	0.188	0.323	Yes	-	-
101304395-S	2.464	0.880	0.306	0.269	-	Yes	-
101304396-S	3.406	0.850	0.329	0.280	-	Yes	-
101304421-S	0.831	1.860	0.094	0.175	Yes	-	-
101304427-S	0.000	0.000	0.353	0.000	-	Yes	-
101304471-S	25.969	1.530	0.635	0.971	-	Yes	Yes
101304506-S	0.448	0.110	0.588	0.065	-	Yes	-
101304519-S	0.700	0.340	0.423	0.144	-	Yes	-
101304544-S	0.301	0.070	0.376	0.026	-	Yes	-
101304568-S	3.306	3.520	0.165	0.579	Yes	-	Yes
101304569-S	4.819	2.340	0.235	0.550	Yes	-	Yes
101304608-S	2.770	0.280	0.658	0.184	-	Yes	-
101304638-S	3.245	0.970	0.306	0.296	-	Yes	-
101304654-S	3.321	0.830	0.517	0.429	-	Yes	Yes
101304655-S	3.448	0.630	0.823	0.518	-	Yes	Yes
101304659-S	2.653	0.820	0.329	0.270	-	Yes	-
101304686-S	1.043	1.960	0.094	0.184	Yes	-	-
101304687-S	1.015	1.760	0.118	0.207	Yes	-	-
101304702-S	5.627	1.450	0.329	0.477	-	Yes	Yes
101304710-S	0.494	0.710	0.306	0.217	-	Yes	-
101304711-S	2.266	0.490	0.400	0.196	-	Yes	-
101304713-S	0.057	0.010	0.658	0.007	-	Yes	-
101304714-S	0.000	0.000	0.447	0.000	-	Yes	-
101304796-S	0.000	0.000	0.447	0.000	-	Yes	-
101304823-S	0.000	0.000	0.494	0.000	-	Yes	-
101304826-S	3.268	0.770	0.353	0.271	-	Yes	-
101304828-S	1.874	2.070	0.141	0.292	Yes	-	-
101304829-S	1.330	2.780	0.094	0.261	Yes	-	-
101304853-S	1.946	1.710	0.165	0.281	Yes	-	-
101304864-S	1.921	2.520	0.141	0.355	Yes	-	-
101304865-S	0.135	0.060	0.376	0.023	-	Yes	-

LOVERS CREEK, HEWITTS CREEK AND SANDY COVE DRAINAGE STUDY AREA
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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101304897-S	6.267	1.700	0.259	0.439	-	-	Yes
101304898-S	3.999	3.870	0.165	0.637	Yes	-	Yes
101304899-S	1.798	1.830	0.141	0.258	Yes	-	-
101304919-S	2.470	0.480	0.353	0.169	-	Yes	-
101304923-S	7.645	1.430	0.306	0.437	-	Yes	Yes
101304924-S	7.233	1.580	0.282	0.446	-	-	Yes
101304925-S	7.634	1.340	0.306	0.409	-	Yes	Yes
101304926-S	10.312	1.600	0.329	0.526	-	Yes	Yes
101304927-S	2.115	0.540	0.353	0.190	-	Yes	-
101304930-S	10.306	1.690	0.306	0.516	-	Yes	Yes
101304931-S	10.523	1.640	0.329	0.540	-	Yes	Yes
101304949-S	1.376	0.860	0.329	0.283	-	Yes	-
101304953-S	2.554	1.940	0.188	0.365	Yes	-	-
101304954-S	2.857	2.130	0.188	0.400	Yes	-	Yes
101304955-S	2.090	0.220	0.799	0.176	-	Yes	-
101304956-S	0.000	0.000	0.541	0.000	-	Yes	-
101304958-S	2.443	2.420	0.165	0.398	Yes	-	-
101305072-S	0.772	5.450	0.047	0.256	Yes	-	-
101305077-S	0.773	2.570	0.071	0.181	Yes	-	-
101305176-S	3.829	1.110	0.306	0.339	-	Yes	-
101305181-S	1.504	1.710	0.141	0.241	Yes	-	-
101305184-S	2.855	0.580	0.470	0.273	-	Yes	-
101305186-S	9.157	1.460	0.447	0.652	-	Yes	Yes
101305187-S	1.687	2.180	0.141	0.307	Yes	-	-
101305191-S	0.984	1.860	0.094	0.175	Yes	-	-
101305196-S	4.347	1.320	0.353	0.465	-	Yes	Yes
101305397-S	0.000	0.000	0.306	0.000	-	Yes	-
101305400-S	3.344	2.180	0.188	0.410	Yes	-	Yes
101305402-S	1.653	0.290	0.470	0.136	-	Yes	-
101305404-S	0.960	1.940	0.094	0.182	Yes	-	-
101305469-S	0.000	0.000	0.752	0.000	-	Yes	-
101305476-S	4.429	0.940	0.376	0.353	-	Yes	-
101305477-S	3.086	0.940	0.376	0.353	-	Yes	-
101305497-S	4.296	0.920	0.376	0.346	-	Yes	-
101305509-S	1.498	1.790	0.141	0.252	Yes	-	-
101305604-S	2.709	0.830	0.306	0.254	-	Yes	-
101305653-S	2.649	2.220	0.165	0.365	Yes	-	-
101305654-S	2.921	2.060	0.188	0.387	Yes	-	-

LOVERS CREEK, HEWITTS CREEK AND SANDY COVE DRAINAGE STUDY AREA
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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101305655-S	2.341	2.290	0.165	0.377	Yes	-	-
101305656-S	2.892	2.630	0.165	0.433	Yes	-	Yes
101305658-S	0.752	1.850	0.094	0.174	Yes	-	-
101305660-S	2.884	0.900	0.306	0.275	-	Yes	-
101305676-S	1.588	1.840	0.141	0.259	Yes	-	-
101305692-S	2.312	3.010	0.141	0.424	Yes	-	Yes
101305745-S	0.245	0.150	0.329	0.049	-	Yes	-
101305926-S	0.615	0.020	1.622	0.032	-	Yes	-
101306511-S	0.741	0.430	0.306	0.131	-	Yes	-
101306516-S	7.742	1.210	0.470	0.569	-	Yes	Yes
101306522-S	3.174	1.980	0.212	0.419	Yes	-	Yes
101306527-S	2.108	1.740	0.165	0.286	Yes	-	-
101306544-S	0.558	0.280	0.306	0.086	-	Yes	-
101306545-S	3.958	0.940	0.353	0.331	-	Yes	-
101306548-S	1.208	0.360	0.306	0.110	-	Yes	-
101306576-S	3.133	0.910	0.306	0.278	-	Yes	-
101307293-S	0.000	0.000	0.306	0.000	-	Yes	-
101307306-S	0.000	0.000	0.329	0.000	-	Yes	-
101307333-S	3.447	1.420	0.329	0.467	-	Yes	Yes
101307334-S	1.165	0.770	0.329	0.253	-	Yes	-
101307339-S	1.580	0.350	0.400	0.140	-	Yes	-
101307346-S	0.000	0.000	0.447	0.000	-	Yes	-
101307363-S	0.000	0.000	0.447	0.000	-	Yes	-
101307371-S	1.576	0.790	0.376	0.297	-	Yes	-
101307375-S	0.000	0.000	0.517	0.000	-	Yes	-
101307405-S	1.070	1.870	0.118	0.220	Yes	-	-
101307406-S	1.373	1.920	0.118	0.226	Yes	-	-
101307410-S	2.157	0.730	0.470	0.343	-	Yes	-
101307412-S	3.334	0.760	0.353	0.268	-	Yes	-
101307414-S	0.606	0.280	0.470	0.132	-	Yes	-
101307487-S	1.469	0.490	0.353	0.173	-	Yes	-
101307795-S	0.391	0.380	0.306	0.116	-	Yes	-
101307796-S	1.965	2.040	0.165	0.336	Yes	-	-
101308008-S	0.771	1.860	0.094	0.175	Yes	-	-
101308014-S	0.920	1.890	0.094	0.178	Yes	-	-
101308061-S	4.542	2.050	0.235	0.482	Yes	-	Yes
101308063-S	1.726	1.800	0.141	0.254	Yes	-	-
101308287-S	2.470	0.520	0.376	0.196	-	Yes	-

LOVERS CREEK, HEWITTS CREEK AND SANDY COVE DRAINAGE STUDY AREA
EXISTING CONDITIONS MAJOR OVERLAND FLOW ROUTE DEFICIENCY SUMMARY
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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101308288-S	0.000	0.000	0.799	0.000	-	Yes	-
101308389-S	0.771	1.760	0.094	0.165	Yes	-	-
101308854-S	1.229	0.870	0.423	0.368	-	Yes	-
101308895-S	1.620	1.770	0.141	0.250	Yes	-	-
101308896-S	1.962	1.830	0.141	0.258	Yes	-	-
101310295-S	0.375	0.130	0.306	0.040	-	Yes	-
101310308-S	5.017	1.270	0.329	0.418	-	Yes	Yes
101310321-S	0.788	0.050	1.810	0.090	-	Yes	-
101310322-S	3.173	0.250	1.246	0.311	-	Yes	-
101310697-S	0.000	0.000	0.917	0.000	-	Yes	-
101310698-S	9.253	1.590	1.528	2.429	-	Yes	Yes
101310802-S	1.281	0.530	0.306	0.162	-	Yes	-
101310965-S	2.146	1.800	0.141	0.254	Yes	-	-
101310967-S	2.491	1.790	0.165	0.294	Yes	-	-
101310981-S	0.475	0.110	0.611	0.067	-	Yes	-
101310986-S	2.976	2.030	0.188	0.382	Yes	-	-
101310987-S	3.670	1.950	0.235	0.458	Yes	-	Yes
101310988-S	4.358	1.650	0.306	0.504	-	Yes	Yes
101311009-S	3.953	1.310	0.306	0.400	-	Yes	Yes
101311021-S	4.953	1.200	0.353	0.423	-	Yes	Yes
101311022-S	4.531	0.240	0.893	0.214	-	Yes	-
101311061-S	6.731	0.940	0.353	0.331	-	Yes	-
101311062-S	3.791	0.570	0.329	0.188	-	Yes	-
101311466-S	1.638	0.580	0.400	0.232	-	Yes	-
101311558-S	4.306	1.990	0.306	0.608	Yes	Yes	Yes
101311560-S	2.786	0.770	0.306	0.235	-	Yes	-
101311749-S	1.801	0.230	0.541	0.124	-	Yes	-
120030025-S	16.870	1.380	1.034	1.427	-	Yes	Yes
120030026-S	16.870	1.380	1.034	1.427	-	Yes	Yes
120030028_1-S	4.558	0.430	0.658	0.283	-	Yes	-
120030049-S	3.760	2.110	0.235	0.496	Yes	-	Yes
120030059-S	4.076	0.550	0.588	0.323	-	Yes	-
120030096-S	10.096	1.500	0.564	0.846	-	Yes	Yes
120030098-S	2.655	1.960	0.188	0.368	Yes	-	-
120077013-S	0.000	0.000	0.494	0.000	-	Yes	-
120179442-S	3.490	0.910	0.329	0.299	-	Yes	-

NVCA WATERSHED DRAINAGE STUDY AREA
EXISTING CONDITIONS MAJOR OVERLAND FLOW ROUTE DEFICIENCY SUMMARY
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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101301942-S	4.327	1.530	0.282	0.431	-	-	Yes
101301947-S	0.364	0.130	0.353	0.046	-	Yes	-
101301949-S	4.509	1.800	0.282	0.508	Yes	-	Yes
101301950-S	2.450	2.130	0.188	0.400	Yes	-	Yes
101301951-S	1.571	1.710	0.141	0.241	Yes	-	-
101301952-S	1.521	2.010	0.141	0.283	Yes	-	-
101301954-S	3.312	1.940	0.212	0.410	Yes	-	Yes
101301955-S	3.691	1.720	0.259	0.445	Yes	-	Yes
101301983-S	3.511	0.160	1.246	0.199	-	Yes	-
101301984-S	3.384	2.530	0.188	0.476	Yes	-	Yes
101301985-S	4.321	1.060	0.353	0.374	-	Yes	-
101301992-S	2.355	0.670	0.353	0.236	-	Yes	-
101301993-S	3.987	0.890	0.376	0.335	-	Yes	-
101302040-S	0.000	0.000	0.776	0.000	-	Yes	-
101302048-S	0.000	0.000	0.588	0.000	-	Yes	-
101302058-S	0.274	0.220	0.353	0.078	-	Yes	-
101302098-S	1.953	0.910	0.329	0.299	-	Yes	-
101302119-S	2.249	0.500	0.517	0.259	-	Yes	-
101302140-S	0.536	1.830	0.071	0.129	Yes	-	-
101302144-S	0.000	0.000	0.376	0.000	-	Yes	-
101302170-S	0.861	0.270	0.564	0.152	-	Yes	-
101302171_1-	5.845	0.870	0.447	0.388	-	Yes	-
101302172-S	4.985	0.790	0.447	0.353	-	Yes	-
101302198-S	0.519	2.010	0.071	0.142	Yes	-	-
101302200-S	0.512	0.150	0.423	0.063	-	Yes	-
101302205-S	0.000	0.000	1.175	0.000	-	Yes	-
101302250-S	0.846	0.110	0.517	0.057	-	Yes	-
101302288-S	1.264	1.480	0.282	0.417	-	-	Yes
101302289-S	1.098	1.850	0.118	0.217	Yes	-	-
101302292-S	1.093	2.020	0.118	0.237	Yes	-	-
101302328-S	3.753	0.830	0.329	0.273	-	Yes	-
101302330-S	2.753	0.930	0.306	0.284	-	Yes	-
101302331-S	2.809	0.880	0.306	0.269	-	Yes	-
101302333-S	0.690	0.090	0.588	0.053	-	Yes	-
101302335-S	2.032	0.120	1.011	0.121	-	Yes	-
101302336-S	1.725	0.510	0.470	0.240	-	Yes	-
101302541-S	0.471	0.150	0.376	0.056	-	Yes	-
101302572-S	7.294	1.140	0.400	0.455	-	Yes	Yes

NVCA WATERSHED DRAINAGE STUDY AREA
EXISTING CONDITIONS MAJOR OVERLAND FLOW ROUTE DEFICIENCY SUMMARY
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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101302573-S	2.015	0.220	0.611	0.134	-	Yes	-
101302579-S	2.435	0.770	0.329	0.253	-	Yes	-
101302586-S	0.555	0.180	0.329	0.059	-	Yes	-
101302645-S	3.962	0.890	0.376	0.335	-	Yes	-
101302657-S	2.519	1.160	0.400	0.463	-	Yes	Yes
101303386-S	0.320	2.750	0.047	0.129	Yes	-	-
101303387-S	20.415	1.660	0.917	1.521	-	Yes	Yes
101303444-S	2.753	0.770	0.329	0.253	-	Yes	-
101303453-S	1.150	2.280	0.094	0.214	Yes	-	-
101303454-S	0.776	1.930	0.094	0.181	Yes	-	-
101303502-S	0.000	0.000	1.175	0.000	-	Yes	-
101303527-S	2.902	0.850	0.353	0.300	-	Yes	-
101303535-S	2.762	0.970	0.423	0.410	-	Yes	Yes
101303549-S	2.329	0.540	0.705	0.381	-	Yes	-
101303550-S	0.167	0.040	0.470	0.019	-	Yes	-
101303561-S	0.943	0.560	0.376	0.211	-	Yes	-
101303586-S	3.198	2.000	0.212	0.423	Yes	-	Yes
101303587-S	3.117	2.630	0.188	0.494	Yes	-	Yes
101303588-S	2.907	1.120	0.306	0.342	-	Yes	-
101303597-S	1.017	1.800	0.118	0.212	Yes	-	-
101303605-S	2.387	1.170	0.306	0.357	-	Yes	-
101303607-S	0.397	1.760	0.071	0.124	Yes	-	-
101303649-S	1.403	0.570	0.306	0.174	-	Yes	-
101303698-S	0.288	0.300	0.400	0.120	-	Yes	-
101303716-S	0.498	0.220	0.306	0.067	-	Yes	-
101303717-S	4.451	1.060	0.353	0.374	-	Yes	-
101303770-S	0.539	0.140	0.376	0.053	-	Yes	-
101303771-S	5.149	1.050	0.400	0.419	-	Yes	Yes
101303772-S	0.000	0.000	0.494	0.000	-	Yes	-
101303813-S	0.000	0.000	0.423	0.000	-	Yes	-
101303946-S	0.907	2.540	0.094	0.239	Yes	-	-
101303977-S	2.424	0.630	0.329	0.207	-	Yes	-
101304003-S	2.682	0.840	0.329	0.276	-	Yes	-
101304006-S	3.812	0.890	0.400	0.356	-	Yes	-
101304031-S	1.578	0.530	0.306	0.162	-	Yes	-
101304032-S	4.359	1.290	0.376	0.485	-	Yes	Yes
101304044-S	1.997	1.800	0.165	0.296	Yes	-	-
101304045-S	2.293	1.820	0.188	0.342	Yes	-	-

NVCA WATERSHED DRAINAGE STUDY AREA
EXISTING CONDITIONS MAJOR OVERLAND FLOW ROUTE DEFICIENCY SUMMARY
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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101304065-S	0.771	2.000	0.094	0.188	Yes	-	-
101304083-S	1.544	0.310	0.447	0.138	-	Yes	-
101304084-S	2.789	0.890	0.306	0.272	-	Yes	-
101304093-S	0.188	0.330	0.306	0.101	-	Yes	-
101304205-S	10.068	1.030	0.447	0.460	-	Yes	Yes
101304210-S	2.054	1.940	0.141	0.274	Yes	-	-
101305283-S	4.429	0.930	0.423	0.393	-	Yes	-
101305284-S	2.211	0.560	0.353	0.197	-	Yes	-
101305285-S	0.779	0.090	0.400	0.036	-	Yes	-
101305616-S	0.519	0.080	0.658	0.053	-	Yes	-
101305617-S	1.065	0.150	0.682	0.102	-	Yes	-
101305619-S	1.278	0.200	0.682	0.136	-	Yes	-
101305620-S	1.608	0.500	0.635	0.317	-	Yes	-
101305621-S	3.550	0.750	0.376	0.282	-	Yes	-
101305847-S	0.807	0.420	0.447	0.188	-	Yes	-
101306060-S	0.585	1.910	0.071	0.135	Yes	-	-
101306061-S	0.521	2.020	0.071	0.142	Yes	-	-
101306062-S	0.522	2.020	0.071	0.142	Yes	-	-
101306063-S	0.563	2.070	0.071	0.146	Yes	-	-
101306068-S	0.558	2.030	0.071	0.143	Yes	-	-
101306069-S	0.601	2.110	0.071	0.149	Yes	-	-
101306074-S	0.608	1.820	0.071	0.128	Yes	-	-
101306075-S	0.882	2.170	0.094	0.204	Yes	-	-
101306077-S	0.887	2.280	0.094	0.214	Yes	-	-
101306078-S	0.928	2.330	0.094	0.219	Yes	-	-
101306079-S	0.958	2.330	0.094	0.219	Yes	-	-
101306080-S	1.004	2.290	0.094	0.215	Yes	-	-
101306582_2-	0.298	0.160	0.306	0.049	-	Yes	-
101306586-S	0.735	0.930	0.376	0.350	-	Yes	-
101306702-S	4.747	1.570	0.282	0.443	-	-	Yes
101306719-S	0.853	0.190	0.635	0.121	-	Yes	-
101306721-S	1.789	1.760	0.165	0.290	Yes	-	-
101306753-S	0.000	0.000	0.611	0.000	-	Yes	-
101306754-S	0.379	0.070	0.423	0.030	-	Yes	-
101307505-S	0.349	0.060	0.564	0.034	-	Yes	-
101307730-S	3.032	0.700	0.494	0.345	-	Yes	-
101307741-S	1.312	0.770	0.353	0.271	-	Yes	-
101307750-S	0.357	0.490	0.470	0.230	-	Yes	-

NVCA WATERSHED DRAINAGE STUDY AREA
EXISTING CONDITIONS MAJOR OVERLAND FLOW ROUTE DEFICIENCY SUMMARY
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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101307755-S	24.833	0.860	1.293	1.112	-	Yes	Yes
101307757-S	2.385	2.670	0.235	0.627	Yes	-	Yes
101307762_2-	2.756	0.840	0.306	0.257	-	Yes	-
101308005-S	0.339	1.840	0.071	0.130	Yes	-	-
101308110-S	0.000	0.000	0.752	0.000	-	Yes	-
101308134-S	0.000	0.000	0.705	0.000	-	Yes	-
101308168-S	0.000	0.000	0.306	0.000	-	Yes	-
101308182-S	1.443	0.700	0.306	0.214	-	Yes	-
101308183-S	2.325	0.600	0.353	0.212	-	Yes	-
101308184-S	11.520	1.450	0.541	0.784	-	Yes	Yes
101308337-S	0.000	0.000	0.588	0.000	-	Yes	-
101308346-S	1.406	1.860	0.118	0.219	Yes	-	-
101308924-S	0.042	0.050	0.353	0.018	-	Yes	-
101309330-S	14.367	1.040	0.564	0.587	-	Yes	Yes
101309338-S	1.378	0.650	0.329	0.214	-	Yes	-
101309345-S	6.496	0.410	0.964	0.395	-	Yes	-
101309354-S	0.000	0.000	0.588	0.000	-	Yes	-
101309376-S	1.083	0.370	0.306	0.113	-	Yes	-
101309384-S	0.920	0.300	0.306	0.092	-	Yes	-
101309520-S	0.000	0.000	0.799	0.000	-	Yes	-
101309521-S	0.000	0.000	0.893	0.000	-	Yes	-
101309522-S	3.318	0.460	0.917	0.422	-	Yes	Yes
101309523-S	5.047	1.460	0.329	0.480	-	Yes	Yes
101309571-S	5.702	1.130	0.400	0.451	-	Yes	Yes
101309577-S	9.937	1.650	0.447	0.737	-	Yes	Yes
101309579-S	2.197	1.860	0.188	0.350	Yes	-	-
101309580-S	3.927	2.590	0.212	0.548	Yes	-	Yes
101309585-S	3.494	3.270	0.165	0.538	Yes	-	Yes
101309586-S	2.767	1.860	0.212	0.393	Yes	-	-
101309587-S	1.307	0.280	0.400	0.112	-	Yes	-
101309588-S	1.287	0.280	0.470	0.132	-	Yes	-
101309591-S	0.762	1.780	0.094	0.167	Yes	-	-
101309593-S	1.487	2.110	0.118	0.248	Yes	-	-
101309594-S	1.433	2.160	0.118	0.254	Yes	-	-
101309605-S	0.310	0.190	0.353	0.067	-	Yes	-
101309607-S	0.090	0.050	0.306	0.015	-	Yes	-
101309612-S	1.243	1.770	0.118	0.208	Yes	-	-
101309613-S	1.253	2.100	0.118	0.247	Yes	-	-

NVCA WATERSHED DRAINAGE STUDY AREA
EXISTING CONDITIONS MAJOR OVERLAND FLOW ROUTE DEFICIENCY SUMMARY
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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101309626_1-	2.442	0.480	0.306	0.147	-	Yes	-
101309627-S	1.874	1.010	0.376	0.380	-	Yes	-
101309628-S	1.972	0.540	0.823	0.444	-	Yes	Yes
101310351-S	1.101	2.070	0.118	0.243	Yes	-	-
101310352-S	0.930	1.940	0.094	0.182	Yes	-	-
101310418-S	0.000	0.000	0.376	0.000	-	Yes	-
101310584-S	4.044	1.460	0.282	0.412	-	-	Yes
101310649-S	1.599	0.380	0.447	0.170	-	Yes	-
101310653-S	3.852	1.140	0.400	0.455	-	Yes	Yes
101310840-S	6.293	0.910	0.494	0.449	-	Yes	Yes
101310855-S	5.928	1.160	0.400	0.463	-	Yes	Yes
101311331-S	0.944	0.360	0.306	0.110	-	Yes	-
101311376-S	3.891	0.820	0.376	0.308	-	Yes	-
101401499-S	0.423	2.620	0.047	0.123	Yes	-	-
101408876-S	0.000	0.000	0.447	0.000	-	Yes	-
1022-S	0.000	0.000	0.447	0.000	-	Yes	-
1118-S	0.185	0.420	0.423	0.178	-	Yes	-
120000833-S	0.247	0.200	0.447	0.089	-	Yes	-
120000835-S	0.218	0.220	0.353	0.078	-	Yes	-
120076372-S	0.725	0.080	0.635	0.051	-	Yes	-
120076373-S	9.231	0.860	0.705	0.606	-	Yes	Yes
120078396-S	0.002	0.000	0.893	0.000	-	Yes	-
120078889-S	4.712	0.760	1.857	1.411	-	Yes	Yes

BARRIE CREEKS DRAINAGE STUDY AREA
FUTURE CONDITIONS MAJOR OVERLAND FLOW ROUTE DEFICIENCY SUMMARY
OCTOBER 2017

Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101300068-S	39.801	2.490	0.940	2.341	Yes	Yes	Yes
101300069-S	13.991	0.570	1.363	0.777	-	Yes	Yes
101300072-S	31.163	0.930	2.303	2.142	-	Yes	Yes
101300116-S	2.626	1.820	0.188	0.342	Yes	-	-
101300121-S	30.573	1.540	0.705	1.086	-	Yes	Yes
101300135-S	9.977	3.150	0.282	0.888	Yes	-	Yes
101300146-S	0.292	0.040	1.034	0.041	-	Yes	-
101300147-S	0.000	0.000	0.400	0.000	-	Yes	-
101300226-S	5.274	0.930	0.423	0.393	-	Yes	-
101301725-S	3.417	2.650	0.188	0.498	Yes	-	Yes
101301726-S	3.811	2.940	0.188	0.553	Yes	-	Yes
101301732-S	0.761	0.990	0.376	0.372	-	Yes	-
101301736-S	1.026	0.170	0.635	0.108	-	Yes	-
101301737-S	4.422	1.350	0.306	0.412	-	Yes	Yes
101301738-S	7.034	0.940	0.517	0.486	-	Yes	Yes
101301740-S	11.725	2.710	0.259	0.701	Yes	-	Yes
101301752-S	2.765	1.940	0.188	0.365	Yes	-	-
101301753-S	16.952	1.900	0.588	1.116	Yes	Yes	Yes
101301754-S	13.138	2.400	0.400	0.959	Yes	Yes	Yes
101301755-S	5.468	1.390	0.306	0.425	-	Yes	Yes
101301757-S	12.311	2.920	0.353	1.029	Yes	Yes	Yes
101301760-S	3.482	1.330	0.400	0.531	-	Yes	Yes
101301772-S	1.411	2.090	0.188	0.393	Yes	-	-
101301773-S	0.449	0.060	0.564	0.034	-	Yes	-
101301775-S	3.333	1.100	0.400	0.439	-	Yes	Yes
101301776-S	2.330	0.680	0.329	0.224	-	Yes	-
101301777-S	7.294	0.760	0.682	0.518	-	Yes	Yes
101301779-S	0.766	2.670	0.071	0.188	Yes	-	-
101301787-S	3.996	1.490	0.282	0.420	-	-	Yes
101301796-S	2.733	3.800	0.118	0.447	Yes	-	Yes
101301807-S	8.122	1.180	0.494	0.582	-	Yes	Yes
101301820-S	3.305	0.470	0.635	0.298	-	Yes	-
101301822-S	3.962	1.970	0.212	0.417	Yes	-	Yes
101301823-S	2.603	1.980	0.165	0.326	Yes	-	-
101301824-S	4.064	0.560	0.353	0.197	-	Yes	-
101301825-S	4.044	1.140	0.329	0.375	-	Yes	-
101301850-S	0.777	0.240	0.400	0.096	-	Yes	-
101301869-S	0.000	0.000	0.917	0.000	-	Yes	-

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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101301872-S	1.444	1.170	0.400	0.467	-	Yes	Yes
101301886-S	2.399	0.720	0.306	0.220	-	Yes	-
101301902-S	2.140	0.850	0.306	0.260	-	Yes	-
101301925-S	3.834	0.300	0.940	0.282	-	Yes	-
101301928-S	0.883	1.790	0.094	0.168	Yes	-	-
101301929-S	4.306	1.740	0.212	0.368	Yes	-	-
101301968-S	6.468	1.180	0.306	0.360	-	Yes	-
101301971-S	4.522	1.720	0.212	0.364	Yes	-	-
101302005-S	2.247	2.550	0.141	0.360	Yes	-	-
101302006-S	2.264	2.170	0.165	0.357	Yes	-	-
101302018-S	2.733	2.830	0.141	0.399	Yes	-	-
101302035-S	0.141	0.050	0.353	0.018	-	Yes	-
101302037-S	0.000	0.000	0.917	0.000	-	Yes	-
101302224-S	1.093	0.710	0.353	0.250	-	Yes	-
101302231-S	3.544	1.090	0.306	0.333	-	Yes	-
101302306-S	0.959	1.710	0.118	0.201	Yes	-	-
101302307-S	2.848	1.920	0.188	0.361	Yes	-	-
101302308-S	2.203	2.400	0.141	0.338	Yes	-	-
101302309-S	2.502	2.590	0.141	0.365	Yes	-	-
101302315-S	4.458	1.150	0.329	0.378	-	Yes	-
101302316-S	4.571	1.480	0.353	0.522	-	Yes	Yes
101302317-S	5.423	0.770	0.611	0.470	-	Yes	Yes
101302324-S	5.644	1.560	0.306	0.477	-	Yes	Yes
101302346-S	0.898	1.800	0.094	0.169	Yes	-	-
101302347-S	0.965	2.320	0.094	0.218	Yes	-	-
101302348-S	0.968	2.180	0.094	0.205	Yes	-	-
101302353-S	37.241	2.590	0.846	2.191	Yes	Yes	Yes
101302354-S	36.351	2.350	0.917	2.154	Yes	Yes	Yes
101302355-S	43.724	2.100	1.175	2.468	Yes	Yes	Yes
101302356-S	38.119	1.470	1.434	2.107	-	Yes	Yes
101302357-S	32.001	1.570	1.152	1.808	-	Yes	Yes
101302361-S	1.100	2.140	0.094	0.201	Yes	-	-
101302363-S	3.564	2.310	0.212	0.489	Yes	-	Yes
101302364-S	5.192	1.620	0.353	0.571	-	Yes	Yes
101302365-S	6.070	1.570	0.588	0.922	-	Yes	Yes
101302372-S	0.490	1.740	0.071	0.123	Yes	-	-
101302378-S	0.931	0.290	0.353	0.102	-	Yes	-
101302379-S	3.648	1.010	0.306	0.309	-	Yes	-

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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101302380-S	2.656	2.350	0.165	0.387	Yes	-	-
101302387-S	0.854	2.350	0.094	0.221	Yes	-	-
101302390-S	8.070	1.290	0.447	0.576	-	Yes	Yes
101302391-S	7.545	1.960	0.329	0.645	Yes	Yes	Yes
101302398-S	2.588	2.220	0.141	0.313	Yes	-	-
101302411-S	2.208	1.870	0.141	0.264	Yes	-	-
101302422-S	7.826	0.890	0.588	0.523	-	Yes	Yes
101302435-S	1.352	2.820	0.094	0.265	Yes	-	-
101302447-S	2.467	0.210	0.729	0.153	-	Yes	-
101302450-S	1.392	1.780	0.141	0.251	Yes	-	-
101302451-S	3.278	1.010	0.353	0.356	-	Yes	-
101302452-S	5.461	0.940	0.447	0.420	-	Yes	Yes
101302453-S	2.820	0.940	0.353	0.331	-	Yes	-
101302456-S	0.458	0.410	0.423	0.173	-	Yes	-
101302481-S	1.324	0.780	0.400	0.312	-	Yes	-
101302482-S	1.914	1.840	0.165	0.303	Yes	-	-
101302488-S	1.846	2.210	0.141	0.312	Yes	-	-
101302491-S	19.982	1.770	1.598	2.828	Yes	Yes	Yes
101302492-S	7.158	0.750	1.669	1.251	-	Yes	Yes
101302493-S	1.133	1.730	0.118	0.203	Yes	-	-
101302494-S	2.733	2.300	0.165	0.378	Yes	-	-
101302500-S	0.000	0.000	0.517	0.000	-	Yes	-
101302531-S	3.439	2.420	0.188	0.455	Yes	-	Yes
101302532-S	4.005	2.100	0.235	0.494	Yes	-	Yes
101302533-S	5.412	2.220	0.259	0.574	Yes	-	Yes
101302534-S	6.536	3.070	0.235	0.721	Yes	-	Yes
101302535-S	34.763	1.710	1.222	2.090	Yes	Yes	Yes
101302536-S	14.058	0.990	1.034	1.024	-	Yes	Yes
101302537-S	0.610	0.850	0.306	0.260	-	Yes	-
101302548-S	0.000	0.000	0.541	0.000	-	Yes	-
101302549-S	5.406	0.590	0.635	0.374	-	Yes	-
101302598-S	1.732	2.090	0.118	0.246	Yes	-	-
101302599-S	2.706	0.980	0.376	0.368	-	Yes	-
101302600-S	18.089	5.140	0.282	1.449	Yes	-	Yes
101302604-S	1.613	2.120	0.118	0.249	Yes	-	-
101302606-S	2.186	2.380	0.141	0.336	Yes	-	-
101302608-S	1.548	0.540	0.329	0.178	-	Yes	-
101302609-S	17.460	3.590	0.329	1.181	Yes	Yes	Yes

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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101302610-S	19.494	3.070	0.400	1.226	Yes	Yes	Yes
101302611-S	17.793	4.760	0.306	1.454	Yes	Yes	Yes
101302612-S	19.673	5.170	0.306	1.579	Yes	Yes	Yes
101302613-S	0.646	1.850	0.071	0.130	Yes	-	-
101302614-S	1.236	2.030	0.118	0.239	Yes	-	-
101302619-S	2.390	1.950	0.188	0.367	Yes	-	-
101302622-S	3.124	1.970	0.188	0.370	Yes	-	-
101302632-S	1.982	2.740	0.118	0.322	Yes	-	-
101302633-S	0.735	2.180	0.071	0.154	Yes	-	-
101302662-S	0.701	1.850	0.094	0.174	Yes	-	-
101302666-S	7.601	1.040	0.494	0.513	-	Yes	Yes
101302667-S	6.907	1.640	0.376	0.617	-	Yes	Yes
101302668-S	2.413	1.410	0.329	0.464	-	Yes	Yes
101302679-S	1.776	1.880	0.141	0.265	Yes	-	-
101302693-S	7.939	1.960	0.329	0.645	Yes	Yes	Yes
101302694-S	8.084	0.940	0.564	0.530	-	Yes	Yes
101302696-S	2.500	2.220	0.165	0.365	Yes	-	-
101302697-S	2.401	2.590	0.141	0.365	Yes	-	-
101302711-S	1.316	3.610	0.094	0.339	Yes	-	-
101302725-S	1.097	1.920	0.118	0.226	Yes	-	-
101302727-S	1.150	1.960	0.118	0.230	Yes	-	-
101302742-S	3.003	3.450	0.141	0.486	Yes	-	Yes
101302743-S	2.478	2.840	0.141	0.400	Yes	-	Yes
101302744-S	2.338	3.560	0.118	0.418	Yes	-	Yes
101302746-S	0.548	1.760	0.071	0.124	Yes	-	-
101302750-S	4.449	3.230	0.188	0.607	Yes	-	Yes
101302751-S	3.611	2.920	0.188	0.549	Yes	-	Yes
101302757-S	1.604	0.350	0.635	0.222	-	Yes	-
101302758-S	1.345	1.760	0.141	0.248	Yes	-	-
101302760-S	6.237	0.930	0.470	0.437	-	Yes	Yes
101302762-S	0.594	0.840	0.353	0.296	-	Yes	-
101302763-S	7.978	1.410	0.423	0.596	-	Yes	Yes
101302765-S	6.605	2.220	0.306	0.678	Yes	Yes	Yes
101302766-S	3.368	0.280	0.893	0.250	-	Yes	-
101302767-S	3.370	0.550	0.776	0.427	-	Yes	Yes
101302768-S	1.092	0.360	1.011	0.364	-	Yes	-
101302773-S	6.806	0.710	0.611	0.434	-	Yes	Yes
101302774-S	6.591	1.220	0.400	0.487	-	Yes	Yes

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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101302775-S	2.858	0.280	0.729	0.204	-	Yes	-
101302776-S	2.327	1.340	0.329	0.441	-	Yes	Yes
101302791-S	7.624	1.230	0.470	0.578	-	Yes	Yes
101302793-S	2.050	0.710	0.306	0.217	-	Yes	-
101302795-S	6.884	0.670	0.705	0.472	-	Yes	Yes
101302796-S	3.270	0.540	0.494	0.266	-	Yes	-
101302798-S	0.713	0.260	0.376	0.098	-	Yes	-
101302810-S	1.496	0.420	1.011	0.424	-	Yes	Yes
101302811-S	1.768	0.970	0.870	0.843	-	Yes	Yes
101302823-S	2.286	3.240	0.118	0.381	Yes	-	-
101302830-S	6.551	2.580	0.259	0.667	Yes	-	Yes
101302831-S	6.596	2.660	0.259	0.688	Yes	-	Yes
101302833-S	2.135	4.220	0.094	0.397	Yes	-	-
101302834-S	2.819	3.090	0.141	0.436	Yes	-	Yes
101302840-S	4.503	2.340	0.235	0.550	Yes	-	Yes
101302855-S	11.818	1.120	0.470	0.526	-	Yes	Yes
101302856-S	8.641	0.730	0.517	0.377	-	Yes	-
101302857-S	2.246	0.610	0.306	0.186	-	Yes	-
101302888-S	0.000	0.000	0.588	0.000	-	Yes	-
101302926-S	3.966	3.520	0.165	0.579	Yes	-	Yes
101302930-S	4.487	0.810	0.423	0.343	-	Yes	-
101302931-S	2.054	2.560	0.141	0.361	Yes	-	-
101302933-S	2.917	0.810	1.434	1.161	-	Yes	Yes
101302934-S	1.745	0.960	0.306	0.293	-	Yes	-
101302939-S	0.954	1.740	0.094	0.164	Yes	-	-
101302945-S	1.421	1.930	0.118	0.227	Yes	-	-
101302946-S	1.257	1.910	0.118	0.224	Yes	-	-
101302955-S	3.704	0.900	0.376	0.338	-	Yes	-
101302974-S	1.468	1.960	0.118	0.230	Yes	-	-
101302981-S	0.923	1.920	0.094	0.180	Yes	-	-
101302982-S	0.786	1.940	0.094	0.182	Yes	-	-
101302984-S	8.358	1.250	0.494	0.617	-	Yes	Yes
101302985-S	0.203	0.350	0.329	0.115	-	Yes	-
101303004-S	0.141	0.250	0.376	0.094	-	Yes	-
101303011-S	0.798	0.590	0.423	0.250	-	Yes	-
101303012-S	2.978	0.400	0.541	0.216	-	Yes	-
101303014-S	9.006	1.180	0.517	0.610	-	Yes	Yes
101303017-S	0.843	0.280	0.423	0.118	-	Yes	-

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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101303018-S	0.959	0.890	0.494	0.439	-	Yes	Yes
101303019-S	1.406	1.100	0.564	0.620	-	Yes	Yes
101303022-S	25.466	0.570	2.350	1.340	-	Yes	Yes
101303023-S	0.000	0.000	1.175	0.000	-	Yes	-
101303028-S	8.194	1.790	0.752	1.346	Yes	Yes	Yes
101303029-S	41.406	2.380	1.481	3.524	Yes	Yes	Yes
101303030-S	6.222	1.810	0.564	1.021	Yes	Yes	Yes
101303031-S	9.464	3.190	0.282	0.900	Yes	-	Yes
101303033-S	4.650	1.770	0.235	0.416	Yes	-	Yes
101303034-S	4.698	1.010	0.329	0.332	-	Yes	-
101303035-S	2.009	2.000	0.165	0.329	Yes	-	-
101303045-S	2.165	2.530	0.141	0.357	Yes	-	-
101303046-S	5.298	1.580	0.423	0.668	-	Yes	Yes
101303048-S	2.809	2.810	0.165	0.462	Yes	-	Yes
101303049-S	2.504	2.600	0.141	0.367	Yes	-	-
101303050-S	0.853	1.800	0.094	0.169	Yes	-	-
101303052-S	2.879	2.510	0.165	0.413	Yes	-	Yes
101303054-S	0.477	0.110	0.376	0.041	-	Yes	-
101303059-S	1.832	2.080	0.141	0.293	Yes	-	-
101303060-S	1.626	0.510	0.306	0.156	-	Yes	-
101303064-S	0.690	1.810	0.094	0.170	Yes	-	-
101303065-S	1.062	2.390	0.094	0.225	Yes	-	-
101303066-S	1.162	2.450	0.094	0.230	Yes	-	-
101303067-S	1.290	2.440	0.094	0.229	Yes	-	-
101303068-S	1.675	2.830	0.118	0.333	Yes	-	-
101303071-S	0.000	0.000	0.447	0.000	-	Yes	-
101303081-S	0.248	1.170	0.494	0.577	-	Yes	Yes
101303083-S	7.755	1.180	0.776	0.915	-	Yes	Yes
101303094-S	4.452	3.630	0.188	0.682	Yes	-	Yes
101303103-S	2.257	3.180	0.118	0.374	Yes	-	-
101303106-S	1.428	2.610	0.094	0.245	Yes	-	-
101303107-S	0.350	0.050	0.635	0.032	-	Yes	-
101303108-S	2.642	0.530	1.175	0.623	-	Yes	Yes
101303109-S	1.600	0.310	0.682	0.211	-	Yes	-
101303113-S	4.445	1.400	0.306	0.428	-	Yes	Yes
101303138-S	2.743	0.840	0.329	0.276	-	Yes	-
101303154-S	4.385	3.390	0.188	0.637	Yes	-	Yes
101303155-S	1.983	2.150	0.165	0.354	Yes	-	-

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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101303166-S	1.419	0.360	0.635	0.228	-	Yes	-
101303167-S	0.000	0.000	0.658	0.000	-	Yes	-
101303168-S	1.804	0.140	1.410	0.197	-	Yes	-
101303169-S	1.580	0.220	1.058	0.233	-	Yes	-
101303170-S	1.157	1.790	0.306	0.547	Yes	Yes	Yes
101303171-S	1.094	2.100	0.094	0.197	Yes	-	-
101303172-S	1.018	1.980	0.094	0.186	Yes	-	-
101303173-S	0.943	1.870	0.094	0.176	Yes	-	-
101303180-S	1.743	2.620	0.118	0.308	Yes	-	-
101303181-S	1.470	2.470	0.118	0.290	Yes	-	-
101303183-S	1.863	1.830	0.165	0.301	Yes	-	-
101303185-S	0.511	1.340	0.353	0.472	-	Yes	Yes
101303188-S	2.063	2.260	0.141	0.319	Yes	-	-
101303189-S	1.554	2.870	0.094	0.270	Yes	-	-
101303190-S	1.777	2.660	0.118	0.313	Yes	-	-
101303196-S	2.327	0.820	0.306	0.251	-	Yes	-
101303202-S	4.060	1.330	0.400	0.531	-	Yes	Yes
101303214-S	0.000	0.000	0.564	0.000	-	Yes	-
101303215-S	0.738	0.860	0.329	0.283	-	Yes	-
101303231-S	10.198	1.610	0.658	1.059	-	Yes	Yes
101303235-S	8.670	1.030	0.564	0.581	-	Yes	Yes
101303242-S	4.865	1.040	0.376	0.391	-	Yes	-
101303275-S	10.715	3.650	0.235	0.858	Yes	-	Yes
101303276-S	11.151	2.960	0.259	0.765	Yes	-	Yes
101303336-S	0.000	0.000	0.353	0.000	-	Yes	-
101303337-S	8.437	2.060	0.447	0.920	Yes	Yes	Yes
101303401-S	7.751	4.660	0.188	0.876	Yes	-	Yes
101303405-S	6.002	2.940	0.235	0.691	Yes	-	Yes
101303406-S	1.341	1.870	0.118	0.220	Yes	-	-
101303407-S	1.383	1.930	0.118	0.227	Yes	-	-
101303411-S	1.368	2.260	0.118	0.266	Yes	-	-
101303491-S	0.637	0.070	0.635	0.044	-	Yes	-
101303514-S	0.077	0.050	0.376	0.019	-	Yes	-
101303622-S	0.000	0.000	0.611	0.000	-	Yes	-
101303628-S	46.382	2.170	1.551	3.366	Yes	Yes	Yes
101303629-S	0.000	0.000	0.588	0.000	-	Yes	-
101303632-S	0.352	0.890	0.470	0.418	-	Yes	Yes
101303633-S	2.645	0.110	1.481	0.163	-	Yes	-

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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101303634-S	0.773	0.090	1.152	0.104	-	Yes	-
101303635-S	0.000	0.000	0.329	0.000	-	Yes	-
101303636-S	0.044	0.190	0.306	0.058	-	Yes	-
101303639-S	1.351	2.160	0.118	0.254	Yes	-	-
101303641-S	1.712	1.850	0.141	0.261	Yes	-	-
101303702-S	1.812	1.820	0.165	0.299	Yes	-	-
101303703-S	1.758	1.730	0.165	0.285	Yes	-	-
101303818-S	0.659	2.040	0.071	0.144	Yes	-	-
101303821-S	0.000	0.000	0.588	0.000	-	Yes	-
101303823-S	0.661	1.840	0.094	0.173	Yes	-	-
101304106-S	0.612	0.080	0.588	0.047	-	Yes	-
101304219-S	4.380	2.440	0.212	0.516	Yes	-	Yes
101304222-S	8.114	2.520	0.306	0.770	Yes	Yes	Yes
101304227-S	4.072	3.280	0.188	0.617	Yes	-	Yes
101304231-S	8.791	1.020	0.564	0.575	-	Yes	Yes
101304250-S	0.818	0.360	0.329	0.118	-	Yes	-
101304252-S	2.619	1.130	0.306	0.345	-	Yes	-
101304256-S	1.482	1.920	0.141	0.271	Yes	-	-
101304259-S	0.000	0.000	1.058	0.000	-	Yes	-
101304270-S	6.273	3.960	0.188	0.744	Yes	-	Yes
101304272-S	5.497	2.530	0.212	0.535	Yes	-	Yes
101304273-S	5.557	1.480	0.306	0.452	-	Yes	Yes
101304274-S	6.069	2.610	0.235	0.613	Yes	-	Yes
101304275-S	6.444	2.720	0.235	0.639	Yes	-	Yes
101304277-S	7.804	4.000	0.212	0.846	Yes	-	Yes
101304278-S	2.873	3.150	0.141	0.444	Yes	-	Yes
101304282-S	0.790	2.330	0.071	0.164	Yes	-	-
101304284-S	13.443	1.040	0.658	0.684	-	Yes	Yes
101304298-S	1.429	0.540	2.350	1.269	-	Yes	Yes
101304299-S	10.419	2.430	0.470	1.142	Yes	Yes	Yes
101304301-S	1.486	0.270	0.964	0.260	-	Yes	-
101304302-S	2.867	2.810	0.165	0.462	Yes	-	Yes
101304306-S	1.178	0.260	0.541	0.141	-	Yes	-
101304307-S	5.834	3.520	0.212	0.744	Yes	-	Yes
101304308-S	5.775	4.560	0.188	0.857	Yes	-	Yes
101304309-S	5.743	4.390	0.188	0.825	Yes	-	Yes
101304310-S	0.455	1.910	0.071	0.135	Yes	-	-
101304311-S	2.892	3.380	0.141	0.477	Yes	-	Yes

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101304312-S	2.434	3.150	0.141	0.444	Yes	-	Yes
101304313-S	1.074	2.250	0.094	0.212	Yes	-	-
101304314-S	0.792	1.900	0.094	0.179	Yes	-	-
101304315-S	8.198	1.890	0.329	0.622	Yes	Yes	Yes
101304316-S	0.662	1.830	0.094	0.172	Yes	-	-
101304317-S	0.000	0.000	0.423	0.000	-	Yes	-
101304318-S	0.938	1.850	0.094	0.174	Yes	-	-
101304326-S	3.607	1.020	0.353	0.360	-	Yes	-
101304327-S	1.074	2.330	0.094	0.219	Yes	-	-
101304328-S	0.910	1.790	0.094	0.168	Yes	-	-
101304335-S	2.637	2.740	0.141	0.386	Yes	-	-
101304336-S	0.146	2.180	0.047	0.102	Yes	-	-
101304347-S	0.092	0.040	0.306	0.012	-	Yes	-
101304348-S	0.000	0.000	0.306	0.000	-	Yes	-
101304351-S	2.160	2.210	0.141	0.312	Yes	-	-
101304352-S	2.172	2.420	0.141	0.341	Yes	-	-
101304353-S	0.736	1.960	0.094	0.184	Yes	-	-
101304945-S	5.606	0.480	0.729	0.350	-	Yes	-
101304966-S	0.089	0.040	0.329	0.013	-	Yes	-
101305037-S	0.000	0.000	0.940	0.000	-	Yes	-
101305054-S	2.497	0.840	0.329	0.276	-	Yes	-
101305062-S	0.000	0.000	0.447	0.000	-	Yes	-
101305080-S	0.626	0.140	0.705	0.099	-	Yes	-
101305110-S	2.178	0.860	0.353	0.303	-	Yes	-
101305117-S	0.000	0.000	0.306	0.000	-	Yes	-
101305204-S	0.199	0.100	0.306	0.031	-	Yes	-
101305264-S	0.192	0.090	0.705	0.063	-	Yes	-
101305414-S	4.984	2.750	0.212	0.582	Yes	-	Yes
101305426-S	1.899	0.830	0.635	0.527	-	Yes	Yes
101305448-S	0.101	0.000	1.199	0.000	-	Yes	-
101305450-S	6.121	0.350	1.105	0.387	-	Yes	-
101305576-S	11.384	0.960	1.199	1.151	-	Yes	Yes
101305686-S	8.842	1.430	0.447	0.638	-	Yes	Yes
101305688-S	5.930	1.040	0.423	0.440	-	Yes	Yes
101305726-S	3.242	0.610	0.306	0.186	-	Yes	-
101305727-S	1.920	0.680	0.470	0.320	-	Yes	-
101305738-S	0.455	0.330	0.376	0.124	-	Yes	-
101305739-S	0.223	0.110	0.423	0.047	-	Yes	-

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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101305740-S	0.322	0.220	0.400	0.088	-	Yes	-
101305741-S	0.689	0.750	0.329	0.247	-	Yes	-
101305805-S	0.000	0.000	0.541	0.000	-	Yes	-
101305806-S	11.739	0.640	1.058	0.677	-	Yes	Yes
101305880-S	4.345	2.430	0.212	0.514	Yes	-	Yes
101305890-S	0.000	0.000	0.423	0.000	-	Yes	-
101305979-S	2.004	1.740	0.141	0.245	Yes	-	-
101305981-S	0.586	2.810	0.071	0.198	Yes	-	-
101306006-S	1.879	1.740	0.141	0.245	Yes	-	-
101306008-S	3.811	0.860	0.353	0.303	-	Yes	-
101306611-S	3.377	2.640	0.494	1.303	Yes	Yes	Yes
101306630-S	1.393	2.330	0.118	0.274	Yes	-	-
101306631-S	3.481	3.130	0.799	2.501	Yes	Yes	Yes
101306638_1-S	12.983	2.100	0.400	0.839	Yes	Yes	Yes
101306642-S	1.948	0.940	0.329	0.309	-	Yes	-
101306645-S	0.452	1.050	0.470	0.494	-	Yes	Yes
101306665-S	4.910	2.760	0.212	0.584	Yes	-	Yes
101306666-S	4.726	2.690	0.188	0.506	Yes	-	Yes
101306667-S	4.510	2.530	0.212	0.535	Yes	-	Yes
101306670-S	1.552	0.570	0.306	0.174	-	Yes	-
101306671-S	0.627	0.470	0.306	0.144	-	Yes	-
101306687-S	4.299	1.920	0.235	0.451	Yes	-	Yes
101306763-S	2.182	0.290	0.658	0.191	-	Yes	-
101306764-S	12.931	1.520	0.564	0.857	-	Yes	Yes
101306765-S	3.594	0.680	0.517	0.352	-	Yes	-
101306767-S	0.242	0.140	0.306	0.043	-	Yes	-
101306770-S	0.159	0.050	0.447	0.022	-	Yes	-
101306773-S	1.075	2.510	0.094	0.236	Yes	-	-
101306779-S	2.161	3.130	0.118	0.368	Yes	-	-
101306780-S	2.215	3.150	0.118	0.370	Yes	-	-
101306781-S	1.696	2.180	0.141	0.307	Yes	-	-
101306784-S	3.372	3.550	0.141	0.501	Yes	-	Yes
101306785-S	2.792	3.050	0.141	0.430	Yes	-	Yes
101306790-S	1.605	2.260	0.118	0.266	Yes	-	-
101306791-S	1.919	2.290	0.118	0.269	Yes	-	-
101306792-S	2.153	2.210	0.141	0.312	Yes	-	-
101306905-S	0.889	0.610	0.400	0.244	-	Yes	-
101306906-S	1.675	0.440	0.353	0.155	-	Yes	-

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101306907_2-S	31.422	4.550	0.470	2.139	Yes	Yes	Yes
101306908-S	3.022	0.920	0.517	0.476	-	Yes	Yes
101306912-S	0.281	0.170	0.870	0.148	-	Yes	-
101306913-S	0.540	0.250	0.423	0.106	-	Yes	-
101307318-S	1.647	2.060	0.118	0.242	Yes	-	-
101307319-S	2.062	2.160	0.141	0.305	Yes	-	-
101307599-S	0.219	0.160	0.376	0.060	-	Yes	-
101307600-S	0.714	0.450	0.611	0.275	-	Yes	-
101307630-S	0.666	2.170	0.071	0.153	Yes	-	-
101307631-S	4.108	0.550	0.517	0.284	-	Yes	-
101307633-S	3.484	2.090	0.212	0.442	Yes	-	Yes
101307634-S	3.859	2.280	0.212	0.482	Yes	-	Yes
101307636-S	3.801	2.150	0.564	1.213	Yes	Yes	Yes
101307641-S	5.584	0.660	0.752	0.496	-	Yes	Yes
101307642-S	1.006	1.810	0.118	0.213	Yes	-	-
101307658-S	6.367	0.260	1.551	0.403	-	Yes	Yes
101307659-S	0.500	0.140	0.917	0.128	-	Yes	-
101307677-S	1.578	1.770	0.141	0.250	Yes	-	-
101307682-S	0.907	0.400	0.329	0.132	-	Yes	-
101307697-S	6.776	0.840	0.376	0.316	-	Yes	-
101307698-S	6.507	0.880	0.353	0.310	-	Yes	-
101307699-S	4.992	2.720	0.188	0.511	Yes	-	Yes
101307702-S	0.956	1.940	0.094	0.182	Yes	-	-
101307703-S	0.781	2.020	0.094	0.190	Yes	-	-
101307707_1-S	33.548	2.360	0.846	1.997	Yes	Yes	Yes
101307710-S	30.374	3.390	0.588	1.992	Yes	Yes	Yes
101307712_1-S	36.294	3.460	0.658	2.277	Yes	Yes	Yes
101307714-S	1.190	0.140	0.611	0.086	-	Yes	-
101307715-S	1.101	0.180	0.494	0.089	-	Yes	-
101307720-S	1.296	2.030	0.118	0.239	Yes	-	-
101307723-S	1.453	1.970	0.118	0.231	Yes	-	-
101307724-S	1.658	2.030	0.141	0.286	Yes	-	-
101307768-S	1.429	2.250	0.118	0.264	Yes	-	-
101307774-S	2.136	0.530	0.870	0.461	-	Yes	Yes
101307775-S	2.715	0.550	0.870	0.478	-	Yes	Yes
101307776-S	3.335	0.740	0.846	0.626	-	Yes	Yes
101307777-S	34.288	2.930	0.611	1.790	Yes	Yes	Yes
101307778-S	3.918	1.120	0.776	0.869	-	Yes	Yes

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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101307779-S	15.391	1.390	1.152	1.601	-	Yes	Yes
101307858-S	1.108	1.880	0.118	0.221	Yes	-	-
101307865-S	3.016	0.720	0.447	0.321	-	Yes	-
101307870-S	10.336	1.370	0.517	0.708	-	Yes	Yes
101307871-S	10.525	1.310	0.541	0.708	-	Yes	Yes
101307877-S	1.984	0.450	0.376	0.169	-	Yes	-
101307879-S	10.613	1.500	0.517	0.776	-	Yes	Yes
101307944-S	0.000	0.000	0.447	0.000	-	Yes	-
101308045-S	4.007	0.640	0.329	0.211	-	Yes	-
101308161-S	0.000	0.000	0.353	0.000	-	Yes	-
101308163-S	1.173	0.250	0.400	0.100	-	Yes	-
101308210-S	0.711	1.750	0.094	0.165	Yes	-	-
101308211-S	1.267	1.720	0.141	0.243	Yes	-	-
101308213-S	3.233	1.870	0.188	0.352	Yes	-	-
101308214-S	3.367	1.830	0.212	0.387	Yes	-	-
101308216-S	3.410	1.900	0.212	0.402	Yes	-	Yes
101308222-S	3.523	1.950	0.212	0.412	Yes	-	Yes
101308230-S	0.591	0.390	0.306	0.119	-	Yes	-
101308231-S	1.540	0.840	0.447	0.375	-	Yes	-
101308232-S	2.404	0.740	0.400	0.296	-	Yes	-
101308233-S	2.818	0.640	1.011	0.647	-	Yes	Yes
101308352-S	3.682	0.900	0.329	0.296	-	Yes	-
101308418-S	0.474	1.950	0.071	0.137	Yes	-	-
101308419-S	0.654	1.730	0.094	0.163	Yes	-	-
101308421-S	8.039	1.230	0.376	0.462	-	Yes	Yes
101308435-S	0.347	0.230	0.306	0.070	-	Yes	-
101308437-S	4.677	0.950	0.376	0.357	-	Yes	-
101308444-S	0.486	0.060	0.517	0.031	-	Yes	-
101308471-S	1.512	0.380	0.588	0.223	-	Yes	-
101308480-S	2.736	1.310	0.400	0.523	-	Yes	Yes
101308481-S	19.119	0.550	1.293	0.711	-	Yes	Yes
101308488-S	46.475	1.610	0.893	1.438	-	Yes	Yes
101308493-S	1.220	0.060	1.246	0.075	-	Yes	-
101308496-S	1.051	0.280	0.353	0.099	-	Yes	-
101308497-S	2.993	0.490	0.306	0.150	-	Yes	-
101308498-S	3.970	0.450	0.423	0.190	-	Yes	-
101308499-S	1.771	0.260	0.329	0.086	-	Yes	-
101308552-S	1.550	2.140	0.118	0.251	Yes	-	-

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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101308553-S	1.859	2.470	0.118	0.290	Yes	-	-
101308554-S	1.939	2.310	0.118	0.271	Yes	-	-
101308564-S	0.612	0.060	0.705	0.042	-	Yes	-
101308587-S	0.000	0.000	0.353	0.000	-	Yes	-
101308639-S	9.639	0.440	1.246	0.548	-	Yes	Yes
101308652-S	5.892	2.780	0.212	0.588	Yes	-	Yes
101308653-S	5.430	2.580	0.212	0.546	Yes	-	Yes
101308690-S	0.529	0.160	0.423	0.068	-	Yes	-
101308691-S	26.398	1.190	1.246	1.482	-	Yes	Yes
101308713-S	2.097	0.350	0.541	0.189	-	Yes	-
101308714-S	1.041	0.630	0.353	0.222	-	Yes	-
101308715-S	2.523	0.690	0.494	0.341	-	Yes	-
101308717-S	9.345	3.700	0.235	0.870	Yes	-	Yes
101308718-S	9.206	2.730	0.282	0.770	Yes	-	Yes
101308720-S	9.883	2.360	0.306	0.721	Yes	Yes	Yes
101308721-S	6.404	3.490	0.212	0.738	Yes	-	Yes
101308722-S	6.339	3.640	0.212	0.770	Yes	-	Yes
101308723-S	6.330	3.240	0.235	0.761	Yes	-	Yes
101308724-S	24.418	0.720	1.293	0.931	-	Yes	Yes
101308725-S	22.313	1.640	1.081	1.773	-	Yes	Yes
101308726-S	8.817	1.530	0.376	0.575	-	Yes	Yes
101308727-S	8.002	2.230	0.282	0.629	Yes	-	Yes
101308728-S	7.657	1.890	0.306	0.577	Yes	Yes	Yes
101308730-S	8.490	1.710	0.353	0.603	Yes	Yes	Yes
101308733-S	1.051	1.980	0.094	0.186	Yes	-	-
101308734-S	0.734	1.790	0.094	0.168	Yes	-	-
101308735-S	1.537	2.470	0.118	0.290	Yes	-	-
101308739-S	5.295	4.080	0.188	0.767	Yes	-	Yes
101308740-S	5.359	3.810	0.188	0.716	Yes	-	Yes
101308742-S	3.201	2.740	0.165	0.451	Yes	-	Yes
101308744-S	0.835	2.070	0.094	0.195	Yes	-	-
101308745-S	1.203	1.820	0.118	0.214	Yes	-	-
101308757-S	1.140	1.720	0.118	0.202	Yes	-	-
101308768-S	5.825	1.820	0.306	0.556	Yes	Yes	Yes
101308769-S	7.439	1.920	0.329	0.632	Yes	Yes	Yes
101308770-S	6.337	2.760	0.259	0.713	Yes	-	Yes
101308773-S	4.424	0.760	0.423	0.321	-	Yes	-
101308776-S	2.452	0.320	0.517	0.165	-	Yes	-

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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101308777-S	1.638	0.830	0.447	0.371	-	Yes	-
101308781-S	7.819	2.380	0.306	0.727	Yes	Yes	Yes
101308782-S	6.816	2.380	0.282	0.671	Yes	-	Yes
101308783-S	7.362	5.170	0.188	0.972	Yes	-	Yes
101308785-S	9.431	1.000	0.611	0.611	-	Yes	Yes
101308787-S	0.000	0.000	1.175	0.000	-	Yes	-
101308803-S	2.067	0.590	0.306	0.180	-	Yes	-
101308806-S	0.329	0.980	0.376	0.368	-	Yes	-
101308807-S	3.936	1.010	0.329	0.332	-	Yes	-
101308809-S	1.563	2.180	0.118	0.256	Yes	-	-
101308810-S	2.260	2.330	0.141	0.329	Yes	-	-
101308818-S	1.456	1.920	0.141	0.271	Yes	-	-
101308819-S	1.586	1.990	0.141	0.281	Yes	-	-
101308820-S	2.404	2.530	0.141	0.357	Yes	-	-
101308821-S	1.875	2.740	0.118	0.322	Yes	-	-
101308822-S	2.157	2.310	0.141	0.326	Yes	-	-
101308824_1-S	4.891	1.820	0.259	0.470	Yes	-	Yes
101308833-S	4.187	2.880	0.188	0.541	Yes	-	Yes
101308834-S	4.429	2.540	0.282	0.716	Yes	-	Yes
101308838-S	0.000	0.000	0.705	0.000	-	Yes	-
101308845-S	0.838	0.370	0.494	0.183	-	Yes	-
101308915-S	1.830	0.400	0.376	0.150	-	Yes	-
101308918-S	0.000	0.000	0.799	0.000	-	Yes	-
101308927-S	4.871	3.150	0.188	0.592	Yes	-	Yes
101309086-S	3.599	2.950	0.165	0.485	Yes	-	Yes
101309087-S	4.475	3.100	0.188	0.583	Yes	-	Yes
101309089-S	4.614	2.430	0.188	0.457	Yes	-	Yes
101309090-S	4.964	2.390	0.188	0.449	Yes	-	Yes
101309092-S	2.215	1.870	0.165	0.308	Yes	-	-
101309093-S	1.867	2.160	0.141	0.305	Yes	-	-
101309094-S	5.459	0.730	0.517	0.377	-	Yes	-
101309096-S	0.852	1.830	0.094	0.172	Yes	-	-
101309433-S	6.053	1.410	0.353	0.497	-	Yes	Yes
101309434-S	4.411	1.540	0.282	0.434	-	-	Yes
101309435-S	6.880	2.210	0.282	0.623	Yes	-	Yes
101309436-S	7.504	2.130	0.306	0.651	Yes	Yes	Yes
101309437-S	10.894	1.460	0.517	0.755	-	Yes	Yes
101309438-S	10.843	1.800	0.447	0.804	Yes	Yes	Yes

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101309440-S	8.084	3.680	0.235	0.865	Yes	-	Yes
101310000-S	3.131	2.830	0.165	0.466	Yes	-	Yes
101310001-S	3.250	1.750	0.212	0.370	Yes	-	-
101310008-2-S	10.328	1.280	0.541	0.692	-	Yes	Yes
101310008-S	1.592	0.510	0.447	0.228	-	Yes	-
101310017-S	0.001	0.000	0.470	0.000	-	Yes	-
101310018-S	0.516	2.170	0.071	0.153	Yes	-	-
101310027-S	0.000	0.000	0.470	0.000	-	Yes	-
101310030-S	3.022	2.570	0.165	0.423	Yes	-	Yes
101310031-S	3.897	1.890	0.235	0.444	Yes	-	Yes
101310039-S	3.839	3.370	0.447	1.505	Yes	Yes	Yes
101310041-S	1.030	1.850	0.118	0.217	Yes	-	-
101310042-S	1.016	1.750	0.118	0.206	Yes	-	-
101310043-S	0.959	1.730	0.118	0.203	Yes	-	-
101310044-S	3.908	2.410	0.212	0.510	Yes	-	Yes
101310045-S	3.717	3.090	0.165	0.508	Yes	-	Yes
101310046-S	1.121	0.320	0.306	0.098	-	Yes	-
101310047-S	3.311	2.170	0.212	0.459	Yes	-	Yes
101310051-S	1.035	1.730	0.118	0.203	Yes	-	-
101310054-S	3.151	1.740	0.259	0.450	Yes	-	Yes
101310055-S	1.907	2.000	0.141	0.282	Yes	-	-
101310058-S	2.479	2.090	0.165	0.344	Yes	-	-
101310060-S	2.434	0.550	0.353	0.194	-	Yes	-
101310062-S	1.271	0.470	0.494	0.232	-	Yes	-
101310069-S	0.969	0.510	0.494	0.252	-	Yes	-
101310090-S	1.400	0.690	0.329	0.227	-	Yes	-
101310091-S	0.965	0.570	0.376	0.214	-	Yes	-
101310139-S	7.253	3.350	0.188	0.630	Yes	-	Yes
101310140-S	7.316	3.380	0.188	0.635	Yes	-	Yes
101310141-S	7.278	3.570	0.188	0.671	Yes	-	Yes
101310142-S	2.742	2.270	0.165	0.373	Yes	-	-
101310143-S	7.168	3.460	0.188	0.650	Yes	-	Yes
101310144-S	10.421	4.150	0.212	0.878	Yes	-	Yes
101310145-S	8.189	2.960	0.282	0.835	Yes	-	Yes
101310146-S	5.068	0.480	0.658	0.316	-	Yes	-
101310151-S	8.457	0.230	2.045	0.470	-	Yes	Yes
101310152-S	12.728	0.580	1.551	0.900	-	Yes	Yes
101310153-S	12.747	2.200	0.823	1.810	Yes	Yes	Yes

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101310160_1-S	0.000	0.000	1.175	0.000	-	Yes	-
101310166-S	0.000	0.000	0.329	0.000	-	Yes	-
101310167-S	4.000	0.840	0.541	0.454	-	Yes	Yes
101310171-S	6.131	1.340	0.329	0.441	-	Yes	Yes
101310172-S	4.833	2.410	0.235	0.566	Yes	-	Yes
101310174-S	6.517	1.590	0.259	0.411	-	-	Yes
101310193-S	14.312	2.010	0.517	1.039	Yes	Yes	Yes
101310194-S	6.519	0.660	0.635	0.419	-	Yes	Yes
101310195-S	5.454	0.390	0.893	0.348	-	Yes	-
101310196-S	6.812	1.240	0.447	0.554	-	Yes	Yes
101310198-S	9.527	1.310	0.517	0.677	-	Yes	Yes
101310199-S	4.225	0.660	0.729	0.481	-	Yes	Yes
101310200-S	4.116	0.580	0.799	0.463	-	Yes	Yes
101310201-S	1.650	0.580	0.353	0.204	-	Yes	-
101310209-S	0.311	0.130	0.306	0.040	-	Yes	-
101310220_3-S	11.911	1.970	0.635	1.250	Yes	Yes	Yes
101310221-S	7.798	1.090	0.658	0.717	-	Yes	Yes
101310222-S	0.655	0.260	0.588	0.153	-	Yes	-
101310223-S	0.598	0.340	0.494	0.168	-	Yes	-
101310227_1-S	13.056	1.460	0.705	1.029	-	Yes	Yes
101310239-S	4.245	1.050	0.329	0.345	-	Yes	-
101310243-S	0.244	0.140	0.306	0.043	-	Yes	-
101310333-S	3.626	2.110	0.212	0.446	Yes	-	Yes
101310334-S	3.681	1.550	0.259	0.401	-	-	Yes
101310336-S	4.530	1.480	0.282	0.417	-	-	Yes
101310341-S	2.570	1.740	0.188	0.327	Yes	-	-
101310370-S	1.749	0.620	0.564	0.350	-	Yes	-
101310377-S	1.724	1.850	0.141	0.261	Yes	-	-
101310378-S	2.320	1.790	0.188	0.337	Yes	-	-
101310379-S	4.865	2.810	0.212	0.594	Yes	-	Yes
101310380-S	4.498	2.590	0.212	0.548	Yes	-	Yes
101310381-S	5.427	2.660	0.235	0.625	Yes	-	Yes
101310382-S	2.025	3.930	0.094	0.369	Yes	-	-
101310384-S	4.043	0.950	0.353	0.335	-	Yes	-
101310385-S	1.378	2.250	0.118	0.264	Yes	-	-
101310386-S	1.646	2.420	0.118	0.284	Yes	-	-
101310387-S	4.050	3.080	0.188	0.579	Yes	-	Yes
101310388-S	3.756	2.630	0.188	0.494	Yes	-	Yes

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101310389-S	6.544	1.000	0.494	0.494	-	Yes	Yes
101310390-S	2.772	2.410	0.165	0.396	Yes	-	-
101310391-S	0.053	0.010	0.400	0.004	-	Yes	-
101310392-S	8.275	1.410	0.470	0.663	-	Yes	Yes
101310393-S	3.781	0.810	0.705	0.571	-	Yes	Yes
101310394-S	2.587	1.190	0.376	0.447	-	Yes	Yes
101310395-S	7.890	0.760	0.658	0.500	-	Yes	Yes
101310396-S	6.744	4.130	0.212	0.873	Yes	-	Yes
101310397-S	6.080	3.110	0.235	0.731	Yes	-	Yes
101310398-S	1.721	1.980	0.165	0.326	Yes	-	-
101310406-S	0.454	0.110	0.494	0.054	-	Yes	-
101310427-S	1.064	1.750	0.118	0.206	Yes	-	-
101310428-S	2.006	0.500	0.329	0.165	-	Yes	-
101310435-S	0.000	0.000	0.376	0.000	-	Yes	-
101310455-S	4.895	0.900	0.400	0.360	-	Yes	-
101310461-S	0.760	1.730	0.094	0.163	Yes	-	-
101310467-S	2.565	1.930	0.212	0.408	Yes	-	Yes
101310468-S	2.451	1.950	0.188	0.367	Yes	-	-
101310470-S	2.412	0.480	0.376	0.180	-	Yes	-
101310471-S	0.813	0.130	0.470	0.061	-	Yes	-
101310473-S	0.000	0.000	0.658	0.000	-	Yes	-
101310475-S	2.848	2.700	0.165	0.444	Yes	-	Yes
101310477-S	1.742	0.470	0.353	0.166	-	Yes	-
101310493-S	0.861	0.110	0.588	0.065	-	Yes	-
101310495-S	0.000	0.000	0.564	0.000	-	Yes	-
101310522-S	3.003	2.290	0.188	0.431	Yes	-	Yes
101310525-S	2.762	0.130	1.222	0.159	-	Yes	-
101310528-S	0.869	0.380	0.353	0.134	-	Yes	-
101310529-S	4.200	1.820	0.470	0.855	Yes	Yes	Yes
101310530-S	4.131	2.890	0.188	0.543	Yes	-	Yes
101310540-S	1.654	1.780	0.141	0.251	Yes	-	-
101310544-S	0.519	2.460	0.423	1.041	Yes	Yes	Yes
101310548-S	1.614	2.130	0.118	0.250	Yes	-	-
101310549-S	1.576	2.120	0.118	0.249	Yes	-	-
101310550-S	1.859	2.440	0.141	0.344	Yes	-	-
101310551-S	0.000	0.000	0.776	0.000	-	Yes	-
101310590-S	0.366	0.350	0.306	0.107	-	Yes	-
101310591-S	1.701	3.930	0.094	0.369	Yes	-	-

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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101310592-S	2.138	2.220	0.141	0.313	Yes	-	-
101310593_1-S	1.661	2.080	0.141	0.293	Yes	-	-
101310595-S	1.260	1.720	0.118	0.202	Yes	-	-
101310596-S	1.178	1.810	0.118	0.213	Yes	-	-
101310607-S	2.231	2.430	0.141	0.343	Yes	-	-
101310615-S	2.561	3.290	0.141	0.464	Yes	-	Yes
101310616-S	2.492	0.920	0.306	0.281	-	Yes	-
101310617-S	3.096	2.430	0.188	0.457	Yes	-	Yes
101310619-S	3.171	1.890	0.353	0.666	Yes	Yes	Yes
101310622-S	0.802	0.340	0.329	0.112	-	Yes	-
101310627-S	0.398	1.730	0.071	0.122	Yes	-	-
101310641-S	1.685	1.320	0.306	0.403	-	Yes	Yes
101310643_1-S	44.573	1.870	1.434	2.681	Yes	Yes	Yes
101310644_2-S	37.212	2.250	0.964	2.168	Yes	Yes	Yes
101310645_1-S	41.398	2.690	0.917	2.465	Yes	Yes	Yes
101310655-S	2.121	2.390	0.141	0.337	Yes	-	-
101310656-S	2.941	2.270	0.188	0.427	Yes	-	Yes
101310657-S	4.038	2.170	0.212	0.459	Yes	-	Yes
101310658-S	3.773	2.470	0.212	0.522	Yes	-	Yes
101310678-S	1.794	1.850	0.141	0.261	Yes	-	-
101310679-S	1.993	2.070	0.141	0.292	Yes	-	-
101310680-S	2.346	2.080	0.165	0.342	Yes	-	-
101310682-S	2.377	0.910	0.564	0.513	-	Yes	Yes
101310690_2-S	30.625	1.200	1.410	1.692	-	Yes	Yes
101310699-S	1.679	2.400	0.118	0.282	Yes	-	-
101310700-S	1.468	2.220	0.118	0.261	Yes	-	-
101310701-S	2.097	2.570	0.118	0.302	Yes	-	-
101310704-S	1.302	1.900	0.118	0.223	Yes	-	-
101310705-S	1.435	1.780	0.118	0.209	Yes	-	-
101310739-S	7.072	0.590	0.799	0.471	-	Yes	Yes
101310771-S	0.865	1.800	0.094	0.169	Yes	-	-
101310772-S	0.954	0.250	1.175	0.294	-	Yes	-
101310809-S	0.531	0.290	0.329	0.095	-	Yes	-
101310843-S	0.998	2.350	0.094	0.221	Yes	-	-
101310844-S	1.162	2.050	0.118	0.241	Yes	-	-
101310845-S	0.990	2.400	0.094	0.226	Yes	-	-
101310846-S	1.057	2.540	0.094	0.239	Yes	-	-
101310847-S	0.863	2.270	0.094	0.213	Yes	-	-

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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101310848-S	0.975	2.440	0.094	0.229	Yes	-	-
101310852-S	0.408	1.800	0.071	0.127	Yes	-	-
101310853-S	0.000	0.000	0.353	0.000	-	Yes	-
101310854-S	0.245	0.130	0.353	0.046	-	Yes	-
101310860-S	1.451	2.600	0.094	0.244	Yes	-	-
101310865-S	4.392	2.310	0.235	0.543	Yes	-	Yes
101310866-S	3.047	3.580	0.141	0.505	Yes	-	Yes
101310872-S	1.424	3.180	0.094	0.299	Yes	-	-
101310874-S	1.661	1.850	0.141	0.261	Yes	-	-
101310877-S	13.307	1.280	0.729	0.932	-	Yes	Yes
101310888-S	1.813	2.410	0.118	0.283	Yes	-	-
101310896_1-S	7.292	1.280	0.423	0.541	-	Yes	Yes
101310898-S	0.288	0.100	0.306	0.031	-	Yes	-
101310912-S	1.402	2.130	0.118	0.250	Yes	-	-
101310913-S	1.519	2.240	0.118	0.263	Yes	-	-
101310923-S	1.114	1.710	0.118	0.201	Yes	-	-
101310925-S	1.685	2.240	0.118	0.263	Yes	-	-
101311083-S	4.158	3.050	0.188	0.573	Yes	-	Yes
101311086-S	1.787	0.530	0.306	0.162	-	Yes	-
101311140-S	0.841	2.110	0.094	0.198	Yes	-	-
101311141-S	0.614	2.550	0.071	0.180	Yes	-	-
101311143-S	1.090	1.710	0.118	0.201	Yes	-	-
101311144-S	0.000	0.000	0.329	0.000	-	Yes	-
101311145-S	4.221	3.710	0.165	0.610	Yes	-	Yes
101311146-S	3.783	3.980	0.400	1.590	Yes	Yes	Yes
101311147-S	7.062	3.790	0.423	1.603	Yes	Yes	Yes
101311148-S	60.453	3.000	1.152	3.455	Yes	Yes	Yes
101311161-S	1.106	1.820	0.118	0.214	Yes	-	-
101311164-S	8.237	3.690	0.235	0.867	Yes	-	Yes
101311166-S	3.702	2.510	0.188	0.472	Yes	-	Yes
101311174-S	5.383	3.820	0.165	0.628	Yes	-	Yes
101311175-S	6.027	3.860	0.188	0.726	Yes	-	Yes
101311177-S	10.951	1.430	0.517	0.739	-	Yes	Yes
101311178-S	5.539	3.920	0.165	0.645	Yes	-	Yes
101311179-S	5.932	4.050	0.188	0.761	Yes	-	Yes
101311180-S	1.091	2.360	0.094	0.222	Yes	-	-
101311188-S	0.507	2.010	0.071	0.142	Yes	-	-
101311191-S	27.446	1.400	0.752	1.053	-	Yes	Yes

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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101311192-S	29.386	2.220	0.776	1.722	Yes	Yes	Yes
101311193-S	16.528	1.150	0.917	1.054	-	Yes	Yes
101311203-S	0.486	0.460	0.400	0.184	-	Yes	-
101311241-S	0.721	1.770	0.094	0.166	Yes	-	-
101311242-S	0.856	1.990	0.094	0.187	Yes	-	-
101311243-S	1.054	2.590	0.094	0.243	Yes	-	-
101311250-S	3.272	0.680	0.376	0.256	-	Yes	-
101311253-S	2.767	2.080	0.188	0.391	Yes	-	-
101311254-S	2.488	2.840	0.141	0.400	Yes	-	Yes
101311258-S	6.546	2.430	0.259	0.628	Yes	-	Yes
101311259-S	6.329	2.730	0.235	0.642	Yes	-	Yes
101311263-S	3.953	2.080	0.212	0.440	Yes	-	Yes
101311264-S	10.304	3.670	0.259	0.949	Yes	-	Yes
101311265-S	9.934	3.300	0.282	0.931	Yes	-	Yes
101311266-S	18.084	4.510	0.306	1.378	Yes	Yes	Yes
101311267-S	18.004	4.720	0.306	1.442	Yes	Yes	Yes
101311274-S	24.685	0.810	1.316	1.066	-	Yes	Yes
101311282-S	3.275	0.620	0.306	0.189	-	Yes	-
101311284-S	4.051	0.210	0.964	0.202	-	Yes	-
101311285-S	6.860	0.340	1.222	0.415	-	Yes	Yes
101311286-S	9.157	1.520	0.823	1.250	-	Yes	Yes
101311287-S	3.187	2.130	0.188	0.400	Yes	-	Yes
101311289-S	0.665	0.230	0.400	0.092	-	Yes	-
101311290-S	3.546	2.210	0.212	0.467	Yes	-	Yes
101311291-S	4.324	1.800	0.306	0.550	Yes	Yes	Yes
101311297-S	5.379	0.810	0.376	0.305	-	Yes	-
101311301-S	0.002	0.000	0.729	0.000	-	Yes	-
101311306-S	2.931	3.010	0.141	0.424	Yes	-	Yes
101311307-S	3.133	3.130	0.165	0.515	Yes	-	Yes
101311452-S	3.063	2.150	0.165	0.354	Yes	-	-
101311453-S	3.128	1.980	0.165	0.326	Yes	-	-
101311462-S	6.394	1.400	0.376	0.526	-	Yes	Yes
101311654-S	1.024	0.410	0.329	0.135	-	Yes	-
101311655-S	0.687	0.220	0.376	0.083	-	Yes	-
101311659-S	2.370	0.870	0.306	0.266	-	Yes	-
101311717-S	3.456	0.990	0.329	0.326	-	Yes	-
101311718-S	3.158	0.960	0.306	0.293	-	Yes	-
101311766-S	2.089	1.860	0.165	0.306	Yes	-	-

BARRIE CREEKS DRAINAGE STUDY AREA
FUTURE CONDITIONS MAJOR OVERLAND FLOW ROUTE DEFICIENCY SUMMARY
OCTOBER 2017

Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101311780-S	1.215	1.840	0.118	0.216	Yes	-	-
101311781-S	2.552	0.620	0.353	0.219	-	Yes	-
101311782-S	1.362	0.360	0.329	0.118	-	Yes	-
101400752-S	1.085	0.320	0.329	0.105	-	Yes	-
101408031-S	0.831	2.300	0.094	0.216	Yes	-	-
101412839-S	1.315	2.260	0.118	0.266	Yes	-	-
1044_2-S	3.892	0.990	0.682	0.675	-	Yes	Yes
1052-S	1.249	4.230	0.071	0.298	Yes	-	-
1080-S	0.790	1.880	0.094	0.177	Yes	-	-
1081-S	0.965	2.010	0.094	0.189	Yes	-	-
1102-S	29.995	4.670	0.447	2.085	Yes	Yes	Yes
1103-S	33.869	3.920	0.564	2.211	Yes	Yes	Yes
1104_1-S	37.988	3.430	0.682	2.338	Yes	Yes	Yes
120003739-S	2.933	2.320	0.188	0.436	Yes	-	Yes
120003740-S	2.710	2.200	0.188	0.414	Yes	-	Yes
120003746_2-S	78.579	2.700	1.598	4.315	Yes	Yes	Yes
120003752-S	3.036	0.140	1.340	0.188	-	Yes	-
120046654-S	3.793	1.110	0.306	0.339	-	Yes	-
120075704-S	0.000	0.000	1.175	0.000	-	Yes	-
120075784-S	0.000	0.000	0.541	0.000	-	Yes	-
120075785-S	0.000	0.000	0.564	0.000	-	Yes	-
120080577-S	2.285	2.540	0.141	0.358	Yes	-	-
120080581-S	0.000	0.000	0.329	0.000	-	Yes	-
120080582-S	2.077	2.400	0.141	0.338	Yes	-	-
120080583-S	2.366	2.400	0.165	0.395	Yes	-	-
120080979-S	3.351	3.460	0.141	0.488	Yes	-	Yes
120080980-S	3.492	3.270	0.188	0.615	Yes	-	Yes
120080982-S	7.054	2.590	0.635	1.643	Yes	Yes	Yes
120081718-S	2.142	0.600	0.306	0.183	-	Yes	-
120179067-S	0.847	1.990	0.094	0.187	Yes	-	-

LOVERS CREEK, HEWITTS CREEK AND SANDY COVE DRAINAGE STUDY AREA
FUTURE CONDITIONS MAJOR OVERLAND FLOW ROUTE DEFICIENCY SUMMARY
OCTOBER 2017

Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
1005-S	0.485	2.060	0.071	0.145	Yes	-	-
101303835-S	5.870	0.410	0.893	0.366	-	Yes	-
101303846-S	9.324	1.280	0.541	0.692	-	Yes	Yes
101303850-S	1.638	0.780	0.329	0.257	-	Yes	-
101304145-S	1.351	1.960	0.118	0.230	Yes	-	-
101304146-S	1.175	0.320	0.329	0.105	-	Yes	-
101304174-S	6.327	1.890	0.282	0.533	Yes	-	Yes
101304175-S	4.970	2.780	0.212	0.588	Yes	-	Yes
101304191-S	4.267	1.070	0.353	0.377	-	Yes	-
101304369-S	3.683	1.020	0.470	0.479	-	Yes	Yes
101304371-S	4.553	0.860	0.353	0.303	-	Yes	-
101304372-S	0.053	2.180	0.165	0.359	Yes	-	-
101304373-S	0.471	1.840	0.071	0.130	Yes	-	-
101304394-S	3.285	1.930	0.235	0.454	Yes	-	Yes
101304395-S	4.167	0.990	0.376	0.372	-	Yes	-
101304396-S	5.662	1.040	0.400	0.415	-	Yes	Yes
101304401-S	2.788	0.840	0.306	0.257	-	Yes	-
101304409-S	0.807	0.470	0.306	0.144	-	Yes	-
101304421-S	1.628	2.420	0.118	0.284	Yes	-	-
101304423-S	1.058	1.790	0.118	0.210	Yes	-	-
101304427-S	0.000	0.000	0.353	0.000	-	Yes	-
101304444-S	1.686	0.600	0.423	0.254	-	Yes	-
101304447-S	2.103	1.220	0.306	0.373	-	Yes	-
101304465-S	1.890	1.780	0.141	0.251	Yes	-	-
101304469-S	2.431	2.220	0.165	0.365	Yes	-	-
101304470-S	7.801	1.640	0.376	0.617	-	Yes	Yes
101304471-S	5.135	0.690	0.588	0.405	-	Yes	Yes
101304472_2-S	1.723	1.780	0.141	0.251	Yes	-	-
101304479-S	0.340	0.430	0.329	0.141	-	Yes	-
101304483-S	1.512	1.710	0.141	0.241	Yes	-	-
101304506-S	2.475	0.410	0.682	0.279	-	Yes	-
101304519-S	1.000	0.380	0.517	0.196	-	Yes	-
101304526_1-S	4.106	1.440	0.329	0.474	-	Yes	Yes
101304532-S	1.862	1.930	0.141	0.272	Yes	-	-
101304544-S	1.333	0.230	0.423	0.097	-	Yes	-
101304546-S	4.289	1.260	0.306	0.385	-	Yes	-
101304568-S	5.953	4.110	0.235	0.966	Yes	-	Yes
101304569-S	7.881	2.490	0.282	0.702	Yes	-	Yes

LOVERS CREEK, HEWITTS CREEK AND SANDY COVE DRAINAGE STUDY AREA
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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101304572-S	1.439	1.980	0.118	0.233	Yes	-	-
101304583-S	3.239	0.450	0.494	0.222	-	Yes	-
101304596-S	4.974	1.570	0.282	0.443	-	-	Yes
101304597-S	6.098	1.340	0.329	0.441	-	Yes	Yes
101304598-S	6.590	1.240	0.353	0.437	-	Yes	Yes
101304608-S	4.142	0.360	0.752	0.271	-	Yes	-
101304638-S	3.399	0.980	0.306	0.299	-	Yes	-
101304639-S	5.043	2.340	0.212	0.495	Yes	-	Yes
101304650-S	2.153	0.770	0.306	0.235	-	Yes	-
101304651-S	2.242	0.620	0.306	0.189	-	Yes	-
101304652-S	3.188	1.750	0.212	0.370	Yes	-	-
101304654-S	4.720	0.840	0.611	0.513	-	Yes	Yes
101304655-S	4.760	0.600	0.940	0.564	-	Yes	Yes
101304666-S	0.938	1.820	0.094	0.171	Yes	-	-
101304685-S	1.119	1.900	0.118	0.223	Yes	-	-
101304686-S	1.468	2.240	0.118	0.263	Yes	-	-
101304687-S	1.477	2.020	0.118	0.237	Yes	-	-
101304699-S	1.083	1.820	0.118	0.214	Yes	-	-
101304701-S	6.362	1.230	0.353	0.434	-	Yes	Yes
101304702-S	12.127	1.810	0.470	0.851	Yes	Yes	Yes
101304706-S	1.572	1.770	0.141	0.250	Yes	-	-
101304709-S	6.002	1.040	0.400	0.415	-	Yes	Yes
101304710-S	0.720	0.770	0.400	0.308	-	Yes	-
101304711-S	3.947	0.560	0.494	0.276	-	Yes	-
101304712-S	3.463	0.760	0.353	0.268	-	Yes	-
101304713-S	0.277	0.030	1.575	0.047	-	Yes	-
101304714-S	1.368	0.190	0.893	0.170	-	Yes	-
101304719-S	2.508	0.550	0.353	0.194	-	Yes	-
101304720-S	0.000	0.000	0.306	0.000	-	Yes	-
101304721-S	0.132	0.050	0.306	0.015	-	Yes	-
101304742-S	2.018	0.730	0.306	0.223	-	Yes	-
101304755-S	2.510	0.610	0.329	0.201	-	Yes	-
101304796-S	3.849	0.500	0.517	0.259	-	Yes	-
101304819-S	2.580	1.990	0.188	0.374	Yes	-	-
101304820-S	0.000	0.000	0.306	0.000	-	Yes	-
101304822-S	2.980	2.440	0.188	0.459	Yes	-	Yes
101304823-S	0.936	0.100	0.635	0.063	-	Yes	-
101304825-S	2.933	2.120	0.188	0.399	Yes	-	-

LOVERS CREEK, HEWITTS CREEK AND SANDY COVE DRAINAGE STUDY AREA
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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101304826-S	2.552	0.420	0.447	0.188	-	Yes	-
101304827-S	3.632	1.480	0.423	0.626	-	Yes	Yes
101304828-S	2.864	2.370	0.165	0.390	Yes	-	-
101304829-S	2.337	3.480	0.165	0.572	Yes	-	Yes
101304839-S	1.999	1.880	0.165	0.309	Yes	-	-
101304848-S	6.373	0.750	0.470	0.353	-	Yes	-
101304853-S	2.900	1.900	0.212	0.402	Yes	-	Yes
101304856-S	1.097	0.890	0.423	0.376	-	Yes	-
101304864-S	6.284	3.560	0.212	0.753	Yes	-	Yes
101304865-S	0.410	0.120	0.611	0.073	-	Yes	-
101304870-S	2.752	2.030	0.188	0.382	Yes	-	-
101304874-S	3.101	1.870	0.682	1.274	Yes	Yes	Yes
101304890-S	1.314	0.420	0.517	0.217	-	Yes	-
101304897-S	9.372	1.890	0.282	0.533	Yes	-	Yes
101304898-S	9.433	4.720	0.235	1.109	Yes	-	Yes
101304899-S	2.688	2.100	0.165	0.345	Yes	-	-
101304910-S	2.535	0.650	0.329	0.214	-	Yes	-
101304919-S	2.253	0.450	0.494	0.222	-	Yes	-
101304923-S	11.105	1.600	0.329	0.526	-	Yes	Yes
101304924-S	10.772	1.720	0.306	0.525	Yes	Yes	Yes
101304925-S	11.463	1.520	0.353	0.536	-	Yes	Yes
101304926-S	15.386	1.820	0.376	0.684	Yes	Yes	Yes
101304927-S	3.153	0.600	0.400	0.240	-	Yes	-
101304930-S	15.654	1.930	0.353	0.680	Yes	Yes	Yes
101304931-S	16.054	1.890	0.376	0.711	Yes	Yes	Yes
101304949-S	1.934	0.860	0.541	0.465	-	Yes	Yes
101304950-S	0.376	0.410	0.306	0.125	-	Yes	-
101304953-S	4.252	2.120	0.235	0.498	Yes	-	Yes
101304954-S	4.630	2.290	0.235	0.538	Yes	-	Yes
101304955-S	4.460	0.320	1.128	0.361	-	Yes	-
101304956-S	0.000	0.000	0.893	0.000	-	Yes	-
101304958-S	3.599	2.740	0.188	0.515	Yes	-	Yes
101304980-S	1.417	0.670	0.353	0.236	-	Yes	-
101304986-S	2.089	1.710	0.188	0.321	Yes	-	-
101305031-S	1.734	1.820	0.141	0.257	Yes	-	-
101305033-S	1.427	1.950	0.118	0.229	Yes	-	-
101305034-S	1.475	1.920	0.141	0.271	Yes	-	-
101305035-S	1.596	1.730	0.141	0.244	Yes	-	-

LOVERS CREEK, HEWITTS CREEK AND SANDY COVE DRAINAGE STUDY AREA
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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101305067-S	1.322	1.830	0.118	0.215	Yes	-	-
101305071-S	1.478	2.090	0.118	0.246	Yes	-	-
101305072-S	2.165	7.210	0.141	1.017	Yes	-	Yes
101305077-S	1.627	3.320	0.094	0.312	Yes	-	-
101305114-S	1.168	0.300	0.306	0.092	-	Yes	-
101305176-S	4.034	1.200	0.329	0.395	-	Yes	-
101305180-S	2.503	1.940	0.188	0.365	Yes	-	-
101305181-S	2.902	2.100	0.188	0.395	Yes	-	-
101305182-S	2.922	2.260	0.188	0.425	Yes	-	Yes
101305183-S	2.876	0.790	0.329	0.260	-	Yes	-
101305184-S	7.342	0.720	0.705	0.508	-	Yes	Yes
101305186-S	9.343	1.460	0.541	0.789	-	Yes	Yes
101305187-S	6.752	3.140	0.235	0.738	Yes	-	Yes
101305188-S	6.265	2.880	0.259	0.744	Yes	-	Yes
101305189-S	8.139	2.150	0.353	0.758	Yes	Yes	Yes
101305191-S	5.718	3.300	0.212	0.698	Yes	-	Yes
101305195-S	0.513	1.050	0.306	0.321	-	Yes	-
101305196-S	9.136	1.690	0.494	0.834	-	Yes	Yes
101305397-S	0.000	0.000	0.306	0.000	-	Yes	-
101305400-S	6.558	2.490	0.235	0.585	Yes	-	Yes
101305402-S	8.158	1.060	0.517	0.548	-	Yes	Yes
101305404-S	1.472	2.140	0.118	0.251	Yes	-	-
101305420-S	8.228	1.910	0.353	0.673	Yes	Yes	Yes
101305469-S	0.000	0.000	0.870	0.000	-	Yes	-
101305476-S	2.630	0.640	0.329	0.211	-	Yes	-
101305477-S	2.827	0.950	0.353	0.335	-	Yes	-
101305509-S	2.396	2.060	0.165	0.339	Yes	-	-
101305521-S	0.767	0.280	0.353	0.099	-	Yes	-
101305580-S	6.599	1.650	0.259	0.427	-	-	Yes
101305604-S	2.892	0.860	0.353	0.303	-	Yes	-
101305645-S	7.745	1.720	0.353	0.606	Yes	Yes	Yes
101305647-S	6.139	1.960	0.282	0.553	Yes	-	Yes
101305653-S	6.308	2.660	0.259	0.688	Yes	-	Yes
101305654-S	6.609	2.300	0.282	0.649	Yes	-	Yes
101305655-S	6.070	2.980	0.235	0.700	Yes	-	Yes
101305656-S	6.813	3.160	0.235	0.743	Yes	-	Yes
101305657-S	3.871	2.820	0.188	0.530	Yes	-	Yes
101305658-S	4.260	3.490	0.165	0.574	Yes	-	Yes

LOVERS CREEK, HEWITTS CREEK AND SANDY COVE DRAINAGE STUDY AREA
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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101305660-S	5.835	1.150	0.400	0.459	-	Yes	Yes
101305667-S	0.935	1.950	0.094	0.183	Yes	-	-
101305674-S	1.211	1.950	0.118	0.229	Yes	-	-
101305676-S	2.906	2.280	0.188	0.429	Yes	-	Yes
101305677-S	2.389	0.630	0.329	0.207	-	Yes	-
101305681-S	4.071	1.350	0.306	0.412	-	Yes	Yes
101305682-S	5.795	1.290	0.376	0.485	-	Yes	Yes
101305692-S	6.789	4.140	0.212	0.876	Yes	-	Yes
101305743-S	0.000	0.000	0.494	0.000	-	Yes	-
101305744-S	0.000	0.000	0.353	0.000	-	Yes	-
101305745-S	3.768	0.270	1.481	0.400	-	Yes	-
101305746-S	6.136	1.180	0.964	1.137	-	Yes	Yes
101305747-S	4.730	2.280	0.447	1.018	Yes	Yes	Yes
101305753-S	0.000	0.000	0.376	0.000	-	Yes	-
101305761_2-S	0.000	0.000	0.353	0.000	-	Yes	-
101305926-S	0.797	0.030	1.692	0.051	-	Yes	-
101305930-S	0.000	0.000	0.329	0.000	-	Yes	-
101306511-S	1.678	0.670	0.423	0.283	-	Yes	-
101306516-S	8.160	1.130	0.494	0.558	-	Yes	Yes
101306519-S	0.635	0.130	0.400	0.052	-	Yes	-
101306522-S	6.120	2.220	0.282	0.626	Yes	-	Yes
101306527-S	4.602	2.190	0.235	0.515	Yes	-	Yes
101306528-S	3.059	1.770	0.212	0.374	Yes	-	-
101306539-S	2.768	0.950	0.306	0.290	-	Yes	-
101306541-S	5.985	0.810	0.447	0.362	-	Yes	-
101306544-S	0.807	0.330	0.329	0.109	-	Yes	-
101306545-S	3.923	0.940	0.353	0.331	-	Yes	-
101306548-S	1.231	0.320	0.376	0.120	-	Yes	-
101306550-S	0.581	0.260	0.306	0.079	-	Yes	-
101306559-S	2.484	1.900	0.188	0.357	Yes	-	-
101306575-S	0.697	0.640	0.306	0.196	-	Yes	-
101306576-S	4.502	0.980	0.400	0.392	-	Yes	-
101306804-S	0.115	0.070	0.353	0.025	-	Yes	-
101306805-S	0.816	0.150	0.494	0.074	-	Yes	-
101307271-S	0.408	0.140	0.400	0.056	-	Yes	-
101307293-S	0.895	0.140	0.447	0.063	-	Yes	-
101307306-S	22.873	0.770	1.387	1.068	-	Yes	Yes
101307333-S	3.565	0.920	0.353	0.324	-	Yes	-

LOVERS CREEK, HEWITTS CREEK AND SANDY COVE DRAINAGE STUDY AREA
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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101307334-S	1.160	0.700	0.353	0.247	-	Yes	-
101307339-S	2.880	0.510	0.423	0.216	-	Yes	-
101307346-S	0.000	0.000	0.752	0.000	-	Yes	-
101307363-S	0.000	0.000	0.752	0.000	-	Yes	-
101307371-S	2.095	0.780	0.423	0.330	-	Yes	-
101307372-S	1.017	0.560	0.329	0.184	-	Yes	-
101307375-S	0.999	0.170	0.564	0.096	-	Yes	-
101307405-S	2.207	2.530	0.141	0.357	Yes	-	-
101307406-S	2.673	2.530	0.165	0.416	Yes	-	Yes
101307410-S	3.772	0.940	0.611	0.574	-	Yes	Yes
101307412-S	3.140	0.740	0.353	0.261	-	Yes	-
101307414-S	1.318	0.880	0.564	0.496	-	Yes	Yes
101307487-S	2.446	0.510	0.447	0.228	-	Yes	-
101307488-S	0.401	0.120	0.306	0.037	-	Yes	-
101307795-S	0.444	0.390	0.329	0.128	-	Yes	-
101307796-S	2.673	2.040	0.188	0.384	Yes	-	-
101308008-S	1.762	2.560	0.118	0.301	Yes	-	-
101308009-S	1.589	2.560	0.118	0.301	Yes	-	-
101308010-S	0.852	1.910	0.094	0.180	Yes	-	-
101308014-S	2.124	2.620	0.141	0.369	Yes	-	-
101308059-S	10.125	1.530	0.329	0.503	-	Yes	Yes
101308060-S	8.499	1.590	0.306	0.486	-	Yes	Yes
101308061-S	6.562	2.170	0.259	0.561	Yes	-	Yes
101308063-S	2.656	2.060	0.188	0.387	Yes	-	-
101308287-S	2.470	0.520	0.376	0.196	-	Yes	-
101308288-S	0.000	0.000	0.799	0.000	-	Yes	-
101308388-S	1.084	1.810	0.118	0.213	Yes	-	-
101308389-S	1.182	1.910	0.118	0.224	Yes	-	-
101308392-S	1.377	2.100	0.118	0.247	Yes	-	-
101308398-S	1.093	0.380	0.564	0.214	-	Yes	-
101308399-S	0.854	0.590	0.376	0.222	-	Yes	-
101308404-S	0.272	0.090	0.400	0.036	-	Yes	-
101308595-S	0.545	1.770	0.071	0.125	Yes	-	-
101308853-S	2.046	1.010	0.494	0.498	-	Yes	Yes
101308854-S	1.626	0.880	0.682	0.600	-	Yes	Yes
101308855-S	0.000	0.000	0.353	0.000	-	Yes	-
101308860-S	0.022	0.040	0.376	0.015	-	Yes	-
101308895-S	2.448	2.040	0.165	0.336	Yes	-	-

LOVERS CREEK, HEWITTS CREEK AND SANDY COVE DRAINAGE STUDY AREA
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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101308896-S	2.889	2.110	0.165	0.347	Yes	-	-
101310281-S	1.051	1.780	0.165	0.293	Yes	-	-
101310282-S	6.294	1.280	0.729	0.932	-	Yes	Yes
101310295-S	0.587	0.170	0.353	0.060	-	Yes	-
101310308-S	6.339	1.340	0.376	0.504	-	Yes	Yes
101310316-S	2.906	0.680	0.353	0.240	-	Yes	-
101310321-S	3.429	0.160	2.045	0.327	-	Yes	-
101310322-S	5.206	0.270	1.481	0.400	-	Yes	-
101310323-S	4.744	0.710	0.470	0.334	-	Yes	-
101310697-S	0.000	0.000	1.081	0.000	-	Yes	-
101310698-S	17.086	1.590	1.857	2.952	-	Yes	Yes
101310802-S	1.872	0.570	0.353	0.201	-	Yes	-
101310838-S	1.453	0.480	0.306	0.147	-	Yes	-
101310959-S	8.148	1.320	0.447	0.589	-	Yes	Yes
101310962-S	3.656	1.820	0.188	0.342	Yes	-	-
101310965-S	3.170	1.970	0.165	0.324	Yes	-	-
101310966-S	3.171	1.770	0.188	0.333	Yes	-	-
101310967-S	3.484	1.950	0.188	0.367	Yes	-	-
101310973-S	3.699	0.960	0.353	0.338	-	Yes	-
101310974-S	3.649	1.780	0.188	0.335	Yes	-	-
101310981-S	2.034	0.180	0.752	0.135	-	Yes	-
101310986-S	5.544	2.200	0.259	0.569	Yes	-	Yes
101310987-S	6.766	2.140	0.282	0.603	Yes	-	Yes
101310988-S	7.685	1.650	0.400	0.659	-	Yes	Yes
101310990-S	4.008	1.130	0.376	0.425	-	Yes	Yes
101310994-S	10.244	1.070	0.564	0.603	-	Yes	Yes
101311003-S	3.489	0.900	0.306	0.275	-	Yes	-
101311004-S	4.979	0.960	0.353	0.338	-	Yes	-
101311021-S	10.045	1.520	0.470	0.714	-	Yes	Yes
101311022-S	5.170	0.290	0.940	0.273	-	Yes	-
101311061-S	6.663	1.230	0.376	0.462	-	Yes	Yes
101311062-S	6.134	0.710	0.376	0.267	-	Yes	-
101311065-S	3.915	1.220	0.306	0.373	-	Yes	-
101311066-S	5.264	0.850	0.329	0.280	-	Yes	-
101311067-S	4.179	1.800	0.212	0.381	Yes	-	-
101311068-S	4.210	2.010	0.188	0.378	Yes	-	-
101311093-S	5.093	0.550	0.611	0.336	-	Yes	-
101311094-S	3.763	0.950	0.353	0.335	-	Yes	-

LOVERS CREEK, HEWITTS CREEK AND SANDY COVE DRAINAGE STUDY AREA
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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101311466-S	2.294	0.570	0.494	0.281	-	Yes	-
101311467-S	2.211	0.850	0.353	0.300	-	Yes	-
101311473-S	3.878	1.590	0.282	0.448	-	-	Yes
101311557-S	3.173	1.730	0.212	0.366	Yes	-	-
101311558-S	5.429	2.000	0.447	0.893	Yes	Yes	Yes
101311560-S	8.075	0.900	0.588	0.529	-	Yes	Yes
101311633-S	3.832	0.710	0.447	0.317	-	Yes	-
101311634-S	5.268	1.160	0.353	0.409	-	Yes	Yes
101311749-S	2.975	0.350	0.564	0.197	-	Yes	-
101311751-S	1.604	1.750	0.141	0.247	Yes	-	-
101311758-S	0.528	1.930	0.071	0.136	Yes	-	-
120005644-S	2.068	0.760	0.329	0.250	-	Yes	-
120006438-S	0.088	0.040	0.470	0.019	-	Yes	-
120006439-S	0.002	0.000	0.329	0.000	-	Yes	-
120006441-S	0.089	0.040	0.470	0.019	-	Yes	-
120030025-S	17.607	1.380	1.058	1.459	-	Yes	Yes
120030026-S	17.607	1.380	1.058	1.459	-	Yes	Yes
120030028_1-S	6.038	0.530	0.705	0.374	-	Yes	-
120030049-S	5.495	2.190	0.259	0.566	Yes	-	Yes
120030059-S	6.066	0.620	0.635	0.393	-	Yes	-
120030096-S	10.159	1.510	0.611	0.923	-	Yes	Yes
120030098-S	4.836	2.140	0.235	0.503	Yes	-	Yes
120077013-S	2.478	0.280	0.588	0.165	-	Yes	-
120179442-S	8.515	1.290	0.470	0.606	-	Yes	Yes
120179443-S	7.309	1.620	0.353	0.571	-	Yes	Yes

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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101301934-S	3.996	1.020	0.353	0.360	-	Yes	-
101301942-S	7.511	1.680	0.376	0.632	-	Yes	Yes
101301943-S	6.952	1.500	0.376	0.564	-	Yes	Yes
101301947-S	0.505	0.170	0.353	0.060	-	Yes	-
101301949-S	7.628	1.890	0.353	0.666	Yes	Yes	Yes
101301950-S	3.587	2.330	0.212	0.493	Yes	-	Yes
101301951-S	2.600	2.140	0.188	0.402	Yes	-	Yes
101301952-S	2.479	2.390	0.165	0.393	Yes	-	-
101301953-S	0.688	0.510	0.329	0.168	-	Yes	-
101301954-S	7.561	2.210	0.329	0.727	Yes	Yes	Yes
101301955-S	8.098	1.890	0.353	0.666	Yes	Yes	Yes
101301956-S	0.631	0.450	0.306	0.137	-	Yes	-
101301974-S	1.250	2.580	0.541	1.394	Yes	Yes	Yes
101301983-S	10.439	0.470	1.293	0.607	-	Yes	Yes
101301984-S	6.758	2.800	0.259	0.724	Yes	-	Yes
101301985-S	0.874	0.230	0.329	0.076	-	Yes	-
101301988-S	0.613	1.770	0.094	0.166	Yes	-	-
101301992-S	3.008	0.700	0.423	0.296	-	Yes	-
101301993-S	8.680	1.300	0.494	0.642	-	Yes	Yes
101302028-S	0.664	5.340	0.141	0.753	Yes	-	Yes
101302034-S	3.470	1.990	0.235	0.468	Yes	-	Yes
101302040-S	14.819	0.660	1.316	0.869	-	Yes	Yes
101302048-S	0.000	0.000	0.729	0.000	-	Yes	-
101302058-S	0.337	0.230	0.447	0.103	-	Yes	-
101302062-S	2.552	1.730	0.212	0.366	Yes	-	-
101302065-S	4.630	1.470	0.306	0.449	-	Yes	Yes
101302066-S	4.300	1.640	0.282	0.462	-	-	Yes
101302069-S	1.320	1.740	0.141	0.245	Yes	-	-
101302089-S	0.364	1.790	0.071	0.126	Yes	-	-
101302098-S	2.898	0.970	0.376	0.365	-	Yes	-
101302119-S	2.177	0.520	0.517	0.269	-	Yes	-
101302140-S	0.762	2.050	0.094	0.193	Yes	-	-
101302144-S	0.000	0.000	0.517	0.000	-	Yes	-
101302147-S	1.810	2.080	0.141	0.293	Yes	-	-
101302149-S	0.000	0.000	0.400	0.000	-	Yes	-
101302152-S	3.690	0.770	0.353	0.271	-	Yes	-
101302168-S	1.210	0.470	0.329	0.155	-	Yes	-
101302169-S	5.577	1.130	0.353	0.398	-	Yes	-

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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101302170-S	1.465	0.290	0.682	0.198	-	Yes	-
101302171_1-S	7.119	0.850	0.541	0.459	-	Yes	Yes
101302172-S	9.043	0.890	0.564	0.502	-	Yes	Yes
101302197-S	0.052	0.010	0.447	0.004	-	Yes	-
101302198-S	2.097	3.300	0.118	0.388	Yes	-	-
101302200-S	27.779	1.080	0.893	0.964	-	Yes	Yes
101302205-S	0.052	0.000	1.199	0.000	-	Yes	-
101302210-S	1.296	1.760	0.141	0.248	Yes	-	-
101302218-S	1.711	2.460	0.118	0.289	Yes	-	-
101302221-S	1.713	1.900	0.141	0.268	Yes	-	-
101302222-S	1.184	2.080	0.118	0.244	Yes	-	-
101302244-S	1.689	2.270	0.141	0.320	Yes	-	-
101302250-S	2.313	0.300	0.541	0.162	-	Yes	-
101302255-S	8.134	0.700	0.494	0.345	-	Yes	-
101302263-S	4.751	0.910	0.306	0.278	-	Yes	-
101302270-S	0.323	0.150	0.306	0.046	-	Yes	-
101302279-S	0.921	1.940	0.094	0.182	Yes	-	-
101302288-S	1.843	1.670	0.400	0.667	-	Yes	Yes
101302289-S	1.573	2.100	0.141	0.296	Yes	-	-
101302292-S	1.557	2.320	0.118	0.273	Yes	-	-
101302328-S	3.991	1.320	0.517	0.682	-	Yes	Yes
101302329-S	1.256	0.130	0.470	0.061	-	Yes	-
101302330-S	4.760	1.030	0.376	0.387	-	Yes	-
101302331-S	4.834	0.990	0.400	0.396	-	Yes	-
101302332_1-S	5.472	1.230	0.376	0.462	-	Yes	Yes
101302333-S	3.385	0.310	0.729	0.226	-	Yes	-
101302334-S	1.987	2.640	0.141	0.372	Yes	-	-
101302335-S	3.763	0.220	1.058	0.233	-	Yes	-
101302336-S	2.631	0.520	0.658	0.342	-	Yes	-
101302341-S	1.151	0.680	0.423	0.288	-	Yes	-
101302541-S	0.661	0.170	0.423	0.072	-	Yes	-
101302556-S	3.712	0.400	0.635	0.254	-	Yes	-
101302572-S	10.078	1.330	0.494	0.656	-	Yes	Yes
101302573-S	3.684	0.280	0.729	0.204	-	Yes	-
101302579-S	10.948	1.280	0.870	1.113	-	Yes	Yes
101302580-S	3.100	1.270	0.494	0.627	-	Yes	Yes
101302581-S	3.028	0.950	0.306	0.290	-	Yes	-
101302586-S	0.690	0.190	0.353	0.067	-	Yes	-

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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101302645-S	4.016	0.890	0.423	0.376	-	Yes	-
101302657-S	2.652	0.970	0.494	0.479	-	Yes	Yes
101302820-S	4.204	2.060	0.235	0.484	Yes	-	Yes
101303304-S	0.898	1.790	0.118	0.210	Yes	-	-
101303327-S	1.805	1.870	0.165	0.308	Yes	-	-
101303340-S	7.761	1.470	0.447	0.656	-	Yes	Yes
101303343-S	5.852	0.830	0.541	0.449	-	Yes	Yes
101303347-S	8.014	1.520	0.470	0.714	-	Yes	Yes
101303373-S	5.708	0.990	0.447	0.442	-	Yes	Yes
101303374-S	6.485	1.150	0.470	0.541	-	Yes	Yes
101303382-S	1.779	1.870	0.165	0.308	Yes	-	-
101303386-S	0.462	2.910	0.047	0.137	Yes	-	-
101303387-S	25.180	1.950	1.222	2.383	Yes	Yes	Yes
101303392-S	1.006	1.840	0.118	0.216	Yes	-	-
101303432-S	1.693	2.380	0.118	0.280	Yes	-	-
101303441-S	1.191	0.370	0.306	0.113	-	Yes	-
101303453-S	3.852	3.060	0.165	0.503	Yes	-	Yes
101303454-S	3.508	2.660	0.165	0.438	Yes	-	Yes
101303455-S	3.758	2.010	0.188	0.378	Yes	-	-
101303463-S	0.260	0.620	0.329	0.204	-	Yes	-
101303502-S	2.466	0.120	1.222	0.147	-	Yes	-
101303525-S	1.412	1.810	0.141	0.255	Yes	-	-
101303527-S	4.602	0.840	0.447	0.375	-	Yes	-
101303529-S	1.491	1.730	0.165	0.285	Yes	-	-
101303531-S	2.560	0.910	0.353	0.321	-	Yes	-
101303535-S	4.225	0.980	0.588	0.576	-	Yes	Yes
101303549-S	4.129	0.640	1.011	0.647	-	Yes	Yes
101303550-S	3.824	0.390	0.776	0.302	-	Yes	-
101303561-S	1.707	0.580	0.517	0.300	-	Yes	-
101303585-S	5.940	1.460	0.353	0.515	-	Yes	Yes
101303586-S	4.314	1.820	0.259	0.470	Yes	-	Yes
101303587-S	4.201	2.790	0.212	0.590	Yes	-	Yes
101303595-S	1.089	1.880	0.118	0.221	Yes	-	-
101303597-S	2.627	2.570	0.165	0.423	Yes	-	Yes
101303602-S	1.458	1.980	0.141	0.279	Yes	-	-
101303605-S	3.058	1.220	0.306	0.373	-	Yes	-
101303607-S	0.674	2.060	0.071	0.145	Yes	-	-
101303608-S	0.569	1.770	0.071	0.125	Yes	-	-

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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101303642-S	0.000	0.000	0.329	0.000	-	Yes	-
101303649-S	2.262	0.600	0.376	0.226	-	Yes	-
101303650-S	4.069	1.560	0.282	0.440	-	-	Yes
101303652-S	3.323	1.880	0.235	0.442	Yes	-	Yes
101303660-S	1.329	1.830	0.141	0.258	Yes	-	-
101303671-S	2.238	2.200	0.282	0.620	Yes	-	Yes
101303674-S	2.765	0.430	0.400	0.172	-	Yes	-
101303695-S	0.479	1.950	0.071	0.137	Yes	-	-
101303697-S	4.453	0.810	0.423	0.343	-	Yes	-
101303698-S	3.259	0.350	0.682	0.239	-	Yes	-
101303699-S	0.137	0.060	0.376	0.023	-	Yes	-
101303716-S	0.915	0.270	0.329	0.089	-	Yes	-
101303717-S	4.585	1.060	0.376	0.399	-	Yes	-
101303751-S	4.034	0.760	0.423	0.321	-	Yes	-
101303756-S	1.550	2.430	0.118	0.286	Yes	-	-
101303762-S	1.997	1.210	0.400	0.483	-	Yes	Yes
101303763-S	9.334	1.140	0.635	0.723	-	Yes	Yes
101303764-S	7.934	1.190	0.541	0.643	-	Yes	Yes
101303767-S	3.195	0.890	0.376	0.335	-	Yes	-
101303770-S	0.996	0.190	0.517	0.098	-	Yes	-
101303771-S	6.304	1.110	0.470	0.522	-	Yes	Yes
101303772-S	0.384	0.120	0.705	0.085	-	Yes	-
101303773-S	0.559	2.050	0.071	0.145	Yes	-	-
101303792-S	0.759	1.790	0.094	0.168	Yes	-	-
101303797-S	0.000	0.000	0.353	0.000	-	Yes	-
101303800-S	0.913	0.340	0.376	0.128	-	Yes	-
101303801-S	0.302	0.100	0.306	0.031	-	Yes	-
101303806-S	8.085	1.170	0.494	0.577	-	Yes	Yes
101303813-S	0.000	0.000	0.658	0.000	-	Yes	-
101303885-S	9.177	1.690	0.423	0.715	-	Yes	Yes
101303888-S	2.675	1.710	0.212	0.362	Yes	-	-
101303931-S	0.612	1.770	0.094	0.166	Yes	-	-
101303932-S	0.605	1.710	0.094	0.161	Yes	-	-
101303933-S	0.717	1.710	0.094	0.161	Yes	-	-
101303936-S	6.612	0.890	0.353	0.314	-	Yes	-
101303946-S	1.354	2.860	0.094	0.269	Yes	-	-
101303977-S	4.075	0.790	0.400	0.316	-	Yes	-
101303993-S	4.055	1.500	0.282	0.423	-	-	Yes

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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101303994-S	4.263	1.240	0.329	0.408	-	Yes	Yes
101303996-S	4.242	1.850	0.259	0.478	Yes	-	Yes
101304002-S	2.967	2.260	0.188	0.425	Yes	-	Yes
101304003-S	2.662	0.840	0.329	0.276	-	Yes	-
101304004-S	2.626	2.350	0.165	0.387	Yes	-	-
101304005-S	2.167	1.790	0.188	0.337	Yes	-	-
101304006-S	3.757	0.880	0.400	0.352	-	Yes	-
101304017-S	0.423	0.260	0.423	0.110	-	Yes	-
101304031-S	2.721	0.650	0.353	0.229	-	Yes	-
101304032-S	8.214	1.300	0.494	0.642	-	Yes	Yes
101304042-S	4.359	1.850	0.259	0.478	Yes	-	Yes
101304043-S	3.568	1.690	0.259	0.437	-	-	Yes
101304044-S	3.819	2.070	0.235	0.486	Yes	-	Yes
101304045-S	4.112	2.000	0.235	0.470	Yes	-	Yes
101304047-S	1.198	2.190	0.118	0.257	Yes	-	-
101304055-S	3.223	0.400	0.470	0.188	-	Yes	-
101304056-S	4.570	1.140	0.517	0.589	-	Yes	Yes
101304064-S	0.000	0.000	0.329	0.000	-	Yes	-
101304065-S	1.555	2.740	0.118	0.322	Yes	-	-
101304070-S	1.858	1.960	0.165	0.322	Yes	-	-
101304082-S	0.380	0.170	0.329	0.056	-	Yes	-
101304083-S	1.516	0.310	0.494	0.153	-	Yes	-
101304084-S	2.749	0.890	0.306	0.272	-	Yes	-
101304093-S	1.647	1.220	0.494	0.602	-	Yes	Yes
101304205-S	10.974	1.010	0.494	0.498	-	Yes	Yes
101304206-S	4.903	0.620	0.400	0.248	-	Yes	-
101304210-S	6.306	2.540	0.212	0.537	Yes	-	Yes
101304211-S	5.931	2.270	0.212	0.480	Yes	-	Yes
101305147-S	1.598	2.330	0.118	0.274	Yes	-	-
101305148-S	1.550	2.050	0.141	0.289	Yes	-	-
101305263-S	1.923	1.790	0.165	0.294	Yes	-	-
101305283-S	4.402	0.930	0.423	0.393	-	Yes	-
101305284-S	3.159	0.610	0.423	0.258	-	Yes	-
101305285-S	1.595	0.110	0.564	0.062	-	Yes	-
101305380-S	0.000	0.000	0.376	0.000	-	Yes	-
101305382-S	0.000	0.000	0.329	0.000	-	Yes	-
101305616-S	0.513	0.080	0.705	0.056	-	Yes	-
101305617-S	1.088	0.160	0.729	0.117	-	Yes	-

NVCA WATERSHED DRAINAGE STUDY AREA
FUTURE CONDITIONS MAJOR OVERLAND FLOW ROUTE DEFICIENCY SUMMARY
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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101305619-S	1.370	0.190	0.729	0.138	-	Yes	-
101305620-S	2.050	0.490	0.682	0.334	-	Yes	-
101305621-S	3.546	0.740	0.423	0.313	-	Yes	-
101305634-S	1.363	1.790	0.141	0.252	Yes	-	-
101305847-S	1.246	0.440	0.541	0.238	-	Yes	-
101305883-S	0.591	1.700	0.306	0.519	-	Yes	Yes
101306059-S	1.126	1.900	0.118	0.223	Yes	-	-
101306060-S	1.145	2.200	0.094	0.207	Yes	-	-
101306061-S	1.136	2.380	0.094	0.224	Yes	-	-
101306062-S	1.207	2.390	0.094	0.225	Yes	-	-
101306063-S	1.326	2.250	0.118	0.264	Yes	-	-
101306068-S	1.786	2.640	0.118	0.310	Yes	-	-
101306069-S	1.949	2.710	0.118	0.318	Yes	-	-
101306073-S	0.848	1.880	0.094	0.177	Yes	-	-
101306074-S	2.092	2.360	0.141	0.333	Yes	-	-
101306075-S	1.403	2.320	0.118	0.273	Yes	-	-
101306077-S	3.448	3.210	0.141	0.453	Yes	-	Yes
101306078-S	3.570	3.230	0.141	0.455	Yes	-	Yes
101306079-S	3.617	3.230	0.141	0.455	Yes	-	Yes
101306080-S	3.679	3.090	0.141	0.436	Yes	-	Yes
101306582_2-S	0.610	0.170	0.423	0.072	-	Yes	-
101306586-S	1.084	0.970	0.541	0.524	-	Yes	Yes
101306699-S	4.330	1.040	0.353	0.367	-	Yes	-
101306700-S	4.303	1.050	0.353	0.370	-	Yes	-
101306702-S	7.544	1.560	0.353	0.550	-	Yes	Yes
101306708-S	3.704	1.120	0.329	0.368	-	Yes	-
101306719-S	2.157	0.360	0.870	0.313	-	Yes	-
101306720-S	2.580	1.800	0.212	0.381	Yes	-	-
101306721-S	2.733	1.960	0.188	0.368	Yes	-	-
101306737-S	1.634	2.570	0.118	0.302	Yes	-	-
101306738-S	1.824	1.970	0.165	0.324	Yes	-	-
101306740-S	1.487	2.650	0.118	0.311	Yes	-	-
101306743-S	1.981	1.350	0.400	0.539	-	Yes	Yes
101306749-S	0.000	0.000	0.400	0.000	-	Yes	-
101306751-S	5.776	0.800	0.517	0.414	-	Yes	Yes
101306753-S	0.000	0.000	0.611	0.000	-	Yes	-
101306754-S	0.883	0.150	0.447	0.067	-	Yes	-
101306758-S	2.694	0.540	0.400	0.216	-	Yes	-

NVCA WATERSHED DRAINAGE STUDY AREA
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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101306761-S	1.410	1.870	0.141	0.264	Yes	-	-
101306818-S	0.550	0.350	0.423	0.148	-	Yes	-
101307505-S	0.712	0.090	0.682	0.061	-	Yes	-
101307578-S	1.085	0.650	0.329	0.214	-	Yes	-
101307596-S	0.344	0.250	0.329	0.082	-	Yes	-
101307601-S	1.941	2.240	0.141	0.316	Yes	-	-
101307625-S	0.000	0.000	0.447	0.000	-	Yes	-
101307725-S	0.434	0.170	0.306	0.052	-	Yes	-
101307730-S	11.631	1.080	1.011	1.091	-	Yes	Yes
101307741-S	1.759	0.770	0.423	0.326	-	Yes	-
101307747-S	1.018	0.580	0.306	0.177	-	Yes	-
101307750-S	0.875	0.780	0.517	0.403	-	Yes	Yes
101307755-S	23.491	0.830	1.269	1.053	-	Yes	Yes
101307762_2-S	4.651	0.950	0.400	0.380	-	Yes	-
101308005-S	0.606	2.160	0.071	0.152	Yes	-	-
101308080-S	2.404	2.220	0.165	0.365	Yes	-	-
101308101-S	1.618	1.730	0.165	0.285	Yes	-	-
101308102-S	1.786	1.910	0.165	0.314	Yes	-	-
101308106-S	2.940	1.430	0.353	0.504	-	Yes	Yes
101308108-S	3.165	0.690	0.376	0.259	-	Yes	-
101308110-S	0.000	0.000	1.175	0.000	-	Yes	-
101308134-S	0.000	0.000	0.846	0.000	-	Yes	-
101308168-S	0.000	0.000	0.423	0.000	-	Yes	-
101308182-S	2.198	0.750	0.376	0.282	-	Yes	-
101308183-S	4.192	0.770	0.423	0.326	-	Yes	-
101308184-S	11.457	1.450	0.564	0.818	-	Yes	Yes
101308185-S	4.157	1.340	0.306	0.409	-	Yes	Yes
101308188-S	4.389	1.360	0.306	0.415	-	Yes	Yes
101308190-S	6.034	1.330	0.376	0.500	-	Yes	Yes
101308201-S	4.553	0.750	0.329	0.247	-	Yes	-
101308337-S	1.675	0.170	0.658	0.112	-	Yes	-
101308344-S	2.395	1.830	0.165	0.301	Yes	-	-
101308345-S	2.424	1.830	0.165	0.301	Yes	-	-
101308346-S	2.352	2.120	0.141	0.299	Yes	-	-
101308358-S	0.080	0.010	0.611	0.006	-	Yes	-
101308406-S	6.786	1.920	0.470	0.902	Yes	Yes	Yes
101308407-S	0.119	0.060	0.306	0.018	-	Yes	-
101308531-S	0.383	1.720	0.071	0.121	Yes	-	-

NVCA WATERSHED DRAINAGE STUDY AREA
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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101308533-S	2.199	1.730	0.165	0.285	Yes	-	-
101308536-S	2.822	1.860	0.165	0.306	Yes	-	-
101308537-S	2.593	1.980	0.188	0.372	Yes	-	-
101308543-S	1.149	1.780	0.118	0.209	Yes	-	-
101308544-S	1.309	1.760	0.141	0.248	Yes	-	-
101308545-S	1.731	1.730	0.165	0.285	Yes	-	-
101308924-S	0.070	0.050	0.447	0.022	-	Yes	-
101309330-S	14.272	1.040	0.564	0.587	-	Yes	Yes
101309336-S	6.048	1.030	0.541	0.557	-	Yes	Yes
101309337-S	5.060	1.000	0.353	0.353	-	Yes	-
101309338-S	2.367	0.700	0.611	0.428	-	Yes	Yes
101309345-S	6.473	0.410	1.011	0.414	-	Yes	Yes
101309354-S	1.688	0.540	0.823	0.444	-	Yes	Yes
101309371-S	3.093	0.670	0.423	0.283	-	Yes	-
101309372-S	8.038	1.250	0.470	0.588	-	Yes	Yes
101309373-S	2.359	1.270	0.306	0.388	-	Yes	-
101309376-S	2.191	0.360	0.470	0.169	-	Yes	-
101309377-S	2.172	0.410	0.423	0.173	-	Yes	-
101309384-S	1.636	0.330	0.400	0.132	-	Yes	-
101309419-S	1.673	1.840	0.141	0.259	Yes	-	-
101309421-S	3.639	1.170	0.306	0.357	-	Yes	-
101309426-S	1.147	1.840	0.118	0.216	Yes	-	-
101309428-S	1.365	0.510	0.353	0.180	-	Yes	-
101309479-S	1.893	1.910	0.165	0.314	Yes	-	-
101309518-S	0.920	0.630	0.306	0.192	-	Yes	-
101309519-S	3.755	0.790	0.376	0.297	-	Yes	-
101309520-S	6.600	0.320	1.222	0.391	-	Yes	-
101309521-S	1.593	0.080	1.246	0.100	-	Yes	-
101309522-S	31.379	1.360	1.434	1.950	-	Yes	Yes
101309523-S	8.238	1.650	0.400	0.659	-	Yes	Yes
101309524-S	6.014	1.420	0.353	0.501	-	Yes	Yes
101309538-S	4.903	1.380	0.329	0.454	-	Yes	Yes
101309548-S	1.028	1.790	0.118	0.210	Yes	-	-
101309549-S	1.176	1.950	0.118	0.229	Yes	-	-
101309554-S	2.249	0.770	0.306	0.235	-	Yes	-
101309555-S	4.153	1.280	0.306	0.391	-	Yes	-
101309563-S	4.479	1.080	0.353	0.381	-	Yes	-
101309571-S	5.857	1.140	0.400	0.455	-	Yes	Yes

NVCA WATERSHED DRAINAGE STUDY AREA
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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101309577-S	15.316	1.900	0.564	1.072	Yes	Yes	Yes
101309579-S	5.594	2.470	0.259	0.638	Yes	-	Yes
101309580-S	7.472	2.630	0.282	0.742	Yes	-	Yes
101309585-S	5.854	3.730	0.212	0.789	Yes	-	Yes
101309586-S	5.192	2.060	0.282	0.581	Yes	-	Yes
101309587-S	2.005	0.330	0.470	0.155	-	Yes	-
101309588-S	1.951	0.310	0.541	0.168	-	Yes	-
101309589-S	1.870	0.490	0.353	0.173	-	Yes	-
101309591-S	1.237	2.160	0.118	0.254	Yes	-	-
101309592-S	1.220	2.010	0.118	0.236	Yes	-	-
101309593-S	2.347	2.450	0.165	0.403	Yes	-	Yes
101309594-S	2.223	2.540	0.141	0.358	Yes	-	-
101309601-S	0.805	1.720	0.094	0.162	Yes	-	-
101309605-S	0.487	0.260	0.494	0.128	-	Yes	-
101309607-S	0.148	0.070	0.400	0.028	-	Yes	-
101309612-S	1.976	2.090	0.165	0.344	Yes	-	-
101309613-S	1.994	2.500	0.141	0.353	Yes	-	-
101309626_2-S	5.281	0.500	0.470	0.235	-	Yes	-
101309627-S	2.796	1.020	0.494	0.503	-	Yes	Yes
101309628-S	2.823	0.550	0.964	0.530	-	Yes	Yes
101310351-S	1.903	2.480	0.141	0.350	Yes	-	-
101310352-S	1.656	2.460	0.118	0.289	Yes	-	-
101310353-S	1.276	2.110	0.118	0.248	Yes	-	-
101310364-S	2.351	0.660	0.329	0.217	-	Yes	-
101310365-S	5.663	1.350	0.353	0.476	-	Yes	Yes
101310418-S	1.718	0.450	0.588	0.264	-	Yes	-
101310578-S	0.019	0.010	0.447	0.004	-	Yes	-
101310579-S	0.568	0.120	0.611	0.073	-	Yes	-
101310584-S	7.780	1.600	0.400	0.639	-	Yes	Yes
101310589-S	6.231	1.380	0.376	0.519	-	Yes	Yes
101310649-S	2.870	0.570	0.494	0.281	-	Yes	-
101310653-S	3.929	0.930	0.447	0.415	-	Yes	Yes
101310712-S	2.528	1.130	0.353	0.398	-	Yes	-
101310759-S	0.264	0.930	0.306	0.284	-	Yes	-
101310839-S	11.473	1.350	0.705	0.952	-	Yes	Yes
101310840-S	6.435	0.900	0.729	0.656	-	Yes	Yes
101310855-S	11.188	1.470	0.541	0.795	-	Yes	Yes
101310856-S	0.771	0.850	0.353	0.300	-	Yes	-

NVCA WATERSHED DRAINAGE STUDY AREA
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Link	Max Flow m^3/s	Max Velocity m/s	Max Depth m	Depth Velocity Product	Velocity > 1.7 m/s	Depth > 0.3 m	Velocity > 0.4 m^2/s
101310950-S	6.428	1.530	0.329	0.503	-	Yes	Yes
101311112-S	0.734	1.970	0.094	0.185	Yes	-	-
101311113-S	2.823	1.030	0.329	0.339	-	Yes	-
101311114-S	3.336	0.750	0.376	0.282	-	Yes	-
101311375-S	0.000	0.000	0.353	0.000	-	Yes	-
101311376-S	4.129	0.840	0.447	0.375	-	Yes	-
101401499-S	0.905	3.160	0.071	0.223	Yes	-	-
101407241-S	0.887	0.280	0.447	0.125	-	Yes	-
101408876-S	0.001	0.000	0.776	0.000	-	Yes	-
101408877-S	0.001	0.000	0.776	0.000	-	Yes	-
101408878-S	7.846	0.510	1.105	0.563	-	Yes	Yes
1021-S	5.772	1.520	0.329	0.500	-	Yes	Yes
1022-S	0.000	0.000	0.776	0.000	-	Yes	-
1024-S	0.000	0.000	0.517	0.000	-	Yes	-
1095-S	1.371	0.560	0.423	0.237	-	Yes	-
1118-S	0.274	0.500	0.447	0.223	-	Yes	-
120000815-S	6.445	1.170	0.470	0.550	-	Yes	Yes
120000816-S	1.252	0.640	0.400	0.256	-	Yes	-
120000832-S	0.324	0.100	0.306	0.031	-	Yes	-
120000833-S	0.817	0.190	0.611	0.116	-	Yes	-
120000835-S	0.453	0.230	0.541	0.124	-	Yes	-
120020075-S	0.086	0.060	0.306	0.018	-	Yes	-
120076372-S	2.298	0.170	0.823	0.140	-	Yes	-
120076373-S	8.507	0.790	1.011	0.798	-	Yes	Yes
120076374-S	1.956	0.570	0.353	0.201	-	Yes	-
120076375-S	0.000	0.000	0.353	0.000	-	Yes	-
120078382-S	1.164	0.250	0.376	0.094	-	Yes	-
120078396-S	13.951	0.670	1.340	0.897	-	Yes	Yes
120078398-S	1.714	1.930	0.282	0.544	Yes	-	Yes
120078700-S	0.780	1.710	0.094	0.161	Yes	-	-
120078889-S	15.446	0.750	2.280	1.710	-	Yes	Yes

Appendix N:
Proposed SSD Tables

KD06
Kidds Creek Watershed
(West Bayfield Secondary Plan Area)

Permenant Pool Elev=	n/a m
Top of Berm =	280.250 m
Berm/Spillway Elev. Between Cells=	n/a m

Orifice 1 Data (Hickenbottom)		**Orifice 2 Data**	
c =	0.630	c =	0.630
Diameter =	0.900 m	Diameter =	n/a m
Area[1] =	0.636 m^2	Area[1] =	n/a m^2
Invert Elev. =	278.000 m	Invert Elev. =	n/a m
Inlet Elevation =	n/a m		
Shape (yes /no)		**Shape (yes /no)**	
Spillway/Weir 1 Data		**Spillway/Weir 2 Data**	
Spillway or Weir? =	Spillway	Spillway or Weir? =	n/a
c =	1.7	c =	n/a
Side Slope[2] =	3 m	Side Slope[2] =	n/a m
Number of Sides =	1	Number of Sides =	n/a
Height of Sides =	0.1 m	Height of Sides =	n/a m
Length =	38 m	Length =	n/a m
Effective Length[3] =	n/a m	Effective Length[3] =	n/a m
Invert Elev. =	280.300 m	Invert Elev. =	n/a m

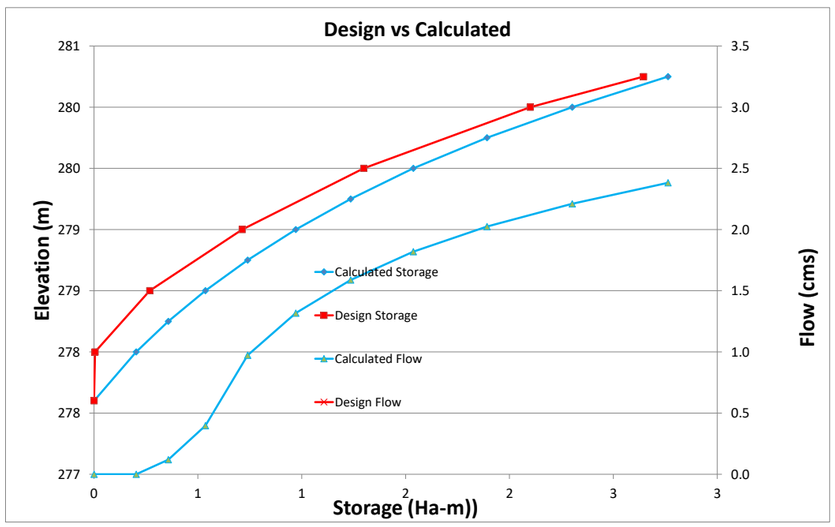
	Formulas		
(1)	**Orifice Area**	(π x Orifice Diameter^2)/4	
(2)	**Side Slope**	Horizontal Distance / Vertical Distance	
(3)	**Effective Length**	Length of Spillway/Wier - Side Slope Ratio x Number of Sides x Height of Sides	
(4)	**Stage**	Current Elev. - Invert of Permanent Pool Elev.	
(5)	**Storage**	[(Current Area+Previous Area)/2 ×(Current Stage-Previous Stage)]/10000+Previous Storage	
(6)	**Orifice Head**	Elev. - Invert Elev. - (Orifice Diameter/2)	
(7)	**Spillway/Weir Head**	Elev. - Weir Invert Elev.	
(8)	**Orifice Flow**	c x Orifice Area x √(2x9.81x Orifice Head)	
(9)	**Spillway/Weir Flow**	c x Weir Length x Weir Head$^{1.5}$	
(10)	**Total Storage**	Cell 1 Storage + Cell 2 Storage	
(11)	**Total Storage**	Cell 1 Storage + Cell 2 Storage + UICS Volume	
(12)	**Total Flow**	Orifice Flow + Wier Flow	

*In cases where the sides are perpendicular to the bottom of the spillway/weir, the slope ratio of 0.1 is used and the number of sides is 2. In cases where the sides are not perpendicular to the bottom, the number of sides used is 1.

Stage and Storage				**Flow Calculations**					**Summary**			
Cell 1				**Orifice**			**Spillway/Weir**					VO Input	
Elev (m)	**Stage[4] (m)**	**Area (m^2)**	**Storage[5] (ha*m)**	**Head[6] (m)**	**Head [7] (m)**	**Flow[8] (m^3/s)**	**Head [7] (m)**	**Flow[9] (m^3/s)**	**Total Flow [12] (m^3/s)**	**Total Storage[10] (ha*m)**	**Total Storage[11] incl. UICS Volume(ha*m)**		
277.60	0.00	4444	0.000	0.00	0.00	**0.000**	n/a	n/a	0.000	0.000	0.161		
278.00	0.40	5695	0.203	0.00	0.00	**0.000**	n/a	n/a	0.000	0.203	0.363	0.000	0.363
278.25	0.65	6669	0.357	0.00	0.25	**0.119**	n/a	n/a	0.119	0.357	0.518	0.119	0.518
278.50	0.90	7642	0.536	0.05	0.00	**0.397**	n/a	n/a	0.397	0.536	0.697	0.397	0.697
278.75	1.15	8616	0.739	0.30	0.00	**0.972**	n/a	n/a	0.972	0.739	0.900	0.972	0.900
279.00	1.40	9917	0.971	0.55	0.00	**1.317**	n/a	n/a	1.317	0.971	1.132	1.317	1.132
279.25	1.65	11217	1.235	0.80	0.00	**1.588**	n/a	n/a	1.588	1.235	1.396	1.588	1.396
279.50	1.90	12937	1.537	1.05	0.00	**1.819**	n/a	n/a	1.819	1.537	1.698	1.819	1.698
279.75	2.15	15417	1.892	1.30	0.00	**2.024**	n/a	n/a	2.024	1.892	2.052	2.024	2.052
280.00	2.40	17428	2.302	1.55	0.00	**2.210**	n/a	n/a	2.210	2.302	2.463	2.210	2.463
280.25	2.65	19441	2.763	1.80	0.00	**2.382**	n/a	n/a	2.382	2.763	2.924	2.382	2.924
280.30	**2.70**	**20520**	2.863	1.85	0.00	**2.415**	**0.00**	**0.000**	2.415	2.863	3.024	2.415	3.024
280.40	**2.80**	**21475**	3.073	1.95	0.00	**2.479**	**0.10**	**1.692**	4.171	3.073	3.234	4.171	3.234
280.50	**2.90**	**22430**	3.292	2.05	0.00	**2.542**	**0.20**	**5.160**	7.702	3.292	3.453	7.702	3.453

Tatham Engineering Revised Calculation Applies NVCA Weir Calculation for Flow Below Orifice Centroid.
Tatham Engineering Extended Values to Include Weir Flow and Additional Storage Based on 2016 LIDAR.
UICS Volume = 1,606 m^3
Proposed Grading Storage: Grade at 10:1 slope from Elev. 278.80 m down to Elev. 277.60 m

Stage-Storage-Discharge from Original Report					
Elevation		**Discharge**		**Storage**	
(ft)	**(m)**	**(ft^3/s)**	**(m^3/s)**	**(ha*m)**	**(m^3)**
	277.60			0.000	0
	278			0.0051	51
	278.5			0.268	2680
	279			0.7135	7135
	279.5			1.2982	12982
	280			2.1	21000
	280.25			2.6455	26455





1:200

Notes: -Red text indicates a value that has been calculated in this spreadsheet
- 280.25m is equal to the low point road elevation, if water levels exceed this elevation water will spill out of the pond and become part of the major street system flow. (See page 6 of KD6-D12-174 FORD STREET.pdf)
- No design discharge values available

BARRIE DRAINAGE MASTER PLAN
KIDDS CREEK WATERSHED
PROJECT NO. 1
SWMF RETROFIT NO. 11 (KD 06)

Stage-Storage Table

Top Elev.: 280.50 m
Pond Bottom Elev.: 277.60 m

Pond Geometry				Pond Volume (m^3)		
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Accum. UICS Volume (m^3)	Live	Accum. Live (m^3)
277.60	0.00	4444	4444	1606	0	1606
277.70	0.10	4757	4600	1606	460	2066
277.80	0.20	5070	4913	1606	491	2557
277.90	0.30	5382	5226	1606	523	3080
278.00	0.40	5695	5539	1606	554	3634
278.10	0.50	6084	5890	1606	589	4223
278.20	0.60	6474	6279	1606	628	4851
278.30	0.70	6863	6669	1606	667	5518
278.40	0.80	7253	7058	1606	706	6223
278.50	0.90	7642	7448	1606	745	6968
278.60	1.00	8032	7837	1606	784	7752
278.70	1.10	8421	8227	1606	823	8574
278.75	1.15	8616	8519	1606	426	9000
278.80	1.20	8876	8746	1606	437	9438
278.90	1.30	9396	9136	1606	914	10351
279.00	1.40	9917	9656	1606	966	11317
279.10	1.50	10437	10177	1606	1018	12335
279.20	1.60	10957	10697	1606	1070	13404
279.25	1.65	11217	11087	1606	554	13959
279.30	1.70	11561	11389	1606	569	14528
279.40	1.80	12249	11905	1606	1190	15719
279.50	1.90	12937	12593	1606	1259	16978
279.60	2.00	13929	13433	1606	1343	18321
279.70	2.10	14921	14425	1606	1442	19764
279.75	2.15	15417	15169	1606	758	20522
279.80	2.20	15819	15618	1606	781	21303
279.90	2.30	16624	16221	1606	1622	22925
280.00	2.40	17428	17026	1606	1703	24628
280.10	2.50	18233	17831	1606	1783	26411
280.20	2.60	19038	18636	1606	1864	28274
280.25	2.65	19441	19240	1606	962	29236
280.30	2.70	20520	19981	1606	999	30235
280.40	2.80	21475	20998	1606	2100	32335
280.50	2.90	22430	21953	1606	2195	34530

Total Active Storage = 34530 m^3

Comments:

1 Red text represents interpolated values

TATHAM ENGINEERING	Project: Barrie Drainage Master Plan	Date: 3-Jan-18
	File No.: 117076	Designed: DRT
	Subject: Conceptual Design - LID	Checked: DAM

CENTRALIZED LID DESIGN

WATERSHED: Kidds Creek
SWMF: KD06
LID TYPE: Underground Infiltration Chamber System

Drainage Area (ha):	60.0
Impervious Drainage Area (ha):	25.8
Catchment ID:	KD101
Infiltration Rate (mm/hr):	47.0
Design Safety Factor:	3.5
LID Foot Print Area (m^2):	1640
Storm Sewer Inlet Invert (m):	275.65
Storm Sewer Outlet Invert (m):	N/A
Target Capture Ratio:	5:1 - 20:1
Capture Ratio:	157

LID SIZING CALCULATIONS

STORAGE RESERVOIR DEPTH

Design Infiltration Rate (mm/hr):	13
Void Ratio for Stone Reservoir:	0.4
Drawdown Time (hr):	48
Maximum Storage Reservoir Depth (mm):	1611

STORAGE RESERVOIR VOLUME

Design Storage Reservoir Depth (mm):	1500
Storage Chamber:	1200 CMP
Unit Storage Volume (m^3/m^2):	0.98
Storage Reservoir Volume (m^3):	1607

VOLUME CONTROL

Control Target - 25mm Storm (mm):	6.49
Runoff Volume Captured (mm):	2.68

UNDERDRAIN DEFAULTS

Orifice Coefficient:	0.60
Gravitational Constant (m/s^2):	9.81
Underdrain Diameter (mm):	200
Orifice Area (m^2):	0.0314

KD05
Kidds Creek Watershed
(Livingston/Etherington)

Permenant Pool Elev=	n/a m
Top of Berm =	280.250 m
Berm/Spillway Elev. Between Cells=	n/a m

Orifice 1 Data		**Orifice 2 Data**	
c =	0.630	c =	0.630
Diameter =	0.442 m	Diameter =	n/a m
Area[1] =	0.153 m^2	Area[1] =	n/a m^2
Invert Elev. =	281.253 m	Invert Elev. =	n/a m
Inlet Elevation =	283.10 m		
Shape (yes /no)		**Shape (yes /no)**	
Spillway/Weir 1 Data		**Spillway/Weir 2 Data**	
Spillway or Weir? =	Spillway	Spillway or Weir? =	n/a
c =	1.7	c =	1.7
Side Slope[2] =	3 m	Side Slope[2] =	3 m
Number of Sides =	1	Number of Sides =	1
Height of Sides =	0.1 m	Height of Sides =	0.1 m
Length =	14.5 m	Length =	22 m
Effective Length[3] =	n/a m	Effective Length[3] =	n/a m
Invert Elev. =	285.400 m	Invert Elev. =	285.500 m

(1)	**Orifice Area**	(π x Orifice Diameter^2)/4
(2)	**Side Slope**	Horizontal Distance / Vertical Distance
(3)	**Effective Length**	Length of Spillway/Wier - Side Slope Ratio x Number of Sides x Height of Sides
(4)	**Stage**	Current Elev. - Invert of Permanent Pool Elev.
(5)	**Storage**	[(Current Area+Previous Area)/2 ×(Current Stage-Previous Stage)]/10000+Previous Storage
(6)	**Orifice Head**	Elev. - Invert Elev. - (Orifice Diameter/2)
(7)	**Spillway/Weir Head**	Elev. - Weir Invert Elev.
(8)	**Orifice Flow**	c x Orifice Area x √(2x9.81x Orifice Head)
(9)	**Spillway/Weir Flow**	c x Weir Length x Weir Head$^{1.5}$
(10)	**Total Storage**	Cell 1 Storage + Cell 2 Storage
(11)	**Total Storage**	Cell 1 Storage + Cell 2 Storage + UICS Volume
(12)	**Total Flow**	Orifice Flow + Wier Flow

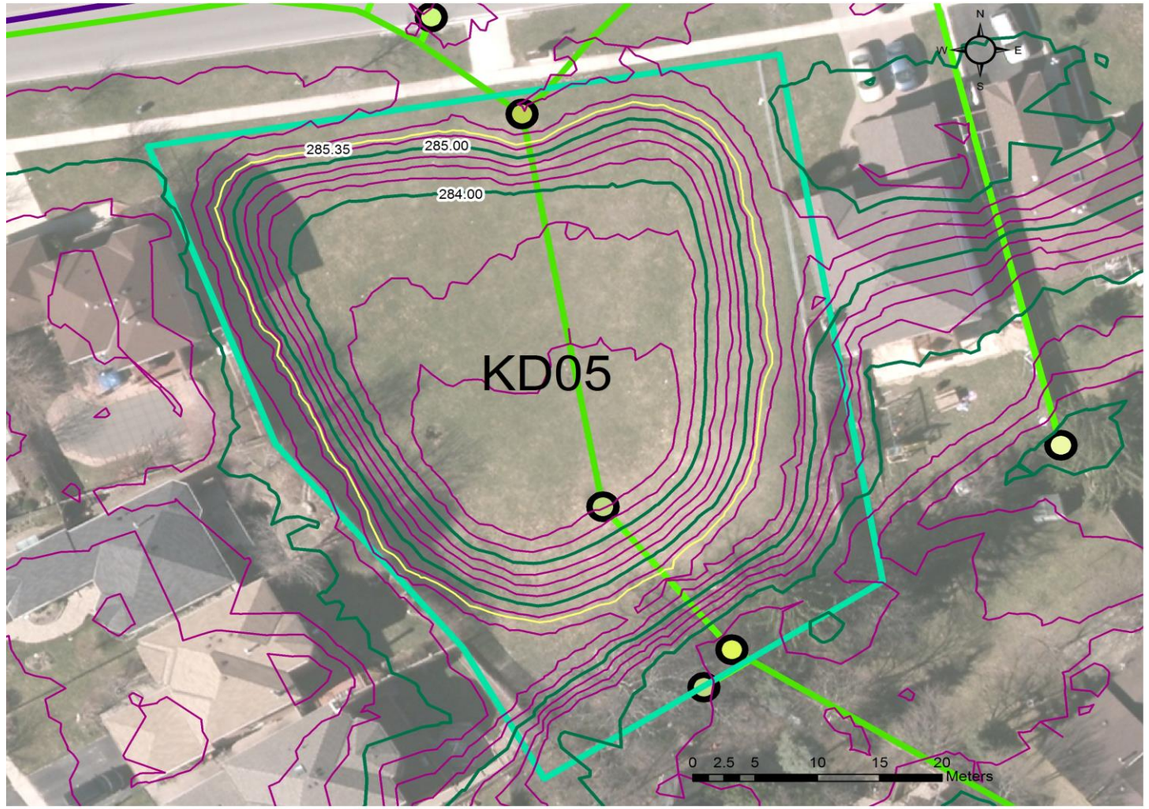
*In cases where the sides are perpendicular to the bottom of the spillway/weir, the slope ratio of 0.1 is used and the number of sides is 2. In cases where the sides are not perpendicular to the bottom, the number of sides used is 1.

Stage and Storage								**Flow Calculations**				**Summary**		
Cell 1				**Cell 2**				**Orifice**		**Spillway/Weir**				
Elev (m)	**Stage[4] (m)**	**Area (m^2)**	**Storage[5] (ha*m)**	**Elev (m)**	**Stage[4] (m)**	**Area (m^2)**	**Storage[5] (ha*m)**	**Head[6] (m)**	**Flow[8] (m^3/s)**	**Head [7] (m)**	**Flow[9] (m^3/s)**	**Total Flow [12] (m^3/s)**	**Total Storage[10] (ha*m)**	**Total Storage[11] incl. UICS Volume (ha*m)**
281.25	0.00	0	0.000		0.00		0.000	0.00	0.000	n/a	n/a	0.000	0.000	0.064
281.50	0.25	30	0.000		0.00		0.000	0.03	0.069	n/a	n/a	0.069	0.000	0.064
281.75	0.50	60	0.001		0.00		0.000	0.28	0.225	n/a	n/a	0.225	0.001	0.065
282.00	0.75	90	0.003		0.00		0.000	0.53	0.311	n/a	n/a	0.311	0.003	0.067
282.25	1.00	120	0.006		0.00		0.000	0.78	0.377	n/a	n/a	0.377	0.006	0.070
282.50	1.25	150	0.009		0.00		0.000	1.03	0.434	n/a	n/a	0.434	0.009	0.073
282.75	1.50	180	0.013		0.00		0.000	1.28	0.484	n/a	n/a	0.484	0.013	0.077
283.00	1.75	210	0.018		0.00		0.000	1.53	0.529	n/a	n/a	0.529	0.018	0.082
283.25	2.00	235	0.024		0.00		0.000	1.78	0.571	n/a	n/a	0.571	0.024	0.088
283.50	2.25	253	0.030		0.00		0.000	2.03	0.609	n/a	n/a	0.609	0.030	0.094
283.75	2.50	582	0.040		0.00		0.000	2.28	0.646	n/a	n/a	0.646	0.040	0.104
284.00	2.75	846	0.058		0.00		0.000	2.53	0.681	n/a	n/a	0.681	0.058	0.122
284.25	3.00	966	0.081		0.00		0.000	2.78	0.713	n/a	n/a	0.713	0.081	0.145
284.50	3.25	1074	0.106		0.00		0.000	3.03	0.745	n/a	n/a	0.745	0.106	0.170
284.75	3.50	1176	0.135		0.00		0.000	3.28	0.775	n/a	n/a	0.775	0.135	0.199
285.00	3.75	1279	0.165		0.00		0.000	3.53	0.804	n/a	n/a	0.804	0.165	0.229
285.25	4.00	1397	0.199		0.00		0.000	3.78	0.832	n/a	n/a	0.832	0.199	0.263
285.40	**4.15**	**1513**	0.221		0.00		0.000	3.93	0.848	**0.00**	**0.000**	0.848	0.221	0.285
285.50	**4.25**	**1678**	0.237		0.00		0.000	4.03	0.859	**0.10**	**0.707**	1.566	0.237	0.301
285.60	**4.35**	**1843**	0.254		0.00		0.000	4.13	0.870	**0.20**	**3.134**	4.004	0.254	0.318

Tatham Engineering Revised Calculations Interpolate Areas Below 283.50 and Calculates Orifice Discharge Below 283.10. SWM Report Does Not Indicate Inlet Elevation of 283.10. Furthermore, Despite Incoming Pipes at 281.25 There Is No Sitting Water Evident From Aerial Photography.

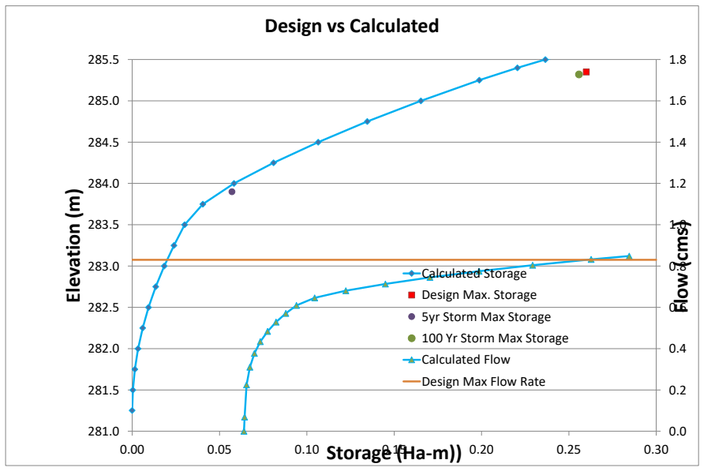
Tatham Engineering Extended Values to Include Weir Flow and Additional Storage Based on 2016 LIDAR.

UICS Volume = 640 m^3



1:500

Stage-Storage-Discharge from Original Report					
	Elevation	**Discharge**		**Storage**	
	(m)	**(ft^3/s)**	**(m^3/s)**	**(ha*m)**	**(m^3)**
Max Storage	285.35		0	0.260	
5yr Storm Max Storage	283.90		0.83	0.057	
100 Yr Storm Max Storage	285.32		0.83	0.256	
Design Max Flow Rate			0.83	0.000	
			0.83	0.300	



Notes:
- Red text indicates a value that has been calculated in this spreadsheet
- Outlet structure is a ditchinlet catch basin. Flows greater than 0.83cms will surcharge out of the control chamber and into the detention pond.
- No stage-storage calculations in the Storm Drainaage and Stormwater Management Report
- 285.35 is equal to the low point of the street for overland flow

Calculated storage is based on contours developed using 2007 LIDAR dat

TATHAM ENGINEERING	Project: Barrie Drainage Master Plan	Date: 8-Feb-18
	File No.: 117076	Designed: ASB
	Subject: Conceptual Design - LID	Checked: DRT

CENTRALIZED LID DESIGN

WATERSHED: Kidds Creek
SWMF: KD05
LID TYPE: Underground Infiltration Chamber System

Drainage Area (ha):	26.7
Impervious Drainage Area (ha):	7.6
Catchment ID:	
Infiltration Rate (mm/hr):	79.0
Design Safety Factor:	3.5
LID Foot Print Area (m^2):	440
Storm Sewer Inlet Invert (m):	296.20
Storm Sewer Outlet Invert (m):	N/A
Target Capture Ratio:	5:1 - 20:1
Capture Ratio:	173

LID SIZING CALCULATIONS

STORAGE RESERVOIR DEPTH

Design Infiltration Rate (mm/hr):	23
Void Ratio for Stone Reservoir:	0.4
Drawdown Time (hr):	48
Maximum Storage Reservoir Depth (mm):	2709

STORAGE RESERVOIR VOLUME

Design Storage Reservoir Depth (mm):	2100
Storage Chamber:	1800 CMP
Unit Storage Volume (m^3/m^2):	1.41
Storage Reservoir Volume (m^3):	620

VOLUME CONTROL

Control Target - 25mm Storm (mm):	
Runoff Volume Captured (mm):	2.33

UNDERDRAIN DEFAULTS

Orifice Coefficient:	0.60
Gravitational Constant (m/s^2):	9.81
Underdrain Diameter (mm):	0
Orifice Area (m^2):	0.0000

KD03
Kidds Creek Watershed
(Northwest Planning Area)

Permenant Pool Elev=	
Top of Berm =	
ay Elev. Between Cells=	

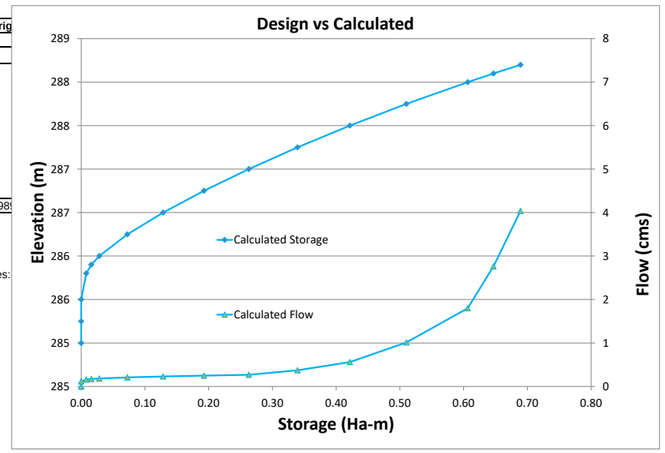
Orifice 1 Data	
c =	
Diameter =	
Area[1] =	
Invert Elev. =	

Shape (yes /no)	no
Spillway/Weir 1 Data	
Spillway or Weir? =	
c =	
Side Slope[2] =	
Number of Sides =	
Height of Sides =	m
Length =	m
Effective Length[3] =	m
Invert Elev. =	m



Stage and Storage	Flow Calculations				Summary		
Cell 1	Spillway/Weir 2		Spillway/Weir 3				
Elev (m)	Head [7] (m)	Flow[8] (m^3/s)	Head [7] (m)	Flow[9] (m^3/s)	Total Flow [12] (m^3/s)	Total Storage[10] (ha*m)	Total Storage[11] incl. UICS Volume (ha*m)
285.00	0.00	0.000	0.00	0.000	n/a	0.000	0.079
285.25	0.00	0.000	0.00	0.000	n/a	0.000	0.079
285.50	0.00	0.000	0.00	0.000	0.117	0.000	0.079
285.80	0.00	0.000	0.00	0.000	0.159	0.008	0.086
285.90	0.00	0.000	0.00	0.000	0.171	0.016	0.094
286.00	0.00	0.000	0.00	0.000	0.182	0.028	0.107
286.25	0.00	0.000	0.00	0.000	0.207	0.072	0.151
286.50	0.00	0.000	0.00	0.000	0.229	0.129	0.207
286.75	0.00	0.000	0.00	0.000	0.250	0.193	0.271
287.00	0.00	0.000	0.00	0.000	0.268	0.263	0.342
287.25	0.00	0.000	0.00	0.000	0.371	0.339	0.418
287.50	0.05	0.017	0.00	0.000	0.560	0.422	0.500
287.75	0.30	0.251	0.00	0.000	1.011	0.510	0.589
288.00	0.55	0.624	0.05	0.162	1.799	0.606	0.685
288.10	0.65	0.802	0.15	0.839	2.765	0.647	0.725
288.20	0.75	0.994	0.25	1.806	4.038	0.689	0.768

*See Notes



age-Discharge from Orig
Elevation
(ft)

ent Report, February 198

Notes:

Formulas
(1)
(2)
(3)
(4)
(5)
(6)
(7)
(8)
(9)
(10)
(11)
(12)

*In cases where the sides are perpendicular to the bottom of the



1:500

VO Input	
0.117	0.079
0.159	0.086
0.171	0.094
0.182	0.107
0.207	0.151
0.229	0.207
0.250	0.271
0.268	0.342
0.371	0.418
0.560	0.500
1.011	0.589
1.799	0.685
2.765	0.725
4.038	0.768

TATHAM ENGINEERING	Project: Barrie Drainage Master Plan	Date: 3-Jan-18
	File No.: 117076	Designed: DRT
	Subject: Conceptual Design - LID	Checked: DAM

CENTRALIZED LID DESIGN

WATERSHED: Kidds Creek
SWMF: KD03
LID TYPE: Underground Infiltration Chamber System

Drainage Area (ha):	27.8
Impervious Drainage Area (ha):	13.5
Catchment ID:	KD130
Infiltration Rate (mm/hr):	93.0
Design Safety Factor:	3.5
LID Foot Print Area (m^2):	560
Storm Sewer Inlet Invert (m):	282.45
Storm Sewer Outlet Invert (m):	N/A
Target Capture Ratio:	5:1 - 20:1
Capture Ratio:	241

LID SIZING CALCULATIONS

STORAGE RESERVOIR DEPTH

Design Infiltration Rate (mm/hr):	27
Void Ratio for Stone Reservoir:	0.4
Drawdown Time (hr):	48
Maximum Storage Reservoir Depth (mm):	3189

STORAGE RESERVOIR VOLUME

Design Storage Reservoir Depth (mm):	2100
Storage Chamber:	1800 CMP
Unit Storage Volume (m^3/m^2):	1.41
Storage Reservoir Volume (m^3):	790

VOLUME CONTROL

Control Target - 25mm Storm (mm):	6.34
Runoff Volume Captured (mm):	2.84

UNDERDRAIN DEFAULTS

Orifice Coefficient:	0.60
Gravitational Constant (m/s^2):	9.81
Underdrain Diameter (mm):	200
Orifice Area (m^2):	0.0314

BARRIE DRAINAGE MASTER PLAN
KIDD'S CREEK WATERSHED
PROJECT NO. 7
SWMF CREATION NO. 17

Stage-Storage Table

Pond Characteristics:

Top Elev.: **257.00** m
Permanent Pool Elev.: **255.50** m
Bottom Elev: **253.50** m

Pond Geometry				Pond Volume (m^3)			
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Accum. Dead	Live	Accum. Live
253.50	0.00	2167	2167	0	0	0	0
253.75	0.25	2518	2343	586	586	0	0
254.00	0.50	2870	2694	674	1259	0	0
254.25	0.75	3221	3045	761	2021	0	0
254.50	1.00	3573	3397	849	2870	0	0
254.75	1.25	3924	3748	937	3807	0	0
255.00	1.50	4275	4100	1025	4832	0	0
255.25	1.75	4627	4451	1113	5944	0	0
255.50	2.00	4978	4802	1201	7145	0	0
255.75	2.25	5347	5163	0	7145	1291	1291
256.00	2.50	5717	5532	0	7145	1383	2674
256.25	2.75	6086	5901	0	7145	1475	4149
256.50	3.00	6455	6271	0	7145	1568	5717
256.75	3.25	6825	6640	0	7145	1660	7377
257.00	3.50	7194	7009	0	7145	1752	9129

Permanent Pool Volume = **7145** **m^3**
Extended Detention Volume = **2674** **m^3**
Total Active Storage = **9129** **m^3**

Comments:

1 Red text represents interpolated values

BARRIE DRAINAGE MASTER PLAN
KIDD'S CREEK WATERSHED
PROJECT NO. 7
SWMF CREATION NO. 17

Stage-Discharge Table

Orifice 1:

Diameter (mm):	195
Area (m^2):	0.03
C:	0.63
Invert (m):	255.50

Overflow Weir:

Length of Weir (m):	10
Weir Sill Elevation (m):	256.00
Weir constant K:	1.7
Side Slope (H:1V):	5

	Orifice 1		Overflow Weir			
Elevation (m)	Head (m)	Discharge (m^3/s)	Head (m)	Discharge (m^3/s)	Hydraulic Control	Total Discharge (m^3/s)
253.50	0.000	0.000	0.000	0.000	-	0.000
253.75	0.000	0.000	0.000	0.000	-	0.000
254.00	0.000	0.000	0.000	0.000	-	0.000
254.25	0.000	0.000	0.000	0.000	-	0.000
254.50	0.000	0.000	0.000	0.000	-	0.000
254.75	0.000	0.000	0.000	0.000	-	0.000
255.00	0.000	0.000	0.000	0.000	-	0.000
255.25	0.000	0.000	0.000	0.000	-	0.000
255.50	0.000	0.000	0.000	0.000		0.000
255.75	0.153	0.033	0.000	0.000	Orifice	0.033
256.00	0.403	0.053	0.000	0.000	Orifice	0.053
256.25	0.653	0.067	0.250	2.128	Orifice/Weir	2.195
256.50	0.903	0.079	0.500	6.732	Orifice/Weir	6.811
256.75	1.153	0.089	0.750	13.565	Orifice/Weir	13.654
257.00	1.403	0.099	1.000	22.694	Orifice/Weir	22.793

Comments:

1 Red text represents calculated values

Calculation Notes

Orifice Equation is: Q = C x A x (2gH)^0.5

Where:
Q = flow rate (cms)
C = constant
A = area of opening(sq. m)
H = net head on the orifice
g = Acceleration due to gravity

Overflow weir calculations completed in accordance with NVCA rectangular broad crested weir equation (NVCA Stormwater Technical Guide, December 2013)

BARRIE DRAINAGE MASTER PLAN
KIDD'S CREEK WATERSHED
PROJECT NO. 7
SWMF CREATION NO. 17

Stage-Storage-Discharge Table

Pond Geometry				Pond Volume (m^3)			Discharge (m^3/s)
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Live	Total	
253.50	0.00	2167	2167	0	0	0	0.000
253.75	0.25	2518	2343	586	0	586	0.000
254.00	0.50	2870	2694	1259	0	1259	0.000
254.25	0.75	3221	3045	2021	0	2021	0.000
254.50	1.00	3573	3397	2870	0	2870	0.000
254.75	1.25	3924	3748	3807	0	3807	0.000
255.00	1.50	4275	4100	4832	0	4832	0.000
255.25	1.75	4627	4451	5944	0	5944	0.000
255.50	2.00	4978	4802	7145	0	7145	0.000
255.75	2.25	5347	5163	7145	1291	8436	0.033
256.00	2.50	5717	5532	7145	2674	9819	0.053
256.25	2.75	6086	5901	7145	4149	11294	2.195
256.50	3.00	6455	6271	7145	5717	12862	6.811
256.75	3.25	6825	6640	7145	7377	14522	13.654
257.00	3.50	7194	7009	7145	9129	16274	22.793

BK03
Bunkers Creek Watershed
(Anne Street and Shelly Lane)

Permenant Pool Elev=	n/a m
Top of Berm =	292.500 m
Berm/Spillway Elev. Between Cells=	n/a m

Orifice 1 Data (Hickenbottom)		**Orifice 2 Data**	
c =	0.630	c =	0.630
Diameter =	0.300 m	Diameter =	1.200 m
Area(1) =	0.071 m^2	Area(1) =	1.131 m^2
Invert Elev. =	288.770 m	Invert Elev. =	290.300 m
Inlet Elevation =	n/a m		
Shape (yes /no)		**Shape (yes /no)**	
Spillway/Weir 1 Data		**Spillway/Weir 2 Data**	
Spillway or Weir? =	n/a	Spillway or Weir? =	n/a
c =	n/a	c =	n/a
Side Slope(2) =	n/a m	Side Slope(2) =	n/a m
Number of Sides =	n/a	Number of Sides =	n/a
Height of Sides =	n/a m	Height of Sides =	n/a m
Length =	n/a m	Length =	n/a m
Effective Length(3) =	n/a m	Effective Length(3) =	n/a m
Invert Elev. =	n/a m	Invert Elev. =	n/a m

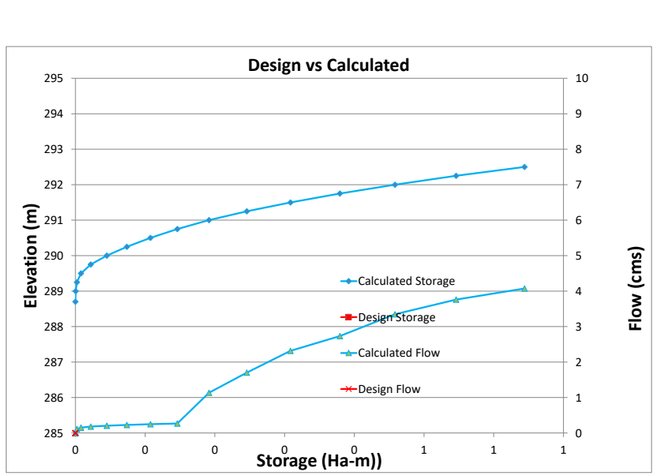
	Formulas	
(1)	**Orifice Area**	(π x Orifice Diameter^2)/4
(2)	**Side Slope**	Horizontal Distance / Vertical Distance
(3)	**Effective Length**	Length of Spillway/Wier - Side Slope Ratio x Number of Sides x Height of Sides
(4)	**Stage**	Current Elev. - Invert of Permanent Pool Elev.
(5)	**Storage**	[(Current Area+Previous Area)/2 ×(Current Stage-Previous Stage)]/10000+Previous Storage
(6)	**Orifice Head**	Elev. - Invert Elev. - (Orifice Diameter/2)
(7)	**Spillway/Weir Head**	Elev. - Weir Invert Elev.
(8)	**Orifice Flow**	c x Orifice Area x √(2x9.81x Orifice Head)
(9)	**Spillway/Weir Flow**	c x Weir Length x Weir Head$^{1.5}$
(10)	**Total Storage**	Cell 1 Storage + Cell 2 Storage
(11)	**Total Flow**	Orifice Flow + Wier Flow

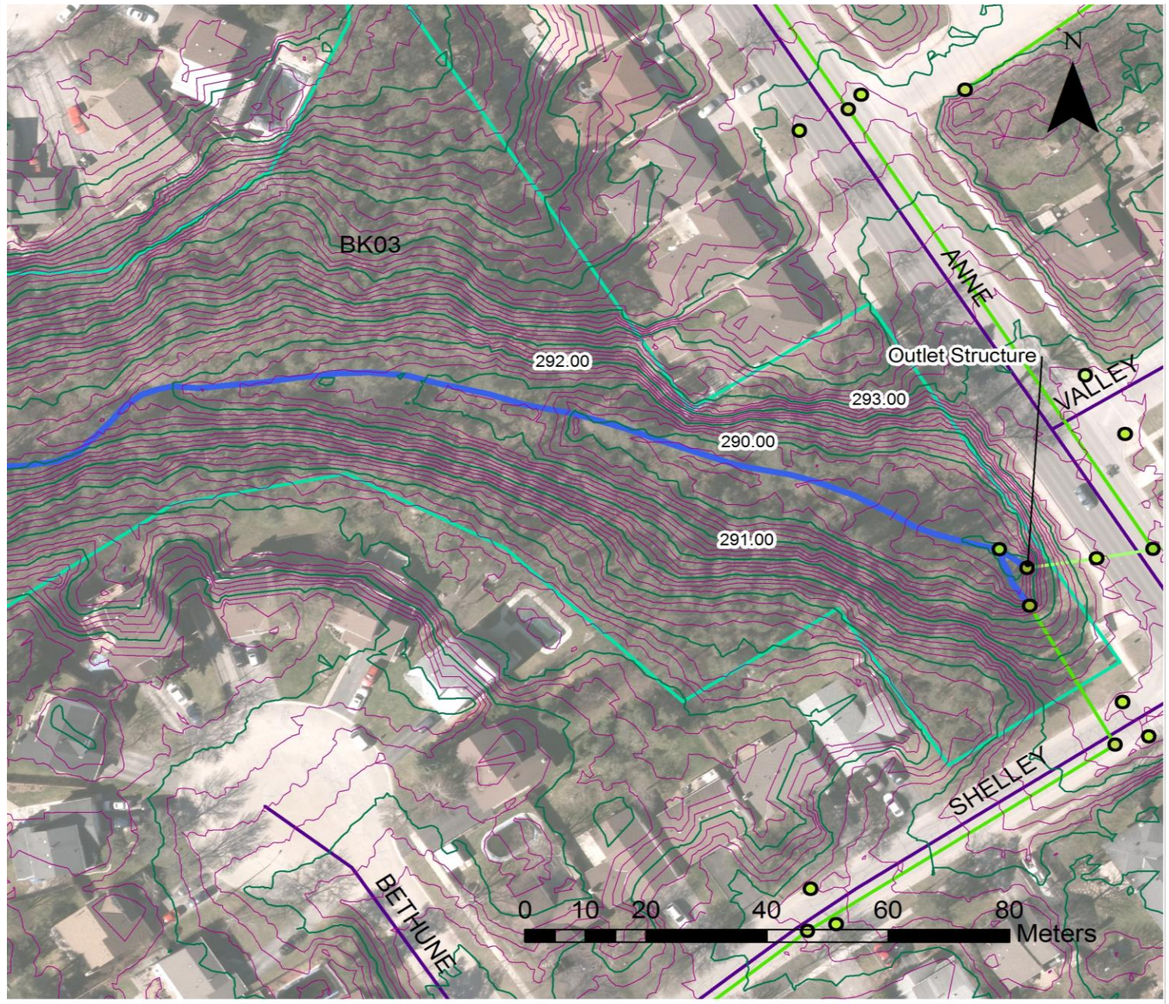
*In cases where the sides are perpendicular to the bottom of the spillway/weir, the slope ratio of 0.1 is used and the number of sides is 2. In cases where the sides are not perpendicular to the bottom, the number of sides used is 1.

Stage and Storage								**Flow Calculations**				**Summary**	
Cell 1				**Cell 2**				**Orifice**		**Orifice**			
Elev	**Stage(4)**	**Area**	**Storage(5)**	**Elev**	**Stage(4)**	**Area**	**Storage(5)**	**Head(6)**	**Flow(8)**	**Head (7)**	**Flow(9)**	**Total Flow (11)**	**Total Storage(10)**
(m)	**(m)**	**(m^2)**	**(ha*m)**	**(m)**	**(m)**	**(m^2)**	**(ha*m)**	**(m)**	**(m^3/s)**	**(m)**	**(m^3/s)**	**(m^3/s)**	**(ha*m)**
288.70	0.00	0	0.000		0.00		0.000	0.00	n/a	n/a	n/a	n/a	0.000
289.00	0.23	28	0.000		0.00		0.000	0.08	n/a	0.00	n/a	n/a	0.000
289.25	0.48	121	0.002		0.00		0.000	0.33	0.113	0.00	n/a	0.113	0.002
289.50	0.73	343	0.008		0.00		0.000	0.58	0.150	0.00	n/a	0.150	0.008
289.75	0.98	780	0.022		0.00		0.000	0.83	0.180	0.00	n/a	0.180	0.022
290.00	1.23	1051	0.045		0.00		0.000	1.08	0.205	0.00	n/a	0.205	0.045
290.25	1.48	1258	0.074		0.00		0.000	1.33	0.227	0.00	n/a	0.227	0.074
290.50	1.73	1445	0.108		0.00		0.000	1.58	0.248	0.00	n/a	0.248	0.108
290.75	1.98	1640	0.146		0.00		0.000	1.83	0.267	0.00	n/a	0.267	0.146
291.00	2.23	1992	0.192		0.00		0.000	2.08	0.284	0.10	0.850	1.134	0.192
291.25	2.48	2349	0.246		0.00		0.000	2.33	0.301	0.35	1.400	1.701	0.246
291.50	2.73	2663	0.308		0.00		0.000	2.58	0.317	0.60	2.000	2.317	0.308
291.75	2.98	3003	0.379		0.00		0.000	2.83	0.332	0.85	2.400	2.732	0.379
292.00	3.23	3326	0.458		0.00		0.000	3.08	0.346	1.10	3.000	3.346	0.458
292.25	3.48	3688	0.546		0.00		0.000	3.33	0.360	1.35	3.400	3.760	0.546
292.50	3.73	4159	0.644		0.00		0.000	3.58	0.373	1.60	3.700	4.073	0.644

Stage-Storage-Discharge from Original Report					
Elevation		**Discharge**		**Storage**	
(ft)	**(m)**	**(ft^3/s)**	**(m^3/s)**	**(ha*m)**	**(ft^3)**
	0.00		0	0.000	
	0.00		0	0.000	
	0.00		0	0.000	
	0.00		0	0.000	
	0.00		0	0.000	
	0.00		0	0.000	
	0.00		0	0.000	
	0.00		0	0.000	
	0.00		0	0.000	
	0.00		0	0.000	
	0.00		0	0.000	
	0.00		0	0.000	
	0.00		0	0.000	
	0.00		0	0.000	
	0.00		0	0.000	
	0.00		0	0.000	

Notes: -Red text indicates a value that has been calculated in this spreadsheet
- Water levels exceeding 292.50m will spill over onto Anne St
- No Design Report





TATHAM ENGINEERING	Project: Barrie Drainage Master Plan	Date: 3-Jan-18
	File No.: 117076	Designed: DRT
	Subject: Conceptual Design - LID	Checked: DAM

CENTRALIZED LID DESIGN

WATERSHED: Bunkers Creek
SWMF: BK03
LID TYPE: Underground Infiltration Chamber System

Drainage Area (ha):	26.6
Impervious Drainage Area (ha):	12.8
Catchment ID:	
Infiltration Rate (mm/hr):	64.0
Design Safety Factor:	3.5
LID Foot Print Area (m^2):	535
Storm Sewer Inlet Invert (m):	296.20
Storm Sewer Outlet Invert (m):	N/A
Target Capture Ratio:	5:1 - 20:1
Capture Ratio:	239

LID SIZING CALCULATIONS

STORAGE RESERVOIR DEPTH

Design Infiltration Rate (mm/hr):	18
Void Ratio for Stone Reservoir:	0.4
Drawdown Time (hr):	48
Maximum Storage Reservoir Depth (mm):	2194

STORAGE RESERVOIR VOLUME

Design Storage Reservoir Depth (mm):	2100
Storage Chamber:	1800 CMP
Unit Storage Volume (m^3/m^2):	1.41
Storage Reservoir Volume (m^3):	754

VOLUME CONTROL

Control Target - 25mm Storm (mm):	4.21
Runoff Volume Captured (mm):	2.83

UNDERDRAIN DEFAULTS

Orifice Coefficient:	0.60
Gravitational Constant (m/s^2):	9.81
Underdrain Diameter (mm):	200
Orifice Area (m^2):	0.0314

BARRIE DRAINAGE MASTER PLAN
BUNKERS CREEK WATERSHED
PROJECT NO. 39
SWMF RETROFIT NO. 94 (Options 1 & 3)

Stage-Storage Table

Pond Characteristics:

Top Elevation: 230.60 m
Bottom Elev: 227.00 m
Stage 0.3 m

Pond Geometry				Storage Volume (m^3)	
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Live	Accum. Live
227.00	0.00	2916	2916	0	0
227.30	0.30	3175	3045	914	914
227.60	0.60	3433	3304	991	1905
227.90	0.90	3692	3563	1069	2974
228.00	1.00	3778	3735	373	3347
228.20	1.20	3962	3870	774	4121
228.50	1.50	4237	4099	1230	5351
228.80	1.80	4512	4375	1312	6663
229.00	2.00	4696	4604	921	7584
229.10	2.10	4793	4745	474	8058
229.40	2.40	5086	4940	1482	9540
229.70	2.70	5378	5232	1570	11110
230.00	3.00	5670	5524	1657	12767
230.30	3.30	6060	5865	1760	14527
230.60	3.60	6450	6255	1876	16403

Total Active Storage = 16403 m^3

Comments:

1 Red text represents interpolated values

BARRIE DRAINAGE MASTER PLAN
BUNKERS CREEK WATERSHED
PROJECT NO. 39
SWMF RETROFIT NO. 94 (Options 1 & 3)

Stage-Discharge Table

Box Culvert:

Width:	1200
Height:	1200
Invert:	227.00

Elevation (m)	Total Discharge (m^3/s)
227.00	0.00
227.30	0.47
227.60	0.94
227.90	1.68
228.00	1.92
228.20	2.54
228.50	3.48
228.80	4.06
229.00	4.44
229.10	4.61
229.40	5.11
229.70	5.55
230.00	6.00
230.30	6.48
230.60	6.96

Comments:

1 Red text represents calculated values

Calculation Notes:

Box culvert calculations in accordance with MTO Design Chart 5.39

BARRIE DRAINAGE MASTER PLAN
BUNKERS CREEK WATERSHED
PROJECT NO. 39
SWMF RETROFIT NO. 94 (Options 1 & 3)

Stage-Storage-Discharge Table

Pond Geometry				Pond Volume (m^3)	Discharge
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Live	(m^3/s)
227.00	0.00	2916	2916	0	0.00
227.30	0.30	3175	3045	914	0.47
227.60	0.60	3433	3304	1905	0.94
227.90	0.90	3692	3563	2974	1.68
228.00	1.00	3778	3735	3347	1.92
228.20	1.20	3962	3870	4121	2.54
228.50	1.50	4237	4099	5351	3.48
228.80	1.80	4512	4375	6663	4.06
229.00	2.00	4696	4604	7584	4.44
229.10	2.10	4793	4745	8058	4.61
229.40	2.40	5086	4940	9540	5.11
229.70	2.70	5378	5232	11110	5.55
230.00	3.00	5670	5524	12767	6.00
230.30	3.30	6060	5865	14527	6.48
230.60	3.60	6450	6255	16403	6.96

BARRIE DRAINAGE MASTER PLAN
BUNKERS CREEK WATERSHED
PROJECT NO. 39
SWMF RETROFIT NO. 94 (Option 2)

Stage-Storage Table

Pond Characteristics:

Top Elevation: 230.60 m
Bottom Elev: 227.00 m

Pond Geometry				Storage Volume (m^3)	
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Live	Accum. Live
228.00	0.00	235	235	0	0
228.20	0.20	386	311	62	62
228.40	0.40	538	462	92	155
228.60	0.60	689	614	123	277
228.80	0.80	841	765	153	430
229.00	1.00	992	916	183	613
229.20	1.20	1186	1089	218	831
229.40	1.40	1380	1283	257	1088
229.60	1.60	1574	1477	295	1383
229.80	1.80	1768	1671	334	1717
230.00	2.00	1962	1865	373	2090

Total Active Storage = 2090 m^3

Comments:

1 Red text represents interpolated values

BARRIE DRAINAGE MASTER PLAN
BUNKERS CREEK WATERSHED
PROJECT NO. 39
SWMF RETROFIT NO. 94 (Option 2)

Stage-Discharge Table

Box Culvert:

Width:	1200
Height:	1200
Invert:	227.00

Elevation (m)	Total Discharge (m^3/s)
228.00	0.00
228.20	0.47
228.40	0.94
228.60	1.43
228.80	1.92
229.00	2.70
229.20	3.48
229.40	3.96
229.60	4.44
229.80	4.78
230.00	5.11

Comments:

1 Red text represents calculated values

Calculation Notes:

Box culvert calculations in accordance with MTO Design Chart 5.39

BARRIE DRAINAGE MASTER PLAN
BUNKERS CREEK WATERSHED
PROJECT NO. 39
SWMF RETROFIT NO. 94 (Option 2)

Stage-Storage-Discharge Table

Pond Geometry				Pond Volume (m^3)	Discharge
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Live	(m^3/s)
228.00	0.00	235	235	0	0.00
228.20	0.20	386	311	62	0.47
228.40	0.40	538	462	155	0.94
228.60	0.60	689	614	277	1.43
228.80	0.80	841	765	430	1.92
229.00	1.00	992	916	613	2.70
229.20	1.20	1186	1089	831	3.48
229.40	1.40	1380	1283	1088	3.96
229.60	1.60	1574	1477	1383	4.44
229.80	1.80	1768	1671	1717	4.78
230.00	2.00	1962	1865	2090	5.11

TATHAM ENGINEERING	Project: Barrie Drainage Master Plan	Date: 3-Jan-18
	File No.: 117076	Designed: DRT
	Subject: Conceptual Design - LID	Checked: DAM

CENTRALIZED LID DESIGN

WATERSHED: Dyments Creek
SWMF: DY02
LID TYPE: Underground Infiltration Chamber System

Drainage Area (ha):	17.9
Impervious Drainage Area (ha):	7.9
Catchment ID:	
Infiltration Rate (mm/hr):	64.0
Design Safety Factor:	3.5
LID Foot Print Area (m^2):	350
Storm Sewer Inlet Invert (m):	293.65
Storm Sewer Outlet Invert (m):	N/A
Target Capture Ratio:	5:1 - 20:1
Capture Ratio:	225

LID SIZING CALCULATIONS

STORAGE RESERVOIR DEPTH

Design Infiltration Rate (mm/hr):	18
Void Ratio for Stone Reservoir:	0.4
Drawdown Time (hr):	48
Maximum Storage Reservoir Depth (mm):	2194

STORAGE RESERVOIR VOLUME

Design Storage Reservoir Depth (mm):	2100
Storage Chamber:	1800 CMP
Unit Storage Volume (m^3/m^2):	1.41
Storage Reservoir Volume (m^3):	494

VOLUME CONTROL

Control Target - 25mm Storm (mm):	7.96
Runoff Volume Captured (mm):	2.76

UNDERDRAIN DEFAULTS

Orifice Coefficient:	0.60
Gravitational Constant (m/s^2):	9.81
Underdrain Diameter (mm):	200
Orifice Area (m^2):	0.0314

BARRIE DRAINAGE MASTER PLAN
DYMENTS CREEK WATERSHED
PROJECT NO. 181
SWMF RETROFIT NO. 78

Stage-Storage Table

Pond Characteristics:

Top Elev.: **237.10** m
Bottom Elev.: **235.10** m

Pond Geometry				Pond Volume (m^3)			
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Accum. Dead	Live	Accum. Live
235.10	0.00	13440	13440	0	0	0	0
235.20	0.20	29870	21655	0	0	2165	2165
235.40	0.40	63170	46520	0	0	9304	11470
235.60	0.60	71821	67496	0	0	13499	24969
235.80	0.80	82045	76933	0	0	15387	40355
236.00	1.00	87920	84983	0	0	16996	57352
236.20	1.20	93300	90610	0	0	18122	75474
236.40	1.40	95129	94215	0	0	18843	94317
236.60	1.60	96958	96044	0	0	19209	113525
236.80	1.80	98787	97873	0	0	19575	133100
237.00	2.00	100616	99702	0	0	19940	153040
237.10	2.20	102445	101531	0	0	10153	163193

Total Active Storage = **163193** m^3

Comments:

1 Red text represents interpolated values

BARRIE DRAINAGE MASTER PLAN
DYMENTS CREEK WATERSHED
PROJECT NO. 181
SWMF RETROFIT NO. 78

Stage-Discharge Table

Orifice #1:		**Overflow Weir:**	
Width (m):	2438	Length of Weir (m):	55
Height (m):	914	Weir Sill Elevation (m):	236.40
C:	0.63	Weir constant K:	1.6
Invert (m):	234.43	Side Slope (H:1V):	5

Elevation (m)	Total Discharge (m^3/s)
235.10	2.197
235.20	2.570
235.40	3.332
235.60	4.125
235.80	4.544
236.00	4.962
236.20	5.526
236.40	6.185
236.60	12.225
236.80	**23.087**
237.00	**43.693**
237.10	**55.818**

HEC-RAS Output	
Elevation (m)	Total Discharge (m^3/s)
235.09	2.160
235.38	3.240
235.55	4.020
236.08	5.130
236.45	6.350
236.52	7.820
236.67	16.080

Comments:

1. Red text represents calculated values
2. **Bold** red text represents calculated weir capacity assuming outlet is blocked. Demonstrates weir capacity for regional event with 0.3 m freeboard assuming outlet is blocked.

BARRIE DRAINAGE MASTER PLAN
DYMENTS CREEK WATERSHED
PROJECT NO. 181
SWMF RETROFIT NO. 78

Stage-Storage-Discharge Table

Pond Geometry				Pond Volume (m^3)			Discharge (m^3/s)
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Live	Total	
235.10	0.00	13440	13440	0	0	0	2.20
235.20	0.20	29870	21655	0	2165	2165	2.57
235.40	0.40	63170	46520	0	11470	11470	3.33
235.60	0.60	71821	67496	0	24969	24969	4.12
235.80	0.80	82045	76933	0	40355	40355	4.54
236.00	1.00	87920	84983	0	57352	57352	4.96
236.20	1.20	93300	90610	0	75474	75474	5.53
236.40	1.40	95129	94215	0	94317	94317	6.19
236.60	1.60	96958	96044	0	113525	113525	12.23
236.80	1.80	98787	97873	0	133100	133100	23.09
237.00	2.00	100616	99702	0	153040	153040	43.69
237.10	2.20	102445	101531	0	163193	163193	55.82

BARRIE DRAINAGE MASTER PLAN
DYMENTS CREEK WATERSHED
PROJECT NO. 170A
SWMF RETROFIT NO. 79 (DY 01)

Stage-Storage Table

Pond Characteristics:

Bottom Elev.: **223.00** m
Permanent Pool Elev.: **225.00** m
Top Elev.: **227.50** m

Pond Geometry				Pond Volume (m^3)			
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Accum. Dead	Live	Accum. Live
223.00	0.00	7712	7712	0	0	0	0
223.25	0.25	8709	8211	2053	2053	0	0
223.50	0.50	9706	9208	2302	4355	0	0
223.75	0.75	10703	10205	2551	6906	0	0
224.00	1.00	11701	11202	2800	9706	0	0
224.25	1.25	12698	12199	3050	12756	0	0
224.50	1.50	13695	13196	3299	16055	0	0
224.75	1.75	14692	14193	3548	19603	0	0
225.00	2.00	15689	15190	3798	23401	0	0
225.25	2.25	17516	16602	0	23401	4151	4151
225.50	2.50	18789	18152	0	23401	4538	8689
225.75	2.75	20063	19426	0	23401	4856	13545
226.00	3.00	20107	20085	0	23401	5021	18566
226.25	3.25	21586	20846	0	23401	5212	23778
226.50	3.50	23064	22325	0	23401	5581	29359
226.75	3.75	24543	23803	0	23401	5951	35310
227.00	4.00	26021	25282	0	23401	6320	41630
227.25	4.25	27500	26760	0	23401	6690	48320
227.50	4.50	28978	28239	0	23401	7060	55380
227.75	4.75	30457	29717	0	23401	7429	62809

Permanent Pool Volume = **23401** m^3
Extended Detention Volume = **18566** m^3
Active Storage = **62809** m^3

Comments:

1 Red text represents interpolated values

BARRIE DRAINAGE MASTER PLAN
DYMENTS CREEK WATERSHED
PROJECT NO. 170A
SWMF RETROFIT NO. 79 (DY 01)

Stage-Discharge Table

Orifice 1:		**DICB 1:**		**Overflow Weir:**	
Diameter (mm):	440	Length (m):	1.2	Length of Weir (m):	15
Area (m^2):	0.15	Grate:	5:1	Weir Sill Elev. (m):	226.60
C:	0.63	Invert (m):	226.10	Weir constant K:	1.7
Invert (m):	225.00			Side Slope (H:1V):	5

	Orifice 1		DICB 1		Overflow Weir			
Elevation (m)	Head (m)	Discharge (m^3/s)	Head (m)	Discharge (m^3/s)	Head (m)	Discharge (m^3/s)	Hydraulic Control	Total Discharge (m^3/s)
223.00	0.000	0.000	0.000	0.000	0.000	0.000	Orifice	0.000
223.25	0.000	0.000	0.000	0.000	0.000	0.000	Orifice	0.000
223.50	0.000	0.000	0.000	0.000	0.000	0.000	Orifice	0.000
223.75	0.000	0.000	0.000	0.000	0.000	0.000	Orifice	0.000
224.00	0.000	0.000	0.000	0.000	0.000	0.000	Orifice	0.000
224.25	0.000	0.000	0.000	0.000	0.000	0.000	Orifice	0.000
224.50	0.000	0.000	0.000	0.000	0.000	0.000	Orifice	0.000
224.75	0.000	0.000	0.000	0.000	0.000	0.000	Orifice	0.000
225.00	0.000	0.000	0.000	0.000	0.000	0.000	Orifice	0.000
225.25	0.030	0.073	0.000	0.000	0.000	0.000	Orifice	0.073
225.50	0.280	0.225	0.000	0.000	0.000	0.000	Orifice	0.225
225.75	0.530	0.309	0.000	0.000	0.000	0.000	Orifice	0.309
226.00	0.780	0.375	0.000	0.000	0.000	0.000	Orifice	0.375
226.25	1.030	0.431	0.149	0.279	0.000	0.000	Orifice	0.709
226.50	1.280	0.480	0.399	1.510	0.000	0.000	Orifice	1.990
226.75	1.530	0.525	0.649	3.794	0.150	1.367	Orifice	5.686
227.00	1.780	0.566	0.899	7.116	0.400	6.635	Orifice	14.317
227.25	2.030	0.605	1.149	11.482	0.650	14.807	Orifice	26.893
227.50	2.280	0.641	1.399	18.072	0.900	25.770	Orifice	44.482
227.75	2.530	0.675	1.649	23.268	1.150	39.568	Orifice	63.510

Comments:

1 Red text represents calculated values

Calculation Notes

Orifice Equation is: Q = C x A x (2gH)^0.5

Where:
Q = flow rate (cms)
C = constant
A = area of opening(sq. m)
H = net head on the orifice
g = Acceleration due to gravity

DICB calculations in accordance with MTO Design Chart 4.20

Overflow weir calculations completed in accordance with NVCA rectangular broad crested weir equation (NVCA Stormwater Technical Guide, December 2013)

BARRIE DRAINAGE MASTER PLAN
DYMENTS CREEK WATERSHED
PROJECT NO. 170A
SWMF RETROFIT NO. 79 (DY 01)

Stage-Storage-Discharge Table

Pond Geometry				Pond Volume (m^3)			Discharge
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m^2)	Dead	Live	Total	(m^3/s)
223.00	0.00	7712	7712	0	0	0	0.00
223.25	0.25	8709	8211	2053	0	2053	0.00
223.50	0.50	9706	9208	4355	0	4355	0.00
223.75	0.75	10703	10205	6906	0	6906	0.00
224.00	1.00	11701	11202	9706	0	9706	0.00
224.25	1.25	12698	12199	12756	0	12756	0.00
224.50	1.50	13695	13196	16055	0	16055	0.00
224.75	1.75	14692	14193	19603	0	19603	0.00
225.00	2.00	15689	15190	23401	0	23401	0.00
225.25	2.25	17516	16602	23401	4151	27552	0.07
225.50	2.50	18789	18152	23401	8689	32090	0.22
225.75	2.75	20063	19426	23401	13545	36946	0.31
226.00	3.00	20107	20085	23401	18566	41967	0.37
226.25	3.25	21586	20846	23401	23778	47179	0.71
226.50	3.50	23064	22325	23401	29359	52760	1.99
226.75	3.75	24543	23803	23401	35310	58711	5.69
227.00	4.00	26021	25282	23401	41630	65031	14.32
227.25	4.25	27500	26760	23401	48320	71721	26.89
227.50	4.50	28978	28239	23401	55380	78781	44.48
227.75	4.75	30457	29717	23401	62809	86210	63.51

BARRIE DRAINAGE MASTER PLAN
HOTCHKISS CREEK WATERSHED
PROJECT NO. 17
SWMF RETROFIT NO. 44

Stage-Storage Table

Pond Characteristics:

Top Elevation: **237.70** m
Bottom Elev: **236.20** m

Pond Geometry				Pond Volume (m^3)			
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Accum. Dead	Live	Accum. Live
236.20	0.00	7822	7822	0	0	0	0
236.30	0.10	8013	7918	792	792	0	0
236.40	0.20	8205	8109	811	1603	0	0
236.50	0.30	8396	8300	830	2433	0	0
236.60	0.40	8601	8498	0	2433	850	850
236.70	0.50	8806	8703	0	2433	870	1720
236.80	0.60	9011	8908	0	2433	891	2611
236.90	0.70	9215	9113	0	2433	911	3522
237.00	0.80	9420	9318	0	2433	932	4454
237.10	0.90	9625	9523	0	2433	952	5406
237.20	1.00	9830	9728	0	2433	973	6379
237.30	1.10	10031	9931	0	2433	993	7372
237.40	1.20	10232	10132	0	2433	1013	8385
237.50	1.30	10443	10337	0	2433	1034	9419
237.60	1.40	10653	10548	1	2434	1055	10474
237.70	1.50	10864	10759	2	2436	1076	11550

Permanent Pool Volume = **2436** m^3
Extended Detention Volume = **4454** m^3
Total Active Storage = **2436** m^3

Comments:

1 Red text represents interpolated values

BARRIE DRAINAGE MASTER PLAN
HOTCHKISS CREEK WATERSHED
PROJECT NO. 17
SWMF RETROFIT NO. 44

Stage-Discharge Table

Orifice / Pipe:	**1**	**2**
Diameter (mm):	240	525
Area (m^2):	0.05	0.22
C:	0.63	0.80
Invert (m):	236.50	236.20

DICB:	
Length (m):	0.6
Grate:	5:1
Invert (m):	237.00

Overflow Weir:	
Length of Weir (m):	15
Weir Sill Elevation (m):	237.30
Weir constant K:	1.7
Side Slope (H:V):	5

	Orifice (1)		DICB		Outlet Pipe (2)		Overflow Weir			
Elevation (m)	Head (m)	Discharge (m^3/s)	Head (m)	Discharge (m^3/s)	Head (m)	Discharge (m^3/s)	Head (m)	Discharge (m^3/s)	Hydraulic Control	Total Discharge (m^3/s)
236.20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Orifice	0.000
236.30	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Orifice	0.000
236.40	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Orifice	0.000
236.50	0.000	0.000	0.000	0.000	0.038	0.149	0.000	0.000	Orifice	0.000
236.60	0.100	0.009	0.000	0.000	0.400	0.185	0.000	0.000	Orifice	0.009
236.70	0.080	0.036	0.000	0.000	0.500	0.248	0.000	0.000	Orifice	0.036
236.80	0.180	0.054	0.000	0.000	0.337	0.446	0.000	0.000	Orifice	0.054
236.90	0.280	0.067	0.000	0.000	0.437	0.507	0.000	0.000	Orifice	0.067
237.00	0.380	0.078	0.000	0.000	0.538	0.562	0.000	0.000	Orifice	0.078
237.10	0.480	0.087	0.100	0.068	0.638	0.612	0.000	0.000	Orifice/DICB	0.156
237.20	0.580	0.096	0.200	0.214	0.738	0.659	0.000	0.000	Orifice/DICB	0.310
237.30	0.680	0.104	0.300	0.443	0.837	0.702	0.000	0.000	Pipe	0.547
237.40	0.780	0.111	0.400	0.755	0.937	0.743	0.100	0.711	Pipe	1.453
237.50	0.880	0.118	0.500	1.150	1.038	0.781	0.200	2.169	Pipe/Weir	2.950
237.60	0.980	0.125	0.600	1.627	1.138	0.818	0.300	4.161	Pipe/Weir	4.980
237.70	1.080	0.131	0.700	2.188	1.238	0.853	0.400	6.635	Pipe/Weir	7.489

Comments:

1 Red text represents calculated values

Orifice discharge calculated as weir flow (see additional notes)

Calculation Notes

Orifice Equation is: Q = C x A x (2gH)^0.5

Where: Q = flow rate (cms)
C = constant
A = area of opening(sq. m)
H = net head on the orifice
g = Acceleration due to gravity

DICB calculations in accordance with MTO Design Chart 4.20

Overflow weir calculations completed in accordance with NVCA rectangular broad crested weir equation (NVCA Stormwater Technical Guide, December 2013)

Additional Notes:

NVCA Weir Flow Calculation Applied For Weir Flow Below Orifice Centroid

$$Q_w = 1.65([(pi*(D^2)/4)(2*\cos^{-1}[(((D/2)-d)/(D/2))*(180/pi)]/360)-((D/2-d)(Dd-d^2)^{0.5})]/d)d^{1.5}$$

Where:
Q_w is weir flow (m^3/s)
D is orifice diameter (m)
d is depth of flow above the invert (m)

BARRIE DRAINAGE MASTER PLAN
HOTCHKISS CREEK WATERSHED
PROJECT NO. 17
SWMF RETROFIT NO. 44

Stage-Storage-Discharge Table

Pond Geometry				Pond Volume (m^3)			Discharge
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Live	Total	(m^3/s)
236.20	0.00	7822	7822	0	0	0	0.00
236.30	0.10	8013	7918	792	0	792	0.00
236.40	0.20	8205	8109	1603	0	1603	0.00
236.50	0.30	8396	8300	2433	0	2433	0.00
236.60	0.40	8601	8498	2433	850	3283	0.01
236.70	0.50	8806	8703	2433	1720	4153	0.04
236.80	0.60	9011	8908	2433	2611	5044	0.05
236.90	0.70	9215	9113	2433	3522	5955	0.07
237.00	0.80	9420	9318	2433	4454	6887	0.08
237.10	0.90	9625	9523	2433	5406	7839	0.16
237.20	1.00	9830	9728	2433	6379	8812	0.31
237.30	1.10	10031	9931	2433	7372	9805	0.55
237.40	1.20	10232	10132	2433	8385	10818	1.45
237.50	1.30	10443	10337	2433	9419	11852	2.95
237.60	1.40	10653	10548	2434	10474	12908	4.98
237.70	1.50	10864	10759	2436	11550	13985	7.49

TATHAM ENGINEERING	Project: Barrie Drainage Master Plan	Date: 12-Apr-18
	File No.: 117076	Designed: DAM
	Subject: Conceptual Design - LID	Checked: DRT

CENTRALIZED LID DESIGN

WATERSHED: Hotchkiss Creek
SWMF: RO44 - Option 2
LID TYPE: Underground Infiltration Chamber System

Drainage Area (ha):	71.3
Impervious Drainage Area (ha):	23.0
Catchment ID:	N/A
Infiltration Rate (mm/hr):	94.0
Design Safety Factor:	3.5
LID Foot Print Area (m^2):	1953
Storm Sewer Inlet Invert (m):	236.50
Storm Sewer Outlet Invert (m):	N/A
Target Capture Ratio:	5:1 - 20:1
Capture Ratio:	118

LID SIZING CALCULATIONS

STORAGE RESERVOIR DEPTH

Design Infiltration Rate (mm/hr):	27
Void Ratio for Stone Reservoir:	0.4
Drawdown Time (hr):	48
Maximum Storage Reservoir Depth (mm):	3223

STORAGE RESERVOIR VOLUME

Design Storage Reservoir Depth (mm):	1079
Storage Chamber:	300XLHD
Unit Storage Volume (m^3/m^2):	0.71
Storage Reservoir Volume (m^3):	1387

VOLUME CONTROL

Control Target - 25mm Storm (mm):	5.2
Runoff Volume Captured (mm):	1.9

UNDERDRAIN DEFAULTS

Orifice Coefficient:	0.60
Gravitational Constant (m/s^2):	9.81
Underdrain Diameter (mm):	0
Orifice Area (m^2):	0.0000

BARRIE DRAINAGE MASTER PLAN
HOTCHKISS CREEK WATERSHED
PROJECT NO. 19
SWMF RETROFIT NO. 81

Stage-Storage Table

Pond Characteristics:

Top Elevation: 232.50 m
Bottom Elev: 229.00 m

Pond Geometry				Pond Volume (m^3)			
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Accum. Dead	Live	Accum. Live
229.00	0.00	**1400**	1400	0	0	325	325
229.25	0.25	**1600**	1500	0	0	375	700
229.50	0.50	**4350**	2975	0	0	744	1444
229.75	0.75	**4500**	4425	0	0	1106	2550
230.00	1.00	**11500**	8000	0	0	2000	4550
230.25	1.25	12474	11987	0	0	2997	7547
230.50	1.50	**13448**	12961	0	0	3240	10787
230.75	1.75	14796	14122	0	0	3531	14318
231.00	2.00	**16144**	15470	0	0	3868	18185
231.25	2.25	16216	16180	0	0	4045	22230
231.50	2.50	16288	16252	0	0	4063	26293
231.75	2.75	16360	16324	0	0	4081	30374
232.00	3.00	**16432**	16396	0	0	4099	34473
232.25	3.25	18074	17253	0	0	4313	38786
232.50	3.50	**18460**	18267	0	0	4567	43353

Total Active Storage = **43353** m^3

Comments:

1. **Bold** text represents set values based on Hotchkiss Creek Master Drainage Plan stage-storage values.
2. Red text represents interpolated values

BARRIE DRAINAGE MASTER PLAN
HOTCHKISS CREEK WATERSHED
PROJECT NO. 19
SWMF RETROFIT NO. 81

Stage-Discharge Table

Orifice #1:		**Overflow Weir:**		
Width:	**4267**	Length of Weir (m):	59	m
Height:	**914**	Weir Sill Elevation:	232.00	m
C:	0.63	Weir constant K:	1.5	
Invert:	**227.79**	Side Slope (H:V):	5	:1

Elevation (m)	Total Discharge (m^3/s)
229.00	6.260
229.25	7.597
229.50	8.857
229.75	10.118
230.00	11.309
230.25	12.066
230.50	12.443
230.75	12.820
231.00	13.130
231.25	13.424
231.50	13.635
231.75	13.850
232.00	18.941
232.25	35.000
232.50	60.000

HEC-RAS Output	
Elevation (m)	Total Discharge (m^3/s)
228.79	5.000
229.08	6.740
229.81	10.420
230.12	11.870
230.75	12.820
231.21	13.390
231.72	13.820
231.76	13.860
232.05	20.000
232.13	25.000
232.20	31.130
232.25	35.000
232.40	50.000

Comments:

1 **Bold** text represents values that have been set based on Hotchkiss Creek Master Drainage Plan.

2 Red text represents calculated values

BARRIE DRAINAGE MASTER PLAN
HOTCHKISS CREEK WATERSHED
PROJECT NO. 19
SWMF RETROFIT NO. 81

Stage-Storage-Discharge Table

Pond Geometry				Pond Volume (m^3)			Discharge (m^3/s)
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Live	Total	
229.00	0.00	1400	1400	0	325	325	6.26
229.25	0.25	1600	1500	0	700	700	7.60
229.50	0.50	4350	2975	0	1444	1444	8.86
229.75	0.75	4500	4425	0	2550	2550	10.12
230.00	1.00	11500	8000	0	4550	4550	11.31
230.25	1.25	12474	11987	0	7547	7547	12.07
230.50	1.50	13448	12961	0	10787	10787	12.44
230.75	1.75	14796	14122	0	14318	14318	12.82
231.00	2.00	16144	15470	0	18185	18185	13.13
231.25	2.25	16216	16180	0	22230	22230	13.42
231.50	2.50	16288	16252	0	26293	26293	13.63
231.75	2.75	16360	16324	0	30374	30374	13.85
232.00	3.00	16432	16396	0	34473	34473	18.94
232.25	3.25	18074	17253	0	38786	38786	35.00
232.50	3.50	18460	18267	0	43353	43353	60.00

BARRIE DRAINAGE MASTER PLAN
HOTCHKISS CREEK WATERSHED
PROJECT NO. 20
SWMF RETROFIT NO. 96

Stage-Storage Table

Pond Characteristics:

Top Elevation: 231.75 m
Bottom Elev: 227.00 m

Pond Geometry				Pond Volume (m^3)			
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Accum. Dead	Live	Accum. Live
227.00	0.00	**50**	50	0	0	18	18
227.25	0.25	738	394	0	0	99	117
227.50	0.50	**1426**	1082	0	0	271	387
227.75	0.75	1680	1553	0	0	388	775
228.00	1.00	**1934**	1807	0	0	452	1227
228.25	1.25	2428	2181	0	0	545	1772
228.50	1.50	**2922**	2675	0	0	669	2441
228.75	1.75	3346	3134	0	0	784	3225
229.00	2.00	**3770**	3558	0	0	890	4114
229.25	2.25	3822	3796	0	0	949	5063
229.50	2.50	**3874**	3848	0	0	962	6025
229.75	2.75	4352	4113	0	0	1028	7053
230.00	3.00	4830	4591	0	0	1148	8201
230.25	3.25	5308	5069	0	0	1267	9468
230.50	3.50	**5786**	5547	0	0	1387	10855
230.75	3.75	7529	6657	1	1	1664	12519
231.00	4.00	9272	8400	2	3	2100	14619
231.25	4.25	11014	10143	3	6	2536	17155
231.50	4.50	12757	11886	4	10	2971	20127
231.75	4.75	**14500**	13629	5	15	3407	23534

Total Active Storage = **23534** m^3

Comments:

1 **Bold** text represents set values based on Hotchkiss Creek Master Drainage Plan stage-storage values.
2 Red text represents interpolated values

BARRIE DRAINAGE MASTER PLAN
HOTCHKISS CREEK WATERSHED
PROJECT NO. 20
SWMF RETROFIT NO. 96

Stage-Discharge Table

Orifice #1:

Width:	**4878**
Height:	**914**
C:	0.63
Invert:	**225.39**

Elevation (m)	Total Discharge (m^3/s)
227.00	8.243
227.25	8.825
227.50	9.408
227.75	9.991
228.00	10.574
228.25	11.108
228.50	11.604
228.75	12.100
229.00	12.514
229.25	12.921
229.50	13.345
229.75	13.760
230.00	14.010
230.25	14.669
230.50	15.848
230.75	17.028
231.00	18.207
231.25	19.387
231.50	26.858
231.75	70.000

HEC-RAS Output	
Elevation (m)	Total Discharge (m^3/s)
226.16	6.000
226.69	7.520
228.11	10.830
228.77	12.140
229.36	13.100
229.72	13.730
230.14	14.150
231.38	20.000
231.48	25.000
231.58	34.290
231.63	40.000
231.67	50.000

Comments:

1 **Bold** text represents values that have been set based on Hotchkiss Creek Master Drainage Plan.

2 Red text represents calculated values

BARRIE DRAINAGE MASTER PLAN
HOTCHKISS CREEK WATERSHED
PROJECT NO. 20
SWMF RETROFIT NO. 96

Stage-Storage-Discharge Table

Pond Geometry				Pond Volume (m^3)			Discharge (m^3/s)
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Live	Total	
227.00	0.00	50	50	0	18	18	8.24
227.25	0.25	738	394	0	117	117	8.83
227.50	0.50	1426	1082	0	387	387	9.41
227.75	0.75	1680	1553	0	775	775	9.99
228.00	1.00	1934	1807	0	1227	1227	10.57
228.25	1.25	2428	2181	0	1772	1772	11.11
228.50	1.50	2922	2675	0	2441	2441	11.60
228.75	1.75	3346	3134	0	3225	3225	12.10
229.00	2.00	3770	3558	0	4114	4114	12.51
229.25	2.25	3822	3796	0	5063	5063	12.92
229.50	2.50	3874	3848	0	6025	6025	13.35
229.75	2.75	4352	4113	0	7053	7053	13.76
230.00	3.00	4830	4591	0	8201	8201	14.01
230.25	3.25	5308	5069	0	9468	9468	14.67
230.50	3.50	5786	5547	0	10855	10855	15.85
230.75	3.75	7529	6657	1	12519	12520	17.03
231.00	4.00	9272	8400	3	14619	14622	18.21
231.25	4.25	11014	10143	6	17155	17161	19.39
231.50	4.50	12757	11886	10	20127	20137	26.86
231.75	4.75	14500	13629	15	23534	23549	70.00

BARRIE DRAINAGE MASTER PLAN
HOTCHKISS CREEK WATERSHED
PROJECT NO. 26
SWMF RETROFIT NO. 48 (HT 03)

Stage-Storage Table

Pond Characteristics:

Top Elevation: **226.50** m
Bottom Elev: **222.00** m

Pond Geometry				Pond Volume (m^3)			
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Accum. Dead	Live	Accum. Live
222.00	0.00	**0**	0	0	0	7	7
222.25	0.25	488	244	0	0	61	68
222.50	0.50	**976**	732	0	0	183	251
222.75	0.75	1380	1178	0	0	295	546
223.00	1.00	**1784**	1582	0	0	396	941
223.25	1.25	2116	1950	0	0	488	1429
223.50	1.50	**2448**	2282	0	0	571	1999
223.75	1.75	2826	2637	0	0	659	2658
224.00	2.00	**3204**	3015	0	0	754	3412
224.25	2.25	3672	3438	0	0	859	4272
224.50	2.50	**4140**	3906	0	0	976	5248
224.75	2.75	5140	4640	0	0	1160	6408
225.00	3.00	**6140**	5640	0	0	1410	7818
225.25	3.25	6828	6484	0	0	1621	9439
225.50	3.50	**7516**	7172	0	0	1793	11232
225.75	3.75	8687	8101	0	0	2025	13257
226.00	4.00	9858	9272	0	0	2318	15576
226.25	4.25	11029	10444	0	0	2611	18186
226.50	4.50	**12200**	11615	0	0	2904	21090

Total Active Storage = **21090** m^3

Comments:

1 **Bold** text represents set values based on Hotchkiss Creek Master Drainage Plan stage-storage values.
2 Red text represents interpolated values

BARRIE DRAINAGE MASTER PLAN
HOTCHKISS CREEK WATERSHED
PROJECT NO. 26
SWMF RETROFIT NO. 48 (HT 03)

Stage-Discharge Table

Orifice #1:

Width:	**3962**
Height:	**2134**
C:	0.63
Invert:	**221.45**

Elevation (m)	Total Discharge (m^3/s)
222.00	0.200
222.25	3.277
222.50	6.082
222.75	8.540
223.00	10.998
223.25	13.500
223.50	16.500
223.75	19.601
224.00	23.011
224.25	26.390
224.50	29.005
224.75	31.310
225.00	33.471
225.25	35.591
225.50	37.711
225.75	39.830
226.00	43.194
226.25	49.015
226.50	60.955

HEC-RAS Output	
Elevation (m)	Total Discharge (m^3/s)
222.00	0.200
222.39	5.000
223.23	13.260
223.69	18.780
223.94	22.200
224.25	26.390
224.51	29.110
224.81	31.860
225.77	40.000
226.13	45.000
226.23	48.060
226.48	60.000

Comments:

1 **Bold** text represents values that have been set based on Hotchkiss Creek Master Drainage Plan.

2 Red text represents calculated values

BARRIE DRAINAGE MASTER PLAN
HOTCHKISS CREEK WATERSHED
PROJECT NO. 26
SWMF RETROFIT NO. 48 (HT 03)

Stage-Storage-Discharge Table

Pond Geometry				Pond Volume (m^3)			Discharge (m^3/s)
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Live	Total	
222.00	0.00	0	0	0	7	7	0.20
222.25	0.25	488	244	0	68	68	3.28
222.50	0.50	976	732	0	251	251	6.08
222.75	0.75	1380	1178	0	546	546	8.54
223.00	1.00	1784	1582	0	941	941	11.00
223.25	1.25	2116	1950	0	1429	1429	13.50
223.50	1.50	2448	2282	0	1999	1999	16.50
223.75	1.75	2826	2637	0	2658	2658	19.60
224.00	2.00	3204	3015	0	3412	3412	23.01
224.25	2.25	3672	3438	0	4272	4272	26.39
224.50	2.50	4140	3906	0	5248	5248	29.01
224.75	2.75	5140	4640	0	6408	6408	31.31
225.00	3.00	6140	5640	0	7818	7818	33.47
225.25	3.25	6828	6484	0	9439	9439	35.59
225.50	3.50	7516	7172	0	11232	11232	37.71
225.75	3.75	8687	8101	0	13257	13257	39.83
226.00	4.00	9858	9272	0	15576	15576	43.19
226.25	4.25	11029	10444	0	18186	18186	49.02
226.50	4.50	12200	11615	0	21090	21090	60.96

BARRIE DRAINAGE MASTER PLAN
HURONIA CREEK WATERSHED
PROJECT NO. 184
SWMF RETROFIT NO. 85 (HR 03)

Stage-Storage Table

Pond Characteristics:

Top Elev.: **230.00** m
Permanent Pool Elev.: **227.75** m
Bottom Elev.: **226.00** m

Pond Geometry				Pond Volume (m^3)			
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Accum. Dead	Live	Accum. Live
226.00	0.00	2115	2115	0	0	0	0
226.25	0.25	2506	2310	578	578	0	0
226.50	0.50	2896	2701	675	1253	0	0
226.75	0.75	3287	3091	773	2026	0	0
227.00	1.00	3677	3482	871	2896	0	0
227.25	1.25	4068	3873	968	3864	0	0
227.50	1.50	4458	4263	1066	4930	0	0
227.75	1.75	4849	4654	1163	6094	0	0
228.00	2.00	5068	4373	0	6094	1093	1093
228.25	2.25	5288	4678	0	6094	1169	2263
228.50	2.50	5507	5398	0	6094	1349	3612
228.75	2.75	5727	5617	0	6094	1404	5016
229.00	3.00	5946	5837	0	6094	1459	6475
229.25	3.25	6166	6056	0	6094	1514	7989
229.50	3.50	6385	6275	0	6094	1569	9558
229.75	3.75	6605	6495	0	6094	1624	11182
230.00	4.00	6824	6714	0	6094	1679	12861

Permanent Pool Volume = **6094** m^3
Extended Detention Volume = **6475** m^3
Active Storage = **12861** m^3

Comments:

1 Red text represents interpolated values

BARRIE DRAINAGE MASTER PLAN
HURONIA CREEK WATERSHED
PROJECT NO. 184
SWMF RETROFIT NO. 85 (HR 03)

Stage-Discharge Table

Orifice:		**Overflow Weir:**		**Outlet Pipe:**	
Diameter (m):	250	Length of Weir (m):	5	Diameter (m):	1680
Area (m^2):	0.05	Weir Sill Elevation:	229.00	Area (m^2):	2.22
C:	0.63	Weir constant K:	1.7	C:	0.63
Invert (m):	227.75	Side Slope (H:V):	5	Invert (m):	227.23

	Orifice		Overflow Weir		Outlet Pipe			
Elevation (m)	Head (m)	Discharge (m^3/s)	Head (m)	Discharge (m^3/s)	Head (m)	Discharge (m^3/s)	Hydraulic Control	Total Discharge (m^3/s)
227.75	0.000	0.000	0.000	0.000	0.000	0.000	Orifice	0.000
228.00	0.125	0.048	0.000	0.000	0.000	0.000	Orifice	0.048
228.25	0.375	0.084	0.000	0.000	0.000	0.000	Orifice	0.084
228.50	0.625	0.108	0.000	0.000	0.000	0.000	Orifice	0.108
228.75	0.875	0.128	0.000	0.000	0.000	0.000	Orifice	0.128
229.00	1.125	0.145	0.000	0.000	0.000	0.000	Orifice	0.145
229.25	1.375	0.161	0.250	1.153	1.180	6.720	Weir	1.313
229.50	1.625	0.175	0.500	3.896	1.430	7.397	Weir	4.071
229.75	1.875	0.188	0.750	8.273	1.680	8.018	Outlet Pipe	8.018
230.00	2.125	0.200	1.000	14.444	1.930	8.594	Outlet Pipe	8.594

Comments:

1 Red text represents calculated values

Calculation Notes:

Orifice/Pipe Equation is: Q = C x A x (2gH)^0.5

Where: Q = flow rate (cms)
C = constant
A = area of opening(sq. m)
H = net head on the orifice
g = Acceleration due to gravity

Overflow weir calculations completed in accordance with NVCA rectangular broad crested weir equation (NVCA Stormwater Technical Guide, December 2013)

BARRIE DRAINAGE MASTER PLAN
HURONIA CREEK WATERSHED
PROJECT NO. 184
SWMF RETROFIT NO. 85 (HR 03)

Stage-Storage-Discharge Table

Pond Geometry				Pond Volume (m^3)			Discharge (m^3/s)
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Live	Total	
227.75	1.75	4849	4654	6094	0	6094	0.00
228.00	2.00	5068	4373	6094	1093	7187	0.05
228.25	2.25	5288	4678	6094	2263	8356	0.08
228.50	2.50	5507	5398	6094	3612	9706	0.11
228.75	2.75	5727	5617	6094	5016	11110	0.13
229.00	3.00	5946	5837	6094	6475	12569	0.15
229.25	3.25	6166	6056	6094	7989	14083	1.31
229.50	3.50	6385	6275	6094	9558	15652	4.07
229.75	3.75	6605	6495	6094	11182	17276	8.02
230.00	4.00	6824	6714	6094	12861	18954	8.59

BARRIE DRAINAGE MASTER PLAN
HURONIA CREEK DRAINAGE AREA
PROJECT NO. 185
SWMF RETROFIT NO. 28 (HR 01)

Stage-Storage Table

Permanent Pool Elev.: **225.42** m
Pond Bottom Elev.: **224.42** m

Pond Geometry				Pond Volume (m^3)			
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Accum. Dead	Live	Accum. Live
223.92	0.00	667	667	0	0	0	0
224.17	0.25	923	795	199	199	0	0
224.42	0.50	1179	1051	263	461	0	0
224.67	0.75	1435	1307	327	788	0	0
224.92	1.00	1690	1562	391	1179	0	0
225.17	1.25	1946	1818	455	1633	0	0
225.42	1.50	2202	2074	519	2152	0	0

Permanent Pool Volume = **2152** m^3

Comments:

1 Red text represents interpolated values

TATHAM ENGINEERING	Project: Barrie Drainage Master Plan	Date: 8-Feb-18
	File No.: 117076	Designed: ASB
	Subject: Conceptual Design - LID	Checked: DRT

CENTRALIZED LID DESIGN

WATERSHED: Whiskey Creek
SWMF: RO42 - Option 1
LID TYPE: Underground Infiltration Chamber System

Drainage Area (ha):	22.8
Impervious Drainage Area (ha):	8.6
Catchment ID:	
Infiltration Rate (mm/hr):	68.0
Design Safety Factor:	6.5
LID Foot Print Area (m^2):	850
Storm Sewer Inlet Invert (m):	299.95
Storm Sewer Outlet Invert (m):	N/A
Target Capture Ratio:	5:1 - 20:1
Capture Ratio:	101

LID SIZING CALCULATIONS

STORAGE RESERVOIR DEPTH

Design Infiltration Rate (mm/hr):	10
Void Ratio for Stone Reservoir:	0.4
Drawdown Time (hr):	48
Maximum Storage Reservoir Depth (mm):	1255

STORAGE RESERVOIR VOLUME

Design Storage Reservoir Depth (mm):	1079
Storage Chamber:	300XLHD
Unit Storage Volume (m^3/m^2):	0.71
Storage Reservoir Volume (m^3):	604

VOLUME CONTROL

Control Target - 25mm Storm (mm):	6.02
Runoff Volume Captured (mm):	2.65

UNDERDRAIN DEFAULTS

Orifice Coefficient:	0.60
Gravitational Constant (m/s^2):	9.81
Underdrain Diameter (mm):	0
Orifice Area (m^2):	0.0000

BARRIE DRAINAGE MASTER PLAN
WHISKEY CREEK WATERSHED
PROJECT NO.67
SMWF RETROFIT NO. 42

Stage-Storage Table - Option 1

Pond Characteristics:

Top Elevation: **304.00** m
Bottom Elev: **302.00** m

Pond Geometry				Pond Volume (m^3)			
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Accum. Dead	Live	Accum. Live
302.00	0.00	2560	2560	0	0	0	0
302.25	0.25	2818	2689	0	0	672	672
302.50	0.50	3075	2946	0	0	737	1409
302.75	0.75	3333	3204	0	0	801	2210
303.00	1.00	3590	3461	0	0	865	3075
303.25	1.25	3848	3719	0	0	930	4005
303.50	1.50	4105	3976	0	0	994	4999
303.75	1.75	4363	4234	0	0	1058	6057
304.00	2.00	4620	4491	0	0	1123	7180

Extended Detention Volume = **4005** m^3
Active Storage = **7180** m^3

Comments:

1 Red text represents interpolated values

BARRIE DRAINAGE MASTER PLAN
WHISKEY CREEK WATERSHED
PROJECT NO.67
SMWF RETROFIT NO. 42

Stage-Storage Table - Option 2

Pond Characteristics:

Top Elev.: **304.00** m
Permanent Pool Elev.: **303.00** m
Bottom Elev.: **301.00** m

Pond Geometry				Pond Volume (m^3)			
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Accum. Dead	Live	Accum. Live
301.00	0.00	500	500	0	0	0	0
301.25	0.25	758	629	157	157	0	0
301.50	0.50	1015	886	222	379	0	0
301.75	0.75	1273	1144	286	665	0	0
302.00	1.00	1530	1401	350	1015	0	0
302.25	1.25	1788	1659	415	1430	0	0
302.50	1.50	2045	1916	479	1909	0	0
302.75	1.75	2303	2174	543	2452	0	0
303.00	2.00	2560	2431	0	2452	608	608
303.25	2.25	2818	2689	0	2452	672	1280
303.50	2.50	3075	2946	0	2452	737	2017
303.75	2.75	3333	3204	0	2452	801	2818
304.00	3.00	3590	3461	0	2452	865	3683
304.25	3.25	3848	3719	0	2452	930	4613
304.50	3.50	4105	3976	0	2452	994	5607
304.75	3.75	4363	4234	0	2452	1058	6665
305.00	4.00	4620	4491	0	2452	1123	7788

Permanent Pool Volume = **2452** m^3
Extended Detention Volume = **1280** m^3
Active Storage = **7788** m^3

Comments:

1 Red text represents interpolated values

BARRIE DRAINAGE MASTER PLAN
WHISKEY CREEK WATERSHED
PROJECT NO.67
SMWF RETROFIT NO. 42

Stage-Discharge Table

Orifice 1:

Diameter (mm):	210
Area (m^2):	0.03
C:	0.63
Invert (m):	302.00

Overflow Weir:

Length of Weir (m):	10
Weir Sill Elevation (m):	303.25
Weir constant K:	1.7
Side Slope (H:1V):	5

	Orifice 1		Overflow Weir			
Elevation (m)	**Head (m)**	**Discharge (m^3/s)**	**Head (m)**	**Discharge (m^3/s)**	**Hydraulic Control**	**Total Discharge (m^3/s)**
302.00	0.000	0.000	0.000	0.000	Orifice	0.000
302.25	0.145	0.037	0.000	0.000	Orifice	0.037
302.50	0.395	0.061	0.000	0.000	Orifice	0.061
302.75	0.645	0.078	0.000	0.000	Orifice	0.078
303.00	0.895	0.091	0.000	0.000	Orifice	0.091
303.25	1.145	0.103	0.000	0.000	Orifice	0.103
303.50	1.395	0.114	0.250	2.128	Weir	2.242
303.75	1.645	0.124	0.500	6.732	Weir	6.856
304.00	1.895	0.133	0.750	13.565	Weir	13.698

Comments:

1 **Bold** text represents values that have been obtained from field inspection and survey
2 Red text represents calculated values

Calculation Notes

Orifice Equation is: Q = C x A x (2gH)^0.5

Where:
Q = flow rate (cms)
C = constant
A = area of opening(sq. m)
H = net head on the orifice
g = Acceleration due to gravity

Overflow weir calculations completed in accordance with NVCA rectangular broad crested weir equation (NVCA Stormwater Technical Guide, December 2013)

Additional Notes:

NVCA Weir Flow Calculation Applied For Weir Flow Below Orifice Centroid

$$Q_w = 1.65([(pi*(D^2)/4)(2*\cos^{-1}[(((D/2)-d)/(D/2))*(180/pi)]/360)-((D/2-d)(Dd-d^2)^{0.5})]/d)d^{1.5}$$

Where:
Q_w is weir flow (m^3/s)
D is orifice diameter (m)
d is depth of flow above the invert (m)

BARRIE DRAINAGE MASTER PLAN
WHISKEY CREEK WATERSHED
PROJECT NO.67
SMWF RETROFIT NO. 42

Stage-Storage-Discharge Table

Pond Geometry				Pond Volume (m^3)			Discharge (m^3/s)
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Live	Total	
302.00	0.00	2560	2560	0	0	0	0.00
302.25	0.25	2818	2689	0	672	672	0.04
302.50	0.50	3075	2946	0	1409	1409	0.06
302.75	0.75	3333	3204	0	2210	2210	0.08
303.00	1.00	3590	3461	0	3075	3075	0.09
303.25	1.25	3848	3719	0	4005	4005	0.10
303.50	1.50	4105	3976	0	4999	4999	2.24
303.75	1.75	4363	4234	0	6057	6057	6.86
304.00	2.00	4620	4491	0	7180	7180	13.70

TATHAM ENGINEERING	Project: Barrie Drainage Master Plan	Date: 8-Feb-18
	File No.: 117076	Designed: ASB
	Subject: Conceptual Design - LID	Checked: DRT

CENTRALIZED LID DESIGN

WATERSHED: Whiskey Creek
SWMF: WK05
LID TYPE: Underground Infiltration Chamber System

Drainage Area (ha):	106.3
Impervious Drainage Area (ha):	44.6
Catchment ID:	
Infiltration Rate (mm/hr):	68.0
Design Safety Factor:	6.5
LID Foot Print Area (m^2):	3000
Storm Sewer Inlet Invert (m):	289.25
Storm Sewer Outlet Invert (m):	N/A
Target Capture Ratio:	5:1 - 20:1
Capture Ratio:	149

LID SIZING CALCULATIONS

STORAGE RESERVOIR DEPTH

Design Infiltration Rate (mm/hr):	10
Void Ratio for Stone Reservoir:	0.4
Drawdown Time (hr):	48
Maximum Storage Reservoir Depth (mm):	1255

STORAGE RESERVOIR VOLUME

Design Storage Reservoir Depth (mm):	1079
Storage Chamber:	300XLHD
Unit Storage Volume (m^3/m^2):	0.71
Storage Reservoir Volume (m^3):	2130

VOLUME CONTROL

Control Target - 25mm Storm (mm):	6.64
Runoff Volume Captured (mm):	2.00

UNDERDRAIN DEFAULTS

Orifice Coefficient:	0.60
Gravitational Constant (m/s^2):	9.81
Underdrain Diameter (mm):	0
Orifice Area (m^2):	0.0000

TATHAM ENGINEERING	Project: Barrie Drainage Master Plan	Date: 8-Feb-18
	File No.: 117076	Designed: ASB
	Subject: Conceptual Design - LID	Checked: DRT

CENTRALIZED LID DESIGN

WATERSHED: Whiskey Creek
SWMF: RO40
LID TYPE: Underground Infiltration Chamber System

Drainage Area (ha):	6.9
Impervious Drainage Area (ha):	3.3
Catchment ID:	
Infiltration Rate (mm/hr):	68.0
Design Safety Factor:	3.5
LID Foot Print Area (m^2):	140
Storm Sewer Inlet Invert (m):	299.95
Storm Sewer Outlet Invert (m):	N/A
Target Capture Ratio:	5:1 - 20:1
Capture Ratio:	237

LID SIZING CALCULATIONS

STORAGE RESERVOIR DEPTH

Design Infiltration Rate (mm/hr):	19
Void Ratio for Stone Reservoir:	0.4
Drawdown Time (hr):	48
Maximum Storage Reservoir Depth (mm):	2331

STORAGE RESERVOIR VOLUME

Design Storage Reservoir Depth (mm):	2100
Storage Chamber:	1800 CMP
Unit Storage Volume (m^3/m^2):	1.41
Storage Reservoir Volume (m^3):	197

VOLUME CONTROL

Control Target - 25mm (mm):	6.02
Runoff Volume Captured (mm):	2.86

UNDERDRAIN DEFAULTS

Orifice Coefficient:	0.60
Gravitational Constant (m/s^2):	9.81
Underdrain Diameter (mm):	0
Orifice Area (m^2):	0.0000

BARRIE DRAINAGE MASTER PLAN
WHISKEY CREEK WATERSHED
PROJECT NO. 82
SWMF RETROFIT NO. 26

Stage-Storage Table

Pond Characteristics:

Top Elev.: **248.75** m
Permanent Pool Elev.: **247.00** m
Bottom Elev.: **245.00** m

Pond Geometry				Pond Volume (m^3)			
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Accum. Dead	Live	Accum. Live
245.00	0.00	1318	1318	0	0	0	0
245.25	0.25	1564	1441	360	360	0	0
245.50	0.50	1809	1686	422	782	0	0
245.75	0.75	2054	1931	483	1265	0	0
246.00	1.00	2299	2177	544	1809	0	0
246.25	1.25	2544	2422	605	2414	0	0
246.50	1.50	2790	2667	667	3081	0	0
246.75	1.75	3035	2912	728	3809	0	0
247.00	2.00	3280	3157	789	4598	0	0
247.25	2.25	3526	3403	0	4598	851	851
247.50	2.50	3773	3650	0	4598	912	1763
247.75	2.75	4019	3896	0	4598	974	2737
248.00	3.00	4265	4142	0	4598	1036	3773
248.25	3.25	4512	4389	0	4598	1097	4870
248.50	3.50	4758	4635	0	4598	1159	6029
248.75	3.75	5004	4881	0	4598	1220	7249

Permanent Pool Volume = **4598** m^3
Extended Detention Volume = **3773** m^3
Active Storage = **7249** m^3

Comments:

1 Red text represents interpolated values

BARRIE DRAINAGE MASTER PLAN
WHISKEY CREEK WATERSHED
PROJECT NO. 82
SWMF RETROFIT NO. 26

Stage-Discharge Table

Orifice 1:

Diameter (mm):	**190**
Area (m^2):	0.03
C:	0.63
Invert (m):	**247.00**

Overflow Weir:

Length of Weir (m):	**10**
Weir Sill Elevation (m):	**248.00**
Weir constant K:	1.7
Side Slope (H:1V):	**5**

	Orifice 1		Overflow Weir			
Elevation (m)	Head (m)	Discharge (m^3/s)	Head (m)	Discharge (m^3/s)	Hydraulic Control	Total Discharge (m^3/s)
245.00	0.000	0.000	0.000	0.000	-	0.000
245.25	0.000	0.000	0.000	0.000	-	0.000
245.50	0.000	0.000	0.000	0.000	-	0.000
245.75	0.000	0.000	0.000	0.000	-	0.000
246.00	0.000	0.000	0.000	0.000	-	0.000
246.25	0.000	0.000	0.000	0.000	-	0.000
246.50	0.000	0.000	0.000	0.000	-	0.000
246.75	0.000	0.000	0.000	0.000	-	0.000
247.00	0.000	0.000	0.000	0.000	-	0.000
247.25	0.155	0.031	0.000	0.000	Orifice	0.031
247.50	0.405	0.050	0.000	0.000	Orifice	0.050
247.75	0.655	0.064	0.000	0.000	Orifice	0.064
248.00	0.905	0.075	0.000	0.000	Orifice	0.075
248.25	1.155	0.085	0.250	2.128	Orifice/Weir	2.213
248.50	1.405	0.094	0.500	6.732	Orifice/Weir	6.826
248.75	1.655	0.102	0.750	13.565	Orifice/Weir	13.666

Comments:

1 Red text represents calculated values

Calculation Notes

Orifice Equation is: Q = C x A x (2gH)^0.5

Where:
Q = flow rate (cms)
C = constant
A = area of opening(sq. m)
H = net head on the orifice
g = Acceleration due to gravity

Overflow weir calculations completed in accordance with NVCA rectangular broad crested weir equation (NVCA Stormwater Technical Guide, December 2013)

BARRIE DRAINAGE MASTER PLAN
WHISKEY CREEK WATERSHED
PROJECT NO. 82
SWMF RETROFIT NO. 26

Stage-Storage-Discharge Table

Pond Geometry				Pond Volume (m^3)			Discharge
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Live	Total	(m^3/s)
245.00	0.00	1318	1318	0	0	0	0.000
245.25	0.25	1564	1441	360	0	360	0.000
245.50	0.50	1809	1686	782	0	782	0.000
245.75	0.75	2054	1931	1265	0	1265	0.000
246.00	1.00	2299	2177	1809	0	1809	0.000
246.25	1.25	2544	2422	2414	0	2414	0.000
246.50	1.50	2790	2667	3081	0	3081	0.000
246.75	1.75	3035	2912	3809	0	3809	0.000
247.00	2.00	3280	3157	4598	0	4598	0.000
247.25	2.25	3526	3403	4598	851	5449	0.031
247.50	2.50	3773	3650	4598	1763	6362	0.050
247.75	2.75	4019	3896	4598	2737	7336	0.064
248.00	3.00	4265	4142	4598	3773	8371	0.075
248.25	3.25	4512	4389	4598	4870	9468	2.213
248.50	3.50	4758	4635	4598	6029	10627	6.826
248.75	3.75	5004	4881	4598	7249	11847	13.666

BARRIE DRAINAGE MASTER PLAN
WHISKEY CREEK WATERSHED
PROJECT NO. 83
SWMF RETROFIT NO. 25 (WK 01)

Stage-Storage Table

Pond Characteristics:

Top Elev.: **237.00** m
Permanent Pool Elev.: **236.70** m
Bottom Elev.: **236.40** m

Pond Geometry				Pond Volume (m^3)			
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Accum. Dead	Live	Accum. Live
236.40	0.00	2356	2356	0	0	0	0
236.50	0.10	2454	2405	240	240	0	0
236.60	0.20	2551	2503	250	491	0	0
236.70	0.30	2649	2600	260	751	0	0
236.80	0.40	2752	2700	0	751	270	270
236.90	0.50	2854	2803	0	751	280	550
237.00	0.60	2957	2906	0	751	291	841

Permanent Pool Volume = **751** m^3
Total Active Storage = **841** m^3

Comments:

1 Red text represents interpolated values

BARRIE DRAINAGE MASTER PLAN
WHISKEY CREEK WATERSHED
PROJECT NO.85
CULVERT IMPROVEMENT NO. 63

Stage-Storage Table

Pond Characteristics:

		Designed:	ASB
Top Elevation:	**237.27** m	**Checked:**	DRT
Bottom Elev:	**233.30** m	**Date:**	13-Mar-18
Stage	0.5 m		

ater Management Pond

Pond Geometry		**Storage Volume (m^3)**			
Elevation (m)	**Depth (m)**	**Area (m^2)**	**Avg. Area (m)**	**Live**	**Accum. Live**
233.30	0.00	**0**	0	0.00	0.00
233.80	0.50	829	414	207.13	207.13
234.30	1.00	1657	1243	621.38	828.50
234.80	1.50	2486	2071	1035.63	1864.13
235.30	2.00	**3314**	2900	1449.88	3314.00
235.80	2.50	7264	5289	2644.50	5958.50
236.00	2.70	8844	8054	1610.80	7569.30
236.30	3.00	11214	10029	3008.70	10578.00
236.80	3.50	15164	13189	6594.50	17172.50
237.00	3.70	**16744**	15954	3190.80	20363.30
237.30	4.00	19075	17909	5372.78	25736.08
237.60	4.30	**21405**	20240	6071.92	31808.00

Comments:

1. **Bold** text represents values measured from drawings
2. Red text represents interpolated values
3. Highlighted columns represent PCSWMM input values

BARRIE DRAINAGE MASTER PLAN
WHISKEY CREEK WATERSHED
PROJECT NO.85
CULVERT IMPROVEMENT NO. 63

Stage-Storage-Discharge Table

Designed:	ASB
Checked:	DRT
Date:	3/13/2018

Stormwater Management Pond					
Pond Geometry				nd Volume (	Discharge
Elevation (m	Depth (m)	Area (m^2)	Avg. Area (m	Live	(m^3/s)
233.30	0.00	0.00	0.00	0.00	0.00
233.80	0.50	828.50	414.25	207.13	4.89
234.30	1.00	1657.00	1242.75	828.50	10.68
234.80	1.50	2485.50	2071.25	1864.13	18.18
235.30	2.00	3314.00	2899.75	3314.00	26.53
235.80	2.50	7264.00	5289.00	5958.50	29.82
236.00	2.70	8844.00	8054.00	7569.30	31.14
236.30	3.00	11214.00	10029.00	10578.00	33.10
236.80	3.50	15164.00	13189.00	17172.50	41.46
237.00	3.70	16744.00	15954.00	20363.30	48.13
237.30	4.00	19074.50	17909.25	25736.08	58.14
237.60	4.30	21405.00	20239.75	31808.00	68.14

Discharge from HEC-RAS model
Total Live Storage = 20363 m^3

Comments:

1. **Bold** text represents values that have been obtained from field survey or investigation
2. Red text represents calculated values
3. Highlighted columns represent PCSWMM input values

BARRIE MASTER DRAINAGE PLAN
WHISKEY CREEK WATERSHED
PROJECT NO. 88
CULVERT IMPROVEMENT NO. 64

Stage-Storage Table

Pond Characteristics:

		Designed:	ASB
Top Elevation:	**229.50** m	**Checked:**	DRT
Bottom Elev:	**223.50** m	**Date:**	13-Mar-18
Stage	0.5 m		

ater Management Pond					
Pond Geometry		**Storage Volume (m^3)**			
Elevation (m)	**Depth (m)**	**Area (m^2)**	**Avg. Area (m)**	**Live**	**Accum. Live**
223.50	0.00	**0**	0	0.00	0.00
224.00	0.50	**69**	35	17.25	17.25
224.50	1.00	663	366	182.92	200.17
225.00	1.50	1256	960	479.75	679.92
225.50	2.00	**1850**	1553	776.58	1456.50
226.00	2.50	2261	2055	1027.65	2484.15
226.50	3.00	2671	2466	1232.95	3717.10
227.00	3.50	3082	2877	1438.25	5155.35
227.50	4.00	3492	3287	1643.55	6798.90
228.00	4.50	**3903**	3698	1848.85	8647.75
228.50	5.00	4216	4060	2029.75	10677.50
229.00	5.50	4529	4373	2186.25	12863.75
229.50	6.00	**4797**	4663	2331.50	15195.25

Comments:

1. **Bold** text represents values measured from drawings
2. Red text represents interpolated values
3. Highlighted columns represent PCSWMM input values

BARRIE MASTER DRAINAGE PLAN
WHISKEY CREEK WATERSHED
PROJECT NO. 88
CULVERT IMPROVEMENT NO. 64

Stage-Storage-Discharge Table

Designed:	ASB
Checked:	DRT
Date:	3/13/2018

Stormwater Management Pond					
Pond Geometry				nd Volume (	Discharge
Elevation (m	Depth (m)	Area (m^2)	Avg. Area (m	Live	(m^3/s)
223.50	0.00	0.00	0.00	0.00	0.00
224.00	0.50	69.00	34.50	17.25	2.70
224.50	1.00	662.67	365.83	200.17	5.40
225.00	1.50	1256.33	959.50	679.92	8.10
225.50	2.00	1850.00	1553.17	1456.50	12.44
226.00	2.50	2260.60	2055.30	2484.15	17.29
226.50	3.00	2671.20	2465.90	3717.10	21.79
227.00	3.50	3081.80	2876.50	5155.35	26.08
227.50	4.00	3492.40	3287.10	6798.90	28.98
228.00	4.50	3903.00	3697.70	8647.75	31.35
228.50	5.00	4216.00	4059.50	10677.50	33.71
229.00	5.50	4529.00	4372.50	12863.75	36.00
229.50	6.00	4797.00	4663.00	15195.25	38.30

Discharge from HEC-RAS model
Total Live Storage = 15195 m^3

Comments:

1. **Bold** text represents values that have been obtained from field survey or investigation
2. Red text represents calculated values
3. Highlighted columns represent PCSWMM input values

BARRIE DRAINAGE MASTER PLAN
LOVERS CREEK WATERSHED
PROJECT NO. 95
SWMF RETROFIT OPPORTUNITY No. 86 (LV 16)

Stage-Storage Table

Pond Characteristics:

Permanent Pool Elev.: 299.10 m
Bottom Elev: 298.80 m

Pond Geometry				Pond Volume (m^3)			
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Accum. Dead	Live	Accum. Live
298.80	0.00	1006	1006	0	0	0	0
298.90	0.10	1088	1047	105	105	0	0
299.00	0.20	1169	1128	113	218	0	0
299.10	0.30	1251	1210	121	339	0	0

Comments:

1 Red text represents calculated values

BARRIE DRAINAGE MASTER PLAN
LOVERS CREEK WATERSHED
PROJECT NO. 96
SWMF RETROFIT OPPORTUNITY No. 87 (LV 17)

Stage-Storage Table

Pond Characteristics:

Permanent Pool Elev.: 292.90 m
Bottom Elev: 292.60 m

Pond Geometry				Pond Volume (m^3)			
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Accum. Dead	Live	Accum. Live
292.60	0.00	1500	1500	0	0	0	0
292.70	0.10	1658	1579	158	158	0	0
292.80	0.20	1817	1738	174	332	0	0
292.90	0.30	1975	1896	190	521	0	0

Permanent Pool Volume = **521** m^3

Comments:

1 Red text represents interpolated values

TATHAM ENGINEERING	Project: Barrie Drainage Master Plan	Date: 3-Jan-18
	File No.: 117076	Designed: DRT
	Subject: Conceptual Design - LID	Checked: DAM

CENTRALIZED LID DESIGN

WATERSHED: Lovers Creek
SWMF: LV07
LID TYPE: Underground Infiltration Chamber System

Drainage Area (ha):	96.9
Impervious Drainage Area (ha):	53.9
Catchment ID:	
Infiltration Rate (mm/hr):	86.0
Design Safety Factor:	3.5
LID Foot Print Area (m^2):	1765
Storm Sewer Inlet Invert (m):	282.45
Storm Sewer Outlet Invert (m):	N/A
Target Capture Ratio:	5:1 - 20:1
Capture Ratio:	305

LID SIZING CALCULATIONS

STORAGE RESERVOIR DEPTH

Design Infiltration Rate (mm/hr):	25
Void Ratio for Stone Reservoir:	0.4
Drawdown Time (hr):	48
Maximum Storage Reservoir Depth (mm):	2949

STORAGE RESERVOIR VOLUME

Design Storage Reservoir Depth (mm):	2400
Storage Chamber:	2100 CMP
Unit Storage Volume (m^3/m^2):	1.65
Storage Reservoir Volume (m^3):	2912

VOLUME CONTROL

Control Target - 25mm (mm):	
Runoff Volume Captured (mm):	3.0

UNDERDRAIN DEFAULTS

Orifice Coefficient:	0.60
Gravitational Constant (m/s^2):	9.81
Underdrain Diameter (mm):	200
Orifice Area (m^2):	0.0314

BARRIE DRAINAGE MASTER PLAN
LOVERS CREEK WATERSHED
PROJECT NO. 102
SWMF RETROFIT NO. 45 (LV 05)

Stage-Storage Table

Pond Characteristics:

Cell #1
Permanent Pool Elev.: 283.50 m
Bottom Elev.: 281.50 m

Cell #2
Permanent Pool Elev.: 279.95 m
Bottom Elev.: 279.00 m

Elevation (m)	Cell #1 Geometry			Cell #1 Volume (m^3)		Cell #2 Geometry			Cell #2 Volume (m^3)		Combined Cell Volumes (m3)	
	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Live	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Live	Accum. Dead	Accum. Live
279.00	0.00	0	0	0	0	0.00	582	582	0	0	0	0
279.50	0.00	0	0	0	0	0.50	853	718	359	0	359	0
279.95	0.00	0	0	0	0	0.95	1096	974	438	0	797	0
280.00	0.00	0	0	0	0	1.00	1130	1113	0	56	797	56
280.50	0.00	0	0	0	0	1.50	1469	1300	0	650	797	705
281.00	0.00	0	0	0	0	2.00	1852	1660	0	830	797	1536
281.50	0.00	117	117	0	0	2.50	2234	2043	0	1021	797	2557
281.79	0.29	211	105	30	0	2.79	2453	2344	0	670	827	3227
282.00	0.50	281	199	99	0	3.00	2617	2535	0	543	927	3770
282.50	1.00	446	364	182	0	3.50	3188	2902	0	1451	1109	5221
283.00	1.50	694	570	285	0	4.00	3759	3473	0	1737	1393	6957
283.50	2.00	941	817	409	0	4.50	4117	3938	0	1969	1802	8926

Permanent Pool Volume = **1802** m^3

Comments:

1 Red text represents interpolated values

BARRIE DRAINAGE MASTER PLAN
LOVERS CREEK WATERSHED
PROJECT NO. 102
SWMF RETROFIT NO. 45 (LV 05)

Stage-Discharge Table

Orifice #1:			**DICB Outlet Pipe:**			**Overflow DICB:**			**Overflow Weir (Road)**		
Width:	**500**	mm	Diameter:	**1000**	mm	Each Width	**2.00**	m	Weir Bottom Width:	33	m
Height:	**500**	mm	Area:	0.7854	m^2	MTO Design Chart	4.20		Weir Downstream Length:	10	m
C:	0.63		C:	0.63		Grate Slope (H:V)	**3**	:1	Side Slope (H:V)	91.5	:1
Invert:	**279.95**	m	Invert:	**279.66**	m	Inlet	**282.65**	m	Weir Sill Elevation:	**283.79**	
			Notes: 1000mm diameter concrete outlet pipe from DICB.			Notes: DICB - 2.0m wide x 1.3m long. Top of grate is 283.10m.			Notes: Overflow Weir geometry approximated using road surface		

	Orifice #1		DICB Outlet Pipe		Overflow DICB		Overflow (Road)			
Elevation (m)	**Head (m)**	**Discharge (m^3/s)**	**Head (m)**	**Discharge (m^3/s)**	**Head (m)**	**Discharge (m^3/s)**	**Head (m)**	**Discharge (m^3/s)**	**Hydraulic Control**	**Total Discharge (m^3/s)**
279.95	0.000	0.000	0.290	0.168	0.000	0.000	0.000	0.000	Orifice #1	0.000
280.00	0.050	0.010	0.340	1.278	0.000	0.000	0.000	0.000	Orifice #1	0.010
280.50	0.300	0.382	0.340	1.278	0.000	0.000	0.000	0.000	Orifice #1	0.382
281.00	0.800	0.624	0.840	2.009	0.000	0.000	0.000	0.000	Orifice #1	0.624
281.50	1.300	0.795	1.340	2.537	0.000	0.000	0.000	0.000	Orifice #1	0.795
281.79	1.586	0.879	1.626	2.795	0.000	0.000	0.000	0.000	Orifice #1	0.879
282.00	1.800	0.936	1.840	2.973	0.000	0.000	0.000	0.000	Orifice #1	0.936
282.50	2.300	1.058	2.340	3.353	0.000	0.000	0.000	0.000	Orifice #1	1.058
283.00	2.800	1.167	2.840	3.694	0.350	1.393	0.000	0.000	Orifice #1	2.560
283.50	3.300	1.267	3.340	4.005	0.850	7.467	0.000	0.000	DICB Outlet Pipe	4.005
283.51	3.310	1.269	3.350	4.011	0.860	7.638	0.000	0.000	DICB Outlet Pipe	4.011
283.60	3.400	1.286	3.440	4.065	0.950	9.261	0.000	0.000	DICB Outlet Pipe	4.065
283.70	3.500	1.305	3.540	4.124	1.050	11.247	0.000	0.000	DICB Outlet Pipe	4.124
283.80	3.600	1.324	3.640	4.181	1.150	13.426	0.015	0.088	DICB Outlet Pipe	4.269
283.90	3.700	1.342	3.740	4.239	1.250	15.797	0.115	2.233	DICB Outlet Pipe	6.471
284.00	3.800	1.360	3.840	4.295	1.350	18.362	0.215	6.665	Weir	10.960
284.10	3.900	1.378	3.940	4.350	1.450	21.119	0.315	13.835	Weir	18.186

Comments:

1 **Bold** text represents values that have been obtained from field inspection and survey.
2 Red text represents calculated values
Orifice discharge calculated as weir flow.

Calculation Notes

Orifice Equation is: Q = C x A x (2gH)^0.5

Where: Q = flow rate (cms)
C = constant
A = area of opening(sq. m)
H = net head on the orifice
g = Acceleration due to gravity

DICB Overflow Determined from MTO Design Chart 4.20 For Ditch Inlet Capacity

Trapezoidal Weir Calculations Completed
Within Tatham Engineering Developed Spreadsheet

Additional Notes:

NVCA Weir Flow Calculation Applied For Weir Flow Below Circular Orifice Centroid

$$Q_w = 1.65([(pi*(D^2)/4)(2*\cos^{-1}[(((D/2)-d)/(D/2))*(180/pi)]/360)-((D/2-d)(Dd-d^2)^{0.5})]/d)d^{1.5}$$

Where:
Q_w is weir flow (m^3/s)
D is orifice diameter (m)
d is depth of flow above the invert (m)

Rectangular Weir Flow Calculation Applied For Rectangular Orifices Below Top of Wall

Rectangular Weir Equation is: Q = 2/3 x C x (2g)^0.5 x L x H^1.5

Where: Q = flow rate (cms)
C = constant (0.63)
L = bottom width (m)
H =head above orifice invert
g = Acceleration due to gravity

BARRIE DRAINAGE MASTER PLAN
LOVERS CREEK WATERSHED
PROJECT NO. 102
SWMF RETROFIT NO. 45 (LV 05)

Stage-Storage-Discharge Table

Stormwater Management Pond							
Pond Geometry				Pond Volume (m^3)			Discharge
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Live	Total	(m^3/s)
279.00	0.00	**582.43**	582.43	0.00	0.00	0.00	0.000
279.50	0.50	852.77	717.60	358.80	0.00	358.80	0.000
279.95	0.95	**1096.08**	974.43	797.29	0.00	797.29	0.000
280.00	1.00	1129.99	1113.03	797.29	55.65	852.95	0.010
280.50	1.50	**1469.08**	1299.53	797.29	705.42	1502.71	0.382
281.00	2.00	1851.65	1660.36	797.29	1535.60	2332.89	0.624
281.50	2.50	2234.22	2042.94	797.29	2557.07	3354.36	0.795
281.79	2.79	2452.94	2343.58	827.41	3227.00	4054.41	0.879
282.00	3.00	**2616.79**	2534.87	926.86	3769.82	4696.68	0.936
282.50	3.50	3187.65	2902.22	1108.62	5220.93	6329.55	1.058
283.00	4.00	**3758.50**	3473.07	1393.47	6957.47	8350.94	2.560
283.50	4.50	**4116.92**	3937.71	1802.19	8926.32	10728.52	4.005
283.51	4.51	**5076.00**	4596.46	1802.19	8972.29	10774.48	4.011
283.60	4.60	5328.87	5202.43	1802.19	9440.51	11242.70	4.065
283.70	4.70	**5609.83**	5469.35	1802.19	9987.44	11789.63	4.124
283.80	4.80	5844.86	5727.34	1802.19	10560.18	12362.37	4.269
283.90	4.90	6079.90	5962.38	1802.19	11156.41	12958.61	6.471
284.00	5.00	6314.93	6197.42	1802.19	11776.16	13578.35	10.960
284.10	5.10	**6549.97**	6432.45	1802.19	12419.40	14221.59	18.186

Total Dead Storage = **1802** m^3
Total Live Storage = **12419** m^3

Comments:

1 **Bold** text represents values that have been obtained from GIS.
2 Red text represents calculated values
3 Highlighted columns represent VO3 input values

TATHAM ENGINEERING	Project:	Barrie Drainage Master Plan	Date: 3-Jan-18
	File No.:	117076	Designed: DRT
	Subject:	Conceptual Design - LID	Checked: DAM

CENTRALIZED LID DESIGN

WATERSHED: Lovers Creek
SWMF: LV12
LID TYPE: Underground Infiltration Chamber System

Drainage Area (ha):	17.1
Impervious Drainage Area (ha):	10.9
Catchment ID:	
Infiltration Rate (mm/hr):	72.0
Design Safety Factor:	3.5
LID Foot Print Area (m^2):	650
Storm Sewer Inlet Invert (m):	282.45
Storm Sewer Outlet Invert (m):	N/A
Target Capture Ratio:	5:1 - 20:1
Capture Ratio:	167

LID SIZING CALCULATIONS

STORAGE RESERVOIR DEPTH

Design Infiltration Rate (mm/hr):	21
Void Ratio for Stone Reservoir:	0.4
Drawdown Time (hr):	48
Maximum Storage Reservoir Depth (mm):	2469

STORAGE RESERVOIR VOLUME

Design Storage Reservoir Depth (mm):	2400
Storage Chamber:	1050 CMP
Unit Storage Volume (m^3/m^2):	0.87
Storage Reservoir Volume (m^3):	566

VOLUME CONTROL

Control Target - 25mm (mm):	
Runoff Volume Captured (mm):	3.30

UNDERDRAIN DEFAULTS

Orifice Coefficient:	0.60
Gravitational Constant (m/s^2):	9.81
Underdrain Diameter (mm):	200
Orifice Area (m^2):	0.0314

BARRIE DRAINAGE MASTER PLAN
LOVERS CREEK WATERSHED
PROJECT NO. 111
SWMF RETROFIT NO. 30 (LV 02)

Stage-Storage Table

Pond Characteristics:

Permanent Pool Elev.:: **255.50** m
Bottom Elev.: **253.50** m

Pond Geometry				Pond Volume (m^3)			
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Accum. Dead	Live	Accum. Live
253.50	0.00	2903	2903	0	0	0	0
253.75	0.25	3203	3053	763	763	0	0
254.00	0.50	3504	3354	838	1602	0	0
254.25	0.75	3805	3655	914	2515	0	0
254.50	1.00	4106	3955	989	3504	0	0
254.75	1.25	4407	4256	1064	4568	0	0
255.00	1.50	4707	4557	1139	5708	0	0
255.25	1.75	5008	4858	1214	6922	0	0
255.50	2.00	5309	5159	1290	8212	0	0

Permanent Pool Volume = **8212** m^3

Comments:

1 Red text represents calculated values

BARRIE DRAINAGE MASTER PLAN
LOVERS CREEK WATERSHED
PROJECT NO. 112
SWMF RETROFIT NO. 31 (LV 03)

Stage-Storage Table

Pond Characteristics:

Top Elev.: 266.50 m
Permanent Pool Elev.: 266.50 m
Bottom Elev: 264.90 m

Pond Geometry				Pond Volume (m^3)			
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Accum. Dead	Live	Accum. Live
264.00	0.00	1312	1312	0	0	0	0
264.10	0.10	1436	1374	137	137	0	0
264.20	0.20	1561	1499	150	287	0	0
264.30	0.30	1685	1623	162	450	0	0
264.40	0.40	1810	1748	175	624	0	0
264.50	0.50	1934	1872	187	812	0	0
264.60	0.60	2059	1997	200	1011	0	0
264.70	0.70	2183	2121	212	1223	0	0
264.80	0.80	2308	2246	225	1448	0	0
264.90	0.90	2707	2508	251	1699	0	0
265.00	1.00	2557	2632	263	1962	0	0
265.05	1.05	2620	2588	131	2093	0	0
265.10	1.10	2680	2650	0	2093	131	131
265.20	1.20	2804	2742	0	2093	274	405
265.28	1.28	2908	2856	0	2093	242	646
265.30	1.30	2927	2918	0	2093	45	691
265.40	1.40	3050	2989	0	2093	299	990
265.50	1.50	3174	3112	0	2093	311	1301
265.55	1.55	3222	3198	0	2093	160	1461
265.60	1.60	3270	3246	0	2093	162	1624
265.70	1.70	3366	3318	0	2093	332	1955
265.80	1.80	3462	3414	0	2093	341	2297
265.90	1.90	3558	3510	0	2093	351	2648
266.00	2.00	3654	3606	0	2093	361	3008
266.10	2.10	3758	3706	0	2093	371	3379
266.20	2.20	3862	3810	0	2093	381	3760
266.30	2.30	3966	3914	0	2093	391	4151
266.40	2.40	4070	4018	0	2093	402	4553
266.50	2.50	4174	4122	0	2093	412	4965

Permanent Pool Volume = **2093** m^3
Extended Detention Volume = **1461** m^3
Total Active Storage = **4965** m^3

Comments:

1 **Bold** text represents values that have been obtained from GIS.
2 Red text represents interpolated values

BARRIE DRAINAGE MASTER PLAN
LOVERS CREEK WATERSHED
PROJECT NO. 112
SWMF RETROFIT NO. 31 (LV 03)

Stage-Discharge Table

Orifice #1:		**Outlet Pipe (Existing):**		**Orifice #2 (Existing):**		**Orifice #3 (Existing):**			**Overflow Spillway:**	
Diameter (mm):	**115**	Diameter (mm):	**1500**	Width:	**600**	Width:	**2400**	mm	Bottom Width (m):	**1.10**
Area (m^2):	**0.01**	Area (m^2):	**1.77**	Height:	**500**	Height:	**420**	mm	Downstream Length (m):	**5**
C:	0.63	C:	0.63	C:	0.63	C:	0.63		Side Slope (H:1V):	**3**
Invert (m):	**265.05**	Invert (m):	**264.45**	Invert:	**265.55**	Invert:	**267.79**	m	Weir Sill Elevation (m):	**265.9**

	Orifice #1		**Outlet Pipe**		**Orifice #2**		**Orifice #3**		**Spillway**			
Elevation (m)	**Head (m)**	**Discharge (m^3/s)**	**Head (m)**	**Discharge (m^3/s)**	**Head (m)**	**Discharge (m^3/s)**	**Head (m)**	**Discharge (m^3/s)**	**Head (m)**	**Discharge (m^3/s)**	**Hydraulic Control**	**Total Discharge (m^3/s)**
265.05	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Orifice #1	0.000
265.10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Orifice #1	0.000
265.20	0.093	0.071	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Orifice #1	0.000
265.28	0.177	0.098	0.081	11.201	0.000	0.000	0.000	0.000	0.000	0.000	Orifice #1	0.098
265.30	0.193	0.102	0.096	12.223	0.000	0.000	0.000	0.000	0.000	0.000	Orifice #1	0.102
265.40	0.293	0.125	0.196	17.465	0.000	0.000	0.000	0.000	0.000	0.000	Orifice #1	0.125
265.50	0.393	0.145	0.296	21.463	0.000	0.000	0.000	0.000	0.000	0.000	Orifice #1	0.145
265.55	0.443	0.154	0.346	23.205	0.000	0.000	0.000	0.000	0.000	0.000	Orifice #1	0.154
265.60	0.493	0.163	0.396	24.826	0.050	0.012	0.000	0.000	0.000	0.000	Orifice #1	0.175
265.70	0.593	0.178	0.496	27.784	0.150	0.065	0.000	0.000	0.000	0.059	Orifice #1	0.302
265.80	0.693	0.193	0.596	30.456	0.250	0.140	0.000	0.000	0.000	0.203	Orifice #1	0.535
265.90	0.793	0.206	0.696	32.912	0.350	0.231	0.000	0.000	0.000	0.439	Spillway	0.877
266.00	0.893	0.219	0.796	35.197	0.450	0.337	0.000	0.000	0.100	0.778	Spillway	1.334
266.10	0.993	0.231	0.896	37.343	0.300	0.459	0.000	0.000	0.200	1.226	Spillway	1.915
266.20	1.093	0.242	0.996	39.372	0.400	0.529	0.000	0.000	0.300	2.226	Spillway	2.997
266.30	1.193	0.253	1.096	41.301	0.500	0.592	0.000	0.000	0.400	3.226	Spillway	4.071
266.40	1.293	0.264	1.196	43.144	0.600	0.648	0.000	0.000	0.500	4.226	Spillway	5.138
266.50	1.393	0.274	1.296	44.911	0.700	0.700	0.000	0.000	0.600	5.226	Spillway	6.200

Comments:

1 **Bold** text represents values that have been obtained from field inspection and survey.
2 Red text represents calculated values

Calculation Notes

Orifice Equation is: Q = C x A x (2gH)^0.5

Where: Q = flow rate (cms)
C = constant
A = area of opening(sq. m)
H = net head on the orifice
g = Acceleration due to gravity

Overflow weir calculations completed in accordance with NVCA rectangular broad crested weir equation (NVCA Stormwater Technical Guide, December 2013)

BARRIE DRAINAGE MASTER PLAN
LOVERS CREEK WATERSHED
PROJECT NO. 112
SWMF RETROFIT NO. 31 (LV 03)

Stage-Storage-Discharge Table

Pond Geometry				Pond Volume (m^3)			Discharge
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Live	Total	(m^3/s)
265.00	1.00	2557	2632	1962	0	1962	0.00
265.10	1.05	2680	2650	2093	131	2224	0.00
265.20	1.10	2804	2742	2093	405	2498	0.00
265.28	1.20	2908	2856	2093	646	2740	0.10
265.30	1.28	2927	2918	2093	691	2785	0.10
265.40	1.30	3050	2989	2093	990	3083	0.13
265.50	1.40	3174	3112	2093	1301	3395	0.15
265.55	1.50	3222	3198	2093	1461	3555	0.15
265.60	1.55	3270	3246	2093	1624	3717	0.18
265.70	1.60	3366	3318	2093	1955	4049	0.30
265.80	1.70	3462	3414	2093	2297	4390	0.54
265.90	1.80	3558	3510	2093	2648	4741	0.88
266.00	1.90	3654	3606	2093	3008	5102	1.33
266.10	2.00	3758	3706	2093	3379	5472	1.92
266.20	2.10	3862	3810	2093	3760	5853	3.00
266.30	2.20	3966	3914	2093	4151	6245	4.07
266.40	2.30	4070	4018	2093	4553	6646	5.14
266.50	2.40	4174	4122	2093	4965	7059	6.20

TATHAM ENGINEERING	Project: Barrie Drainage Master Plan	Date: 3-Jan-18
	File No.: 117076	Designed: DRT
	Subject: Conceptual Design - LID	Checked: DAM

CENTRALIZED LID DESIGN

WATERSHED: Lovers Creek
SWMF: LV10
LID TYPE: Underground Infiltration Chamber System

Drainage Area (ha):	18.2
Impervious Drainage Area (ha):	5.8
Catchment ID:	
Infiltration Rate (mm/hr):	77.0
Design Safety Factor:	3.5
LID Foot Print Area (m^2):	375
Storm Sewer Inlet Invert (m):	282.45
Storm Sewer Outlet Invert (m):	N/A
Target Capture Ratio:	5:1 - 20:1
Capture Ratio:	153

LID SIZING CALCULATIONS

STORAGE RESERVOIR DEPTH

Design Infiltration Rate (mm/hr):	22
Void Ratio for Stone Reservoir:	0.4
Drawdown Time (hr):	48
Maximum Storage Reservoir Depth (mm):	2640

STORAGE RESERVOIR VOLUME

Design Storage Reservoir Depth (mm):	1800
Storage Chamber:	1500 CMP
Unit Storage Volume (m^3/m^2):	1.19
Storage Reservoir Volume (m^3):	446

VOLUME CONTROL

Control Target - 25mm (mm):	5.40
Runoff Volume Captured (mm):	2.46

UNDERDRAIN DEFAULTS

Orifice Coefficient:	0.60
Gravitational Constant (m/s^2):	9.81
Underdrain Diameter (mm):	200
Orifice Area (m^2):	0.0314

BARRIE DRAINAGE MASTER PLAN
LOVERS CREEK WATERSHED
PROJECT NO. 119
SWMF RETROFIT NO. 68 (LV 01)

Stage-Storage Table

Pond Characteristics:

Top Elevation: 237.20 m
Bottom Elev: 233.82 m
Permanent Pool: 234.12 m

Pond Geometry				Pond Volume (m^3)			
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Accum. Dead	Live	Accum. Live
232.62	0.00	3450	3450	0	0	0	0
232.80	0.18	3683	3567	642	642	0	0
233.00	0.38	3941	3812	762	1404	0	0
233.20	0.58	4199	4070	814	2218	0	0
233.40	0.78	4474	4337	867	3086	0	0
233.60	0.98	4750	4612	922	4008	0	0
233.80	1.18	5026	4888	978	4986	0	0
234.00	1.38	5301	5163	1033	6018	0	0
234.12	1.50	5386	5343	641	6659	0	0
234.20	1.58	5577	5481	0	6659	439	439
234.30	1.68	5715	5646	0	6659	565	1003
234.40	1.78	5852	5784	0	6659	578	1581
234.60	1.98	6128	5990	0	6659	1198	2779
234.80	2.18	6404	6266	0	6659	1253	4033
235.00	2.38	6679	6542	0	6659	1308	5341
235.20	2.58	6955	6817	0	6659	1363	6704
235.40	2.78	7386	7170	0	6659	1434	8138
235.60	2.98	7817	7601	0	6659	1520	9659
235.80	3.18	8248	8032	0	6659	1606	11265
236.00	3.38	8679	8463	0	6659	1693	12958
236.20	3.58	9109	8894	0	6659	1779	14737
236.40	3.78	9540	9325	0	6659	1865	16602
236.60	3.98	9971	9756	0	6659	1951	18553
236.80	4.18	10402	10187	0	6659	2037	20590
237.00	4.38	10833	10617	0	6659	2123	22714
237.20	4.58	11264	11048	0	6659	2210	24923

Permanent Pool Volume = 6659 m^3

Comments:

1 Red text represents interpolated values

BARRIE DRAINAGE MASTER PLAN
LOVERS CREEK WATERSHED
PROJECT NO. 119
SWMF RETROFIT NO. 68 (LV 01)

Stage-Discharge Table

Orifice #1:		Orifice #2:		Orifice #3:		Overflow Weir:		
Diameter:	48	Diameter:	685	Diameter:	675	Weir Bottom Width	15.4	m
Area:	0.0018	Area:	0.3685	Area:	0.3578	Weir Sill Elevation	236.70	m
C:	0.63	C:	0.63	C:	0.63	Weir Downstream Lengt	5	m
Invert:	234.12	Invert:	236.02	Invert:	233.48	Side Slope (H:V)	0.01	:1
Notes: Orifice Plate - 6 rows of 6 x 48 mm diameter holes		Notes: Circular Orifice in Horizontal Plane		Notes: Outlet Pipe		Notes: Width of weir increased to provide emergency capacity for regional storm		

	Orifice #1 Row 1		Orifice #1 Row 2		Orifice #1 Row 3		Orifice #1 Row 4		Orifice #1 Row 5		Orifice #1 Row 6	
Elevation (m)	Head (m)	Discharge (m^3/s)	Area (m^2) (m)	Avg. Area (m (m^3/s)	Head (m)	Discharge (m^3/s)	Head (m)	Discharge (m^3/s)	Head (m)	Discharge (m^3/s)	Head (m)	Discharge (m^3/s)
234.12	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
234.20	0.056	0.007	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
234.30	0.156	0.012	0.081	0.009	0.006	0.002	0.000	0.000	0.000	0.000	0.000	0.000
234.40	0.256	0.015	0.181	0.013	0.106	0.010	0.031	0.005	0.000	0.000	0.000	0.000
234.60	0.456	0.020	0.381	0.019	0.306	0.017	0.231	0.015	0.156	0.012	0.081	0.009
234.80	0.656	0.025	0.581	0.023	0.506	0.022	0.431	0.020	0.356	0.018	0.281	0.016
235.00	0.856	0.028	0.781	0.027	0.706	0.025	0.631	0.024	0.556	0.023	0.481	0.021
235.20	1.056	0.031	0.981	0.030	0.906	0.029	0.831	0.028	0.756	0.026	0.681	0.025
235.40	1.256	0.034	1.181	0.033	1.106	0.032	1.031	0.031	0.956	0.030	0.881	0.028
235.60	1.456	0.037	1.381	0.036	1.306	0.035	1.231	0.034	1.156	0.033	1.081	0.032
235.80	1.656	0.039	1.581	0.038	1.506	0.037	1.431	0.036	1.356	0.035	1.281	0.034
236.00	1.856	0.041	1.781	0.040	1.706	0.040	1.631	0.039	1.556	0.038	1.481	0.037
236.20	2.056	0.043	1.981	0.043	1.906	0.042	1.831	0.041	1.756	0.040	1.681	0.039
236.40	2.256	0.046	2.181	0.045	2.106	0.044	2.031	0.043	1.956	0.042	1.881	0.042
236.60	2.456	0.047	2.381	0.047	2.306	0.046	2.231	0.045	2.156	0.044	2.081	0.044
236.80	2.656	0.049	2.581	0.049	2.506	0.048	2.431	0.047	2.356	0.047	2.281	0.046
237.00	2.856	0.051	2.781	0.051	2.706	0.050	2.631	0.049	2.556	0.048	2.481	0.048
237.20	3.056	0.053	2.981	0.052	2.906	0.052	2.831	0.051	2.756	0.050	2.681	0.050

Comments: Red text represents calculated values

1

2

Trapezoidal Weir Calculations Completed
Within Tatham Developed Spreadsheet

Calculation Notes

Orifice Equation is: Q = C x A x (2gH)^0.5

Where: Q = flow rate (cms)
C = constant
A = area of opening(sq. m)
H = net head on the orifice
g = Acceleration due to gravity

Additional Notes:

BARRIE DRAINAGE MASTER PLAN
LOVERS CREEK WATERSHED
PROJECT NO. 119
SWMF RETROFIT NO. 68 (LV 01)

Stage-Discharge Table

Orifice #1:		Orifice #2:		Orifice #3:		Overflow Weir:		
Diameter:	48	Diameter:	685	Diameter:	675	Weir Bottom Width	15.4	m
Area:	0.0018	Area:	0.3685	Area:	0.3578	Weir Sill Elevation	236.70	m
C:	0.63	C:	0.63	C:	0.63	Weir Downstream Length	5	m
Invert:	234.12	Invert:	236.02	Invert:	233.48	Side Slope (H:V)	0.01	:1
Notes: Orifice Plate - 6 rows of 6 x 48 mm diameter holes		Notes: Circular Orifice in Horizontal Plane		Notes: Outlet Pipe		Notes: Width of weir increased to provide emergency capacity for regional storm		

Orifice #1	Orifice #2		Orifice #3		Overflow Weir			
Discharge (m^3/s)	Head (m)	Discharge (m^3/s)	Head (m)	Discharge (m^3/s)	Head (m)	Discharge (m^3/s)	Hydraulic Control	Total Discharge (m^3/s)
0.000	0.000	0.000	0.303	0.549	0.000	0.000	Orifice Plates	0.000
0.007	0.000	0.000	0.382	0.618	0.000	0.000	Orifice Plates	0.007
0.023	0.000	0.000	0.483	0.694	0.000	0.000	Orifice Plates	0.023
0.043	0.000	0.000	0.582	0.762	0.000	0.000	Orifice Plates	0.043
0.091	0.000	0.000	0.782	0.883	0.000	0.000	Orifice Plates	0.091
0.123	0.000	0.000	0.982	0.990	0.000	0.000	Orifice Plates	0.123
0.148	0.000	0.000	1.182	1.086	0.000	0.000	Orifice Plates	0.148
0.169	0.000	0.000	1.382	1.174	0.000	0.000	Orifice Plates	0.169
0.188	0.000	0.000	1.582	1.256	0.000	0.000	Orifice Plates	0.188
0.204	0.000	0.000	1.782	1.333	0.000	0.000	Orifice Plates	0.204
0.220	0.000	0.000	1.982	1.406	0.000	0.000	Orifice Plates	0.220
0.235	0.000	0.000	2.182	1.475	0.000	0.000	Orifice Plates	0.235
0.248	0.180	0.436	2.382	1.541	0.000	0.000	Orifice Plates	0.685
0.261	0.380	0.634	2.582	1.605	0.000	0.000	Orifice Plates	0.895
0.274	0.580	0.783	2.782	1.666	0.000	0.000	Orifice Plates	1.057
0.286	0.780	0.908	2.982	1.725	0.100	0.682	Orifice Plates/Weir	1.876
0.297	0.980	1.018	3.182	1.781	0.300	3.879	Orifice Plates/Weir	5.194
0.308	1.180	1.117	3.383	1.837	0.500	8.562	Orifice Plates/Weir	9.987

BARRIE DRAINAGE MASTER PLAN
LOVERS CREEK WATERSHED
PROJECT NO. 119
SWMF RETROFIT NO. 68 (LV 01)

Stage-Storage-Discharge Table

Stormwater Management Pond							
Pond Geometry				Pond Volume (m^3)			Discharge (m^3/s)
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Live	Total	
232.80	0.18	3682.68	3566.57	641.98	0.00	641.98	0.000
233.00	0.38	3940.71	3811.70	1404.32	0.00	1404.32	0.000
233.20	0.58	4198.74	4069.73	2218.27	0.00	2218.27	0.000
233.40	0.78	4474.37	4336.56	3085.58	0.00	3085.58	0.000
233.60	0.98	4749.99	4612.18	4008.01	0.00	4008.01	0.000
233.80	1.18	5025.61	4887.80	4985.57	0.00	4985.57	0.000
234.00	1.38	5301.23	5163.42	6018.26	0.00	6018.26	0.000
234.12	1.50	**5385.69**	5343.46	6659.47	0.00	6659.47	0.000
234.20	1.58	5576.85	5481.27	6659.47	438.50	7097.97	0.007
234.30	1.68	5714.66	5645.75	6659.47	1003.08	7662.55	0.023
234.40	1.78	5852.47	5783.57	6659.47	1581.43	8240.91	0.043
234.60	1.98	6128.09	5990.28	6659.47	2779.49	9438.96	0.091
234.80	2.18	6403.71	6265.90	6659.47	4032.67	10692.14	0.123
235.00	2.38	6679.33	6541.52	6659.47	5340.97	12000.45	0.148
235.20	2.58	**6954.95**	6817.14	6659.47	6704.40	13363.88	0.169
235.40	2.78	7385.84	7170.40	6659.47	8138.48	14797.95	0.188
235.60	2.98	7816.73	7601.28	6659.47	9658.74	16318.21	0.204
235.80	3.18	8247.61	8032.17	6659.47	11265.17	17924.65	0.220
236.00	3.38	8678.50	8463.06	6659.47	12957.79	19617.26	0.235
236.20	3.58	9109.39	8893.94	6659.47	14736.57	21396.05	0.685
236.40	3.78	9540.27	9324.83	6659.47	16601.54	23261.01	0.895
236.60	3.98	9971.16	9755.72	6659.47	18552.68	25212.16	1.057
236.80	4.18	10402.05	10186.60	6659.47	20590.00	27249.48	1.876
237.00	4.38	10832.93	10617.49	6659.47	22713.50	29372.97	5.194
237.20	4.58	**11263.82**	11048.38	6659.47	24923.18	31582.65	9.987

Total Dead Storage = 6659
Total Live Storage = 24923

Comments:

1 **Bold** text represents values that have been obtained from GIS
2 Red text represents calculated values
3 Highlighted columns represent PCSWMM input values

BARRIE DRAINAGE MASTER PLAN
HEWITTS CREEK WATERSHED
PROJECT NO. 128
SWMF RETROFIT NO. 27

Stage-Storage Table

Pond Characteristics:

Top Elev.: 245.15 m
Permanent Pool Elev.: 242.04 m
Bottom Elev: 241.00 m

Pond Geometry				Pond Volume (m^3)			
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Accum. Dead	Live	Accum. Live
240.10	0.00	1037	1037	0	0	0	0
240.20	0.10	1092	1065	106	106	0	0
240.30	0.20	1148	1120	112	218	0	0
240.40	0.30	1203	1175	118	336	0	0
240.50	0.40	1258	1231	123	459	0	0
240.60	0.50	1313	1286	129	588	0	0
240.70	0.60	1369	1341	134	722	0	0
240.80	0.70	1424	1396	140	861	0	0
240.90	0.80	1479	1452	145	1007	0	0
241.00	0.90	1535	1507	151	1157	0	0
241.10	1.00	1590	1562	156	1313	0	0
241.20	1.10	1658	1624	162	1476	0	0
241.30	1.20	1727	1692	169	1645	0	0
241.40	1.30	1795	1761	176	1821	0	0
241.50	1.40	1863	1829	183	2004	0	0
241.60	1.50	1931	1897	190	2194	0	0
241.70	1.60	2000	1966	197	2390	0	0
241.80	1.70	2068	2034	203	2594	0	0
241.90	1.80	2136	2102	210	2804	0	0
242.00	1.90	2205	2171	217	3021	0	0
242.04	1.94	2234	2220	96	3117	0	0
242.10	2.00	2273	2254	0	3117	128	128
242.20	2.10	2341	2307	0	3117	231	359
242.30	2.20	2410	2376	0	3117	238	596
242.40	2.30	2478	2444	0	3117	244	841
242.50	2.40	2546	2512	0	3117	251	1092
242.60	2.50	2631	2589	0	3117	259	1351
242.70	2.60	2716	2673	0	3117	267	1618
242.80	2.70	2800	2758	0	3117	276	1894
242.87	2.77	2863	2832	0	3117	208	2102
242.90	2.80	2885	2874	0	3117	76	2178
243.00	2.90	2970	2927	0	3117	293	2471
243.10	3.00	3054	3012	0	3117	301	2772
243.20	3.10	3139	3097	0	3117	310	3082
243.30	3.20	3224	3181	0	3117	318	3400
243.40	3.30	3308	3266	0	3117	327	3726
243.50	3.40	3393	3351	0	3117	335	4062
243.60	3.50	3478	3435	0	3117	344	4405
243.70	3.60	3562	3520	0	3117	352	4757
243.80	3.70	3647	3605	0	3117	360	5118
243.90	3.80	3732	3689	0	3117	369	5487
244.00	3.90	3816	3774	0	3117	377	5864
244.10	4.00	3901	3859	0	3117	386	6250

Permanent Pool Volume = **3117** m^3
Extended Detention Volume = **2178** m^3
Total Active Storage = **6250** m^3

Comments:

1 Red text represents interpolated values

BARRIE DRAINAGE MASTER PLAN
HEWITTS CREEK WATERSHED
PROJECT NO. 128
SWMF RETROFIT NO. 27

Stage-Discharge Table

Orifice #1:		**DCIB Outlet Pipe #1 (4)**			**Overflow DICB #1**		**Weir**	
Diameter (mm):	140	Diameter:	600	mm	Each Width (m):	1.20	Bottom Width of Weir (m):	10
Area (m^2):	0.02	Area:	1.13	m^2	Total Width (m):	4.8	Weir Sill Elevation (m):	243.75
C:	0.63	C:	0.63		Grate Slope (H:1V):	6	Downstream Length (m):	5
Invert (m):	242.04	Invert:	242.04	m	Inlet Invert (m):	242.9	Side Slope (H:1V):	3

	Orifice #1		DCIB Outlet Pipe #1		DCIB #1		Weir			
Elevation (m)	**Head (m)**	**Discharge (m^3/s)**	**Head (m)**	**Discharge (m^3/s)**	**Head (m)**	**Discharge (m^3/s)**	**Head (m)**	**Discharge (m^3/s)**	**Hydraulic Control**	**Total Discharge (m^3/s)**
242.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Orifice Pipe	0.00
242.10	0.06	0.01	0.06	0.02	0.00	0.00	0.00	0.00	Orifice Pipe	0.01
242.20	0.09	0.01	0.16	0.16	0.00	0.00	0.00	0.00	Orifice Pipe	0.01
242.30	0.19	0.02	0.26	0.40	0.00	0.00	0.00	0.00	Orifice Pipe	0.02
242.40	0.29	0.02	0.36	0.70	0.00	0.00	0.00	0.00	Orifice Pipe	0.02
242.50	0.39	0.03	0.46	1.04	0.00	0.00	0.00	0.00	Orifice Pipe	0.03
242.60	0.49	0.03	0.26	1.61	0.00	0.00	0.00	0.00	Orifice Pipe	0.03
242.70	0.59	0.03	0.36	1.89	0.00	0.00	0.00	0.00	Orifice Pipe	0.03
242.80	0.69	0.04	0.46	2.14	0.00	0.00	0.00	0.00	Orifice Pipe	0.04
242.87	0.76	0.04	0.53	2.31	0.00	0.00	0.00	0.00	Orifice Pipe	0.04
242.90	0.79	0.04	0.56	2.36	0.00	0.00	0.00	0.00	Orifice Pipe	0.04
243.00	0.89	0.04	0.66	2.56	0.10	0.62	0.00	0.00	Orifice Pipe	0.66
243.10	0.99	0.04	0.76	2.75	0.20	1.96	0.00	0.00	Orifice Pipe	2.00
243.20	1.09	0.04	0.86	2.93	0.30	4.06	0.00	0.00	Orifice Pipe	2.93
243.30	1.19	0.05	0.96	3.09	0.40	6.92	0.00	0.00	Orifice Pipe	3.09
243.40	1.29	0.05	1.06	3.25	0.50	10.54	0.00	0.00	Orifice Pipe	3.25
243.50	1.39	0.05	1.16	3.40	0.60	14.93	0.00	0.00	Orifice Pipe	3.40
243.60	1.49	0.05	1.26	3.54	0.70	20.09	0.00	0.00	Orifice Pipe	3.54
243.70	1.59	0.05	1.36	3.68	0.80	26.01	0.00	0.00	Orifice Pipe	3.68
243.80	1.69	0.06	1.46	3.81	0.90	32.69	0.05	0.24	Orifice Pipe	4.05
243.90	1.79	0.06	1.56	3.94	1.00	40.13	0.15	1.29	Orifice Pipe	5.23
244.00	1.89	0.06	1.66	4.07	1.10	48.34	0.25	2.94	Orifice Pipe	7.01
244.10	1.99	0.06	1.76	4.19	1.20	57.32	0.35	5.05	Orifice Pipe	9.23

Comments:

1 **Bold** text represents values that have been obtained from field inspection and survey.
2 Red text represents calculated values
Orifice discharge calculated as weir flow (see additional notes).

Calculation Notes

Orifice Equation is: Q = C x A x (2gH)^0.5

Where: Q = flow rate (cms)
C = constant
A = area of opening(sq. m)
H = net head on the orifice
g = Acceleration due to gravity

DICB calculations in accordance with MTO Design Chart 4.20

Overflow weir calculations completed in accordance with NVCA rectangular broad crested weir equation (NVCA Stormwater Technical Guide, December 2013)

Additional Notes:

NVCA Weir Flow Calculation Applied For Weir Flow Below Circular Orifice Centroid (Highlighted in Yellow)

$$Q_w = 1.65([(pi*(D^2)/4)(2*\cos^{-1}[(((D/2)-d)/(D/2))*(180/pi)]/360)-((D/2-d)(Dd-d^2)^{0.5})]/d)d^{1.5}$$

Where:
Q_w is weir flow (m^3/s)
D is orifice diameter (m)
d is depth of flow above the invert (m)

BARRIE DRAINAGE MASTER PLAN
HEWITTS CREEK WATERSHED
PROJECT NO. 128
SWMF RETROFIT NO. 27

Stage-Storage-Discharge Table

Pond Geometry				Pond Volume (m^3)			Discharge
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Live	Total	(m^3/s)
242.04	1.94	2234	2220	3117	0	3117	0.00
242.10	2.00	2273	2254	3117	128	3245	0.01
242.20	2.10	2341	2307	3117	359	3476	0.01
242.30	2.20	2410	2376	3117	596	3713	0.02
242.40	2.30	2478	2444	3117	841	3958	0.02
242.50	2.40	2546	2512	3117	1092	4209	0.03
242.60	2.50	2631	2589	3117	1351	4468	0.03
242.70	2.60	2716	2673	3117	1618	4735	0.03
242.80	2.70	2800	2758	3117	1894	5011	0.04
242.87	2.77	2863	2832	3117	2102	5219	0.04
242.90	2.80	2885	2874	3117	2178	5295	0.04
243.00	2.90	2970	2927	3117	2471	5588	0.66
243.10	3.00	3054	3012	3117	2772	5889	2.00
243.20	3.10	3139	3097	3117	3082	6199	2.93
243.30	3.20	3224	3181	3117	3400	6517	3.09
243.40	3.30	3308	3266	3117	3726	6843	3.25
243.50	3.40	3393	3351	3117	4062	7179	3.40
243.60	3.50	3478	3435	3117	4405	7522	3.54
243.70	3.60	3562	3520	3117	4757	7874	3.68
243.80	3.70	3647	3605	3117	5118	8235	4.05
243.90	3.80	3732	3689	3117	5487	8604	5.23
244.00	3.90	3816	3774	3117	5864	8981	7.01
244.10	4.00	3901	3859	3117	6250	9367	9.23

BARRIE DRAINAGE MASTER PLAN
GEORGIAN CREEK WATERSHED
PROJECT NO. 134
SWMF RETROFIT NO. 76 (GR 04)

Stage-Storage Table

Pond Characteristics:

Top Elevation: 259.50 m
Bottom Elev: 255.00 m

Pond Geometry				Pond Volume (m^3)			
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Accum. Dead	Live	Accum. Live
255.25	0.00	485	485	0	0	0	0
255.50	0.25	895	690	172	172	0	0
255.75	0.50	1304	1100	275	447	0	0
256.00	0.75	1714	1509	377	825	0	0
256.25	1.00	2124	1919	480	1304	0	0
256.50	1.25	2534	2329	582	1887	0	0
256.75	1.50	2943	2738	685	2571	0	0
257.00	1.75	3353	3148	787	3358	0	0

Permanent Pool Volume = **3358** m^3

Comments:

1 Red text represents interpolated values

BARRIE DRAINAGE MASTER PLAN
GEORGIAN CREEK WATERSHED
PROJECT NO. 134
SWMF RETROFIT NO. 76 (GR 04)

Stage-Discharge Table

Pipe	1		Orifice			
Diameter:	600	mm	Width:	800	2700	mm
			Height:	750	400	mm
Area:	0.2827	m^2	Area:	0.6000	1.0800	m^2
C:	0.63		C:	0.63	0.63	
Invert:	257.08	m	Invert:	257.70	258.53	m
Notes: Concrete rectangular orifice 0.8m wide			Notes: Concrete rectangular orifice 2.7m			

	Orifice #1		Orifice #2		Orifice #3			
Elevation (m)	Head (m)	Discharge (m^3/s)	Head (m)	Discharge (m^3/s)	Head (m)	Discharge (m^3/s)	Hydraulic Control	Total Discharge (m^3/s)
255.25	0.000	0.000	0.000	0.000	0.000	0.000	Orifice	0.000
257.50	0.120	0.273	0.000	0.000	0.000	0.000	Orifice	0.273
257.75	0.370	0.480	0.050	0.017	0.000	0.000	Orifice	0.497
258.00	0.620	0.621	0.300	0.245	0.000	0.000	Orifice	0.866
258.25	0.870	0.736	0.550	0.607	0.000	0.000	Orifice	1.343
258.50	1.120	0.835	0.425	1.092	0.000	0.000	Orifice	1.927
258.75	1.370	0.924	0.675	1.376	0.220	0.518	Orifice	2.817
259.00	1.620	1.004	0.925	1.610	0.270	1.566	Orifice	4.181
259.25	1.870	1.079	1.175	1.815	0.520	2.173	Orifice	5.067
259.50	2.120	1.149	1.425	1.999	0.770	2.645	Orifice	5.792

Comments:

1 **Bold** text represents values that have been obtained from field survey or investigation
2 Red text represents calculated values
Weir equation

Calculation Notes

Orifice Equation is: Q = C x A x (2gH)^0.5

Where: Q = flow rate (cms)
C = constant
A = area of opening(sq. m)
H = net head on the orifice
g = Acceleration due to gravity

Rectangular Weir Flow Calculation Applied For Rectangular Orifices Below Top of Wall

Rectangular Weir Equation is: Q = 2/3 x C x (2g)^0.5 x L x H^1.5

Where: Q = flow rate (cms)
C = constant (0.63)
L = bottom width (m)
H =head above orifice invert
g = Acceleration due to gravity

NVCA Weir Flow Calculation Applied For Weir Flow Below Circular Orifice Centroid

$$Q_w = 1.65([(pi*(D^2)/4)(2*\cos^{-1}[(((D/2)-d)/(D/2))*(180/pi)]/360)-((D/2-d)(Dd-d^2)^{0.5})]/d)d^{1.5}$$

Where:
Q_w is weir flow (m^3/s)
D is orifice diameter (m)
d is depth of flow above the invert (m)

BARRIE DRAINAGE MASTER PLAN
GEORGIAN CREEK WATERSHED
PROJECT NO. 134
SWMF RETROFIT NO. 76 (GR 04)

Stage-Storage-Discharge Table

Stormwater Management Pond							
Pond Geometry				Pond Volume (m^3)			Discharge
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Live	Total	(m^3/s)
255.25	0.00	485.00	485.00	0.00	0.00	0.00	0.000
257.50	2.25	3459.80	3433.10	0.00	858.27	1703.20	0.273
257.75	2.50	3513.19	3486.50	0.00	871.62	2574.82	0.497
258.00	2.75	12590.74	8051.97	0.00	2012.99	4587.81	0.866
258.25	3.00	21668.28	17129.51	0.00	4282.38	8870.19	1.343
258.50	3.25	30745.83	26207.05	0.00	6551.76	15421.95	1.927
258.75	3.50	39823.37	35284.60	0.00	8821.15	24243.10	2.817
259.00	3.75	48900.91	44362.14	0.00	11090.54	35333.64	4.181
259.25	4.00	57978.46	53439.68	0.00	13359.92	48693.56	5.067
259.50	4.25	67056.00	62517.23	0.00	15629.31	64322.87	5.792

Total Dead Storage = 0 m^3
Total Live Storage = 64323 m^3

Comments:

1 **Bold** text represents values that have been obtained from field survey or investigation
2 Red text represents calculated values
3 Highlighted columns represent PCSWMM input values

BARRIE DRAINAGE MASTER PLAN
GEORGIAN CREEK WATERSHED
PROJECT NO. 138
SWMF RETROFIT NO. 75 (GR 01)

Stage-Storage Table

Pond Characteristics:

Permanent Pool Elev.: 254.80 m
Bottom Elev.: 253.80 m
Stage 0.1 m

Pond Geometry				Pond Volume (m^3)			
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Accum. Dead	Live	Accum. Live
253.80	0.00	840	840	0	0	0	0
253.90	0.10	1066	953	95	95	0	0
254.00	0.20	1292	1179	118	213	0	0
254.10	0.30	1518	1405	140	354	0	0
254.20	0.40	1744	1631	163	517	0	0
254.30	0.50	1970	1857	186	702	0	0
254.40	0.60	2196	2083	208	911	0	0
254.50	0.70	2422	2309	231	1142	0	0
254.60	0.80	2648	2535	253	1395	0	0
254.70	0.90	2874	2761	276	1671	0	0
254.80	1.00	3100	2987	299	1970	0	0

Permanent Pool Volume = **1970** m^3

Comments:

1 Red text represents interpolated values

BARRIE CITYWIDE MINOR & MAJOR STORMWATER MODEL DEVELOPMENT
LITTLE LAKE WATERSHED
LT01

Stage-Storage-Discharge Table

Stormwater Management Pond			
Pond Geometry			
Elevation (m)	Volume (m^3)	Volume (ha-m)	Discharge (m^3/s)
263.50	0.00	0.000	0.0000
265.00	661.00	0.066	2.4000
265.10	1013.23	0.101	2.5000
265.20	1365.48	0.137	2.6000
265.30	1717.73	0.172	2.7000
265.40	2070.00	0.207	2.8100
265.50	2422.30	0.242	2.9100
265.60	2774.62	0.277	3.0200
265.70	3126.96	0.313	3.1300
265.80	3479.34	0.348	3.2400
265.90	3831.75	0.383	3.3500
266.00	4184.19	0.418	3.4700
266.10	4536.67	0.454	3.5900
266.20	4889.17	0.489	3.7100
266.30	5241.71	0.524	3.8300
266.40	5594.27	0.559	3.9500
266.50	5946.85	0.595	4.0800
266.60	6299.46	0.630	4.2000
266.70	6552.08	0.655	4.4700
266.80	7004.72	0.700	5.0400
266.90	7357.36	0.736	5.7800
267.00	7710.00	0.771	6.6900
267.10	8263.75	0.826	7.9100
267.20	8817.50	0.882	9.2600
267.30	9371.25	0.937	10.7100
267.40	9925.00	0.993	12.2600
267.50	10478.75	1.048	13.9000

Comments:

1 Higgins (1991)

BARRIE CITYWIDE MINOR & MAJOR STORMWATER MODEL DEVELOPMENT
LITTLE LAKE CREEK WATERSHED
LT01

Stage-Storage-Discharge Table

Stormwater Management Pond			
Pond Geometry			
Elevation (m)	Volume (m^3)	Volume (ha-m)	Discharge (m^3/s)
264.00	0.00	0.000	0.0000
264.10	1.78	0.000	0.0000
264.20	5.52	0.001	0.0000
264.30	11.22	0.001	0.0000
264.40	18.88	0.002	0.2376
264.50	28.50	0.003	0.3361
264.60	39.88	0.004	0.3501
264.70	52.82	0.005	0.3502
264.80	67.32	0.007	0.3503
264.90	83.38	0.008	0.3504
265.00	101.00	0.010	0.3505
265.10	124.90	0.012	0.3506
265.20	159.80	0.016	0.3507
265.30	205.70	0.021	0.3508
265.40	262.60	0.026	0.3509
265.50	330.50	0.033	0.3510
265.60	421.48	0.042	0.3511
265.70	547.62	0.055	0.3512
265.80	708.92	0.071	0.3513
265.90	905.38	0.091	0.3514
266.00	1137.00	0.114	0.3515
266.10	1391.33	0.139	0.3516
266.20	1655.92	0.166	0.7020
266.30	1930.77	0.193	0.7021
266.40	2215.88	0.222	0.7022
266.50	2511.25	0.251	0.7023
266.60	2817.10	0.282	0.7024
266.70	3133.65	0.313	1.0568
266.80	3460.90	0.346	1.7498
266.90	3798.85	0.380	2.7083
267.00	4147.50	0.415	3.2141
267.10	4507.77	0.451	4.6669
267.20	4880.58	0.488	6.3649
267.30	5265.93	0.527	8.3105
267.40	5663.82	0.566	10.5077
267.50	6074.25	0.607	12.9609

Comments:

1 Tatham Engineering (2005)

TATHAM ENGINEERING	Project: Barrie Drainage Master Plan	Date: 20-Feb-18
	File No.: 117076	Designed: ASB
	Subject: Conceptual Design - LID	Checked: DRT

CENTRALIZED LID DESIGN

WATERSHED: Little Lake
SWMF: LT01
LID TYPE: Underground Infiltration Chamber System

Drainage Area (ha):	65.9
Impervious Drainage Area (ha):	30.7
Catchment ID:	LT119
Infiltration Rate (mm/hr):	101.0
Design Safety Factor:	3.5
LID Foot Print Area (m^2):	1760
Storm Sewer Inlet Invert (m):	262.88
Storm Sewer Outlet Invert (m):	N/A
Target Capture Ratio:	5:1 - 20:1
Capture Ratio:	175

LID SIZING CALCULATIONS

STORAGE RESERVOIR DEPTH

Design Infiltration Rate (mm/hr):	29
Void Ratio for Stone Reservoir:	0.4
Drawdown Time (hr):	48
Maximum Storage Reservoir Depth (mm):	3463

STORAGE RESERVOIR VOLUME

Design Storage Reservoir Depth (mm):	1079
Storage Chamber:	330 XLHD
Unit Storage Volume (m^3/m^2):	0.71
Storage Reservoir Volume (m^3):	1250

VOLUME CONTROL

Control Target - 25mm (mm):	6.9
Runoff Volume Captured (mm):	1.9

UNDERDRAIN DEFAULTS

Orifice Coefficient:	0.60
Gravitational Constant (m/s^2):	9.81
Underdrain Diameter (mm):	200
Orifice Area (m^2):	0.0314

BARRIE DRAINAGE MASTER PLAN
LITTLE LAKE WATERSHED
PROJECT NO. 142
SWMF RETROFIT NO. 77 (LT 01) - Option 1

Stage-Storage Table

Pond Characteristics:

Top Elevation: **266.50** m
Bottom Elev: **262.00** m

Pond Geometry				Pond Volume (m^3)			
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Accum. Dead	Live	Accum. Live
262.00	0.00	375	375	0	0	0	0
262.25	0.25	533	454	114	114	0	0
262.50	0.50	691	612	153	267	0	0
262.75	0.75	849	770	193	459	0	0
263.00	1.00	1007	928	232	691	0	0
263.25	1.25	1165	1086	272	963	0	0
263.50	1.50	1323	1244	311	1274	0	0
263.75	1.75	1945	1634	0	1274	409	409
264.00	2.00	2567	2256	0	1274	564	973
264.25	2.25	3434	3001	0	1274	750	1723
264.50	2.50	4302	3868	0	1274	967	2690
264.75	2.75	5169	4735	0	1274	1184	3873
265.00	3.00	6036	5602	0	1274	1401	5274
265.25	3.25	6298	6167	0	1274	1542	6816
265.50	3.50	6559	6429	0	1274	1607	8423
265.75	3.75	6821	6690	0	1274	1673	10095
266.00	4.00	7083	6952	0	1274	1738	11833
266.10	4.10	7187	7135	0	1274	714	12547
266.20	4.20	7292	7240	0	1274	724	13271
266.30	4.30	7397	7344	0	1274	734	14005
266.40	4.40	7501	7449	0	1274	745	14750
266.50	4.50	7606	7554	0	1274	755	15506
266.60	4.60	7711	7658	0	1274	766	16271
266.70	4.70	7815	7763	0	1274	776	17048
266.80	4.80	7920	7868	0	1274	787	17834
266.90	4.90	8025	7972	0	1274	797	18632
267.00	5.00	8129	8077	0	1274	808	19439
267.10	5.10	8234	8182	0	1274	818	20258
267.20	5.20	8339	8286	0	1274	829	21086
267.25	5.25	8391	8365	0	1274	418	21504

Permanent Pool Volume = **1274** m^3
Total Active Storage = **21504** m^3

Comments:

1 Red text represents interpolated values

BARRIE DRAINAGE MASTER PLAN
LITTLE LAKE WATERSHED
PROJECT NO. 142
SWMF RETROFIT NO. 77 (LT 01) - Option 1

Stage-Discharge Table

	Orifice #1	Pipe #1	Pipe #2	
Diameter:	600	800	800	mm
Area:	0.2827	0.5027	0.5027	m^2
C:	0.63	0.8	0.8	
Invert:	263.50	266.10	266.10	m

Overflow Weir:

Length of Weir:	6.5	m
Weir Sill Elevation:	266.60	m
Weir constant K:	1.65	
Side Slope (H:V):	3	:1

Note: Pipe capacity limited to 0.35 cms due to flat slope (0.24%)

	Orifice #1		Pipe #1		Pipe #2		Overflow Weir			
Elevation (m)	Head (m)	Discharge (m^3/s)	Head (m)	Discharge (m^3/s)	Head (m)	Discharge (m^3/s)	Head (m)	Discharge (m^3/s)	Hydraulic Control	Total Discharge (m^3/s)
262.00	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	Orifice	0.000
262.25	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	Orifice	0.000
262.50	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	Orifice	0.000
262.75	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	Orifice	0.000
263.00	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	Orifice	0.000
263.25	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	Orifice	0.000
263.50	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	Orifice	0.000
263.75	0.250	0.092	0.000	0.000	0.000	0.000	0	0.000	Orifice	0.092
264.00	0.200	0.353	0.000	0.000	0.000	0.000	0	0.000	Orifice	0.350
264.25	0.450	0.529	0.000	0.000	0.000	0.000	0	0.000	Orifice	0.350
264.50	0.700	0.660	0.000	0.000	0.000	0.000	0	0.000	Orifice	0.350
264.75	0.950	0.769	0.000	0.000	0.000	0.000	0	0.000	Orifice	0.350
265.00	1.200	0.864	0.000	0.000	0.000	0.000	0	0.000	Orifice	0.350
265.25	1.450	0.950	0.000	0.000	0.000	0.000	0	0.000	Orifice	0.350
265.50	1.700	1.029	0.000	0.000	0.000	0.000	0	0.000	Orifice	0.350
265.75	1.950	1.102	0.000	0.000	0.000	0.000	0	0.000	Orifice	0.350
266.00	2.200	1.170	0.000	0.000	0.000	0.000	0	0.000	Orifice	0.350
266.10	2.300	1.197	0.000	0.000	0.000	0.000	0	0.000	Orifice	0.350
266.20	2.400	1.222	0.100	0.350	0.100	0.350	0	0.000	Orifice	0.700
266.30	2.500	1.248	0.200	0.350	0.200	0.350	0	0.000	Orifice	0.700
266.40	2.600	1.272	0.300	0.350	0.300	0.350	0	0.000	Orifice	0.700
266.50	2.700	1.296	0.400	0.350	0.400	0.350	0	0.000	Orifice	0.700
266.60	2.800	1.320	0.100	0.350	0.100	0.350	0	0.000	Orifice	0.700
266.70	2.900	1.344	0.200	0.350	0.200	0.350	0.1	0.370	Orifice / Weir	1.070
266.80	3.000	1.367	0.300	0.350	0.300	0.350	0.2	1.136	Orifice / Weir	1.836
266.90	3.100	1.389	0.400	0.350	0.400	0.350	0.3	2.250	Orifice / Weir	2.950
267.00	3.200	1.411	0.500	0.350	0.500	0.350	0.4	3.715	Orifice / Weir	4.415
267.10	3.300	1.433	0.600	0.350	0.600	0.350	0.5	5.542	Orifice / Weir	6.242
267.20	3.400	1.455	0.700	0.350	0.700	0.350	0.6	7.745	Orifice / Weir	8.445
267.25	3.450	1.466	0.750	0.350	0.750	0.350	0.65	8.993	Orifice / Weir	9.693

Comments:

1 Red text represents calculated values

2 Total discharge = 0.35 cms (when only one pipe is activated), 0.70 cms (when riser is activated and weir equation is used when overflow spillway is activated

Orifice discharge calculated as weir flow (see additional notes)

Calculation Notes

Orifice Equation is: Q = C x A x (2gH)^0.5

Where:
Q = flow rate (cms)
C = constant
A = area of opening(sq. m)
H = net head on the orifice
g = Acceleration due to gravity

Weir Formula is: Q = K x L x H^1.5

Where:
Q = flow rate (cms)
K = constant
L = length (m)
H = head on the weir

Additional Notes:

NVCA Weir Flow Calculation Applied For Weir Flow Below Orifice Centroid

$$Q_w = 1.65([(pi*(D^2)/4)(2*\cos^{-1}[(((D/2)-d)/(D/2))*(180/pi)]/360)-((D/2-d)(Dd-d^2)^{0.5})]/d)d^{1.5}$$

Where:
Q_w is weir flow (m^3/s)
D is orifice diameter (m)
d is depth of flow above the invert (m)

BARRIE DRAINAGE MASTER PLAN
LITTLE LAKE WATERSHED
PROJECT NO. 142
SWMF RETROFIT NO. 77 (LT 01) - Option 1

Stage-Storage-Discharge Table

Pond Geometry				Pond Volume (m^3)			Discharge
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Live	Total	(m^3/s)
262.00	0.00	375	375	0	0	0	0.00
262.25	0.25	533	454	114	0	114	0.00
262.50	0.50	691	612	267	0	267	0.00
262.75	0.75	849	770	459	0	459	0.00
263.00	1.00	1007	928	691	0	691	0.00
263.25	1.25	1165	1086	963	0	963	0.00
263.50	1.50	1323	1244	1274	0	1274	0.00
263.75	1.75	1945	1634	1274	409	1682	0.09
264.00	2.00	2567	2256	1274	973	2246	0.35
264.25	2.25	3434	3001	1274	1723	2996	0.35
264.50	2.50	4302	3868	1274	2690	3963	0.35
264.75	2.75	5169	4735	1274	3873	5147	0.35
265.00	3.00	6036	5602	1274	5274	6548	0.35
265.25	3.25	6298	6167	1274	6816	8089	0.35
265.50	3.50	6559	6429	1274	8423	9696	0.35
265.75	3.75	6821	6690	1274	10095	11369	0.35
266.00	4.00	7083	6952	1274	11833	13107	0.35
266.10	4.10	7187	7135	1274	12547	13820	0.35
266.20	4.20	7292	7240	1274	13271	14544	0.70
266.30	4.30	7397	7344	1274	14005	15279	0.70
266.40	4.40	7501	7449	1274	14750	16024	0.70
266.50	4.50	7606	7554	1274	15506	16779	0.70
266.60	4.60	7711	7658	1274	16271	17545	0.70
266.70	4.70	7815	7763	1274	17048	18321	1.07
266.80	4.80	7920	7868	1274	17834	19108	1.84
266.90	4.90	8025	7972	1274	18632	19905	2.95
267.00	5.00	8129	8077	1274	19439	20713	4.42
267.10	5.10	8234	8182	1274	20258	21531	6.24
267.20	5.20	8339	8286	1274	21086	22360	8.45
267.25	5.25	8391	8365	1274	21504	22778	9.69

BARRIE DRAINAGE MASTER PLAN
WHISKEY CREEK WATERSHED
PROJECT NO. 142
SWMF RETROFIT NO. 77 (LT 01) - Option 2

Stage-Storage Table

Pond Geometry				Pond Volume (m^3)			
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Accum. Dead	Live	Accum. Live
261.00	0.00	157	0	0	0	0	0
261.50	0.50	662	662	331	331	0	0
262.00	1.00	1167	1167	584	915	0	0
262.50	1.50	1673	915	457	1372	0	0
263.00	2.00	2178	1925	963	2335	0	0
263.50	2.50	2683	2430	1215	3550	0	0
264.00	3.00	3321	3002	0	3550	1501	1501
264.50	3.50	3958	3639	0	3550	1820	3321
265.00	4.00	4596	4277	0	3550	2139	5459
265.50	4.50	5233	4915	0	3550	2457	7916
266.00	5.00	5871	5552	0	3550	2776	10693
266.10	5.10	5999	5935	0	3550	593	11286
266.20	5.20	6126	6062	0	3550	606	11892
266.30	5.30	6254	6190	0	3550	619	12511
266.40	5.40	6381	6317	0	3550	632	13143
266.50	5.50	6509	6445	0	3550	644	13787
266.60	5.60	6636	6572	0	3550	657	14445
266.70	5.70	6764	6700	0	3550	670	15115
266.80	5.80	6891	6827	0	3550	683	15797
266.90	5.90	7019	6955	0	3550	695	16493
267.00	6.00	7146	7082	0	3550	708	17201
267.10	6.10	7274	7210	0	3550	721	17922
267.20	6.20	7401	7337	0	3550	734	18656
267.25	6.25	7465	7433	0	3550	372	19028

Permanent Pool Volume = **3550** m^3
Total Active Storage = **19028** m^3

Comments:

1 Red text represents calculated values

BARRIE DRAINAGE MASTER PLAN
WHISKEY CREEK WATERSHED
PROJECT NO. 142
SWMF RETROFIT NO. 77 (LT 01) - Option 2

Stage-Discharge Table

	Orifice #1	Pipe #1	DICB1:		Pipe #2		DICB2:		Overflow Weir:		
Diameter (mm):	170	450	Length (m):	1.465	Diameter (mm):	1050	Length (m):	2.93	Length of Weir	6.5	m
Area (m^2):	0.02	0.16	Width (m):	0.768	Area (m^2):	0.87	Width (m):	0.77	Weir Sill Elevation	266.85	m
C:	0.63	0.8	Grate:	4:1	C:	0.8	Grate:	4:1	Weir constant K	1.65	
Invert (m):	263.50	263.50	Invert (m):	264.20	Invert (m):	263.50	Invert (m):	265.10	Side Slope (H:V)	3	:1
			Cd:	0.63			Cd:	0.63			
			Opening:	0.75			Opening:	0.75			

	Orifice #1		Pipe #1		DICB #1		Pipe #2		DICB #2		Overflow Weir		Hydraulic Control	Total Discharge
Elevation (m)	Head (m)	Discharge (m^3/s)	Head (m)	Discharge (m^3/s)	Head (m)	Discharge (m^3/s)	Head (m)	Discharge (m^3/s)	Head (m)	Discharge (m^3/s)	Head (m)	Discharge (m^3/s)		(m^3/s)
263.50	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	Orifice	0.000
264.00	0.415	0.041	0.275	0.296	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	Orifice	0.041
264.50	0.915	0.061	0.775	0.496	0.300	0.926	0.475	2.115	0.000	0.000	0	0.000	Orifice	0.496
265.00	1.415	0.075	1.275	0.636	0.800	2.106	0.975	3.030	0.000	0.000	0	0.000	Orifice	0.636
265.50	1.915	0.088	1.775	0.751	1.300	2.685	1.475	3.727	0.400	3.149	0	0.000	Orifice	3.900
266.00	2.415	0.098	2.275	0.850	1.800	3.159	1.975	4.312	0.900	4.468	0	0.000	Orifice	5.162
266.10	2.515	0.100	2.375	0.869	1.900	3.246	2.075	4.420	1.000	4.710	0	0.000	Orifice	5.288
266.20	2.615	0.102	2.475	0.887	2.000	3.330	2.175	4.525	1.100	4.939	0	0.000	Orifice	5.412
266.30	2.715	0.104	2.575	0.904	2.100	3.412	2.275	4.628	1.200	5.159	0	0.000	Orifice	5.532
266.40	2.815	0.106	2.675	0.922	2.200	3.493	2.375	4.729	1.300	5.370	0	0.000	Orifice	5.650
266.50	2.915	0.108	2.775	0.939	2.300	3.571	2.475	4.827	1.400	5.572	0	0.000	Orifice	5.766
266.60	3.015	0.110	2.875	0.956	2.400	3.648	2.575	4.924	1.500	5.768	0	0.000	Orifice	5.879
266.70	3.115	0.112	2.975	0.972	2.500	3.723	2.675	5.018	1.600	5.957	0	0.000	Orifice	5.991
266.80	3.215	0.114	3.075	0.988	2.600	3.797	2.775	5.111	1.700	6.141	0	0.000	Orifice	6.100
266.90	3.315	0.115	3.175	1.004	2.700	3.869	2.875	5.203	1.800	6.319	0.05	0.125	Orifice / Weir	6.332
267.00	3.415	0.117	3.275	1.020	2.800	3.940	2.975	5.292	1.900	6.492	0.15	0.709	Orifice / Weir	7.022
267.10	3.515	0.119	3.375	1.035	2.900	4.010	3.075	5.381	2.000	6.660	0.25	1.650	Orifice / Weir	8.066
267.20	3.615	0.120	3.475	1.051	3.000	4.079	3.175	5.467	2.100	6.825	0.35	2.938	Orifice / Weir	9.456
267.25	3.665	0.121	3.525	1.058	3.050	4.112	3.225	5.510	2.150	6.906	0.4	3.715	Orifice / Weir	10.283

Comments:

1. Red text represents calculated values
2. DICB calculations in accordance with MTO Design Chart 4.20
3. Orifice equation used to calculate DICB discharge

Calculation Notes

Orifice Equation is: Q = C x A x (2gH)^0.5

Where:
- Q = flow rate (cms)
- C = constant
- A = area of opening(sq. m)
- H = net head on the orifice
- g = Acceleration due to gravity

Weir Formula is: Q = K x L x H^1.5

Where:
- Q = flow rate (cms)
- K = constant
- L = length (m)
- H = head on the weir

BARRIE DRAINAGE MASTER PLAN
WHISKEY CREEK WATERSHED
PROJECT NO. 142
SWMF RETROFIT NO. 77 (LT 01) - Option 2

Stage-Storage-Discharge Table

Pond Geometry				Pond Volume (m^3)			Discharge
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Live	Total	(m^3/s)
261.00	0.00	157	0	0	0	0	0.00
261.50	0.50	662	662	331	0	331	0.00
262.00	1.00	1167	1167	915	0	915	0.00
262.50	1.50	1673	915	1372	0	1372	0.00
263.00	2.00	2178	1925	2335	0	2335	0.00
263.50	2.50	2683	2430	3550	0	3550	0.00
264.00	3.00	3321	3002	3550	1501	5051	0.04
264.50	3.50	3958	3639	3550	3321	6871	0.50
265.00	4.00	4596	4277	3550	5459	9009	0.64
265.50	4.50	5233	4915	3550	7916	11466	3.90
266.00	5.00	5871	5552	3550	10693	14243	5.16
266.10	5.10	5999	5935	3550	11286	14836	5.29
266.20	5.20	6126	6062	3550	11892	15442	5.41
266.30	5.30	6254	6190	3550	12511	16061	5.53
266.40	5.40	6381	6317	3550	13143	16693	5.65
266.50	5.50	6509	6445	3550	13787	17337	5.77
266.60	5.60	6636	6572	3550	14445	17995	5.88
266.70	5.70	6764	6700	3550	15115	18665	5.99
266.80	5.80	6891	6827	3550	15797	19347	6.10
266.90	5.90	7019	6955	3550	16493	20043	6.33
267.00	6.00	7146	7082	3550	17201	20751	7.02
267.10	6.10	7274	7210	3550	17922	21472	8.07
267.20	6.20	7401	7337	3550	18656	22206	9.46
267.25	6.25	7465	7433	3550	19028	22578	10.28

BARRIE DRAINAGE MASTER PLAN
WHISKEY CREEK WATERSHED
PROJECT NO. 142
SWMF RETROFIT NO. 77 (LT 01) - Option 3

Stage-Storage Table

Pond Geometry				Pond Volume (m^3)			
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Accum. Dead	Live	Accum. Live
262.00	0.00	93	0	0	0	0	0
262.50	0.50	355	224	112	112	0	0
263.00	1.00	616	486	243	355	0	0
263.50	1.50	878	747	374	728	0	0
264.00	2.00	1344	1111	0	728	555	555
264.50	2.50	1809	1577	0	728	788	1344
265.00	3.00	2275	2042	0	728	1021	2365
265.50	3.50	2717	2496	0	728	1248	3613
266.00	4.00	3138	2928	0	728	1464	5077
266.10	4.10	3245	3192	0	728	319	5396
266.20	4.20	3352	3299	0	728	330	5726
266.30	4.30	3460	3406	0	728	341	6066
266.40	4.40	3567	3513	0	728	351	6417
266.50	4.50	3674	3620	0	728	362	6780
266.60	4.60	3804	3739	0	728	374	7153
266.70	4.70	3933	3868	0	728	387	7540
266.80	4.80	4063	3998	0	728	400	7940
266.90	4.90	4192	4128	0	728	413	8353
267.00	5.00	4322	4257	0	728	426	8779
267.10	5.10	4456	4389	0	728	439	9217
267.20	5.20	4590	4523	0	728	452	9670
267.25	5.25	4657	4624	0	728	231	9901

Permanent Pool Volume = **728** m^3
Total Active Storage = **9901** m^3

Comments:

1 Red text represents calculated values

BARRIE DRAINAGE MASTER PLAN
WHISKEY CREEK WATERSHED
PROJECT NO. 142
SWMF RETROFIT NO. 77 (LT 01) - Option 3

Stage-Discharge Table

	Orifice #1	Pipe #1	Pipe #2	
Diameter:	0	1200	1200	mm
Area:	0.00	1.13	1.13	m^2
C:	0.63	0.8	0.8	
Invert:	264.00	263.50	263.50	m
Riser Inv.:		263.50	265.50	m

Overflow Weir:

Length of Weir	6.5	m
Weir Sill Elevation	266.60	m
Weir constant K	1.65	
Side Slope (H:V)	3	:1

Note: Pipe capacity limited to 0.72 cms due to flat slope (0.24%)

	Orifice #1		Pipe #1		Pipe #2		Overflow Weir			
Elevation (m)	Head (m)	Discharge (m^3/s)	Head (m)	Discharge (m^3/s)	Head (m)	Discharge (m^3/s)	Head (m)	Discharge (m^3/s)	Hydraulic Control	Total Discharge (m^3/s)
262.00	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	Orifice	0.000
262.50	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	Orifice	0.000
263.00	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	Orifice	0.000
263.50	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	Orifice	0.000
264.00	0.000	0.000	0.000	1.030	0.000	0.000	0	0.000	Orifice	1.030
264.50	0.500	0.000	0.400	1.030	0.000	0.000	0	0.000	Orifice	1.030
265.00	1.000	0.000	0.900	1.030	0.000	0.000	0	0.000	Orifice	1.030
265.50	1.500	0.000	1.400	1.030	0.000	0.000	0	0.000	Orifice	1.030
266.00	2.000	0.000	1.900	1.030	0.000	0.000	0	0.000	Orifice	1.030
266.10	2.100	0.000	2.000	1.030	0.000	1.030	0	0.000	Orifice	2.060
266.20	2.200	0.000	2.100	1.030	0.100	1.030	0	0.000	Orifice	2.060
266.30	2.300	0.000	2.200	1.030	0.200	1.030	0	0.000	Orifice	2.060
266.40	2.400	0.000	2.300	1.030	0.300	1.030	0	0.000	Orifice	2.060
266.50	2.500	0.000	2.400	1.030	0.400	1.030	0	0.000	Orifice	2.060
266.60	2.600	0.000	2.500	1.030	0.500	1.030	0	0.000	Orifice	2.060
266.70	2.700	0.000	2.600	1.030	0.600	1.030	0.1	0.370	Orifice / Weir	2.430
266.80	2.800	0.000	2.700	1.030	0.700	1.030	0.2	1.136	Orifice / Weir	3.196
266.90	2.900	0.000	2.800	1.030	0.800	1.030	0.3	2.250	Orifice / Weir	4.310
267.00	3.000	0.000	2.900	1.030	0.900	1.030	0.4	3.715	Orifice / Weir	5.775
267.10	3.100	0.000	3.000	1.030	1.000	1.030	0.5	5.542	Orifice / Weir	7.602
267.20	3.200	0.000	3.100	1.030	1.100	1.030	0.6	7.745	Orifice / Weir	9.805
267.25	3.250	0.000	3.150	1.030	1.150	1.030	0.65	8.993	Orifice / Weir	11.053

Comments:

1 Red text represents calculated values
2 Total discharge = 1.03 cms (when only one pipe is activated), 2.06 cms (when riser is activated) and weir equation is used when overflow spillway is activated

Calculation Notes

Orifice Equation is: Q = C x A x (2gH)^0.5

Where:
Q = flow rate (cms)
C = constant
A = area of opening(sq. m)
H = net head on the orifice
g = Acceleration due to gravity

Weir Formula is: Q = K x L x H^1.5

Where:
Q = flow rate (cms)
K = constant
L = length (m)
H = head on the weir

BARRIE DRAINAGE MASTER PLAN
WHISKEY CREEK WATERSHED
PROJECT NO. 142
SWMF RETROFIT NO. 77 (LT 01) - Option 3

Stage-Storage-Discharge Table

Pond Geometry				Pond Volume (m^3)			Discharge
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Live	Total	(m^3/s)
262.00	0.00	93	0	0	0	0	0.000
262.50	0.50	355	224	112	0	112	0.000
263.00	1.00	616	486	355	0	355	0.000
263.50	1.50	878	747	728	0	728	0.000
264.00	2.00	1344	1111	728	555	1284	1.030
264.50	2.50	1809	1577	728	1344	2072	1.030
265.00	3.00	2275	2042	728	2365	3093	1.030
265.50	3.50	2717	2496	728	3613	4341	1.030
266.00	4.00	3138	2928	728	5077	5805	1.030
266.10	4.10	3245	3192	728	5396	6124	2.060
266.20	4.20	3352	3299	728	5726	6454	2.060
266.30	4.30	3460	3406	728	6066	6794	2.060
266.40	4.40	3567	3513	728	6417	7146	2.060
266.50	4.50	3674	3620	728	6780	7508	2.060
266.60	4.60	3804	3739	728	7153	7882	2.060
266.70	4.70	3933	3868	728	7540	8268	2.430
266.80	4.80	4063	3998	728	7940	8668	3.196
266.90	4.90	4192	4128	728	8353	9081	4.310
267.00	5.00	4322	4257	728	8779	9507	5.775
267.10	5.10	4456	4389	728	9217	9946	7.602
267.20	5.20	4590	4523	728	9670	10398	9.805
267.25	5.25	4657	4624	728	9901	10629	11.053

BARRIE DRAINAGE MASTER PLAN
LITTLE LAKE WATERSHED
PROJECT NO. 144
SWMF RETROFIT NO. 89 (LT 05)

Stage-Storage Table

Pond Characteristics:

Top Elevation: 242.50 m
Permanent Pool Elev.: 241.00 m
Bottom Elev: 239.00 m

Pond Geometry				Pond Volume (m^3)			
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Accum. Dead	Live	Accum. Live
239.00	0.00	640	640	0	0	0	0
239.25	0.25	816	728	182	182	0	0
239.50	0.50	992	904	226	408	0	0
239.75	0.75	1168	1080	270	678	0	0
240.00	1.00	1344	1256	314	992	0	0
240.25	1.25	1520	1432	358	1350	0	0
240.50	1.50	1696	1608	402	1752	0	0
240.75	1.75	1872	1784	446	2198	0	0
241.00	2.00	2048	1960	490	2688	0	0
241.05	2.05	2093	2071	0	2688	104	104
241.10	2.10	2139	2116	0	2688	106	209
241.15	2.15	2184	2161	0	2688	108	317
241.20	2.20	2230	2207	0	2688	110	428
241.25	2.25	2275	2252	0	2688	113	540
241.30	2.30	2320	2298	0	2688	115	655
241.35	2.35	2366	2343	0	2688	117	772
241.40	2.40	2411	2388	0	2688	119	892
241.45	2.45	2456	2434	0	2688	122	1013
241.50	2.50	2502	2479	0	2688	124	1137
241.55	2.55	2547	2524	0	2688	126	1264
241.60	2.60	2593	2570	0	2688	128	1392
241.65	2.65	2638	2615	0	2688	131	1523
241.70	2.70	2683	2661	0	2688	133	1656
241.75	2.75	2729	2706	0	2688	135	1791
241.80	2.80	2774	2751	0	2688	138	1929
242.00	3.00	2955	2865	0	2688	573	2502
242.20	3.20	3137	3046	0	2688	609	3111
242.40	3.40	3318	3228	0	2688	646	3757
242.50	3.50	3409	3364	0	2688	336	4093

Permanent Pool Volume = **2688** m^3
Extended Detention Volume = **1392** m^3
Total Active Storage = **4093** m^3

Comments:

1 Red text represents interpolated values

BARRIE DRAINAGE MASTER PLAN
LITTLE LAKE WATERSHED
PROJECT NO. 144
SWMF RETROFIT NO. 89 (LT 05)

Stage-Discharge Table

Orifice / Pipe:				**DICB:**		**Overflow Weir:**	
Diameter (mm):	135	600	<- X3	Length (m):	3.6	Length of Weir (m):	4.5
Area (m^2):	0.01	0.28		Grate:	5:1	Weir Sill Elevation (m):	242.10
C:	0.63	0.8				Weir constant K:	1.6
Invert (m):	240.55	240.55		Invert (m):	241.60	Side Slope (H:1V):	3

	Orifice #1		Outlet Pipe		DICB		Overflow Weir			
Elevation (m)	Head (m)	Discharge (m^3/s)	Head (m)	Discharge (m^3/s)	Head (m)	Discharge (m^3/s)	Head (m)	Discharge (m^3/s)	Hydraulic Control	Total Discharge (m^3/s)
241.00	0.382	0.025	0.150	1.164	0.000	0.000	0	0.000	Orifice	0.025
241.05	0.433	0.026	0.200	1.344	0.000	0.000	0	0.000	Orifice	0.026
241.10	0.483	0.028	0.250	1.503	0.000	0.000	0	0.000	Orifice	0.028
241.15	0.533	0.029	0.300	1.646	0.000	0.000	0	0.000	Orifice	0.029
241.20	0.583	0.030	0.350	1.778	0.000	0.000	0	0.000	Orifice	0.030
241.25	0.633	0.032	0.400	1.901	0.000	0.000	0	0.000	Orifice	0.032
241.30	0.683	0.033	0.450	2.016	0.000	0.000	0	0.000	Orifice	0.033
241.35	0.733	0.034	0.500	2.125	0.000	0.000	0	0.000	Orifice	0.034
241.40	0.783	0.035	0.550	2.229	0.000	0.000	0	0.000	Orifice	0.035
241.45	0.833	0.036	0.600	2.328	0.000	0.000	0	0.000	Orifice	0.036
241.50	0.883	0.038	0.650	2.423	0.000	0.000	0	0.000	Orifice	0.038
241.55	0.933	0.039	0.700	2.515	0.000	0.000	0	0.000	Orifice	0.039
241.60	0.983	0.040	0.750	2.603	0.000	0.000	0	0.000	Orifice	0.040
241.65	1.033	0.041	0.800	2.688	0.050	0.157	0	0.000	Orifice	0.198
241.70	1.083	0.042	0.850	2.771	0.100	0.408	0	0.000	Orifice	0.450
241.75	1.133	0.043	0.900	2.852	0.150	0.784	0	0.000	Orifice	0.827
241.80	1.183	0.043	0.950	2.930	0.200	1.284	0	0.000	Orifice	1.328
242.00	1.382	0.047	1.150	3.223	0.400	4.529	0	0.000	Orifice	3.223
242.20	1.582	0.050	1.350	3.492	0.600	9.764	0.1	0.258	Orifice / Weir	3.750
242.40	1.782	0.053	1.550	3.742	0.800	16.989	0.3	1.656	Orifice / Weir	5.398
242.50	1.882	0.055	1.650	3.861	0.900	21.348	0.4	2.793	Orifice / Weir	6.654

Comments:

1 Red text represents calculated values

Calculation Notes

Orifice Equation is: Q = C x A x (2gH)^0.5

Where:
Q = flow rate (cms)
C = constant
A = area of opening(sq. m)
H = net head on the orifice
g = Acceleration due to gravity

Weir Formula is: Q = K x L x H^1.5

Where:
Q = flow rate (cms)
K = constant
L = length (m)
H = head on the weir

DICB calculations in accordance with MTO Design Chart 4.20

BARRIE DRAINAGE MASTER PLAN
LITTLE LAKE WATERSHED
PROJECT NO. 144
SWMF RETROFIT NO. 89 (LT 05)

Stage-Storage-Discharge Table

Pond Geometry				Pond Volume (m^3)			Discharge (m^3/s)
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Live	Total	
241.00	2.00	2048	1960	2688	0	2688	0.02
241.05	2.05	2093	2071	2688	104	2792	0.03
241.10	2.10	2139	2116	2688	209	2897	0.03
241.15	2.15	2184	2161	2688	317	3005	0.03
241.20	2.20	2230	2207	2688	428	3116	0.03
241.25	2.25	2275	2252	2688	540	3228	0.03
241.30	2.30	2320	2298	2688	655	3343	0.03
241.35	2.35	2366	2343	2688	772	3460	0.03
241.40	2.40	2411	2388	2688	892	3580	0.04
241.45	2.45	2456	2434	2688	1013	3701	0.04
241.50	2.50	2502	2479	2688	1137	3825	0.04
241.55	2.55	2547	2524	2688	1264	3952	0.04
241.60	2.60	2593	2570	2688	1392	4080	0.04
241.65	2.65	2638	2615	2688	1523	4211	0.20
241.70	2.70	2683	2661	2688	1656	4344	0.45
241.75	2.75	2729	2706	2688	1791	4479	0.83
241.80	2.80	2774	2751	2688	1929	4617	1.33
242.00	3.00	2955	2865	2688	2502	5190	3.22
242.20	3.20	3137	3046	2688	3111	5799	3.75
242.40	3.40	3318	3228	2688	3757	6445	5.40
242.50	3.50	3409	3364	2688	4093	6781	6.65

BARRIR DRAINAGE MASTER PLAN
LITTLE LAKE WATERSHED
PROJECT NO. 145
SMWF RETROFIT NO. 84 (LTGM)

Stage-Storage Table

Pond Characteristics:

Top Elevation: 276.70 m
Bottom Elev: 270.00 m

Pond Geometry				Pond Volume (m^3)			
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Accum. Dead	Live	Accum. Live
273.00	0.00	3833	798	0	0	0	0
273.10	0.10	4246	4040	404	404	0	0
273.20	0.20	4660	4453	445	849	0	0
273.30	0.30	5073	4866	487	1336	0	0
273.40	0.40	5487	5280	528	1864	0	0
273.50	0.50	5900	5693	569	2433	0	0
273.60	0.60	5073	5486	549	2982	0	0
273.70	0.70	5280	5176	518	3499	0	0
273.80	0.80	5486	5383	538	4038	0	0
273.90	0.90	5693	5590	559	4597	0	0
274.00	1.00	5900	5796	580	5176	0	0
274.10	1.10	6106	6003	600	5777	0	0
274.20	1.20	6313	6210	621	6398	0	0
274.30	1.30	6520	6416	642	7039	0	0
274.40	1.40	6726	6623	662	7702	0	0
274.50	1.50	6933	6830	683	8385	0	0
274.60	1.60	7140	7036	704	9088	0	0
274.70	1.70	7346	7243	724	9813	0	0
274.80	1.80	7553	7450	745	10558	0	0
274.90	1.90	7760	7657	766	11323	0	0
275.00	2.00	7690	7725	772	12096	0	0
275.10	2.10	8173	7932	0	12096	793	793
275.20	2.20	8380	8277	0	12096	828	1621
275.30	2.30	8587	8483	0	12096	848	2469
275.40	2.40	8793	8690	0	12096	869	3338
275.50	2.50	9000	8897	0	12096	890	4228
275.60	2.60	9208	9104	0	12096	910	5138
275.70	2.70	9417	9313	0	12096	931	6069
275.80	2.80	9625	9521	0	12096	952	7022
275.90	2.90	9833	9729	0	12096	973	7994
276.00	3.00	10042	9938	0	12096	994	8988
276.10	3.10	10250	10146	0	12096	1015	10003
276.20	3.20	10458	10354	0	12096	1035	11038
276.30	3.30	10667	10563	0	12096	1056	12094
276.40	3.40	10875	10771	0	12096	1077	13172
276.50	3.50	11083	10979	0	12096	1098	14269
276.60	3.60	11292	11188	0	12096	1119	15388
276.70	3.70	11500	11396	0	12096	1140	16528

Permanent Pool Volume = 12096 m^3
Extended Detention Volume = 7022 m^3
Total Active Storage = 16528 m^3

Comments:

1 Red text represents interpolated values

BARRIR DRAINAGE MASTER PLAN
LITTLE LAKE WATERSHED
PROJECT NO. 145
SMWF RETROFIT NO. 84 (LTGM)

Stage-Discharge Table

Orifice / Pipe			Overflow Weir		
Diameter:	270	mm	Length of Weir	15	m
Area:	0.06	m^2	Weir Sill Elevation	275.80	m
C:	0.63		Weir constant K	1.6	
Invert:	275.00	m	Side Slope (H:V)	5	:1

	Orifice		Overflow Weir			
Elevation (m)	Head (m)	Discharge (m^3/s)	Head (m)	Discharge (m^3/s)	Hydraulic Control	Total Discharge (m^3/s)
273.00	0.000	0.000	0.000	0.000	Orifice	0.000
273.10	0.000	0.000	0.000	0.000	Orifice	0.000
273.20	0.000	0.000	0.000	0.000	Orifice	0.000
275.30	0.165	0.065	0.000	0.000	Orifice	0.065
275.40	0.265	0.082	0.000	0.000	Orifice	0.082
275.50	0.365	0.097	0.000	0.000	Orifice	0.097
275.60	0.465	0.109	0.000	0.000	Orifice	0.109
275.70	0.565	0.120	0.000	0.000	Orifice	0.120
275.80	0.665	0.130	0.000	0.000	Orifice	0.130
275.90	0.765	0.140	0.100	0.736	Weir	0.875
276.00	0.865	0.149	0.200	2.213	Weir	2.362
276.10	0.965	0.157	0.300	4.232	Weir	4.389
276.20	1.065	0.165	0.400	6.742	Weir	6.907
276.30	1.165	0.172	0.500	9.723	Weir	9.896
276.40	1.265	0.180	0.600	13.167	Weir	13.347
276.50	1.365	0.187	0.700	17.073	Weir	17.260
276.60	1.465	0.193	0.800	21.444	Weir	21.637
276.70	1.565	0.200	0.900	26.284	Weir	26.484

Comments:

1 Red text represents calculated values

Calculation Notes

Orifice Equation is: Q = C x A x (2gH)^0.5

Where:
Q = flow rate (cms)
C = constant
A = area of opening(sq. m)
H = net head on the orifice
g = Acceleration due to gravity

Overflow weir calculations completed in accordance with NVCA rectangular broad crested weir equation (NVCA Stormwater Technical Guide, December 2013)

BARRIR DRAINAGE MASTER PLAN
LITTLE LAKE WATERSHED
PROJECT NO. 145
SMWF RETROFIT NO. 84 (LTGM)

Stage-Storage-Discharge Table

Pond Geometry				Pond Volume (m^3)			Discharge
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Live	Total	(m^3/s)
273.00	0.00	3833	798	0	0	0	0.00
273.10	0.10	4246	4040	404	0	404	0.00
273.20	0.20	4660	4453	849	0	849	0.00
273.30	0.30	5073	4866	1336	0	1336	0.00
273.40	0.40	5487	5280	1864	0	1864	0.00
273.50	0.50	5900	5693	2433	0	2433	0.00
273.60	0.60	5073	5486	2982	0	2982	0.00
273.70	0.70	5280	5176	3499	0	3499	0.00
273.80	0.80	5486	5383	4038	0	4038	0.00
273.90	0.90	5693	5590	4597	0	4597	0.00
274.00	1.00	5900	5796	5176	0	5176	0.00
274.10	1.10	6106	6003	5777	0	5777	0.00
274.20	1.20	6313	6210	6398	0	6398	0.00
274.30	1.30	6520	6416	7039	0	7039	0.00
274.40	1.40	6726	6623	7702	0	7702	0.00
274.50	1.50	6933	6830	8385	0	8385	0.00
274.60	1.60	7140	7036	9088	0	9088	0.00
274.70	1.70	7346	7243	9813	0	9813	0.00
274.80	1.80	7553	7450	10558	0	10558	0.00
274.90	1.90	7760	7657	11323	0	11323	0.00
275.00	2.00	7690	7725	12096	0	12096	0.00
275.10	2.10	8173	7932	12096	793	12889	0.01
275.20	2.20	8380	8277	12096	1621	13716	0.04
275.30	2.30	8587	8483	12096	2469	14565	0.06
275.40	2.40	8793	8690	12096	3338	15434	0.08
275.50	2.50	9000	8897	12096	4228	16323	0.10
275.60	2.60	9208	9104	12096	5138	17234	0.11
275.70	2.70	9417	9313	12096	6069	18165	0.12
275.80	2.80	9625	9521	12096	7022	19117	0.13
275.90	2.90	9833	9729	12096	7994	20090	0.88
276.00	3.00	10042	9938	12096	8988	21084	2.36
276.10	3.10	10250	10146	12096	10003	22098	4.39
276.20	3.20	10458	10354	12096	11038	23134	6.91
276.30	3.30	10667	10563	12096	12094	24190	9.90
276.40	3.40	10875	10771	12096	13172	25267	13.35
276.50	3.50	11083	10979	12096	14269	26365	17.26
276.60	3.60	11292	11188	12096	15388	27484	21.64
276.70	3.70	11500	11396	12096	16528	28623	26.48

BARRIE DRAINAGE MASTER PLAN
BEAR CREEK WATERSHED
PROJECT NO. 178A
SWMF RETROFIT NO. 91 (LT 04) - Option 1

Stage-Storage Table

Pond Characteristics:

Permanent Pool Elev.: 264.50 m
Bottom Elev.: 263.00 m

Pond Geometry				Pond Volume (m^3)			
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Accum. Dead	Live	Accum. Live
263.00	0.00	**5100**	5100	0	0	0	0
263.25	0.25	5417	5258	1315	1315	0	0
263.50	0.50	5733	5575	1394	2708	0	0
263.75	0.75	6050	5892	1473	4181	0	0
264.00	1.00	6367	6208	1552	5733	0	0
264.25	1.25	6683	6525	1631	7365	0	0
264.50	1.50	**7000**	6842	1710	9075	0	0

Permanent Pool Volume = **9075** m^3

Comments:

1 Red text represents interpolated values

BARRIE DRAINAGE MASTER PLAN
BEAR CREEK WATERSHED
PROJECT NO. 178B
SWMF RTROFIT NO. 91 (LT 04) - Option 2

Stage-Storage Table

Pond Characteristics:

Permanent Pool Elev.: 264.50 m
Bottom Elev.: 262.00 m

Pond Geometry				Pond Volume (m^3)			
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Accum. Dead	Live	Accum. Live
262.00	0.00	**5006**	5006	0	0	0	0
262.25	0.25	5522	5264	1316	1316	0	0
262.50	0.50	6039	5781	1445	2761	0	0
262.75	0.75	6555	6297	1574	4335	0	0
263.00	1.00	7072	6813	1703	6039	0	0
263.25	1.25	7588	7330	1832	7871	0	0
263.50	1.50	8104	7846	1962	9833	0	0
263.75	1.75	8621	8363	2091	11923	0	0
264.00	2.00	9137	8879	2220	14143	0	0
264.25	2.25	9654	9395	2349	16492	0	0
264.50	2.50	**10170**	9912	2478	18970	0	0
264.75	2.75	10662	10416	0	18970	2604	2604
265.00	3.00	11154	10908	0	18970	2727	5331
265.25	3.25	11646	11400	0	18970	2850	8181
265.50	3.50	12137	11892	0	18970	2973	11154
265.75	3.75	12629	12383	0	18970	3096	14250
266.00	4.00	13121	12875	0	18970	3219	17468
266.25	4.25	13613	13367	0	18970	3342	20810
266.50	4.50	14105	13859	0	18970	3465	24275
266.75	4.75	14597	14351	0	18970	3588	27863
267.00	5.00	**15089**	14843	0	18970	3711	31573
267.25	5.25	15728	15408	0	18970	3852	35425
267.50	5.50	16368	16048	0	18970	4012	39437
267.75	5.75	17007	16688	0	18970	4172	43609
268.00	6.00	17647	17327	0	18970	4332	47941
268.25	6.25	18286	17967	0	18970	4492	52433
268.50	6.50	18926	18606	0	18970	4652	57084
268.75	6.75	19565	19246	0	18970	4811	61896
269.00	7.00	20205	19885	0	18970	4971	66867
269.25	7.25	**20845**	20525	0	18970	5131	71998

Permanent Pool Volume = **18970** m^3

Comments:

1 Red text represents interpolated values

BARRIE DRAINAGE MASTER PLAN
BEAR CREEK WATERSHED
PROJECT NO. 150
SWMF RETROFIT NO. 61 (BR 08B)

Stage-Storage Table

Designed: NHF
Checked:
Date: 16-Dec-15

Wet Pond Characteristics:

Top Elevation: **290.50** m
Bottom Elev: **285.25** m
Stage 0.25 m

Stormwater Management Pond							
Pond Geometry				Pond Volume (m^3)			
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Accum. Dead	Live	Accum. Live
285.25	0.00	**29**	29	0.00	0.00	0.00	0.00
285.50	0.25	**234**	132	0.00	0.00	32.91	32.91
285.75	0.50	**542**	388	0.00	0.00	97.04	129.95
286.00	0.75	**931**	737	0.00	0.00	184.17	314.12
286.25	1.00	**1345**	1138	0.00	0.00	284.51	598.63
286.50	1.25	**2006**	1676	0.00	0.00	418.88	1017.51
286.75	1.50	**2565**	2286	0.00	0.00	571.49	1589.00
287.00	1.75	**3105**	2835	0.00	0.00	708.81	2297.81
287.25	2.00	**3558**	3332	0.00	0.00	832.94	3130.75
287.50	2.25	**3968**	3763	0.00	0.00	940.85	4071.60
287.75	2.50	**4509**	4239	0.00	0.00	1059.72	5131.32
288.00	2.75	**4782**	4646	0.00	0.00	1161.42	6292.74
288.25	3.00	**7175**	5978	0.00	0.00	1494.61	7787.36
288.50	3.25	**7690**	7432	0.00	0.00	1858.09	9645.45
288.75	3.50	**8185**	7938	0.00	0.00	1984.39	11629.83
289.00	3.75	**8679**	8432	0.00	0.00	2108.02	13737.85
289.25	4.00	**9183**	8931	0.00	0.00	2232.76	15970.62
289.50	4.25	**9737**	9460	0.00	0.00	2364.98	18335.60
289.75	4.50	**10363**	10050	0.00	0.00	2512.41	20848.02
290.00	4.75	**11020**	10691	0.00	0.00	2672.84	23520.86
290.25	5.00	**11658**	11339	0.00	0.00	2834.70	26355.55
290.50	5.25	**12308**	11983	0.00	0.00	2995.65	29351.21

Comments:

1 **Bold** text represents values that have been obtained from GIS or survey.
2 Red text represents calculated values
3 Highlighted columns represent PCSWMM input values

BARRIE DRAINAGE MASTER PLAN
BEAR CREEK WATERSHED
PROJECT NO. 150
SWMF RETROFIT NO. 61 (BR 08B)

Stage-Storage Table

Pond Characteristics:

Permanent Pool Elev.: 290.80 m
Bottom Elev.: 283.00 m

Pond Geometry				Pond Volume (m^3)			
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Accum. Dead	Live	Accum. Live
283.25	0.00	355	355	0	0	0	0
283.50	0.25	513	434	109	109	0	0
283.75	0.50	671	592	148	257	0	0
284.00	0.75	829	750	188	444	0	0
284.25	1.00	988	908	227	671	0	0
284.50	1.25	1146	1067	267	938	0	0
284.75	1.50	1304	1225	306	1244	0	0
285.00	1.75	1462	1383	346	1590	0	0
285.25	2.00	1620	1541	385	1975	0	0

Permanent Pool Volume = **1975** m^3

Comments:

1 Red text represents interpolated values

BARRIE DRAINAGE MASTER PLAN
BEAR CREEK WATERSHED
PROJECT NO. 151
SWMF RETROFIT NO. 69 (BR 13)

Stage-Storage Table

Pond Characteristics:

Top Elev.: 266.50 m
Permanent Pool Elev.: 264.00 m
Bottom Elev.: 262.00 m

Pond Geometry				Pond Volume (m^3)			
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Accum. Dead	Live	Accum. Live
262.00	0	2626	2626	0	0	0	0
262.25	0.25	2964	2795	699	699	0	0
262.50	0.50	3315	3140	785	1484	0	0
262.75	0.75	3717	3516	879	2363	0	0
263.00	1.00	4119	3918	979	3342	0	0
263.25	1.25	4521	4320	1080	4422	0	0
263.50	1.50	4923	4722	1180	5602	0	0
263.75	1.75	5324	5123	1281	6883	0	0
264.00	2.00	5726	5525	1381	8265	0	0
264.25	2.25	6128	5927	0	8265	1482	1482
264.50	2.50	6530	6329	0	8265	1582	3064
264.75	2.75	7019	6774	0	8265	1694	4758
265.00	3.00	7650	7334	0	8265	1834	6591
265.25	3.25	8115	7882	0	8265	1971	8562
265.50	3.50	8580	8347	0	8265	2087	10649
265.75	3.75	9045	8812	0	8265	2203	12852
266.00	4.00	9510	9277	0	8265	2319	15171
266.25	4.25	9975	9742	0	8265	2436	17607
266.50	4.50	10440	10207	0	8265	2552	20158

Permanent Pool Volume = **8265** m^3
Extended Detention Volume = **8562** m^3
Total Active Storage = **20158** m^3

Comments:

1 Red text represents interpolated values

BARRIE DRAINAGE MASTER PLAN
BEAR CREEK WATERSHED
PROJECT NO. 151
SWMF RETROFIT NO. 69 (BR 13)

Stage-Discharge Table

Orifice / Pipe:		
Diameter (mm):	**220**	**750**
Area (m^2):	0.04	0.44
C:	0.63	0.80
Invert (m):	**264.00**	**262.00**

DICB:	
Length (m):	**1.465**
Width (m):	**0.768**
Grate:	5:1
Invert (m):	**265.40**
Cd:	0.63
Opening:	0.75

Overflow Weir:	
Length of Weir (m):	**15**
Weir Sill Elevation (m):	**266.10**
Weir constant K:	1.7
Side Slope (H:V):	**5**

	Orifice		Pipe		DICB		Overflow Weir			
Elevation (m)	Head (m)	Discharge (m^3/s)	Head (m)	Discharge (m^3/s)	Head (m)	Discharge (m^3/s)	Head (m)	Discharge (m^3/s)	Hydraulic Control	Total Discharge (m^3/s)
264.00	0.000	0.000	1.625	1.996	0.000	0.000	0.000	0.000	Orifice	0.000
264.25	0.140	0.040	1.875	2.144	0.000	0.000	0.000	0.000	Orifice	0.040
264.50	0.390	0.066	2.125	2.282	0.000	0.000	0.000	0.000	Orifice	0.066
264.75	0.640	0.085	2.375	2.413	0.000	0.000	0.000	0.000	Orifice	0.085
265.00	0.890	0.100	2.625	2.536	0.000	0.000	0.000	0.000	Orifice	0.100
265.25	1.140	0.113	2.875	2.654	0.000	0.000	0.000	0.000	Orifice	0.113
265.50	1.390	0.125	3.125	2.767	0.099	0.166	0.000	0.000	Orifice	0.291
265.75	1.640	0.136	3.375	2.876	0.349	1.437	0.000	0.000	Orifice	1.573
266.00	1.890	0.146	3.625	2.981	0.599	1.823	0.000	0.000	Orifice	1.969
266.25	2.140	0.155	3.875	3.082	0.849	2.170	0.150	1.367	Orifice	3.692
266.50	2.390	0.164	4.125	3.180	1.099	2.469	0.400	6.635	Orifice	9.268

Comments:

1. Red text represents calculated values
2. DICB calculations in accordance with MTO Design Chart 4.20
3. Orifice equation used to calculate DICB discharge

Calculation Notes

Orifice Equation is: Q = C x A x (2gH)^0.5

Where:
Q = flow rate (cms)
C = constant
A = area of opening(sq. m)
H = net head on the orifice
g = Acceleration due to gravity

Overflow weir calculations completed in accordance with NVCA rectangular broad crested weir equation (NVCA Stormwater Technical Guide, December 2013)

BARRIE DRAINAGE MASTER PLAN
BEAR CREEK WATERSHED
PROJECT NO. 151
SWMF RETROFIT NO. 69 (BR 13)

Stage-Storage-Discharge Table

Pond Geometry				Pond Volume (m^3)			Discharge (m^3/s)
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Live	Total	
262.00	0.00	2626	2626	0	0	0	0.00
262.25	0.25	2964	2795	699	0	699	0.00
262.50	0.50	3315	3140	1484	0	1484	0.00
262.75	0.75	3717	3516	2363	0	2363	0.00
263.00	1.00	4119	3918	3342	0	3342	0.00
263.25	1.25	4521	4320	4422	0	4422	0.00
263.50	1.50	4923	4722	5602	0	5602	0.00
263.75	1.75	5324	5123	6883	0	6883	0.00
264.00	2.00	5726	5525	8265	0	8265	0.00
264.25	2.25	6128	5927	8265	1482	9746	0.04
264.50	2.50	6530	6329	8265	3064	11329	0.07
264.75	2.75	7019	6774	8265	4758	13022	0.08
265.00	3.00	7650	7334	8265	6591	14856	0.10
265.25	3.25	8115	7882	8265	8562	16826	0.11
265.50	3.50	8580	8347	8265	10649	18913	0.29
265.75	3.75	9045	8812	8265	12852	21116	1.57
266.00	4.00	9510	9277	8265	15171	23436	1.97
266.25	4.25	9975	9742	8265	17607	25871	3.69
266.50	4.50	10440	10207	8265	20158	28423	9.27

BARRIE DRAINAGE MASTER PLAN
BEAR CREEK WATERSHED
PROJECT NO. 152
SWMF RETROFIT NO. 90 (BR 14)

Stage-Storage Table

Pond Characteristics:

Permanent Pool Elev.: 237.40 m
Bottom Elev.: 235.40 m

Pond Geometry				Pond Volume (m^3)			
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Accum. Dead	Live	Accum. Live
235.90	0.00	1251	1251	0	0	0	0
236.15	0.25	2095	1673	418	418	0	0
236.40	0.50	2939	2517	629	1048	0	0
236.65	0.75	3784	3361	840	1888	0	0
236.90	1.00	4628	4206	1051	2939	0	0
237.15	1.25	5472	5050	1262	4202	0	0
237.40	1.50	6316	5894	1473	5675	0	0

Permanent Pool Volume = **5675** m^3

Comments:

1 Red text represents interpolated values

BARRIE DRAINAGE MASTER PLAN
BEAR CREEK WATERSHED
PROJECT NO. 153
SWMF RETROFIT NO. 62 (BR 05)

Stage-Storage Table

Pond Characteristics:

Permanent Pool Elev.: 297.00 m
Bottom Elev.: 292.10 m

Pond Geometry				Pond Volume (m^3)			
Elevation (m)	Depth (m)	Area (m^2)	Avg. Area (m)	Dead	Accum. Dead	Live	Accum. Live
292.10	0.00	700	700	0	0	0	0
292.60	0.50	946	823	412	412	0	0
293.10	1.00	1193	1070	535	946	0	0
293.60	1.50	1439	1316	658	1604	0	0
294.00	1.90	1699	1569	0	1604	628	628
294.50	2.40	2025	1862	0	1604	931	1559
295.00	2.90	2351	2188	0	1604	1094	2653
295.50	3.40	2676	2514	0	1604	1257	3910
295.55	3.45	2712	2694	0	1604	135	4044
296.00	3.90	3030	2871	0	1604	1292	5336
296.25	4.15	3207	3119	0	1604	780	6116
296.50	4.40	3384	3296	0	1604	824	6940
296.60	4.50	3455	3420	0	1604	342	7282
296.75	4.65	3561	3508	0	1604	526	7808
296.80	4.70	3619	3590	0	1604	180	7988
296.95	4.85	3792	3706	0	1604	556	8544
297.00	4.90	3850	3821	0	1604	191	8735

Permanent Pool Volume = **1604** m^3

Comments:

1 Red text represents interpolated values

Appendix O:
Lot Level, Linear and Centralized LID Details

TATHAM ENGINEERING	Project: Barrie Drainage Master Plan	Date: 8-Jan-18
	File No.: 117076	Designed: ASB
	Subject: Infiltration Rate Calculation	Checked: DRT

INFILTRATION RATE GIVEN HYDRAULIC CONDUCTIVITY

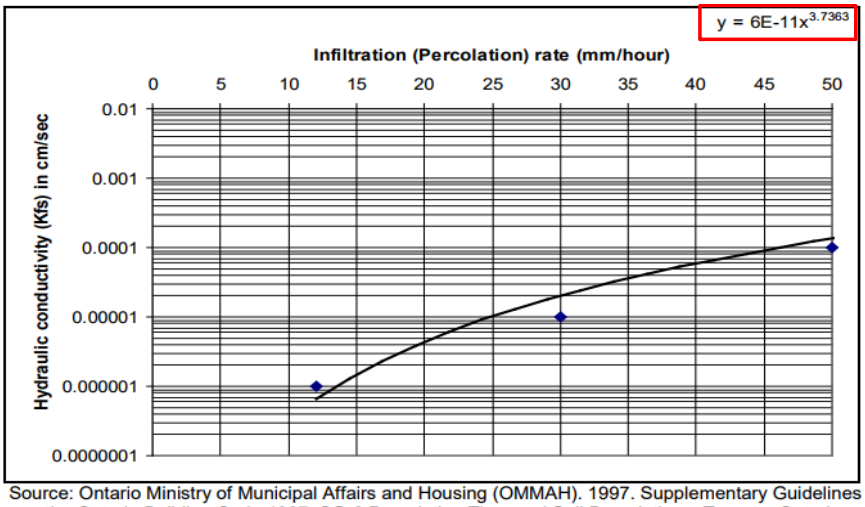
Reference: TRCA, CVC Low Impact Development Stormwater Management Planning and Design Guide (2011) - Appendix C

Table C1: Approximate relationships between hydraulic conductivity, percolation time and infiltration rate

Hydraulic Conductivity, K_{fs} (centimetres/second)	Percolation Time, T (minutes/centimetre)	Infiltration Rate, 1/T (millimetres/hour)
0.1	2	300
0.01	4	150
0.001	8	75
0.0001	12	50
0.00001	20	30
0.000001	50	12

Source: Ontario Ministry of Municipal Affairs and Housing (OMMAH). 1997. Supplementary Guidelines to the Ontario Building Code 1997. SG-6 Percolation Time and Soil Descriptions. Toronto, Ontario.

Figure C1: Approximate relationship between infiltration rate and hydraulic conductivity



Source: Ontario Ministry of Municipal Affairs and Housing (OMMAH). 1997. Supplementary Guidelines to the Ontario Building Code 1997. SG-6 Percolation Time and Soil Descriptions. Toronto, Ontario.

Infiltration rate (mm/hr) = *(1.6667*(10^10) * kfs)^(1/3.7363)* *where* k_{fs} *= saturated hydraulic conductivity (cm/s)*

UICS ID	Park	k_{fs} (cm/s)	Infiltration rate (mm/hr)
28	Bear Creek	0.000341	64
29	Cartwright	0.000854	82
31	Dunsmore	0.000341	64
35	Lougheed	0.000341	64
37	Strabane	0.001840	101
38	Wessenger	0.000214	57

TATHAM ENGINEERING

Project:	Barrie Drainage Master Plan	**Prepared By:**	DRT
File No.:	117076	**Reviewed By:**	DAM
Revision:	1	**Date:**	January 10, 2018
Description:	Low Impact Development Safety Correction Factors		

Safety Factors for Calculating Design Infiltration Rates

Soil Texture Class	Minimum Infiltration Rate (mm/hr)	K_{fs} (cm/hr)	K_{fs} (cm/s)	Design Infiltration Rate (mm/hr)	Ratio of Mean Measured Infiltration Rates	Safety Correction Factor
Sand	141.00	235.6	0.006544444	141.66	1.0	2.5
Loamy Sand	42.00	59.8	0.001661111	98.15	2.3	3.5
Sandy Loam	20.30	21.8	0.000605556	74.92	3.7	3.5
Loam	7.60	13.2	0.000366667	65.50	8.6	6.5
Silt Loam	7.60	6.8	0.000188889	54.85	7.2	6.5
Sandy Clay Loam	5.10	3	8.33333E-05	44.06	8.6	6.5
Clay Loam	1.50	2	5.55556E-05	39.53	26.4	8.5
Silty Clay Loam	1.50	2	5.55556E-05	39.53	26.4	8.5
Sandy Clay	1.50	1.2	3.33333E-05	34.48	23.0	8.5
Silty Clay	1.50	1	2.77778E-05	32.84	21.9	8.5
Clay	1.50	0.6	1.66667E-05	28.64	19.1	8.5

Source: Table 10.4 Green and Ampt Method Parameters (NVCA Stormwater Technical Guide)

TATHAM ENGINEERING

Project:	Barrie Drainage Master Plan	**Prepared By:**	DRT
File No.:	117076	**Reviewed By:**	DAM
Revision:	1	**Date:**	January 10, 2018
Description:	Low Impact Development Safety Correction Factors		

10.4 Green and Ampt Method Parameters

Table 10.4: Green and Ampt method parameters

Soil texture class	Porosity ϕ	Wetting front soil suction head S_f cm	Saturated hydraulic conductivity* K_s cm/h
Sand	0.437 (0.374-0.500)	4.95 (0.97-25.36)	23.56
Loamy sand	0.437 (0.363-0.506)	6.13 (1.35-27.94)	5.98
Sandy loam	0.453 (0.351-0.555)	11.01 (2.67-45.47)	2.18
Loam	0.463 (0.375-0.551)	8.89 (1.33-59.38)	1.32
Silt loam	0.501 (0.420-0.582)	16.68 (2.92-95.39)	0.68
Sandy clay loam	0.398 (0.332-0.464)	21.85 (4.42-108.0)	0.30
Clay loam	0.464 (0.409-0.519)	20.88 (4.79-91.10)	0.20
Silty clay loam	0.471 (0.418-0.524)	27.30 (5.67-131.50)	0.20
Sandy clay	0.430 (0.370-0.490)	23.90 (4.08-140.2)	0.12
Silty clay	0.479 (0.425-0.533)	29.22 (6.13-139.4)	0.10
Clay	0.475 (0.427-0.523)	31.63 (6.39-156.5)	0.06

*K_s can be modified to obtain the Green-Ampt K. For bare ground conditions K can be taken as $k_s/2$.

Ref: Rawls, W.J., Gish, T.J., Brakensiek, D.L. and D.L. Shirmohammadi, A. (1993) from ASCE Hydrology Handbook, page 108.

Table 7.2: Safety factor for calculating design infiltration rates

Ratio of Mean Measured Infiltration Rates[1]	Safety Correction Factor[2]
≤1	2.5
1.1 to 4.0	3.5
4.1 to 8.0	4.5
8.1 to 16.0	6.5
16.1 or greater	8.5

Ref: Wisconsin Department of Natural Resources. 2004. Conservation Practice Standards. Site Evaluation for Stormwater Infiltration (1002). Madison, WI.

Notes:

1. Ratio is determined by dividing the geometric mean measured infiltration rate at the proposed bottom elevation of the BMP by the geometric mean measured infiltration rate of the least permeable soil horizon within 1.5 metres below the proposed bottom elevation of the BMP.
2. The design infiltration rate is calculated by dividing the geometric mean measured infiltration rate at the proposed bottom elevation of the BMP by the safety correction factor.

Table 7.1: Approximate relationships between hydraulic conductivity, percolation time and infiltration rate

Hydraulic Conductivity, K_{fs} (cm/second)	Percolation Time, T (minutes/cm)	Infiltration Rate, 1/T (mm/hour)
0.1	2	300
0.01	4	150
0.001	8	75
0.0001	12	50
0.00001	20	30
0.000001	50	12

Ref: Ontario Ministry of Municipal Affairs and Housing (OMMAH). 1997. Supplementary Guidelines to the Ontario Building Code 1997. SG-6 Percolation Time and Soil Descriptions. Toronto, Ontario.

Table 1: Rain Barrel Parameters

Parameter	Description and Source
Subcatchment Name	Unique user assigned subcatchment name (PCSWMM)
Total Area (sq.m)	Subcatchment total area (measured in GIS)
Impervious Area (sq.m)	Subcatchment total impervious area (measured in GIS)
Residential Building Area (sq.m)	Subcatchment building areas in residential zoning (measured in GIS)
LID Capture Area (sq.m)	Assumed 25% of homes implement rain barrels and 25% of rooftop drains to rain barrel. Calculated as 6.25% of Residential Building Area (calculated in Excel)
Roof Count	Number of buildings within subcatchment (counted in GIS)
Replicate Units	Counted at rate of 1 unit per 4 roofs rounded up to the nearest whole unit (calculated in Excel)
LID Unit Area	Assumed rain barrel surface area of 0.336 m^2
LID Footprint Area (sq.m)	Based on number of Replicate Units and Unit Area
% of Subcatchment Occupied	Percentage of total subcatchment area occupied by LID Footprint (calculated in Excel)
Surface Width per Unit	LID surface width perpendicular to direction of flow over LID's surface (constant; assumed to be no flow, 0 m)
% Initially Saturated	Percentage of area that is initially saturated (constant; Assumed to be 0)
% Impervious Area Treated	Percentage of impervious area that is treated by LID (calculated in Excel as percentage of LID Capture Area in Impervious Area)
Alternate Drain Outlet	Outlet from LID (constant; blank to use outlet of current subcatchment)
To Pervious Area	Does LID drain to pervious area within subcatchment (constant; assumed to be yes = 1)
Orifice Coefficient	Constant; assumed to be 0.6
Gravity Constant	Acceleration due to gravity (constant; equals 9.81 m/s^2)
Underdrain Diameter	Constant; assumed to be 19 mm

Orifice Area (sq.m)	Calculated based on underdrain diameter (calculated in Excel)
Area LID	Constant; assumed each rain barrel has a surface area of 0.336 m^2
Area Ratio	Orifice Area divided by Area LID (calculated in Excel)
Barrel Height	Constant; assumed to be 1250 mm
Drain Coefficient	Formula based on Gravity Constant, Orifice Coefficient and Area Ratio provided by CHI during Advanced LID Modeling Workshop
Drain Exponent	Constant; assumed to be 0.5
Drain Offset Height	Constant; assumed to be 0 mm (drain at bottom of barrel)
Drain Delay	Constant; assumed to be 6 hours (drain is closed when rainfall begins and is opened after 6 dry weather hours)

Table 2: Soakaway Pit Parameters

Parameter	Description and Source
Subcatchment Name	Unique user assigned subcatchment name (PCSWMM)
LID Control Name	Unique name assigned based on subcatchment (generated in Excel)
Total Area (sq.m)	Subcatchment total area (measured in GIS)
Impervious Area (sq.m)	Subcatchment total impervious area (measured in GIS)
Residential Building Area (sq.m)	Subcatchment building areas in residential zoning (measured in GIS)
LID Capture Area (sq.m)	Assumed 25% of homes implement rain barrels and 25% of rooftop drains to rain barrel. Calculated as 6.25% of Residential Building Area (calculated in Excel)
Roof Count	Number of buildings within subcatchment (counted in GIS)
Replicate Units	Counted at rate of 1 unit per 4 roofs rounded up to the nearest whole unit (calculated in Excel)
LID Unit Area	Constant; assumed soakaway pit surface area of 4.0 m^2
LID Footprint Area (sq.m)	Based on number of Replicate Units and LID Unit Area
LID Capture Ratio	LID Capture Area divided by LID Footprint Area (Calculated in Excel)
% of Subcatchment Occupied	Percentage of total subcatchment area occupied by LID Footprint (calculated in Excel)
Surface Width per Unit	LID surface width perpendicular to direction of flow over LID's surface (constant; assumed to be no flow, 0 m)
% Initially Saturated	Percentage of area that is initially saturated (constant; Assumed to be 0)
% Impervious Area Treated	Percentage of impervious area that is treated by LID (calculated in Excel as percentage of LID Capture Area in Impervious Area)
Seepage (mm/hr)	Hydraulic conductivity based on soil type (PCSWMM)
Infiltration (mm/hr)	Seepage value (hydraulic conductivity) converted to infiltration rate using TRCA, CVC conversion equation (determined in Excel)

Safety Factor	Assumed based on calculated infiltration rate (generally sandy soils have lower safety factors than clays)
Design Infiltration (mm/hr)	Calculated infiltration rate divided by safety factor
Max Depth (mm)	Calculation based on design infiltration, void ratio of 0.4 and drain time of 48 hours
Design Depth (mm)	Maximum thickness is 900 mm and the minimum thickness is 300 mm. If calculation has depth less than 300 mm, no soakaway pits are applied within the subcatchment
Alternate Drain Outlet	Outlet from LID (constant; blank to use outlet of current subcatchment)
To Pervious Area	Does LID drain to pervious area within subcatchment (constant; assumed to be yes = 1)
Surface Berm Height	Constant; assumed to be 0
Vegetation Volume	Constant; assumed to be 0 (fraction)
Surface Roughness (Manning's n)	Constant; assumed to be 0.15
Surface Slope (%)	Constant; assumed to be 0
Storage Thickness (mm)	Design depth (calculated in Excel)
Void Ratio (Voids/Solids)	Constant; assumed to be 0.4 (gravel)
Seepage Rate (mm/hr)	Design seepage (calculated in Excel)
Clogging Factor	Constant; assumed to be 0
Drain Coefficient	Constant; assumed to be 0 with no underdrain
Drain Exponent	Constant; assumed to be 0.5 (N/A)
Drain Offset Height	Constant; assumed to be 0 mm (N/A)

Table 3: Linear LID Parameters

Parameter	Description and Source
Subcatchment Name	Unique user assigned subcatchment name (PCSWMM)
LID Control Name	Unique name assigned based on subcatchment (generated in Excel)
Total Area (sq.m)	Subcatchment total area (measured in GIS)
Impervious Area (sq.m)	Subcatchment total impervious area (measured in GIS)
Road Area (sq.m)	Subcatchment road area with Local Classification (measured in GIS)
Driveway Area (sq.m)	Subcatchment driveway area connected to local road (measured in GIS)
LID Capture Area (sq.m)	Sum of driveway area and road area (calculated in Excel)
LID Footprint Area (sq.m)	Based on an assumed percentage of road area (calculated in Excel); assumed to be 16% of road area (1.4 m of 8.5 m paved roadway)
LID Capture Ratio	LID Capture Area divided by LID Footprint Area (calculated in Excel); target ratio is between 5 and 10
Replicate Units	Number of LID units in given subcatchment (constant; Set to 1)
% of Subcatchment Occupied	Percentage of total subcatchment area occupied by LID Footprint (calculated in Excel)
Surface Width per Unit (m)	LID Surface Width (constant; assumed to be 1.0 m)
% Initially Saturated	Percentage of area that is initially saturated (constant; assumed to be 0)
% Impervious Area Treated	Percentage of impervious area that is treated by LID (calculated in Excel as percentage of LID Capture Area in Impervious Area)
Seepage (mm/hr)	Hydraulic conductivity based on soil type (PCSWMM)
WHPA	Flag for subcatchment within WHPA-A or WHPA-B (determined in GIS)
Infiltration (mm/hr)	Set to 0 for subcatchments within WHPA-A or WHPA-B. Seepage value (hydraulic conductivity) converted to infiltration rate using TRCA, CVC conversion equation for all other subcatchments (determined in Excel)

Safety Factor	Assumed based on calculated infiltration rate (generally sandy soils have lower safety factors than clays)
Design Infiltration (mm/hr)	Calculated infiltration rate divided by safety factor
Max Depth (mm)	Calculation based on design infiltration, void ratio of 0.4 and drain time of 48 hours
Design Depth (mm)	Maximum thickness is 900 mm and minimum thickness is 300 mm. If calculation has max depth less than 300 mm, design depth is 900 mm with an underdrain at the bottom of the trench
Underdrain Diameter	No underdrain for subcatchments with max calculated depths 300 mm or greater and 200 mm underdrains for all subcatchments that require underdrains
Orifice Coefficient	Constant; assumed to be 0.6
Gravity Constant	Acceleration due to gravity (constant; equals 9.81 m/s^2)
Orifice Area (sq.m)	Calculated based on underdrain diameter (calculated in Excel)
Area Ratio	Orifice Area divided by LID Footprint Area (calculated in Excel)
Alternate Drain Outlet	Outlet from LID (constant; blank to use outlet of current subcatchment)
To Pervious Area	Does LID drain to pervious area within subcatchment (constant; assumed to be no = 0)
Surface Berm Height	Constant; assumed to be 0
Vegetation Volume (fraction)	Constant; assumed to be 0
Surface Roughness (Manning's n)	Constant; assumed to be 0.013
Surface Slope (%)	Constant; assumed to be 0
Storage Thickness	Design depth (calculated in Excel)
Void Ratio (Voids/Solids)	Constant; assumed to be 0.4 (gravel)
Seepage Rate (mm/hr)	Set to Seepage (hydraulic conductivity)
Clogging Factor	Constant; assumed to be 0

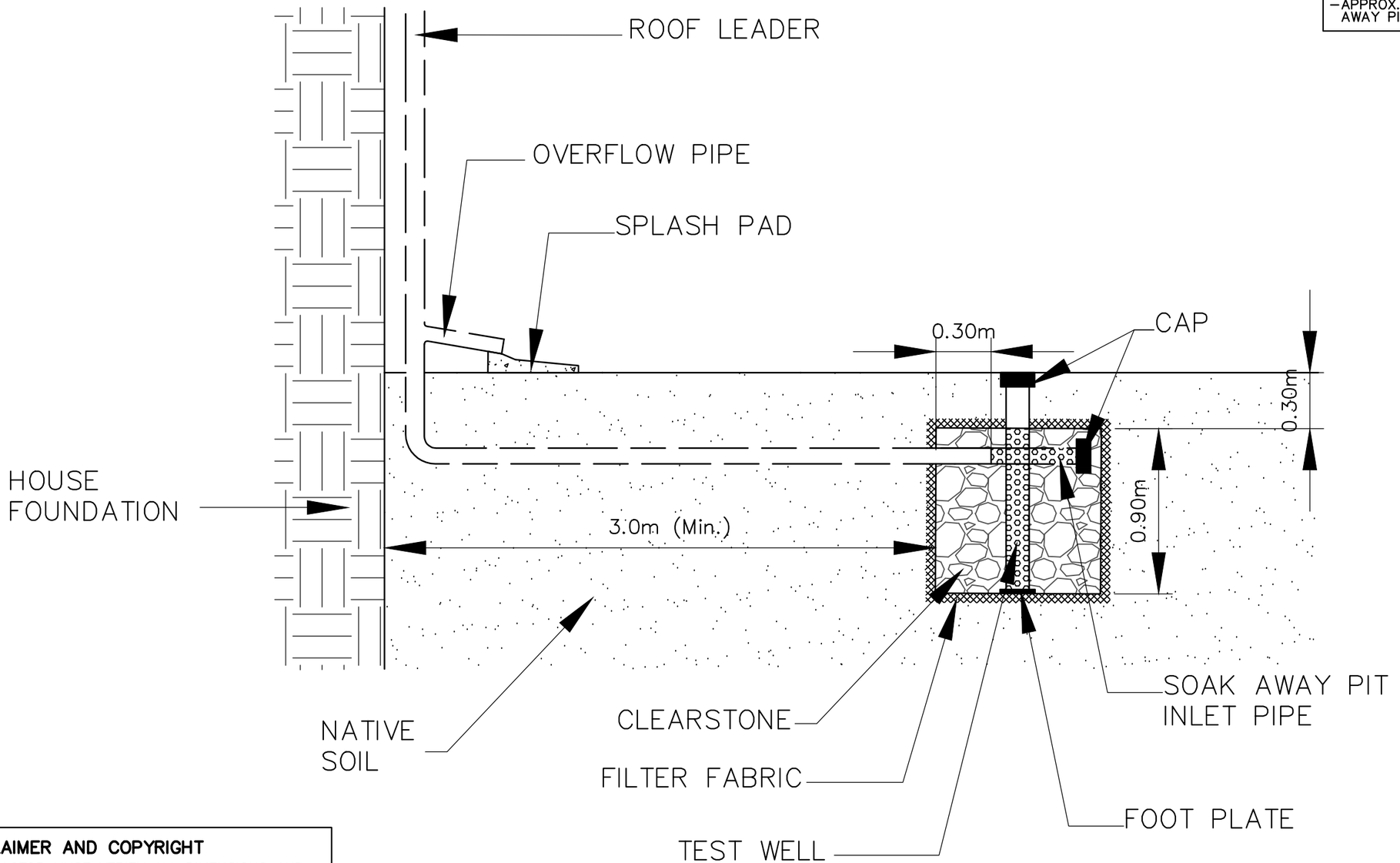
Drain Coefficient	For subcatchments with underdrains, a formula based on Gravity Constant, Orifice Coefficient and Area Ratio provided by CHI during Advanced LID Modeling Workshop. 0 for subcatchments with no underdrains.
Drain Exponent	Constant; assumed to be 0.5
Drain Offset Height	Constant; assumed to be 0 mm for all subcatchments with underdrains

117076_FIG.15_SOAK-AWAY-PIT.dwg: 20190329.0902: 1000.00

NOTES

FOOT PRINT = 2 m X 2 m (4 SQ.m)
POROSITY = 0.4 (GRAVEL)
STORAGE VOLUME = 1.44 CU.m

LID USAGE – RESIDENTIAL AREAS
–ASSUME 25% OF HOMES IMPLEMENT SOAKAWAY PIT
–ASSUME 25% OF ROOFTOP DRAINS TO SOAKAWAY PIT
–APPROX. 6.25% OF ROOFTOP WILL DRAIN TO SOAK AWAY PITS IN EACH SUBCATCHMENT



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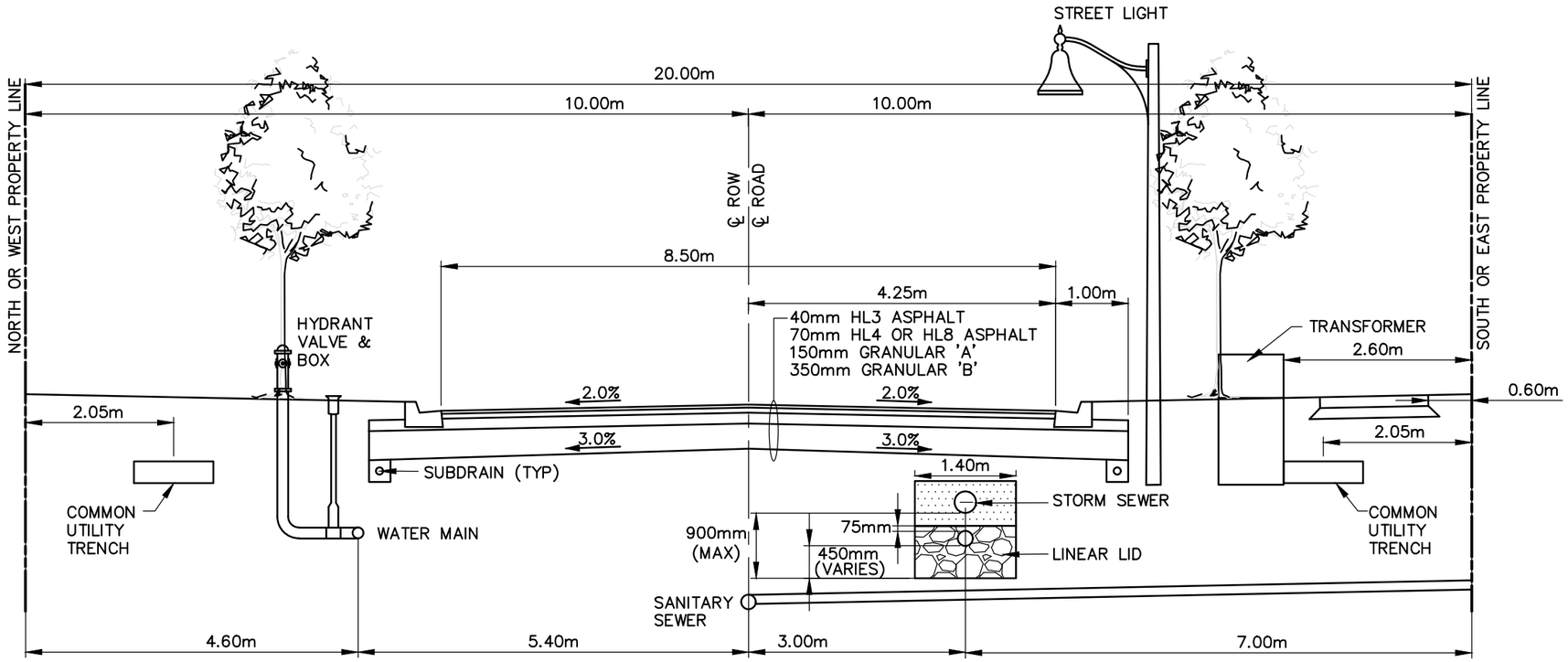
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CITY OF BARRIE
BARRIE DRAINAGE MASTER PLAN
TYPICAL SOAKAWAY PIT DETAIL

DWG. No. **FIG. 14**

SCALE: 1:25	DRAWN: DEP	DATE: JUNE/18	JOB NO. 117076

Drawing Name: 117076_FIG.15_SOAK-AWAY-PIT.dwg, Plotted: Mar 29, 2019



20m ROW – URBAN CROSS–SECTION WITH LINEAR LID

NTS

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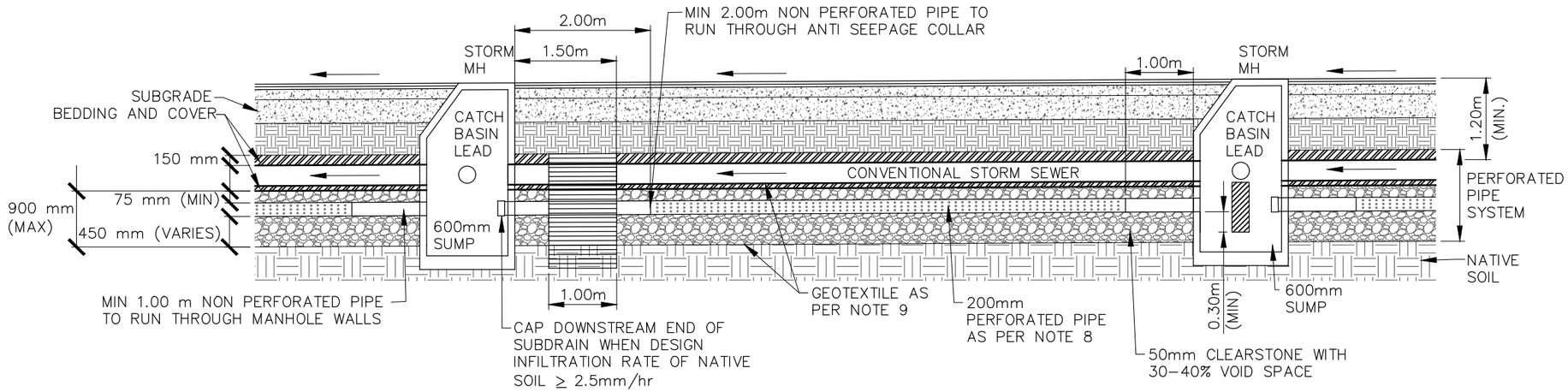
CITY OF BARRIE
BARRIE DRAINAGE MASTER PLAN
TYPICAL LINEAR LID ROAD CROSS-SECTION

DWG. No. **FIG. 15A**

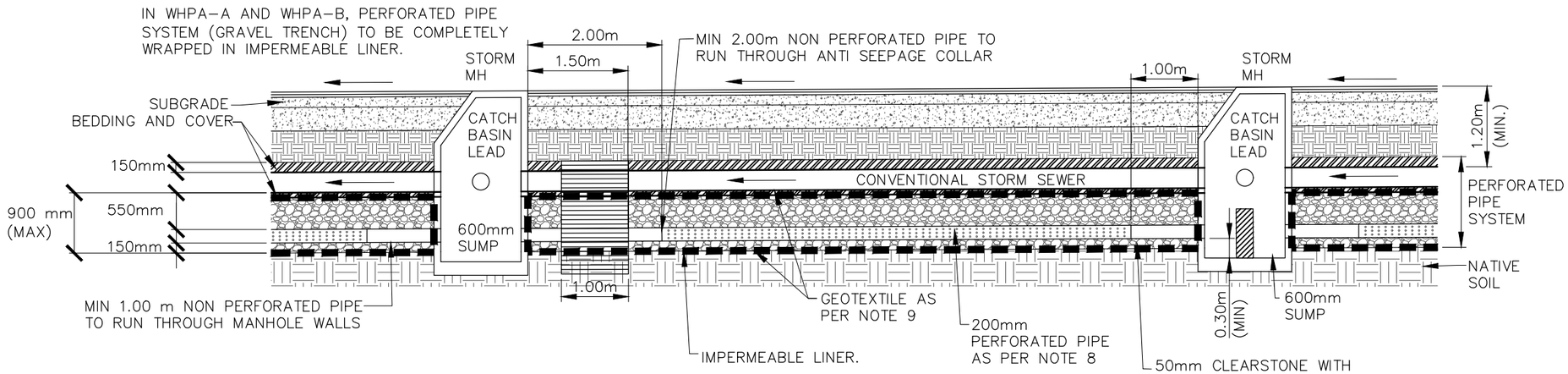
SCALE: 1:75	DRAWN: DEP	DATE: JUNE/17	JOB NO. 117076

Drawing Name: 117076_FIG.16A.dwg, Plotted: Mar 29, 2019

117076_FIG.16B.dwg,20190329,0905,1000,0.0



OUTSIDE WHPA–A OR WHPA–B



WITHIN WHPA–A OR WHPA–B

NOTES:

1. STORMWATER CONVENTIONAL SYSTEM TO BE DESIGNED IN ACCORDANCE WITH THE CITY OF BARRIE STORM DRAINAGE MANUAL.
2. PERFORATED PIPES TO BE PLUGGED AT DOWNSTREAM END USING APPROPRIATE SIZED MECHANICAL PLUG OR EQUIVALENT. TEMP. PLUG TO BE INSTALLED UNTIL TRIBUTARY AREA IS STABLIZED.
3. GRAVEL BED AND INLET PIPE TO BE BELOW LOCAL FROST LINE AND BE INSTALLED IN RECTANGULAR EXCAVATIONS WITH A BOTTOM WIDTH MIN. 1.4m.
4. BAFFLE SHALL BE INSTALLED IN UPSTREAM MANHOLE PER MANUFACTURERS INSTRUCTIONS.
5. ANTI–SEEPAGE COLLARS SHALL BE INSTALLED ON ALL PERFORATED PIPES OR AS DIRECTED BY A GEOTECHNICAL ENGINEER.
6. FLOWS SHALL BE COLLECTED BY USE OF CONVENTIONAL CATCHBASINS COMPLETE WITH MINIMUM PRETREATMENT THE CITY OF BARRIE STORM DRAINAGE MANUAL.
7. BEARING CAPACITY OF INFILTRATION SOIL SHALL BE ASSESSED, AND INFILTRATION TRENCH DESIGNED SUCH THAT SETTLEMENT OF THE UNDERLYING SOILS DOES NOT NEGATIVELY AFFECT INFILTRATION RATES, OR RESULT IN SETTLEMENT & REDUCED LIFESPAN OF THE ROAD STRUCTURE ABOVE.
8. ALL PERFORATED PIPES TO BE SMOOTH WALLED MIN 200mm INSIDE DIA. CONTINUOUSLY PERFORATED TYPE SDR28 PVC PIPE, WITH 4X12 PERFORATIONS TO A MAXIMUM SPACING OF 150mm, WRAPPED WITH GEOTEXTILE SOCK PER OPSS 1860, CLASS II, NON–WOVEN NEEDLE PUNCHED OR WOVEN MONOFILAMENT AND COVERED WITH MIN. 75mm CLEAR STONE OVER PIPE.
9. GEOTEXTILE FABRIC PER OPSS 1860, CLASS II, NON–WOVEN NEEDLE PUNCHED OR WOVEN MONOFILAMENT TO BE INSTALLED AROUND ALL TRENCH FACILITIES WITH 300mm MIN. OVERLAP.
10. CATCHBASINS PER OPSD 705.010, TO HAVE 900mm SUMP AND MINIMUM PRETREATMENT, AS DEFINED IN THE CITY OF BARRIE DRAINAGE MANUAL.

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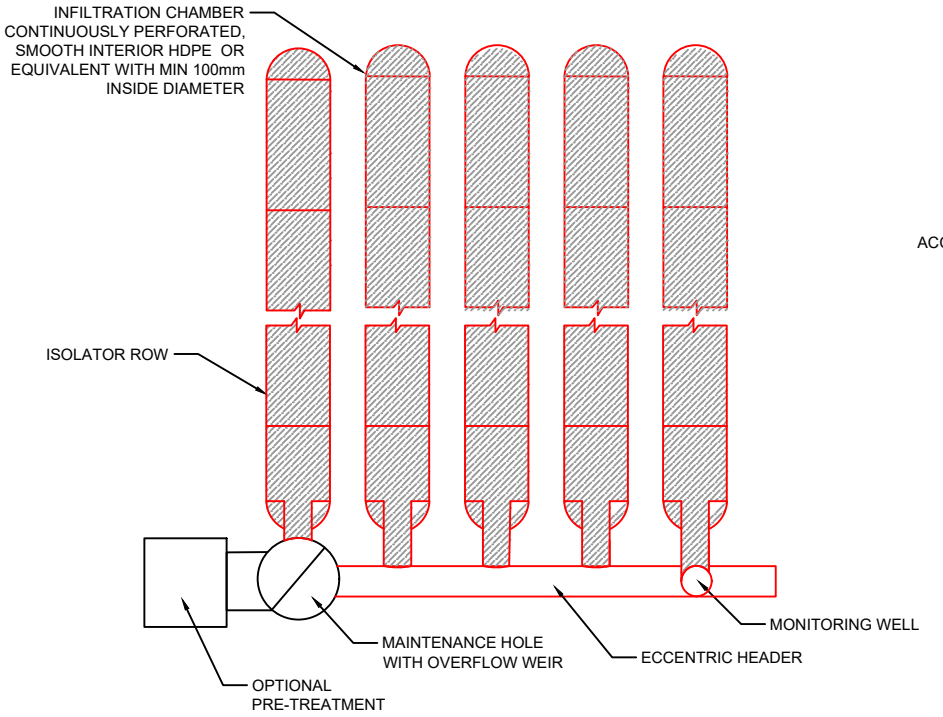
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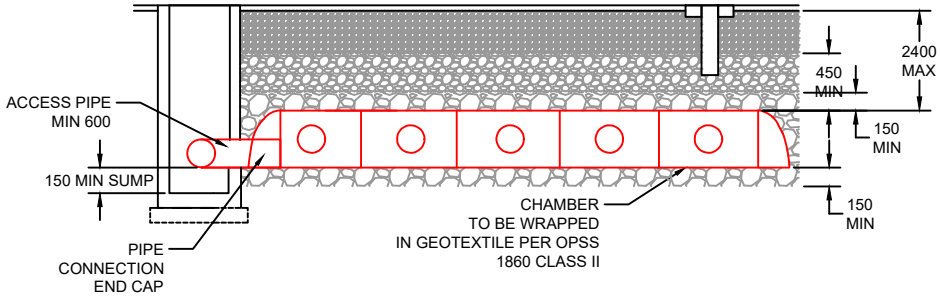
CITY OF BARRIE
BARRIE DRAINAGE MASTER PLAN
TYPICAL LINEAR LID DETAIL

DWG. No. **FIG. 15B**

SCALE: 1:75	DRAWN: DEP	DATE: JUNE/17	JOB NO. 117076

Drawing Name: 117076_FIG.16B.dwg, Plotted: Mar 29, 2019





NOTES:

1. INLET PIPE AND THE TOP OF THE FACILITY LOCATED BELOW LOCAL MAXIMUM FROST DEPTH.
2. NATURAL SLOPES LESS THAN 15% REQUIRED.
3. SUITABLE IN HYDROLOGIC GROUP A OR B.
4. IF RECEIVING ROAD OR PARKING LOT RUNOFF THIS SHALL NOT BE IN WHPA-B AS PER APPROVED SOUTH GEORGIAN BAY LAKE SIMCOE SOURCE PROTECTION PLAN.
5. NOT SUITABLE IN AREAS IDENTIFIED AS A DRINKING WATER THREAT AS DEFINED BY THE CLEAN WATER ACT (SECTION 2(1)) AND AS OUTLINED UNDER PRESCRIBED THREATS IN APPROVED SOUTH GEORGIAN BAY LAKE SIMCOE SOURCE PROTECTION PLAN.
6. OVERFLOW PIPES SHALL DISCHARGE TO PERVIOUS AREAS AT LEAST 2000MM FROM BUILDING FOUNDATIONS AND SLOPE AWAY FROM SAID BUILDING.
7. MONITORING WELL SHALL HAVE A LOCKABLE CAP AND BE A VERTICAL STANDPIPE WITH ANCHORED 100-150MM DIAMETER OF PERFORATED PIPE.
8. REQUIRED ADEQUATE SEDIMENTATION PRETREATMENT.
9. MAXIMUM RATIO OF 10:1 FOR IMPERVIOUS DRAINAGE AREA TO TREATMENT FACILITY.
10. HORIZONTAL AND VERTICAL OFFSETS FROM UTILITIES TO BE MAINTAINED.
11. SUITABLE ONLY FOR INDUSTRIAL, COMMERCIAL AND INSTITUTIONAL APPLICATIONS.
12. ALL DIMENSIONS SHOWN IN MILLIMETERS, UNLESS OTHERWISE NOTED.

The City of BARRIE

STANDARD DETAIL

DRAFT

UNDERGROUND INFILTRATION CHAMBER SYSTEM

REV No.	DATE:JULY 2017
1	SCALE: N.T.S.

BSD-1502

APPROVED

DATE . . . . . .

. . . . . .

DIRECTOR OF ENGINEERING

TATHAM ENGINEERING

Project:	Barrie Drainage Master Plan	**Prepared By:**	DAM
File No.:	117076	**Reviewed By:**	DRT
Revision:	1	**Date:**	January 12, 2018
Description:	Centralized LID Underground Storage Volumes		

Cultec Stormwater Chambers

Cultec Stormwater Chamber	Chamber and Stone Storage Per Unit (m^3)			Required Surface Area Per Unit (m^2)	Storage Volume Per m^2 Surface Area (m^3)			Chamber Height (mm)	Required Trench Depth (mm)		
Stone Depth Below Unit (mm)	152	305	457		152	305	457		152	305	457
Contactor 100HD	0.82	0.96	1.10	2.32	0.35	0.41	0.47	318	662	775	927
Recharger 150 XLHD	1.42	1.61	1.80	3.09	0.46	0.52	0.58	470	774	927	1079
Recharger 280 HD	1.83	2.00	2.17	2.82	0.65	0.71	0.77	673	977	1130	1282
Recharger 300XLHD	2.24	2.44	2.63	3.14	0.71	0.78	0.84	775	1079	1232	1384

Contect Corrugated Metal Pipe

Pipe Diameter (mm)	Cross-sectional Area (m^2)	Volume / m (m^3)	Trench Width (m)	Trench Height (m)	Volume / m (m^3)	Total Volume / m (m^3)	Total Volume / m^2 (m^3)
300	0.0707	0.0707	0.600	0.600	0.1157	0.1864	0.31
375	0.1104	0.1104	0.675	0.675	0.1381	0.2485	0.37
450	0.1590	0.1590	0.750	0.750	0.1614	0.3204	0.43
525	0.2165	0.2165	0.825	0.825	0.1857	0.4021	0.49
600	0.2827	0.2827	0.900	0.900	0.2109	0.4936	0.55
675	0.3578	0.3578	1.013	0.975	0.2517	0.6096	0.60
750	0.4418	0.4418	1.125	1.050	0.2958	0.7376	0.66
900	0.6362	0.6362	1.350	1.200	0.3935	1.0297	0.76

TATHAM ENGINEERING

Project:	Barrie Drainage Master Plan	**Prepared By:**	DAM
File No.:	117076	**Reviewed By:**	DRT
Revision:	1	**Date:**	January 12, 2018
Description:	Centralized LID Underground Storage Volumes		

Contect Corrugated Metal Pipe (continued…)

Pipe Diameter (mm)	Cross-sectional Area (m^2)	Volume / m (m^3)	Trench Width (m)	Trench Height (m)	Volume / m (m^3)	Total Volume / m (m^3)	Total Volume / m^2 (m^3)
1050	0.8659	0.8659	1.575	1.350	0.5041	1.3700	0.87
1200	1.1310	1.1310	1.800	1.500	0.6276	1.7586	0.98
1350	1.4314	1.4314	2.025	1.650	0.7639	2.1953	1.08
1500	1.7671	1.7671	2.250	1.800	0.9131	2.6803	1.19
1650	2.1382	2.1382	2.475	1.950	1.0752	3.2134	1.30
1800	2.5447	2.5447	2.700	2.100	1.2501	3.7948	1.41
1950	2.9865	2.9865	2.850	2.250	1.3704	4.3569	1.53
2100	3.4636	3.4636	3.000	2.400	1.4946	4.9582	1.65

TATHAM ENGINEERING	Project: Barrie Drainage Master Plan	Date: 15-Jan-18
	File No.: 117076	Designed: DAM
	Subject: Conceptual Design - LID	Checked: DRT

CENTRALIZED LID DESIGN

WATERSHED: Hotchkiss Creek
PARK: Allandale Heights
LID TYPE: Underground Infiltration Chamber System

Drainage Area (ha):	2.5
Impervious Drainage Area (ha):	1.1
Catchment ID:	UICS01
Infiltration Rate (mm/hr):	110.9
Design Safety Factor:	2.5
LID Foot Print Area (m^2):	85
Storm Sewer Inlet Invert (m):	269.44
Storm Sewer Outlet Invert (m):	N/A
Target Capture Ratio:	5:1 - 20:1
Capture Ratio:	133

LID SIZING CALCULATIONS

STORAGE RESERVOIR DEPTH	
Design Infiltration Rate (mm/hr):	44
Void Ratio for Stone Reservoir:	0.4
Drawdown Time (hr):	48
Maximum Storage Reservoir Depth (mm):	5322
STORAGE RESERVOIR VOLUME	
Design Storage Reservoir Depth (mm):	1384
Storage Chamber:	330XLHD
Unit Storage Volume (m^3/m^2):	0.84
Storage Reservoir Volume (m^3):	71
VOLUME CONTROL	
Control Target - 25 mm Storm (mm):	1.70
Runoff Volume Captured (mm):	2.82

UNDERDRAIN DEFAULTS	
Orifice Coefficient:	0.60
Gravitational Constant (m/s^2):	9.81
Underdrain Diameter (mm):	200
Orifice Area (m^2):	0.0314

LID MODELING CALCUALTIONS

SURFACE	
Berm Height (mm):	-
Vegetation Volume:	-
Surface Roughness:	-
Surface Slope (%):	-
STORAGE	
Thickness (mm):	1384.00
Void Ratio (voids/solids):	0.61
Seepage Rate (mm/hr):	94.32
Clogging Factor:	0
DRAIN COEFFICIENT	
Area Ratio:	0.00
Drain Coefficient:	NO DRAIN
Drain Exponent:	0.50
Drain Offset Height (mm):	0.00
LID USAGE	
Number of Replicate Units:	1
% of Subcatchment Occupied:	100
Surface Width / Unit (m):	9
% Initially Saturated:	0
% of Impervious Area Treated:	100

NOTES:
1. PCSWMM subcatchment delineation to be revised so each UICS is its own subcatchment.
2. The UICS subcatchment ID is to reference the UICS ID (eg. UICS01).
3. The subcatchment tag for each UICS is to be the Park Name.
4. The minimum trench design depth is 622 mm. If the maximum storage reservoir depth calculation is less than 622 mm, the underdrain offset is to be set to the maximum storage reservoir depth. For maximum storage reservoir depths greater than 622 mm, there is no underdrain and the drain coefficient is set equal to 0.
5. The control target equals the runoff produced from the contributing area for the 25 mm design storm.

TATHAM ENGINEERING	Project: Barrie Drainage Master Plan	Date: 15-Jan-18
	File No.: 117076	Designed: DAM
	Subject: Conceptual Design - LID	Checked: DRT

CENTRALIZED LID DESIGN

WATERSHED: Whiskey Creek
PARK: Assikinack Park
LID TYPE: Underground Infiltration Chamber System

Drainage Area (ha):	7.3
Impervious Drainage Area (ha):	3.2
Catchment ID:	UICS02
Infiltration Rate (mm/hr):	93.2
Design Safety Factor:	3.5
LID Foot Print Area (m^2):	335
Storm Sewer Inlet Invert (m):	247.03
Storm Sewer Outlet Invert (m):	N/A
Target Capture Ratio:	5:1 - 20:1
Capture Ratio:	96

LID SIZING CALCULATIONS

STORAGE RESERVOIR DEPTH	
Design Infiltration Rate (mm/hr):	27
Void Ratio for Stone Reservoir:	0.4
Drawdown Time (hr):	48
Maximum Storage Reservoir Depth (mm):	3196
STORAGE RESERVOIR VOLUME	
Design Storage Reservoir Depth (mm):	2400
Storage Chamber:	2100 CMP
Unit Storage Volume (m^3/m^2):	1.65
Storage Reservoir Volume (m^3):	553
VOLUME CONTROL	
Control Target - 25 mm Storm (mm):	7.48
Runoff Volume Captured (mm):	7.54

UNDERDRAIN DEFAULTS	
Orifice Coefficient:	0.60
Gravitational Constant (m/s^2):	9.81
Underdrain Diameter (mm):	200
Orifice Area (m^2):	0.0314

LID MODELING CALCUALTIONS

SURFACE	
Berm Height (mm):	-
Vegetation Volume:	-
Surface Roughness:	-
Surface Slope (%):	-
STORAGE	
Thickness (mm):	2400.00
Void Ratio (voids/solids):	0.69
Seepage Rate (mm/hr):	49.32
Clogging Factor:	0
DRAIN COEFFICIENT	
Area Ratio:	0.00
Drain Coefficient:	NO DRAIN
Drain Exponent:	0.50
Drain Offset Height (mm):	0.00
LID USAGE	
Number of Replicate Units:	1
% of Subcatchment Occupied:	100
Surface Width / Unit (m):	22
% Initially Saturated:	0
% of Impervious Area Treated:	100

NOTES:
1. PCSWMM subcatchment delineation to be revised so each UICS is its own subcatchment.
2. The UICS subcatchment ID is to reference the UICS ID (eg. UICS01).
3. The subcatchment tag for each UICS is to be the Park Name.
4. The minimum trench design depth is 622 mm. If the maximum storage reservoir depth calculation is less than 622 mm, the underdrain offset is to be set to the maximum storage reservoir depth. For maximum storage reservoir depths greater than 622 mm, there is no underdrain and the drain coefficient is set equal to 0.
5. The control target equals the runoff produced from the contributing area for the 25 mm design storm.

TATHAM ENGINEERING	Project: Barrie Drainage Master Plan	Date: 15-Jan-18
	File No.: 117076	Designed: DAM
	Subject: Conceptual Design - LID	Checked: DRT

CENTRALIZED LID DESIGN

WATERSHED: Dyments Creek
PARK: Cloughley Park
LID TYPE: Underground Infiltration Chamber System

Drainage Area (ha):	1.5
Impervious Drainage Area (ha):	0.9
Catchment ID:	UICS04
Infiltration Rate (mm/hr):	64.2
Design Safety Factor:	6.5
LID Foot Print Area (m^2):	150
Storm Sewer Inlet Invert (m):	302.22
Storm Sewer Outlet Invert (m):	N/A
Target Capture Ratio:	5:1 - 20:1
Capture Ratio:	58

LID SIZING CALCULATIONS

STORAGE RESERVOIR DEPTH

Design Infiltration Rate (mm/hr):	10
Void Ratio for Stone Reservoir:	0.4
Drawdown Time (hr):	48
Maximum Storage Reservoir Depth (mm):	1186

STORAGE RESERVOIR VOLUME

Design Storage Reservoir Depth (mm):	1079
Storage Chamber:	330XLHD
Unit Storage Volume (m^3/m^2):	0.71
Storage Reservoir Volume (m^3):	107

VOLUME CONTROL

Control Target - 25 mm Storm (mm):	6.97
Runoff Volume Captured (mm):	7.07

UNDERDRAIN DEFAULTS

Orifice Coefficient:	0.60
Gravitational Constant (m/s^2):	9.81
Underdrain Diameter (mm):	200
Orifice Area (m^2):	0.0314

LID MODELING CALCUALTIONS

SURFACE

Berm Height (mm):	-
Vegetation Volume:	-
Surface Roughness:	-
Surface Slope (%):	-

STORAGE

Thickness (mm):	1079.00
Void Ratio (voids/solids):	0.66
Seepage Rate (mm/hr):	12.28
Clogging Factor:	0

DRAIN COEFFICIENT

Area Ratio:	0.00
Drain Coefficient:	NO DRAIN
Drain Exponent:	0.50
Drain Offset Height (mm):	0.00

LID USAGE

Number of Replicate Units:	1
% of Subcatchment Occupied:	100
Surface Width / Unit (m):	18
% Initially Saturated:	0
% of Impervious Area Treated:	100

NOTES:
1. PCSWMM subcatchment delineation to be revised so each UICS is its own subcatchment.
2. The UICS subcatchment ID is to reference the UICS ID (eg. UICS01).
3. The subcatchment tag for each UICS is to be the Park Name.
4. The minimum trench design depth is 622 mm. If the maximum storage reservoir depth calculation is less than 622 mm, the underdrain offset is to be set to the maximum storage reservoir depth. For maximum storage reservoir depths greater than 622 mm, there is no underdrain and the drain coefficient is set equal to 0.
5. The control target equals the runoff produced from the contributing area for the 25 mm design storm.

TATHAM ENGINEERING	Project: Barrie Drainage Master Plan	Date: 15-Jan-18
	File No.: 117076	Designed: DAM
	Subject: Conceptual Design - LID	Checked: DRT

CENTRALIZED LID DESIGN

WATERSHED: Bunkers Creek
PARK: Gibbon Park
LID TYPE: Underground Infiltration Chamber System

Drainage Area (ha):	4.3
Impervious Drainage Area (ha):	2.0
Catchment ID:	UICS06
Infiltration Rate (mm/hr):	71.6
Design Safety Factor:	3.5
LID Foot Print Area (m^2):	170
Storm Sewer Inlet Invert (m):	260.35
Storm Sewer Outlet Invert (m):	N/A
Target Capture Ratio:	5:1 - 20:1
Capture Ratio:	120

LID SIZING CALCULATIONS

STORAGE RESERVOIR DEPTH	
Design Infiltration Rate (mm/hr):	20
Void Ratio for Stone Reservoir:	0.4
Drawdown Time (hr):	48
Maximum Storage Reservoir Depth (mm):	2455
STORAGE RESERVOIR VOLUME	
Design Storage Reservoir Depth (mm):	1384
Storage Chamber:	330XLHD
Unit Storage Volume (m^3/m^2):	0.84
Storage Reservoir Volume (m^3):	143
VOLUME CONTROL	
Control Target - 25 mm Storm (mm):	3.31
Runoff Volume Captured (mm):	3.31
UNDERDRAIN DEFAULTS	
Orifice Coefficient:	0.60
Gravitational Constant (m/s^2):	9.81
Underdrain Diameter (mm):	200
Orifice Area (m^2):	0.0314

LID MODELING CALCUALTIONS

SURFACE	
Berm Height (mm):	-
Vegetation Volume:	-
Surface Roughness:	-
Surface Slope (%):	-
STORAGE	
Thickness (mm):	1384.00
Void Ratio (voids/solids):	0.61
Seepage Rate (mm/hr):	18.40
Clogging Factor:	0
DRAIN COEFFICIENT	
Area Ratio:	0.00
Drain Coefficient:	NO DRAIN
Drain Exponent:	0.50
Drain Offset Height (mm):	0.00
LID USAGE	
Number of Replicate Units:	1
% of Subcatchment Occupied:	100
Surface Width / Unit (m):	13
% Initially Saturated:	0
% of Impervious Area Treated:	100

NOTES:
1. PCSWMM subcatchment delineation to be revised so each UICS is its own subcatchment.
2. The UICS subcatchment ID is to reference the UICS ID (eg. UICS01).
3. The subcatchment tag for each UICS is to be the Park Name.
4. The minimum trench design depth is 622 mm. If the maximum storage reservoir depth calculation is less than 622 mm, the underdrain offset is to be set to the maximum storage reservoir depth. For maximum storage reservoir depths greater than 622 mm, there is no underdrain and the drain coefficient is set equal to 0.
5. The control target equals the runoff produced from the contributing area for the 25 mm design storm.

TATHAM ENGINEERING	Project: Barrie Drainage Master Plan	Date: 15-Jan-18
	File No.: 117076	Designed: DAM
	Subject: Conceptual Design - LID	Checked: DRT

CENTRALIZED LID DESIGN

WATERSHED: Huronia
PARK: Greenfield Park
LID TYPE: Underground Infiltration Chamber System

Drainage Area (ha):	27.1
Impervious Drainage Area (ha):	10.4
Catchment ID:	UICS07
Infiltration Rate (mm/hr):	102.0
Design Safety Factor:	2.5
LID Foot Print Area (m^2):	820
Storm Sewer Inlet Invert (m):	250.08
Storm Sewer Outlet Invert (m):	249.85
Target Capture Ratio:	5:1 - 20:1
Capture Ratio:	126

LID SIZING CALCULATIONS

STORAGE RESERVOIR DEPTH

Design Infiltration Rate (mm/hr):	41
Void Ratio for Stone Reservoir:	0.4
Drawdown Time (hr):	48
Maximum Storage Reservoir Depth (mm):	4898

STORAGE RESERVOIR VOLUME

Design Storage Reservoir Depth (mm):	2400
Storage Chamber:	2100 CMP
Unit Storage Volume (m^3/m^2):	1.65
Storage Reservoir Volume (m^3):	1353

VOLUME CONTROL

Control Target - 25mm Storm (mm):	4.99
Runoff Volume Captured (mm):	5.00

UNDERDRAIN DEFAULTS

Orifice Coefficient:	0.60
Gravitational Constant (m/s^2):	9.81
Underdrain Diameter (mm):	200
Orifice Area (m^2):	0.0314

LID MODELING CALCUALTIONS

SURFACE

Berm Height (mm):	-
Vegetation Volume:	-
Surface Roughness:	-
Surface Slope (%):	-

STORAGE

Thickness (mm):	2400.00
Void Ratio (voids/solids):	0.69
Seepage Rate (mm/hr):	69.12
Clogging Factor:	0

DRAIN COEFFICIENT

Area Ratio:	0.00
Drain Coefficient:	NO DRAIN
Drain Exponent:	0.50
Drain Offset Height (mm):	0.00

LID USAGE

Number of Replicate Units:	1
% of Subcatchment Occupied:	100
Surface Width / Unit (m):	23
% Initially Saturated:	0
% of Impervious Area Treated:	100

NOTES:
1. PCSWMM subcatchment delineation to be revised so each UICS is its own subcatchment.
2. The UICS subcatchment ID is to reference the UICS ID (eg. UICS01).
3. The subcatchment tag for each UICS is to be the Park Name.
4. The minimum trench design depth is 622 mm. If the maximum storage reservoir depth calculation is less than 622 mm, the underdrain offset is to be set to the maximum storage reservoir depth. For maximum storage reservoir depths greater than 622 mm, there is no underdrain and the drain coefficient is set equal to 0.
5. The control target equals the runoff produced from the contributing area for the 25 mm design storm.

TATHAM ENGINEERING	Project: Barrie Drainage Master Plan	Date: 15-Jan-18
	File No.: 117076	Designed: DAM
	Subject: Conceptual Design - LID	Checked: DRT

CENTRALIZED LID DESIGN

WATERSHED: Whiskey Creek
PARK: Harvie Park
LID TYPE: Underground Infiltration Chamber System

Drainage Area (ha):	2.5
Impervious Drainage Area (ha):	1.0
Catchment ID:	UICS08
Infiltration Rate (mm/hr):	58.1
Design Safety Factor:	6.5
LID Foot Print Area (m^2):	275
Storm Sewer Inlet Invert (m):	311.31
Storm Sewer Outlet Invert (m):	N/A
Target Capture Ratio:	5:1 - 20:1
Capture Ratio:	38

LID SIZING CALCULATIONS

STORAGE RESERVOIR DEPTH	
Design Infiltration Rate (mm/hr):	9
Void Ratio for Stone Reservoir:	0.4
Drawdown Time (hr):	48
Maximum Storage Reservoir Depth (mm):	1072
STORAGE RESERVOIR VOLUME	
Design Storage Reservoir Depth (mm):	1050
Storage Chamber:	750 CMP
Unit Storage Volume (m^3/m^2):	0.66
Storage Reservoir Volume (m^3):	182
VOLUME CONTROL	
Control Target - 25 mm Storm (mm):	7.18
Runoff Volume Captured (mm):	7.20

UNDERDRAIN DEFAULTS	
Orifice Coefficient:	0.60
Gravitational Constant (m/s^2):	9.81
Underdrain Diameter (mm):	200
Orifice Area (m^2):	0.0314

LID MODELING CALCUALTIONS

SURFACE	
Berm Height (mm):	-
Vegetation Volume:	-
Surface Roughness:	-
Surface Slope (%):	-
STORAGE	
Thickness (mm):	1050.00
Void Ratio (voids/solids):	0.63
Seepage Rate (mm/hr):	8.42
Clogging Factor:	0
DRAIN COEFFICIENT	
Area Ratio:	0.00
Drain Coefficient:	NO DRAIN
Drain Exponent:	0.50
Drain Offset Height (mm):	0.00
LID USAGE	
Number of Replicate Units:	1
% of Subcatchment Occupied:	100
Surface Width / Unit (m):	25
% Initially Saturated:	0
% of Impervious Area Treated:	100

NOTES:
1. PCSWMM subcatchment delineation to be revised so each UICS is its own subcatchment.
2. The UICS subcatchment ID is to reference the UICS ID (eg. UICS01).
3. The subcatchment tag for each UICS is to be the Park Name.
4. The minimum trench design depth is 622 mm. If the maximum storage reservoir depth calculation is less than 622 mm, the underdrain offset is to be set to the maximum storage reservoir depth. For maximum storage reservoir depths greater than 622 mm, there is no underdrain and the drain coefficient is set equal to 0.
5. The control target equals the runoff produced from the contributing area for the 25 mm design storm.

TATHAM ENGINEERING	Project: Barrie Drainage Master Plan	Date: 15-Jan-18
	File No.: 117076	Designed: DAM
	Subject: Conceptual Design - LID	Checked: DRT

CENTRALIZED LID DESIGN

WATERSHED: Whiskey Creek
PARK: Mapleton Park
LID TYPE: Underground Infiltration Chamber System

Drainage Area (ha):	2.1
Impervious Drainage Area (ha):	1.1
Catchment ID:	UICS10
Infiltration Rate (mm/hr):	71.6
Design Safety Factor:	2.5
LID Foot Print Area (m^2):	215
Storm Sewer Inlet Invert (m):	308.93
Storm Sewer Outlet Invert (m):	N/A
Target Capture Ratio:	5:1 - 20:1
Capture Ratio:	49

LID SIZING CALCULATIONS

STORAGE RESERVOIR DEPTH	
Design Infiltration Rate (mm/hr):	29
Void Ratio for Stone Reservoir:	0.4
Drawdown Time (hr):	48
Maximum Storage Reservoir Depth (mm):	3436
STORAGE RESERVOIR VOLUME	
Design Storage Reservoir Depth (mm):	1384
Storage Chamber:	330XLHD
Unit Storage Volume (m^3/m^2):	0.84
Storage Reservoir Volume (m^3):	181
VOLUME CONTROL	
Control Target - 25 mm Storm (mm):	8.50
Runoff Volume Captured (mm):	8.67

UNDERDRAIN DEFAULTS	
Orifice Coefficient:	0.60
Gravitational Constant (m/s^2):	9.81
Underdrain Diameter (mm):	200
Orifice Area (m^2):	0.0314

LID MODELING CALCUALTIONS

SURFACE	
Berm Height (mm):	-
Vegetation Volume:	-
Surface Roughness:	-
Surface Slope (%):	-
STORAGE	
Thickness (mm):	1384.00
Void Ratio (voids/solids):	0.61
Seepage Rate (mm/hr):	18.40
Clogging Factor:	0
DRAIN COEFFICIENT	
Area Ratio:	0.00
Drain Coefficient:	NO DRAIN
Drain Exponent:	0.50
Drain Offset Height (mm):	0.00
LID USAGE	
Number of Replicate Units:	1
% of Subcatchment Occupied:	100
Surface Width / Unit (m):	22
% Initially Saturated:	0
% of Impervious Area Treated:	100

NOTES:
1. PCSWMM subcatchment delineation to be revised so each UICS is its own subcatchment.
2. The UICS subcatchment ID is to reference the UICS ID (eg. UICS01).
3. The subcatchment tag for each UICS is to be the Park Name.
4. The minimum trench design depth is 622 mm. If the maximum storage reservoir depth calculation is less than 622 mm, the underdrain offset is to be set to the maximum storage reservoir depth. For maximum storage reservoir depths greater than 622 mm, there is no underdrain and the drain coefficient is set equal to 0.
5. The control target equals the runoff produced from the contributing area for the 25 mm design storm.

TATHAM ENGINEERING	Project: Barrie Drainage Master Plan	Date: 15-Jan-18
	File No.: 117076	Designed: DAM
	Subject: Conceptual Design - LID	Checked: DRT

CENTRALIZED LID DESIGN

WATERSHED: Whiskey Creek
PARK: Montserrand Park
LID TYPE: Underground Infiltration Chamber System

Drainage Area (ha):	12.3
Impervious Drainage Area (ha):	6.1
Catchment ID:	UICS11
Infiltration Rate (mm/hr):	65.1
Design Safety Factor:	2.5
LID Foot Print Area (m^2):	583
Storm Sewer Inlet Invert (m):	303.40
Storm Sewer Outlet Invert (m):	N/A
Target Capture Ratio:	5:1 - 20:1
Capture Ratio:	104

LID SIZING CALCULATIONS

STORAGE RESERVOIR DEPTH	
Design Infiltration Rate (mm/hr):	26
Void Ratio for Stone Reservoir:	0.4
Drawdown Time (hr):	48
Maximum Storage Reservoir Depth (mm):	3124
STORAGE RESERVOIR VOLUME	
Design Storage Reservoir Depth (mm):	2400
Storage Chamber:	2100 CMP
Unit Storage Volume (m^3/m^2):	1.65
Storage Reservoir Volume (m^3):	962
VOLUME CONTROL	
Control Target - 25mm Storm (mm):	7.79
Runoff Volume Captured (mm):	7.79

UNDERDRAIN DEFAULTS	
Orifice Coefficient:	0.60
Gravitational Constant (m/s^2):	9.81
Underdrain Diameter (mm):	200
Orifice Area (m^2):	0.0314

LID MODELING CALCUALTIONS

SURFACE	
Berm Height (mm):	-
Vegetation Volume:	-
Surface Roughness:	-
Surface Slope (%):	-
STORAGE	
Thickness (mm):	2400.00
Void Ratio (voids/solids):	0.69
Seepage Rate (mm/hr):	12.89
Clogging Factor:	0
DRAIN COEFFICIENT	
Area Ratio:	0.00
Drain Coefficient:	NO DRAIN
Drain Exponent:	0.50
Drain Offset Height (mm):	0.00
LID USAGE	
Number of Replicate Units:	1
% of Subcatchment Occupied:	100
Surface Width / Unit (m):	18
% Initially Saturated:	0
% of Impervious Area Treated:	100

NOTES:
1. PCSWMM subcatchment delineation to be revised so each UICS is its own subcatchment.
2. The UICS subcatchment ID is to reference the UICS ID (eg. UICS01).
3. The subcatchment tag for each UICS is to be the Park Name.
4. The minimum trench design depth is 622 mm. If the maximum storage reservoir depth calculation is less than 622 mm, the underdrain offset is to be set to the maximum storage reservoir depth. For maximum storage reservoir depths greater than 622 mm, there is no underdrain and the drain coefficient is set equal to 0.
5. The control target equals the runoff produced from the contributing area for the 25 mm design storm.

TATHAM ENGINEERING	Project: Barrie Drainage Master Plan	Date: 15-Jan-18
	File No.: 117076	Designed: DAM
	Subject: Conceptual Design - LID	Checked: DRT

CENTRALIZED LID DESIGN

WATERSHED: Johnson
PARK: Shoreview Park
LID TYPE: Underground Infiltration Chamber System

Drainage Area (ha):	20.3
Impervious Drainage Area (ha):	6.4
Catchment ID:	UICS14
Infiltration Rate (mm/hr):	104.6
Design Safety Factor:	2.5
LID Foot Print Area (m^2):	575
Storm Sewer Inlet Invert (m):	244.38
Storm Sewer Outlet Invert (m):	N/A
Target Capture Ratio:	5:1 - 20:1
Capture Ratio:	112

LID SIZING CALCULATIONS

STORAGE RESERVOIR DEPTH	
Design Infiltration Rate (mm/hr):	42
Void Ratio for Stone Reservoir:	0.4
Drawdown Time (hr):	48
Maximum Storage Reservoir Depth (mm):	5023
STORAGE RESERVOIR VOLUME	
Design Storage Reservoir Depth (mm):	2400
Storage Chamber:	2100 CMP
Unit Storage Volume (m^3/m^2):	1.65
Storage Reservoir Volume (m^3):	949
VOLUME CONTROL	
Control Target - 25 mm Storm (mm):	4.65
Runoff Volume Captured (mm):	4.67

UNDERDRAIN DEFAULTS	
Orifice Coefficient:	0.60
Gravitational Constant (m/s^2):	9.81
Underdrain Diameter (mm):	200
Orifice Area (m^2):	0.0314

LID MODELING CALCUALTIONS

SURFACE	
Berm Height (mm):	-
Vegetation Volume:	-
Surface Roughness:	-
Surface Slope (%):	-
STORAGE	
Thickness (mm):	2400.00
Void Ratio (voids/solids):	0.69
Seepage Rate (mm/hr):	75.96
Clogging Factor:	0
DRAIN COEFFICIENT	
Area Ratio:	0.00
Drain Coefficient:	NO DRAIN
Drain Exponent:	0.50
Drain Offset Height (mm):	0.00
LID USAGE	
Number of Replicate Units:	1
% of Subcatchment Occupied:	100
Surface Width / Unit (m):	24
% Initially Saturated:	0
% of Impervious Area Treated:	100

NOTES:
1. PCSWMM subcatchment delineation to be revised so each UICS is its own subcatchment.
2. The UICS subcatchment ID is to reference the UICS ID (eg. UICS01).
3. The subcatchment tag for each UICS is to be the Park Name.
4. The minimum trench design depth is 622 mm. If the maximum storage reservoir depth calculation is less than 622 mm, the underdrain offset is to be set to the maximum storage reservoir depth. For maximum storage reservoir depths greater than 622 mm, there is no underdrain and the drain coefficient is set equal to 0.
5. The control target equals the runoff produced from the contributing area for the 25 mm design storm.

TATHAM ENGINEERING	Project: Barrie Drainage Master Plan	Date: September 2018
	File No.: 117076	Designed: DAM
	Subject: Conceptual Design - LID	Checked: DRT

CENTRALIZED LID DESIGN

WATERSHED: Kidds Creek
PARK: Sunnidale Park
LID TYPE: Underground Infiltration Chamber System

Drainage Area (ha):	7.7
Impervious Drainage Area (ha):	0.8
Catchment ID:	UICS15
Infiltration Rate (mm/hr):	76.1
Design Safety Factor:	2.5
LID Foot Print Area (m^2):	180
Storm Sewer Inlet Invert (m):	271.30
Storm Sewer Outlet Invert (m):	N/A
Target Capture Ratio:	5:1 - 20:1
Capture Ratio:	45

LID SIZING CALCULATIONS

STORAGE RESERVOIR DEPTH	
Design Infiltration Rate (mm/hr):	30
Void Ratio for Stone Reservoir:	0.4
Drawdown Time (hr):	48
Maximum Storage Reservoir Depth (mm):	3651
STORAGE RESERVOIR VOLUME	
Design Storage Reservoir Depth (mm):	1384
Storage Chamber:	330XLHD
Unit Storage Volume (m^3/m^2):	0.84
Storage Reservoir Volume (m^3):	151
VOLUME CONTROL	
Control Target - 25 mm Storm (mm):	1.94
Runoff Volume Captured (mm):	1.95
UNDERDRAIN DEFAULTS	
Orifice Coefficient:	0.60
Gravitational Constant (m/s^2):	9.81
Underdrain Diameter (mm):	200
Orifice Area (m^2):	0.0314

LID MODELING CALCUALTIONS

SURFACE	
Berm Height (mm):	-
Vegetation Volume:	-
Surface Roughness:	-
Surface Slope (%):	-
STORAGE	
Thickness (mm):	1384.00
Void Ratio (voids/solids):	0.61
Seepage Rate (mm/hr):	23.08
Clogging Factor:	0
DRAIN COEFFICIENT	
Area Ratio:	0.00
Drain Coefficient:	NO DRAIN
Drain Exponent:	0.50
Drain Offset Height (mm):	0.00
LID USAGE	
Number of Replicate Units:	1
% of Subcatchment Occupied:	100
Surface Width / Unit (m):	16
% Initially Saturated:	0
% of Impervious Area Treated:	100

NOTES:
1. PCSWMM subcatchment delineation to be revised so each UICS is its own subcatchment.
2. The UICS subcatchment ID is to reference the UICS ID (eg. UICS01).
3. The subcatchment tag for each UICS is to be the Park Name.
4. The minimum trench design depth is 622 mm. If the maximum storage reservoir depth calculation is less than 622 mm, the underdrain offset is to be set to the maximum storage reservoir depth. For maximum storage reservoir depths greater than 622 mm, there is no underdrain and the drain coefficient is set equal to 0.
5. The control target equals the runoff produced from the contributing area for the 25 mm design storm.

TATHAM ENGINEERING	Project: Barrie Drainage Master Plan	Date: 9-Jan-18
	File No.: 117076	Designed: NHF
	Subject: Conceptual Design - LID	Checked: DRT

CENTRALIZED LID DESIGN

WATERSHED: Lovers Creek
PARK: Carter Park
LID TYPE: Underground Infiltration Chamber System

Drainage Area (ha):	4.6
Impervious Drainage Area (ha):	1.8
Catchment ID:	UICS18
Infiltration Rate (mm/hr):	85
Design Safety Factor:	3.5
LID Foot Print Area (m^2):	190
Storm Sewer Inlet Invert (m):	239.29
Storm Sewer Outlet Invert (m):	N/A
Target Capture Ratio:	5:1 - 20:1
Capture Ratio:	0.01

LID SIZING CALCULATIONS

STORAGE RESERVOIR DEPTH

Design Infiltration Rate (mm/hr):	24
Void Ratio for Stone Reservoir:	0.4
Drawdown Time (hr):	48
Maximum Storage Reservoir Depth (mm):	2914

STORAGE RESERVOIR VOLUME

Design Storage Reservoir Depth (mm):	2400
Storage Chamber:	2100 CMP
Unit Storage Volume (m^3/m^2):	1.65
Storage Reservoir Volume (m^3):	314

VOLUME CONTROL

Control Target - 25 mm Storm (mm):	6.80
Runoff Volume Captured (mm):	6.76

UNDERDRAIN DEFAULTS

Orifice Coefficient:	0.60
Gravitational Constant (m/s^2):	9.81
Underdrain Diameter (mm):	200
Orifice Area (m^2):	0.0314

LID MODELING CALCULATIONS

SURFACE

Berm Height (mm):	-
Vegetation Volume:	-
Surface Roughness:	-
Surface Slope (%):	-

STORAGE

Thickness (mm):	2400.00
Void Ratio (voids/solids):	0.69
Seepage Rate (mm/hr):	35.71
Clogging Factor:	0

DRAIN COEFFICIENT

Area Ratio:	0.00
Drain Coefficient:	NO DRAIN
Drain Exponent:	0.50
Drain Offset Height (mm):	0.00

LID USAGE

Number of Replicate Units:	1
% of Subcatchment Occupied:	100
Surface Width / Unit (m):	5
% Initially Saturated:	0
% of Impervious Area Treated:	100

NOTES:
1. PCSWMM subcatchment delineation to be revised so each UICS is its own subcatchment.
2. The UICS subcatchment ID is to reference the UICS ID (eg. UICS01).
3. The subcatchment tag for each UICS is to be the Park Name.
4. The minimum trench design depth is 622 mm. If the maximum storage reservoir depth calculation is less than 622 mm, the underdrain offset is to be set to the maximum storage reservoir depth. For maximum storage reservoir depths greater than 622 mm, there is no underdrain and the drain coefficient is set equal to 0.
5. The control target equals the runoff produced from the contributing area for the 25 mm design storm.

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	Subject: Conceptual Design - LID	Checked: DRT

CENTRALIZED LID DESIGN

WATERSHED: Lovers Creek
PARK: Golden Meadow Park
LID TYPE: Underground Infiltration Chamber System

Drainage Area (ha):	34.0
Impervious Drainage Area (ha):	16.4
Catchment ID:	UICS21
Infiltration Rate (mm/hr):	72
Design Safety Factor:	3.5
LID Foot Print Area (m^2):	1450
Storm Sewer Inlet Invert (m):	240.33
Storm Sewer Outlet Invert (m):	N/A
Target Capture Ratio:	5:1 - 20:1
Capture Ratio:	113.30

LID SIZING CALCULATIONS

STORAGE RESERVOIR DEPTH

Design Infiltration Rate (mm/hr):	21
Void Ratio for Stone Reservoir:	0.4
Drawdown Time (hr):	48
Maximum Storage Reservoir Depth (mm):	2469

STORAGE RESERVOIR VOLUME

Design Storage Reservoir Depth (mm):	2400
Storage Chamber:	2100 CMP
Unit Storage Volume (m^3/m^2):	1.65
Storage Reservoir Volume (m^3):	2393

VOLUME CONTROL

Control Target - 25 mm Storm (mm):	7.00
Runoff Volume Captured (mm):	7.04

UNDERDRAIN DEFAULTS

Orifice Coefficient:	0.60
Gravitational Constant (m/s^2):	9.81
Underdrain Diameter (mm):	200
Orifice Area (m^2):	0.0314

LID MODELING CALCULATIONS

SURFACE

Berm Height (mm):	-
Vegetation Volume:	-
Surface Roughness:	-
Surface Slope (%):	-

STORAGE

Thickness (mm):	2400.00
Void Ratio (voids/solids):	0.69
Seepage Rate (mm/hr):	18.40
Clogging Factor:	0

DRAIN COEFFICIENT

Area Ratio:	0.00
Drain Coefficient:	NO DRAIN
Drain Exponent:	0.50
Drain Offset Height (mm):	0.00

LID USAGE

Number of Replicate Units:	1
% of Subcatchment Occupied:	100
Surface Width / Unit (m):	35
% Initially Saturated:	0
% of Impervious Area Treated:	100

NOTES:

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3. The subcatchment tag for each UICS is to be the Park Name.
4. The minimum trench design depth is 622 mm. If the maximum storage reservoir depth calculation is less than 622 mm, the underdrain offset is to be set to the maximum storage reservoir depth. For maximum storage reservoir depths greater than 622 mm, there is no underdrain and the drain coefficient is set equal to 0.
5. The control target equals the runoff produced from the contributing area for the 25 mm design storm.

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CENTRALIZED LID DESIGN

WATERSHED: Lovers Creek / Hewitts Creek
PARK: Kuzmich Park
LID TYPE: Underground Infiltration Chamber System

Drainage Area (ha):	1.3
Impervious Drainage Area (ha):	0.6
Catchment ID:	UICS 22
Infiltration Rate (mm/hr):	122
Design Safety Factor:	2.5
LID Foot Print Area (m^2):	175
Storm Sewer Inlet Invert (m):	257.55
Storm Sewer Outlet Invert (m):	N/A
Target Capture Ratio:	5:1 - 20:1
Capture Ratio:	36.57

LID SIZING CALCULATIONS

STORAGE RESERVOIR DEPTH

Design Infiltration Rate (mm/hr):	49
Void Ratio for Stone Reservoir:	0.4
Drawdown Time (hr):	48
Maximum Storage Reservoir Depth (mm):	5856

STORAGE RESERVOIR VOLUME

Design Storage Reservoir Depth (mm):	1050
Storage Chamber:	750 CMP
Unit Storage Volume (m^3/m^2):	0.66
Storage Reservoir Volume (m^3):	116

VOLUME CONTROL

Control Target - 25 mm Storm (mm):	8.92
Runoff Volume Captured (mm):	9.23

UNDERDRAIN DEFAULTS

Orifice Coefficient:	0.60
Gravitational Constant (m/s^2):	9.81
Underdrain Diameter (mm):	200
Orifice Area (m^2):	0.0314

LID MODELING CALCULATIONS

SURFACE

Berm Height (mm):	-
Vegetation Volume:	-
Surface Roughness:	-
Surface Slope (%):	-

STORAGE

Thickness (mm):	1050.00
Void Ratio (voids/solids):	0.63
Seepage Rate (mm/hr):	133.56
Clogging Factor:	0

DRAIN COEFFICIENT

Area Ratio:	0.00
Drain Coefficient:	NO DRAIN
Drain Exponent:	0.50
Drain Offset Height (mm):	0.00

LID USAGE

Number of Replicate Units:	1
% of Subcatchment Occupied:	100
Surface Width / Unit (m):	12
% Initially Saturated:	0
% of Impervious Area Treated:	100

NOTES:
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3. The subcatchment tag for each UICS is to be the Park Name.
4. The minimum trench design depth is 622 mm. If the maximum storage reservoir depth calculation is less than 622 mm, the underdrain offset is to be set to the maximum storage reservoir depth. For maximum storage reservoir depths greater than 622 mm, there is no underdrain and the drain coefficient is set equal to 0.
5. The control target equals the runoff produced from the contributing area for the 25 mm design storm.

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	Subject: Conceptual Design - LID	Checked: DRT

CENTRALIZED LID DESIGN

WATERSHED: Lovers Creek
PARK: Madelaine Park
LID TYPE: Underground Infiltration Chamber System

Drainage Area (ha):	5.6
Impervious Drainage Area (ha):	2.9
Catchment ID:	UICS 23
Infiltration Rate (mm/hr):	80
Design Safety Factor:	3.5
LID Foot Print Area (m^2):	295
Storm Sewer Inlet Invert (m):	251.05
Storm Sewer Outlet Invert (m):	N/A
Target Capture Ratio:	5:1 - 20:1
Capture Ratio:	99.63

LID SIZING CALCULATIONS

STORAGE RESERVOIR DEPTH

Design Infiltration Rate (mm/hr):	23
Void Ratio for Stone Reservoir:	0.4
Drawdown Time (hr):	48
Maximum Storage Reservoir Depth (mm):	2743

STORAGE RESERVOIR VOLUME

Design Storage Reservoir Depth (mm):	2400
Storage Chamber:	2100 CMP
Unit Storage Volume (m^3/m^2):	1.65
Storage Reservoir Volume (m^3):	487

VOLUME CONTROL

Control Target - 25 mm Storm (mm):	8.68
Runoff Volume Captured (mm):	8.68

UNDERDRAIN DEFAULTS

Orifice Coefficient:	0.60
Gravitational Constant (m/s^2):	9.81
Underdrain Diameter (mm):	200
Orifice Area (m^2):	0.0314

LID MODELING CALCULATIONS

SURFACE

Berm Height (mm):	-
Vegetation Volume:	-
Surface Roughness:	-
Surface Slope (%):	-

STORAGE

Thickness (mm):	2400.00
Void Ratio (voids/solids):	0.69
Seepage Rate (mm/hr):	27.65
Clogging Factor:	0

DRAIN COEFFICIENT

Area Ratio:	0.00
Drain Coefficient:	NO DRAIN
Drain Exponent:	0.50
Drain Offset Height (mm):	0.00

LID USAGE

Number of Replicate Units:	1
% of Subcatchment Occupied:	100
Surface Width / Unit (m):	17
% Initially Saturated:	0
% of Impervious Area Treated:	100

NOTES:
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3. The subcatchment tag for each UICS is to be the Park Name.
4. The minimum trench design depth is 622 mm. If the maximum storage reservoir depth calculation is less than 622 mm, the underdrain offset is to be set to the maximum storage reservoir depth. For maximum storage reservoir depths greater than 622 mm, there is no underdrain and the drain coefficient is set equal to 0.
5. The control target equals the runoff produced from the contributing area for the 25 mm design storm.

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	Subject: Conceptual Design - LID	Checked: DRT

CENTRALIZED LID DESIGN

WATERSHED: Hewitts Creek
PARK: Queensway / Hyde Park
LID TYPE: Underground Infiltration Chamber System

Drainage Area (ha):	42.3
Impervious Drainage Area (ha):	14.2
Catchment ID:	UICS 24
Infiltration Rate (mm/hr):	73
Design Safety Factor:	3.5
LID Foot Print Area (m^2):	1370
Storm Sewer Inlet Invert (m):	252.29
Storm Sewer Outlet Invert (m):	N/A
Target Capture Ratio:	5:1 - 20:1
Capture Ratio:	103.47

LID SIZING CALCULATIONS

STORAGE RESERVOIR DEPTH

Design Infiltration Rate (mm/hr):	21
Void Ratio for Stone Reservoir:	0.4
Drawdown Time (hr):	48
Maximum Storage Reservoir Depth (mm):	2503

STORAGE RESERVOIR VOLUME

Design Storage Reservoir Depth (mm):	2400
Storage Chamber:	2100 CMP
Unit Storage Volume (m^3/m^2):	1.64
Storage Reservoir Volume (m^3):	2247

VOLUME CONTROL

Control Target - 25 mm Storm (mm):	5.30
Runoff Volume Captured (mm):	5.31

UNDERDRAIN DEFAULTS

Orifice Coefficient:	0.60
Gravitational Constant (m/s^2):	9.81
Underdrain Diameter (mm):	200
Orifice Area (m^2):	0.0314

LID MODELING CALCULATIONS

SURFACE

Berm Height (mm):	-
Vegetation Volume:	-
Surface Roughness:	-
Surface Slope (%):	-

STORAGE

Thickness (mm):	2400.00
Void Ratio (voids/solids):	0.68
Seepage Rate (mm/hr):	19.94
Clogging Factor:	0

DRAIN COEFFICIENT

Area Ratio:	0.00
Drain Coefficient:	NO DRAIN
Drain Exponent:	0.50
Drain Offset Height (mm):	0.00

LID USAGE

Number of Replicate Units:	1
% of Subcatchment Occupied:	100
Surface Width / Unit (m):	26
% Initially Saturated:	0
% of Impervious Area Treated:	100

NOTES:

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3. The subcatchment tag for each UICS is to be the Park Name.
4. The minimum trench design depth is 622 mm. If the maximum storage reservoir depth calculation is less than 622 mm, the underdrain offset is to be set to the maximum storage reservoir depth. For maximum storage reservoir depths greater than 622 mm, there is no underdrain and the drain coefficient is set equal to 0.
5. The control target equals the runoff produced from the contributing area for the 25 mm design storm.

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	Subject: Conceptual Design - LID	Checked: DRT

CENTRALIZED LID DESIGN

WATERSHED: Hewitts Creek
PARK: Sandringham Park
LID TYPE: Underground Infiltration Chamber System

Drainage Area (ha):	79.4
Impervious Drainage Area (ha):	25.4
Catchment ID:	UICS 25
Infiltration Rate (mm/hr):	77
Design Safety Factor:	3.5
LID Foot Print Area (m^2):	2390
Storm Sewer Inlet Invert (m):	240.61
Storm Sewer Outlet Invert (m):	N/A
Target Capture Ratio:	5:1 - 20:1
Capture Ratio:	106.28

LID SIZING CALCULATIONS

STORAGE RESERVOIR DEPTH

Design Infiltration Rate (mm/hr):	22
Void Ratio for Stone Reservoir:	0.4
Drawdown Time (hr):	48
Maximum Storage Reservoir Depth (mm):	2640

STORAGE RESERVOIR VOLUME

Design Storage Reservoir Depth (mm):	1500
Storage Chamber:	1200 CMP
Unit Storage Volume (m^3/m^2):	0.98
Storage Reservoir Volume (m^3):	2342

VOLUME CONTROL

Control Target - 25 mm Storm (mm):	4.91
Runoff Volume Captured (mm):	2.95

UNDERDRAIN DEFAULTS

Orifice Coefficient:	0.60
Gravitational Constant (m/s^2):	9.81
Underdrain Diameter (mm):	200
Orifice Area (m^2):	0.0314

LID MODELING CALCULATIONS

SURFACE

Berm Height (mm):	-
Vegetation Volume:	-
Surface Roughness:	-
Surface Slope (%):	-

STORAGE

Thickness (mm):	1500.00
Void Ratio (voids/solids):	0.65
Seepage Rate (mm/hr):	24.52
Clogging Factor:	0

DRAIN COEFFICIENT

Area Ratio:	0.00
Drain Coefficient:	NO DRAIN
Drain Exponent:	0.50
Drain Offset Height (mm):	0.00

LID USAGE

Number of Replicate Units:	1
% of Subcatchment Occupied:	100
Surface Width / Unit (m):	40
% Initially Saturated:	0
% of Impervious Area Treated:	100

NOTES:
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3. The subcatchment tag for each UICS is to be the Park Name.
4. The minimum trench design depth is 622 mm. If the maximum storage reservoir depth calculation is less than 622 mm, the underdrain offset is to be set to the maximum storage reservoir depth. For maximum storage reservoir depths greater than 622 mm, there is no underdrain and the drain coefficient is set equal to 0.
5. The control target equals the runoff produced from the contributing area for the 25 mm design storm.

TATHAM ENGINEERING	Project: Barrie Drainage Master Plan	Date: 15-Jan-18
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	Subject: Conceptual Design - LID	Checked: DRT

CENTRALIZED LID DESIGN

WATERSHED: Bear Creek
PARK: Bear Creek Park
LID TYPE: Underground Infiltration Chamber System

Drainage Area (ha):	73.0
Impervious Drainage Area (ha):	36.4
Catchment ID:	UICS 28
Infiltration Rate (mm/hr):	64.0
Design Safety Factor:	6.5
LID Foot Print Area (m^2):	7000
Storm Sewer Inlet Invert (m):	295.67
Storm Sewer Outlet Invert (m):	N/A
Target Capture Ratio:	5:1 - 20:1
Capture Ratio:	51.94

LID SIZING CALCULATIONS

STORAGE RESERVOIR DEPTH	
Design Infiltration Rate (mm/hr):	10
Void Ratio for Stone Reservoir:	0.4
Drawdown Time (hr):	48
Maximum Storage Reservoir Depth (mm):	1182
STORAGE RESERVOIR VOLUME	
Design Storage Reservoir Depth (mm):	1050
Storage Chamber:	750 CMP
Unit Storage Volume (m^3/m^2):	0.66
Storage Reservoir Volume (m^3):	4620
VOLUME CONTROL	
Control Target - 25 mm Storm (mm):	6.29
Runoff Volume Captured (mm):	6.33

UNDERDRAIN DEFAULTS	
Orifice Coefficient:	0.60
Gravitational Constant (m/s^2):	9.81
Underdrain Diameter (mm):	200
Orifice Area (m^2):	0.0314

LID MODELING CALCUALTIONS

SURFACE	
Berm Height (mm):	-
Vegetation Volume:	-
Surface Roughness:	-
Surface Slope (%):	-
STORAGE	
Thickness (mm):	1050.00
Void Ratio (voids/solids):	0.63
Seepage Rate (mm/hr):	12.28
Clogging Factor:	0
DRAIN COEFFICIENT	
Area Ratio:	0.00
Drain Coefficient:	NO DRAIN
Drain Exponent:	0.50
Drain Offset Height (mm):	0.00
LID USAGE	
Number of Replicate Units:	1
% of Subcatchment Occupied:	100
Surface Width / Unit (m):	64
% Initially Saturated:	0
% of Impervious Area Treated:	100

NOTES:
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3. The subcatchment tag for each UICS is to be the Park Name.
4. The minimum trench design depth is 622 mm. If the maximum storage reservoir depth calculation is less than 622 mm, the underdrain offset is to be set to the maximum storage reservoir depth. For maximum storage reservoir depths greater than 622 mm, there is no underdrain and the drain coefficient is set equal to 0.
5. The control target equals the runoff produced from the contributing area for the 25 mm design storm.

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	Subject: Conceptual Design - LID	Checked: DRT

CENTRALIZED LID DESIGN

WATERSHED: Little Lake
PARK: Cartwright Park
LID TYPE: Underground Infiltration Chamber System

Drainage Area (ha):	3.1
Impervious Drainage Area (ha):	1.5
Catchment ID:	UICS 29
Infiltration Rate (mm/hr):	82.0
Design Safety Factor:	3.5
LID Foot Print Area (m^2):	300
Storm Sewer Inlet Invert (m):	267.91
Storm Sewer Outlet Invert (m):	N/A
Target Capture Ratio:	5:1 - 20:1
Capture Ratio:	51.40

LID SIZING CALCULATIONS

STORAGE RESERVOIR DEPTH

Design Infiltration Rate (mm/hr):	23
Void Ratio for Stone Reservoir:	0.4
Drawdown Time (hr):	48
Maximum Storage Reservoir Depth (mm):	2811

STORAGE RESERVOIR VOLUME

Design Storage Reservoir Depth (mm):	1079
Storage Chamber:	330XLHD
Unit Storage Volume (m^3/m^2):	0.71
Storage Reservoir Volume (m^3):	213

VOLUME CONTROL

Control Target - 25 mm Storm (mm):	6.74
Runoff Volume Captured (mm):	6.84

UNDERDRAIN DEFAULTS

Orifice Coefficient:	0.60
Gravitational Constant (m/s^2):	9.81
Underdrain Diameter (mm):	200
Orifice Area (m^2):	0.0314

LID MODELING CALCUALTIONS

SURFACE

Berm Height (mm):	-
Vegetation Volume:	-
Surface Roughness:	-
Surface Slope (%):	-

STORAGE

Thickness (mm):	1079.00
Void Ratio (voids/solids):	0.66
Seepage Rate (mm/hr):	30.74
Clogging Factor:	0

DRAIN COEFFICIENT

Area Ratio:	0.00
Drain Coefficient:	NO DRAIN
Drain Exponent:	0.50
Drain Offset Height (mm):	0.00

LID USAGE

Number of Replicate Units:	1
% of Subcatchment Occupied:	100
Surface Width / Unit (m):	20
% Initially Saturated:	0
% of Impervious Area Treated:	100

NOTES:
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3. The subcatchment tag for each UICS is to be the Park Name.
4. The minimum trench design depth is 622 mm. If the maximum storage reservoir depth calculation is less than 622 mm, the underdrain offset is to be set to the maximum storage reservoir depth. For maximum storage reservoir depths greater than 622 mm, there is no underdrain and the drain coefficient is set equal to 0.
5. The control target equals the runoff produced from the contributing area for the 25 mm design storm.

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CENTRALIZED LID DESIGN

WATERSHED: Georgian Creek
PARK: Dunsmore Park
LID TYPE: Underground Infiltration Chamber System

Drainage Area (ha):	16.1
Impervious Drainage Area (ha):	6.2
Catchment ID:	UICS 31
Infiltration Rate (mm/hr):	64.0
Design Safety Factor:	6.5
LID Foot Print Area (m^2):	1410
Storm Sewer Inlet Invert (m):	255.08
Storm Sewer Outlet Invert (m):	N/A
Target Capture Ratio:	5:1 - 20:1
Capture Ratio:	43.81

LID SIZING CALCULATIONS

STORAGE RESERVOIR DEPTH	
Design Infiltration Rate (mm/hr):	10
Void Ratio for Stone Reservoir:	0.4
Drawdown Time (hr):	48
Maximum Storage Reservoir Depth (mm):	1182
STORAGE RESERVOIR VOLUME	
Design Storage Reservoir Depth (mm):	1050
Storage Chamber:	750 CMP
Unit Storage Volume (m^3/m^2):	0.66
Storage Reservoir Volume (m^3):	931
VOLUME CONTROL	
Control Target - 25 mm Storm (mm):	5.76
Runoff Volume Captured (mm):	5.78

UNDERDRAIN DEFAULTS	
Orifice Coefficient:	0.60
Gravitational Constant (m/s^2):	9.81
Underdrain Diameter (mm):	200
Orifice Area (m^2):	0.0314

LID MODELING CALCUALTIONS

SURFACE	
Berm Height (mm):	-
Vegetation Volume:	-
Surface Roughness:	-
Surface Slope (%):	-
STORAGE	
Thickness (mm):	1050.00
Void Ratio (voids/solids):	0.63
Seepage Rate (mm/hr):	12.28
Clogging Factor:	0
DRAIN COEFFICIENT	
Area Ratio:	0.00
Drain Coefficient:	NO DRAIN
Drain Exponent:	0.50
Drain Offset Height (mm):	0.00
LID USAGE	
Number of Replicate Units:	1
% of Subcatchment Occupied:	100
Surface Width / Unit (m):	29
% Initially Saturated:	0
% of Impervious Area Treated:	100

NOTES:
1. PCSWMM subcatchment delineation to be revised so each UICS is its own subcatchment.
2. The UICS subcatchment ID is to reference the UICS ID (eg. UICS01).
3. The subcatchment tag for each UICS is to be the Park Name.
4. The minimum trench design depth is 622 mm. If the maximum storage reservoir depth calculation is less than 622 mm, the underdrain offset is to be set to the maximum storage reservoir depth. For maximum storage reservoir depths greater than 622 mm, there is no underdrain and the drain coefficient is set equal to 0.
5. The control target equals the runoff produced from the contributing area for the 25 mm design storm.

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CENTRALIZED LID DESIGN

WATERSHED: Bear Creek
PARK: Lougheed Park
LID TYPE: Underground Infiltration Chamber System

Drainage Area (ha):	14.6
Impervious Drainage Area (ha):	7.4
Catchment ID:	UICS 35
Infiltration Rate (mm/hr):	64.0
Design Safety Factor:	6.5
LID Foot Print Area (m^2):	1520
Storm Sewer Inlet Invert (m):	287.07
Storm Sewer Outlet Invert (m):	N/A
Target Capture Ratio:	5:1 - 20:1
Capture Ratio:	48.69

LID SIZING CALCULATIONS

STORAGE RESERVOIR DEPTH	
Design Infiltration Rate (mm/hr):	10
Void Ratio for Stone Reservoir:	0.4
Drawdown Time (hr):	48
Maximum Storage Reservoir Depth (mm):	1182

STORAGE RESERVOIR VOLUME	
Design Storage Reservoir Depth (mm):	1050
Storage Chamber:	750 CMP
Unit Storage Volume (m^3/m^2):	0.66
Storage Reservoir Volume (m^3):	1003

VOLUME CONTROL	
Control Target - 25 mm Storm (mm):	6.84
Runoff Volume Captured (mm):	6.86

UNDERDRAIN DEFAULTS	
Orifice Coefficient:	0.60
Gravitational Constant (m/s^2):	9.81
Underdrain Diameter (mm):	200
Orifice Area (m^2):	0.0314

LID MODELING CALCUALTIONS

SURFACE	
Berm Height (mm):	-
Vegetation Volume:	-
Surface Roughness:	-
Surface Slope (%):	-

STORAGE	
Thickness (mm):	1050.00
Void Ratio (voids/solids):	0.63
Seepage Rate (mm/hr):	12.28
Clogging Factor:	0

DRAIN COEFFICIENT	
Area Ratio:	0.00
Drain Coefficient:	NO DRAIN
Drain Exponent:	0.50
Drain Offset Height (mm):	0.00

LID USAGE	
Number of Replicate Units:	1
% of Subcatchment Occupied:	100
Surface Width / Unit (m):	32
% Initially Saturated:	0
% of Impervious Area Treated:	100

NOTES:
1. PCSWMM subcatchment delineation to be revised so each UICS is its own subcatchment.
2. The UICS subcatchment ID is to reference the UICS ID (eg. UICS01).
3. The subcatchment tag for each UICS is to be the Park Name.
4. The minimum trench design depth is 622 mm. If the maximum storage reservoir depth calculation is less than 622 mm, the underdrain offset is to be set to the maximum storage reservoir depth. For maximum storage reservoir depths greater than 622 mm, there is no underdrain and the drain coefficient is set equal to 0.
5. The control target equals the runoff produced from the contributing area for the 25 mm design storm.

TATHAM ENGINEERING	Project: Barrie Drainage Master Plan	Date: 15-Jan-18
	File No.: 117076	Designed: ASB
	Subject: Conceptual Design - LID	Checked: DRT

CENTRALIZED LID DESIGN

WATERSHED: Georgian Creek
PARK: Strabane Park
LID TYPE: Underground Infiltration Chamber System

Drainage Area (ha):	4.9
Impervious Drainage Area (ha):	1.8
Catchment ID:	UICS 37
Infiltration Rate (mm/hr):	101.0
Design Safety Factor:	3.5
LID Foot Print Area (m^2):	320
Storm Sewer Inlet Invert (m):	264.08
Storm Sewer Outlet Invert (m):	N/A
Target Capture Ratio:	5:1 - 20:1
Capture Ratio:	56.31

LID SIZING CALCULATIONS

STORAGE RESERVOIR DEPTH

Design Infiltration Rate (mm/hr):	29
Void Ratio for Stone Reservoir:	0.4
Drawdown Time (hr):	48
Maximum Storage Reservoir Depth (mm):	3463

STORAGE RESERVOIR VOLUME

Design Storage Reservoir Depth (mm):	1200
Storage Chamber:	900 CMP
Unit Storage Volume (m^3/m^2):	0.76
Storage Reservoir Volume (m^3):	243

VOLUME CONTROL

Control Target - 25 mm Storm (mm):	4.95
Runoff Volume Captured (mm):	5.00

UNDERDRAIN DEFAULTS

Orifice Coefficient:	0.60
Gravitational Constant (m/s^2):	9.81
Underdrain Diameter (mm):	200
Orifice Area (m^2):	0.0314

LID MODELING CALCUALTIONS

SURFACE

Berm Height (mm):	-
Vegetation Volume:	-
Surface Roughness:	-
Surface Slope (%):	-

STORAGE

Thickness (mm):	1200.00
Void Ratio (voids/solids):	0.63
Seepage Rate (mm/hr):	66.24
Clogging Factor:	0

DRAIN COEFFICIENT

Area Ratio:	0.00
Drain Coefficient:	NO DRAIN
Drain Exponent:	0.50
Drain Offset Height (mm):	0.00

LID USAGE

Number of Replicate Units:	1
% of Subcatchment Occupied:	100
Surface Width / Unit (m):	20
% Initially Saturated:	0
% of Impervious Area Treated:	100

NOTES:
1. PCSWMM subcatchment delineation to be revised so each UICS is its own subcatchment.
2. The UICS subcatchment ID is to reference the UICS ID (eg. UICS01).
3. The subcatchment tag for each UICS is to be the Park Name.
4. The minimum trench design depth is 622 mm. If the maximum storage reservoir depth calculation is less than 622 mm, the underdrain offset is to be set to the maximum storage reservoir depth. For maximum storage reservoir depths greater than 622 mm, there is no underdrain and the drain coefficient is set equal to 0.
5. The control target equals the runoff produced from the contributing area for the 25 mm design storm.

TATHAM ENGINEERING	Project: Barrie Drainage Master Plan	Date: 15-Jan-18
	File No.: 117076	Designed: ASB
	Subject: Conceptual Design - LID	Checked: DRT

CENTRALIZED LID DESIGN

WATERSHED: Bear Creek
PARK: Wessenger Park
LID TYPE: Underground Infiltration Chamber System

Drainage Area (ha):	9.3
Impervious Drainage Area (ha):	5.0
Catchment ID:	UICS 38
Infiltration Rate (mm/hr):	57.0
Design Safety Factor:	6.5
LID Foot Print Area (m^2):	970
Storm Sewer Inlet Invert (m):	306.26
Storm Sewer Outlet Invert (m):	N/A
Target Capture Ratio:	5:1 - 20:1
Capture Ratio:	51.87

LID SIZING CALCULATIONS

STORAGE RESERVOIR DEPTH	
Design Infiltration Rate (mm/hr):	9
Void Ratio for Stone Reservoir:	0.4
Drawdown Time (hr):	48
Maximum Storage Reservoir Depth (mm):	1052

STORAGE RESERVOIR VOLUME	
Design Storage Reservoir Depth (mm):	1050
Storage Chamber:	750 CMP
Unit Storage Volume (m^3/m^2):	0.66
Storage Reservoir Volume (m^3):	640

VOLUME CONTROL	
Control Target - 25 mm Storm (mm):	6.82
Runoff Volume Captured (mm):	6.88

UNDERDRAIN DEFAULTS	
Orifice Coefficient:	0.60
Gravitational Constant (m/s^2):	9.81
Underdrain Diameter (mm):	200
Orifice Area (m^2):	0.0314

LID MODELING CALCUALTIONS

SURFACE	
Berm Height (mm):	-
Vegetation Volume:	-
Surface Roughness:	-
Surface Slope (%):	-

STORAGE	
Thickness (mm):	1050.00
Void Ratio (voids/solids):	0.63
Seepage Rate (mm/hr):	7.70
Clogging Factor:	0

DRAIN COEFFICIENT	
Area Ratio:	0.00
Drain Coefficient:	NO DRAIN
Drain Exponent:	0.50
Drain Offset Height (mm):	0.00

LID USAGE	
Number of Replicate Units:	1
% of Subcatchment Occupied:	100
Surface Width / Unit (m):	22
% Initially Saturated:	0
% of Impervious Area Treated:	100

NOTES:
1. PCSWMM subcatchment delineation to be revised so each UICS is its own subcatchment.
2. The UICS subcatchment ID is to reference the UICS ID (eg. UICS01).
3. The subcatchment tag for each UICS is to be the Park Name.
4. The minimum trench design depth is 622 mm. If the maximum storage reservoir depth calculation is less than 622 mm, the underdrain offset is to be set to the maximum storage reservoir depth. For maximum storage reservoir depths greater than 622 mm, there is no underdrain and the drain coefficient is set equal to 0.
5. The control target equals the runoff produced from the contributing area for the 25 mm design storm.

Appendix P:
Geotechnical Investigation

Peto MacCallum Ltd.
CONSULTING ENGINEERS

PRELIMINARY GEOTECHNICAL INVESTIGATION
CITY OF BARRIE MASTER DRAINAGE PLAN UPDATE
BARRIE, ONTARIO

for

C.C. TATHAM & ASSOCIATES LTD.

PETO MacCALLUM LTD.
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PML Ref.: 17BF024
Report: 1
January 2018

Peto MacCallum Ltd.
CONSULTING ENGINEERS

January 31, 2018

PML Ref.: 17BF024
Report: 1

Mr. Daniel Twigger, P.Eng.
C.C. Tatham & Associates Ltd.
115 Sandford Fleming Drive
Suite 200
Collingwood, Ontario
L9Y 5A6

Dear Mr. Twigger

Preliminary Geotechnical Investigation
City of Barrie Master Drainage Plan Update
Barrie, Ontario

Peto MacCallum Ltd. (PML) is pleased to present the results of the preliminary geotechnical investigation recently completed at the above noted project site. Authorization for the work described in this report was provided by Mr. D. Twigger, in an email dated April 21, 2017.

The City of Barrie is proposing to update the Master Drainage Plan. As part of the update, 43 deficient culverts, slated for upgrade, require preliminary geotechnical investigation. Also, infiltration facilities/strategies are being considered in some parks and Storm Water Management (SWM) facilities.

Upon further review, the number of culverts to be investigated was reduced to 34 by the Client and PML, as existing borehole information was present at some locations and the Client deduced that some culverts were not deficient. All culvert locations are shown on Drawings 1 to 4, appended.

Permeability testing was requested at 14 potential SWM pond retrofit locations and in 22 City parks, where Low Impact Development (LID) facilities are being considered. Test locations at these 36 sites are shown on Drawings 5 to 13, appended.

The purpose of this report was to review previously completed boreholes and conduct a supplementary program of additional boreholes, in order to assess/compile the generalized soil and ground water conditions throughout the City of Barrie's watersheds at select culvert sites. Based on this information, a preliminary assessment of the subsurface conditions at the proposed culvert replacement locations is to be provided. As well, parameters for infiltration are to be provided at 14 SWM pond sites and 22 City parks, based on results of the Guelph Permeameter testing.

Geo-environmental services (observations, recording, testing or assessment of the environmental conditions of the soil and ground water) were not within the terms of reference for this assignment, and no work has been carried out in this regard. If excess soils requiring transportation off-site are generated, a program of sampling and testing will be needed to determine the chemical properties of the soil to evaluate receiving site options, in accordance with the MOECC document; Management of Excess Soil – A Guide for Best Management Practices, January 2014.

Archive boreholes utilized as part of this present study are noted below and copies are provided in Appendix A along with borehole location plans.

EARLIER GEOTECHNICAL INVESTIGATION	BOREHOLES
Proposed Donald Street Reconstruction, Barrie, Ontario Prepared by PML PML Ref.: 08BF028	6, 7 (Boring date April 2008)
Proposed Ferndale Drive Reconstruction – Tiffin Street to Dunlop Street, Barrie, Ontario Prepared by PML PML Ref.: 13BF061	103, 104 (Boring date November 2013)
Proposed Dyment's Creek Culvert Replacement at Bradford Street, Barrie, Ontario Prepared by PML PML Ref.: 16BF010	1, 2 (Boring date April 2016)
Harvie Road Reconstruction, Barrie, Ontario Prepared by PML PML Ref.: 11BF068	E, F, G (Boring date December 2011 and January 2012)
Bayview Drive and Big Bay Point Road Improvements, Barrie, Ontario Prepared by PML PML Ref.: 15BF048	5 (Boring date October 2015)

The assessment provided in this report is based on the subsurface conditions as revealed in the previous and current boreholes. Final design, including inverts and finished grades are not yet established. Accordingly, the comments and recommendations provided in this report are preliminary in nature, and suitable only for preliminary planning purposes. When design details are available, supplementary investigation and analysis will be required to finalize the geotechnical design. It is further noted that some time has passed since the archive boreholes were drilled as such the near surface conditions may have changed.

INVESTIGATION PROCEDURES

The boreholes for this current investigation were carried out between June 29 and August 15, 2017 and consisted of Boreholes 1 to 3, 5, 6, 8, 10 to 15, 17 to 25, 29 to 38, 40, 41 and 43 drilled to 6.4 to 12.6 m depth. The locations of the 40 deficient culverts and corresponding applicable boreholes are shown on Drawings 1 to 4, attached. The three locations for which the culverts were deemed not deficient are also shown on the appended drawings.

The present boreholes were advanced using continuous flight solid stem augers, powered by a rubber tire mounted CME-75 drill rig, equipped with an automatic hammer, supplied and operated by a specialist drilling contractor, working under the full-time supervision of a member of our engineering staff.

Representative samples of the overburden soils were recovered at frequent depth intervals for identification purposes using a conventional split spoon sampler. Standard penetration tests were carried out simultaneously with the sampling operations to assess the strength characteristics of the subsoil. The ground water conditions in the boreholes were assessed during drilling by visual examination of the soil samples, the sampler, and drill rods as the samples were retrieved, and measurement of the water level in the open boreholes upon completion, if any. Pavement component thicknesses encountered in the boreholes were measured and samples of the granular material collected. Topsoil thicknesses were measured in off-road areas.

The location of each borehole was established in the field by PML, cognizant of underground utility locates.

Traffic control was provided by PML in accordance with the Ontario Traffic Manual, Book 7, as required. All boreholes were backfilled as per O.Reg. 903 and capped with cold mix asphalt, where required. All recovered samples were returned to our laboratory for moisture content determination and detailed examination to confirm field classification.

Guelph Permeameter tests were carried out between September 1 and November 28, 2017 to obtain the field saturated hydraulic conductivity values of the in-situ soils at 36 SWM ponds and parks, chosen by the Client. Locations are shown on Drawings 5 to 13, appended.

SUMMARIZED SUBSURFACE CONDITIONS

Reference is made to the appended Log of Boreholes sheets for the presently completed boreholes for details of the subsurface conditions, including soil classifications, pavement thicknesses, inferred stratigraphy, Standard Penetration N values, ground water observations and the results of laboratory water content determinations.

Due to soil sampling procedures and limited sample size, the depth demarcations on the borehole logs must be viewed as “transitional” zones between layers, and cannot be construed as exact geologic boundaries between layers. PML should be retained to assist in defining the geologic boundaries in the field during construction, if required.

A summary of the 40 assessed culvert sites, including description of the distribution of the subsurface conditions encountered in the current and archive boreholes is presented in Table 1, attached.

GEOTECHNICAL ENGINEERING CONSIDERATIONS

Culvert Replacements

The assessment provided in this report is based on the subsurface conditions as revealed in the previous boreholes and current boreholes. Final design, including culvert types, inverts and finished grades are not yet established. Accordingly, the comments and recommendations provided in this report are preliminary in nature, and suitable only for preliminary planning purposes. When design details are available, supplementary investigation and analysis will be required to finalize the geotechnical design.

Table 1, appended, summarizes the soil and ground water conditions and provides preliminary culvert foundation bearing capacity recommendations for the 40 assessed culvert sites.

Founding soils are generally expected to comprise competent native soils comprising granular soils (typically sand and till) common to the Barrie area, however this should be confirmed when the invert levels are finalized. Ground water and surface water are generally expected. Locally, deep foundations will be necessary.

Reference is made to OPSS 400 Series and OPSD 800 Series for general culvert installation requirements including granular bedding, embedment, cover material requirements and frost tapers.

Culvert walls must be designed to resist the unbalanced lateral earth pressure imposed by the backfill adjacent to the culvert.

In general, excavated site soils are expected to be acceptable for reuse as backfill above the culverts, subject to exclusion of deleterious content/organics, excessively wet material, and geotechnical review and approval during construction.

Excavation and Ground Water Control

All construction work must be carried out in accordance with the requirements of the Occupational Health and Safety Act (OHSA). Typically the site soils are considered as Type 3 soil requiring side walls to be constructed at no steeper than one horizontal to one vertical (1H:1V) from the base of the excavation.

Considering the nature of the proposed work, excavation is generally required near existing creeks, and thus surface water and ground water can be expected, the volume of which and associated and dewatering requirements will vary based on the size and depth of excavation. Where excavation is below the ground water table, dewatering through well points will be required. Creek diversion is also likely required at some sites.

Water taking in Ontario is governed by the Ontario Water Resources Act (OWRA) and the Water Taking and Transfer Regulation O.Reg. 387/040, Section 34 of the OWRA requires any one taking more than 50,000 L/d to obtain a PTTW from the Ministry of Environment and Climate Change (MOECC). This requirement applies to all withdrawals, whether for consumption, temporary construction dewatering or permanent drainage improvements. Recently the MOECC made some changes to the PTTW requirements. Projects assessed to be taking more than 50,000 L/d but less than 400,000 L/d of ground water can obtain a permit/permission online via the Environmental Activity and Sector Registry (EASR) system. Where it is assessed that more than 400,000 L/d of ground water taking is required then a Category 3 PTTW is required.

A PTTW or registry on the EASR is generally anticipated where inverts are at or below the ground water levels noted in the boreholes. Further hydrogeological studies are required when project details are available in order to assess dewatering and PTTW/EASR requirements.

Infiltration/Guelph Permeameter Testing

As part of the Master Drainage Plan update, Guelph Permeameter testing was completed to obtain the field saturated hydraulic conductivity values of the in-situ soils at 14 potential SWM pond retrofit locations and 22 City parks where potential LID facilities are being considered. Test locations at these 36 sites were selected based on access and are shown on Drawings 5 to 13, appended. The results of the field tests are summarized in the table below:

CITY OF BARRIE POTENTIAL SWM RETROFITS			
POND RETROFIT OPPORTUNITY NUMBER	**SWM POND**	**TESTING DEPTH BELOW GROUND SURFACE (mm)**	**K_{fs} (cm/s)**
11	KD06	150	1.1E-03
		500	1.1E-04
13	KD03	190	3.0E-04
		470	1.3E-03
15	DY02	240	5.5E-04
		500	3.4E-04
21	LV13	170	4.7E-04
		480	4.7E-04
31	LV03	200	2.9E-03
		500	1.9E-03
32	LV12	260	3.8E-04
		600	5.1E-04
37	LV10	200	6.8E-04
		550	6.8E-04
38	Patterson Road/Railway	180	3.5E-04
		510	5.1E-04
42	East of Montserrand Street	150	4.2E-04
		490	3.8E-04
60	West of Lougheed Road	160	2.0E-04
		520	2.3E-04
65	LV07	250	2.8E-03
		400	1.0E-03
69	BR13	210	5.1E-04
		480	1.8E-04

CITY OF BARRIE POTENTIAL SWM RETROFITS			
POND RETROFIT OPPORTUNITY NUMBER	**SWM POND**	**TESTING DEPTH BELOW GROUND SURFACE (mm)**	**K_{fs} (cm/s)**
75	GR01	230	6.8E-05
		500	2.6E-05
77	LT01	200	1.4E-04
		510	1.9E-03
CITY OF BARRIE PARKS POTENTIAL LID FACILITIES			
UICS ID	**LOCATION**	**TESTING DEPTH BELOW GROUND SURFACE (mm)**	**K_{fs} (cm/s)**
1	Allandale Heights Park	260	1.0E-03
		660	2.6E-03
2	Assikinack Park	190	1.7E-03
		500	1.4E-03
4	Cloughey Park	300	3.4E-04
		500	3.4E-04
6	Gibbon Park	200	3.5E-04
		500	5.1E-04
7	Greenfield Park	180	1.6E-03
		550	1.9E-03
8	Harvie Park	160	2.3E-04
		510	2.3E-04
10	Mapleton Park	150	3.4E-04
		520	5.1E-04
11	Montserrand Park	170	5.1E-04
		510	3.6E-04
14	Shoreview Park	210	2.8E-03
		300	2.1E-03
15	Sunnidale Park	150	1.3E-03
		520	6.4E-04
18	Carter Park	130	2.6E-03
		260	9.9E-04
21	Golden Meadow Park	120	7.0E-04
		280	5.1E-04

CITY OF BARRIE PARKS POTENTIAL LID FACILITIES			
UICS ID	**LOCATION**	**TESTING DEPTH BELOW GROUND SURFACE (mm)**	**K_{fs} (cm/s)**
22	Kuzmich Park	300	4.3E-03
		540	3.7E-03
23	Madelaine Park	160	3.4E-04
		400	7.7E-04
24	Queensway/Hyde Park	200	3.4E-04
		330	5.5E-04
25	Sandringham Park	120	3.4E-04
		500	6.8E-04
28	Bear Creek Park	130	6.8E-04
		530	3.4E-04
29	Cartwright Park	200	1.1E-04
		500	8.5E-04
31	Dunsmore Park	150	5.1E-04
		500	3.4E-04
35	Lougheed Park	150	3.4E-04
		500	3.4E-04
37	Strabane Park	240	2.3E-03
		520	1.8E-03
38	Wessenger Park	160	2.9E-04
		490	2.1E-04

It should be noted, a fifteenth potential SWM pond retrofit location was requested to be investigated, that of Pond No. 3 (HT06), however the site is an active construction site which was inaccessible at the time of our field work.

Based on the K_{fs} values above, there is varying potential for LID galleries at the various facilities.

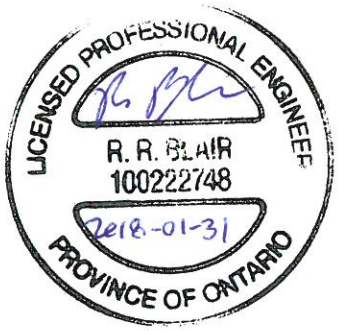
It is noted that the results of the Guelph Permeameter testing are specific to each location and depth.

CLOSURE

We trust this report is complete within our terms of reference, and the information presented is sufficient for your present purposes. If you have any questions, or when we may be of further assistance, please do not hesitate to call our office.

Sincerely

Peto MacCallum Ltd.



Richard Blair, P.Eng.
Project Engineer, Geotechnical Services



Geoffrey R. White, P.Eng.
Associate
Manager, Geotechnical and Geo-environmental Services

RB/GRW:jlb

Enclosures:
Table 1- Soil/Ground Water Summary and Preliminary Culvert Foundation Recommendations
List of Abbreviations
Log of Borehole Nos. 1 to 3, 5, 6, 8, 10 to 15, 17 to 25, 29 to 38, 40, 41 and 43
Culvert Location Plan Drawing No.s 1 to 4
Guelph Permeameter Test Location Plan Drawing No.s 5 to 13
Appendix A – Archive Boreholes

TABLE 1 – SOIL/GROUND WATER SUMMARY AND PRELIMINARY CULVERT FOUNDATION RECOMMENDATIONS

CULVERT ID NUMBER	LOCATION	ASSOCIATED BOREHOLE(S)	SOIL/GROUND WATER SUMMARY	PRELIMINARY CULVERT FOUNDATION RECOMMENDATIONS**
82	Penetanguishene Road Between Grove Street and Cheltenham Road	1	Borehole revealed 200 mm of shoulder granular, over sand/sandy silt fill to 2.1 m, over compact to very dense silty sand till to 4.0 m, over compact to dense silty fine sand to 6.5 m. First water strike at 6.1 m and no water upon completion.*	Culvert can be founded on native silty sand till at 2.1 m depth or deeper. Bearing capacity of 150 to 300 kPa at SLS is available depending on founding depth.
17	Eccles Street North Between Sophia Street and Wellington Street	2	Borehole revealed 600 mm of pavement, over silty sand fill to 2.1 m, over compact sand to 4.0 m, over very dense sand to 5.5 m, over very dense silty sand to 6.4 m. First water strike and water upon completion was at 4.9 m.*	Culvert can be founded on native sand at 2.1 m depth or deeper. Bearing capacity of 100 to 300 kPa at SLS is available depending on founding depth.
18	Wellington Street West Between Eccles Street and Donald Street	3	Borehole revealed 500 mm of pavement, over sand fill to 3.3 m, over compact to dense sand to 6.5 m. First water strike at 2.4 m and water upon completion was at 2.4 m.*	Culvert can be founded on native sand at 3.3 m depth or deeper. Bearing capacity of 200 kPa at SLS is available.
20	Donald Street Between Eccles Street and Frances Street	08BF028 BH 6 and 7	Boreholes revealed 300 to 520 mm of pavement, over sand fill to 1.9 m, over compact to dense sand to the 5.0 m. Wet cave or water upon completion was at 2.4 m to 2.9 m.*	As per PML Ref.: 08BF028, Report 1, dated 2008-09-04, open bottom box culvert can be founded on native sand based on a bearing capacity of 150 kPa at SLS.
22	Innisfil Street Between Vespra Street and Perry Street	5	Borehole revealed sand fill to 2.9 m, over compact to loose sand to 6.5 m. First water strike at 2.4 m and water upon completion was at 2.1 m.*	Culvert can be founded on native sand at 2.9 m depth or deeper. Bearing capacity of 50 kPa at SLS is available.
24	Bradford Street Between Vespra Street and Simcoe Street	6	Borehole revealed 540 mm of pavement, over sand fill to 2.1 m, overlying loose to compact native sand to 6.5 m. First water strike at 1.8 m and water upon completion was at 1.5 m.*	Culvert can be founded on native sand at 2.1 m depth or deeper. Bearing capacity of 50 to 100 kPa at SLS is available depending on founding depth.
27	Sproule Street Between Bird Street and End of Cul-de-Sac	7 (CANCELLED)	N/A	Client determined existing culvert is not deficient.
28	Dunlop Street West Between Ferndale Drive and Miller Drive	8	Borehole revealed sand fill to 2.1 m depth, over compact native sand to 4.0 m depth, over stiff clayey silt to 6.5 m. First water strike at 2.4 m and wet cave upon completion at 2.1 m.*	Culvert can be founded on native sand or clayey silt at 2.1 m depth or deeper. Bearing capacity of 150 kPa at SLS is available.

TABLE 1 – SOIL/GROUND WATER SUMMARY AND PRELIMINARY CULVERT FOUNDATION RECOMMENDATIONS

CULVERT ID NUMBER	LOCATION	ASSOCIATED BOREHOLE(S)	SOIL/GROUND WATER SUMMARY	PRELIMINARY CULVERT FOUNDATION RECOMMENDATIONS**
29	Ferndale Drive North Between Elliot Avenue and Dunlop Street	13BF061 BH 103 and 104	Boreholes revealed 350 to 370 mm of pavement, over sand fill to 3.0 m, over very loose to compact silty sand to sandy silt to 10.0 m, over loose to dense silt to 18.8 m depth. Water was noted within 1 m of the ground surface.*	As per PML Ref.: 13BF061, Report 1, dated 2014-04-04, proposed CSP culvert can be founded on a thickened layer of Granular A bedding. Fill extends about 0.7 to 0.8 m below proposed invert.
30	Sarjeant Drive Between Elliot Avenue and Dunlop Street	10	Borehole 10 revealed 250 mm of shoulder granular over sand fill to 1.4 m, over organic silt to 2.1 m, over compact sand to 4.0 m, overlying very stiff to firm clayey silt to 6.5 m. First water strike and water upon completion was at 2.1 m.*	Culvert can be founded on native sand at 2.1 m depth or deeper. Bearing capacity of 150 kPa at SLS is available.
33	Hart Drive Between Vespra Street and Dunlop Street	11	Borehole revealed 200 mm of shoulder granular, over sand fill to 2.1 m, over peat to 4.0 m, over compact to loose silty sand to 6.4 m, over firm clay to 6.5 m. First water strike at 2.3 m and water upon completion was at 1.8 m.*	Culvert can be founded on native silty sand at 4.0 m depth or deeper. Bearing capacity of 100 kPa at SLS is available.
34	George Street Between Anne Street and Hart Drive	12	Borehole revealed 500 mm of pavement, over sand fill to 2.9 m, over peat to 5.5 m depth, over compact native sand to 6.5 m. First water strike at 3.1 m and water upon completion was at 2.6 m.*	Culvert can be founded on native sand at 5.5 m depth or deeper. Bearing capacity of 200 kPa at SLS is available. A deep foundation may be required to support culvert and deeper boreholes are required.
36	Anne Street South/ John Street Intersection	13	Borehole revealed 100 mm of topsoil, over sand fill to 3.2 m depth, over peat to 5.5 m depth, over loose native sand to 8.1 m. First water strike at 2.9 m and water upon completion was at 1.8 m.*	Culvert can be founded on native sand at 5.5 m depth or deeper. Bearing capacity of 50 kPa at SLS is available. A deep foundation may be required to support culvert and deeper boreholes are required.
37	Innisfil Street Between Brock Street and Frederick Street	14	Borehole revealed 560 mm of pavement, over sand fill to 5.5 m, over peat to 8.5 m depth, over loose native sand to 9.6 m. First water strike at 2.3 m and wet cave upon completion was at 0.9 m.*	A deep foundation will be required to support culvert and deeper boreholes are required.
38	Sandford Street Between Brock Street and John Street	15	Borehole revealed 300 mm of pavement, over sand fill to 4.0 m, over peat to 8.5 m depth, over loose native sand to 9.6 m. First water strike at 3.1 m and water upon completion was at 3.7 m.*	A deep foundation will be required to support culvert and deeper boreholes are required.

TABLE 1 – SOIL/GROUND WATER SUMMARY AND PRELIMINARY CULVERT FOUNDATION RECOMMENDATIONS

CULVERT ID NUMBER	LOCATION	ASSOCIATED BOREHOLE(S)	SOIL/GROUND WATER SUMMARY	PRELIMINARY CULVERT FOUNDATION RECOMMENDATIONS**
39	Bradford Street Between Brock Street and John Street	16BF010 BH 1 and 2	Boreholes revealed 430 mm of pavement, over sand fill to 4.0 to 4.9 m, over peat to 5.5 to 10.0 m depth, over very loose to compact sand and silty sand to 17.0 m depth, over stiff to hard clay to 20 to 23 m, over compact to dense silt to 24 to 26 m, over compact sand to silty sand to 30 m, over dense to very dense sand and gravel to 31 to 33 m depth, over very dense silt to 34 m. Stabilized ground water was measured at 1.9 m below road grade.*	As per PMl Ref.: 16BF010, Draft Report, dated 2016-05-16, a deep foundation is required to support culvert foundations. 356 mm diameter pipe piles founded below 30 m depth have a bearing resistance of 1000 kN at SLS.
41	Mayfair Drive Between Ardagh Road and Florence Park Road	17	Borehole revealed 500 mm of pavement, over silty sand fill to 3.3 m, over loose to dense sand to 6.5 m. No water was noted during drilling or upon completion.*	Culvert can be founded on native sand at 4.0 m depth or deeper. Bearing capacity of 200 kPa at SLS is available.
42	Ardagh Road Between Mayfair Drive and Florence Park Road	18	Borehole revealed 540 mm of pavement, over sand fill to 2.1 m, over compact native silty sand till to 5.5 m, over dense sand to 6.5 m. First water strike at 6.1 m and water upon completion was at 5.5 m.*	Culvert can be founded on native silty sand till at 2.1 m depth or deeper. Bearing capacity of 100 kPa at SLS is available.
43	Morrow Road Between Fraser Court and Patterson Road	19	Borehole revealed 440 mm of pavement, over sand/sand and gravel fill to 2.9 m, over peat to 4.0 m, over loose silt to 6.5 m. First water strike at 1.5 m and wet cave upon completion was at 1.8 m.*	Culvert can be founded on native silt at 4.0 m depth or deeper. Bearing capacity of 75 kPa at SLS is available. A deep foundation may be required to support culvert and deeper boreholes are required.
47	Wood Street Between Alfred Street and End of Cul-de-Sac	20	Borehole revealed 350 mm pavement, over silty sand fill to 1.4 m, over compact sand to 4.0 m, over compact silty sand to 6.5 m. First water strike at 2.1 m and water upon completion was at 1.2 m.*	Culvert can be founded on native sand at 1.4 m depth or deeper. Bearing capacity of 150 kPa at SLS is available.
48	Tiffin Street Between Anne Street and Dyment Road	21	Borehole revealed 100 mm of topsoil, over sand fill to 3.7 m, over peat to 5.5 m, over loose to compact sand to 8.1 m depth. First water strike at 2.7 m and wet cave upon completion was at 2.1 m.*	Culvert can be founded on native sand at 5.5 m depth or deeper. Bearing capacity of 50 kPa at SLS is available. A deep foundation may be required to support culvert and deeper boreholes are required.
49	Anne Street South Between Tiffin Street and Brock Street	22	Borehole revealed sand to silty sand fill to 7.9 m depth, over peat to 11.6 m depth, over loose native sand to 12.6 m. First water strike at 4.6 m and wet cave upon completion was at 4.2 m.*	A deep foundation will be required to support culvert and deeper boreholes are required.

TABLE 1 – SOIL/GROUND WATER SUMMARY AND PRELIMINARY CULVERT FOUNDATION RECOMMENDATIONS

CULVERT ID NUMBER	LOCATION	ASSOCIATED BOREHOLE(S)	SOIL/GROUND WATER SUMMARY	PRELIMINARY CULVERT FOUNDATION RECOMMENDATIONS**
50	Innisfil Street Between Tiffin Street and Brock Street	23	Borehole revealed 740 mm of pavement, over sand/sand and gravel fill to 4.0 m, over peat to 5.5 m depth, over compact native sand to 6.5 m. First water strike at 4.3 m and water upon completion was at 4.1 m.*	Culvert can be founded on native sand at 5.5 m depth or deeper. Bearing capacity of 100 kPa at SLS is available. A deep foundation may be required to support culvert and deeper boreholes are required.
51	Bradford Street Between Tiffin Street and Brock Street	24	Borehole revealed 120 mm of topsoil, over sand/silty sand fill to 2.1 m, over peat to 5.5 m, over loose sand to 6.5 m depth. First water strike at 2.3 m and wet cave upon completion was at 2.4 m.*	Culvert can be founded on native sand at 5.5 m depth or deeper. Bearing capacity of 50 kPa at SLS is available. A deep foundation may be required to support culvert and deeper boreholes are required.
80	County Road 27 Between Dunlop Street and Ardagh Road	25	Borehole revealed 150 mm of shoulder granular, over sand fill to 0.7 m, over peat to 2.1 m, over loose to compact sand to 6.5 m. First water strike at 0.8 m and wet cave upon completion was at 0.6 m.*	Culvert can be founded on native sand at 2.1 m depth or deeper. Bearing capacity of 75 kPa at SLS is available.
53	Harvie Road Between Thrushwood Drive and Highway 400	11BF068 BH E and F	Borehole E revealed 200 mm of pavement, over sand fill to 2.9 m, over stiff clayey silt to 3.8 m, over very dense sand to 6.5 m. Borehole F revealed 200 mm of pavement, over sand fill to 1.4 m depth, over compact sand to 2.1 m, over compact silt to 4.0 m, over very dense sand to 6.4 m. Ground water was observed to be perched within the fill and upper sand, with the deeper sand being damp.*	As per PML Ref.: 11BF068, Report 1, dated 2012-03-30, open bottom box culvert foundations at about 4.0 m below grade. Culvert can be founded on native sand at 4.0 m depth or deeper. Bearing capacity of 250 kPa at SLS is available.
54	Harvie Road Between Thrushwood Drive and Highway 400	11BF068 BH G	Borehole revealed 200 mm of pavement, over sand fill to 2.4 m, over compact to very dense sand to 6.6 m. Ground water was not observed.*	As per PML Ref.: 11BF068, Report 1, dated 2012-03-30, no culvert foundation recommendation provided. Culvert can be founded on native sand at 3.0 m depth or deeper. Bearing capacity of 300 kPa at SLS is available.
57	Bayview Drive Between Big Bay Point Road and Mollard Court	15BF048 BH 5	Borehole revealed 470 mm of pavement, over silty sand/sandy silt fill to 4.0 m, over loose to dense sand to 10.1 m. Wet cave upon completion was at 3.2 m.	As per PML ref.: 15BF048, Report 1, dated 2016-01-13, closed bottom concrete box culvert or CSP culvert can be founded on a thickened layer of Granular A bedding. Native soil at 6.0 m or deeper will support bearing capacity of 300 kPa at SLS.

TABLE 1 – SOIL/GROUND WATER SUMMARY AND PRELIMINARY CULVERT FOUNDATION RECOMMENDATIONS

CULVERT ID NUMBER	LOCATION	ASSOCIATED BOREHOLE(S)	SOIL/GROUND WATER SUMMARY	PRELIMINARY CULVERT FOUNDATION RECOMMENDATIONS**
59	McConkey Place Between Bristow Court and Little Avenue	29	Borehole revealed 520 mm of pavement, over sand fill to 3.7 m, over compact to dense sand to 6.5 m. First water strike at 3.7 m and water upon completion was at 3.2 m.*	Culvert can be founded on native sand at 4.0 m depth or deeper. Bearing capacity of 300 kPa at SLS is available.
60	Huronia Road Between Webb Street and Little Avenue	30	Borehole revealed 100 mm of topsoil, over sand fill to 2.9 m, over loose to dense silty sand till to 5.5 m, over compact sand to 6.5 m. First water strike at 3.1 m and wet cave upon completion was at 2.0 m.*	Culvert can be founded on native silty sand till at 2.9 m depth or deeper. Bearing capacity of 100 to 200 kPa at SLS is available depending on founding depth.
62	Little Avenue Between Firman Drive and Huronia Road	31	Borehole revealed 560 mm of pavement, over sand fill to 2.9 m, over compact sand/sand and gravel to 5.5 m depth, over dense silt to 6.5 m. First water strike at 2.1 m and wet cave upon completion was at 1.8 m.*	Culvert can be founded on native sand at 2.9 m depth or deeper. Bearing capacity of 100 to 200 kPa at SLS is available depending on founding depth.
63	Yonge Street Between Foster Drive and Minets Point Road	32	Borehole revealed 610 mm of pavement, over sand/silty sand fill to 4.5 m, overlying very loose native silty sand to 5.5 m depth, underlain by very dense silty sand till to 6.5 m. First water strike and water upon completion was at 4.4 m.*	Culvert can be founded on native till at 5.5 m depth or deeper. Bearing capacity of 300 kPa at SLS is available. A deep foundation may be required to support culvert and deeper boreholes are required
64	Hurst Drive Between Wallwins Way and Minet Point Road	33	Borehole revealed 600 mm of pavement, over sand/silty sand fill 5.5 m, over peat to 6.4 m depth, over compact native sand to 6.5 m. Ground water was not observed.*	A deep foundation will be required to support culvert and deeper boreholes are required.
65	The Boulevard Between Cliff Road and White Oaks Road	34	Borehole 34 revealed 600 mm of pavement, over sand fill to 1.8 m, over peat to 3.0 m depth, over compact to dense native fine sand to 6.5 m. First water strike at 1.2 m and water upon completion was at 0.9 m.*	Culvert can be founded on native fine sand at 3.0 m depth or deeper. Bearing capacity of 150 to 300 kPa at SLS is available depending on founding depth.
66	Brennan Avenue Between Lismer Boulevard and White Oaks Road	35	Borehole revealed 580 mm of pavement, over sand fill to 1.4 m, over peat to 2.9 m depth, over native very dense sand to 4.5 m, over compact silty sand to 6.5 m. First water strike at 2.7 m and wet cave upon completion was at 2.4 m.*	Culvert can be founded on native soil at 2.9 m depth or deeper. Bearing capacity of 150 kPa at SLS is available.
88	Bayview Drive Between Lockhart Road and Saunders Road	36	Borehole revealed 580 mm of pavement, over dense to very dense native sand and silt to 2.9 m, over compact to very dense silty sand to 4.5 m, over very dense sand to 6.4 m depth. Ground water was not observed.*	Culvert can be founded on native soil at 1.5 m depth or deeper. Bearing capacity of 150 to 300 kPa at SLS is available depending on founding depth.

TABLE 1 – SOIL/GROUND WATER SUMMARY AND PRELIMINARY CULVERT FOUNDATION RECOMMENDATIONS

CULVERT ID NUMBER	LOCATION	ASSOCIATED BOREHOLE(S)	SOIL/GROUND WATER SUMMARY	PRELIMINARY CULVERT FOUNDATION RECOMMENDATIONS**
89	Lockhart Road Between Rawson Avenue and Bayview Drive	37	Borehole revealed 560 mm of pavement, over sandy silt fill to 1.4 m, over organic sandy silt to 2.1 m, over loose silty sand to 3.0 m, over compact sand and gravel to 4.0 m depth, over very dense silty sand to 6.4 m. First water strike at 2.4 m and wet cave upon completion was at 3.1 m.*	Culvert can be founded on native soil at 3.0 m depth or deeper. Bearing capacity of 150 to 300 kPa at SLS is available depending on founding depth.
91	Lockhart Road Between Finsbury Street and Huronia Road	38	Borehole revealed 460 mm of pavement, over sand/silt fill to 2.9 m, over peat to 4.0 m, over compact native sand and gravel to 5.5 m, over compact silty sand till to 6.5 m depth. First water strike at 1.2 m and water upon completion was at 0.9 m.*	Culvert can be founded on native sand and gravel at 4.0 m depth or deeper. Bearing capacity of 100 kPa at SLS is available.
92	Huronia Road Between Saunders Road and Mapleview Drive	39 (CANCELLED)	N/A	Client determined existing culvert is not deficient.
94	Welham Road Between Mapleview Drive and Churchill Drive	40	Borehole encountered 50 mm of topsoil, over sand fill to 1.4 m, over compact to dense native sand to 6.5 m depth. First water strike at 2.3 m and water upon completion was at 1.7 m.*	Culvert can be founded on native sand at 1.4 m depth or deeper. Bearing capacity of 200 kPa at SLS is available.
95	Mapleview Drive East Between Huronia Road and Welham Road	41	Borehole revealed 640 mm of pavement, over sand fill to 4.4 m, over compact sand and gravel to 5.5 m depth, over dense sand to 6.5 m. First water strike at 1.8 m and water upon completion was at 1.5 m.*	Culvert can be founded on native compact sand and gravel at 4.4 m depth or deeper. Bearing capacity of 250 kPa at SLS is available.
96	Mapleview Drive East Between Huronia Road and Country Lane	42 (CANCELLED)	N/A	Client determined existing culvert is not deficient.
97	Huronia Road Between Mapleview Drive and Loon Avenue	43	Borehole 43 revealed 530 mm of pavement, over sand fill to 2.5 m, over firm to stiff clay to 6.5 m. First water strike at 2.1 m and water upon completion was at 1.8 m.*	Culvert can be founded on native firm to stiff clay at 4.4 m depth or deeper. Bearing capacity of 50 kPa at SLS is available.

* Ground water levels will fluctuate seasonally and in response to variations in precipitation.
** Reference is made to OPSS 400 Series and OPSD 800 Series for general culvert installation requirements.
SLS = Serviceability Limit State.

LIST OF ABBREVIATIONS

PENETRATION RESISTANCE

Standard Penetration Resistance N: - The number of blows required to advance a standard split spoon sampler 0.3 m into the subsoil. Driven by means of a 63.5 kg hammer falling freely a distance of 0.76 m.

Dynamic Penetration Resistance: - The number of blows required to advance a 51 mm, 60 degree cone, fitted to the end of drill rods, 0.3 m into the subsoil. The driving energy being 475 J per blow.

DESCRIPTION OF SOIL

The consistency of cohesive soils and the relative density or denseness of cohesionless soils are described in the following terms:

CONSISTENCY	N (blows/0.3 m)	c (kPa)	DENSENESS	N (blows/0.3 m)
Very Soft	0 - 2	0 - 12	Very Loose	0 - 4
Soft	2 - 4	12 - 25	Loose	4 - 10
Firm	4 - 8	25 - 50	Compact	10 - 30
Stiff	8 - 15	50 - 100	Dense	30 - 50
Very Stiff	15 - 30	100 - 200	Very Dense	> 50
Hard	> 30	> 200		

WTPL	Wetter Than Plastic Limit
APL	About Plastic Limit
DTPL	Drier Than Plastic Limit

TYPE OF SAMPLE

SS	Split Spoon	ST	Slotted Tube Sample
WS	Washed Sample	TW	Thinwall Open
SB	Scraper Bucket Sample	TP	Thinwall Piston
AS	Auger Sample	OS	Oesterberg Sample
CS	Chunk Sample	FS	Foil Sample
GS	Grab Sample	RC	Rock Core

PH	Sample Advanced Hydraulically
PM	Sample Advanced Manually

SOIL TESTS

Qu	Unconfined Compression	LV	Laboratory Vane
Q	Undrained Triaxial	FV	Field Vane
Qcu	Consolidated Undrained Triaxial	C	Consolidation
Qd	Drained Triaxial		

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LOG OF BOREHOLE NO. 1

17T 607698E 4918041N

Culvert 82 - Georgian Creek Watershed - Penetanguishene Road

PROJECT City of Barrie Master Drainage Plan Update — **PML REF.** 17BF024

LOCATION Barrie, Ontario — **BORING DATE** July 13, 2017 — **ENGINEER** GW

BORING METHOD Continuous Flight Solid Stem Augers — **TECHNICIAN** AT

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	SHEAR STRENGTH (kPa) / WATER CONTENT (%)	UNIT WEIGHT kN/m³	GROUND WATER OBSERVATIONS AND REMARKS / GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL
	SURFACE ELEVATION							
0.20	SHOULDER GRANULAR: 200 mm granular base, moist		1	SS	14			
0.76	FILL: Brown, sand, trace organics, trace silt, trace gravel, moist Becoming dark brown to black, sandy silt, trace clay, trace organics, very moist		2	SS	52/290mm			
			3	SS	5			
2.1	SILTY SAND TILL: Compact to very dense, brown, silty sand, trace gravel, cobbles and boulders, moist		4	SS	16			
			5	SS	50			
4.0	SILTY SAND: Compact to dense, brown, silty fine sand, trace gravel, moist		6	SS	28			
6.5			7	SS	34			First water strike at 6.1 m
	BOREHOLE TERMINATED AT 6.5 m							Upon completion of augering No water Cave at 5.8 m

SHEAR STRENGTH (kPa): + FIELD VANE △ TORVANE ○ Qu ▲ POCKET PENETROMETER O Q; 50 100 150 200; DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST ●; 20 40 60 80

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L; WATER CONTENT (%): 10 20 30 40

NOTES

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LOG OF BOREHOLE NO. 2

17T 603516E 4915884N
Culvert 17 - Kidds Creek Watershed - Eccles Street North

PROJECT City of Barrie Master Drainage Plan Update
LOCATION Barrie, Ontario
BORING METHOD Continuous Flight Solid Stem Augers
BORING DATE August 14, 2017
PML REF. 17BF024
ENGINEER GW
TECHNICIAN AT

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	ELEVATION SCALE	SHEAR STRENGTH (kPa) / DYNAMIC CONE PENETRATION / STANDARD PENETRATION TEST	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT / WATER CONTENT (%)	UNIT WEIGHT kN/m³	GROUND WATER OBSERVATIONS AND REMARKS / GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL
	SURFACE ELEVATION									
0.0	PAVEMENT: 140 mm asphalt, over 180 mm granular base, over		1A	GS	-					
0.60	280 mm granular subbase, moist		1B							
	FILL: Dark brown, silty sand, trace to some gravel, moist		2	SS	25					
1.0										
			3	SS	41					
2.0										
2.1	SAND: Compact, brown, sand, some silt, trace gravel, stratified, moist		4	SS	12					
3.0			5	SS	28					
4.0										
	SILT: Very dense, brown, silt, trace sand, sand seams, trace gravel, very moist		6	SS	66					First water strike at 4.9 m
5.0										
5.5	SILTY SAND: Very dense, brown, silty sand, trace gravel, very moist to wet									
6.0			7	SS	65/290mm					
6.4	BOREHOLE TERMINATED AT 6.4 m									Upon completion of augering Water at 4.9 m Cave at 5.0 m
7.0										
8.0										
9.0										
10.0										
11.0										
12.0										
13.0										
14.0										
15.0										

SHEAR STRENGTH (kPa): +FIELD VANE △TORVANE ○ Qu ▲POCKET PENETROMETER ○ Q; 50 100 150 200; DYNAMIC CONE PENETRATION ×; STANDARD PENETRATION TEST ●; 20 40 60 80; >>

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L; WATER CONTENT (%); 10 20 30 40

NOTES

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LOG OF BOREHOLE NO. 3

17T 603313E 4915991N

Culvert 18 - Kidds Creek Watershed - Wellington Street West

PROJECT City of Barrie Master Drainage Plan Update — **PML REF.** 17BF024

LOCATION Barrie, Ontario — **BORING DATE** July 17, 2017 — **ENGINEER** GW

BORING METHOD Continuous Flight Solid Stem Augers — **TECHNICIAN** AT

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	SHEAR STRENGTH (kPa) / WATER CONTENT (%)	UNIT WEIGHT kN/m³	GROUND WATER OBSERVATIONS AND REMARKS / GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL
	SURFACE ELEVATION							
0.0	PAVEMENT: 100 mm asphalt, over 190 mm granular base, over		1A	GS	-			
0.50	210 mm granular subbase, moist		1B					
	FILL: Brown, medium to coarse sand, trace silt, some gravel, wet		2	SS	14			
1.0								
			3	SS	16			
2.0								
			4	SS	17			First water strike at 2.4 m
3.0								
3.3			5	SS	21			
	SAND: Compact to dense, brown, fine sand, some silt, trace gravel, wet							
4.0								
			6	SS	22			
5.0								
6.0								
6.5			7	SS	31			
	BOREHOLE TERMINATED AT 6.5 m							Upon completion of augering Water at 1.1 m Cave at 1.2 m
7.0								
8.0								
9.0								
10.0								
11.0								
12.0								
13.0								
14.0								
15.0								

SHEAR STRENGTH (kPa): +FIELD VANE △TORVANE ○ Qu ▲POCKET PENETROMETER ○ Q; 50 100 150 200; DYNAMIC CONE PENETRATION ×; STANDARD PENETRATION TEST ●; 20 40 60 80

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L; WATER CONTENT (%); 10 20 30 40

NOTES

Peto MacCallum Ltd.
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LOG OF BOREHOLE NO. 5

17T 603790E 4915211N
Culvert 22 - Bunkers Creek Watershed - Innisfil Street

PROJECT City of Barrie Master Drainage Plan Update
PML REF. 17BF024
LOCATION Barrie, Ontario
BORING DATE July 6, 2017
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN AT

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER OBSERVATIONS AND REMARKS / GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL
	SURFACE ELEVATION					
0.0	FILL: Dark brown, sand, trace to some silt, trace gravel, moist to wet		1	SS	20	
1.0			2	SS	13	
2.0			3	SS	2	
2.9			4	SS	9	First water strike at 2.4 m
3.0	SAND: Compact to loose, dark brown, sand, trace silt, some gravel, wet		5	SS	12	
4.0						
5.0			6	SS	5	
6.0						
6.5			7	SS	6	
	BOREHOLE TERMINATED AT 6.5 m					Upon completion of augering Water at 2.1 m Cave at 4.6 m
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						
13.0						
14.0						
15.0						

ELEVATION SCALE

SHEAR STRENGTH (kPa)
+ FIELD VANE △ TORVANE ○ Qu
▲ POCKET PENETROMETER O Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

NOTES

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LOG OF BOREHOLE NO. 6

17T 604078E 4915224N
Culvert 24 - Bunkers Creek Watershed - Bradford Street

PROJECT City of Barrie Master Drainage Plan Update
PML REF. 17BF024
LOCATION Barrie, Ontario
BORING DATE July 17, 2017
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN AT

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	ELEVATION SCALE	SHEAR STRENGTH (kPa) +FIELD VANE △TORVANE ○ Qu ▲POCKET PENETROMETER ○ Q / DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST ●	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT w_P w w_L / WATER CONTENT (%)	UNIT WEIGHT kN/m³	GROUND WATER OBSERVATIONS AND REMARKS / GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL
	SURFACE ELEVATION						50 100 150 200 / 20 40 60 80	10 20 30 40		
0.0	PAVEMENT: 130 mm asphalt, over 150 mm granular base, over		1A	GS	-					
0.54	260 mm granular subbase, moist		1B							
	FILL: Brown, sand, trace silt, trace gravel, moist to wet		2	SS	14					
1.0										
1.5	Becoming some gravel to gravelly		3	SS	9					
2.0										First water strike at 1.8 m
2.1	SAND: Loose to compact, brown to dark grey, medium to coarse sand, trace to some silt, trace gravel, wet		4	SS	18					
3.0			5	SS	11					
4.0										
5.0			6	SS	5					
6.0										
6.5			7	SS	10					
	BOREHOLE TERMINATED AT 6.5 m									Upon completion of augering Wet cave at 1.5 m
7.0										
8.0										
9.0										
10.0										
11.0										
12.0										
13.0										
14.0										
15.0										

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 8

17T 601814E 4914356N

Culvert 28 - Dyments Creek Watershed - Dunlop Street West

PROJECT City of Barrie Master Drainage Plan Update — **PML REF.** 17BF024

LOCATION Barrie, Ontario — **BORING DATE** July 6, 2017 — **ENGINEER** GW

BORING METHOD Continuous Flight Solid Stem Augers — **TECHNICIAN** AT

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	SHEAR STRENGTH (kPa) / DYNAMIC CONE PENETRATION / STANDARD PENETRATION TEST	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%)	UNIT WEIGHT kN/m³	GROUND WATER OBSERVATIONS AND REMARKS / GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL
	SURFACE ELEVATION								
0.0	FILL: Brown, sand, trace silt, trace gravel, trace organics, moist to very moist		1	SS	6				
1.0			2	SS	30				
2.0			3	SS	9				
2.1	SAND: Compact, dark brown to grey, sand, some silt, wet		4	SS	18				First water strike at 2.4 m
3.0			5	SS	13				
4.0									
4.0	CLAYEY SILT: Stiff, grey, clayey silt, APL		6	SS	15				
5.0									
6.0			7	SS	15				
6.5	BOREHOLE TERMINATED AT 6.5 m								Upon completion of augering Wet cave at 2.1 m
7.0									
8.0									
9.0									
10.0									
11.0									
12.0									
13.0									
14.0									
15.0									

SHEAR STRENGTH (kPa): + FIELD VANE △ TORVANE ○ Qu ▲ POCKET PENETROMETER ○ Q; 50 100 150 200; DYNAMIC CONE PENETRATION ×; STANDARD PENETRATION TEST ●; 20 40 60 80

WATER CONTENT (%): 10 20 30 40

NOTES

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CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 10

17T 602290E 4914530N

Culvert 30 - Dyments Creek Watershed - Sarjeant Drive

PROJECT City of Barrie Master Drainage Plan Update
PML REF. 17BF024

LOCATION Barrie, Ontario
BORING DATE July 14, 2017
ENGINEER GW

BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN AT

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER OBSERVATIONS AND REMARKS / GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL
	SURFACE ELEVATION					
0.25	SHOULDER GRANULAR: 250 mm granular base, moist		1	SS	21	
	FILL: Brown, sand, some silt, trace gravel, moist		2	SS	22	
1.4	ORGANIC SILT: Very loose, grey, organic silt, trace clay, wet		3	SS	2	
2.1	SAND: Compact, grey, sand, some silt to silty sand, wet		4	SS	21	First water strike at 2.1 m
			5	SS	10	
4.0	CLAYEY SILT: Very stiff to firm, grey, clayey silt, trace sand, APL		6	SS	22	
6.5			7	SS	7	
	BOREHOLE TERMINATED AT 6.5 m					Upon completion of augering Water at 2.1 m Cave at 3.5 m

ELEVATION SCALE

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 11

17T 602740E 4914823N
Culvert 33 - Dyments Creek Watershed - Hart Drive

PROJECT City of Barrie Master Drainage Plan Update
PML REF. 17BF024
LOCATION Barrie, Ontario
BORING DATE August 15, 2017
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN AT

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	ELEVATION SCALE	SHEAR STRENGTH (kPa) + FIELD VANE △ TORVANE ○ Qu ▲ POCKET PENETROMETER ○ Q / DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST ●	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%)	UNIT WEIGHT kN/m³	GROUND WATER OBSERVATIONS AND REMARKS / GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL
	SURFACE ELEVATION						50 100 150 200 / 20 40 60 80	10 20 30 40		
0.0	SHOULDER GRANULAR: 200 mm granular base, over		1A 1B	GS	-					
0.45	250 mm granular subbase, moist									
	FILL: Brown, sand, trace silt, trace gravel, moist		2	SS	6					
1.0										
1.5	Trace brick		3	SS	9					
2.0										
2.1	PEAT: Black, amorphic peat, very moist		4	SS	1					First water strike at 2.3 m
3.0										
3.1	Wood pieces		5	SS	17					
4.0										
	SILTY SAND: Compact to loose, dark brown, silty sand, trace organics, trace gravel, moist to very moist		6	SS	16					
5.0										
6.0										
6.4			7	SS	8					
6.5	CLAY: Firm, grey, clay, trace silt, WTPL									
	BOREHOLE TERMINATED AT 6.5 m									Upon completion of augering Water at 1.8 m Cave at 2.3 m
7.0										
8.0										
9.0										
10.0										
11.0										
12.0										
13.0										
14.0										
15.0										

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 12

17T 602994E 4914720N
Culvert 34 - Dyments Creek Watershed - George Street

PROJECT City of Barrie Master Drainage Plan Update
LOCATION Barrie, Ontario
BORING METHOD Continuous Flight Solid Stem Augers
BORING DATE July 14, 2017
PML REF. 17BF024
ENGINEER GW
TECHNICIAN AT

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	ELEVATION SCALE	SHEAR STRENGTH (kPa) / DYNAMIC CONE PENETRATION / STANDARD PENETRATION TEST	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT / WATER CONTENT (%)	UNIT WEIGHT kN/m³	GROUND WATER OBSERVATIONS AND REMARKS / GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL
	SURFACE ELEVATION									
0.0	PAVEMENT: 100 mm asphalt, over 150 mm granular base, over 250 mm granular subbase, moist		1A 1B	GS	-					
0.50	FILL: Brown, sand, trace silt, trace gravel, trace organics, moist to wet		2	SS	12					
1.0			3	SS	6					
2.0										
2.3	Organic pockets		4	SS	2					
2.9	PEAT: Brown, amorphic sandy peat, wet		5	SS	5					First water strike at 3.1 m
3.0										
4.0			6	SS	6					
5.0										
5.5	SAND: Compact, grey, fine sand, trace silt, some gravel, moist		7	SS	21					
6.0										
6.5	BOREHOLE TERMINATED AT 6.5 m									Upon completion of augering Water at 2.6 m Cave at 3.1 m
7.0										
8.0										
9.0										
10.0										
11.0										
12.0										
13.0										
14.0										
15.0										

SHEAR STRENGTH (kPa): +FIELD VANE △TORVANE ○ Qu ▲POCKET PENETROMETER O Q; 50 100 150 200; DYNAMIC CONE PENETRATION ×; STANDARD PENETRATION TEST ●; 20 40 60 80

PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L; WATER CONTENT (%): 10 20 30 40

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 13

17T 603440E 4914664N

Culvert 36 - Dyments Creek Watershed - Anne Street South/John Street

PROJECT City of Barrie Master Drainage Plan Update — **PML REF.** 17BF024

LOCATION Barrie, Ontario — **BORING DATE** June 26, 2017 — **ENGINEER** GW

BORING METHOD Continuous Flight Solid Stem Augers — **TECHNICIAN** AT

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	SHEAR STRENGTH (kPa) + FIELD VANE △ TORVANE ○ Qu ▲ POCKET PENETROMETER ○ Q / DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST ●	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%)	UNIT WEIGHT kN/m³	GROUND WATER OBSERVATIONS AND REMARKS / GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL
	SURFACE ELEVATION					50 100 150 200 / 20 40 60 80	10 20 30 40		
0.0									
0.10	TOPSOIL: Brown, sand, trace silt, trace gravel, moist		1	SS	9				
	FILL: Brown to black, sand, trace to some silt, trace to some gravel, moist to very moist		2	SS	12				
1.0									
			3	SS	18				
2.0									
			4	SS	16				
3.0									
3.2									First water strike at 2.9 m
	PEAT: Black, amorphic peat, wet		5	SS	5				
4.0									
			6	SS	5			63	
5.0									
5.5									
	SAND: Loose, grey to dark grey, sand, trace to some silt, trace gravel, trace organics, wet		7	SS	5				
6.0									
7.0									
			8	SS	8				
8.0									
8.1	BOREHOLE TERMINATED AT 8.1 m								Upon completion of augering Water at 1.8 m Cave at 5.8 m
9.0									
10.0									
11.0									
12.0									
13.0									
14.0									
15.0									

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 14

17T 603890E 4914687N
Culvert 37 - Dyments Creek Watershed - Innisfil Street

PROJECT City of Barrie Master Drainage Plan Update
LOCATION Barrie, Ontario
BORING METHOD Continuous Flight Solid Stem Augers
BORING DATE August 14, 2017
PML REF. 17BF024
ENGINEER GW
TECHNICIAN AT

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	ELEVATION SCALE
	SURFACE ELEVATION					
0.0	PAVEMENT: 140 mm asphalt, over 200 mm granular base, over		1A 1B	GS	-	
0.56	220 mm granular subbase, moist					
	FILL: Brown, sand, trace silt, some gravel, trace organics, moist to wet		2	SS	18	
1.0			3	SS	6	
2.0						
2.3	Becoming dark grey		4	SS	15	
3.0			5	SS	5	
4.0						
			6	SS	11	
5.0						
5.5	PEAT: Dark brown to black, amorphic peat, wood pieces, very moist to wet					
6.0			7	SS	7	
7.0						
			8	SS	5	
8.0						
8.5	SAND: Loose, dark grey, sand, trace silt, trace gravel, trace organics, wet					
9.0			9	SS	4	
9.6	BOREHOLE TERMINATED AT 9.6 m					
10.0						
11.0						
12.0						
13.0						
14.0						
15.0						

SHEAR STRENGTH (kPa)
+ FIELD VANE △ TORVANE ○ Qu
▲ POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³
133

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

First water strike at 2.3 m

Upon completion of augering
Wet cave 0.9 m

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 15

17T 603953E 4914693N

Culvert 38 - Dyments Creek Watershed - Sandford Street

PROJECT City of Barrie Master Drainage Plan Update
PML REF. 17BF024
LOCATION Barrie, Ontario
BORING DATE July 18, 2017
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN AT

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	ELEVATION SCALE	SHEAR STRENGTH (kPa) + FIELD VANE △ TORVANE ○ Qu ▲ POCKET PENETROMETER ○ Q; DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST ●	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L; WATER CONTENT (%)	UNIT WEIGHT kN/m³	GROUND WATER OBSERVATIONS AND REMARKS; GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL
	SURFACE ELEVATION						50 100 150 200; 20 40 60 80	10 20 30 40		
0.0	PAVEMENT: 30 mm asphalt, over		1A	GS	-					
0.30	120 mm granular base, over		1B							
	150 mm granular subbase, moist									
	FILL: Brown to dark grey, sand, trace silt, trace gravel, silt pockets, moist		2	SS	6					
1.0										
			3	SS	19					
2.0										
			4	SS	10					
3.0										
3.0	Organics, wet		5	SS	3					First water strike at 3.1 m
4.0										
4.0	PEAT: Brown, coarse fibrous peat, wood pieces, wet									
			6	SS	18					
5.0										
6.0										
6.0	Becoming amorphic peat, trace sand		7	SS	9					
7.0										
			8	SS	5					
8.0										
8.5										
	SAND: Loose, grey, sand, some silt, trace gravel, trace organics, wet									
9.0			9	SS	5					
9.6	BOREHOLE TERMINATED AT 9.6 m									Upon completion of augering Water at 3.7 m Cave at 6.5 m
10.0										
11.0										
12.0										
13.0										
14.0										
15.0										

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 17

17T 603521E 4912252N
Culvert 41 - Hotchkiss Creek Watershed - Mayfair Drive

PROJECT City of Barrie Master Drainage Plan Update
LOCATION Barrie, Ontario
BORING METHOD Continuous Flight Solid Stem Augers
BORING DATE July 24, 2017
PML REF. 17BF024
ENGINEER GW
TECHNICIAN AT/WP

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER OBSERVATIONS AND REMARKS / GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL
	SURFACE ELEVATION					
0.0	PAVEMENT: 100 mm asphalt, over 200 mm granular base, over 300 mm granular subbase, moist		1A, 1B	GS	-	
0.60	FILL: Brown, silty sand, trace gravel, moist to very moist		2	SS	40	
			3	SS	8	
			4	SS	4	
3.3			5	SS	5	
	SAND: Loose to dense, brown to light brown, sand, trace silt, trace gravel, moist		6	SS	22	
6.5			7	SS	44	
	BOREHOLE TERMINATED AT 6.5 m					Upon completion of augering No water No cave

ELEVATION SCALE

SHEAR STRENGTH (kPa)
+ FIELD VANE △ TORVANE ○ Qu
▲ POCKET PENETROMETER O Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 18

17T 603461E 4912453N
Culvert 42 - Hotchkiss Creek Watershed - Ardagh Road

PROJECT City of Barrie Master Drainage Plan Update
LOCATION Barrie, Ontario
BORING METHOD Continuous Flight Solid Stem Augers
BORING DATE July 24, 2017
PML REF. 17BF024
ENGINEER GW
TECHNICIAN AT/WP

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER OBSERVATIONS AND REMARKS / GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL
SURFACE ELEVATION						
0.0	PAVEMENT: 140 mm asphalt, over 180 mm granular base, over		1A	GS	-	
0.54	220 mm granular subbase, moist		1B			
	FILL: Brown, sand, some silt, trace gravel, trace organics, moist		2	SS	9	
			3	SS	17	
2.1	SILTY SAND TILL: Compact, brown, silty sand, trace gravel, cobbles and boulders, moist		4	SS	10	
			5	SS	15	
			6	SS	13	
5.5	SAND: Dense, grey, sand, trace silt, trace gravel, wet					
6.5			7	SS	30	First water strike at 6.1 m
	BOREHOLE TERMINATED AT 6.5 m					Upon completion of augering Water at 5.5 m No cave

ELEVATION SCALE

SHEAR STRENGTH (kPa)
+ FIELD VANE △ TORVANE ○ Qu
▲ POCKET PENETROMETER O Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 19

17T 603156E 4913112N
Culvert 43 - Hotchkiss Creek Watershed - Morrow Road

PROJECT City of Barrie Master Drainage Plan Update
LOCATION Barrie, Ontario
BORING METHOD Continuous Flight Solid Stem Augers
BORING DATE August 15, 2017
PML REF. 17BF024
ENGINEER GW
TECHNICIAN AT

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	ELEVATION SCALE	SHEAR STRENGTH (kPa) / DYNAMIC CONE PENETRATION / STANDARD PENETRATION TEST	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT kN/m³	GROUND WATER OBSERVATIONS AND REMARKS / GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL
	SURFACE ELEVATION									
0.0	PAVEMENT: 100 mm asphalt, over		1A	GS	-					
0.44	140 mm granular base, over 200 mm granular subbase, moist		1B							
	FILL: Brown, sand, trace silt, trace gravel, moist to wet		2	SS	7					
1.0										
			3	SS	8					First water strike at 1.5 m
2.0										
2.1	Becoming sand and gravel, wet		4	SS	8					
2.9										
3.0	PEAT: Brown, amorphic peat, wood pieces, wet		5	SS	3					
4.0										
	SILT: Loose, grey, sandy silt, wet		6	SS	9					
5.0										
5.5	Becoming clayey silt, APL									
6.0			7	SS	9					
6.5	BOREHOLE TERMINATED AT 6.5 m									Upon completion of augering Wet cave at 1.8 m
7.0										
8.0										
9.0										
10.0										
11.0										
12.0										
13.0										
14.0										
15.0										

SHEAR STRENGTH (kPa): + FIELD VANE △ TORVANE ○ Qu ▲ POCKET PENETROMETER ○ Q; 50 100 150 200; DYNAMIC CONE PENETRATION ×; STANDARD PENETRATION TEST ●; 20 40 60 80

PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT; WATER CONTENT (%): 10 20 30 40

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 20

17T 603486E 4913722N
Culvert 47 - Hotchkiss Creek Watershed - Wood Street

PROJECT City of Barrie Master Drainage Plan Update
PML REF. 17BF024
LOCATION Barrie, Ontario
BORING DATE June 29, 2017
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN AT

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	ELEVATION SCALE
0.0	SURFACE ELEVATION					
0.35	PAVEMENT: 40 mm asphalt, over 110 mm granular base, over 200 mm granular subbase, moist		1A 1B	GS	-	
1.4	FILL: Dark brown, silty sand, very moist		2	SS	15	
4.0	SAND: Compact, brown, fine sand, trace to some silt, wet		3 4 5	SS SS SS	17 22 23	
6.5	SILTY SAND: Compact, grey, silty sand, wet		6 7	SS SS	15 18	
	BOREHOLE TERMINATED AT 6.5 m					

SHEAR STRENGTH (kPa)
+ FIELD VANE △ TORVANE ○ Qu
▲ POCKET PENETROMETER O Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

First water strike at 2.1 m

Upon completion of augering
Water at 1.2 m
No cave

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 21

17T 603657E 4914109N
Culvert 48 - Hotchkiss Creek Watershed - Tiffin Street

PROJECT City of Barrie Master Drainage Plan Update
LOCATION Barrie, Ontario
BORING METHOD Continuous Flight Solid Stem Augers
BORING DATE July 24, 2017
PML REF. 17BF024
ENGINEER GW
TECHNICIAN AT/WP

DEPTH ELEV (metres)	DESCRIPTION	NUMBER	TYPE	"N" VALUES
0.0	SURFACE ELEVATION			
0.10	TOPSOIL: Brown, sand, trace silt, trace gravel, moist	1	SS	13
	FILL: Brown, sand, trace silt, trace gravel, moist	2	SS	7
		3	SS	3
		4	SS	1
3.1	Becoming dark grey, trace organics	5	SS	3
3.7	PEAT: Dark brown, amorphic peat, trace sand, wood pieces, wet	6	SS	25
		7	SS	2
5.5	SAND: Loose to compact, dark brown to black, sand, trace silt, trace gravel, trace orgaincs, wet	8	SS	5
7.0	Becoming brown, sand, some silt	9	SS	10
8.1	BOREHOLE TERMINATED AT 8.1 m			

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER O Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

First water strike at 2.7 m

Upon completion of augering
Wet cave at 2.1 m

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 22

17T 603858E 4914223N

Culvert 49 - Hotchkiss Creek Watershed - Anne Street South

PROJECT City of Barrie Master Drainage Plan Update — **PML REF.** 17BF024

LOCATION Barrie, Ontario — **BORING DATE** June 26/27, 2017 — **ENGINEER** GW

BORING METHOD Continuous Flight Solid Stem Augers — **TECHNICIAN** AT

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER OBSERVATIONS AND REMARKS / GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL
	SURFACE ELEVATION					
0.0	FILL: Brown, sand, trace silt, trace to some gravel, moist		1	SS	9	
			2	SS	21	
1.0						
			3	SS	16	
2.0						
			4	SS	23	
3.0	3.0					
	Becoming dark brown to black, sand to silty sand, trace gravel, wet		5	SS	22	
4.0			6	SS	12	
			7	SS	12	First water strike at 4.6 m
5.0						
6.0	6.0					
	Becoming medium to coarse sand, trace silt		8	SS	5	
7.0						
7.9			9	SS	20	
8.0	PEAT: Brown, fine fibrous peat, wet					
9.0	9.0					
	Becoming amorphic peat		10	SS	7	
10.0						
			11	SS	5	
11.0						
11.6						
	SAND: Loose, brown, sand, trace silt, trace gravel, wet					
12.0			12	SS	10	
12.6	BOREHOLE TERMINATED AT 12.6 m					Upon completion of augering Wet cave at 4.2 m
13.0						
14.0						
15.0						

SHEAR STRENGTH (kPa): + FIELD VANE △ TORVANE ○ Qu ▲ POCKET PENETROMETER O Q; 50 100 150 200; DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST ●; 20 40 60 80

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L; WATER CONTENT (%); 10 20 30 40

UNIT WEIGHT kN/m³: 56 56

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 23

17T 603974E 4914336N
Culvert 50 - Hotchkiss Creek Watershed - Innisfil Street

PROJECT City of Barrie Master Drainage Plan Update
LOCATION Barrie, Ontario
BORING METHOD Continuous Flight Solid Stem Augers
BORING DATE August 14, 2017
PML REF. 17BF024
ENGINEER GW
TECHNICIAN AT

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES
0.0	SURFACE ELEVATION				
	PAVEMENT: 140 mm asphalt, over 200 mm granular base, over 400 mm granular subbase, moist		1A, 1B	GS	-
0.74	FILL: Brown, sand, trace to some silt and gravel, moist		2	SS	0
			3	SS	8
			4	SS	7
2.9	Becoming sand and gravel, trace silt		5	SS	68/290mm
4.0	PEAT: Brown, amorphic peat, wet		6	SS	3
5.5	SAND: Compact, dark brown, sand, trace silt, some gravel, trace organics, wet		7	SS	12
6.5	BOREHOLE TERMINATED AT 6.5 m				

ELEVATION SCALE

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER O Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

First water strike at 4.3 m

Upon completion of augering
Water at 4.1 m
Cave at 4.3 m

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 24

17T 604225E 4914418N

Culvert 51 - Hotchkiss Creek Watershed - Bradford Street

PROJECT City of Barrie Master Drainage Plan Update
PML REF. 17BF024
LOCATION Barrie, Ontario
BORING DATE August 14, 2017
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN AT

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	SHEAR STRENGTH (kPa) / DYNAMIC CONE PENETRATION / STANDARD PENETRATION TEST	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT kN/m³	GROUND WATER OBSERVATIONS AND REMARKS / GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL
	SURFACE ELEVATION								
0.12	TOPSOIL: Brown, sand, trace silt, trace gravel, moist		1	SS	19				
0.76	FILL: Dark brown, silty sand, trace gravel, moist to wet								
1.0	Trace brick, wood pieces		2	SS	15				
1.5	Becoming sand, trace silt		3	SS	5				
2.1	PEAT: Black, amorphic peat, wood pieces, wet		4	SS	3				First water strike at 2.3 m
3.0			5	SS	2				
4.0								68	
5.0			6	SS	14				
5.5	SAND: Loose, dark grey, sand, trace silt, trace gravel, trace orgaincs, wet								
6.0			7	SS	4				
6.5	BOREHOLE TERMINATED AT 6.5 m								Upon completion of augering Wet cave at 2.4 m

SHEAR STRENGTH (kPa): + FIELD VANE △ TORVANE ○ Qu ▲ POCKET PENETROMETER O Q; 50 100 150 200; DYNAMIC CONE PENETRATION ×; STANDARD PENETRATION TEST ●; 20 40 60 80

PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT; WATER CONTENT (%): 10 20 30 40

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 25

17T 600044E 4912435N
Culvert 80 - Bear Creek Watershed - County Road 27

PROJECT City of Barrie Master Drainage Plan Update
LOCATION Barrie, Ontario
BORING METHOD Continuous Flight Solid Stem Augers

BORING DATE August 15, 2017

PML REF. 17BF024
ENGINEER GW
TECHNICIAN AT

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	ELEVATION SCALE	SHEAR STRENGTH (kPa) + FIELD VANE △ TORVANE ○ Qu ▲ POCKET PENETROMETER ○ Q / DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST ●	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT kN/m³	GROUND WATER OBSERVATIONS AND REMARKS / GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL
	SURFACE ELEVATION						50 100 150 200 / 20 40 60 80	10 20 30 40		
0.15	SHOULDER GRANULAR: 150 mm granular base, moist		1	SS	11					
0.70	FILL: Brown, sand, trace silt, trace gravel, moist to wet									
	PEAT: Black, amorphic peat, wet		2	SS	1				329	First water strike at 0.8 m
			3	SS	0				329	
2.1	SAND: Loose to compact, black, sand, trace silt, trace gravel, wet		4	SS	8					
3.0	Becoming grey		5	SS	7					
4.5	Becoming silty fine sand		6	SS	15					
6.5	BOREHOLE TERMINATED AT 6.5 m		7	SS	14					Upon completion of augering Wet cave at 0.6 m

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 29

17T 605875E 4913176N

Culvert 59 - Whiskey Creek Watershed - McConkey Place

PROJECT City of Barrie Master Drainage Plan Update — **PML REF.** 17BF024

LOCATION Barrie, Ontario — **BORING DATE** July 18, 2017 — **ENGINEER** GW

BORING METHOD Continuous Flight Solid Stem Augers — **TECHNICIAN** AT

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	SHEAR STRENGTH (kPa) / DYNAMIC CONE PENETRATION / STANDARD PENETRATION TEST	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT kN/m³	GROUND WATER OBSERVATIONS AND REMARKS / GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL
	SURFACE ELEVATION								
0.52	PAVEMENT: 100 mm asphalt, over 180 mm granular base, over 250 mm granular subbase, moist		1A 1B	GS	-				
	FILL: Brown, sand, trace to some silt, trace gravel, moist to very moist		2	SS	27				
			3	SS	9				
			4	SS	7				
			5	SS	3				
3.7	SAND: Compact to dense, brown, sand, trace silt, trace gravel, very moist to wet		6	SS	16				First water strike at 3.7 m
			7	SS	39				
6.5	BOREHOLE TERMINATED AT 6.5 m		8	SS	32				Upon completion of augering Water at 3.2 m Cave at 3.5 m

SHEAR STRENGTH (kPa): + FIELD VANE △ TORVANE ○ Qu ▲ POCKET PENETROMETER O Q; 50 100 150 200

DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●

20 40 60 80

PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT

w_P w w_L

WATER CONTENT (%): 10 20 30 40

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 30

17T 606093E 4913272N
Culvert 60 - Whiskey Creek Watershed - Huronia Road

PROJECT City of Barrie Master Drainage Plan Update
LOCATION Barrie, Ontario
BORING METHOD Continuous Flight Solid Stem Augers

BORING DATE August 14, 2017

PML REF. 17BF024
ENGINEER GW
TECHNICIAN AT

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES
	SURFACE ELEVATION				
0.10	TOPSOIL: Brown, sand, trace silt, trace gravel, moist		1	SS	14
	FILL: Brown to dark brown, sand, trace silt, trace gravel, moist		2	SS	9
1.5	Becoming dark grey, very moist to wet		3	SS	5
			4	SS	14
2.9	SILTY SAND TILL: Loose to dense, grey, silty sand, trace gravel, cobbles and boulders, wet		5	SS	8
			6	SS	30
5.5	SAND: Compact, grey, sand, some silt, wet		7	SS	21
6.5	BOREHOLE TERMINATED AT 6.5 m				

ELEVATION SCALE

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

First water strike at 3.1 m

Upon completion of augering
Wet cave at 2.0 m

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 31

17T 606258E 4913374N
Culvert 62 - Whiskey Creek Watershed - Little Avenue

PROJECT City of Barrie Master Drainage Plan Update
LOCATION Barrie, Ontario
BORING METHOD Continuous Flight Solid Stem Augers
BORING DATE August 9, 2017
PML REF. 17BF024
ENGINEER GW
TECHNICIAN AT

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER OBSERVATIONS AND REMARKS
SURFACE ELEVATION						
	PAVEMENT: 120 mm asphalt, over 200 mm granular base, over		1A	GS	-	
0.56	240 mm granular subbase, moist		1B			
	FILL: Brown, sand, trace silt, trace to some gravel, moist to wet		2	SS	32	
			3	SS	9	
			4	SS	9	First water strike at 2.1 m
2.9						
	SAND: Compact, dark grey, sand, trace silt, trace to some gravel, wet		5	SS	13	
4.0						
	SAND AND GRAVEL: Compact, grey, sand and gravel, trace silt, wet		6	SS	23	
5.5						
	SILT: Dense, grey, silt, trace sand, clay layers, very moist		7	SS	46	
6.5						
	BOREHOLE TERMINATED AT 6.5 m					Upon completion of augering Wet cave at 1.8 m

ELEVATION SCALE: 0.0, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0, 11.0, 12.0, 13.0, 14.0, 15.0

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 32

17T 606136E 4913800N
Culvert 63 - Whiskey Creek Watershed - Yonge Street

PROJECT City of Barrie Master Drainage Plan Update
PML REF. 17BF024
LOCATION Barrie, Ontario
BORING DATE August 4, 2017
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN AT

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	SHEAR STRENGTH (kPa) / DYNAMIC CONE PENETRATION / STANDARD PENETRATION TEST	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT / WATER CONTENT (%)	UNIT WEIGHT kN/m³	GROUND WATER OBSERVATIONS AND REMARKS / GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL
	SURFACE ELEVATION								
0.0	PAVEMENT: 130 mm asphalt, over 200 mm granular base, over		1A	GS	-				
0.61	280 mm granular subbase, moist		1B						
1.0	FILL: Brown to dark brown, sand, trace silt, some gravel, moist		2	SS	21				
2.0			3	SS	11				
2.1	Becoming silty sand, trace gravel		4	SS	15				
3.0			5	SS	10				
4.0			6	SS	21				
4.5	SILTY SAND: Very loose, brown, silty sand, trace gravel, wet		7	SS	2				First water strike at 4.4 m
5.0									
5.5	SILTY SAND TILL: Very dense, grey, silty sand, trace gravel, cobbles and boulders, very moist to wet								
6.0									
6.5			8	SS	84				
	BOREHOLE TERMINATED AT 6.5 m								Upon completion of augering Water at 4.4 m Cave at 6.2 m
7.0									
8.0									
9.0									
10.0									
11.0									
12.0									
13.0									
14.0									
15.0									

SHEAR STRENGTH (kPa): + FIELD VANE △ TORVANE ○ Qu ▲ POCKET PENETROMETER ○ Q; 50 100 150 200; DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST ●; 20 40 60 80

PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L; WATER CONTENT (%) 10 20 30 40

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 33

17T 606141E 4914161N

Culvert 64 - Whiskey Creek Watershed - Tollendal Mill Road

PROJECT City of Barrie Master Drainage Plan Update — **PML REF.** 17BF024

LOCATION Barrie, Ontario — **BORING DATE** August 9, 2017 — **ENGINEER** GW

BORING METHOD Continuous Flight Solid Stem Augers — **TECHNICIAN** AT

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES
	SURFACE ELEVATION				
0.0	PAVEMENT: 110 mm asphalt, over 260 mm granular base, over		1A	GS	-
0.60	230 mm granular subbase, moist		1B		
	FILL: Brown, sand, trace silt, trace gravel, moist		2	SS	25
1.5					
	Wood pieces, very moist		3	SS	39
2.3					
	Becoming dark grey, sandy silt to silty sand, trace gravel, very moist		4	SS	22
			5	SS	58
			6	SS	27
5.5	PEAT: Black, amporphic peat, moist				
6.4			7	SS	21
6.5	SAND: Compact, brown, sand, trace silt, trace gravel, moist				
	BOREHOLE TERMINATED AT 6.5 m				

ELEVATION SCALE

SHEAR STRENGTH (kPa)
+ FIELD VANE △ TORVANE ○ Qu
▲ POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS

GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

Upon completion of augering
No water
No cave

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 34

17T 606172E 4914350N
Culvert 65 - Whiskey Creek Watershed - The Boulevard

PROJECT City of Barrie Master Drainage Plan Update
PML REF. 17BF024
LOCATION Barrie, Ontario
BORING DATE July 18, 2017
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN AT

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	ELEVATION SCALE	SHEAR STRENGTH (kPa) / DYNAMIC CONE PENETRATION / STANDARD PENETRATION TEST	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT / WATER CONTENT (%)	UNIT WEIGHT kN/m³	GROUND WATER OBSERVATIONS AND REMARKS / GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL
	SURFACE ELEVATION									
0.0	PAVEMENT: 80 mm asphalt, over 200 mm granular base, over		1A	GS	-					
0.60	320 mm granular subbase, moist		1B							
	FILL: Brown, sand, trace silt, trace gravel, very moist to wet		2	SS	8					First water strike at 1.2 m
1.8			3	SS	2				305	
	PEAT: Brown, amorphic peat, trace sand, wet		4	SS	7					
3.0										
	FINE SAND: Compact to dense, brown to grey, fine sand, some silt, trace gravel, wet		5	SS	15					
			6	SS	32					
6.5			7	SS	20					
	BOREHOLE TERMINATED AT 6.5 m									Upon completion of augering Water at 0.9 m Cave at 1.0 m

SHEAR STRENGTH (kPa): +FIELD VANE △TORVANE ○ Qu ▲POCKET PENETROMETER ○ Q; 50 100 150 200; DYNAMIC CONE PENETRATION ×; STANDARD PENETRATION TEST ●; 20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L; WATER CONTENT (%); 10 20 30 40

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 35

17T 606174E 4914413N

Culvert 66 - Whiskey Creek Watershed - Brennan Avenue

PROJECT City of Barrie Master Drainage Plan Update — **PML REF.** 17BF024

LOCATION Barrie, Ontario — **BORING DATE** August 9, 2017 — **ENGINEER** GW

BORING METHOD Continuous Flight Solid Stem Augers — **TECHNICIAN** AT

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	SHEAR STRENGTH (kPa) / WATER CONTENT (%)	UNIT WEIGHT kN/m³	GROUND WATER OBSERVATIONS AND REMARKS / GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL
	SURFACE ELEVATION							
0.0	PAVEMENT: 140 mm asphalt, over 200 mm granular base, over		1A	GS	-			
0.58	240 mm granular subbase, moist		1B					
	FILL: Brown, sand, trace silt, trace gravel, moist		2	SS	5			
1.4	PEAT: Black, amorphic peat, trace sand, very moist		3	SS	3			
			4	SS	8			
2.9								First water strike at 2.7 m
	SAND: Very dense, brown, sand, trace silt, trace to some gravel, very moist to wet		5	SS	55			
4.5								
	SILTY SAND: Compact, grey, silty fine sand, wet		6	SS	11			
6.5			7	SS	11			
	BOREHOLE TERMINATED AT 6.5 m							Upon completion of augering Wet cave at 2.4 m

SHEAR STRENGTH (kPa): + FIELD VANE △ TORVANE ○ Qu ▲ POCKET PENETROMETER O Q; 50 100 150 200; DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST ●; 20 40 60 80

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L; WATER CONTENT (%); 10 20 30 40

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 36

17T 605528E 4909122N
Culvert 88 - Lovers Creek Watershed - Bayview Drive

PROJECT City of Barrie Master Drainage Plan Update
PML REF. 17BF024
LOCATION Barrie, Ontario
BORING DATE August 15, 2017
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN AT

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES
	SURFACE ELEVATION				
0.0	PAVEMENT: 80 mm asphalt, over 180 mm granular base, over		1A	GS	-
0.50	240 mm granular subbase, moist		1B		
	SAND AND SILT: Dense to very dense, brown, silty fine sand to sandy silt, silt layers, moist		2	SS	45
			3	SS	54
			4	SS	38
2.9					
	SILTY SAND: Compact to very dense, brown, silty sand, some gravel, moist		5	SS	16
4.5					
	SAND: Very dense, brown, sand, trace silt, trace gravel, moist		6	SS	92/290mm
6.4			7	SS	88/290mm
	BOREHOLE TERMINATED AT 6.4 m				

ELEVATION SCALE

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER O Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

Upon completion of augering
No water
No cave

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 37

17T 606354E 4909065N
Culvert 89 - Lovers Creek Watershed - Lockhart Road

PROJECT City of Barrie Master Drainage Plan Update
LOCATION Barrie, Ontario
BORING METHOD Continuous Flight Solid Stem Augers
BORING DATE August 9, 2017
PML REF. 17BF024
ENGINEER GW
TECHNICIAN AT

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"N" VALUES
	SURFACE ELEVATION				
0.0	PAVEMENT: 130 mm asphalt, over 190 mm granular base, over		1A	GS	-
0.56	240 mm granular subbase, moist		1B		
	FILL: Brown, sandy silt, trace gravel, moist		2	SS	18
1.4					
	ORGANIC SANDY SILT: Very loose, brown, organic sandy silt, very moist		3	SS	2
2.1					
	SILTY SAND: Loose, brown to dark grey, silty sand, trace gravel, wet		4	SS	5
3.0					
	SAND AND GRAVEL: Compact, brown, sand and gravel, trace silt, wet		5	SS	17
4.0					
	SILTY SAND: Very dense, grey, silty sand, very moist		6	SS	82/270mm
6.4			7	SS	86/250mm
	BOREHOLE TERMINATED AT 6.4 m				

ELEVATION SCALE

SHEAR STRENGTH (kPa)
+ FIELD VANE △ TORVANE ○ Qu
▲ POCKET PENETROMETER O Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS

First water strike at 2.4 m

Upon completion of augering
Wet cave at 3.1 m

GRAIN SIZE DISTRIBUTION (%)
GR SA SI&CL

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 38

17T 607119E 4909318N
Culvert 91 - Lovers Creek Watershed - Lockhart Road

PROJECT City of Barrie Master Drainage Plan Update
LOCATION Barrie, Ontario
BORING METHOD Continuous Flight Solid Stem Augers
BORING DATE August 15, 2017
PML REF. 17BF024
ENGINEER GW
TECHNICIAN AT

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES
	SURFACE ELEVATION				
0.0	PAVEMENT: 60 mm asphalt, over 140 mm granular base, over 260 mm granular subbase, moist		1A 1B	GS	-
0.46	FILL: Brown, sand, trace silt, trace gravel, moist		2	SS	23
1.0			3	SS	4
2.0					
2.3	Becoming black, silt, trace to some sand, some gravel, very moist		4	SS	7
2.9	PEAT: Black, amorphic peat, moist		5	SS	6
3.0					
4.0	SAND AND GRAVEL: Compact, grey, sand and gravel, trace silt, wet		6	SS	13
5.0					
5.5	SILTY SAND TILL: Compact, grey, silty sand, trace gravel, cobbles and boulders, wet		7	SS	10
6.0					
6.5	BOREHOLE TERMINATED AT 6.5 m				
7.0					
8.0					
9.0					
10.0					
11.0					
12.0					
13.0					
14.0					
15.0					

ELEVATION SCALE

SHEAR STRENGTH (kPa)
+ FIELD VANE △ TORVANE ○ Qu
▲ POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS

First water strike at 4.3 m

Upon completion of augering
Water at 3.1 m
Cave at 4.6 m

GRAIN SIZE DISTRIBUTION (%)
GR SA SI&CL

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 40

17T 606041E 4910406N
Culvert 94 - Lovers Creek Watershed - Welham Road

PROJECT City of Barrie Master Drainage Plan Update
PML REF. 17BF024
LOCATION Barrie, Ontario
BORING DATE July 17, 2017
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN AT

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	ELEVATION SCALE	SHEAR STRENGTH (kPa) / DYNAMIC CONE PENETRATION / STANDARD PENETRATION TEST	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT / WATER CONTENT (%)	UNIT WEIGHT kN/m³	GROUND WATER OBSERVATIONS AND REMARKS / GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL
	SURFACE ELEVATION									
0.05	TOPSOIL: Brown, sand, trace silt, trace gravel, moist		1	SS	4					
	FILL: Light to dark brown, sand, trace to some silt, moist		2	SS	9					
1.4	SAND: Compact to dense, brown, sand, trace silt, trace to some gravel, very moist to wet		3	SS	24					
			4	SS	28					First water strike at 2.3 m
			5	SS	27					
			6	SS	32					
6.5			7	SS	30					
	BOREHOLE TERMINATED AT 6.5 m									Upon completion of augering Water at 1.7 m Cave at 1.8 m

SHEAR STRENGTH (kPa): + FIELD VANE △ TORVANE ○ Qu ▲ POCKET PENETROMETER ○ Q; 50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80
PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%): 10 20 30 40

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 41

17T 606125E 4910388N
Culvert 95 - Lovers Creek Watershed - Mapleview Drive

PROJECT City of Barrie Master Drainage Plan Update
LOCATION Barrie, Ontario
BORING METHOD Continuous Flight Solid Stem Augers
BORING DATE August 4, 2017
PML REF. 17BF024
ENGINEER GW
TECHNICIAN AT

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES
	SURFACE ELEVATION				
0.0	PAVEMENT: 160 mm asphalt, over 200 mm granular base, over 280 mm granular subbase, moist		1A, 1B	GS	-
0.64	FILL: Brown, sand, trace to some silt, some gravel, very moist to wet		2	SS	20
1.0			3	SS	8
2.0			4	SS	9
3.0			5	SS	17
4.0			6	SS	23
4.4	SAND AND GRAVEL: Compact, brown, sand and gravel, trace to some silt, wet		7	SS	25
5.0					
5.5	SAND: Dense, brown, sand, trace to some silt, trace to some gravel, wet				
6.0			8	SS	34
6.5	BOREHOLE TERMINATED AT 6.5 m				
7.0					
8.0					
9.0					
10.0					
11.0					
12.0					
13.0					
14.0					
15.0					

ELEVATION SCALE

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER O Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS

First water strike at 1.8 m

Upon completion of augering
Water at 1.5 m
Cave at 4.6 m

GRAIN SIZE DISTRIBUTION (%)
GR SA SI&CL

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 43

17T 606524E 4911127N
Culvert 97 - Lovers Creek Watershed - Huronia Road

PROJECT City of Barrie Master Drainage Plan Update
PML REF. 17BF024
LOCATION Barrie, Ontario
BORING DATE August 9, 2017
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN AT

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	ELEVATION SCALE	SHEAR STRENGTH (kPa) / DYNAMIC CONE PENETRATION / STANDARD PENETRATION TEST	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT / WATER CONTENT (%)	UNIT WEIGHT kN/m³	GROUND WATER OBSERVATIONS AND REMARKS / GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL
	SURFACE ELEVATION									
0.0	PAVEMENT: 70 mm asphalt, over 260 mm granular base, over 200 mm granular subbase, moist		1A / 1B	GS	-					
0.53	FILL: Brown, sand, some silt to silty, trace gravel, moist		2	SS	11					
1.0										
1.5	Becoming sand, trace silt, trace gravel, organics, moist to very moist		3	SS	3					
2.0										First water strike at 2.1 m
2.5	CLAY: Firm to stiff, grey, clay, trace silt, silt layers, APL		4	SS	5					
3.0			5	SS	8					
4.0										
5.0			6	SS	10					
6.0										
6.5			7	SS	6					
	BOREHOLE TERMINATED AT 6.5 m									Upon completion of augering Wet cave at 1.8 m
7.0										
8.0										
9.0										
10.0										
11.0										
12.0										
13.0										
14.0										
15.0										

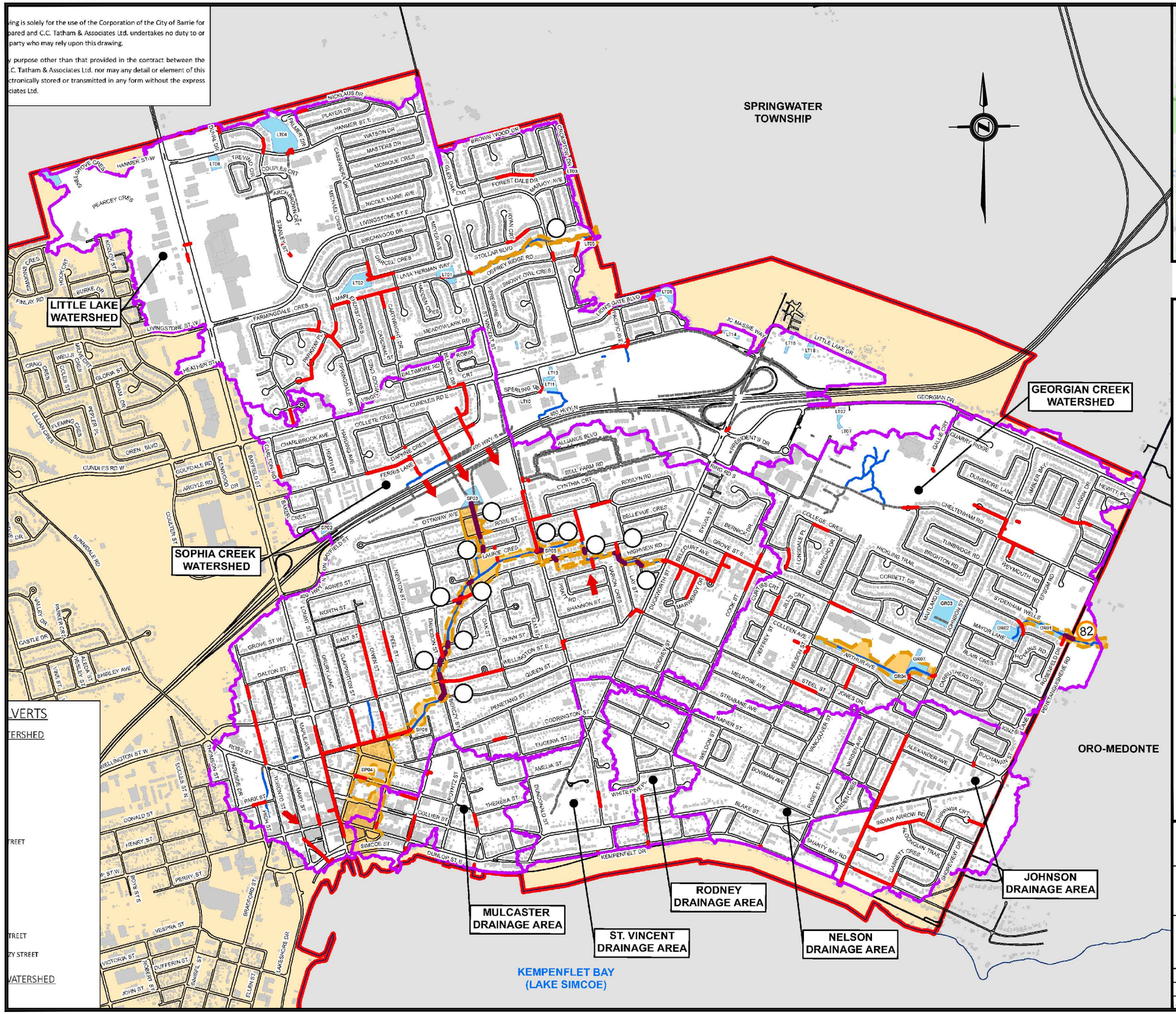
SHEAR STRENGTH (kPa): +FIELD VANE △TORVANE ○ Qu ▲POCKET PENETROMETER ○ Q; 50 100 150 200; DYNAMIC CONE PENETRATION ×; STANDARD PENETRATION TEST ●; 20 40 60 80

PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L; WATER CONTENT (%); 10 20 30 40

NOTES

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C. Tatham & Associates Ltd. nor may any detail or element of this
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ciates Ltd.





KEY PLAN
BARRIE, ONTARIO

LEGEND:

82 — CULVERT 82
(CURRENT BOREHOLE IN BELOW TABLE)

CULVERT ID	ASSOCIATED BOREHOLE
82	BOREHOLE 1

REFERENCE:

BASE PLAN PROVIDED BY CLIENT.
KEY PLAN PRODUCED USING GOOGLE MAPS, JAN. 2018.

SCALE = 1:10,000

0 125 250 500 750 1,000 Meters

SOPHIA CREEK, GEORGIAN CREEK & LITTLE LAKE WATERSHEDS

CULVERT LOCATION PLAN

CITY OF BARRIE MASTER DRAINAGE PLAN UPDATE
BARRIE, ONTARIO

Peto MacCallum Ltd.
CONSULTING ENGINEERS

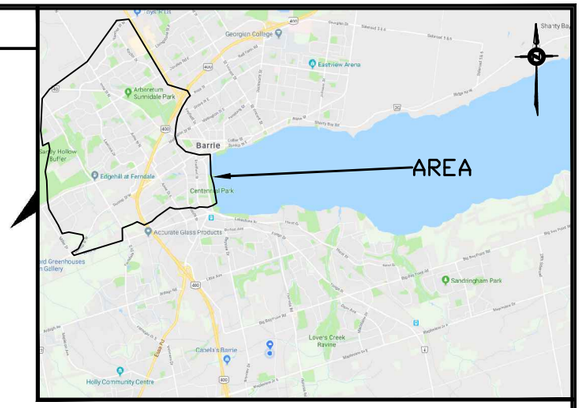
		DATE	SCALE	PML REF.	DRAWING NO.
DRAWN	RB	JAN. 2018	AS SHOWN	17BF024	1
CHECKED	GW				
APPROVED	GW				

KIDDS CREEK WATERSHED

DYMENTS CREEK WATERSHED

BUNKERS CREEK WATERSHED

KEMPENFELT BAY (LAKE SIMCOE)



KEY PLAN
BARRIE, ONTARIO

LEGEND:

17 — CULVERT 17 (CURRENT BOREHOLE IN BELOW TABLE)

20 — CULVERT 20 (ARCHIVE BOREHOLE IN BELOW TABLE)

27 — CULVERT 27 (NOT DEFICIENT, NO BOREHOLE DRILLED)

CULVERT ID	ASSOCIATED BOREHOLE
17	BOREHOLE 2
18	BOREHOLE 3
20	BOREHOLES 6/7 FROM 08BF028
22	BOREHOLE 5
24	BOREHOLE 6
27	BOREHOLE CANCELLED – NOT DEFICIENT CULVERT
28	BOREHOLE 8
29	BOREHOLES 103/104 FROM 13BF061
30	BOREHOLE 10
33	BOREHOLE 11
34	BOREHOLE 12
36	BOREHOLE 13
37	BOREHOLE 14
38	BOREHOLE 15
39	BOREHOLES 1/2 FROM 16BF010

REFERENCE:

BASE PLAN PROVIDED BY CLIENT.
KEY PLAN PRODUCED USING GOOGLE MAPS, JAN. 2018.

SCALE = 1:10,000

0 125 250 500 750 1,000 Meters

BUNKERS CREEK, DYMENTS CREEK & KIDDS CREEK WATERSHEDS

CULVERT LOCATION PLAN

CITY OF BARRIE MASTER DRAINAGE PLAN UPDATE
BARRIE, ONTARIO

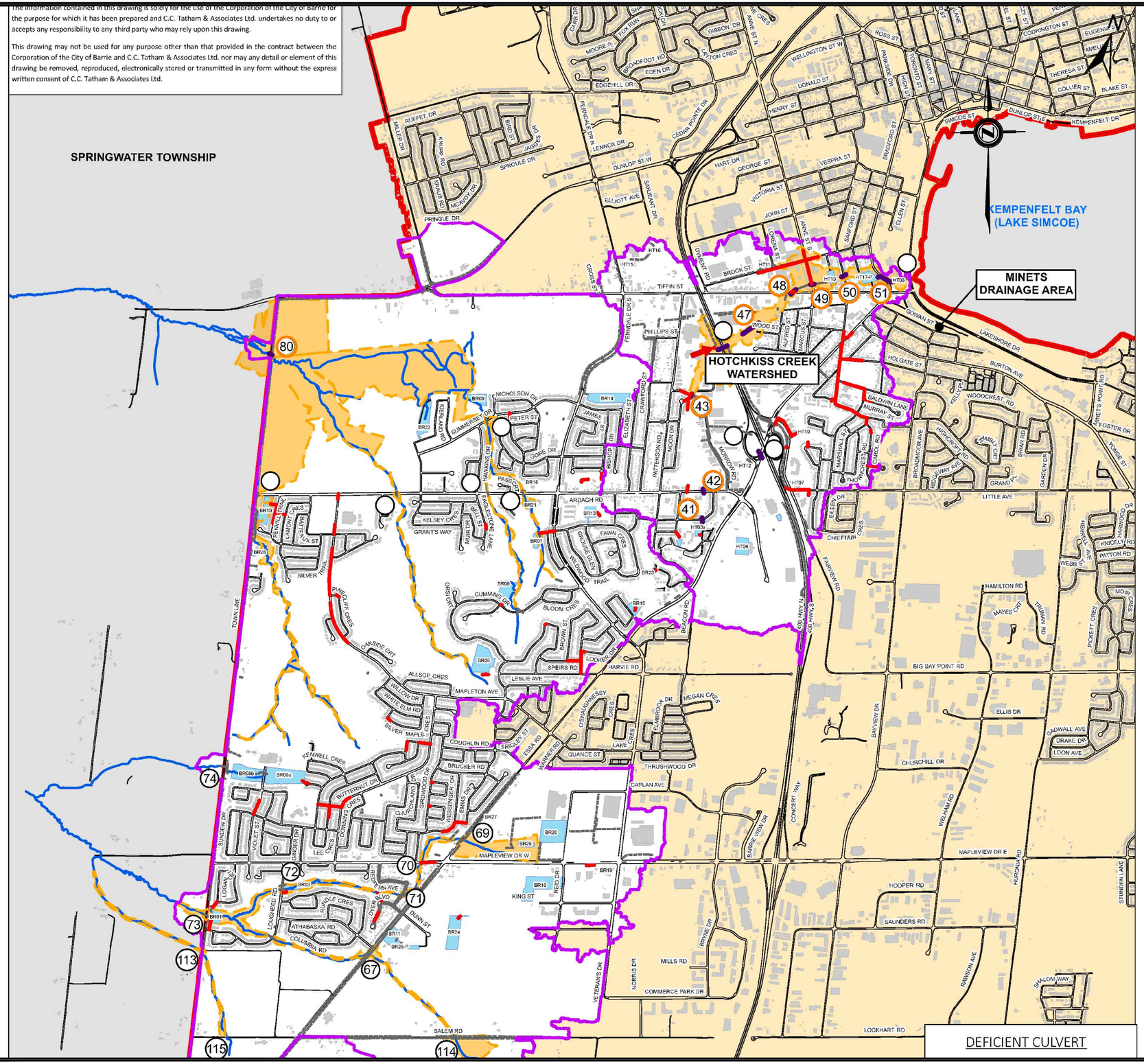
Peto MacCallum Ltd.
CONSULTING ENGINEERS

DRAWN	RB	DATE	SCALE	PML REF.	DRAWING NO.
CHECKED	GW	JAN. 2018	AS SHOWN	17BF024	2
APPROVED	GW				

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KEY PLAN
BARRIE, ONTARIO

LEGEND:

(41) CULVERT 41
(CURRENT BOREHOLE IN BELOW TABLE)

CULVERT ID	ASSOCIATED BOREHOLE
41	BOREHOLE 17
42	BOREHOLE 18
43	BOREHOLE 19
47	BOREHOLE 20
48	BOREHOLE 21
49	BOREHOLE 22
50	BOREHOLE 23
51	BOREHOLE 24
80	BOREHOLE 25

REFERENCE:

BASE PLAN PROVIDED BY CLIENT.
KEY PLAN PRODUCED USING GOOGLE MAPS, JAN. 2018.

SCALE = 1:15,000

0 190 380 760 1,140 1,520 Meters

BEAR CREEK, THORNTON CREEK
& HOTCHKISS CREEK WATERSHEDS

CULVERT LOCATION PLAN

CITY OF BARRIE MASTER DRAINAGE PLAN UPDATE
BARRIE, ONTARIO

Peto MacCallum Ltd.
CONSULTING ENGINEERS

DRAWN	RB	DATE	SCALE	PML REF.	DRAWING NO.
CHECKED	GW	JAN. 2018	AS SHOWN	17BF024	3
APPROVED	GW				

K WATERSHED

of the City of Barrie for
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e contract between the
detail or element of this
rm without the express

KEMPENFELT BAY
(LAKE SIMCOE)

MINETS
DRAINAGE AREA

ROYAL OAK
DRAINAGE AREA

GRAY LANE
DRAINAGE AREA

WHISKEY CREEK
WATERSHED

LOVERS CREEK
WATERSHED

TOWN OF INNISFIL



KEY PLAN
BARRIE, ONTARIO

LEGEND:

59 — CULVERT 59
(CURRENT BOREHOLE IN BELOW TABLE)

53 — CULVERT 53
(ARCHIVE BOREHOLE IN BELOW TABLE)

92 — CULVERT 92
(NOT DEFICIENT, NO BOREHOLE DRILLED)

CULVERT ID	ASSOCIATED BOREHOLE
53	BOREHOLES E/F FROM 11BF068
54	BOREHOLE G FROM 11BF068
57	BOREHOLE 5 FROM 15BF048
59	BOREHOLE 29
60	BOREHOLE 30
62	BOREHOLE 31
63	BOREHOLE 32
64	BOREHOLE 33
65	BOREHOLE 34
66	BOREHOLE 35
88	BOREHOLE 36
89	BOREHOLE 37
91	BOREHOLE 38
92	BOREHOLE CANCELLED – NOT DEFICIENT CULVERT
94	BOREHOLE 40
95	BOREHOLE 41
96	BOREHOLE CANCELLED – NOT DEFICIENT CULVERT
97	BOREHOLE 43

REFERENCE:

BASE PLAN PROVIDED BY CLIENT.
KEY PLAN PRODUCED USING GOOGLE MAPS, JAN. 2018.

SCALE = 1:15,000

0 190 380 760 1,140 1,520 Meters

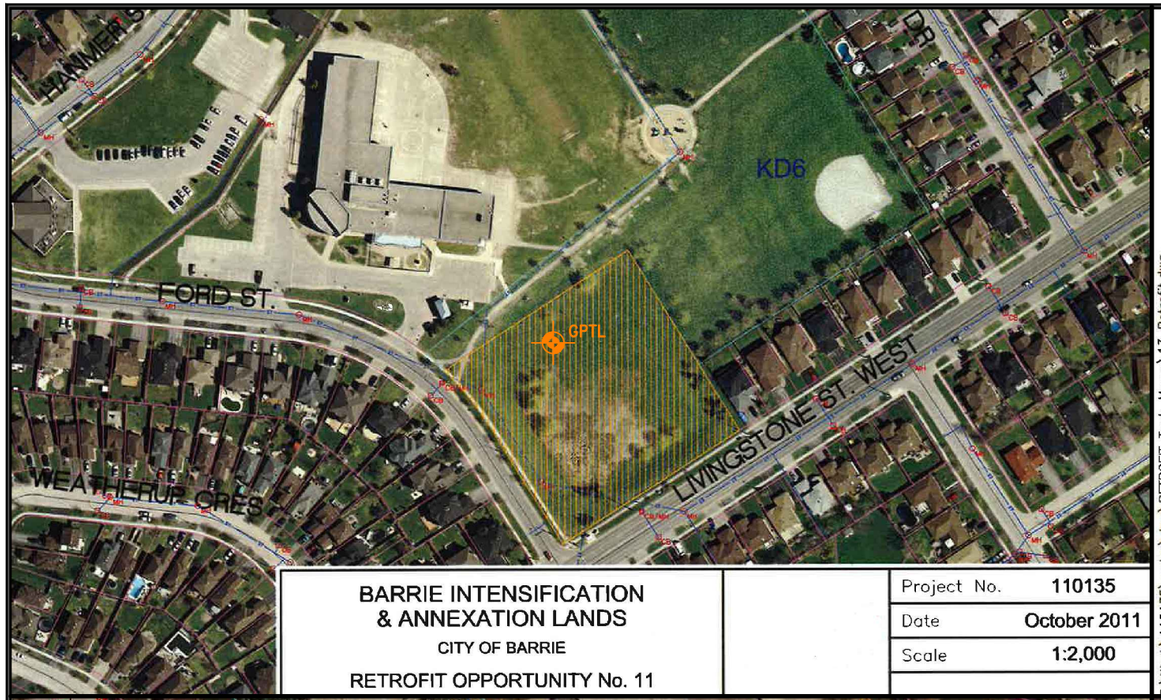
LOVERS CREEK & WHISKEY CREEK WATERSHEDS;
MINETS, ROYAL OAK & GRAY LANE DRAINAGE AREAS

CULVERT LOCATION PLAN

CITY OF BARRIE MASTER DRAINAGE PLAN UPDATE
BARRIE, ONTARIO

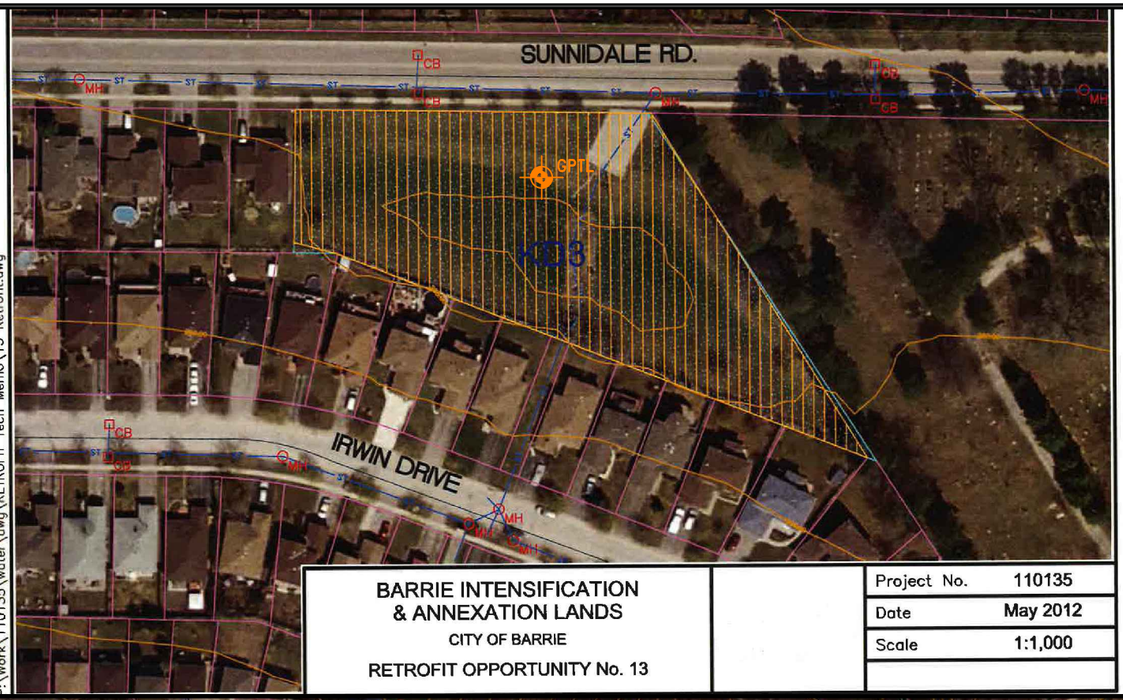
Peto MacCallum Ltd.
CONSULTING ENGINEERS

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CHECKED	GW	JAN. 2018	AS SHOWN	17BF024	4
APPROVED	GW				



BARRIE INTENSIFICATION
& ANNEXATION LANDS
CITY OF BARRIE
RETROFIT OPPORTUNITY No. 11

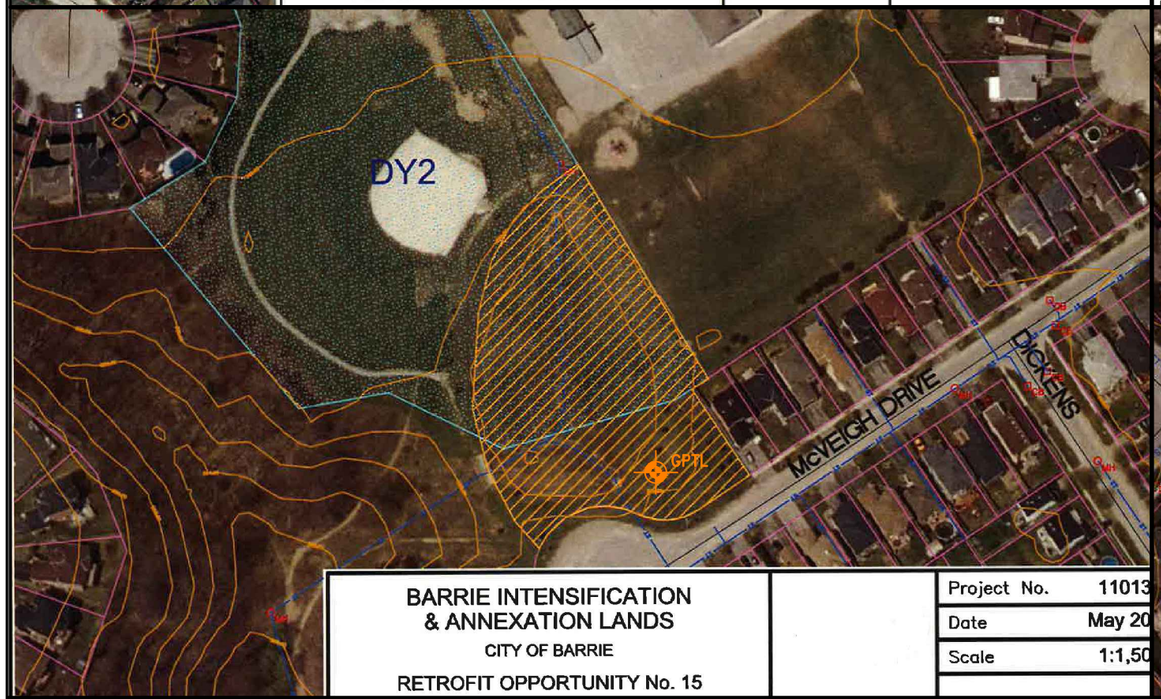
Project No.	110135
Date	October 2011
Scale	1:2,000



BARRIE INTENSIFICATION
& ANNEXATION LANDS
CITY OF BARRIE
RETROFIT OPPORTUNITY No. 13

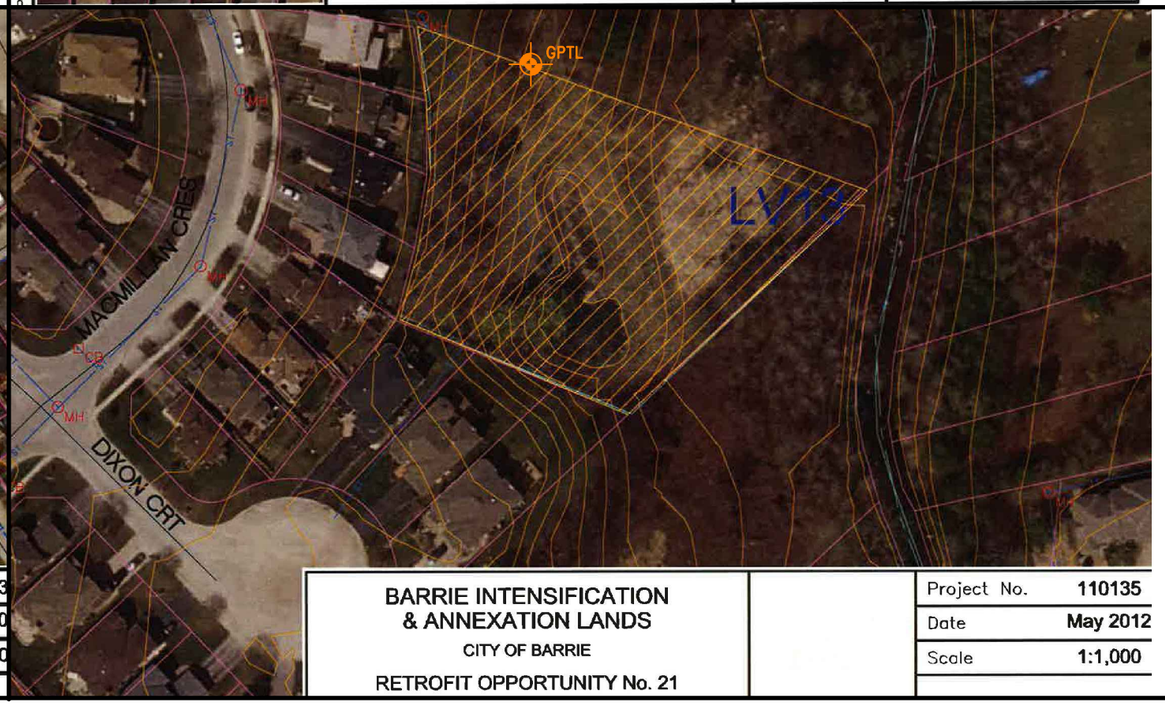
Project No.	110135
Date	May 2012
Scale	1:1,000

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BARRIE INTENSIFICATION
& ANNEXATION LANDS
CITY OF BARRIE
RETROFIT OPPORTUNITY No. 15

Project No.	11013
Date	May 20
Scale	1:1,50



BARRIE INTENSIFICATION
& ANNEXATION LANDS
CITY OF BARRIE
RETROFIT OPPORTUNITY No. 21

Project No.	110135
Date	May 2012
Scale	1:1,000

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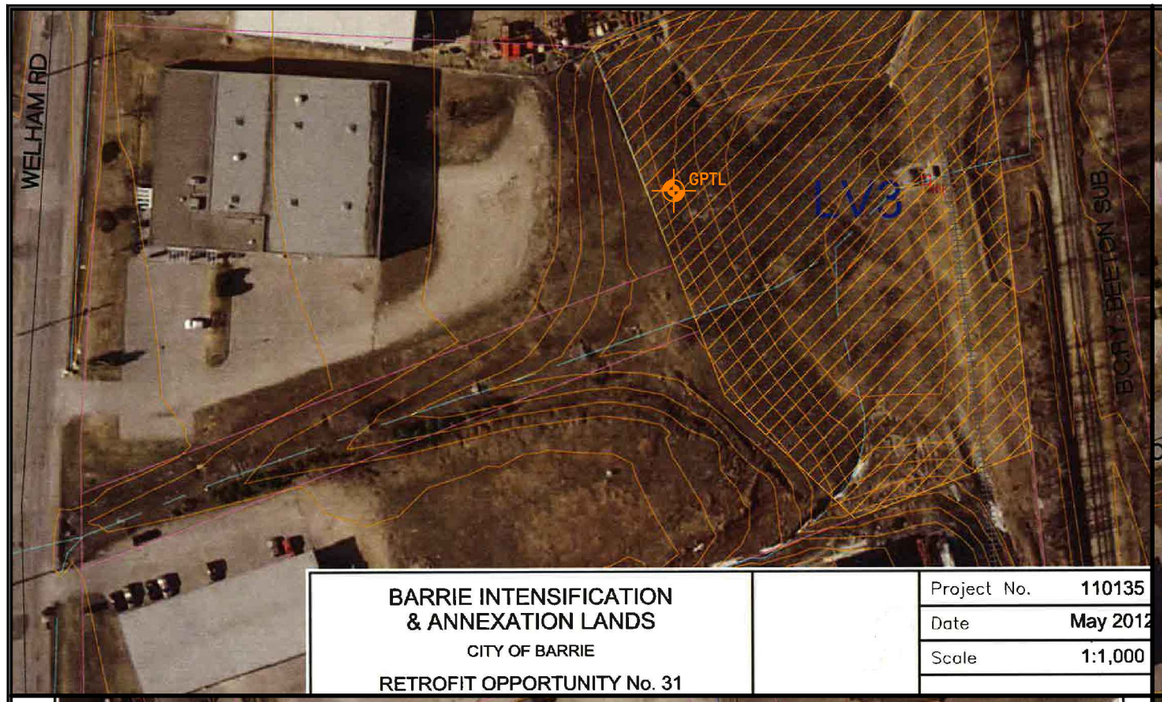
GPTL — GUELPH PERMEAMETER TEST LOCATION

GUELPH PERMEAMETER TEST LOCATION PLAN

CITY OF BARRIE MASTER DRAINAGE PLAN UPDATE
BARRIE, ONTARIO

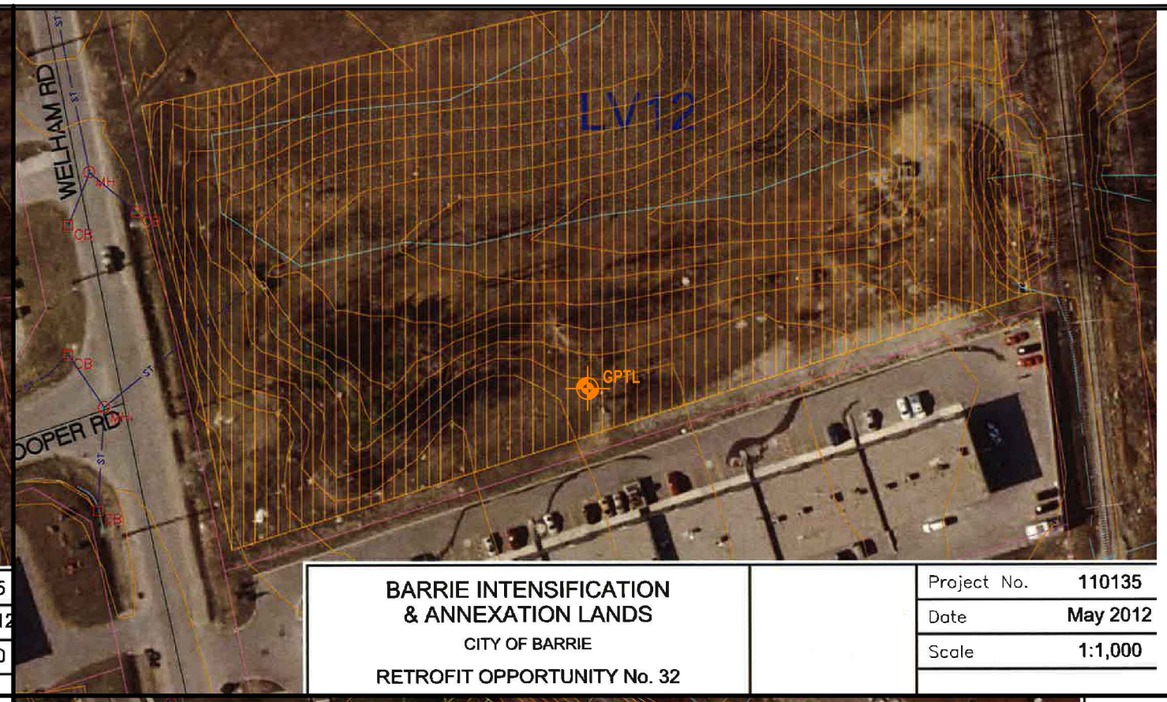
Peto MacCallum Ltd.
CONSULTING ENGINEERS

DRAWN	RB	DATE	SCALE	PML REF.	DRAWING NO.
CHECKED	GW	JAN. 2018	NTS	17BF024	5
APPROVED	GW				



BARRIE INTENSIFICATION & ANNEXATION LANDS	
CITY OF BARRIE	
RETROFIT OPPORTUNITY No. 31	

Project No.	110135
Date	May 2012
Scale	1:1,000



BARRIE INTENSIFICATION & ANNEXATION LANDS	
CITY OF BARRIE	
RETROFIT OPPORTUNITY No. 32	

Project No.	110135
Date	May 2012
Scale	1:1,000



BARRIE INTENSIFICATION & ANNEXATION LANDS	
CITY OF BARRIE	
RETROFIT OPPORTUNITY No. 38	

Project No.	110135
Date	May 2012
Scale	1:1,000



BARRIE INTENSIFICATION & ANNEXATION LANDS	
CITY OF BARRIE	
RETROFIT OPPORTUNITY No. 37	

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Date	May 2012
Scale	1:1,000

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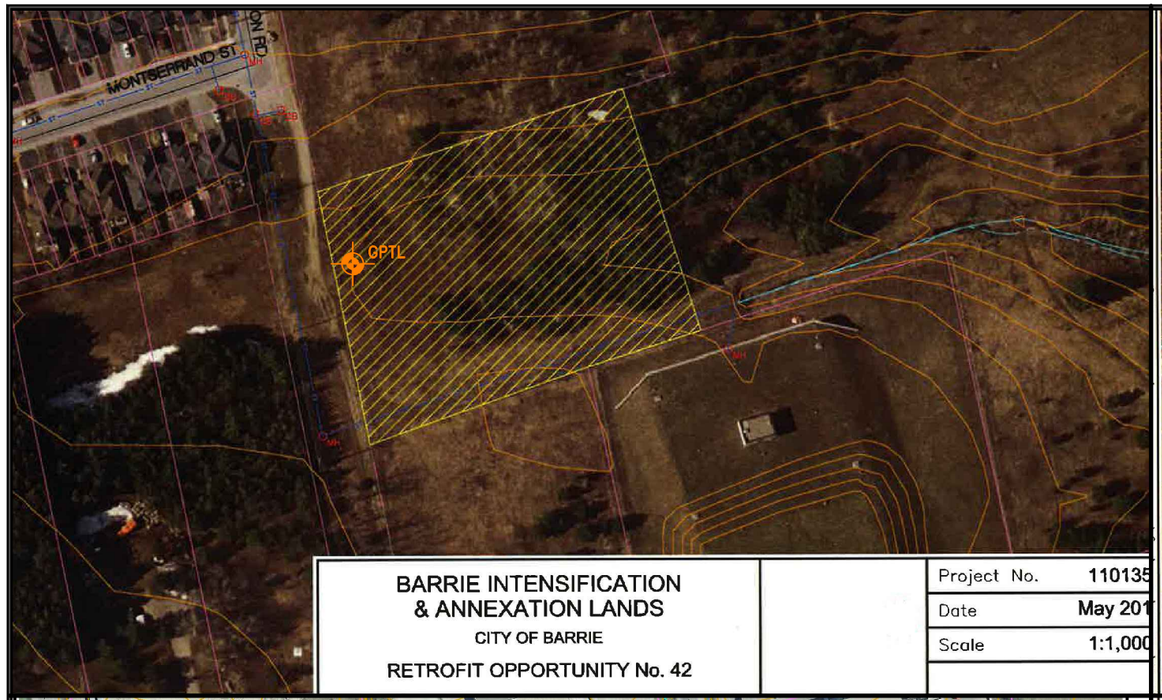
GPTL — GUELPH PERMEAMETER TEST LOCATION

GUELPH PERMEAMETER TEST LOCATION PLAN

CITY OF BARRIE MASTER DRAINAGE PLAN UPDATE
BARRIE, ONTARIO

Peto MacCallum Ltd.
CONSULTING ENGINEERS

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CHECKED	GW	JAN. 2018	NTS	17BF024	6
APPROVED	GW				



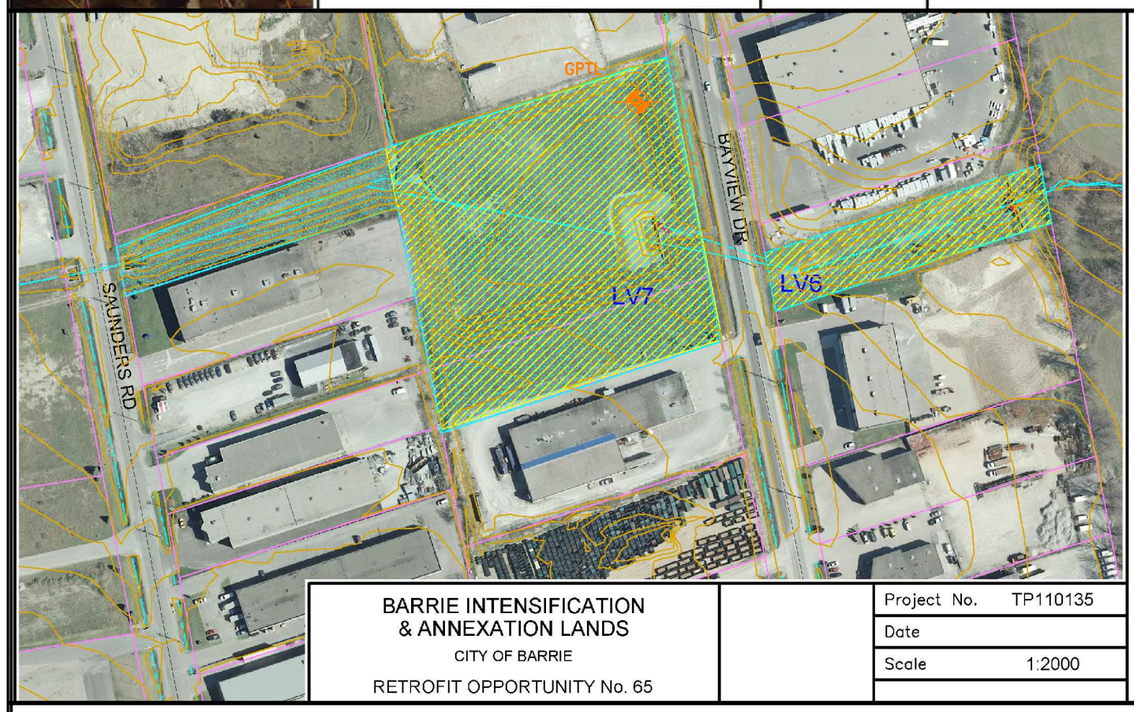
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& ANNEXATION LANDS
CITY OF BARRIE
RETROFIT OPPORTUNITY No. 42

Project No.	110135
Date	May 201
Scale	1:1,000



BARRIE INTENSIFICATION
& ANNEXATION LANDS
CITY OF BARRIE
RETROFIT OPPORTUNITY No. 60

Project No.	TP110135
Date	May 2012
Scale	1:1,000



BARRIE INTENSIFICATION
& ANNEXATION LANDS
CITY OF BARRIE
RETROFIT OPPORTUNITY No. 65

Project No.	TP110135
Date	
Scale	1:2000



BARRIE INTENSIFICATION
& ANNEXATION LANDS
CITY OF BARRIE
RETROFIT OPPORTUNITY No. 69

Project No.	TP110135
Date	May 2012
Scale	1:1,500

LEGEND:

GPTL — GUELPH PERMEAMETER TEST LOCATION

GUELPH PERMEAMETER TEST LOCATION PLAN

CITY OF BARRIE MASTER DRAINAGE PLAN UPDATE
BARRIE, ONTARIO

Peto MacCallum Ltd.
CONSULTING ENGINEERS

		DATE	SCALE	PML REF.	DRAWING NO.
DRAWN	RB	JAN. 2018	NTS	17BF024	7
CHECKED	GW				
APPROVED	GW				



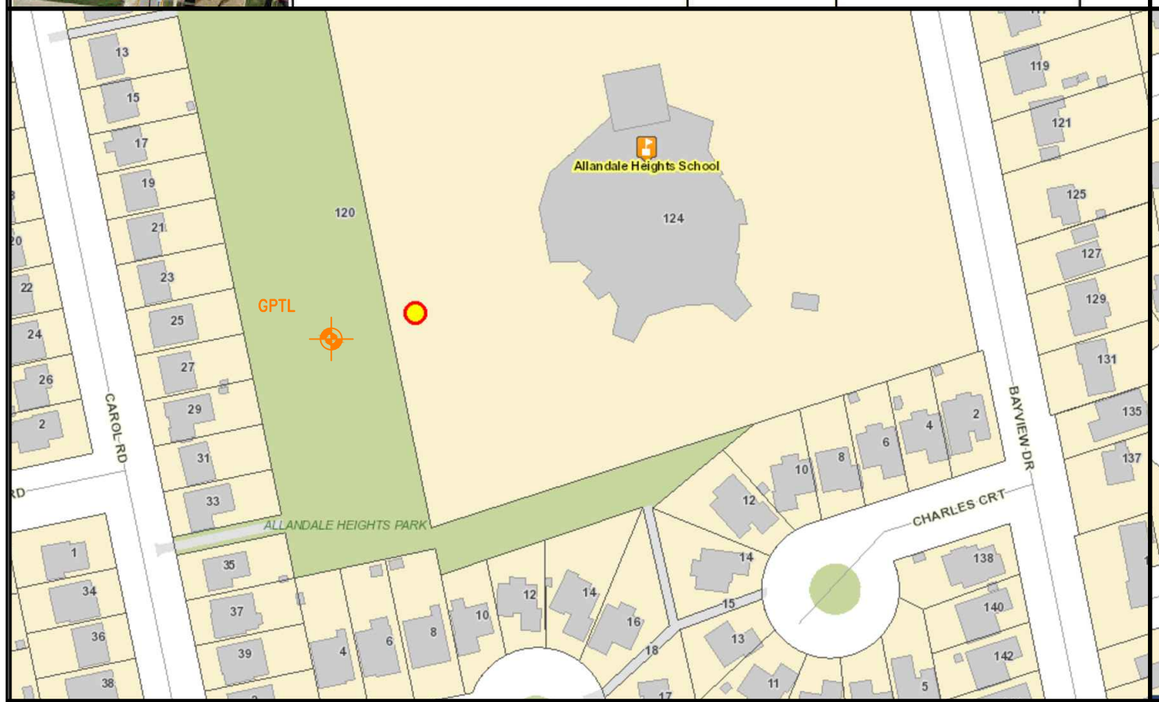
BARRIE INTENSIFICATION & ANNEXATION LANDS
CITY OF BARRIE
RETROFIT OPPORTUNITY No. 75

Project No.	TP110135
Date	May 2012
Scale	1:1,500



BARRIE INTENSIFICATION & ANNEXATION LANDS
CITY OF BARRIE
RETROFIT OPPORTUNITY No. 77

Project No.	TP110135
Date	May 2012
Scale	1:1,500





LEGEND:

GPTL — GUELPH PERMEAMETER TEST LOCATION

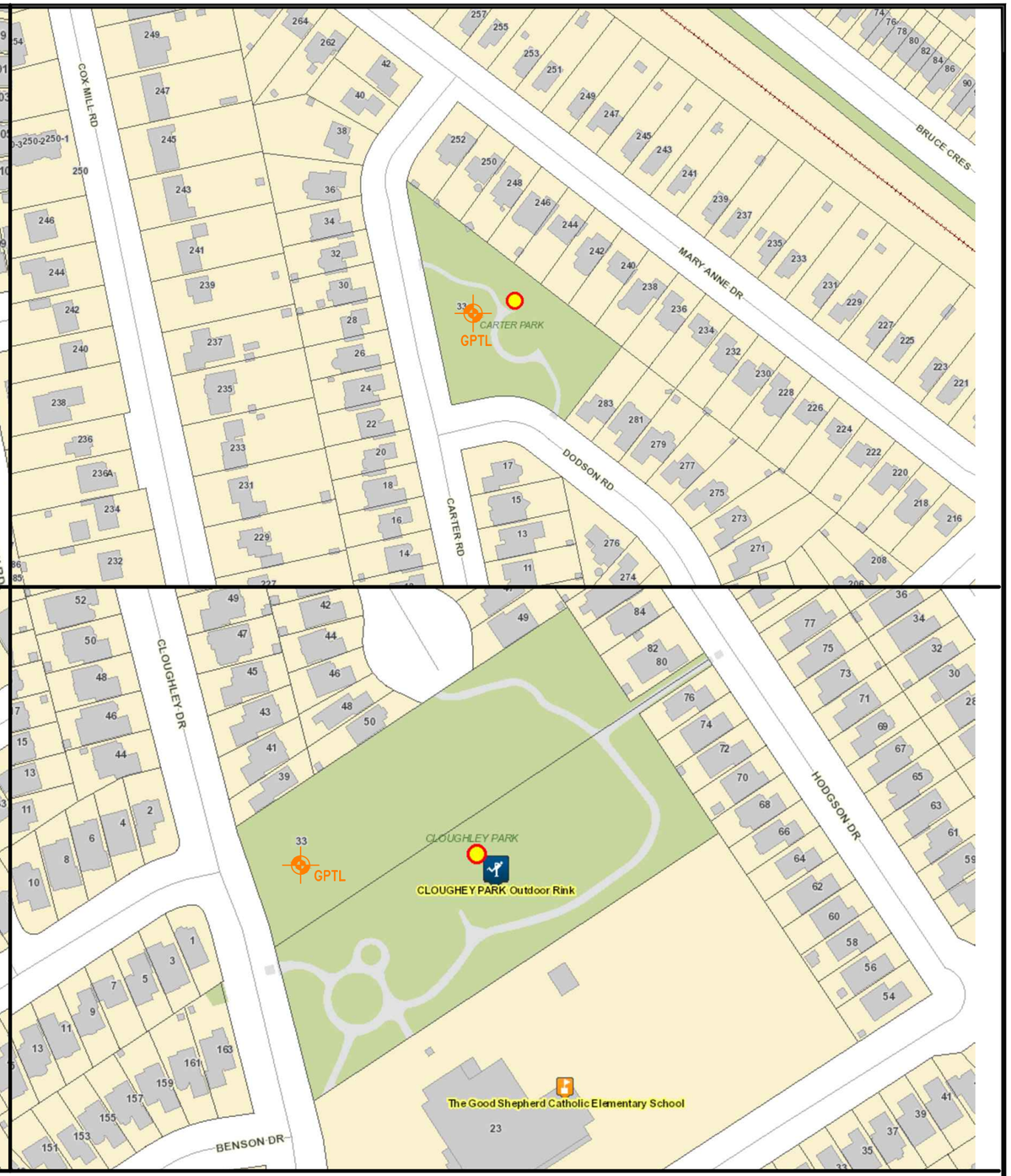
GUELPH PERMEAMETER TEST LOCATION PLAN

CITY OF BARRIE MASTER DRAINAGE PLAN UPDATE
BARRIE, ONTARIO

Peto MacCallum Ltd.
CONSULTING ENGINEERS

		DATE	SCALE	PML REF.	DRAWING NO.
DRAWN	RB	JAN. 2018	NTS	17BF024	8
CHECKED	GW				
APPROVED	GW				





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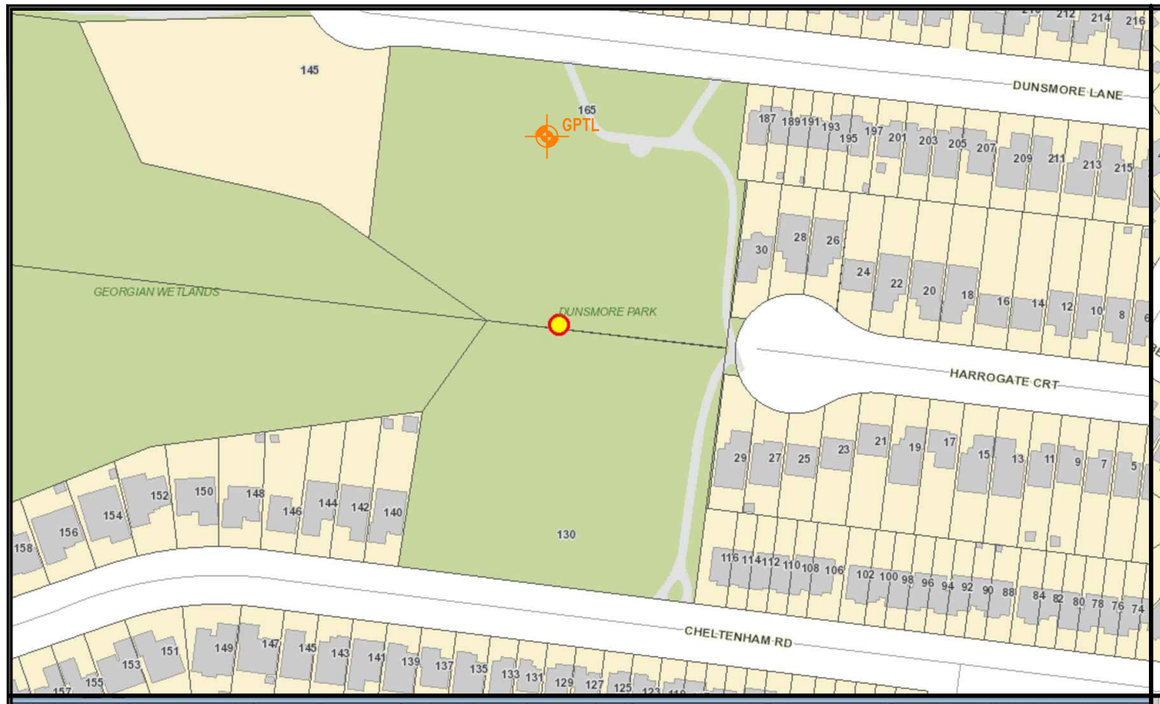
GPTL — GUELPH PERMEAMETER TEST LOCATION

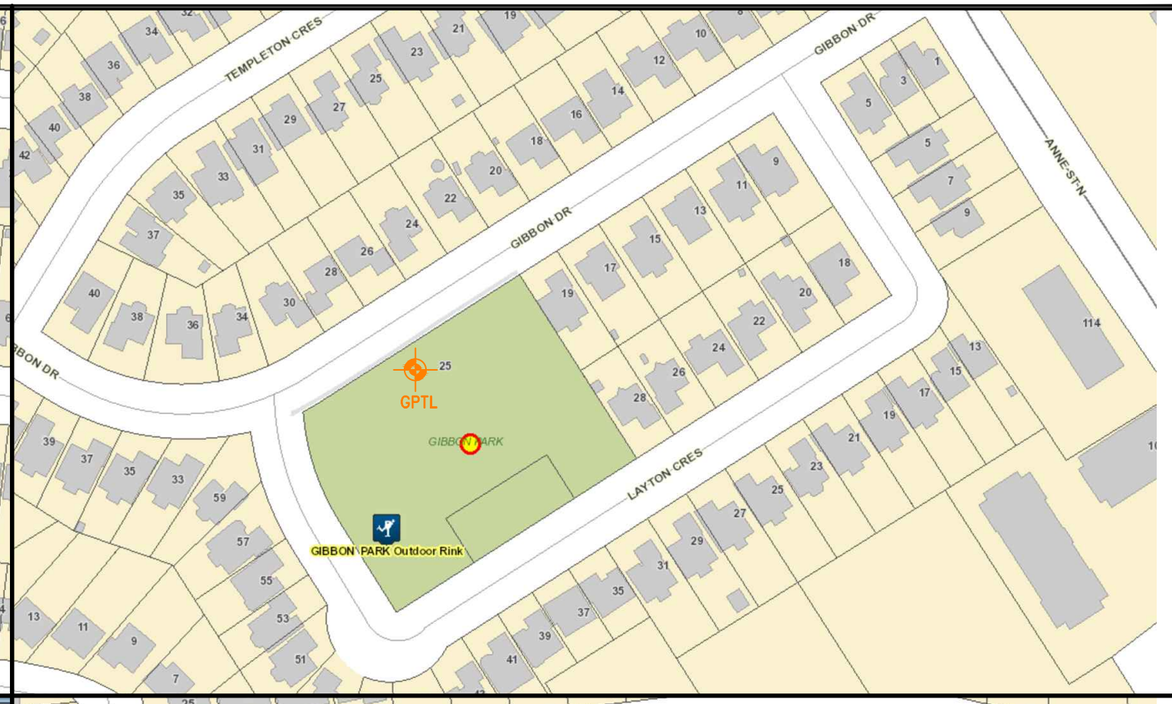
GUELPH PERMEAMETER TEST LOCATION PLAN

CITY OF BARRIE MASTER DRAINAGE PLAN UPDATE
BARRIE, ONTARIO

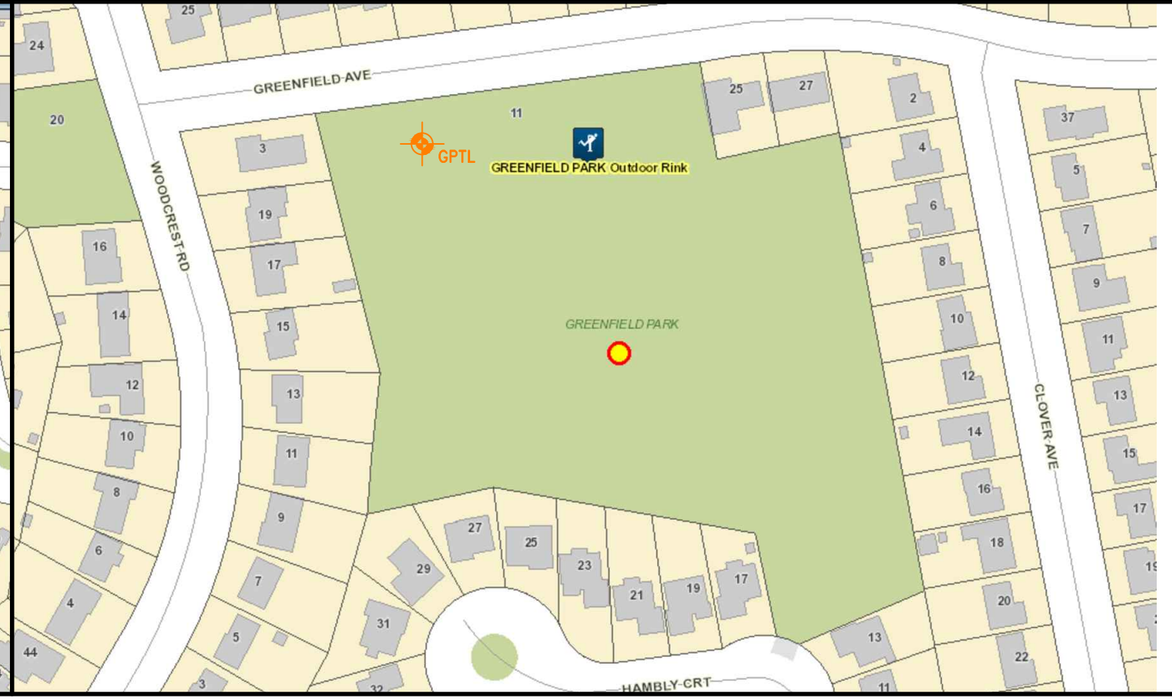
Peto MacCallum Ltd.
CONSULTING ENGINEERS

		DATE	SCALE	PML REF.	DRAWING NO.
DRAWN	RB	JAN. 2018	NTS	17BF024	9
CHECKED	GW				
APPROVED	GW				









LEGEND:

GPTL — GUELPH PERMEAMETER TEST LOCATION

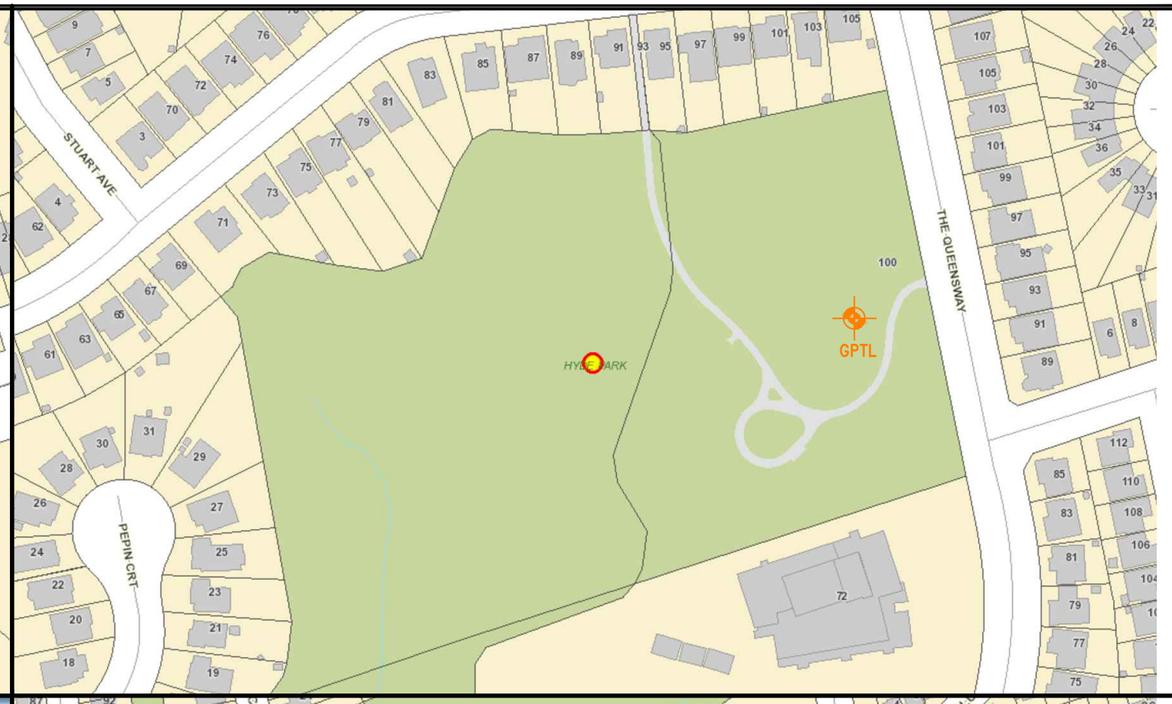
GUELPH PERMEAMETER TEST LOCATION PLAN

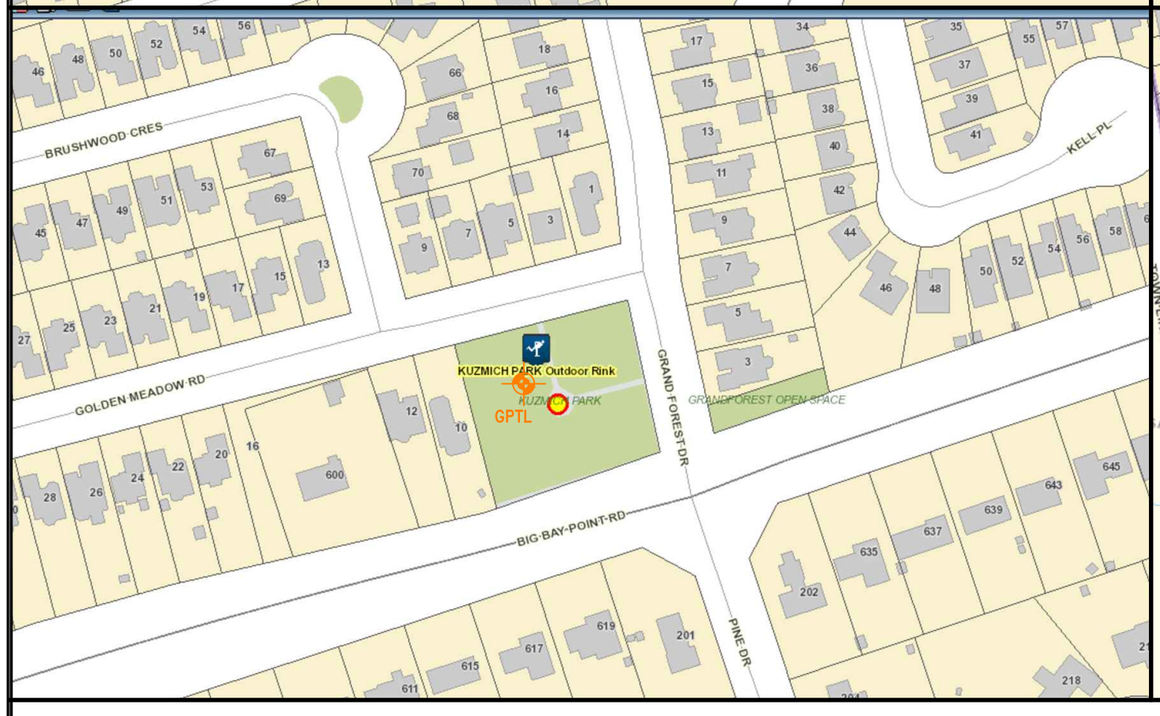
CITY OF BARRIE MASTER DRAINAGE PLAN UPDATE
BARRIE, ONTARIO

Peto MacCallum Ltd.
CONSULTING ENGINEERS

		DATE	SCALE	PML REF.	DRAWING NO.
DRAWN	RB	JAN. 2018	NTS	17BF024	10
CHECKED	GW				
APPROVED	GW				









LEGEND:

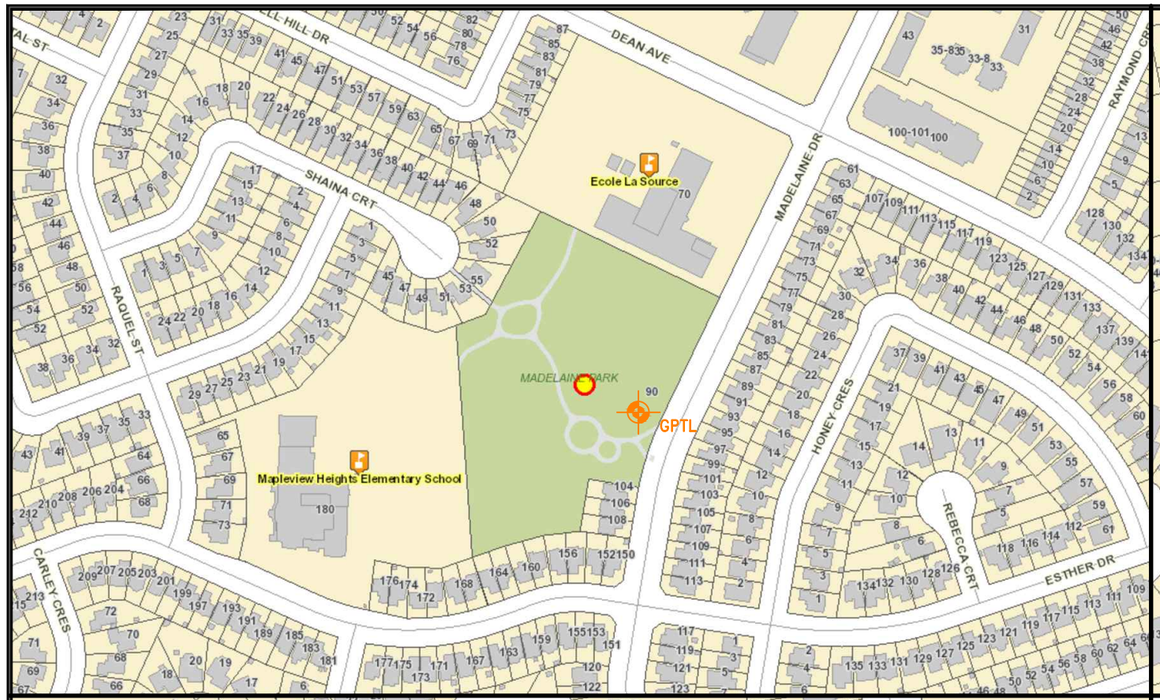
GPTL — GUELPH PERMEAMETER TEST LOCATION

GUELPH PERMEAMETER TEST LOCATION PLAN

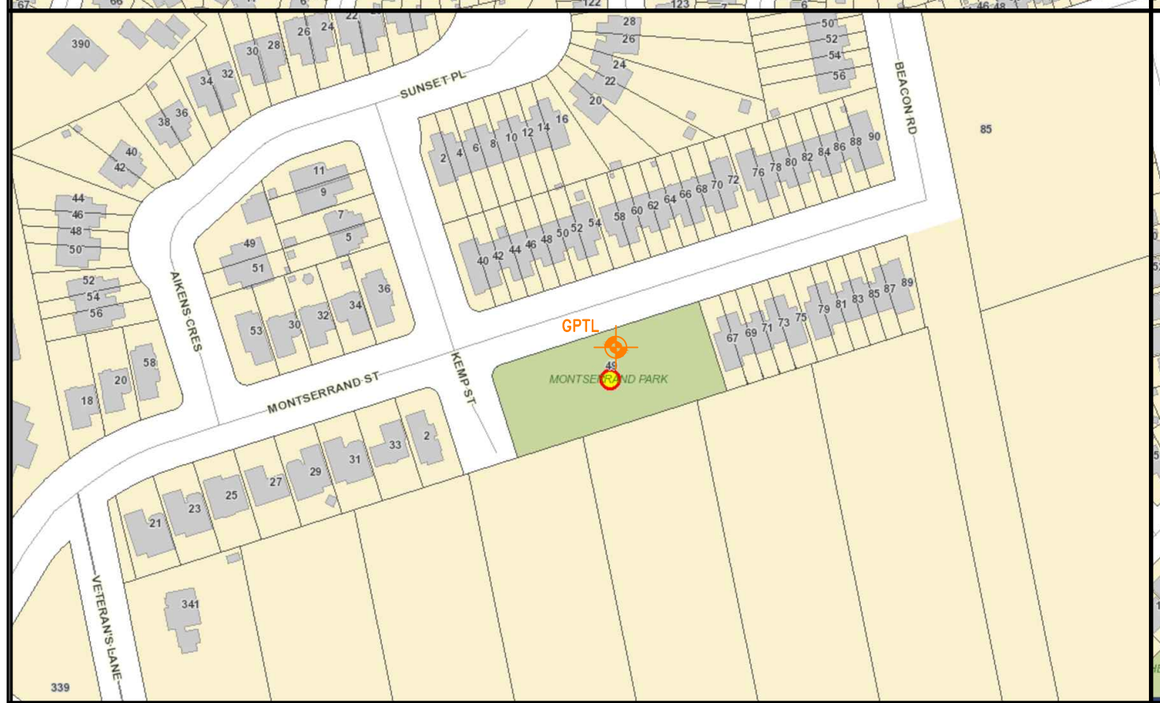
CITY OF BARRIE MASTER DRAINAGE PLAN UPDATE
BARRIE, ONTARIO

Peto MacCallum Ltd.
CONSULTING ENGINEERS

		DATE	SCALE	PML REF.	DRAWING NO.
DRAWN	RB	JAN. 2018	NTS	17BF024	11
CHECKED	GW				
APPROVED	GW				









LEGEND:

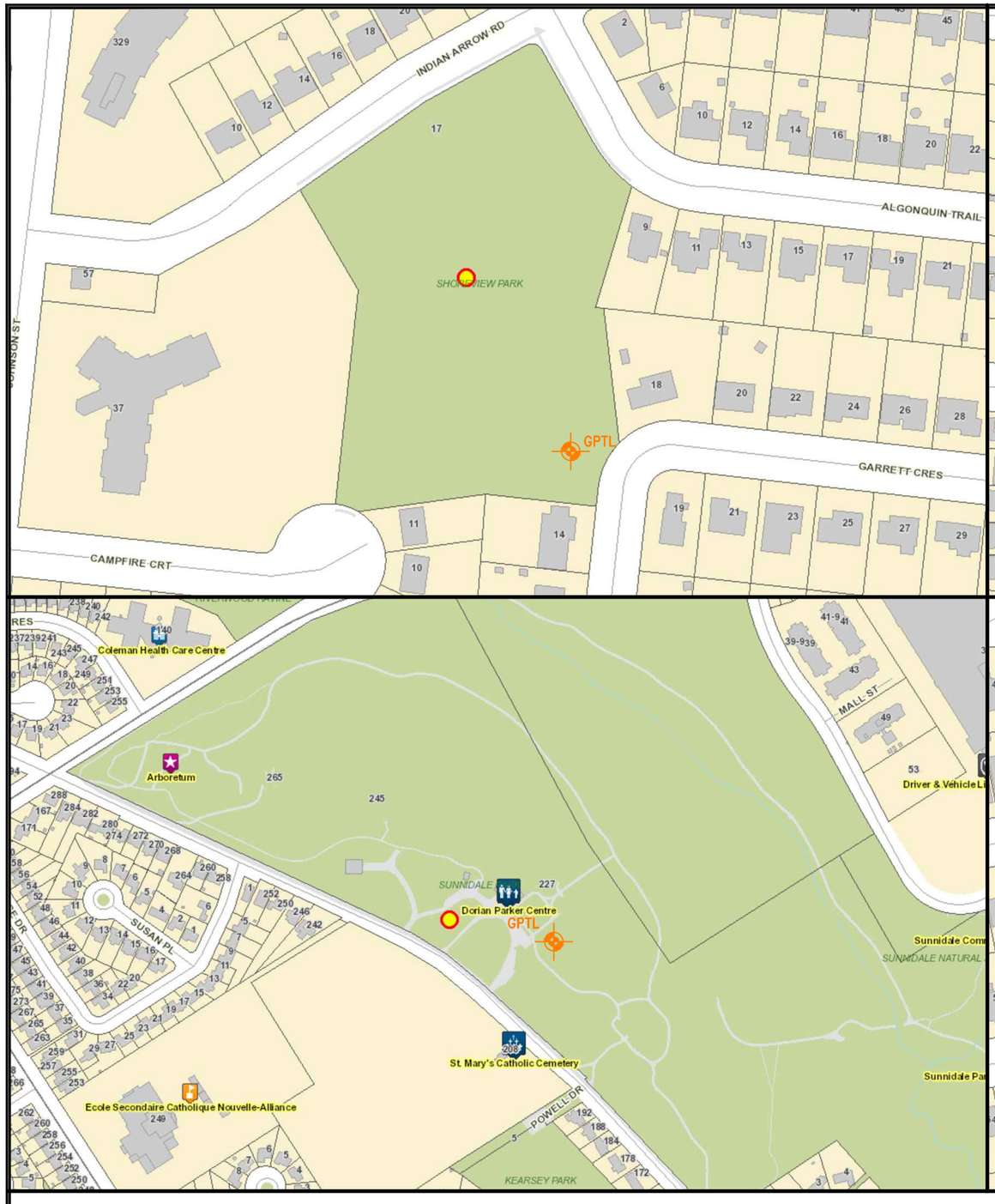
GPTL — GUELPH PERMEAMETER TEST LOCATION

GUELPH PERMEAMETER TEST LOCATION PLAN

CITY OF BARRIE MASTER DRAINAGE PLAN UPDATE
BARRIE, ONTARIO

Peto MacCallum Ltd.
CONSULTING ENGINEERS

		DATE	SCALE	PML REF.	DRAWING NO.
DRAWN	RB	JAN. 2018	NTS	17BF024	12
CHECKED	GW				
APPROVED	GW				





LEGEND:

GPTL — GUELPH PERMEAMETER TEST LOCATION

GUELPH PERMEAMETER TEST LOCATION PLAN

CITY OF BARRIE MASTER DRAINAGE PLAN UPDATE
BARRIE, ONTARIO

Peto MacCallum Ltd.
CONSULTING ENGINEERS

		DATE	SCALE	PML REF.	DRAWING NO.
DRAWN	RB	JAN. 2018	NTS	17BF024	13
CHECKED	GW				
APPROVED	GW				

APPENDIX A

Previous Boreholes

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 6

PROJECT Proposed Donald Street Reconstruction, Wellington Street to Eccles Street
OUR PROJECT NO. 08BF028
LOCATION Barrie, Ontario
BORING DATE April 23, 2008
ENGINEER GW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN JH

DEPTH in METRES	DESCRIPTION	LEGEND	ELEVATION	NUMBER	TYPE	BLOWS/0.3m N - VALUES	GROUND WATER OBSERVATIONS AND REMARKS
	GROUND ELEVATION 228.80						
0.52	PAVEMENT: 100 mm asphaltic concrete, over 140 mm brown, crushed, sand and gravel, trace silt, over 280 mm brown, sand and gravel, moist		228	1	SS	12	
1.50	FILL: Brown, sand, some gravel, some silt, trace organics, moist		227	2	SS	5	
1.90	SAND: Compact to dense, brown, sand, some gravel, trace silt, moist to saturated		226	3	SS	5	
3.00			225	4	SS	15	
4.50			224	5	SS	16	
5.00	BOREHOLE TERMINATED AT 5.00 m			6	SS	37	Upon completion of augering Wet cave at 2.4 m

SHEAR STRENGTH C_u(kPa) ▲ (20 40 60 80)
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
BLOWS/0.3M (20 40 60 80)

LIQUID LIMIT ____ W_L
PLASTIC LIMIT ____ W_P
WATER CONTENT ____ W
W_P W W_L
WATER CONTENT % (10 20 30)

NOTES

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Peto MacCallum Ltd
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 7

PROJECT Proposed Donald Street Reconstruction, Wellington Street to Eccles Street — **OUR PROJECT NO.** 08BF028
LOCATION Barrie, Ontario — **BORING DATE** April 23, 2008 — **ENGINEER** GW
BORING METHOD Continuous Flight Solid Stem Augers — **TECHNICIAN** JH

DEPTH In METRES	DESCRIPTION	LEGEND	ELEVATION	SAMPLES NUMBER	SAMPLES TYPE	BLOWS/0.3m N - VALUES
	GROUND ELEVATION 228.40					
0.30	PAVEMENT: 90 mm asphaltic concrete, over 110 mm brown, crushed, gravely sand, trace silt, over 100 mm brown, sand and gravel, trace silt, moist		228	1	SS	13
1.50	FILL: Brown, sand, some gravel, some silt, moist		227	2	SS	15
1.90	SAND: Compact to dense, brown, sand, trace silt, moist to saturated		226	3	SS	7
3.00			225	4	SS	16
4.50			224	5	SS	18
5.00	BOREHOLE TERMINATED AT 5.00 m			6	SS	34

SHEAR STRENGTH C_u(kPa) ▲ (20 40 60 80)
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
BLOWS/0.3M (20 40 60 80)

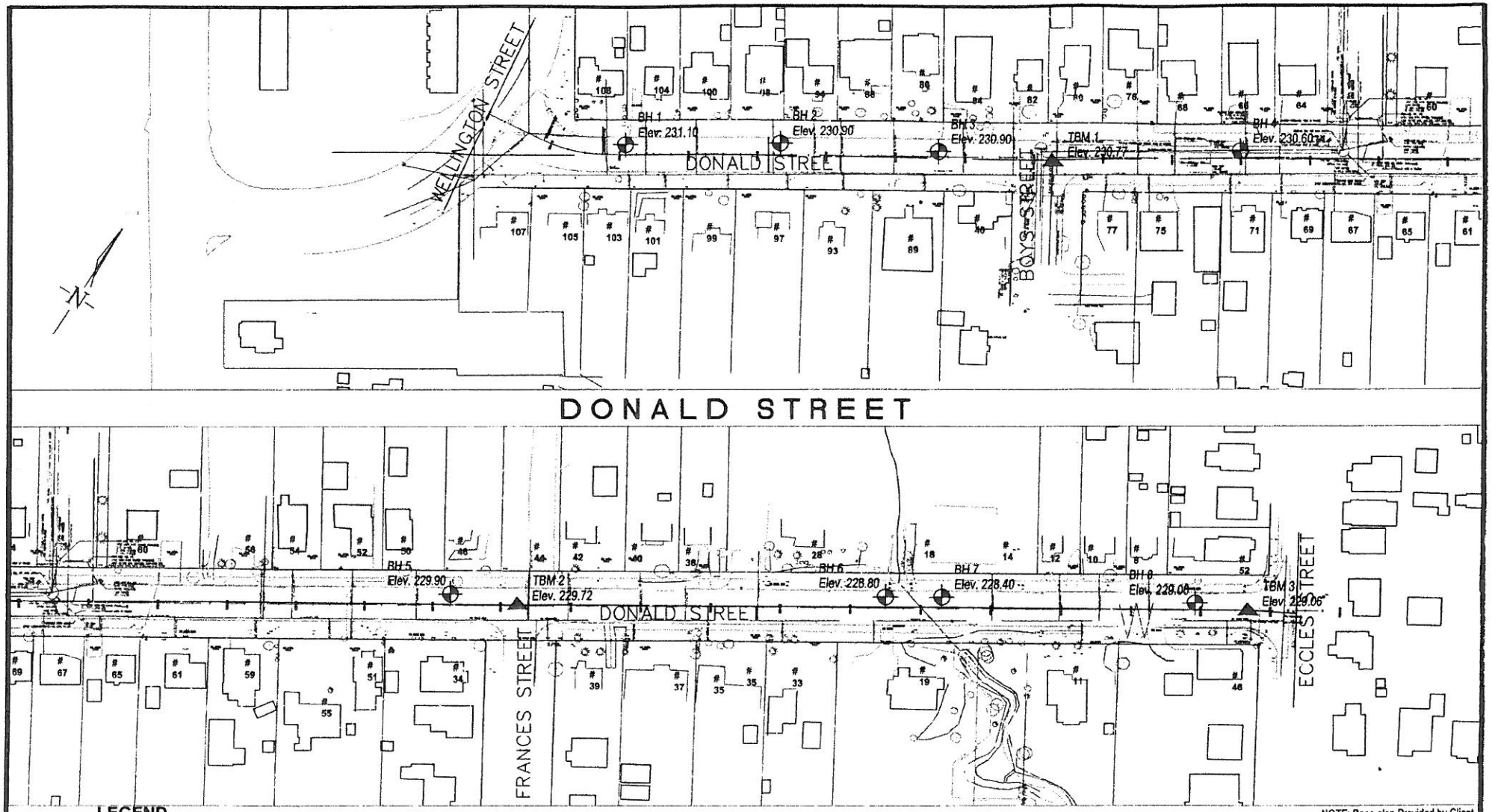
LIQUID LIMIT W_L
PLASTIC LIMIT W_P
WATER CONTENT W
W_P — W — W_L
WATER CONTENT % (10 20 30)

GROUND WATER OBSERVATIONS AND REMARKS

Upon completion of augering
Free water at 2.9 m
Cave at 3.1 m

NOTES

CHECKED BY



NOTE: Base plan Provided by Client

LEGEND

BH 1 Elev. 231.10	**Borehole 1** **Ground Surface Elevation**
TBM 1 Elev. 230.77	**Temporary Bench Mark 1** **Top of Existing Sanitary Manhole Cover 2048**
TBM 2 Elev. 229.72	**Temporary Bench Mark 2** **Top of Existing Sanitary Manhole Cover 2022**
TBM 3 Elev. 229.06	**Temporary Bench Mark 3** **Top of Existing Sanitary Manhole Cover 2123**

BOREHOLE LOCATION PLAN

DONALD STREET RECONSTRUCTION FROM WELLINGTON STREET WEST TO ECCLES STREET BARRIE, ONTARIO

PML Peto MacCallum Ltd.
CONSULTING ENGINEERS

DATE	SCALE	JOB NO.	DRAWING NO.
SEPT 2008	1:1000	08BF028	1

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 103

PROJECT Proposed Ferndale Drive Reconstruction- Tiffin Street to Dunlop Street
OUR PROJECT NO. 13BF061
LOCATION Barrie, Ontario
BORING DATE: November 19, 2013
ENGINEER GW
BORING METHOD Continuous Flight Hollow Stem Augers
TECHNICIAN AT

DEPTH In METRES	ELEVATION	DESCRIPTION	LEGEND	NUMBER	TYPE	BLOWS/0.3m N - VALUES
		GROUND ELEVATION 234.05				
0.0	233.68	PAVEMENT: 150 mm asphalt, over 100 mm, granular base, over 120 mm, granular subbase, moist		1	GS	-
0.37		FILL: Brown, sand trace silt to silty sand, trace gravel, moist to wet		2	SS	22
1.0						
				3	SS	18
2.0						
				4	SS	0
3.0	231.1					
3.0		SILTY SAND TO SANDY SILT: Very loose to compact, grey, silty fine sand to fine sandy silt, wet		5	SS	2
4.0						
				6	SS	13
5.0						
6.0				7	SS	7
7.0						
				8	SS	18
8.0						
9.0				9	SS	11
10.0	224.1					
10.0		SILT: Loose to dense, grey, silt, trace sand, trace clay, wet		10	SS	7
11.0		With clayey silt and sandy silt layers				
12.0				11	SS	12
13.0						
14.0				12	SS	8
15.0						

ELEVATION SCALE: 233, 232, 231, 230, 229, 228, 227, 226, 225, 224, 223, 222, 221, 220

SHEAR STRENGTH C_u (kPa) 20 40 60 80
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
BLOWS/0.3M 20 40 60 80

LIQUID LIMIT ____ W_L
PLASTIC LIMIT ____ W_P
WATER CONTENT ___ W
W_P W W_L
WATER CONTENT % 10 20 30

UNIT WEIGHT γ kN/m³

GROUND WATER OBSERVATIONS AND REMARKS

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL.

NOTES:

SENSITIVITY
+ UNDISTURBED FIELD VANE
⊕ REMOLDED FIELD VANE
⊗ LAB SHEAR TEST
▲ POCKET PENETROMETER

CHECKED BY

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 103

PROJECT Proposed Ferndale Drive Reconstruction- Tiffin Street to Dunlop Street
OUR PROJECT NO. 13BF061
LOCATION Barrie, Ontario
BORING DATE: November 19, 2013
ENGINEER GW
BORING METHOD Continuous Flight Hollow Stem Augers
TECHNICIAN AT

DEPTH In METRES	DESCRIPTION	LEGEND	NUMBER	TYPE	BLOWS/0.3m N - VALUES	ELEVATION SCALE	SHEAR STRENGTH C_u (kPa) 20 40 60 80 / DYNAMIC CONE PENETRATION × / STANDARD PENETRATION TEST ● / BLOWS/0.3M 20 40 60 80	LIQUID LIMIT ____ W_L / PLASTIC LIMIT ____ W_P / WATER CONTENT ____ W / W_P W W_L / WATER CONTENT % 10 20 30	UNIT WEIGHT γ kN/m³	GROUND WATER OBSERVATIONS AND REMARKS / GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	CONTINUED FROM PREVIOUS PAGE									
219.1	SILT: Loose to dense, grey, silt, trace sand, trace clay, wet *(continued)*		13	SS	31					
16.0	With clayey silt and sandy silt layers					218				
17.0			14	SS	35	217				
18.0						216				
215.3 18.8	BOREHOLE TERMINATED AT 18.8 m		15	SS	16					Upon completion of augering Water used during drilling No water measurement taken
19.0										
20.0										
21.0										
22.0										
23.0										
24.0										
25.0										
26.0										
27.0										
28.0										
29.0										
30.0										

NOTES:

$\dagger^{T}$ SENSITIVITY
\+ UNDISTURBED FIELD VANE
⊕ REMOLDED FIELD VANE
⊛ LAB SHEAR TEST
▲ POCKET PENETROMETER

CHECKED BY

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 104

PROJECT Proposed Ferndale Drive Reconstruction- Tiffin Street to Dunlop Street
LOCATION Barrie, Ontario
BORING METHOD Continuous Flight Hollow Stem Augers
BORING DATE: November 22, 2013
OUR PROJECT NO. 13BF061
ENGINEER GW
TECHNICIAN AT

GROUND ELEVATION 234.15

DEPTH in METRES	ELEVATION	DESCRIPTION	NUMBER	TYPE	BLOWS/0.3m N - VALUES
0.0	234.15	PAVEMENT: 100 mm asphalt, over 120 mm, granular base, over 130 mm, granular subbase, moist	1	GS	-
0.35	233.80	FILL: Brown, sand trace silt, to silty sand, trace gravel, moist to wet	2	SS	13
1.0	233				
			3	SS	11
2.0	232				
			4	SS	6
3.0	231.2				
3.0	231	SILTY SAND TO SANDY SILT: Very loose to compact, grey, silty fine sand to fine sandy silt, wet	5	SS	0
4.0	230				
			6	SS	27
5.0	229				
6.0	228		7	SS	15
7.0	227				
8.0	226		8	SS	1
9.0	225		9	SS	8
10.0	224.2				
10.0	224	SILT: Compact to dense, grey, silt, trace sand, trace clay, wet	10	SS	10
11.0	223				
12.0	222	With clayey silt and sandy silt layers	11	SS	11
13.0	221				
14.0	220		12	SS	13
15.0					

SHEAR STRENGTH C_u (kPa) 20 40 60 80
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
BLOWS/0.3M 20 40 60 80

LIQUID LIMIT ____ W_L
PLASTIC LIMIT ____ W_P
WATER CONTENT ___ W
W_P W W_L
WATER CONTENT % 10 20 30

UNIT WEIGHT γ kN/m³

GROUND WATER OBSERVATIONS AND REMARKS

GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

NOTES:

SENSITIVITY
+ UNDISTURBED FIELD VANE
⊕ REMOLDED FIELD VANE
⊖ LAB SHEAR TEST
▲ POCKET PENETROMETER

CHECKED BY

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 104

PROJECT Proposed Ferndale Drive Reconstruction- Tiffin Street to Dunlop Street
OUR PROJECT NO. 13BF061
LOCATION Barrie, Ontario
BORING DATE: November 22, 2013
ENGINEER GW
BORING METHOD Continuous Flight Hollow Stem Augers
TECHNICIAN AT

DEPTH in METRES	DESCRIPTION	LEGEND	NUMBER	TYPE	BLOWS/0.3m N - VALUES	ELEVATION SCALE	UNIT WEIGHT γ kN/m³	GROUND WATER OBSERVATIONS AND REMARKS / GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	CONTINUED FROM PREVIOUS PAGE							
219.2	SILT: Compact to dense, grey, silty, trace sand, trace clay, wet *(continued)*					219		
			13	SS	30			
16.0	With clayey silt and sandy silt layers					218		
17.0			14	SS	15	217		
18.0						216		
			15	SS	37			
215.4 18.8	BOREHOLE TERMINATED AT 18.8 m							Upon completion of augering Water used during drilling No water measurement taken
19.0								
20.0								
21.0								
22.0								
23.0								
24.0								
25.0								
26.0								
27.0								
28.0								
29.0								
30.0								

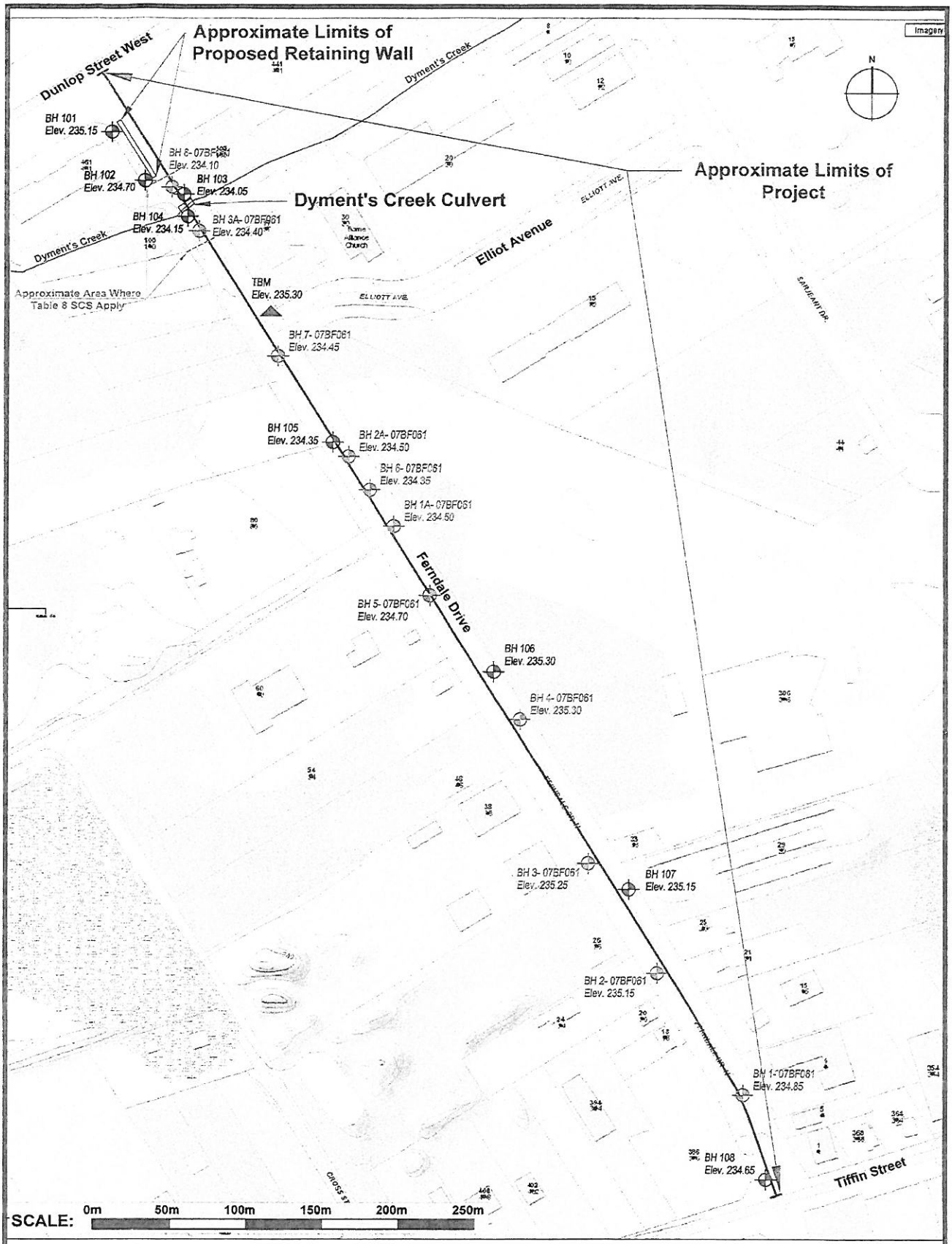
SHEAR STRENGTH C_u (kPa) 20 40 60 80
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
BLOWS/0.3M 20 40 60 80

LIQUID LIMIT ____ W_L
PLASTIC LIMIT ____ W_P
WATER CONTENT ____ W
W_P W W_L
WATER CONTENT % 10 20 30

NOTES:

SENSITIVITY
+ UNDISTURBED FIELD VANE
⊕ REMOLDED FIELD VANE
⊖ LAB SHEAR TEST
▲ POCKET PENETROMETER

CHECKED BY



LEGEND

BH 101 Elev. 235.15 — Borehole 1 Ground Surface Elevation

BH 105 Elev. 234.35 — Borehole 5 (With Monitoring Well) Ground Surface Elevation

BH 1- 07BF061 Elev. 234.85 — Borehole 1- PML Ref.: 07BF061 (Report 1, June 19, 2008) Ground Surface Elevation

TBM Elev. 235.30 — Temporary Bench Mark Top Nut of Fire Hydrant #H894 At the Northeast Corner of Ferndale Drive and Elliott Avenue Elevation 235.30 (metric, geodetic)

BOREHOLE LOCATION PLAN

PROPOSED FERNDALE DRIVE RECONSTRUCTION
BARRIE, ONTARIO

Peto MacCallum Ltd.
CONSULTING ENGINEERS

DATE	SCALE	JOB NO.	DRAWING NO.
APRIL 2014	AS SHOWN	13BF061	1

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE/MONITORING WELL NO. 1

PROJECT Proposed Dyment's Creek Culvert Replacement at Bradford Street
LOCATION Barrie, Ontario
BORING METHOD Continuous Flight Hollow Stem Augers

17T 0604034E
4914721N

BORING DATE April 13/14, 2016

PML REF. 16BF010
ENGINEER GW
TECHNICIAN AT

DEPTH (metres)	ELEV	DESCRIPTION	NUMBER	TYPE	"N" VALUES
	100.30	SURFACE ELEVATION 100.30			
0.0		PAVEMENT: 100 mm asphalt, over 130 mm granular base, over 200 mm granular subbase, moist	1A 1B	GS	-
0.43	99.87	FILL: Brown to dark grey, sand, trace silt, trace gravel, moist to wet	2	SS	9
1.5	98.8	Becoming gravelly sand, trace silt	3	SS	4
			4	SS	14
			5	SS	25
4.0	96.3	Becoming sand, trace silt, trace gravel			
4.9	95.4	PEAT: Brown to black, amorphous, trace sand, wood peices, wet	6	SS	3
5.5	94.8	SAND: Very loose, brown, sand, some silt, wet	7	SS	2
8.0	92.3	SILTY SAND: Loose to compact, grey, silty fine sand, trace clay, wet	8	SS	6
			9	SS	16
		CONTINUED			

SHEAR STRENGTH (kPa)
+ FIELD VANE △ TORVANE ○ Qu
▲ POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

214

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Flush mount casing
Concrete
Bentonite seal
Approximate Culvert/Channel Invert EL. 97.5
50 mm slotted pipe
Filter sand

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE/MONITORING WELL NO. 1

PROJECT Proposed Dyment's Creek Culvert Replacement at Bradford Street
17T 0604034E
4914721N
PML REF. 16BF010

LOCATION Barrie, Ontario
BORING DATE April 13/14, 2016
ENGINEER GW

BORING METHOD Continuous Flight Hollow Stem Augers
TECHNICIAN AT

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES
15.0 / 85.3	CONTINUED FROM PREVIOUS PAGE		10	SS	7
17.0 / 83.3	CLAY: Stiff to hard, grey, clay, trace sand, WTLL to APL		11	SS	10
			12	SS	32
23.0 / 77.3	SILT: Compact, grey, silt, trace sand, trace clay, wet		13	SS	24
26.0 / 74.3	SAND: Compact, grey, sand, some gravel, trace silt, wet		14	SS	15
			15	SS	15
	CONTINUED				

SHEAR STRENGTH (kPa)
+ FIELD VANE △ TORVANE ○ Qu
▲ POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE/MONITORING WELL NO. 1

PROJECT Proposed Dyment's Creek Culvert Replacement at Bradford Street
17T 0604034E
4914721N
PML REF. 16BF010

LOCATION Barrie, Ontario
BORING DATE April 13/14, 2016
ENGINEER GW

BORING METHOD Continuous Flight Hollow Stem Augers
TECHNICIAN AT

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	ELEVATION SCALE
30.0	CONTINUED FROM PREVIOUS PAGE					
70.3	SAND AND GRAVEL: Very dense to dense, grey, sand and gravel, trace silt, wet		16	SS	54	
			17	SS	47	
33.0						
67.3	SILT: Very dense, grey, silt, trace sand, very moist to wet		18	SS	89/290 mm	
34.1						
66.2	REFUSAL TO AUGER AT 34.1 m					

SHEAR STRENGTH (kPa)
+ FIELD VANE △ TORVANE ○ Qu
▲ POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Upon completion of augering
No water measurement taken as water was used during drilling
Cave at 19.8 m

Water Level Readings:

Date	Depth (m)/Elev.
Apr. 27	1.9/98.4

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 2

PROJECT Proposed Dyment's Creek Culvert Replacement at Bradford Street
LOCATION Barrie, Ontario
BORING METHOD Continuous Flight Hollow Stem Augers
17T 0604106E
4914752N
BORING DATE April 11/12, 2016
PML REF. 16BF010
ENGINEER GW
TECHNICIAN AT

DEPTH (metres)	ELEV	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	ELEVATION SCALE
		SURFACE ELEVATION 100.00					
0.0	100.00	PAVEMENT: 60 mm asphalt, over 170 mm granular base, over 200 mm granular subbase, moist		1A / 1B	GS	-	
0.43	99.57	FILL: Brown to dark grey, sand, trace silt, trace gravel, moist to wet		2	SS	14	99
1.0				3	SS	2	98
2.0				4	SS	12	
3.0				5	SS	13	97
4.0	96.0	PEAT: Brown to black, amorphous, trace sand, wood peices, wet		6	SS	6	96
5.0				7	SS	9	95
6.0				8	SS	6	94
7.0				9	SS	7	93
8.0							92
9.0							91
10.0	90.0	SILTY SAND: Loose to compact, grey, silty fine sand, trace clay, wet		10	SS	7	90
11.0							89
12.0							88
13.0							87
14.0							86
15.0		CONTINUED					

SHEAR STRENGTH (kPa)
+ FIELD VANE △ TORVANE ○ Qu
▲ POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

80
136
213
248

GROUND WATER OBSERVATIONS AND REMARKS

Approximate Culvert/Channel Invert EL. 97.5

GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 2

PROJECT Proposed Dyment's Creek Culvert Replacement at Bradford Street
LOCATION Barrie, Ontario
BORING METHOD Continuous Flight Hollow Stem Augers

17T 0604106E
4914752N

BORING DATE April 11/12, 2016

PML REF. 16BF010
ENGINEER GW
TECHNICIAN AT

DEPTH (metres)	ELEV	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES
15.0	85.0	CONTINUED FROM PREVIOUS PAGE				
				11	SS	12
				12	SS	12
20.0	80.0	SILT: Compact to dense, grey, silt, trace sand, trace clay, wet		13	SS	24
				14	SS	34
24.0	76.0	SILTY SAND: Compact, grey, silty fine sand, trace clay, wet		15	SS	10
				16	SS	19
27.0	73.0	SAND: Compact, grey, sand, some gravel, trace silt, very moist		17	SS	23
30.0		CONTINUED				

ELEVATION SCALE: 84, 83, 82, 81, 80, 79, 78, 77, 76, 75, 74, 73, 72, 71

SHEAR STRENGTH (kPa)
+ FIELD VANE △ TORVANE ○ Qu
▲ POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

NOTES

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 2

PROJECT Proposed Dyment's Creek Culvert Replacement at Bradford Street
17T 0604106E
4914752N
PML REF. 16BF010
LOCATION Barrie, Ontario
BORING DATE April 11/12, 2016
ENGINEER GW
BORING METHOD Continuous Flight Hollow Stem Augers
TECHNICIAN AT

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	ELEVATION SCALE
30.0	CONTINUED FROM PREVIOUS PAGE					
70.0	SAND AND GRAVEL: Very dense, grey, sand and gravel, trace silt, wet		18	SS	95/290 mm	69
31.0						
69.0	SILT: Very dense, grey, silt, trace sand, very moist to wet		19	SS	95/290 mm	68
34.0			20	SS	69	67
66.0	BOREHOLE TERMINATED AT 34.0 m BEGIN DYNAMIC CONE PENETRATION TEST					66
38.1						65
61.9	DYNAMIC CONE PENETRATION TEST TERMINATED AT 38.1 m					64
						63
						62

SHEAR STRENGTH (kPa)
+ FIELD VANE △ TORVANE ○ Qu
▲ POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

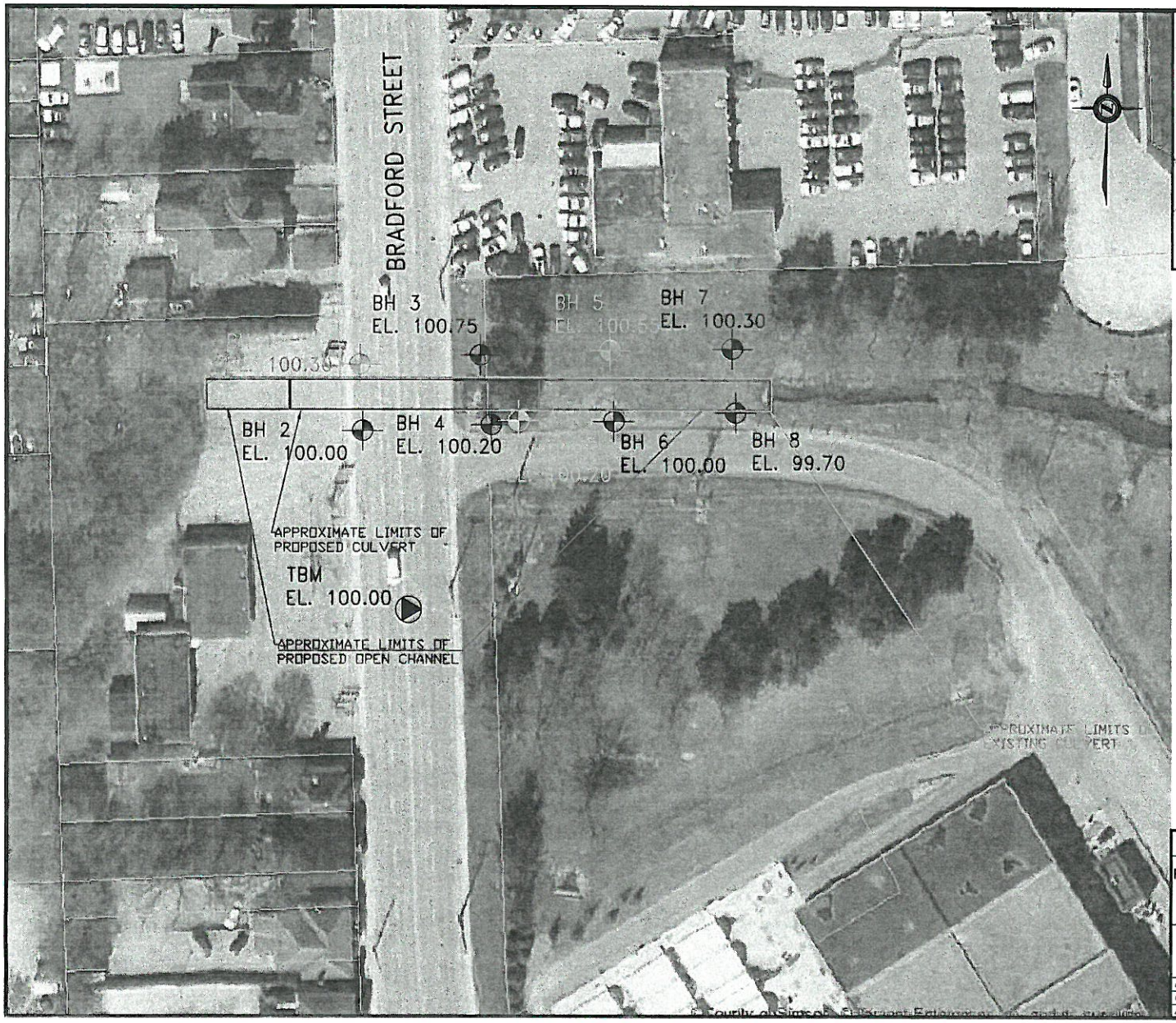
PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

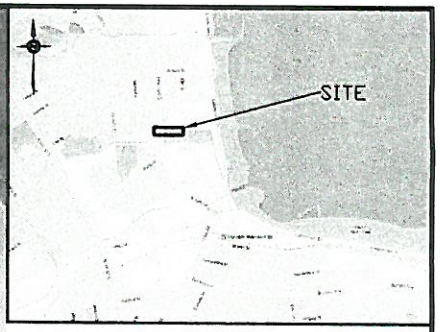
UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Upon completion of augering
No water measurement taken as water was used during drilling
Cave at 6.7 m

NOTES





KEY PLAN
BARRIE, ONTARIO

LEGEND:

BH 1 EL. 100.30	BOREHOLE 1 (WITH MONITORING WELL) SURFACE ELEVATION
BH 2 EL. 100.00	BOREHOLE 2 SURFACE ELEVATION
MW D29 EL. 100.20	MONITORING WELL D29 (BY OTHERS) SURFACE ELEVATION
TBM EL. 100.00	TEMPORARY BENCH MARK TOP OF MANHOLE ON BRADFORD STREET JUST SOUTH OF ENTRANCE TO WASTE WATER TREATMENT PLANT ELEVATION (METRIC, ASSIGNED)

REFERENCE:

BASE PLAN PRODUCED FROM SIMCOE COUNTY GIS OVERHEAD MAPPING.

0m 10 20 30 40 50

SCALE

BOREHOLE LOCATION PLAN

PROPOSED DYMENT'S CREEK CULVERT REPLACEMENT
AT BRADFORD STREET
BARRIE, ONTARIO

PML Peto MacCallum Ltd.
CONSULTING ENGINEERS

		DATE	SCALE	PML REF.	DRAWING NO.
DRAWN	RB	MAY 2016	AS SHOWN	16BF010	1
CHECKED	GW				
APPROVED	GW				

Peto MacCallum Ltd
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. E

METRIC

1 of 1

PROJECT Supplemental Geotechnical and Geoenvironmental Investigation, Harvie Road Reconstruction — *OUR PROJECT NO.* 11BF068

LOCATION Barrie, Ontario — *BORING DATE* December 23, 2011 — *ENGINEER* GRW

BORING METHOD Continuous Flight Solid Stem Augers — *TECHNICIAN* UD

SOIL PROFILE			SAMPLES								
ELEV / DEPTH in meters	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	SHEAR STRENGTH kPa (○ UNCONFINED + FIELD VANE, ▲ POCKET PENETROMETER, DYNAMIC CONE PENETRATION ×, STANDARD PENETRATION TEST ●) 50 100 150 200 / 20 40 60 80	PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L; WATER CONTENT (%) 10 20 30 40	UNIT WEIGHT γ kg/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
293.1										
292.9 0.0	PAVEMENT: 40 mm, asphaltic concrete over 160 mm, brown, crushed, gravelly sand, trace silt, moist		1	GS	-	293				Flushmount cap Concrete Bentonite seal
0.2	FILL: Dark brown, sand, some silt to silty, trace gravel, moist		2	SS	19	292				
			3	SS	12					Native backfill
	Wet		4	SS	16	291				
290.2 2.9	CLAYEY SILT: Stiff, grey, clayey silt, APL		5	SS	9	290				
289.3 3.8	SAND: Very dense, brown, sand, some gravel, trace silt, damp		6	SS	85	289				Slotted pipe Filter sand
						288				
			7	SS	99/225mm	287				
286.6 6.5	BOREHOLE TERMINATED AT 6.5 m									

Upon completion of augering
No water
Cave at 2.2 m

Water Level Readings

Date	Depths (m)
Feb 16	No water

+7, ×5: Numbers refer to Sensitivity

20 / 15 / 10 / 5 (%) STRAIN AT FAILURE

Peto MacCallum Ltd
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. F

METRIC

1 of 1

PROJECT Supplemental Geotechnical and Geoenvironmental Investigation, Harvie Road Reconstruction
OUR PROJECT NO. 11BF068
LOCATION Barrie, Ontario
BORING DATE January 25, 2012
ENGINEER GRW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN UD

ELEV / DEPTH in meters	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES
292.9					
292.7 0.0	PAVEMENT: 40 mm, asphaltic concrete over 160 mm, brown, crushed, gravelly sand, trace silt, moist		1	GS	-
0.2	FILL: Brown, sand, trace gravel, trace silt, moist		2	SS	7
291.5 1.4	SAND: Compact, brown, sand, trace gravel, trace silt, wet		3	SS	19
290.8 2.1	SILT: Compact, dark brown, sandy silt, trace organics, moist to wet		4	SS	15
	Becoming silt with sand seams, moist to wet		5	SS	23
288.9 4.0	SAND: Very dense, brown, sand, trace gravel, trace silt, stratified, damp		6	SS	85
286.5 6.4	BOREHOLE TERMINATED AT 6.4 m		7	SS	72/275 mm

ELEVATION SCALE: 292, 291, 290, 289, 288, 287

SHEAR STRENGTH kPa
○ UNCONFINED + FIELD VANE
▲ POCKET PENETROMETER
50 100 150 200

DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT γ kg/m³

REMARKS & GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

Upon completion of augering
No water
No cave

+, ×: Numbers refer to Sensitivity

20
15 ○ 5
10

(%) STRAIN AT FAILURE

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. G

METRIC

1 of 1

PROJECT Supplemental Geotechnical and Geoenvironmental Investigation, Harvie Road Reconstruction
OUR PROJECT NO. 11BF068
LOCATION Barrie, Ontario
BORING DATE December 23, 2011 *ENGINEER* GRW
BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN UD

ELEV / DEPTH n meters	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"N" VALUES
287.5					
287.3 0.0	PAVEMENT: 40 mm, asphaltic concrete over 160 mm, dark brown, sand, some gravel, moist		1	GS	-
0.2	FILL: Dark brown, sand to silty sand, trace gravel, moist		2	SS	19
			3	SS	28
285.1 2.4	SAND: Compact to very dense, brown, sand, trace silt, trace gravel, stratified, damp		4	SS	11
			5	SS	37
			6	SS	55
			7	SS	57
280.9 6.6	BOREHOLE TERMINATED AT 6.6 m				

ELEVATION SCALE: 287, 286, 285, 284, 283, 282, 281

SHEAR STRENGTH kPa
o UNCONFINED + FIELD VANE
▲ POCKET PENETROMETER
50 100 150 200

DYNAMIC CONE PENETRATION X
STANDARD PENETRATION TEST o
20 40 60 80

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT γ kg/m³

REMARKS & GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

Flushmount cap
Concrete
Bentonite seal
Native backfill
Slotted pipe
Filter sand

Upon completion of augering
No water
No cave

Water Level Readings

Date	Depths (m)
Feb 16	No water

+ , X : Numbers refer to Sensitivity

15 — 20 — 5 (%) STRAIN AT FAILURE
10



LEGEND

BH D Elev. 297.7	Borehole D Ground Surface Elevation
BH E Elev. 293.1	Borehole E (With Monitoring Well) Ground Surface Elevation

SCALE 0m 15m 30m 45m 60m 75m

BOREHOLE LOCATION PLAN

SUPPLEMENTAL GEOTECHNICAL AND GEOENVIRONMENTAL INVESTIGATION
HARVIE ROAD RECONSTRUCTION
BARRIE, ONTARIO

Peto MacCallum Ltd.
CONSULTING ENGINEERS

DATE	SCALE	JOB NO.	DRAWING NO.
MARCH 2012	1:1500	11BF068	2

Peto MacCallum Ltd.
CONSULTING ENGINEERS

LOG OF BOREHOLE NO. 5

PROJECT Class EA Phase 3 and 4 - Bayview Drive and Big Bay Point Road Improvements
17T 0605154E
4911795N
PML REF. 15BF048

LOCATION Barrie, Ontario
BORING DATE October 26, 2015
ENGINEER GW

BORING METHOD Continuous Flight Solid Stem Augers
TECHNICIAN AT

DEPTH ELEV (metres)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER OBSERVATIONS AND REMARKS / GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	SURFACE ELEVATION					
0.0	PAVEMENT: 110 mm asphalt, over 160 mm granular base, over 200 mm granular subbase, moist		1A 1B	GS	-	
0.47	FILL: Brown to dark grey, silty sand/sandy silt, trace gravel, moist to wet		2	SS	19	
1.0			3	SS	24	
2.0			4	SS	6	Approximate Invert Depth of Existing Culvert 2.1 m Below Road Surface
3.0			5	SS	6	
4.0	SAND: Loose to dense, brown, sand, trace to some silt, wet		6	SS	6	
5.0						
6.0	Trace gravel		7	SS	45	
7.0						
8.0						
9.0						
10.0			8	SS	56	
10.1	BOREHOLE TERMINATED AT 10.1 m					Upon completion of augering Wet cave at 3.2 m
11.0						
12.0						
13.0						
14.0						
15.0						

ELEVATION SCALE

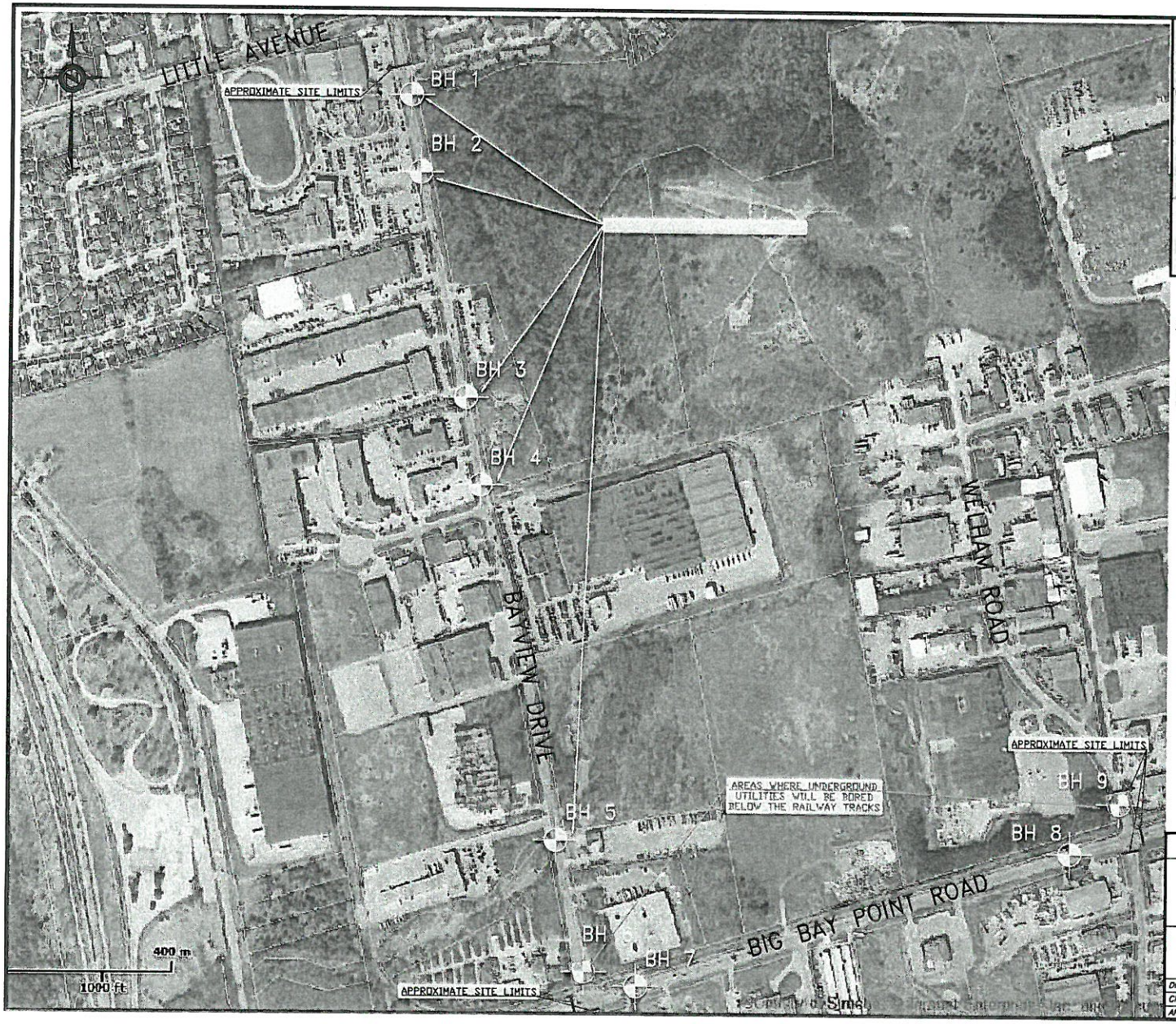
SHEAR STRENGTH (kPa)
+ FIELD VANE △ TORVANE ○ Qu
▲ POCKET PENETROMETER ○ Q
50 100 150 200

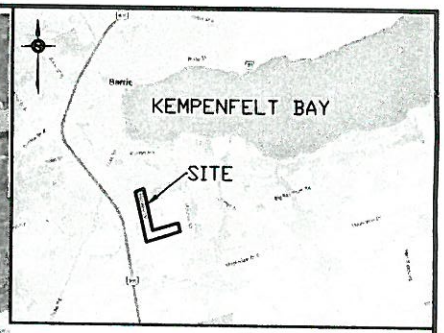
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT w_p | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_l
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

NOTES





KEY PLAN
BARRIE, ONTARIO

LEGEND:

BOREHOLE 1

REFERENCE:

PLAN PRODUCED FROM 2012 SIMCOE COUNTY SATELLITE MAPPING

0m 80 160 240 320 400

SCALE

BOREHOLE LOCATION PLAN

CLASS EA PHASE 3 AND 4 FOR BAYVIEW DRIVE AND BIG BAY POINT ROAD IMPROVEMENTS
BARRIE, ONTARIO

PML Peto MacCallum Ltd.
CONSULTING ENGINEERS

		DATE	SCALE	PML REF.	DRAWING NO.
DRAWN	AT	JAN. 2016	AS SHOWN	15BF048	1
CHECKED	GRW				
APPROVED	GRW				

Appendix Q:
LID Analysis Results Summaries

BARRIE DRAINAGE MASTER PLAN
LID APPLICATION COMPARISON
JANUARY, 2018

BARRIE CREEKS STUDY AREA - 25mm STORM
WATERSHED RUNOFF CHARACTERISITICS

Watershed	Area (ha)	Weighted Infiltration (mm)				
		No LIDs	Lot Level LIDs	Linear LIDs	Centralized LIDs	Combined LIDs
Bunkers Creek	360.39	19.34	19.44	20.25	19.36	20.37
Dyments Creek	579.92	18.64	18.73	19.30	18.65	19.40
Hotchkiss Creek	483.36	19.45	19.49	19.81	19.46	19.85
Huronia	93.03	18.61	18.78	20.40	19.65	21.23
Johnson	82.57	17.92	18.15	18.77	18.75	19.78
Kidds Creek	488.29	19.14	19.30	20.16	19.16	20.33
Minets	6.33	18.98	19.24	22.38	18.98	22.62
Mulcaster	41.40	15.25	15.36	16.28	15.25	16.38
Nelson	61.69	19.06	19.29	21.37	19.06	21.58
Rodney	29.00	19.34	19.57	21.84	19.34	22.06
Sophia	463.21	19.31	19.40	19.97	19.31	20.05
St. Vincent	35.93	18.91	19.12	19.98	18.91	20.18
Whiskey	638.43	19.01	19.13	19.93	19.11	20.15
Williams & Holgate	84.13	17.92	18.11	18.83	17.92	19.02

Watershed	Area (ha)	Weighted Runoff Depth (mm)				
		No LIDs	Lot Level LIDs	Linear LIDs	Centralized LIDs	Combined LIDs
Bunkers Creek	360.39	4.79	4.69	3.89	4.77	3.77
Dyments Creek	579.92	5.80	5.70	5.14	5.79	5.04
Hotchkiss Creek	483.36	4.80	4.77	4.44	4.79	4.40
Huronia	93.03	5.65	5.48	3.86	4.59	3.01
Johnson	82.57	6.27	6.04	5.42	5.41	4.40
Kidds Creek	488.29	5.18	5.02	4.17	5.16	3.99
Minets	6.33	5.26	5.01	1.88	5.26	1.64
Mulcaster	41.40	8.69	8.58	7.67	8.69	7.56
Nelson	61.69	5.24	5.01	2.94	5.24	2.73
Rodney	29.00	4.95	4.72	2.47	4.95	2.25
Sophia	463.21	4.82	4.73	4.00	4.82	3.92
St. Vincent	35.93	5.44	5.23	4.36	5.44	4.15
Whiskey	638.43	5.77	5.65	4.85	5.66	4.63
Williams & Holgate	84.13	6.29	6.10	5.38	6.29	5.19

Watershed	Area (ha)	Runoff Volume (ML)				
		No LIDs	Lot Level LIDs	Linear LIDs	Centralized LIDs	Combined LIDs
Bunkers Creek	360.39	17.25	16.83	13.98	17.18	13.54
Dyments Creek	579.92	33.59	33.10	29.76	33.55	29.29
Hotchkiss Creek	483.36	23.18	23.02	21.27	23.14	21.12
Huronia	93.03	5.25	5.13	3.52	4.26	2.75
Johnson	82.57	5.17	5.05	4.53	4.46	3.64
Kidds Creek	488.29	25.30	24.51	20.27	25.21	19.44
Minets	6.33	0.33	0.32	0.12	0.33	0.10
Mulcaster	41.40	3.61	3.56	3.20	3.61	3.15
Nelson	61.69	3.23	3.12	1.82	3.23	1.69
Rodney	29.00	1.40	1.36	0.69	1.40	0.60
Sophia	463.21	22.19	21.82	18.39	22.19	17.98
St. Vincent	35.93	1.96	1.88	1.55	1.96	1.47
Whiskey	638.43	36.82	36.01	30.86	36.13	29.49
Williams & Holgate	84.13	5.27	5.14	4.49	5.27	4.35

BARRIE DRAINAGE MASTER PLAN
LID APPLICATION COMPARISON
JANUARY, 2018

BARRIE CREEKS STUDY AREA - 5 YEAR 6 HOUR SCS STORM (59.5 mm)
WATERSHED RUNOFF CHARACTERISITICS

Watershed	Area (ha)	Weighted Infiltration (mm)				
		No LIDs	Lot Level LIDs	Linear LIDs	Centralized LIDs	Combined LIDs
Bunkers Creek	360.39	44.58	44.84	46.75	44.59	47.02
Dyments Creek	579.92	43.56	43.79	45.00	43.57	45.23
Hotchkiss Creek	483.36	45.03	45.12	45.88	45.04	45.98
Huronia	93.03	43.09	43.52	46.80	44.25	48.36
Johnson	82.57	38.44	38.98	40.12	39.39	41.59
Kidds Creek	488.29	44.91	45.31	47.22	44.93	47.62
Minets	6.33	43.86	44.50	49.50	43.86	50.13
Mulcaster	41.40	35.33	35.61	37.85	35.33	38.11
Nelson	61.69	45.77	46.32	51.42	45.77	51.96
Rodney	29.00	46.48	47.05	52.67	46.48	53.22
Sophia	463.21	39.66	39.87	41.05	39.66	41.25
St. Vincent	35.93	45.39	45.90	47.96	45.39	48.47
Whiskey	638.43	44.70	45.00	46.41	44.80	46.80
Williams & Holgate	84.13	42.22	42.68	44.18	42.22	44.64

Watershed	Area (ha)	Weighted Runoff Depth (mm)				
		No LIDs	Lot Level LIDs	Linear LIDs	Centralized LIDs	Combined LIDs
Bunkers Creek	360.39	14.29	14.03	12.13	14.27	11.86
Dyments Creek	579.92	15.72	15.49	14.28	15.71	14.05
Hotchkiss Creek	483.36	14.02	13.93	13.17	14.01	13.07
Huronia	93.03	15.92	15.50	12.22	14.72	10.61
Johnson	82.57	20.51	19.98	18.76	19.52	17.24
Kidds Creek	488.29	14.06	13.66	11.76	14.04	11.36
Minets	6.33	15.19	14.55	9.56	15.19	8.93
Mulcaster	41.40	23.29	23.01	20.78	23.29	20.51
Nelson	61.69	13.10	12.54	7.46	13.10	6.92
Rodney	29.00	12.38	11.81	6.20	12.38	5.65
Sophia	463.21	19.21	19.00	17.39	19.21	17.18
St. Vincent	35.93	13.60	13.08	10.97	13.60	10.46
Whiskey	638.43	15.43	15.14	13.73	15.33	13.33
Williams & Holgate	84.13	16.66	16.20	14.70	16.66	14.24

Watershed	Area (ha)	Runoff Volume (ML)				
		No LIDs	Lot Level LIDs	Linear LIDs	Centralized LIDs	Combined LIDs
Bunkers Creek	360.39	51.52	50.60	43.71	51.45	42.78
Dyments Creek	579.92	91.23	89.97	82.96	91.19	81.49
Hotchkiss Creek	483.36	67.75	67.28	63.65	67.67	63.15
Huronia	93.03	14.79	14.42	11.39	13.67	9.91
Johnson	82.57	16.96	16.52	15.48	16.15	14.23
Kidds Creek	488.29	68.68	66.72	57.40	68.58	55.54
Minets	6.33	0.97	0.93	0.61	0.97	0.56
Mulcaster	41.40	9.60	9.47	8.58	9.60	8.45
Nelson	61.69	8.06	7.74	4.59	8.06	4.28
Rodney	29.00	3.55	3.44	1.80	3.55	1.65
Sophia	463.21	89.01	87.98	80.54	89.01	79.59
St. Vincent	35.93	4.88	4.70	3.91	4.88	3.78
Whiskey	638.43	98.58	96.72	87.64	97.88	85.07
Williams & Holgate	84.13	14.01	13.63	12.34	14.01	11.95

BARRIE DRAINAGE MASTER PLAN
LID APPLICATION COMPARISON
JANUARY, 2018

BARRIE CREEKS STUDY AREA - 100 YEAR 6 HOUR SCS STORM (106.5 mm)
WATERSHED RUNOFF CHARACTERISITICS

Watershed	Area (ha)	Weighted Infiltration (mm)				
		No LIDs	Lot Level LIDs	Linear LIDs	Centralized LIDs	Combined LIDs
Bunkers Creek	360.39	66.46	66.93	69.58	66.48	70.06
Dyments Creek	579.92	70.34	70.70	71.89	70.35	72.25
Hotchkiss Creek	483.36	70.73	70.90	72.01	70.75	72.19
Huronia	93.03	61.58	62.25	65.37	62.73	67.17
Johnson	82.57	53.17	53.94	54.91	54.10	56.61
Kidds Creek	488.29	71.82	72.45	74.52	71.84	75.16
Minets	6.33	60.73	61.81	66.22	60.73	67.29
Mulcaster	41.40	55.79	56.22	59.08	55.79	59.50
Nelson	61.69	79.66	80.62	87.95	79.66	88.89
Rodney	29.00	76.26	77.21	84.48	76.26	85.41
Sophia	463.21	55.76	56.13	57.79	55.76	58.15
St. Vincent	35.93	76.13	76.93	79.45	76.13	80.25
Whiskey	638.43	68.99	69.42	70.68	69.08	71.20
Williams & Holgate	84.13	64.77	65.50	66.96	64.77	67.69
Watershed	Area (ha)	Weighted Runoff Depth (mm)				
		No LIDs	Lot Level LIDs	Linear LIDs	Centralized LIDs	Combined LIDs
Bunkers Creek	360.39	39.87	39.40	36.75	39.85	36.27
Dyments Creek	579.92	36.56	36.21	35.01	36.55	34.66
Hotchkiss Creek	483.36	35.92	35.75	34.64	35.90	34.46
Huronia	93.03	44.90	44.24	41.12	43.66	39.23
Johnson	82.57	53.13	52.34	51.29	52.12	49.51
Kidds Creek	488.29	34.52	33.89	31.83	34.50	31.18
Minets	6.33	45.82	44.74	40.33	45.82	39.28
Mulcaster	41.40	50.29	49.87	47.00	50.29	46.58
Nelson	61.69	26.52	25.56	18.24	26.52	17.30
Rodney	29.00	30.16	29.22	21.96	30.16	21.03
Sophia	463.21	50.46	50.09	47.93	50.46	47.57
St. Vincent	35.93	30.47	29.65	27.06	30.47	26.25
Whiskey	638.43	39.80	39.37	38.11	39.68	37.57
Williams & Holgate	84.13	41.58	40.85	39.39	41.58	38.66
Watershed	Area (ha)	Runoff Volume (ML)				
		No LIDs	Lot Level LIDs	Linear LIDs	Centralized LIDs	Combined LIDs
Bunkers Creek	360.39	143.76	142.01	132.43	143.69	130.77
Dyments Creek	579.92	212.08	210.01	203.07	212.04	201.03
Hotchkiss Creek	483.36	173.64	172.82	167.56	173.55	166.50
Huronia	93.03	41.81	41.25	38.32	40.66	36.50
Johnson	82.57	43.86	43.18	42.33	43.02	40.86
Kidds Creek	488.29	168.45	165.46	155.34	168.35	152.33
Minets	6.33	2.91	2.83	2.57	2.91	2.50
Mulcaster	41.40	20.83	20.65	19.46	20.83	19.29
Nelson	61.69	16.34	15.78	11.24	16.34	10.66
Rodney	29.00	8.74	8.47	6.32	8.74	6.06
Sophia	463.21	233.60	231.88	221.98	233.60	220.25
St. Vincent	35.93	10.96	10.61	9.73	10.96	9.40
Whiskey	638.43	254.01	251.29	243.26	253.30	239.86
Williams & Holgate	84.13	34.98	34.37	33.08	34.98	32.52

BARRIE DRAINAGE MASTER PLAN
LID APPLICATION COMPARISON
JANUARY, 2018

LOVERS & HEWITTS STUDY AREA - 25mm STORM
WATERSHED RUNOFF CHARACTERISITICS

Watershed	Area (ha)	Weighted Infiltration (mm)				
		No LIDs	Lot Level	Linear	Centralized	Combined LIDs
Bayshore	50.01	19.77	20.02	21.43	19.77	21.68
Gray Lane	19.27	19.76	19.95	21.83	19.76	22.02
Hewitts Creek	516.88	19.70	19.95	21.38	20.06	21.98
Lovers Creek	1636.10	17.96	18.18	18.60	17.99	18.84
Royal Oak	14.08	20.09	20.28	22.69	20.09	22.87
Watershed	Area (ha)	Weighted Runoff Depth (mm)				
		No LIDs	Lot Level	Linear	Centralized	Combined LIDs
Bayshore	50.01	4.46	4.21	2.81	4.46	2.56
Gray Lane	19.27	4.62	4.43	2.55	4.62	2.37
Hewitts Creek	516.88	4.75	4.51	3.08	4.37	2.47
Lovers Creek	1636.10	6.16	5.94	5.50	6.13	5.27
Royal Oak	14.08	4.30	4.12	1.71	4.30	1.53
Watershed	Area (ha)	Runoff Volume (ML)				
		No LIDs	Lot Level	Linear	Centralized	Combined LIDs
Bayshore	50.01	2.23	2.11	1.38	2.23	1.31
Gray Lane	19.27	0.88	0.86	0.52	0.88	0.48
Hewitts Creek	516.88	24.53	23.11	15.85	22.58	12.67
Lovers Creek	1636.10	101.95	98.51	91.28	101.43	87.40
Royal Oak	14.08	0.60	0.58	0.23	0.60	0.19

BARRIE DRAINAGE MASTER PLAN
LID APPLICATION COMPARISON
JANUARY, 2018

LOVERS & HEWITTS STUDY AREA - 5 YEAR 6 HOUR SCS STORM (59.5 mm)
WATERSHED RUNOFF CHARACTERISITICS

Watershed	Area (ha)	Weighted Infiltration (mm)				
		No LIDs	Lot Level	Linear	Centralized	Combined LIDs
Bayshore	50.01	44.73	45.34	48.42	44.73	49.02
Gray Lane	19.27	46.76	47.22	50.69	46.76	51.15
Hewitts Creek	516.88	46.35	46.91	49.31	46.69	50.20
Lovers Creek	1636.10	42.29	42.78	43.44	42.35	43.99
Royal Oak	14.08	47.37	47.82	52.12	47.37	52.56
Watershed	Area (ha)	Weighted Runoff Depth (mm)				
		No LIDs	Lot Level	Linear	Centralized	Combined LIDs
Bayshore	50.01	14.33	13.72	10.65	14.33	10.05
Gray Lane	19.27	12.33	11.86	8.40	12.33	7.95
Hewitts Creek	516.88	12.78	12.22	9.83	12.40	8.89
Lovers Creek	1636.10	16.17	15.68	15.00	16.11	14.45
Royal Oak	14.08	11.78	11.34	7.04	11.78	6.60
Watershed	Area (ha)	Runoff Volume (ML)				
		No LIDs	Lot Level	Linear	Centralized	Combined LIDs
Bayshore	50.01	7.17	6.82	5.35	7.17	5.00
Gray Lane	19.27	2.37	2.27	1.58	2.37	1.51
Hewitts Creek	516.88	65.99	63.10	50.76	64.01	45.87
Lovers Creek	1636.10	268.35	260.14	249.02	267.23	239.91
Royal Oak	14.08	1.65	1.58	0.98	1.65	0.92

BARRIE DRAINAGE MASTER PLAN
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LOVERS & HEWITTS STUDY AREA - 100 YEAR 6 HOUR SCS STORM (106.5 mm)
WATERSHED RUNOFF CHARACTERISITICS

Watershed	Area (ha)	Weighted Infiltration (mm)				
		No LIDs	Lot Level	Linear	Centralized	Combined LIDs
Bayshore	50.01	61.91	62.83	65.88	61.91	66.79
Gray Lane	19.27	68.43	69.10	72.30	68.43	73.33
Hewitts Creek	516.88	72.89	73.63	75.81	73.21	76.87
Lovers Creek	1636.10	68.77	69.95	70.44	69.35	71.15
Royal Oak	14.08	67.87	68.48	72.46	67.87	73.07
Watershed	Area (ha)	Weighted Runoff Depth (mm)				
		No LIDs	Lot Level	Linear	Centralized	Combined LIDs
Bayshore	50.01	44.58	43.66	40.62	44.58	39.70
Gray Lane	19.27	38.14	37.46	34.27	38.14	33.24
Hewitts Creek	516.88	33.54	32.79	30.62	33.14	29.49
Lovers Creek	1636.10	36.52	36.33	35.82	36.91	35.10
Royal Oak	14.08	38.81	38.20	34.23	38.81	33.62
Watershed	Area (ha)	Runoff Volume (ML)				
		No LIDs	Lot Level	Linear	Centralized	Combined LIDs
Bayshore	50.01	22.32	21.82	20.36	22.32	19.89
Gray Lane	19.27	7.36	7.21	6.61	7.36	6.97
Hewitts Creek	516.88	173.24	169.46	158.18	171.20	152.35
Lovers Creek	1636.10	605.29	594.29	586.18	604.11	574.18
Royal Oak	14.08	5.48	5.36	4.82	5.48	4.70

BARRIE DRAINAGE MASTER PLAN
LID APPLICATION COMPARISON
JANUARY, 2018

NVCA STUDY AREA - 25mm STORM
WATERSHED RUNOFF CHARACTERISITICS

Watershed	Area (ha)	Weighted Infiltration (mm)				
		No LIDs	Lot Level LIDs	Linear LIDs	Centralized LIDs	Combined LIDs
Bear Creek	1699.81	21.65	21.75	22.44	21.78	22.68
Georgian Creek	270.35	18.40	18.68	20.17	18.61	20.61
Little Lake	445.06	16.65	16.93	18.09	16.69	18.37
Watershed	Area (ha)	Weighted Runoff Depth (mm)				
		No LIDs	Lot Level LIDs	Linear LIDs	Centralized LIDs	Combined LIDs
Bear Creek	1699.81	3.17	3.05	2.26	3.02	1.99
Georgian Creek	270.35	5.78	5.49	3.89	5.55	3.43
Little Lake	445.06	7.77	7.48	6.34	7.73	6.06
Watershed	Area (ha)	Runoff Volume (ML)				
		No LIDs	Lot Level LIDs	Linear LIDs	Centralized LIDs	Combined LIDs
Bear Creek	1699.81	53.76	51.63	38.30	51.20	33.76
Georgian Creek	270.35	15.59	14.81	10.50	14.98	9.22
Little Lake	445.06	34.51	33.15	28.08	34.35	26.83

BARRIE DRAINAGE MASTER PLAN
LID APPLICATION COMPARISON
JANUARY, 2018

NVCA STUDY AREA - 5 YEAR 6 HOUR SCS STORM (59.5 mm)
WATERSHED RUNOFF CHARACTERISITICS

Watershed	Area (ha)	Weighted Infiltration (mm)				
		No LIDs	Lot Level LIDs	Linear LIDs	Centralized LIDs	Combined LIDs
Bear Creek	1699.81	51.39	51.65	53.29	51.49	53.45
Georgian Creek	270.35	37.94	38.59	41.71	38.15	42.54
Little Lake	445.06	38.52	39.15	41.96	38.56	42.59
Watershed	Area (ha)	Weighted Runoff Depth (mm)				
		No LIDs	Lot Level LIDs	Linear LIDs	Centralized LIDs	Combined LIDs
Bear Creek	1699.81	8.62	8.32	6.39	8.46	5.91
Georgian Creek	270.35	21.02	20.35	16.86	20.78	15.97
Little Lake	445.06	21.51	20.84	17.88	21.47	17.21
Watershed	Area (ha)	Runoff Volume (ML)				
		No LIDs	Lot Level LIDs	Linear LIDs	Centralized LIDs	Combined LIDs
Bear Creek	1699.81	146.54	141.30	108.48	143.96	101.19
Georgian Creek	270.35	56.81	54.96	45.60	56.15	43.12
Little Lake	445.06	95.70	92.74	79.65	95.52	76.45

BARRIE DRAINAGE MASTER PLAN
LID APPLICATION COMPARISON
JANUARY, 2018

NVCA STUDY AREA - 100 YEAR 6 HOUR SCS STORM (106.5 mm)
WATERSHED RUNOFF CHARACTERISITICS

Watershed	Area (ha)	Weighted Infiltration (mm)				
		No LIDs	Lot Level LIDs	Linear LIDs	Centralized LIDs	Combined LIDs
Bear Creek	1699.81	86.47	86.87	89.05	86.23	89.18
Georgian Creek	270.35	51.81	52.68	55.97	51.99	57.00
Little Lake	445.06	55.68	56.53	59.92	55.71	60.76
Watershed	Area (ha)	Weighted Runoff Depth (mm)				
		No LIDs	Lot Level LIDs	Linear LIDs	Centralized LIDs	Combined LIDs
Bear Creek	1699.81	22.34	21.87	19.28	22.08	18.57
Georgian Creek	270.35	54.38	53.44	49.82	54.13	48.66
Little Lake	445.06	54.16	53.26	49.74	54.12	48.84
Watershed	Area (ha)	Runoff Volume (ML)				
		No LIDs	Lot Level LIDs	Linear LIDs	Centralized LIDs	Combined LIDs
Bear Creek	1699.81	379.77	371.78	327.73	377.13	317.40
Georgian Creek	270.35	147.06	144.48	134.80	146.38	131.56
Little Lake	445.06	241.05	237.14	221.48	240.85	217.44

BARRIE DRAINAGE MASTER PLAN
LID APPLICATION COMPARISON
JANUARY, 2018

BARRIE CREEKS STUDY AREA - 25mm STORM
WATERCOURSE PEAK FLOWS

Culvert Inlet Junction	Contributing Area (ha)	Contributing Impervious Area (ha)	Peak Flows (m^3/s)				
			No LIDs	Lot Level LIDs	Linear LIDs	Centralized LIDs	Combined LIDs
Bunkers Creek							
J632BK	311.075	138.308	2.816	2.721	2.098	2.768	1.997
J451BK	337.153	150.956	2.818	2.728	2.122	2.774	2.021
J67BK	358.867	162.867	3.603	3.524	3.340	3.687	3.269
Dyments Creek							
J4942DY	155.164	40.533	1.468	1.445	1.108	1.455	1.041
J4245DY	192.308	45.459	1.584	1.561	1.23	1.572	1.164
J3776DY	212.487	48.418	1.609	1.583	1.261	1.597	1.19
J3146DY	236.43	52.28	1.174	1.134	0.703	1.158	0.643
J2907DY	296.685	69.375	0.961	0.961	0.961	0.961	0.961
J2595DY	426.431	110.544	1.095	1.091	1.094	1.095	1.091
J2322DY	456.002	128.002	1.907	1.902	1.912	1.911	1.909
J2077DY	494.699	151.036	2.546	2.544	2.546	2.546	2.546
J1923DY	499.412	152.906	2.611	2.608	2.611	2.611	2.61
J1945DY	499.412	152.906	2.615	2.612	2.615	2.615	2.614
J1670DY	510.708	161.251	2.821	2.819	2.821	2.821	2.82
J1434DY	522.106	169.468	0.798	0.797	0.797	0.798	0.797
J1117DY	527.643	171.793	0.791	0.789	0.787	0.791	0.787
J693DY	553.205	190.219	1.304	1.302	1.259	1.304	1.257
J572DY	557.404	191.617	1.283	1.279	1.231	1.283	1.227
J505DY	557.404	191.617	1.282	1.278	1.23	1.282	1.227
Hotchkiss Creek							
J10HT	7.07	2.848	0.054	0.051	0.041	0.054	0.039
J11HT	9.366	3.375	0.055	0.052	0.04	0.055	0.037
J461HT	27.695	10.993	0.111	0.11	0.111	0.111	0.11
J277HT	51.660	16.461	1.111	1.11	1.111	1.111	1.11
J75_1HT	61.055	18.057	1.219	1.218	1.219	1.219	1.218
J107HT	110.074	45.142	0.995	0.973	0.748	0.995	0.694
J1796HT	227.557	81.931	1.997	1.977	1.791	1.997	1.725
J1574HT	284.442	104.23	2.916	2.896	2.668	2.916	2.583
J623HT	403.325	170.999	4.163	4.136	3.854	4.165	3.82
J337HT	472.542	200.089	4.61	4.586	4.36	4.593	4.308
Kidds Creek							
J297_1KD	0.012	0.003	0	0	0	0	0
J120KD	9.5	3.625	0.436	0.433	0.429	0.436	0.423
J1084KD	239.00	77.237	2.751	2.698	2.152	2.751	2.008
J973KD	239.70	77.307	2.486	2.453	2.071	2.486	1.941
J839KD	423.683	141.475	1.378	1.371	1.324	1.377	1.314
J411KD	440.709	145.163	1.407	1.4	1.351	1.405	1.339
J311KD	443.164	146.736	1.416	1.409	1.361	1.414	1.348
J104KD	445.037	147.496	1.449	1.442	1.393	1.447	1.38
J345_1KD	458.064	152.840	1.477	1.47	1.419	1.475	1.405
J157KD	466.346	156.77	1.498	1.49	1.436	1.496	1.421
J14_1KD	468.648	158.105	1.505	1.497	1.441	1.503	1.425
Sophia Creek							
J1013SP	60.091	26.525	1.682	1.66	1.406	1.682	1.381
J914SP	61.443	26.834	1.606	1.588	1.389	1.606	1.364
J639SP	81.092	34.586	1.885	1.865	1.63	1.885	1.604
J350SP	99.863	42.709	2.068	2.044	1.765	2.068	1.733
J203SP	103.123	45.504	0.988	0.976	0.835	0.988	0.823
J40SP	140.532	66.001	2.539	2.518	2.253	2.539	2.22
J917SP	245.589	111.875	2.82	2.799	2.59	2.82	2.566
J810SP	251.364	113.814	2.78	2.761	2.566	2.78	2.543

BARRIE DRAINAGE MASTER PLAN
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BARRIE CREEKS STUDY AREA - 25mm STORM
WATERCOURSE PEAK FLOWS

Culvert Inlet Junction	Contributing Area (ha)	Contributing Impervious Area (ha)	Peak Flows (m^3/s)				
			No LIDs	Lot Level LIDs	Linear LIDs	Centralized LIDs	Combined LIDs
J559SP	270.7	121.917	2.85	2.831	2.628	2.85	2.605
J506SP	271.337	122.109	2.85	2.832	2.628	2.85	2.605
J382SP	290.909	130.77	2.896	2.876	2.663	2.896	2.639
J26SP	337.317	150.935	3.007	2.985	2.749	3.007	2.722
Whiskey Creek							
J138WK	46.837	11.724	0.637	0.618	0.475	0.637	0.46
J407WK	36.527	15.816	1.14	1.139	1.14	1.14	1.13
J125WK	37.095	8.282	0.765	0.759	0.575	0.24	0.147
J196WK	42.694	16.555	1.165	1.164	1.165	1.165	1.153
J45WK	42.871	16.555	1.164	1.163	1.164	1.164	1.152
J241WK	110.215	45.965	0.908	0.898	0.82	0.903	0.802
2WK	169.124	54.433	1.501	1.488	1.347	1.144	0.845
J1734WK	190.809	55.651	1.518	1.507	1.368	1.155	0.859
J1481WK	216.418	60.479	1.567	1.556	1.406	1.177	0.903
J1160WK	223.863	62.917	1.595	1.584	1.431	1.194	0.936
J388WK	394.678	117.751	2.854	2.835	2.64	2.854	2.619
J145_1WK	465.798	146.124	3.119	3.096	2.871	3.127	2.815
J1549WK	567.415	187.845	3.235	3.162	2.786	3.123	2.718
J1095WK	588.553	192.106	3.2	3.127	2.702	3.064	2.634
J905WK	617.845	205.111	3.414	3.334	2.791	3.271	2.715
J495WK	628.124	209.272	3.558	3.469	2.862	3.412	2.77
J324WK	648.197	213.502	3.575	3.485	2.912	3.43	2.897
J225WK	650.162	213.962	3.721	3.643	2.989	3.594	2.859

BARRIE DRAINAGE MASTER PLAN
LID APPLICATION COMPARISON
JANUARY, 2018

BARRIE CREEKS STUDY AREA - 5 Year 6 HOUR SCS STORM (59.5 mm)
WATERCOURSE PEAK FLOWS

Culvert Inlet Junction	Contributing Area (ha)	Contributing Impervious Area (ha)	Peak Flows (m^3/s)				
			No LIDs	Lot Level LIDs	Linear LIDs	Centralized LIDs	Combined LIDs
Bunkers Creek							
J632BK	311.075	138.308	8.751	8.662	7.825	8.711	7.611
J451BK	337.153	150.956	8.104	8.03	7.500	8.074	7.374
J67BK	358.867	162.867	7.965	7.963	7.583	7.954	7.467
Dyments Creek							
J4942DY	155.164	40.533	1.883	1.869	1.702	1.878	1.666
J4245DY	192.308	45.459	2.391	2.362	2.079	2.381	2.018
J3776DY	212.487	48.418	2.623	2.587	2.289	2.612	2.229
J3146DY	236.43	52.28	2.117	2.089	1.878	2.11	1.831
J2907DY	296.685	69.375	2.791	2.783	2.804	2.792	2.793
J2595DY	426.431	110.544	3.338	3.331	3.335	3.338	3.326
J2322DY	456.002	128.002	5.521	5.525	5.558	5.527	5.509
J2077DY	494.699	151.036	4.762	4.594	4.732	4.539	4.429
J1923DY	499.412	152.906	3.92	3.917	3.92	3.919	3.919
J1945DY	499.412	152.906	3.92	3.917	3.92	3.919	3.92
J1670DY	510.708	161.251	4.833	4.832	4.832	4.833	4.829
J1434DY	522.106	169.468	2.794	2.736	2.505	2.782	2.447
J1117DY	527.643	171.793	2.794	2.737	2.506	2.783	2.446
J693DY	553.205	190.219	3.135	3.13	3.058	3.135	3.053
J572DY	557.404	191.617	3.195	3.187	3.116	3.195	3.108
J505DY	557.404	191.617	3.183	3.175	3.105	3.182	3.098
Hotchkiss Creek							
J10HT	7.07	2.848	0.137	0.135	0.127	0.137	0.125
J11HT	9.366	3.375	0.143	0.14	0.128	0.143	0.125
J461HT	27.695	10.993	0.817	0.794	0.541	0.817	0.525
J277HT	51.660	16.461	1.811	1.81	1.811	1.811	1.81
J75_1HT	61.055	18.057	2.027	2.025	2.027	2.027	2.025
J107HT	110.074	45.142	2.59	2.563	2.338	2.589	2.299
J1796HT	227.557	81.931	4.85	4.823	4.619	4.855	4.885
J1574HT	284.442	104.23	7.928	7.97	7.466	7.326	7.215
J623HT	403.325	170.999	6.978	6.969	6.938	6.936	6.896
J337HT	472.542	200.089	7.95	7.935	7.832	7.942	7.805
Kidds Creek							
J297_1KD	0.012	0.003	0.041	0.039	0.035	0.041	0.034
J120KD	9.5	3.625	0.602	0.596	0.593	0.602	0.587
J1084KD	239.00	77.237	3.905	3.843	3.423	3.911	3.359
J973KD	239.70	77.307	3.865	3.776	3.304	3.866	3.193
J839KD	423.683	141.475	1.736	1.728	1.68	1.731	1.661
J411KD	440.709	145.163	2.238	2.219	2.152	2.233	2.116
J311KD	443.164	146.736	2.331	2.305	2.181	2.319	2.145
J104KD	445.037	147.496	2.364	2.326	2.227	2.357	2.19
J345_1KD	458.064	152.840	2.995	2.935	2.687	2.987	2.625
J157KD	466.346	156.77	3.224	3.149	2.865	3.216	2.777
J14_1KD	468.648	158.105	3.261	3.184	2.892	3.254	2.804
Sophia Creek							
J1013SP	60.091	26.525	4.395	4.384	4.251	4.395	4.223
J914SP	61.443	26.834	4.364	4.352	4.204	4.364	4.176
J639SP	81.092	34.586	5.581	5.557	5.32	5.584	5.287
J350SP	99.863	42.709	5.935	5.891	5.38	5.939	5.338
J203SP	103.123	45.504	2.716	2.699	2.579	2.716	2.56
J40SP	140.532	66.001	8.888	8.851	8.531	8.894	8.507
J917SP	245.589	111.875	11.017	10.944	10.22	11.022	10.16

BARRIE DRAINAGE MASTER PLAN
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BARRIE CREEKS STUDY AREA - 5 Year 6 HOUR SCS STORM (59.5 mm)
WATERCOURSE PEAK FLOWS

Culvert Inlet Junction	Contributing Area (ha)	Contributing Impervious Area (ha)	Peak Flows (m^3/s)				
			No LIDs	Lot Level LIDs	Linear LIDs	Centralized LIDs	Combined LIDs
J810SP	251.364	113.814	11.216	11.125	10.31	11.222	10.212
J559SP	270.7	121.917	9.817	9.711	8.957	9.821	8.877
J506SP	271.337	122.109	9.749	9.639	8.882	9.752	8.797
J382SP	290.909	130.77	9.756	9.662	8.897	9.758	8.813
J26SP	337.317	150.935	9.789	9.704	8.97	9.79	8.88
Whiskey Creek							
J138WK	46.837	11.724	1.561	1.535	1.404	1.561	1.378
J407WK	36.527	15.816	2.801	2.799	2.801	2.801	2.785
J125WK	37.095	8.282	1.65	1.601	1.238	1.434	0.876
J196WK	42.694	16.555	2.828	2.826	2.828	2.828	2.813
J45WK	42.871	16.555	2.827	2.824	2.827	2.827	2.811
J241WK	110.215	45.965	1.104	1.096	1.049	1.103	1.037
2WK	169.124	54.433	2.681	2.615	2.181	2	1.712
J1734WK	190.809	55.651	2.23	2.202	2.008	1.951	1.745
J1481WK	216.418	60.479	2.426	2.408	2.254	2.106	1.969
J1160WK	223.863	62.917	2.671	2.649	2.462	2.393	2.228
J388WK	394.678	117.751	7.303	7.279	7.038	7.303	7.01
J145_1WK	465.798	146.124	6.765	6.737	6.579	6.861	6.621
J1549WK	567.415	187.845	7.321	7.227	6.809	7.303	6.703
J1095WK	588.553	192.106	7.306	7.207	6.808	7.285	6.701
J905WK	617.845	205.111	7.494	7.391	6.993	7.473	6.881
J495WK	628.124	209.272	7.514	7.429	7.079	7.495	6.966
J324WK	648.197	213.502	7.524	7.439	7.091	7.505	6.98
J225WK	650.162	213.962	7.612	7.527	7.175	7.593	7.06

BARRIE DRAINAGE MASTER PLAN
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BARRIE CREEKS STUDY AREA - 100 Year 6 HOUR SCS STORM (106.5 mm)
WATERCOURSE PEAK FLOWS

Culvert Inlet Junction	Contributing Area (ha)	Contributing Impervious Area (ha)	Peak Flows (m^3/s)				
			No LIDs	Lot Level LIDs	Linear LIDs	Centralized LIDs	Combined LIDs
Bunkers Creek							
J632BK	311.075	138.308	16.793	16.793	16.220	16.853	16.211
J451BK	337.153	150.956	17.855	17.62	17.036	17.722	16.858
J67BK	358.867	162.867	17.545	17.433	16.719	17.466	16.498
Dyments Creek							
J4942DY	155.164	40.533	3.141	3.13	3.033	3.139	3.011
J4245DY	192.308	45.459	5.23	5.227	5.111	5.232	5.091
J3776DY	212.487	48.418	6.103	6.072	5.939	6.102	5.89
J3146DY	236.43	52.28	4.445	4.408	4.185	4.439	4.126
J2907DY	296.685	69.375	5.832	5.832	5.832	5.831	5.832
J2595DY	426.431	110.544	6.696	6.674	6.629	6.694	6.618
J2322DY	456.002	128.002	11.284	11.182	11.184	11.187	11.211
J2077DY	494.699	151.036	6.775	6.689	6.787	6.869	6.684
J1923DY	499.412	152.906	6.089	6.091	5.97	6.106	5.948
J1945DY	499.412	152.906	6.131	6.128	6.013	6.132	5.992
J1670DY	510.708	161.251	7.006	7.007	7.009	7.006	7.009
J1434DY	522.106	169.468	6.052	6.044	5.934	6.058	5.909
J1117DY	527.643	171.793	6.058	6.049	5.940	6.063	5.915
J693DY	553.205	190.219	6.057	6.050	5.985	6.06	5.967
J572DY	557.404	191.617	5.954	5.947	5.886	5.957	5.869
J505DY	557.404	191.617	5.985	5.981	5.918	5.988	5.899
Hotchkiss Creek							
J10HT	7.07	2.848	0.611	0.597	0.523	0.611	0.51
J11HT	9.366	3.375	0.632	0.615	0.529	0.633	0.521
J461HT	27.695	10.993	3.611	3.584	3.361	3.609	3.332
J277HT	51.660	16.461	3.701	3.7	3.7	3.699	3.699
J75_1HT	61.055	18.057	4.108	4.107	4.108	4.107	4.113
J107HT	110.074	45.142	11.418	11.373	11.02	11.414	10.581
J1796HT	227.557	81.931	8.942	8.825	8.93	8.923	11.162
J1574HT	284.442	104.23	14.692	14.51	14.226	13.859	15.957
J623HT	403.325	170.999	9.188	9.18	9.111	8.569	9.335
J337HT	472.542	200.089	10.868	10.614	10.366	9.783	10.751
Kidds Creek							
J297_1KD	0.012	0.003	0.348	0.337	0.318	0.348	0.309
J120KD	9.5	3.625	1.008	1.002	1.002	1.008	0.996
J1084KD	239.00	77.237	12.261	12.159	11.967	12.266	11.786
J973KD	239.70	77.307	11.971	11.719	11.186	11.995	10.977
J839KD	423.683	141.475	2.352	2.346	2.306	2.35	2.294
J411KD	440.709	145.163	3.711	3.693	3.652	3.709	3.628
J311KD	443.164	146.736	4.095	4.076	4.03	4.093	4.003
J104KD	445.037	147.496	4.302	4.277	4.233	4.3	4.198
J345_1KD	458.064	152.840	6.976	6.587	6.025	6.965	5.656
J157KD	466.346	156.77	5.963	5.948	5.931	5.962	5.924
J14_1KD	468.648	158.105	6.01	5.966	5.9	6.008	5.889
Sophia Creek							
J1013SP	60.091	26.525	8.915	8.832	8.302	8.926	8.239
J914SP	61.443	26.834	8.874	8.791	8.3	8.883	8.231
J639SP	81.092	34.586	12.668	12.612	12.347	12.666	12.292
J350SP	99.863	42.709	12.415	12.379	12.19	12.413	12.153
J203SP	103.123	45.504	9.712	9.684	9.592	9.713	9.57
J40SP	140.532	66.001	21.356	21.303	21.081	21.353	21.033
J917SP	245.589	111.875	28.136	27.995	27.31	28.161	27.201
J810SP	251.364	113.814	28.521	28.391	27.649	28.533	27.539

BARRIE DRAINAGE MASTER PLAN
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BARRIE CREEKS STUDY AREA - 100 Year 6 HOUR SCS STORM (106.5 mm)
WATERCOURSE PEAK FLOWS

Culvert Inlet Junction	Contributing Area (ha)	Contributing Impervious Area (ha)	Peak Flows (m^3/s)				
			No LIDs	Lot Level LIDs	Linear LIDs	Centralized LIDs	Combined LIDs
J559SP	270.7	121.917	30.418	30.264	29.455	30.427	29.34
J506SP	271.337	122.109	30.428	30.273	29.471	30.439	29.353
J382SP	290.909	130.77	31.854	31.695	30.893	31.86	30.765
J26SP	337.317	150.935	33.706	33.609	32.793	33.794	32.615
Whiskey Creek							
J138WK	46.837	11.724	4.78	4.802	4.855	4.774	4.854
J407WK	36.527	15.816	6.263	6.262	6.264	6.263	6.237
J125WK	37.095	8.282	3.584	3.569	3.561	3.466	3.393
J196WK	42.694	16.555	5.382	5.364	5.366	5.377	5.366
J45WK	42.871	16.555	4.753	4.743	4.75	4.747	4.758
J241WK	110.215	45.965	1.352	1.348	1.335	1.352	1.331
2WK	169.124	54.433	5.573	5.546	5.488	5.416	5.249
J1734WK	190.809	55.651	4.391	4.388	4.312	4.307	4.175
J1481WK	216.418	60.479	4.497	4.487	4.421	4.429	4.297
J1160WK	223.863	62.917	5.253	5.244	5.166	5.166	4.984
J388WK	394.678	117.751	19.477	19.436	19.032	19.248	18.664
J145_1WK	465.798	146.124	11.657	11.642	11.558	11.609	11.499
J1549WK	567.415	187.845	18.313	18.201	18.006	18.242	17.832
J1095WK	588.553	192.106	18.602	18.503	18.314	18.544	18.143
J905WK	617.845	205.111	19.162	19	18.718	19.114	18.476
J495WK	628.124	209.272	19.462	17.581	17.613	18.45	16.588
J243WK	648.197	213.502	15.308	15.226	14.829	15.233	14.595
J225WK	650.162	213.962	15.314	15.181	14.835	15.237	14.602

BARRIE DRAINAGE MASTER PLAN
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LOVERS & HEWITTS STUDY AREA - 25mm STORM
WATERCOURSE PEAK FLOWS

Culvert Inlet Junction	Contributing Area (ha)	Contributing Impervious Area (ha)	Peak Flows (m^3/s)				
			No LIDs	Lot Level LIDs	Linear LIDs	Centralized LIDs	Combined LIDs
Hewitts Creek							
J1460.708HW	1632.81	186.978	0.44	0.431	0.334	0.396	0.282
J3445.696HW	1224.87	76.84	0.396	0.388	0.325	0.396	0.317
J347.1400HW	155.132	51.412	0.271	0.269	0.252	0.264	0.234
J892.8565HW	150.718	50.901	0.766	0.76	0.711	0.741	0.661
OF1HW	1741.75	219.23	0.514	0.503	0.395	0.468	0.341
Lovers Creek							
J1090LV	42.632	17.809	1.133	1.116	1.133	1.133	1.116
J1160.818LV	5886.53	1090.375	2.045	1.948	1.913	1.971	1.746
J1302.252LV	5772.342	1045.82	1.873	1.781	1.78	1.868	1.7
J1519LV	163.691	79.02	1.171	1.124	1.171	1.171	1.124
J1554.214LV	185.284	86.003	4.378	4.233	4.378	4.378	4.233
J1678LV	153.639	74.265	0.897	0.88	0.897	0.897	0.880
J1746.581LV	90.913	40.61	1.597	1.553	1.597	1.597	1.553
J2037LV	63.739	22.064	0.418	0.402	0.418	0.418	0.402
J2127.919LV	5714.441	1029.728	1.938	1.846	1.858	1.934	1.775
J271.5753LV	610.584	133.901	1.036	1.016	1.036	1.036	1.016
J2734.631LV	5679.664	1017.741	2.322	2.265	2.097	2.322	2.045
J2792LV	46.838	18.04	0.142	0.142	0.142	0.142	0.142
J4535.809LV	5060.574	793.097	1.23	1.185	1.198	1.23	1.153
J474.0832LV	210.166	102.614	1.901	1.871	1.91	1.899	1.874
J478LV	48.427	32.988	1.836	1.785	1.836	1.836	1.785
J539.9620LV	214.482	106.024	1.412	1.379	1.412	1.412	1.379
J545.2612LV	5905.799	1094.368	2.027	1.936	1.878	1.950	1.731
J6626.625LV	4328.984	632.484	0.901	0.887	0.901	0.901	0.887
J727.7307LV	253.936	53.454	0	0	0	0	0
J785.9333LV	211.586	103.99	1.439	1.403	1.439	1.439	1.403
J902LV	81.181	35.263	1.363	1.332	1.363	1.363	1.332
J939.5140LV	225.546	106.37	3.122	3.088	3.122	3.122	3.087
OF1LV	5913.22	1095.754	2.152	2.062	2.002	2.074	1.841
Royal Oak							
100118095	14.076	4.259	0.479	0.458	0.183	0.479	0.163
Gray Lane							
100120708	5.097	1.968	0.261	0.252	0.162	0.261	0.154
100110641	14.173	4.066	0.422	0.401	0.206	0.422	0.186
Bayshore							
OF1BY	35.499	13.088	0.23	0.203	0.104	0.230	0.081
100115964	14.511	6.627	0.019	0.019	0.008	0.019	0.007

BARRIE DRAINAGE MASTER PLAN
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LOVERS & HEWITTS STUDY AREA - 5 Year 6 HOUR SCS STORM (59.5 mm)
WATERCOURSE PEAK FLOWS

Culvert Inlet Junction	Contributing Area (ha)	Contributing Impervious Area (ha)	Peak Flows (m^3/s)				
			No LIDs	Lot Level LIDs	Linear LIDs	Centralized LIDs	Combined LIDs
Hewitts Creek							
J1460.708HW	1632.81	186.978	2.289	2.121	1.384	2.000	1.054
J3445.696HW	1224.87	76.84	1.080	1.080	1.080	1.079	1.079
J347.1400HW	155.132	51.412	1.157	1.103	0.759	1.076	0.527
J892.8565HW	150.718	50.901	1.232	1.177	0.967	1.150	0.883
OF1HW	1741.751	219.232	2.670	2.472	1.592	2.326	1.146
Lovers Creek							
J1090LV	42.632	17.809	3.014	3.052	3.085	3.029	3.044
J1160.818LV	5886.53	1090.375	6.597	6.364	6.295	6.523	5.932
J1302.252LV	5772.342	1045.82	6.252	6.044	5.989	6.244	5.753
J1519LV	163.691	79.02	2.596	2.533	2.587	2.587	2.532
J1554.214LV	185.284	86.003	10.703	10.426	10.704	10.703	10.426
J1678LV	153.639	74.265	4.288	4.173	4.247	4.266	4.133
J1746.581LV	90.913	40.61	2.996	2.921	2.996	2.996	2.921
J2037LV	63.739	22.064	0.600	0.578	0.600	0.600	0.578
J2127.919LV	5714.441	1029.728	6.258	6.049	5.994	6.250	5.759
J271.5753LV	610.584	133.901	3.543	3.471	3.540	3.542	3.468
J2734.631LV	5679.664	1017.741	6.290	6.076	6.021	6.281	5.785
J2792LV	46.838	18.04	0.185	0.185	0.185	0.185	0.185
J4535.809LV	5060.574	793.097	3.699	3.586	3.594	3.700	3.483
J474.0832LV	210.166	102.614	4.373	4.227	4.362	4.362	4.227
J478LV	48.427	32.988	7.105	7.290	6.977	7.382	7.176
J539.9620LV	214.482	106.024	3.579	3.518	3.577	3.579	3.516
J545.2612LV	5905.799	1094.368	6.621	6.415	6.353	6.569	6.050
J6626.625LV	4328.984	632.484	2.903	2.800	2.899	2.903	2.797
J727.7307LV	253.936	53.454	0.080	0.080	0.080	0.080	0.080
J785.9333LV	211.586	103.99	6.170	4.054	6.101	6.168	3.997
J902LV	81.181	35.263	2.326	2.258	2.325	2.325	2.257
J939.5140LV	225.546	106.37	4.310	4.247	4.311	4.311	4.247
OF1LV	5913.22	1095.754	6.763	6.557	6.495	6.711	6.191
Royal Oak							
100118095	14.076	4.259	0.888	0.864	0.704	0.888	0.681
Gray Lane							
100120708	5.097	1.968	0.459	0.448	0.437	0.459	0.427
100110641	14.173	4.066	0.813	0.785	0.585	0.813	0.557
Bayshore							
OF1BY	35.499	13.088	0.958	0.927	0.817	0.958	0.782
100115964	14.511	6.627	0.036	0.035	0.030	0.036	0.030

BARRIE DRAINAGE MASTER PLAN
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LOVERS & HEWITTS STUDY AREA - 100 Year 6 HOUR SCS STORM (106.5 mm)
WATERCOURSE PEAK FLOWS

Culvert Inlet Junction	Contributing Area (ha)	Contributing Impervious Area (ha)	Peak Flows (m^3/s)				
			No LIDs	Lot Level LIDs	Linear LIDs	Centralized LIDs	Combined LIDs
Hewitts Creek							
J1460.708HW	1632.81	186.978	12.595	12.357	11.533	12.087	10.439
J3445.696HW	1224.87	76.84	2.929	2.929	2.929	2.929	2.929
J347.1400HW	155.132	51.412	4.435	4.352	4.09	4.173	3.753
J892.8565HW	150.718	50.901	4.651	4.532	4.156	4.241	3.685
OF1HW	1741.751	219.232	13.384	13.134	12.321	12.854	11.168
Lovers Creek							
J1090LV	42.632	17.809	4.902	4.854	4.915	4.879	4.861
J1160.818LV	5886.53	1090.375	20.644	20.784	20.914	21.016	20.665
J1302.252LV	5772.342	1045.82	19.875	19.948	20.012	20.157	19.832
J1519LV	162.107	78.941	7.157	5.221	5.794	5.418	5.191
J1554.214LV	185.284	86.003	59.208	56.313	59.232	59.266	56.622
J1678LV	153.639	74.265	23.041	22.861	23.331	23.257	22.903
J1746.581LV	90.913	40.61	7.039	6.958	7.039	7.039	6.958
J2037LV	63.739	22.064	1.669	1.670	1.669	1.669	1.669
J2127.919LV	5714.441	1029.728	19.887	19.960	20.023	20.170	19.843
J271.5753LV	610.584	133.901	5.716	5.692	5.691	5.770	5.687
J2734.631LV	5679.664	1017.741	19.956	20.034	20.102	20.245	19.922
J2792LV	46.838	18.04	0.817	0.831	0.824	0.835	0.823
J4535.809LV	5060.574	793.097	17.116	17.093	17.113	17.123	17.11
J474.0832LV	210.166	102.614	9.138	8.679	8.874	8.875	8.676
J478LV	48.427	32.988	6.419	6.831	6.683	6.817	6.467
J539.9620LV	214.482	106.024	5.335	5.306	5.335	5.335	5.306
J545.2612LV	5905.799	1094.368	20.347	20.359	20.387	20.417	20.05
J6626.625LV	4328.984	632.484	9.411	9.377	9.411	9.411	9.377
J727.7307LV	253.936	53.454	2.053	2.053	2.053	2.053	2.053
J785.9333LV	211.586	103.99	36.011	36.776	36.072	36.046	36.779
J902LV	81.181	35.263	7.326	7.308	7.322	7.311	7.272
J939.5140LV	225.546	106.37	6.126	6.031	6.126	6.126	6.03
OF1LV	5913.22	1095.754	20.481	20.491	20.159	20.551	20.184
Royal Oak							
100118095	14.076	4.259	2.312	2.307	2.314	2.312	2.308
Gray Lane							
100120708	5.097	1.968	0.93	0.927	0.93	0.930	0.926
100110641	14.173	4.066	2.149	2.105	2.095	2.149	2.026
Bayshore							
OF1BY	35.499	13.088	3.098	3.093	3.075	3.099	3.068
100115964	14.511	6.627	1.375	1.340	1.121	1.375	1.086

BARRIE DRAINAGE MASTER PLAN
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NVCA STUDY AREA - 25mm STORM
WATERCOURSE PEAK FLOWS

Culvert Inlet Junction	Contributing Area (ha)	Contributing Impervious Area (ha)	Peak Flows (m^3/s)				
			No LIDs	Lot Level LIDs	Linear LIDs	Centralized LIDs	Combined LIDs
Bear Creek							
J1079_1BR	210.552	17.491	1.312	1.298	1.279	1.312	0.874
J1275BR	80.949	10.046	0.116	0.112	0.061	0.116	0.054
J1419BR	211.395	77.68	1.595	1.500	0.867	1.332	0.636
J169BR	52.207	9.356	0.026	0.024	0.006	0.026	0.004
J1736BR	184.212	69.258	1.364	1.273	0.690	1.028	0.414
J1849_1BR	92.381	20.619	0.347	0.338	0.244	0.347	0.225
J1942BR	51.562	1.292	0.228	0.225	0.027	0.228	0.024
J2161BR	139.649	49.112	0.180	0.175	0.180	0.18	0.175
J233BR	935.787	173.247	0.759	0.754	0.759	0.759	0.754
J235BR	145.632	64.547	0.464	0.458	0.411	0.444	0.37
J246BR	25.357	7.012	0.277	0.274	0.245	0.277	0.241
J2541BR	126.582	47.419	0.117	0.115	0.117	0.117	0.115
J259BR	820.428	152.696	0.070	0.067	0.064	0.07	0.063
J195_1BR	543.053	126.2	1.71	1.659	1.647	1.51	0.487
J313BR	244.995	19.75	1.239	1.217	1.180	1.239	0.738
J413BR	249.722	91.361	0.862	0.774	0.280	0.694	0.174
J944BR	215.77	33.198	0.078	0.074	0.031	0.078	0.031
OF4BR	938.271	173.283	0.549	0.545	0.549	0.549	0.545
Little Lake							
J330LT	119.198	58.639	0.858	0.830	0.730	0.856	0.693
OF1LT	178.5	85.454	2.223	2.121	1.463	2.219	1.345
Georgian Creek							
J227GR	138.873	59.491	0.902	0.851	0.572	0.856	0.523
OF2GR	147.504	60.426	0.903	0.853	0.572	0.861	0.525

BARRIE DRAINAGE MASTER PLAN
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NVCA STUDY AREA - 5 Year 6 HOUR SCS STORM (59.5 mm)
WATERCOURSE PEAK FLOWS

Culvert Inlet Junction	Contributing Area (ha)	Contributing Impervious Area (ha)	Peak Flows (m^3/s)				
			No LIDs	Lot Level LIDs	Linear LIDs	Centralized LIDs	Combined LIDs
Bear Creek							
J1079_1BR	210.552	17.491	2.104	2.081	2.052	2.104	1.648
J1275BR	80.949	10.046	0.262	0.248	0.162	0.262	0.158
J1419BR	211.395	77.68	4.594	4.452	3.481	4.359	2.848
J169BR	52.207	9.356	0.071	0.067	0.032	0.071	0.028
J1736BR	184.212	69.258	4.074	3.98	3.249	3.914	2.551
J1849_1BR	92.381	20.619	0.663	0.646	0.519	0.662	0.503
J1942BR	51.562	1.292	0.294	0.289	0.035	0.294	0.03
J2161BR	139.649	49.112	0.264	0.257	0.265	0.264	0.258
J233BR	935.787	173.247	2.592	2.574	2.592	2.592	2.574
J235BR	145.632	64.547	0.675	0.658	0.576	0.648	0.536
J246BR	25.357	7.012	0.329	0.325	0.292	0.329	0.287
J2541BR	126.582	47.419	0.343	0.339	0.343	0.343	0.339
J259BR	820.428	152.696	0.318	0.312	0.318	0.318	0.312
J195_1BR	543.053	126.2	4.712	4.532	3.643	4.789	2.96
J313BR	244.995	19.75	2.481	2.302	2.147	2.233	1.73
J413BR	249.722	91.361	3.957	3.815	2.869	3.749	2.4
J944BR	215.77	33.198	0.288	0.272	0.161	0.288	0.155
OF4BR	938.271	173.283	1.63	1.621	1.630	1.63	1.621
Little Lake							
J330LT	119.198	58.639	2.170	1.903	1.288	2.054	1.256
OF1LT	178.5	85.454	5.025	4.797	3.653	5.092	3.539
Georgian Creek							
J227GR	138.873	59.491	2.788	2.75	2.741	2.752	2.727
OF2GR	147.504	60.426	2.2	2.183	2.088	2.196	2.173

BARRIE DRAINAGE MASTER PLAN
LID APPLICATION COMPARISON
JANUARY, 2018

NVCA STUDY AREA - 100 Year 6 HOUR SCS STORM (106.5 mm)
WATERCOURSE PEAK FLOWS

Culvert Inlet Junction	Contributing Area (ha)	Contributing Impervious Area (ha)	Peak Flows (m^3/s)				
			No LIDs	Lot Level LIDs	Linear LIDs	Centralized LIDs	Combined LIDs
Bear Creek							
J1079_1BR	210.552	17.491	4.659	4.623	4.575	4.659	3.893
J1275BR	80.949	10.046	0.660	0.653	0.616	0.66	0.609
J1456BR	194.733	74.384	10.482	10.328	9.793	10.305	9.272
J169BR	52.207	9.356	0.536	0.518	0.376	0.535	0.357
J1786BR	182.294	68.535	9.497	9.243	8.604	9.172	7.815
J1849_1BR	92.381	20.619	1.226	1.221	1.182	1.226	1.177
J1942BR	51.562	1.292	0.966	0.959	0.516	0.966	0.508
J2161BR	139.649	49.112	0.927	0.916	0.924	0.926	0.913
J233BR	935.787	173.247	5.855	5.814	5.855	5.855	5.814
J235BR	145.632	64.547	1.314	1.272	1.102	1.245	1.024
J204BR	31.566	10.036	1.55	1.546	1.507	1.55	1.492
J2541BR	126.582	47.419	0.726	0.724	0.726	0.726	0.724
J259BR	820.428	152.696	3.290	3.255	3.29	3.291	3.255
J195_1BR	543.053	126.2	8.687	8.632	8.405	8.673	8.3
J417BR	214.258	18.711	4.649	4.609	4.531	4.649	3.988
J413BR	249.722	91.361	6.315	6.288	6.176	6.288	6.131
J944BR	215.77	33.198	2.767	2.691	2.153	2.771	2.073
OF4BR	938.271	173.283	2.243	2.239	2.243	2.243	2.239
Little Lake							
J330LT	119.198	58.639	10.143	9.806	8.418	9.978	8.062
OF1LT	178.5	85.454	17.754	17.35	15.684	17.597	15.249
Georgian Creek							
J227GR	138.873	59.491	5.080	4.82	4.303	4.8	3.992
OF2GR	147.504	60.426	4.489	4.364	3.987	4.469	4.282

Appendix R: Preliminary Preferred Alternative Solution Flow Summary

Barrie Drainage Master Plan
Hydrologic & Hydraulic Modeling Technical Memorandum
Preliminary Preferred Alternative Solution Peak Flow Summary
March 2019

Barrie Creeks Watershed

Project No.	Description	HEC RAS			VO5	Peak Flow (m^3/s)						
		River	River Reach	River Station	Hydrograph	1:2 Year	1:5 Year	1:10 Year	1:25 Year	1:50 Year	1:100 Year	Regional
Bunkers Creek (6 Hour SCS Type II Design Storm)												
-	Downstream of Boys St. (Reach Bu-12)	Bunkers	4	80	17922	1.97	3.16	4.04	5.46	6.50	7.63	10.24
41	Channel Improvement No. 8 (stabilize bank scour)	Bunkers	5	365	17917	5.39	8.86	11.60	15.68	19.32	21.36	22.97
41	Channel Improvement No. 8 (stabilize bank scour)	Bunkers	5	88	17918	6.64	10.49	13.66	18.43	22.43	25.33	24.71
-	Upstream of Milligan's Pond (Reach Bu-13)	Bunkers	3	13	17923	8.50	13.61	17.54	23.68	28.84	32.75	35.18
-	Downstream of Boys St. (Reach Bu-14)	Bunkers	2	173	17920	1.02	1.51	1.87	2.34	2.70	3.11	1.38
41	Channel Improvement No. 8 (stabilize bank scour)	Bunkers	1	814	17924	9.29	14.86	19.10	25.70	31.04	35.38	36.79
-	Upstream of Innisfil St. (Reach Bu-15)	Bunkers	1	612	17932	8.98	14.56	18.79	25.27	30.55	34.87	37.04
43	Culvert Improvement No. 22 (Innisfil St.)	Bunkers	1	579	17933	10.04	15.24	17.64	19.73	23.20	29.51	39.96
44	Culvert Improvement No. 23 (Commerical Plaza Entrance Road)	Bunkers	1	442	17934	10.16	15.41	17.96	20.06	23.36	29.70	40.26
45	Culvert Improvement No. 24 (Bradford St.)	Bunkers	1	321	17935	10.62	16.03	18.92	21.70	24.01	30.55	41.71
46	Channel Improvement No. 27 (regrade channel)	Bunkers	1	176	17936	10.21	15.77	18.61	21.20	23.81	29.95	41.77
-	Lakeshore Dr.	Bunkers	1	67	17937	10.44	16.13	19.09	21.92	24.26	30.44	42.63

Note: Regional Storm - Hurricane Hazel; Regional storm peak flows generated under AMC III soil conditions with SWMFs removed (uncontrolled Regional storm peak flow); peak flows are worst case (with or without spills).

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March 2019

Barrie Creeks Watershed

Project No.	Description	HEC RAS			VO5	Peak Flow (m^3/s)						
		River	River Reach	River Station	Hydrograph	1:2 Year	1:5 Year	1:10 Year	1:25 Year	1:50 Year	1:100 Year	Regional
Dyments Creek (6 Hour SCS Type II Design Storm)												
-	Upstream of Landfill Entrance (Reach Dy-1)	Dyments	1	5093	18909	2.15	2.69	3.01	3.48	4.49	5.63	16.02
-	Barrie Landfill Entrance Road	Dyments	1	4942	18910	2.42	3.19	3.72	4.38	5.36	6.72	18.53
-	U/S of Edgehill Dr. (Reach Dy-1)	Dyments	1	4589	18911	2.57	3.43	4.04	4.85	5.81	7.26	19.56
-	Edgehill Dr.	Dyments	1	4256	18912	2.59	3.50	4.15	5.00	5.96	7.45	19.98
-	Downstream of Edgehill Dr. (Reach Dy-1)	Dyments	1	4215	18913	2.78	3.86	4.67	5.74	6.76	8.40	21.69
-	Sproule Dr.	Dyments	1	3785	18914	2.69	3.82	4.60	5.68	6.84	8.44	21.83
183	Channel Improvement No. 9 (channel realignment)	Dyments	1	3146	18915	2.80	4.16	5.14	6.53	7.93	9.70	23.61
183	Channel Improvement No. 9 (channel realignment)	Dyments	1	3107	18916	2.69	3.22	3.53	4.01	4.42	4.90	23.85
50	Culvert Improvement No. 29 (Ferndale Dr.)	Dyments	1	2916	18918	3.66	5.41	6.85	8.96	10.62	12.30	30.46
51	Channel Improvement No. 10 (regrade channel)	Dyments	1	2875	18919	3.91	6.16	8.00	10.75	12.73	15.01	45.56
52	Culvert Improvement No. 30 (Sarjeant Dr.)	Dyments	1	2595	18921	4.31	7.25	9.54	12.79	15.30	17.96	45.13
-	Upstream of Dunlop St. On-Ramp (Reach Dy-2c)	Dyments	1	2380	18922	5.23	8.57	11.14	14.80	17.63	20.71	46.21
53	Culvert Improvement No. 31 (Dunlop St. On-Ramp)	Dyments	1	2251	18923	7.57	12.17	15.96	21.30	25.33	29.62	49.45
54	Culvert Improvement No. 33 (Highway 400)	Dyments	1	2085	18924	7.93	12.73	16.52	21.74	25.63	30.73	54.02
-	Upstream of Hart Dr. (Reach Dy-3)	Dyments	1	1945	18925	8.15	13.03	16.90	22.25	26.33	31.57	58.57
56	Channel Improvement No. 11 (daylight channel)	Dyments	1	1876	18926	8.15	13.07	16.96	22.33	26.39	31.58	58.64
57	Culvert Improvement No. 34 (George St.)	Dyments	1	1685	18927	8.18	13.09	17.08	22.54	26.74	32.15	59.48
170	SWMF Retrofit No. 79 (DY01)	Dyments	1	1637	18928	8.92	14.03	18.19	24.16	28.63	34.46	60.58
169	Culvert Improvement No. 35 (Victoria St.)	Dyments	1	1442	18001	3.83	7.84	11.96	17.68	22.58	27.53	60.58
170	SWMF Retrofit No. 79 (DY01)	Dyments	1	1389	18929	3.84	7.87	12.02	17.81	22.73	27.70	60.80
58	Culvert Improvement No. 36 (John St.)	Dyments	1	1124	18930	4.00	7.94	12.18	18.17	23.32	28.66	62.99
-	Downstream of John St. (Reach Dy-5)	Dyments	1	970	18931	4.02	7.96	12.22	18.24	23.41	28.75	63.24
60	Culvert Improvement No. 37 (Innisfil St.)	Dyments	1	718	18932	4.04	8.00	12.23	18.26	23.39	28.79	63.59
-	Downstream of Innisfil St. (Reach Dy-5)	Dyments	1	654	18933	4.06	8.03	12.28	18.35	23.50	28.92	63.78
61	Culvert Improvement No. 38 (Sanford St.)	Dyments	1	581	18934	17.16	15.92	15.56	18.41	23.57	29.00	64.00
62	Culvert Improvement No. 39 (Bradford St.)	Dyments	1	461	18935	4.12	8.14	12.46	18.68	23.96	29.50	64.82
63	Channel Improvement No. 28 (regrade channel)	Dyments	1	295	18937	4.20	8.27	12.70	19.09	24.41	30.24	65.89
-	Lakeshore Dr.	Dyments	1	168	18938	4.21	8.26	12.83	19.33	24.70	30.60	66.36

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Barrie Drainage Master Plan
Hydrologic & Hydraulic Modeling Technical Memorandum
Preliminary Preferred Alternative Solution Peak Flow Summary
March 2019

Barrie Creeks Watershed

Project No.	Description	HEC RAS			VO5	Peak Flow (m^3/s)						
		River	River Reach	River Station	Hydrograph	1:2 Year	1:5 Year	1:10 Year	1:25 Year	1:50 Year	1:100 Year	Regional
Hotchkiss Creek (6 Hour SCS Type II Design Storm)												
-	Downstream of Loggers Run (Reach Ho-1)	Hotchkiss	6	821	19901	0.42	0.58	0.72	0.95	1.10	1.28	0.72
12	Culvert Improvement No. 41 (Mayfair Dr.)	Hotchkiss	6	701	19902	0.49	0.67	0.85	1.13	1.33	1.55	0.88
-	Downstream of Mayfair Dr. (Reach Ho-1)	Hotchkiss	6	555	19903	0.24	0.32	0.38	0.77	1.12	1.55	1.13
13	Culvert Improvement No. 42 (Ardagh Rd.)	Hotchkiss	6	362	19904	0.56	0.88	1.10	1.44	1.87	2.52	1.92
-	Downstream of Ardagh Rd. (Reach Ho-2)	Hotchkiss	7	290	19906	0.40	0.64	0.80	1.04	1.22	1.39	0.84
-	Downstream of Essa Rd. (Reach Ho-5)	Hotchkiss	5	260	19121	0.46	0.65	0.80	1.01	1.20	1.37	0.57
-	Upstream of Essa Rd. (Reach Ho-4)	Hotchkiss	4	480	19914	2.52	3.65	4.55	5.82	6.89	7.96	7.03
16	Culvert Improvement No. 44 (Essa Rd.)	Hotchkiss	4	260	19913	2.50	3.65	4.57	5.83	6.92	8.03	8.28
-	Downstream of Essa Rd. (Reach Ho-4)	Hotchkiss	4	201	19928	2.57	3.73	4.68	5.96	7.08	8.21	8.34
-	Essa Rd. On-Ramp	Hotchkiss	4	67	19912	2.63	3.83	4.82	6.18	7.37	8.51	8.58
-	Start of Reach Ho-3	Hotchkiss	3	839	19905	1.20	1.90	2.44	3.19	3.77	4.51	3.48
-	Morrow Rd.	Hotchkiss	3	438	19907	2.53	4.16	5.42	7.18	8.63	10.12	7.67
-	Downstream of Morrow Rd. (Reach Ho-3)	Hotchkiss	3	415	19929	4.37	7.33	9.73	12.97	15.54	18.41	12.87
-	Upstream of Highway 400 (Reach Ho-3)	Hotchkiss	3	107	19909	4.63	7.68	10.07	13.45	16.14	19.10	13.73
-	Downstream of Essa Rd. On-Ramp (Reach Ho-6)	Hotchkiss	2	533	19911	3.25	4.86	6.18	7.96	9.44	10.92	8.98
-	Highway 400	Hotchkiss	1	1802	19910	6.34	11.70	15.49	21.05	25.40	29.87	24.54
19	SWMF Retrofit No. 81	Hotchkiss	1	1574	19917	9.14	16.25	21.28	28.56	34.72	40.63	31.13
21	Culvert Improvement No. 135 (Railway Crossing)	Hotchkiss	1	1236	19084	9.76	14.09	15.96	17.70	18.79	19.78	34.29
22	Culvert Improvement No. 48 (Tiffin St.)	Hotchkiss	1	1049	19919	10.66	13.73	15.16	16.21	16.99	17.96	35.95
23	Channel Improvement No. 6 (daylight channel)	Hotchkiss	1	969	19920	16.37	22.36	26.30	31.24	34.62	38.68	46.38
27	Culvert Improvement No. 50 (Innisfil St.)	Hotchkiss	1	623	19922	16.60	22.97	26.98	31.90	35.09	38.36	54.38
28	Channel Improvement No. 14 (stabilize bank erosion)	Hotchkiss	1	462	19923	16.68	23.18	27.22	32.21	35.57	38.88	54.90
-	Bradford St.	Hotchkiss	1	337	19924	14.95	23.18	27.22	32.27	35.63	38.98	55.17
-	Downstream of Bradford St. (Reach Ho-9)	Hotchkiss	1	182	19925	15.16	23.54	27.64	32.81	36.28	39.72	56.96
-	Lakeshore Dr.	Hotchkiss	1	129	19926	15.17	23.58	27.73	32.96	36.48	39.95	57.18
-	Downstream of Lakeshore Dr. (Reach Ho-9)	Hotchkiss	1	0	19927	15.18	23.71	27.78	33.00	36.59	40.01	57.14

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Preliminary Preferred Alternative Solution Peak Flow Summary
March 2019

Barrie Creeks Watershed

Project No.	Description	HEC RAS			VO5	Peak Flow (m^3/s)						
		River	River Reach	River Station	Hydrograph	1:2 Year	1:5 Year	1:10 Year	1:25 Year	1:50 Year	1:100 Year	Regional
Kidds Creek (6 Hour SCS Type II Design Storm)												
4	Chanel Improvement No. 1 (stabilize bank erosion)	Kidds	5	1514	16924	3.58	5.78	7.69	10.34	14.28	18.06	24.81
4	Chanel Improvement No. 1 (stabilize bank erosion)	Kidds	5	1259	16905	3.61	5.90	7.94	10.78	14.66	18.38	25.66
4	Chanel Improvement No. 1 (stabilize bank erosion)	Kidds	5	1115	16906	3.92	6.48	8.68	11.77	15.67	19.69	27.01
5	Culvert Improvement No. 13 (Cundles Rd.)	Kidds	5	906	16907	5.06	7.43	10.33	14.45	18.60	23.18	31.09
-	Downstream of Cundles Rd. (Reach Ki-3)	Kidds	5	818	16908	6.04	8.92	11.72	16.45	20.72	25.74	34.14
-	D/S of Cundles Rd. and Highway 400 (Reach Ki-4)	Kidds	5	341	16909	6.58	9.80	12.85	17.89	22.49	27.52	36.80
-	Start of Reach Ki-5	Kidds	4	297	16139	1.79	2.76	3.41	4.28	5.02	5.71	2.23
-	Downstream of Coulter Rd. (Reach Ki-5)	Kidds	4	223	16925	4.02	6.19	7.72	9.70	11.20	12.76	4.94
-	Start of Reach Ki-6	Kidds	3	1152	16910	9.01	14.33	18.31	24.25	29.57	35.20	43.62
-	Upstream of Highway 400 (Reach Ki-6)	Kidds	3	981	16911	9.49	15.13	19.45	25.88	31.73	37.80	46.69
-	Highway 400	Kidds	3	839	16912	2.35	2.66	2.82	3.10	4.25	7.02	47.50
-	Wellington St. / Ross St.	Kidds	3	472	16913	2.65	3.56	4.15	4.94	5.64	7.18	49.34
8	Culvert Improvement No. 16 (Thomson St.)	Kidds	3	319	16914	2.10	2.49	2.71	2.97	3.23	3.91	49.42
163	Channel Improvement No. 2 (stabilize bank erosion)	Kidds	3	112	16915	2.18	2.65	2.98	3.37	3.71	3.95	49.73
-	Downstream of Highway 400 (Reach Ki-9)	Kidds	2	389	16927	0.64	0.86	1.03	1.33	1.55	1.86	2.54
-	Downstream of Wellington St. (Reach Ki-9)	Kidds	2	120	16917	0.71	0.95	1.15	1.49	1.74	2.09	2.69
10	Channel Improvement No. 3 (stabilize bank erosion)	Kidds	1	1489	16916	2.51	3.53	4.15	4.93	5.56	5.92	44.97
-	Donald St.	Kidds	1	1406	16926	2.76	4.01	4.82	5.88	6.68	7.22	45.64
-	Eccles St.	Kidds	1	1230	16918	2.91	4.34	5.25	6.48	7.45	8.11	46.12
165	Channel Improvement No. 25 (daylight channel)	Kidds	1	1073	16919	3.49	5.50	6.82	8.63	10.13	11.60	52.16
165	Channel Improvement No. 25 (daylight channel)	Kidds	1	1051	16920	3.95	6.44	8.08	10.21	11.95	13.74	53.11
166	Culvert Improvement No. 145 (Dunlop St.)	Kidds	1	1000	16921	4.22	6.86	8.62	10.93	12.79	14.71	53.47
-	Overland flow at Bradford St.	Kidds	1	814	16921	0.01	0.01	0.01	0.01	0.01	0.01	31.47
-	Overland flow at Toronto St.	Kidds	1	518	16921	0.01	0.01	0.01	0.01	0.01	0.01	31.47
-	Downstream of Toronto St.	Kidds	1	495	16922	4.56	7.40	9.30	11.84	13.84	15.91	53.93
-	Upstream of Marina Access Road	Kidds	1	411	16923	4.49	7.31	9.18	11.80	13.82	15.94	53.99

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Project No.	Description	HEC RAS			VO5	Peak Flow (m^3/s)						
		River	River Reach	River Station	Hydrograph	1:2 Year	1:5 Year	1:10 Year	1:25 Year	1:50 Year	1:100 Year	Regional
Sophia Creek (6 Hour SCS Type II Design Storm)												
-	Start of Owen Street Flow Diversion (Wellington St.)	Owen Street	1	504.1	N/A	0.00	0.00	0.00	0.00	0.00	0.00	0.00
-	McDonald St.	Owen Street	1	406.5	15150	0.32	0.44	0.53	0.65	0.76	0.86	0.42
-	Worsley St.	Owen Street	1	275.4	15936	0.70	0.96	1.14	1.39	1.62	1.85	0.82
-	Collier St.	Owen Street	1	159.8	15937	0.92	1.27	1.50	1.85	2.16	2.46	1.03
-	Dunlop St.	Owen Street	1	26.8	15938	1.09	1.50	1.78	2.20	2.56	2.90	1.18
-	Outlet to Kempenfelt Bay	Owen Street	1	-240	15940	1.45	2.02	2.41	3.02	3.52	4.02	1.61
-	Downstream of Duckworth St.	Sophia	6	1124	15121	3.64	6.08	8.04	10.87	12.76	14.81	7.95
-	Howard Cres.	Sophia	6	1017	15908	3.73	6.23	8.24	11.15	13.09	15.20	8.14
-	Lay St.	Sophia	6	920	15909	3.79	6.36	8.38	11.38	13.43	15.60	8.35
-	Downstream of Lay St.	Sophia	6	822	15910	4.55	7.64	10.12	13.68	16.27	18.91	9.89
-	Upstream of Grove St.	Sophia	6	698	15911	5.12	8.70	11.48	15.48	18.43	21.44	11.09
-	Flow exceeding Grove St. culvert capacity	Sophia	5	253	N/A	0.00	0.00	0.00	0.00	0.00	0.00	0.00
-	Grove St. (South of H.G. Robinson Park)	Sophia	4	645	15912	5.10	8.68	11.48	15.44	18.41	21.42	11.12
-	Downstream of Grove St.	Sophia	4	550	15913	5.94	10.16	13.38	17.95	21.40	24.80	13.02
-	Upstream of St. Vincent St.	Sophia	3	389	15913	5.94	10.16	13.38	17.95	21.40	24.80	13.02
-	St. Vincent St.	Sophia	3	355	15914	5.81	9.96	13.16	17.69	21.08	24.36	13.64
-	Downstream of St. Vincent St.	Sophia	3	321	15915	8.92	15.01	19.63	26.09	30.89	35.70	18.71
-	Upstream of SWMF SP01	Sophia	3	79	15916	8.42	14.36	18.52	25.62	30.43	35.14	18.97
-	SWMF SP03	Sophia	2	389	15905	2.34	4.79	8.00	12.78	15.97	19.14	12.26
-	Downstream of Rose St.	Sophia	2	222	15906	2.68	5.52	9.10	14.51	18.16	21.79	13.95
-	Upstream of Laurie Cres.	Sophia	2	203	15907	2.71	5.60	9.22	14.60	18.43	21.96	14.08
-	Upstream of Bothwell Cres.	Sophia	1	1640	15917	10.80	19.03	26.46	38.36	47.94	56.58	33.15
-	Bothwell Cres.	Sophia	1	1597	15918	10.99	19.32	26.75	38.56	48.43	56.94	33.66
-	Grove St. (West of Bothwell Cres.)	Sophia	1	1496	15919	12.01	20.89	28.55	41.05	51.40	60.40	35.97
-	Parkdale Cres.	Sophia	1	1239	15920	12.06	20.89	28.56	40.87	51.23	60.41	36.51
-	Davidson St. / Gunn St.	Sophia	1	1186	15921	12.64	21.77	29.60	42.36	53.09	62.54	38.24
-	Downstream of Gunn St.	Sophia	1	1105	15922	13.02	22.38	30.29	43.36	54.24	63.88	39.29
-	Berczy St.	Sophia	1	1062	15923	13.92	23.75	31.91	45.56	56.84	66.94	41.79
-	Downstream of Berczy St.	Sophia	1	920	15924	14.82	25.03	33.44	47.75	59.48	70.08	45.15
-	Upstream of Peel St.	Sophia	1	680	15957	14.92	25.21	33.66	47.86	59.48	70.18	45.65
-	Peel St.	Sophia	1	671.2	15925	15.42	25.96	34.50	49.07	60.88	71.82	47.26
-	Overland flow at Sophia St. (West of Peel St.)	Sophia	1	644.1	N/A	2.06	12.60	21.14	35.71	47.52	58.46	36.13
-	Overland flow at Sophia St. / Owen St.	Sophia	1	559.7	15926	4.33	14.90	23.44	38.05	49.89	60.87	36.33
-	Overland flow at Sophia St. / Mcdonald St.	Sophia	1	464.6	15927	4.85	15.71	24.39	39.37	51.50	63.01	38.60
-	Overland flow at Sophia St. / Bayfield St.	Sophia	1	403.8	15928	5.07	16.09	24.81	39.93	52.17	63.83	39.57
-	Overland flow at Sophia St. / Ross St.	Sophia	1	229	15929	5.19	16.22	24.95	40.10	52.36	64.09	39.88
-	Overland flow at Sophia St. / Collier St.	Sophia	1	109.4	15930	5.26	16.31	25.06	40.24	52.52	64.27	40.15
-	Overland flow at Sophia St. / Dunlop St.	Sophia	1	-21	15934	6.20	17.62	26.38	41.79	54.40	66.61	42.86

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Project No.	Description	HEC RAS			VO5	Peak Flow (m^3/s)						
		River	River Reach	River Station	Hydrograph	1:2 Year	1:5 Year	1:10 Year	1:25 Year	1:50 Year	1:100 Year	Regional
Sophia Creek (6 Hour SCS Type II Design Storm)												
-	Overland flow at Sophia St. / Simcoe St.	Sophia	1	-237	15935	6.29	17.83	26.50	41.92	54.57	66.79	43.11
-	Overland flow at Berczy St.	Sophia 2	Berczy Overland	125	N/A	4.80	13.56	21.11	34.01	44.76	54.50	32.02

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Project No.	Description	HEC RAS			VO5	Peak Flow (m^3/s)						
		River	River Reach	River Station	Hydrograph	1:2 Year	1:5 Year	1:10 Year	1:25 Year	1:50 Year	1:100 Year	Regional
Whiskey Creek (24 Hour SCS Type II Design Storm)												
-	Upstream of Highway 4000 (Reach Wh-5)	Whiskey	5	640	23943	0.11	0.22	0.31	0.43	0.54	0.65	1.41
-	Fairview Rd.	Whiskey	5	280	23941	0.68	1.10	1.58	2.12	2.48	2.89	2.45
-	D/S of Fairview Rd. and U/S of Bayview Dr. (Reach Wh-5)	Whiskey	5	-1	23913	1.12	1.85	2.54	3.43	4.06	4.80	4.54
-	Bayview Dr.	Whiskey	5	-289	23914	1.73	2.89	3.84	5.39	6.37	7.49	5.52
67	SWMF Retrofit No. 42	Whiskey	7	494	23111	0.83	1.42	1.86	2.50	3.04	3.55	2.41
68	Culvert Improvement No. 53 (Harvie Rd.)	Whiskey	7	125	23906	0.24	0.54	1.28	2.26	3.06	3.91	4.16
-	Downstream of SWMF WK05 (Reach Wh-1)	Whiskey	6	432	23902	3.74	6.59	8.80	11.86	14.57	17.00	11.43
-	Upstream of Harvie Rd. (Reach Wh-3)	Whiskey	4	2254	23905	1.58	2.10	3.11	4.37	5.36	6.42	18.46
171	Channel Improvement No. 15 (channel realignment)	Whiskey	4	2142	23907	1.67	2.21	3.30	4.67	5.76	6.90	19.19
172	Culvert Improvement No. 55 (Highway 400)	Whiskey	4	2010	23908	1.84	2.57	3.73	5.38	6.67	8.03	21.23
71	Culvert Improvement No. 56 (Fairview Rd.)	Whiskey	4	1709	23909	1.91	2.74	3.95	5.66	7.03	8.44	22.00
-	Railway Crossing	Whiskey	4	1481	23910	2.08	3.08	4.36	6.36	7.91	9.54	23.68
72	Culvert Improvement No. 57 (Bayview Dr.)	Whiskey	4	1160	23911	2.14	3.19	4.44	6.50	8.15	9.76	24.39
73	Channel Improvement No. 16 (regrade channel)	Whiskey	4	1100	23912	2.18	3.29	4.54	6.65	8.34	10.01	24.75
-	Start of Reach Wh-6	Whiskey	3	1697	23915	6.01	10.04	13.07	17.58	21.34	24.89	38.16
-	South of Tamarack Rd. (Reach Wh-6)	Whiskey	3	1351	23916	5.96	9.94	12.72	16.97	20.51	23.93	39.65
77	Channel Improvement No. 18 (stabilize bank erosion)	Whiskey	3	953	23917	5.93	9.92	12.71	16.91	20.41	23.84	40.78
-	Upstream of McConkey Pl. (Reach Wh-6)	Whiskey	3	512	23918	5.48	9.43	12.37	16.72	19.98	23.36	41.81
-	McConkey Pl.	Whiskey	3	352	23919	5.54	9.53	12.50	16.91	20.20	23.64	42.34
-	Upstream of Railway Crossing (Reach Wh-7a)	Whiskey	3	222	23940	7.49	12.91	16.98	23.10	27.42	31.94	49.53
78	Culvert Improvement No. 147 (Railway Crossing)	Whiskey	3	169	23002	7.44	12.73	16.51	22.02	25.74	29.16	49.53
80	Culvert Improvement No. 60 (Huronia Rd.)	Whiskey	3	108	23920	7.54	12.90	16.73	22.31	26.06	29.50	50.00
-	Start of Reach Wh-8	Whiskey	2	1332	23922	2.32	3.76	4.84	6.37	7.54	8.96	2.92
-	Huronia North Park (Reach Wh-8)	Whiskey	2	1059	23923	0.90	2.44	3.91	5.50	6.53	7.93	4.82
-	Upstream of Herrell Ave. (Reach Wh-8)	Whiskey	2	864	23924	1.04	2.64	3.96	5.66	6.80	8.15	5.56
-	Herrell Ave.	Whiskey	2	683	23925	1.75	4.01	5.93	8.56	10.51	12.48	9.22
-	Downstream of Herrell Ave. (Reach Wh-8)	Whiskey	2	601	23926	2.51	4.90	7.20	10.43	12.97	15.19	11.35
-	Upstream of SWMF WK01 (Reach Wh-8)	Whiskey	2	383	23927	2.47	4.93	7.27	10.52	13.13	15.40	11.53
83	SWMF Retrofit No. 25 (WK01)	Whiskey	2	110	23921	9.86	18.76	24.77	33.42	39.37	44.80	63.01
84	Culvert Improvement No. 62 (Little Ave.)	Whiskey	1	1549	23928	7.57	12.56	18.46	26.80	33.68	39.49	63.39
81	Channel Improvement No. 31 (channel realignment)	Whiskey	1	1515	23929	7.57	12.58	18.40	26.74	33.24	39.44	63.31
85	Culvert Improvement No. 63 (Yonge St.)	Whiskey	1	974	23930	7.74	12.72	17.99	26.12	32.46	38.88	66.08
-	Downstream of Yonge St. (Reach Wh-9)	Whiskey	1	929	23931	7.74	12.72	17.95	26.03	32.05	36.67	66.18
86	Culvert Improvement No. 138 (Railway Crossing)	Whiskey	1	663	23932	7.91	13.03	18.40	26.66	32.88	37.62	67.72
-	D/S of Railway Crossing and U/S of Hurst Dr. (Reach Wh-9)	Whiskey	1	562	23933	8.08	13.28	18.73	27.18	33.44	38.26	68.99
88	Culvert Improvement No. 64 (Hurst Dr.)	Whiskey	1	495	23935	8.10	13.33	18.79	27.26	33.53	38.34	69.27
89	Channel Improvement No. 19 (stabilize bank erosion)	Whiskey	1	451	23934	8.10	13.33	18.70	26.95	32.88	37.33	69.56
174	Culvert Improvement No. 65 (The Boulevard)	Whiskey	1	243	23936	8.11	13.33	18.71	26.90	32.83	37.33	69.62

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Barrie Creeks Watershed

Project No.	Description	HEC RAS			VO5	Peak Flow (m^3/s)						
		River	River Reach	River Station	Hydrograph	1:2 Year	1:5 Year	1:10 Year	1:25 Year	1:50 Year	1:100 Year	Regional
Whiskey Creek (24 Hour SCS Type II Design Storm)												
175	Channel Improvement No. 20 (regrade channel)	Whiskey	1	225	23937	8.14	13.38	18.77	26.98	32.98	37.43	69.96
176	Culvert Improvement No. 66 (Brennan Ave.)	Whiskey	1	180	23938	8.14	13.36	18.78	26.98	32.93	37.39	70.07
-	Downstream of Brennan Ave. (Reach Wh-10)	Whiskey	1	30	23939	8.11	13.31	18.61	26.69	32.77	37.31	70.04

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Project No.	Description	HEC RAS			VO5	Peak Flow (m^3/s)						
		River	River Reach	River Station	Hydrograph	1:2 Year	1:5 Year	1:10 Year	1:25 Year	1:50 Year	1:100 Year	Regional
Georgian Creek (24 Hour SCS Type II Design Storm)												
-	Start of Reach Ge-2	Georgian	1	690	30902	1.84	3.49	5.12	7.60	9.49	11.38	3.69
-	Approx. 70 m D/S from Start of Reach Ge-2	Georgian	1	618	30905	1.99	3.72	5.44	8.02	10.02	11.98	3.91
-	Approx. 260 m D/S from Start of Reach Ge-2	Georgian	1	422	30907	2.53	4.64	6.65	9.67	11.95	13.94	4.89
134	SWMF Retrofit No. 76 (GR04)	Georgian	1	189	30908	2.50	4.48	6.50	9.36	11.76	13.76	5.13
134	SWMF Retrofit No. 76 (GR04)	Georgian	1	177	30909	2.84	5.11	7.38	10.54	13.21	15.47	5.88
134	SWMF Retrofit No. 76 (GR04)	Georgian	1	159	30911	2.84	5.11	7.38	10.54	13.21	15.47	5.88
135	Trunk Storm Sewer No. 3	Georgian	1	0	30913	1.52	1.80	1.95	2.14	2.26	2.58	5.88
138	SWMF Retrofit No. 75 (GR01)	Georgian	2	477	30920	3.53	5.18	6.46	8.02	9.41	10.74	11.56
139	Culvert Improvement No. 82 (Penetanguishene Rd.)	Georgian	2	227	30922	1.93	2.92	3.50	4.12	4.60	5.10	11.91
-	Downstream of Penetanguishene Rd. (Reach Ge-1)	Georgian	2	0	30923	1.97	2.99	3.60	4.32	4.94	5.63	12.54

Note: Regional Storm - Timmins Storm; Regional storm peak flows generated under AMC II soil conditions with SWMFs removed (uncontrolled Regional storm peak flow).

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Project No.	Description	HEC RAS			VO5	Peak Flow (m^3/s)						
		River	River Reach	River Station	Hydrograph	1:2 Year	1:5 Year	1:10 Year	1:25 Year	1:50 Year	1:100 Year	Regional
Little Lake (24 Hour SCS Type II Design Storm)												
-	Start of Reach Li-1	Little Lake	1	776	31919	0.90	1.24	2.20	4.24	6.23	8.50	9.12
-	Livingstone St.	Little Lake	1	330	31920	0.90	1.26	2.27	4.45	6.50	8.86	9.40
143	Channel Improvement No. 24 (stabilize bank erosion)	Little Lake	1	263	31924	0.91	1.26	2.28	4.46	6.53	8.88	9.44
-	Reach Li-1 near SWMF LT05	Little Lake	1	22	31927	2.94	5.96	8.17	11.02	13.39	15.11	14.39
-	Reach Li-1 D/S of SWMF LT05	Little Lake	1	0	31928	2.95	5.98	8.16	10.99	13.38	15.06	14.39

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		River	River Reach	River Station	Hydrograph	1:2 Year	1:5 Year	1:10 Year	1:25 Year	1:50 Year	1:100 Year	Regional
Bear Creek (24 Hour SCS Type II Design Storm)												
-	Downstream of Essa Rd. (Reach Be-1)	Bear Creek	13	1045	32904	0.88	1.70	2.50	3.53	4.45	5.56	7.81
-	Lougheed Rd.	Bear Creek	13	327	32905	1.55	2.68	3.60	4.92	5.93	7.03	10.05
-	Start of Reach Be-2	Bear Creek	14	2730	32918	0.43	0.73	1.09	1.76	2.45	3.25	5.38
-	Mapleview Community Church Entrance Road	Bear Creek	14	2552	32916	0.71	1.25	1.66	2.17	2.68	3.54	5.70
-	Driveway for 320 Mapleview Dr. (Reach Be-2)	Bear Creek	14	2513	32915	0.77	1.30	1.64	2.32	2.80	3.55	5.73
-	Private crossing at 364 Mapleview Dr. (Reach Be-3)	Bear Creek	14	2333	32914	0.72	1.26	1.68	2.27	2.86	3.76	5.86
-	Essa Rd.	Bear Creek	14	2167	32913	0.83	1.39	1.98	2.70	3.47	4.50	6.28
-	D/S of Essa Rd. and U/S of Mapleview Dr. (Reach Be-3)	Bear Creek	14	1896	32912	2.65	4.63	6.18	8.63	10.36	11.92	8.38
-	Mapleview Dr.	Bear Creek	14	1744	32911	3.19	5.56	7.42	10.21	12.22	14.30	9.00
-	Redfern Ave.	Bear Creek	14	1430	32910	3.55	6.25	8.54	11.82	14.16	16.63	9.77
-	Approx. 190 m D/S of Redfern Ave. (Reach Be-4)	Bear Creek	14	1199	32909	3.70	6.53	9.00	12.44	14.88	17.58	10.05
-	Lougheed Rd.	Bear Creek	14	421	32908	4.57	8.00	11.00	15.17	18.25	21.65	11.85
-	Start of Reach Be-5	Bear Creek	12	431	32906	4.34	6.91	8.63	13.25	17.10	20.34	21.64
-	County Rd. 27	Bear Creek	12	277	32920	4.58	7.43	9.46	13.81	17.84	21.23	22.38
-	Immediately D/S of County Rd. 27 (Reach Be-5)	Bear Creek	12	195	32001	4.58	7.42	9.41	13.69	17.14	20.03	21.42
-	Approx. 210 m D/S of County Rd. 27 (Reach Be-5)	Bear Creek	12	19	32921	4.63	7.56	9.66	13.84	17.32	20.21	21.59
-	Start of Reach Be-17	Bear Creek	6	290	32148	0.06	0.14	0.20	0.29	0.37	0.45	0.30
-	Start of Reach Be-6	Bear Creek	5	135	32147	0.02	0.04	0.06	0.09	0.11	0.13	0.06
-	Start of Reach Be-7	Bear Creek	4	327	32926	0.08	0.17	0.24	0.35	0.44	0.55	0.36
-	Start of Reach Be-8	Bear Creek	3	716	32149	0.02	0.05	0.06	0.09	0.12	0.14	0.06
-	Start of Reach Be-9	Bear Creek	2	2458	32927	0.36	0.76	1.08	1.57	1.98	2.44	2.15
-	Start of Reach Be-10	Bear Creek	2	1250	32928	0.52	1.06	1.50	2.21	2.80	3.48	3.47
-	Ardagh Rd.	Bear Creek	2	953	32930	1.38	2.86	3.88	5.39	6.88	8.63	7.44
-	Start of Reach Be-11	Bear Creek	8	2948	32936	0.26	0.48	0.65	0.83	0.97	1.09	1.01
-	Ardagh Rd.	Bear Creek	8	1315	32935	0.47	0.92	1.26	1.72	2.08	2.45	2.37
-	Start of Reach Be-13	Bear Creek	11	1163	32941	0.13	0.29	0.41	0.58	0.73	0.89	0.51
-	Approx. 220 m D/S from Start of Reach Be-13	Bear Creek	11	949	32942	0.23	0.42	0.67	1.01	1.27	1.78	1.69
-	Ardagh Rd.	Bear Creek	11	183	32943	0.28	0.54	0.84	1.24	1.56	2.20	2.07
-	Downstream of Ardagh Rd. (Reach Be-13)	Bear Creek	11	126	32944	0.28	0.54	0.84	1.24	1.56	2.20	2.07
-	Start of Reach Be-14	Bear Creek	10	969	32184	0.02	0.05	0.06	0.09	0.11	0.13	0.07
-	Approx. 400 m D/S from Start of Reach Be-14	Bear Creek	10	574	32945	0.83	1.31	1.69	2.26	2.66	3.08	1.24
-	Approx. 420 m D/S from Start of Reach Be-14	Bear Creek	10	555	32007	0.32	0.44	0.50	0.56	0.60	0.64	0.73
-	Approx. 60 m U/S of Ardagh Rd. (Reach Be-14)	Bear Creek	10	285	32947	0.37	0.54	0.64	0.74	0.83	0.92	0.89
154	Culvert Improvement No. 78 (Ardagh Rd.)	Bear Creek	10	254	32946	0.82	1.14	1.38	1.75	2.00	2.27	1.18
155	Channel Improvement No. 33 (stabilize bed erosion)	Bear Creek	9	2171	32948	0.84	1.38	1.84	2.50	3.00	3.72	3.34

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		River	River Reach	River Station	Hydrograph	1:2 Year	1:5 Year	1:10 Year	1:25 Year	1:50 Year	1:100 Year	Regional
Bear Creek (24 Hour SCS Type II Design Storm)												
-	Summerset Dr.	Bear Creek	9	1864	32949	0.83	1.40	1.90	2.57	3.12	3.89	3.46
-	Approx. 180 m D/S of Summerset Dr. (Reach Be-15)	Bear Creek	9	1642	32953	1.09	1.74	2.26	3.00	3.65	4.91	4.39
-	Approx. 370 m D/S of Summerset Dr. (Reach Be-15)	Bear Creek	9	1456	32954	1.31	2.62	3.55	5.10	6.40	8.34	7.63
-	Approx. 590 m D/S of Summerset Dr. (Reach Be-15)	Bear Creek	9	1233	32340	1.34	3.31	4.63	6.65	8.30	10.57	14.29
-	Start of Reach Be-16	Bear Creek	7	187	32932	1.99	4.20	5.74	8.52	10.39	12.48	18.48
156	Culvert Improvement No. 134 (Railway Crossing)	Bear Creek	1	270	32931	2.76	6.06	8.52	12.74	15.60	18.74	26.50
157	Culvert Improvement No. 80 (County Rd. 27)	Bear Creek	1	233	32933	3.28	6.97	9.76	14.44	17.65	21.18	30.22
-	Approx. 200 m D/S of County Rd. 27 (Reach Be-16)	Bear Creek	1	20	32955	3.25	6.92	9.74	14.39	17.63	21.14	30.25
-	County Rd. 27 (Unevaluated Reach)	Bear Creek	15	1290.42	32956	0.49	0.95	1.31	1.85	2.29	2.77	2.26

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Lovers Creek, Hewitts Creek and Sandy Cove Drainage Study Area

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		River	River Reach	River Station	Hydrograph	1:2 Year	1:5 Year	1:10 Year	1:25 Year	1:50 Year	1:100 Year	Regional
Hewitts Creek (24 Hour SCS Type II Design Storm)												
-	Unevaluated Reach	Hewitts	Main02	3593.722	29906	7.95	15.64	21.57	28.92	34.36	40.09	94.48
125	Culvert Improvement No. 83 (Mapleview Dr.)	Hewitts	Main02	3445.696	291000	7.94	15.62	21.45	28.54	34.19	39.94	94.48
-	Downstream of Mapleview Dr. (Reach He-1)	Hewitts	Main02	3408.654	29907	8.02	15.72	21.57	28.68	34.38	40.17	95.37
-	Reach He-1 near Coronation Pkwy.	Hewitts	Main02	3129.259	29908	8.12	15.91	21.78	28.97	34.76	40.61	96.79
-	Start of Reach He-2	Hewitts	Trib. 1	1258.764	29144	0.12	0.22	0.31	0.43	0.52	0.62	2.15
-	Upstream of Prince William Way (Reach He-2)	Hewitts	Trib. 1	1051.061	29909	4.82	8.63	12.20	17.74	22.16	26.72	17.39
-	Prince William Way	Hewitts	Trib. 1	892.8565	29008	1.29	2.34	3.46	5.20	6.84	8.73	17.39
-	Consort Dr.	Hewitts	Trib. 1	347.14	29910	1.31	2.37	3.46	5.07	6.46	8.14	17.28
-	Start of Reach He-3	Hewitts	Main01	2743.481	29912	9.24	17.61	23.85	31.59	38.10	44.72	106.63
-	Reach He-3 near SWMF HW05	Hewitts	Main01	2396.606	29913	9.72	18.35	24.75	32.74	39.60	46.56	114.18
-	Reach He-3 D/S of SWMF HW05	Hewitts	Main01	2291.371	29914	10.00	18.88	25.43	33.72	40.85	48.18	120.99
-	Approx. 290 m U/S of Big Bay Point Rd. (Reach He-3)	Hewitts	Main01	1719.604	29915	10.01	18.88	25.41	33.77	40.77	48.18	121.66
-	Big Bay Point Rd.	Hewitts	Main01	1460.708	29916	10.08	18.98	25.54	33.95	40.97	48.45	123.11
-	Approx. 200 m U/S of Kempenfelt Bay Outlet (Reach He-4)	Hewitts	Main01	203.2475	29917	10.25	19.39	26.02	34.62	41.62	49.24	127.56
-	Approx. 110 m U/S of Kempenfelt Bay Outlet (Reach He-4)	Hewitts	Main01	106.3736	29918	10.28	19.44	26.09	34.72	41.80	49.50	129.02
-	Outlet to Kempenfelt Bay (Reach He-4)	Hewitts	Main01	46.29602	29919	10.31	19.50	26.16	34.83	41.94	49.69	130.12

Note: Regional Storm - Hurricane Hazel; Regional storm peak flows generated under AMC III soil conditions with SWMFs removed (uncontrolled Regional storm peak flow).

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Lovers Creek, Hewitts Creek and Sandy Cove Drainage Study Area

Project No.	Description	HEC RAS			VO5	Peak Flow (m^3/s)						
		River	River Reach	River Station	Hydrograph	1:2 Year	1:5 Year	1:10 Year	1:25 Year	1:50 Year	1:100 Year	Regional
Lovers Creek (24 Hour SCS Type II Design Storm)												
	Start of Reach Lo-6	LoversTrib4.1	Trib. 4.1.1	1904.3	26926	1.53	2.19	2.70	3.45	4.00	4.57	9.78
	Saunders Rd.	LoversTrib4.1	Trib. 4.1.1	1746.581	26991	2.26	3.41	4.22	5.39	6.34	7.26	11.02
	Downstream of Saunders Rd. (Reach Lo-6)	LoversTrib4.1	Trib. 4.1.1	1704.249	26919	6.54	10.02	12.44	15.81	18.47	21.16	20.61
	Bayview Dr.	LoversTrib4.1	Trib. 4.1.1	1479.158	26920	1.41	3.68	5.40	7.57	9.88	12.54	21.25
	Downstream of Saunders Rd. (Reach Lo-6)	LoversTrib4.1	Trib. 4.1.1	1287.58	26006	1.67	3.33	5.12	7.22	9.44	11.95	15.32
98	Culvert Improvement No. 126 (Railway Crossing)	LoversTrib4.1	Trib. 4.1.1	785.9333	26921	2.60	3.86	5.50	8.00	10.55	13.30	26.00
99	Culvert Improvement No. 89 (Lockhart Rd.)	LoversTrib4.1	Trib. 4.1.1	539.962	26918	2.66	4.04	5.55	8.06	10.68	13.46	26.31
-	Upstream of Huronia Rd. (Reach Lo-6)	LoversTrib4	Trib. 4.1	322.0645	26917	2.62	5.85	8.72	12.93	16.24	19.75	52.40
-	Upstream of Lockhart Rd. (Reach Lo-7)	Lovers	Main04	6658.264	26916	16.26	32.37	45.75	65.28	81.18	96.66	270.89
101	Culvert Improvement No. 91 (Lockhart Rd.)	Lovers	Main04	6626.625	26929	16.26	32.37	45.76	65.30	81.18	96.68	270.86
-	Downstream of Lockhart Rd. (Reach Lo-7)	Lovers	Main04	6341.946	26930	16.25	32.37	45.71	65.28	81.17	96.73	270.91
-	Downstream of Shalom Park (Reach Lo-7)	Lovers	Main04	5902.777	26931	16.33	32.52	45.91	65.49	81.50	97.19	272.91
-	Start of Reach Lo-9	LoversTrib3	Trib. 3.2	2345	26160	0.01	0.01	0.01	0.01	0.01	0.01	31.47
-	Approx. 50 m D/S of Start Reach Lo-9	LoversTrib3	Trib. 3.2	2292	26943	0.01	0.01	0.01	0.01	0.01	0.01	31.47
-	Upstream of Welham Rd. (Reach Lo-9)	LoversTrib3	Trib. 3.2	2133	26941	1.43	2.51	3.89	5.45	7.39	9.55	17.83
103	Culvert Improvement No. 94 (Welham Rd.)	LoversTrib4	Trib. 3.2	1786	26939	1.44	2.52	3.94	5.58	7.42	9.57	18.35
104	Culvert Improvement No. 95 (Mapleview Dr.)	LoversTrib3	Trib. 3.2	1678	26938	1.46	2.52	3.94	5.60	7.43	9.62	18.46
105	Culvert Improvement No. 123 (Railway Crossing)	LoversTrib3	Trib. 3.2	1519	26937	2.05	3.05	4.08	5.76	7.68	10.00	19.62
-	Start of Reach Lo-8	LoversTrib3	Trib. 3.1	1500	26012	0.76	1.17	1.51	1.79	2.01	2.23	1.63
-	Railway Crossing	LoversTrib3	Trib. 3.1	1393	26936	0.80	1.27	1.65	1.99	2.25	2.52	2.60
-	Rawson Ave.	LoversTrib3	Trib. 3.1	1205	26935	0.81	1.28	1.67	2.02	2.30	2.58	2.69
-	Upstream of Huronia Rd. (Reach Lo-10)	LoversTrib3	Trib. 3.0	561.1898	26934	2.80	4.20	5.12	7.10	9.52	12.18	23.00
107	Culvert Improvement No. 92 (Huronia Rd.)	LoversTrib3	Trib. 3.0	474.0832	26933	3.93	6.08	7.58	9.65	11.30	13.10	25.22
-	Start of Reach Lo-11	Lovers	Main03	5420.499	26932	16.92	33.19	46.39	65.32	81.32	97.82	278.52
108	Culvert Improvement No. 125 (Lockhart Rd.)	LoversTrib2	Trib. 2	1930.824	26173	1.44	2.72	3.73	5.16	6.32	7.54	15.20
-	Downstream of Lockhart Rd. (Reach Lo-12)	LoversTrib2	Trib. 2	1712.844	26173	1.44	2.72	3.73	5.16	6.32	7.54	15.20
-	End of Reach Lo-12	LoversTrib2	Trib. 2	303.7247	26952	2.86	5.51	7.50	10.20	12.26	14.45	28.58
-	Start of Reach Lo-13	Lovers	Main02	4968.416	26951	18.27	36.17	51.06	72.39	89.65	107.97	304.15
-	Mapleview Dr.	Lovers	Main02	4535.809	26953	18.22	36.14	50.99	72.29	89.67	107.92	304.38
-	Start of Reach Lo-14	LoversTrib1	Trib. 1.4	3300	26966	0.12	0.24	0.30	0.37	0.42	0.47	4.18
-	Highway 400	LoversTrib1	Trib. 1.4	2792	26965	0.22	0.43	0.58	0.77	0.92	1.07	5.13
-	Bayview Dr.	LoversTrib1	Trib. 1.4	2037	26964	0.62	1.02	1.32	1.79	2.13	2.56	6.76
-	Immediately Downstream of Bayview Dr. (Reach Lo-14)	LoversTrib1	Trib. 1.4	1992	26963	1.95	3.04	3.81	4.93	5.73	6.62	8.92
-	Approx. 140 m D/S of Bayview Dr. (Reach Lo-14)	LoversTrib1	Trib. 1.4	1850	26961	2.49	3.92	4.93	6.25	7.26	8.37	9.52

Note: Regional Storm - Hurricane Hazel; Regional storm peak flows generated under AMC III soil conditions with SWMFs removed (uncontrolled Regional storm peak flow).

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Project No.	Description	HEC RAS			VO5	Peak Flow (m^3/s)						
		River	River Reach	River Station	Hydrograph	1:2 Year	1:5 Year	1:10 Year	1:25 Year	1:50 Year	1:100 Year	Regional
Lovers Creek (24 Hour SCS Type II Design Storm)												
-	Start of Reach Lo-15	LoversTrib1	Trib. 1.3	1817	26185	1.23	1.87	2.35	3.03	3.64	4.34	2.57
109	Culvert Improvement No. 99 (Ellis Dr.)	LoversTrib1	Trib. 1.3	1094	26960	2.58	4.17	5.30	6.83	8.30	9.66	5.43
-	Start of Reach Lo-16	LoversTrib1	Trib. 1.2	1621	26959	6.65	10.69	13.65	17.48	20.78	23.85	17.27
110	Culvert Improvement No. 98 (Welham Rd.)	LoversTrib1	Trib. 1.2	1554.214	26958	8.62	13.85	17.73	22.61	26.93	31.21	21.70
-	Railway Crossing	LoversTrib1	Trib. 1.2	1278.773	26956	10.04	16.31	20.68	26.58	31.59	36.76	26.70
-	Downstream of Railway Crossing (Reach Lo-17)	LoversTrib1	Trib. 1.0	1218.55	26002	4.01	4.65	5.04	5.47	5.76	6.18	18.01
113	Culvert Improvement No. 97 (Huronia Rd.)	LoversTrib1	Trib. 1.0	939.514	26957	4.39	5.23	5.84	6.79	7.29	8.00	26.78
-	Approx. 470 m D/S of Huronia Rd. (Reach Lo-17)	LoversTrib1	Trib. 1.0	446.5532	26955	4.34	5.42	6.16	7.11	7.86	8.61	29.23
-	Start of Reach Lo-18	Lovers	Main01	4159.121	26970	19.37	39.37	55.66	77.67	95.82	114.70	321.48
-	Approx. 570 m D/S from Start of Reach Lo-18	Lovers	Main01	3586.156	26971	19.50	39.56	56.04	78.10	96.54	115.85	324.76
-	Approx. 830 m D/S from Start of Reach Lo-18	Lovers	Main01	3327.937	26974	19.90	40.32	57.06	79.76	98.35	117.66	333.34
-	Big Bay Point Rd.	Lovers	Main01	2734.631	26975	19.94	40.42	57.19	80.00	98.56	117.88	335.23
-	Yonge St.	Lovers	Main01	2127.919	26977	19.88	40.31	57.11	79.92	98.46	117.65	335.37
-	Immediately Downstream of Yonge St. (Reach Lo-19)	Lovers	Main01	2074.773	26979	19.91	40.36	57.17	80.00	98.56	117.82	335.77
-	Approx. 500 m D/S of Yonge St. (Reach Lo-19)	Lovers	Main01	1601.441	26980	19.96	40.44	57.29	80.17	98.77	117.98	336.48
-	Approx. 70 m U/S of Railway Crossing (Reach Lo-19)	Lovers	Main01	1357.49	26982	19.96	40.46	57.31	80.21	98.82	118.01	336.49
-	Railway Crossing	Lovers	Main01	1302.252	26983	19.98	40.54	57.41	80.34	98.99	118.16	337.48
-	Downstream of Railway Crossing (Reach Lo-19)	Lovers	Main01	1264.763	26986	20.29	41.10	58.31	81.58	100.37	119.65	341.67
-	Hurst Dr.	Lovers	Main01	1160.818	26987	20.30	41.14	58.34	81.65	100.42	119.77	341.99
-	Downstream of Hurst Dr. (Reach Lo-20)	Lovers	Main01	1049.722	26988	20.30	41.12	58.38	81.70	100.51	119.83	342.47
122	Culvert Improvement No. 105 (Tollendal Mill Rd.)	Lovers	Main01	545.2612	26989	20.22	40.88	58.06	81.40	100.02	119.15	343.26
-	Outlet to Kempenfelt Bay (Reach Lo-20)	Lovers	Main01	17.79831	26990	20.15	40.73	57.77	81.19	99.56	118.78	342.86

Note: Regional Storm - Hurricane Hazel; Regional storm peak flows generated under AMC III soil conditions with SWMFs removed (uncontrolled Regional storm peak flow).

Appendix S: Final Preferred Alternative Solution Flow Summary

Barrie Drainage Master Plan
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Final Preferred Alternative Solution Peak Flow Summary
March 2019

Barrie Creeks Watershed

Project No.	Description	HEC RAS			VO5	Peak Flow (m^3/s)						
		River	River Reach	River Station	Hydrograph	1:2 Year	1:5 Year	1:10 Year	1:25 Year	1:50 Year	1:100 Year	Regional
Bunkers Creek (6 Hour SCS Type II Design Storm)												
-	Downstream of Boys St. (Reach Bu-12)	Bunkers	4	80	17922	1.97	3.16	4.04	5.46	6.50	7.63	10.24
41	Channel Improvement No. 8 (stabilize bank scour)	Bunkers	5	365	17917	4.87	8.10	10.92	14.92	17.96	19.94	22.97
41	Channel Improvement No. 8 (stabilize bank scour)	Bunkers	5	88	17918	5.94	9.60	12.58	17.18	20.88	23.41	24.71
-	Upstream of Milligan's Pond (Reach Bu-13)	Bunkers	3	13	17923	7.88	12.80	16.64	22.63	27.43	31.03	35.18
-	Downstream of Boys St. (Reach Bu-14)	Bunkers	2	173	17920	1.02	1.51	1.87	2.34	2.70	3.11	1.38
41	Channel Improvement No. 8 (stabilize bank scour)	Bunkers	1	814	17924	8.69	14.04	18.16	24.56	29.59	33.68	36.79
-	Upstream of Innisfil St. (Reach Bu-15)	Bunkers	1	612	17932	8.53	13.87	17.98	24.30	29.22	33.30	37.04
43	Culvert Improvement No. 22 (Innisfil St.)	Bunkers	1	579	17933	9.54	14.66	17.28	19.32	22.74	28.70	39.96
44	Culvert Improvement No. 23 (Commerical Plaza Entrance Road)	Bunkers	1	442	17934	9.65	14.82	17.56	19.64	22.91	28.82	40.26
45	Culvert Improvement No. 24 (Bradford St.)	Bunkers	1	321	17935	10.04	15.44	18.37	21.20	23.45	29.59	41.71
46	Channel Improvement No. 27 (regrade channel)	Bunkers	1	176	17936	9.76	15.22	18.17	20.71	23.32	29.21	41.77
-	Lakeshore Dr.	Bunkers	1	67	17937	9.97	15.55	18.60	21.43	23.75	29.74	42.63

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Project No.	Description	HEC RAS			VO5	Peak Flow (m^3/s)						
		River	River Reach	River Station	Hydrograph	1:2 Year	1:5 Year	1:10 Year	1:25 Year	1:50 Year	1:100 Year	Regional
Dyments Creek (6 Hour SCS Type II Design Storm)												
-	Upstream of Landfill Entrance (Reach Dy-1)	Dyments	1	5093	18909	2.15	2.69	3.01	3.48	4.49	5.63	16.02
-	Barrie Landfill Entrance Road	Dyments	1	4942	18910	2.42	3.19	3.72	4.38	5.36	6.72	18.53
-	U/S of Edgehill Dr. (Reach Dy-1)	Dyments	1	4589	18911	2.57	3.43	4.04	4.85	5.81	7.26	19.56
-	Edgehill Dr.	Dyments	1	4256	18912	2.59	3.50	4.15	5.00	5.96	7.45	19.98
-	Downstream of Edgehill Dr. (Reach Dy-1)	Dyments	1	4215	18913	2.78	3.86	4.67	5.74	6.76	8.40	21.69
-	Sproule Dr.	Dyments	1	3785	18914	2.69	3.82	4.60	5.68	6.84	8.44	21.83
183	Channel Improvement No. 9 (channel realignment)	Dyments	1	3146	18915	2.80	4.16	5.14	6.53	7.93	9.70	23.61
183	Channel Improvement No. 9 (channel realignment)	Dyments	1	3107	18916	2.69	3.22	3.53	4.01	4.42	4.90	23.85
50	Culvert Improvement No. 29 (Ferndale Dr.)	Dyments	1	2916	18918	3.66	5.41	6.85	8.96	10.62	12.30	30.46
51	Channel Improvement No. 10 (regrade channel)	Dyments	1	2875	18919	3.91	6.16	8.00	10.75	12.73	15.01	45.56
52	Culvert Improvement No. 30 (Sarjeant Dr.)	Dyments	1	2595	18921	4.31	7.25	9.54	12.79	15.30	17.96	45.13
-	Upstream of Dunlop St. On-Ramp (Reach Dy-2c)	Dyments	1	2380	18922	5.23	8.57	11.14	14.80	17.63	20.71	46.21
53	Culvert Improvement No. 31 (Dunlop St. On-Ramp)	Dyments	1	2251	18923	7.57	12.17	15.96	21.30	25.33	29.62	49.45
54	Culvert Improvement No. 33 (Highway 400)	Dyments	1	2085	18924	7.93	12.73	16.52	21.74	25.63	30.73	54.02
-	Upstream of Hart Dr. (Reach Dy-3)	Dyments	1	1945	18925	8.15	13.03	16.90	22.25	26.33	31.57	58.57
56	Channel Improvement No. 11 (daylight channel)	Dyments	1	1876	18926	8.15	13.07	16.96	22.33	26.39	31.58	58.64
57	Culvert Improvement No. 34 (George St.)	Dyments	1	1685	18927	8.18	13.09	17.08	22.54	26.74	32.15	59.48
170	SWMF Retrofit No. 79 (DY01)	Dyments	1	1637	18928	8.92	14.03	18.19	24.16	28.63	34.46	60.58
169	Culvert Improvement No. 35 (Victoria St.)	Dyments	1	1442	18001	8.71	13.40	16.81	20.93	23.95	27.11	60.58
170	SWMF Retrofit No. 79 (DY01)	Dyments	1	1389	18929	8.77	13.51	16.92	21.07	24.12	27.28	60.80
58	Culvert Improvement No. 36 (John St.)	Dyments	1	1124	18930	9.16	14.36	17.80	22.37	25.73	28.94	62.99
-	Downstream of John St. (Reach Dy-5)	Dyments	1	970	18931	9.19	14.42	17.88	22.49	25.81	29.06	63.24
60	Culvert Improvement No. 37 (Innisfil St.)	Dyments	1	718	18932	9.24	14.48	18.00	22.64	26.02	29.33	63.59
-	Downstream of Innisfil St. (Reach Dy-5)	Dyments	1	654	18933	9.28	14.56	18.08	22.75	26.15	29.46	63.78
61	Culvert Improvement No. 38 (Sanford St.)	Dyments	1	581	18934	9.30	14.60	18.17	22.87	26.28	29.58	64.00
62	Culvert Improvement No. 39 (Bradford St.)	Dyments	1	461	18935	9.49	14.90	18.50	23.29	26.77	30.14	64.82
63	Channel Improvement No. 28 (regrade channel)	Dyments	1	295	18937	9.78	15.32	19.00	24.05	27.65	31.24	65.89
-	Lakeshore Dr.	Dyments	1	168	18938	9.83	15.58	19.34	24.44	28.06	31.63	66.36

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Project No.	Description	HEC RAS			VO5	Peak Flow (m^3/s)						
		River	River Reach	River Station	Hydrograph	1:2 Year	1:5 Year	1:10 Year	1:25 Year	1:50 Year	1:100 Year	Regional
Hotchkiss Creek (6 Hour SCS Type II Design Storm)												
-	Downstream of Loggers Run (Reach Ho-1)	Hotchkiss	6	821	19901	0.42	0.58	0.72	0.95	1.10	1.28	0.72
12	Culvert Improvement No. 41 (Mayfair Dr.)	Hotchkiss	6	701	19902	0.49	0.67	0.85	1.13	1.33	1.55	0.88
-	Downstream of Mayfair Dr. (Reach Ho-1)	Hotchkiss	6	555	19903	0.24	0.32	0.38	0.77	1.12	1.55	1.13
13	Culvert Improvement No. 42 (Ardagh Rd.)	Hotchkiss	6	362	19904	0.56	0.88	1.10	1.44	1.87	2.52	1.92
-	Downstream of Ardagh Rd. (Reach Ho-2)	Hotchkiss	7	290	19906	0.40	0.64	0.80	1.04	1.22	1.39	0.84
-	Downstream of Essa Rd. (Reach Ho-5)	Hotchkiss	5	260	19121	0.46	0.65	0.80	1.01	1.20	1.37	0.57
-	Upstream of Essa Rd. (Reach Ho-4)	Hotchkiss	4	480	19914	2.52	3.65	4.55	5.82	6.89	7.96	7.03
16	Culvert Improvement No. 44 (Essa Rd.)	Hotchkiss	4	260	19913	2.50	3.65	4.57	5.83	6.92	8.03	8.28
-	Downstream of Essa Rd. (Reach Ho-4)	Hotchkiss	4	201	19928	2.57	3.73	4.68	5.96	7.08	8.21	8.34
-	Essa Rd. On-Ramp	Hotchkiss	4	67	19912	2.63	3.83	4.82	6.18	7.37	8.51	8.58
-	Start of Reach Ho-3	Hotchkiss	3	839	19905	1.20	1.90	2.44	3.19	3.77	4.51	3.48
-	Morrow Rd.	Hotchkiss	3	438	19907	2.53	4.16	5.42	7.18	8.63	10.12	7.67
-	Downstream of Morrow Rd. (Reach Ho-3)	Hotchkiss	3	415	19929	4.37	7.33	9.73	12.97	15.54	18.41	12.87
-	Upstream of Highway 400 (Reach Ho-3)	Hotchkiss	3	107	19909	4.63	7.68	10.07	13.45	16.14	19.10	13.73
-	Downstream of Essa Rd. On-Ramp (Reach Ho-6)	Hotchkiss	2	533	19911	3.25	4.86	6.18	7.96	9.44	10.92	8.98
-	Highway 400	Hotchkiss	1	1802	19910	6.34	11.70	15.49	21.05	25.40	29.87	24.54
19	SWMF Retrofit No. 81	Hotchkiss	1	1590	19917	9.14	16.25	21.28	28.56	34.72	40.63	31.13
21	Culvert Improvement No. 135 (Railway Crossing)	Hotchkiss	1	1236	19084	9.76	14.09	15.96	17.70	18.79	19.78	34.29
22	Culvert Improvement No. 48 (Tiffin St.)	Hotchkiss	1	1049	19919	10.66	13.73	15.16	16.21	16.99	17.96	35.95
23	Channel Improvement No. 6 (daylight channel)	Hotchkiss	1	969	19920	16.37	22.36	26.30	31.24	34.62	38.68	46.38
27	Culvert Improvement No. 50 (Innisfil St.)	Hotchkiss	1	623	19922	17.11	23.69	27.97	33.35	37.32	41.74	54.38
28	Channel Improvement No. 14 (stabilize bank erosion)	Hotchkiss	1	462	19923	17.15	23.92	28.24	33.74	37.76	42.29	54.90
-	Bradford St.	Hotchkiss	1	337	19924	15.80	23.89	28.22	33.70	37.82	42.29	55.17
-	Downstream of Bradford St. (Reach Ho-9)	Hotchkiss	1	182	19925	15.82	24.37	28.76	34.43	38.72	43.34	56.96
-	Lakeshore Dr.	Hotchkiss	1	129	19926	15.82	24.46	28.98	34.70	38.81	43.42	57.18
-	Downstream of Lakeshore Dr. (Reach Ho-9)	Hotchkiss	1	0	19927	15.89	24.52	29.06	34.74	38.90	43.56	57.14

Note: Regional Storm - Hurricane Hazel; Regional storm peak flows generated under AMC III soil conditions with SWMFs removed (uncontrolled Regional storm peak flow); peak flows are worst case (with or without spills).

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Barrie Creeks Watershed

Project No.	Description	HEC RAS			VO5	Peak Flow (m^3/s)						
		River	River Reach	River Station	Hydrograph	1:2 Year	1:5 Year	1:10 Year	1:25 Year	1:50 Year	1:100 Year	Regional
Kidds Creek (6 Hour SCS Type II Design Storm)												
4	Chanel Improvement No. 1 (stabilize bank erosion)	Kidds	5	1514	16924	3.58	5.78	7.69	10.34	14.28	18.06	24.81
4	Chanel Improvement No. 1 (stabilize bank erosion)	Kidds	5	1259	16905	3.61	5.90	7.94	10.78	14.66	18.38	25.66
4	Chanel Improvement No. 1 (stabilize bank erosion)	Kidds	5	1115	16906	3.92	6.48	8.68	11.77	15.67	19.69	27.01
5	Culvert Improvement No. 13 (Cundles Rd.)	Kidds	5	906	16907	5.06	7.43	10.33	14.45	18.60	23.18	31.09
-	Downstream of Cundles Rd. (Reach Ki-3)	Kidds	5	818	16908	6.04	8.92	11.72	16.45	20.72	25.74	34.14
-	D/S of Cundles Rd. and Highway 400 (Reach Ki-4)	Kidds	5	341	16909	6.58	9.80	12.85	17.89	22.49	27.52	36.80
-	Start of Reach Ki-5	Kidds	4	297	16139	1.79	2.76	3.41	4.28	5.02	5.71	2.23
-	Downstream of Coulter Rd. (Reach Ki-5)	Kidds	4	223	16925	4.02	6.19	7.72	9.70	11.20	12.76	4.94
-	Start of Reach Ki-6	Kidds	3	1152	16910	9.32	14.42	18.17	23.41	27.96	33.26	43.62
-	Upstream of Highway 400 (Reach Ki-6)	Kidds	3	981	16911	9.94	15.43	19.54	25.26	30.29	36.06	46.69
-	Highway 400	Kidds	3	839	16912	2.36	2.66	2.83	3.14	4.24	7.00	47.50
-	Wellington St. / Ross St.	Kidds	3	472	16913	2.84	3.68	4.25	5.04	5.74	7.14	49.34
8	Culvert Improvement No. 16 (Thomson St.)	Kidds	3	319	16914	2.31	2.61	2.83	3.08	3.32	3.89	43.61
163	Channel Improvement No. 2 (stabilize bank erosion)	Kidds	3	112	16915	2.38	2.78	3.11	3.49	3.80	3.91	43.92
-	Downstream of Highway 400 (Reach Ki-9)	Kidds	2	389	16927	0.64	0.86	1.03	1.33	1.55	1.86	2.54
-	Downstream of Wellington St. (Reach Ki-9)	Kidds	2	120	16917	0.71	0.95	1.15	1.49	1.74	2.09	2.69
10	Channel Improvement No. 3 (stabilize bank erosion)	Kidds	1	1489	16916	2.88	3.70	4.30	5.06	5.66	6.00	44.97
-	Donald St.	Kidds	1	1406	16926	3.17	4.19	5.03	6.02	6.80	7.32	45.64
-	Eccles St.	Kidds	1	1230	16918	3.34	4.53	5.49	6.63	7.57	8.21	46.12
165	Channel Improvement No. 25 (daylight channel)	Kidds	1	1073	16919	3.91	5.68	7.08	8.81	10.26	11.71	52.16
165	Channel Improvement No. 25 (daylight channel)	Kidds	1	1051	16920	4.40	6.71	8.40	10.40	12.08	13.86	53.11
166	Culvert Improvement No. 145 (Dunlop St.)	Kidds	1	1000	16921	4.68	7.15	8.96	11.11	12.94	14.82	53.47
-	Overland flow at Bradford St.	Kidds	1	814	16921	0.01	0.01	0.01	0.01	0.01	0.01	31.47
-	Overland flow at Toronto St.	Kidds	1	518	16921	0.01	0.01	0.01	0.01	0.01	0.01	31.47
-	Downstream of Toronto St.	Kidds	1	495	16922	4.98	7.73	9.67	12.04	13.98	16.03	53.93
-	Upstream of Marina Access Road	Kidds	1	411	16923	4.93	7.66	9.61	12.04	13.99	16.06	53.99

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Project No.	Description	HEC RAS			VO5	Peak Flow (m^3/s)						
		River	River Reach	River Station	Hydrograph	1:2 Year	1:5 Year	1:10 Year	1:25 Year	1:50 Year	1:100 Year	Regional
Sophia Creek (6 Hour SCS Type II Design Storm)												
-	Start of Owen Street Flow Diversion (Wellington St.)	Owen Street	1	504.1	N/A	0.00	0.00	0.00	0.00	0.00	0.00	0.00
-	McDonald St.	Owen Street	1	406.5	15150	0.32	0.44	0.53	0.65	0.76	0.86	0.42
-	Worsley St.	Owen Street	1	275.4	15936	0.70	0.96	1.14	1.39	1.62	1.85	0.82
-	Collier St.	Owen Street	1	159.8	15937	0.92	1.27	1.50	1.85	2.16	2.46	1.03
-	Dunlop St.	Owen Street	1	26.8	15938	1.09	1.50	1.78	2.20	2.56	2.90	1.18
-	Outlet to Kempenfelt Bay	Owen Street	1	-240	15940	1.45	2.02	2.41	3.02	3.52	4.02	1.61
-	Downstream of Duckworth St.	Sophia	6	1124	15121	3.64	6.08	8.04	10.87	12.76	14.81	7.95
-	Howard Cres.	Sophia	6	1017	15908	3.73	6.23	8.24	11.15	13.09	15.20	8.14
-	Lay St.	Sophia	6	920	15909	3.79	6.36	8.38	11.38	13.43	15.60	8.35
-	Downstream of Lay St.	Sophia	6	822	15910	4.55	7.64	10.12	13.68	16.27	18.91	9.89
-	Upstream of Grove St.	Sophia	6	698	15911	5.12	8.70	11.48	15.48	18.43	21.44	11.09
-	Flow exceeding Grove St. culvert capacity	Sophia	5	253	N/A	0.00	0.00	0.00	0.00	0.00	0.00	0.00
-	Grove St. (South of H.G. Robinson Park)	Sophia	4	645	15912	5.10	8.68	11.48	15.44	18.41	21.42	11.12
-	Downstream of Grove St.	Sophia	4	550	15913	5.94	10.16	13.38	17.95	21.40	24.80	13.02
-	Upstream of St. Vincent St.	Sophia	3	389	15913	5.94	10.16	13.38	17.95	21.40	24.80	13.02
-	St. Vincent St.	Sophia	3	355	15914	5.81	9.96	13.16	17.69	21.08	24.36	13.64
-	Downstream of St. Vincent St.	Sophia	3	321	15915	8.92	15.01	19.63	26.09	30.89	35.70	18.71
-	Upstream of SWMF SP01	Sophia	3	79	15916	8.42	14.36	18.52	25.62	30.43	35.14	18.97
-	SWMF SP03	Sophia	2	389	15905	2.34	4.79	8.00	12.78	15.97	19.14	12.26
-	Downstream of Rose St.	Sophia	2	222	15906	2.68	5.52	9.10	14.51	18.16	21.79	13.95
-	Upstream of Laurie Cres.	Sophia	2	203	15907	2.71	5.60	9.22	14.60	18.43	21.96	14.08
-	Upstream of Bothwell Cres.	Sophia	1	1640	15917	10.80	19.03	26.46	38.36	47.94	56.58	33.15
-	Bothwell Cres.	Sophia	1	1597	15918	10.99	19.32	26.75	38.56	48.43	56.94	33.66
-	Grove St. (West of Bothwell Cres.)	Sophia	1	1496	15919	12.01	20.89	28.55	41.05	51.40	60.40	35.97
-	Parkdale Cres.	Sophia	1	1239	15920	12.06	20.89	28.56	40.87	51.23	60.41	36.51
-	Davidson St. / Gunn St.	Sophia	1	1186	15921	12.64	21.77	29.60	42.36	53.09	62.54	38.24
-	Downstream of Gunn St.	Sophia	1	1105	15922	13.02	22.38	30.29	43.36	54.24	63.88	39.29
-	Berczy St.	Sophia	1	1062	15923	13.92	23.75	31.91	45.56	56.84	66.94	41.79
-	Downstream of Berczy St.	Sophia	1	920	15924	14.82	25.03	33.44	47.75	59.48	70.08	45.15
-	Upstream of Peel St.	Sophia	1	680	15957	14.92	25.21	33.66	47.86	59.48	70.18	45.65
-	Peel St.	Sophia	1	671.2	15925	15.42	25.96	34.50	49.07	60.88	71.82	47.26
-	Overland flow at Sophia St. (West of Peel St.)	Sophia	1	644.1	N/A	2.06	12.60	21.14	35.71	47.52	58.46	36.13
-	Overland flow at Sophia St. / Owen St.	Sophia	1	559.7	15926	4.33	14.90	23.44	38.05	49.89	60.87	36.33
-	Overland flow at Sophia St. / Mcdonald St.	Sophia	1	464.6	15927	4.85	15.71	24.39	39.37	51.50	63.01	38.60
-	Overland flow at Sophia St. / Bayfield St.	Sophia	1	403.8	15928	5.07	16.09	24.81	39.93	52.17	63.83	39.57
-	Overland flow at Sophia St. / Ross St.	Sophia	1	229	15929	5.19	16.22	24.95	40.10	52.36	64.09	39.88
-	Overland flow at Sophia St. / Collier St.	Sophia	1	109.4	15930	5.26	16.31	25.06	40.24	52.52	64.27	40.15
-	Overland flow at Sophia St. / Dunlop St.	Sophia	1	-21	15934	6.20	17.62	26.38	41.79	54.40	66.61	42.86
-	Overland flow at Sophia St. / Simcoe St.	Sophia	1	-237	15935	6.29	17.83	26.50	41.92	54.57	66.79	43.11
-	Overland flow at Berczy St.	Sophia 2	Berczy Overland	125	N/A	4.80	13.56	21.11	34.01	44.76	54.50	32.02

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Project No.	Description	HEC RAS			VO5	Peak Flow (m^3/s)						
		River	River Reach	River Station	Hydrograph	1:2 Year	1:5 Year	1:10 Year	1:25 Year	1:50 Year	1:100 Year	Regional
Whiskey Creek (24 Hour SCS Type II Design Storm)												
-	Upstream of Highway 4000 (Reach Wh-5)	Whiskey	5	640	23943	0.11	0.22	0.31	0.43	0.54	0.65	1.41
-	Fairview Rd.	Whiskey	5	280	23941	0.68	1.10	1.58	2.12	2.48	2.89	2.45
-	D/S of Fairview Rd. and U/S of Bayview Dr. (Reach Wh-5)	Whiskey	5	-1	23913	1.12	1.85	2.54	3.43	4.06	4.80	4.54
-	Bayview Dr.	Whiskey	5	-289	23914	1.73	2.89	3.84	5.39	6.37	7.49	5.52
67	SWMF Retrofit No. 42	Whiskey	7	494	23111	0.83	1.42	1.86	2.50	3.04	3.55	2.41
68	Culvert Improvement No. 53 (Harvie Rd.)	Whiskey	7	125	23906	0.24	0.54	1.28	2.26	3.06	3.91	4.16
-	Downstream of SWMF WK05 (Reach Wh-1)	Whiskey	6	432	23902	3.74	6.59	8.80	11.86	14.57	17.00	11.43
-	Upstream of Harvie Rd. (Reach Wh-3)	Whiskey	4	2254	23905	1.58	2.10	3.11	4.37	5.36	6.42	18.46
171	Channel Improvement No. 15 (channel realignment)	Whiskey	4	2142	23907	1.67	2.21	3.30	4.67	5.76	6.90	19.19
172	Culvert Improvement No. 55 (Highway 400)	Whiskey	4	2010	23908	1.84	2.57	3.73	5.38	6.67	8.03	21.23
71	Culvert Improvement No. 56 (Fairview Rd.)	Whiskey	4	1709	23909	1.91	2.74	3.95	5.66	7.03	8.44	22.00
-	Railway Crossing	Whiskey	4	1481	23910	2.08	3.08	4.36	6.36	7.91	9.54	23.68
72	Culvert Improvement No. 57 (Bayview Dr.)	Whiskey	4	1160	23911	2.14	3.19	4.44	6.50	8.15	9.76	24.39
73	Channel Improvement No. 16 (regrade channel)	Whiskey	4	1100	23912	2.18	3.29	4.54	6.65	8.34	10.01	24.75
-	Start of Reach Wh-6	Whiskey	3	1697	23915	6.01	10.04	13.07	17.58	21.34	24.89	38.16
-	South of Tamarack Rd. (Reach Wh-6)	Whiskey	3	1351	23916	5.96	9.94	12.72	16.97	20.51	23.93	39.65
77	Channel Improvement No. 18 (stabilize bank erosion)	Whiskey	3	953	23917	5.93	9.92	12.71	16.91	20.41	23.84	40.78
-	Upstream of McConkey Pl. (Reach Wh-6)	Whiskey	3	512	23918	5.48	9.43	12.37	16.72	19.98	23.36	41.81
-	McConkey Pl.	Whiskey	3	352	23919	5.54	9.53	12.50	16.91	20.20	23.64	42.34
-	Upstream of Railway Crossing (Reach Wh-7a)	Whiskey	3	222	23940	7.49	12.91	16.98	23.10	27.42	31.94	49.53
78	Culvert Improvement No. 147 (Railway Crossing)	Whiskey	3	169	23002	7.44	12.73	16.51	22.02	25.74	29.16	49.53
80	Culvert Improvement No. 60 (Huronia Rd.)	Whiskey	3	108	23920	7.54	12.90	16.73	22.31	26.06	29.50	50.00
-	Start of Reach Wh-8	Whiskey	2	1332	23922	1.42	2.26	2.89	3.78	4.44	5.26	2.92
-	Huronia North Park (Reach Wh-8)	Whiskey	2	1059	23923	2.22	3.64	4.70	6.10	7.28	8.69	4.82
-	Upstream of Herrell Ave. (Reach Wh-8)	Whiskey	2	864	23924	2.21	3.58	4.67	6.12	7.31	8.72	5.56
-	Herrell Ave.	Whiskey	2	683	23925	3.52	5.78	7.37	10.09	11.89	14.34	9.22
-	Downstream of Herrell Ave. (Reach Wh-8)	Whiskey	2	601	23926	4.24	7.03	9.00	12.43	14.77	17.63	11.35
-	Upstream of SWMF WK01 (Reach Wh-8)	Whiskey	2	383	23927	4.22	7.06	9.05	12.44	14.80	17.72	11.53
83	SWMF Retrofit No. 25 (WK01)	Whiskey	2	110	23921	11.77	19.58	25.40	33.59	39.55	45.55	63.01
84	Culvert Improvement No. 62 (Little Ave.)	Whiskey	1	1549	23928	8.15	12.94	18.94	27.05	33.64	39.28	63.39
81	Channel Improvement No. 31 (channel realignment)	Whiskey	1	1515	23929	8.14	12.94	18.90	26.84	33.28	39.22	63.31
85	Culvert Improvement No. 63 (Yonge St.)	Whiskey	1	974	23930	8.29	13.09	18.49	26.30	32.59	38.77	66.08
-	Downstream of Yonge St. (Reach Wh-9)	Whiskey	1	929	23931	8.29	13.08	18.47	26.20	32.11	36.65	66.18
86	Culvert Improvement No. 138 (Railway Crossing)	Whiskey	1	663	23932	8.47	13.40	18.92	26.84	32.92	37.60	67.72
-	D/S of Railway Crossing and U/S of Hurst Dr. (Reach Wh-9)	Whiskey	1	562	23933	8.64	13.66	19.32	27.32	33.52	38.23	68.99
88	Culvert Improvement No. 64 (Hurst Dr.)	Whiskey	1	495	23935	8.66	13.70	19.39	27.42	33.64	38.33	69.27
89	Channel Improvement No. 19 (stabilize bank erosion)	Whiskey	1	451	23934	8.68	13.69	19.26	27.12	32.96	37.40	69.56
174	Culvert Improvement No. 65 (The Boulevard)	Whiskey	1	243	23936	8.68	13.69	19.26	27.07	32.90	37.38	69.62
175	Channel Improvement No. 20 (regrade channel)	Whiskey	1	225	23937	8.72	13.73	19.32	27.14	32.99	37.49	69.96
176	Culvert Improvement No. 66 (Brennan Ave.)	Whiskey	1	180	23938	8.72	13.73	19.33	27.14	32.95	37.46	70.07
-	Downstream of Brennan Ave. (Reach Wh-10)	Whiskey	1	30	23939	8.68	13.70	19.19	26.88	32.80	37.34	70.04

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NVCA Study Area

Project No.	Description	HEC RAS			VO5	Peak Flow (m^3/s)						
		River	River Reach	River Station	Hydrograph	1:2 Year	1:5 Year	1:10 Year	1:25 Year	1:50 Year	1:100 Year	Regional
Georgian Creek (24 Hour SCS Type II Design Storm)												
-	Start of Reach Ge-2	Georgian	1	690	30902	1.84	3.49	5.12	7.60	9.49	11.38	3.69
-	Approx. 70 m D/S from Start of Reach Ge-2	Georgian	1	618	30905	1.99	3.72	5.44	8.02	10.02	11.98	3.91
-	Approx. 260 m D/S from Start of Reach Ge-2	Georgian	1	422	30907	2.53	4.64	6.65	9.67	11.95	13.94	4.89
134	Eastview Park Walking Trail	Georgian	1	189	30908	2.50	4.48	6.50	9.36	11.76	13.76	5.13
134	Downstream of Eastview Park Walking Trail (Reach Ge-2)	Georgian	1	177	30909	2.84	5.11	7.38	10.54	13.21	15.47	5.88
134	SWMF GR04	Georgian	1	159	30911	2.84	5.11	7.38	10.54	13.21	15.47	5.88
135	Trunk Storm Sewer No. 3	Georgian	1	0	30913	1.52	1.80	1.95	2.14	2.26	2.58	5.88
138	Start of Reach Ge-1	Georgian	2	477	30920	3.53	5.18	6.46	8.02	9.41	10.74	11.56
139	Culvert Improvement No. 82 (Penetanguishene Rd.)	Georgian	2	227	30922	1.93	2.92	3.50	4.12	4.60	5.10	11.91
-	Downstream of Penetanguishene Rd. (Reach Ge-1)	Georgian	2	0	30923	1.97	2.99	3.60	4.32	4.94	5.63	12.54

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		River	River Reach	River Station	Hydrograph	1:2 Year	1:5 Year	1:10 Year	1:25 Year	1:50 Year	1:100 Year	Regional
Little Lake (24 Hour SCS Type II Design Storm)												
-	Start of Reach Li-1	Little Lake	1	776	31919	2.39	4.55	5.56	6.76	7.37	7.86	9.12
-	Livingstone St.	Little Lake	1	330	31920	2.45	4.69	5.76	7.03	7.70	8.26	9.40
143	Channel Improvement No. 24 (stabilize bank erosion)	Little Lake	1	263	31924	2.45	4.70	5.78	7.07	7.74	8.30	9.44
-	Reach Li-1 near SWMF LT05	Little Lake	1	22	31927	3.67	7.07	10.25	14.29	16.88	19.73	14.39
-	Reach Li-1 D/S of SWMF LT05	Little Lake	1	0	31928	3.67	7.06	10.25	14.28	16.87	19.75	14.39

Note: Regional Storm - Timmins Storm; Regional storm peak flows generated under AMC II soil conditions with SWMFs removed (uncontrolled Regional storm peak flow).

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Project No.	Description	HEC RAS			VO5	Peak Flow (m^3/s)						
		River	River Reach	River Station	Hydrograph	1:2 Year	1:5 Year	1:10 Year	1:25 Year	1:50 Year	1:100 Year	Regional
Bear Creek (24 Hour SCS Type II Design Storm)												
-	Downstream of Essa Rd. (Reach Be-1)	Bear Creek	13	1045	32904	0.73	1.42	2.08	2.94	3.71	4.63	7.81
-	Lougheed Rd.	Bear Creek	13	327	32905	1.29	2.23	3.00	4.10	4.94	5.86	10.05
-	Start of Reach Be-2	Bear Creek	14	2730	32918	0.36	0.61	0.91	1.47	2.04	2.71	5.38
-	Mapleview Community Church Entrance Road	Bear Creek	14	2552	32916	0.59	1.04	1.38	1.81	2.23	2.95	5.70
-	Driveway for 320 Mapleview Dr. (Reach Be-2)	Bear Creek	14	2513	32915	0.64	1.08	1.37	1.93	2.33	2.96	5.73
-	Private crossing at 364 Mapleview Dr. (Reach Be-3)	Bear Creek	14	2333	32914	0.60	1.05	1.40	1.89	2.38	3.13	5.86
-	Essa Rd.	Bear Creek	14	2167	32913	0.69	1.16	1.65	2.25	2.89	3.75	6.28
-	D/S of Essa Rd. and U/S of Mapleview Dr. (Reach Be-3)	Bear Creek	14	1896	32912	2.21	3.86	5.15	7.19	8.63	9.93	8.38
-	Mapleview Dr.	Bear Creek	14	1744	32911	2.66	4.63	6.18	8.51	10.18	11.92	9.00
-	Redfern Ave.	Bear Creek	14	1430	32910	2.96	5.21	7.12	9.85	11.80	13.86	9.77
-	Approx. 190 m D/S of Redfern Ave. (Reach Be-4)	Bear Creek	14	1199	32909	3.08	5.44	7.50	10.37	12.40	14.65	10.05
-	Lougheed Rd.	Bear Creek	14	421	32908	3.81	6.67	9.17	12.64	15.21	18.04	11.85
-	Start of Reach Be-5	Bear Creek	12	431	32906	3.50	5.58	7.00	10.75	13.90	16.54	21.64
-	County Rd. 27	Bear Creek	12	277	32920	3.69	5.95	7.46	11.22	14.25	17.26	22.38
-	Immediately D/S of County Rd. 27 (Reach Be-5)	Bear Creek	12	195	32001	3.69	5.95	7.43	11.11	13.94	20.72	21.42
-	Approx. 210 m D/S of County Rd. 27 (Reach Be-5)	Bear Creek	12	19	32921	3.73	6.05	7.65	11.23	14.09	16.49	21.59
-	Start of Reach Be-17	Bear Creek	6	290	32148	0.05	0.12	0.17	0.24	0.31	0.38	0.30
-	Start of Reach Be-6	Bear Creek	5	135	32147	0.02	0.04	0.05	0.07	0.09	0.11	0.06
-	Start of Reach Be-7	Bear Creek	4	327	32926	0.07	0.14	0.20	0.29	0.37	0.46	0.36
-	Start of Reach Be-8	Bear Creek	3	716	32149	0.02	0.04	0.05	0.08	0.10	0.12	0.06
-	Start of Reach Be-9	Bear Creek	2	2458	32927	0.30	0.63	0.90	1.31	1.65	2.03	2.15
-	Start of Reach Be-10	Bear Creek	2	1250	32928	0.43	0.88	1.25	1.84	2.33	2.90	3.47
-	Ardagh Rd.	Bear Creek	2	953	32930	1.15	2.38	3.23	4.49	5.73	7.19	7.44
-	Start of Reach Be-11	Bear Creek	8	2948	32936	0.22	0.40	0.54	0.69	0.81	0.91	1.01
-	Ardagh Rd.	Bear Creek	8	1315	32935	0.39	0.77	1.05	1.43	1.73	2.04	2.37
-	Start of Reach Be-13	Bear Creek	11	1163	32941	0.11	0.24	0.34	0.48	0.61	0.74	0.51
-	Approx. 220 m D/S from Start of Reach Be-13	Bear Creek	11	949	32942	0.19	0.35	0.56	0.84	1.06	1.48	1.69
-	Ardagh Rd.	Bear Creek	11	183	32943	0.23	0.45	0.70	1.03	1.30	1.83	2.07
-	Downstream of Ardagh Rd. (Reach Be-13)	Bear Creek	11	126	32944	0.23	0.45	0.70	1.03	1.30	1.83	2.07
-	Start of Reach Be-14	Bear Creek	10	969	32184	0.02	0.04	0.05	0.08	0.09	0.11	0.07
-	Approx. 400 m D/S from Start of Reach Be-14	Bear Creek	10	574	32945	0.69	1.09	1.41	1.88	2.22	2.57	1.24
-	Approx. 420 m D/S from Start of Reach Be-14	Bear Creek	10	555	32007	0.27	0.37	0.42	0.47	0.50	0.53	0.73
-	Approx. 60 m U/S of Ardagh Rd. (Reach Be-14)	Bear Creek	10	285	32947	0.31	0.45	0.53	0.62	0.69	0.77	0.89
154	Culvert Improvement No. 78 (Ardagh Rd.)	Bear Creek	10	254	32946	0.68	0.95	1.15	1.46	1.67	1.89	1.18
155	Channel Improvement No. 33 (stabilize bed erosion)	Bear Creek	9	2171	32948	0.70	1.15	1.53	2.08	2.50	3.10	3.34
-	Summerset Dr.	Bear Creek	9	1864	32949	0.69	1.17	1.58	2.14	2.60	3.24	3.46

Note: Regional Storm - Timmins Storm; Regional storm peak flows generated under AMC II soil conditions with SWMFs removed (uncontrolled Regional storm peak flow).

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Project No.	Description	HEC RAS			VO5	Peak Flow (m^3/s)						
		River	River Reach	River Station	Hydrograph	1:2 Year	1:5 Year	1:10 Year	1:25 Year	1:50 Year	1:100 Year	Regional
Bear Creek (24 Hour SCS Type II Design Storm)												
-	Approx. 180 m D/S of Summerset Dr. (Reach Be-15)	Bear Creek	9	1642	32953	0.91	1.45	1.88	2.50	3.04	4.09	4.39
-	Approx. 370 m D/S of Summerset Dr. (Reach Be-15)	Bear Creek	9	1456	32954	1.09	2.18	2.96	4.25	5.33	6.95	7.63
-	Approx. 590 m D/S of Summerset Dr. (Reach Be-15)	Bear Creek	9	1233	32340	1.70	3.20	4.42	6.11	7.56	9.57	14.29
-	Start of Reach Be-16	Bear Creek	7	187	32932	2.00	3.97	5.58	7.55	9.12	10.95	18.48
156	Railway Crossing (Reach Be-16)	Bear Creek	1	270	32931	2.62	5.45	7.89	11.06	13.45	16.16	26.50
157	County Rd. 27 (Reach Be-16)	Bear Creek	1	233	32933	3.05	6.21	8.92	12.44	15.15	18.17	30.22
-	Approx. 200 m D/S of County Rd. 27 (Reach Be-16)	Bear Creek	1	20	32955	3.03	6.19	8.89	12.41	15.13	18.15	30.25
-	County Rd. 27 (Unevaluated Reach)	Bear Creek	15	1290.42	32956	0.41	0.79	1.09	1.54	1.91	2.31	2.26

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Project No.	Description	HEC RAS			VO5	Peak Flow (m^3/s)						
		River	River Reach	River Station	Hydrograph	1:2 Year	1:5 Year	1:10 Year	1:25 Year	1:50 Year	1:100 Year	Regional
Hewitts Creek (24 Hour SCS Type II Design Storm)												
-	Unevaluated Reach	Hewitts	Main02	3593.722	29906	7.96	15.64	21.58	28.92	34.36	40.09	94.48
125	Culvert Improvement No. 83 (Mapleview Dr.)	Hewitts	Main02	3445.696	291000	7.94	15.62	21.46	28.54	34.20	39.94	94.48
-	Downstream of Mapleview Dr. (Reach He-1)	Hewitts	Main02	3408.654	29907	8.02	15.72	21.56	28.68	34.38	40.18	95.37
-	Reach He-1 near Coronation Pkwy.	Hewitts	Main02	3129.259	29908	8.12	15.91	21.78	28.97	34.76	40.61	96.79
-	Start of Reach He-2	Hewitts	Trib. 1	1258.764	29144	0.12	0.23	0.31	0.43	0.53	0.62	2.15
-	Upstream of Prince William Way (Reach He-2)	Hewitts	Trib. 1	1051.061	29909	4.82	8.63	12.19	17.75	22.15	26.72	17.39
-	Prince William Way	Hewitts	Trib. 1	892.8565	29008	1.30	2.34	3.46	5.20	6.84	8.72	17.39
-	Consort Dr.	Hewitts	Trib. 1	347.14	29910	1.31	2.38	3.46	5.06	6.46	8.14	17.28
-	Start of Reach He-3	Hewitts	Main01	2743.481	29912	9.24	17.60	23.84	31.58	38.10	44.72	106.63
-	Reach He-3 near SWMF HW05	Hewitts	Main01	2396.606	29913	9.72	18.35	24.74	32.75	39.60	46.56	114.18
-	Reach He-3 D/S of SWMF HW05	Hewitts	Main01	2291.371	29914	10.00	18.85	25.40	33.66	40.79	48.10	120.99
-	Approx. 290 m U/S of Big Bay Point Rd. (Reach He-3)	Hewitts	Main01	1719.604	29915	10.00	18.86	25.39	33.72	40.72	48.12	121.66
-	Big Bay Point Rd.	Hewitts	Main01	1460.708	29916	10.07	18.97	25.51	33.91	40.92	48.38	123.11
-	Approx. 200 m U/S of Kempenfelt Bay Outlet (Reach He-4)	Hewitts	Main01	203.2475	29917	10.25	19.37	25.99	34.58	41.59	49.21	127.56
-	Approx. 110 m U/S of Kempenfelt Bay Outlet (Reach He-4)	Hewitts	Main01	106.3736	29918	10.27	19.43	26.05	34.69	41.78	49.46	129.02
-	Outlet to Kempenfelt Bay (Reach He-4)	Hewitts	Main01	46.29602	29919	10.30	19.49	26.14	34.80	41.92	49.66	130.12

Note: Regional Storm - Hurricane Hazel; Regional storm peak flows generated under AMC III soil conditions with SWMFs removed (uncontrolled Regional storm peak flow).

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Project No.	Description	HEC RAS			VO5	Peak Flow (m^3/s)						
		River	River Reach	River Station	Hydrograph	1:2 Year	1:5 Year	1:10 Year	1:25 Year	1:50 Year	1:100 Year	Regional
Lovers Creek (24 Hour SCS Type II Design Storm)												
-	Start of Reach Lo-6	LoversTrib4.1	Trib. 4.1.1	1904.3	26926	1.52	2.18	2.70	3.46	4.00	4.57	9.78
-	Saunders Rd.	LoversTrib4.1	Trib. 4.1.1	1746.581	26991	2.27	3.41	4.22	5.39	6.34	7.26	11.02
-	Downstream of Saunders Rd. (Reach Lo-6)	LoversTrib4.1	Trib. 4.1.1	1704.249	26919	6.54	10.02	12.43	15.80	18.48	21.17	20.61
-	Bayview Dr.	LoversTrib4.1	Trib. 4.1.1	1479.158	26920	1.40	3.67	5.40	7.57	9.88	12.54	21.25
-	Downstream of Saunders Rd. (Reach Lo-6)	LoversTrib4.1	Trib. 4.1.1	1287.58	26006	1.67	3.32	5.12	7.22	9.44	11.95	15.32
98	Culvert Improvement No. 126 (Railway Crossing)	LoversTrib4.1	Trib. 4.1.1	785.9333	26921	2.60	3.86	5.51	7.99	10.56	13.30	26.00
99	Culvert Improvement No. 89 (Lockhart Rd.)	LoversTrib4.1	Trib. 4.1.1	539.962	26918	2.66	4.03	5.56	8.05	10.68	13.45	26.31
-	Upstream of Huronia Rd. (Reach Lo-6)	LoversTrib4	Trib. 4.1	322.0645	26917	2.62	5.84	8.71	12.94	16.24	19.75	52.40
-	Upstream of Lockhart Rd. (Reach Lo-7)	Lovers	Main04	6658.264	26916	16.26	32.36	45.76	65.28	81.18	96.66	270.89
101	Culvert Improvement No. 91 (Lockhart Rd.)	Lovers	Main04	6626.625	26929	16.26	32.38	45.76	65.29	81.18	96.68	270.86
-	Downstream of Lockhart Rd. (Reach Lo-7)	Lovers	Main04	6341.946	26930	16.26	32.38	45.71	65.28	81.17	96.73	270.91
-	Downstream of Shalom Park (Reach Lo-7)	Lovers	Main04	5902.777	26931	16.33	32.52	45.91	65.50	81.50	97.19	272.91
-	Start of Reach Lo-9	LoversTrib3	Trib. 3.2	2345	26160	0.49	0.71	0.86	1.08	1.25	1.42	31.47
-	Approx. 50 m D/S of Start Reach Lo-9	LoversTrib3	Trib. 3.2	2292	26943	0.50	0.74	0.94	1.19	1.38	1.58	31.47
-	Upstream of Welham Rd. (Reach Lo-9)	LoversTrib3	Trib. 3.2	2133	26941	1.46	3.11	3.96	5.54	7.73	9.77	17.83
103	Welham Rd.	LoversTrib4	Trib. 3.2	1786	26939	1.50	3.11	4.06	5.63	7.76	9.82	18.35
104	Mapleview Dr.	LoversTrib3	Trib. 3.2	1678	26938	1.52	3.11	4.06	5.65	7.79	9.85	18.46
105	Culvert Improvement No. 123 (Railway Crossing)	LoversTrib3	Trib. 3.2	1519	26937	2.15	3.20	4.21	5.84	8.04	10.22	19.62
-	Start of Reach Lo-8	LoversTrib3	Trib. 3.1	1500	26012	0.76	1.18	1.51	1.79	2.02	2.23	1.63
-	Railway Crossing	LoversTrib3	Trib. 3.1	1393	26936	0.80	1.26	1.66	1.99	2.26	2.52	2.60
-	Rawson Ave.	LoversTrib3	Trib. 3.1	1205	26935	0.80	1.27	1.68	2.03	2.30	2.58	2.69
-	Upstream of Huronia Rd. (Reach Lo-10)	LoversTrib3	Trib. 3.0	561.1898	26934	2.90	4.27	5.21	7.43	9.97	12.49	23.00
107	Culvert Improvement No. 92 (Huronia Rd.)	LoversTrib3	Trib. 3.0	474.0832	26933	4.03	6.16	7.66	9.72	11.36	13.31	25.22
-	Start of Reach Lo-11	Lovers	Main03	5420.499	26932	16.94	33.18	46.38	65.51	81.65	98.08	278.52
108	Culvert Improvement No. 125 (Lockhart Rd.)	LoversTrib2	Trib. 2	1930.824	26173	1.44	2.72	3.73	5.16	6.32	7.54	15.20
-	Downstream of Lockhart Rd. (Reach Lo-12)	LoversTrib2	Trib. 2	1712.844	26173	1.44	2.72	3.73	5.16	6.32	7.54	15.20
-	End of Reach Lo-12	LoversTrib2	Trib. 2	303.7247	26952	2.86	5.51	7.50	10.20	12.25	14.45	28.58
-	Start of Reach Lo-13	Lovers	Main02	4968.416	26951	18.29	36.16	51.08	72.55	89.92	108.26	304.15
-	Mapleview Dr.	Lovers	Main02	4535.809	26953	18.24	36.12	51.00	72.46	89.93	108.18	304.38
-	Start of Reach Lo-14	LoversTrib1	Trib. 1.4	3300	26966	0.12	0.24	0.30	0.37	0.42	0.47	4.18
-	Highway 400	LoversTrib1	Trib. 1.4	2792	26965	0.22	0.43	0.58	0.77	0.91	1.07	5.13
-	Bayview Dr.	LoversTrib1	Trib. 1.4	2037	26964	0.62	1.02	1.32	1.79	2.12	2.57	6.76
-	Immediately Downstream of Bayview Dr. (Reach Lo-14)	LoversTrib1	Trib. 1.4	1992	26963	1.94	3.04	3.82	4.93	5.74	6.62	8.92
-	Approx. 140 m D/S of Bayview Dr. (Reach Lo-14)	LoversTrib1	Trib. 1.4	1850	26961	2.48	3.92	4.93	6.25	7.26	8.38	9.52
-	Start of Reach Lo-15	LoversTrib1	Trib. 1.3	1817	26185	1.22	1.87	2.35	3.02	3.65	4.33	2.57
109	Culvert Improvement No. 99 (Ellis Dr.)	LoversTrib1	Trib. 1.3	1094	26960	2.58	4.18	5.30	6.83	8.29	9.66	5.43

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		River	River Reach	River Station	Hydrograph	1:2 Year	1:5 Year	1:10 Year	1:25 Year	1:50 Year	1:100 Year	Regional
Lovers Creek (24 Hour SCS Type II Design Storm)												
-	Start of Reach Lo-16	LoversTrib1	Trib. 1.2	1621	26959	6.65	10.69	13.66	17.48	20.78	23.86	17.27
110	Culvert Improvement No. 98 (Welham Rd.)	LoversTrib1	Trib. 1.2	1554.214	26958	8.63	13.85	17.72	22.61	26.93	31.21	21.70
-	Railway Crossing	LoversTrib1	Trib. 1.2	1278.773	26956	10.04	16.31	20.68	26.58	31.60	36.77	26.70
-	Downstream of Railway Crossing (Reach Lo-17)	LoversTrib1	Trib. 1.0	1218.55	26002	4.01	4.66	5.04	5.47	5.76	6.18	18.01
113	Culvert Improvement No. 97 (Huronia Rd.)	LoversTrib1	Trib. 1.0	939.514	26957	4.39	5.23	5.84	6.79	7.30	7.99	26.78
-	Approx. 470 m D/S of Huronia Rd. (Reach Lo-17)	LoversTrib1	Trib. 1.0	446.5532	26955	4.34	5.42	6.16	7.12	7.86	8.60	29.23
-	Start of Reach Lo-18	Lovers	Main01	4159.121	26970	19.28	39.35	55.63	77.98	96.01	114.46	321.48
-	Approx. 570 m D/S from Start of Reach Lo-18	Lovers	Main01	3586.156	26971	19.39	39.54	56.04	78.44	96.71	115.49	324.76
-	Approx. 830 m D/S from Start of Reach Lo-18	Lovers	Main01	3327.937	26974	19.90	40.32	57.06	79.76	98.35	117.66	333.34
-	Big Bay Point Rd.	Lovers	Main01	2734.631	26975	19.94	40.42	57.19	80.00	98.56	117.88	335.23
-	Yonge St.	Lovers	Main01	2127.919	26977	19.88	40.31	57.11	79.92	98.46	117.65	335.37
-	Immediately Downstream of Yonge St. (Reach Lo-19)	Lovers	Main01	2074.773	26979	19.91	40.36	57.17	80.00	98.56	117.82	335.77
-	Approx. 500 m D/S of Yonge St. (Reach Lo-19)	Lovers	Main01	1601.441	26980	19.96	40.44	57.29	80.17	98.77	117.98	336.48
-	Approx. 70 m U/S of Railway Crossing (Reach Lo-19)	Lovers	Main01	1357.49	26982	19.96	40.46	57.31	80.21	98.82	118.01	336.49
-	Railway Crossing	Lovers	Main01	1302.252	26983	19.98	40.54	57.41	80.34	98.99	118.16	337.48
-	Downstream of Railway Crossing (Reach Lo-19)	Lovers	Main01	1264.763	26986	20.32	41.17	58.38	81.58	100.39	119.71	341.67
-	Hurst Dr.	Lovers	Main01	1160.818	26987	20.33	41.21	58.43	81.64	100.45	119.74	341.99
-	Downstream of Hurst Dr. (Reach Lo-20)	Lovers	Main01	1049.722	26988	20.34	41.22	58.44	81.73	100.60	119.76	342.47
122	Culvert Improvement No. 105 (Tollendal Mill Rd.)	Lovers	Main01	545.2612	26989	20.24	40.97	58.15	81.31	100.04	119.23	343.26
-	Outlet to Kempenfelt Bay (Reach Lo-20)	Lovers	Main01	17.79831	26990	20.18	40.81	57.85	81.07	99.54	118.91	342.86

Note: Regional Storm - Hurricane Hazel; Regional storm peak flows generated under AMC III soil conditions with SWMFs removed (uncontrolled Regional storm peak flow).

Appendix T: Preliminary Preferred Alternative Solution Culvert Summaries

Table 1: Kidd's Creek Preliminary Preferred Solution Culvert Capacity Summary

Culvert ID	Location	Size	Capacity (m^3/s)	Level of Service	Design Criteria
13	Cundles Road West	3455 mm x 2195 mm Conc. Elliptical Culvert	23.2	1:100 Year	1:100 Year
16	Thomson Street	1800 mm × 900 mm Conc. Box Culvert	3.9	1:100 Year	1:100 Year
18	Wellington Street	855 mm x 1345 mm CSPA	>2.5	Regional	1:100 Year
145	Dunlop Street West	6000 mm x 1500 mm Conc. Box Culvert	14.8	1:100 Year	1:100 Year
146	Bradford Street	6000 mm x 1500 mm Conc. Box Culvert	14.8	1:100 Year	1:100 Year

Table 2: Kidd's Creek Preliminary Preferred Solution Road/Rail Crossing Summary

Crossing ID	Location	Regulatory Flow (m^3/s)	Weir Flow (m^3/s)	Depth of Weir Flow (m)	Velocity of Weir Flow (m/s)
13	Cundles Road West	31.1	1.5	0.17	0.55
16	Thomson Street	43.6	39.4	0.86	1.23
18	Wellington Street	2.5	0.0	0.00	0.00
145	Dunlop Street West	53.5	21.5	0.56	0.86
146	Bradford Street	53.5	31.5	0.37	1.30

Table 3: Bunkers Creek Preliminary Preferred Solution Culvert Capacity Summary

Culvert ID	Location	Size	Capacity (m^3/s)	Level of Service	Design Criteria
22	Innisfil Street	10.06 m Open Bottom Span Structure	28.7	1:100 Year	1:100 Year
23	Commercial Plaza Entrance Road	Twin 7.62 m Open Bottom Span Structures	29.7	1:100 Year	1:100 Year
24	Bradford Street	Twin 7.62 m Open Bottom Span Structures	41.7	Regional	1:100 Year

Table 4: Bunkers Creek Preliminary Preferred Solution Road/Rail Crossing Summary

Crossing ID	Location	Regulatory Flow (m^3/s)	Weir Flow (m^3/s)	Depth of Weir Flow (m)	Velocity of Weir Flow (m/s)
22	Innisfil Street	39.9	3.1	0.15	0.41
23	Commercial Plaza Entrance Road	40.3	1.6	0.24	0.62
24	Bradford Street	41.7	0.0	0.00	0.00

Table 5: Dyments Creek Preliminary Preferred Alternative Solution Culvert Capacity Summary

Culvert ID	Location	Size	Capacity (m^3/s)	Level of Service	Design Criteria
28	Dunlop Street West	3043 mm × 914 mm Conc. Box Culvert	8.4	1:100 Year	1:100 Year
29	Ferndale Drive North	10.67 m Open Bottom Span Structure	12.3	1:100 Year	1:100 Year
30	Sarjeant Drive	Twin 3000 mm × 1500 mm Conc. Box Culvert	18.0	1:100 Year	1:100 Year
31	Dunlop Street / Highway 400 On-Ramp	9000 mm x 1500 mm Conc. Box Culvert (per MTO)	29.6	1:100 Year	1:100 Year
33	Highway 400	9000 mm x 2000 mm Conc. Box Culvert (per MTO)	>54.0	Regional	1:100 Year
32	Hart Drive	10.67 m Open Bottom Span Structure	31.6	1:100 Year	1:100 Year
34	George Street	Twin 3600 mm × 1800 mm Conc. Box Culvert	32.2	1:100 Year	1:100 Year
35	Victoria Street	Culvert crossing to be removed			
36	John Street	Twin 3000 mm × 2100 mm Conc. Box Culvert	28.9	1:100 Year	1:100 Year
37	Innisfil Street	6.71 m Open Bottom Span Structure	23.4	1:50 Year	1:100 Year
38	Sandford Street	4200 mm x 2100 mm Conc. Box Culvert	23.6	1:50 Year	1:100 Year
39	Bradford Street	10.67 m Open Bottom Span Structure	29.5	1:100 Year	Regional

Table 6: Dyments Creek Preliminary Preferred Solution Road/Rail Crossing Summary

Crossing ID	Location	Regulatory Flow (m^3/s)	Weir Flow (m^3/s)	Depth of Weir Flow (m)	Velocity of Weir Flow (m/s)
28	Dunlop Street West	50.1	42.1	0.34	0.66
29	Ferndale Drive North	36.7	24.2	0.60	0.28
30	Sarjeant Drive	45.1	31.5	0.44	0.77
31	Dunlop Street / Highway 400 On-Ramp	49.5	20.7	0.43	0.73
33	Highway 400	54.0	0.0	0.00	0.00
32	Hart Drive	58.6	33.9	0.54	1.13
34	George Street	59.5	33.1	0.58	0.94
35	Victoria Street	Culvert crossing to be removed			
36	John Street	63.0	32.3	0.69	1.03
37	Innisfil Street	63.6	34.5	0.78	1.35
38	Sandford Street	64.0	52.6	0.77	1.12
39	Bradford Street	64.8	4.9	0.37	2.40

Table 7: Hotchkiss Creek Preliminary Preferred Solution Culvert Capacity Summary

Culvert ID	Location	Size	Capacity (m^3/s)	Level of Service	Design Criteria
41	Mayfair Drive	750 mm Dia. Conc. Pipe	>1.6	1:100 Year	1:50 Year
42	Ardagh Road	900 mm Dia. Conc. Pipe	>2.5	1:100 Year	1:100 Year
44	Essa Road	3048 mm × 914 mm Conc. Box Culvert	>8.3	Regional	1:100 Year
46	Highway 400	1800 mm Dia. Conc. Pipe, Existing 1070 mm Dia. Conc. Pipe & 2100 mm Dia. Conc. Pipe To Remain	>29.9	1:100 Year	1:50 Year
48	Tiffin Street	4267 mm × 1829 mm Conc. Box Culvert	17.0	1:50 Year	1:100 Year
49	Anne Street South	Extend Existing 4270 mm x 2440 mm Conc. Box Culvert	34.6	1:100 Year	1:100 Year
50	Innisfil Street	3962 mm x 2134 mm Conc. Box Culvert	37.3	1:100 Year	1:100 Year
135	Rail Crossing	4878 mm x 914 mm Conc. Box Culvert	19.8	1:100 Year	1:100 Year

Table 8: Hotchkiss Creek Preliminary Preferred Solution Road/Rail Crossing Summary

Crossing ID	Location	Regulatory Flow (m^3/s)	Weir Flow (m^3/s)	Depth of Weir Flow (m)	Velocity of Weir Flow (m/s)
41	Mayfair Drive	1.55	0.0	0.00	0.00
42	Ardagh Road	2.52	0.0	0.00	0.00
44	Essa Road	8.3	0.0	0.00	0.00
46	Highway 400	29.9	0.0	0.00	0.00
48	Tiffin Street	36.0	20.3	0.56	0.90
49	Anne Street South	46.4	10.5	0.40	0.75
50	Innisfil Street	54.4	9.7	0.48	0.93
135	Rail Crossing	34.3	12.5	0.57	0.72

Table 9: Whiskey Creek Preliminary Preferred Solution Culvert Capacity Summary

Culvert ID	Location	Size	Capacity (m^3/s)	Level of Service	Design Criteria
53	Harvie Road	2100 mm x 900 mm Conc. Box Culvert	3.9	1:100 Year	1:100 Year
54	Harvie Road	1800 mm Dia. Conc. Pipe	6.4	1:100 Year	1:100 Year
55	Highway 400	2250 mm Dia. Conc. Pipe	21.2	Regional	1:100 Year
56	Fairview Road	2700 mm × 1200 mm Conc. Box Culvert	8.4	1:100 Year	1:100 Year
57	Bayview Drive	Twin 2400 mm x 900 Conc. Box Culverts	8.2	1:50 Year	1:100 Year
60	Huronia Road	10.67 m Open Bottom Span Structure	26.1	1:50 Year	1:100 Year
62	Little Avenue	Twin 7.36 Open Bottom Span Structures	27.1	1:25 Year	1:100 Year
63	Yonge Street	Twin 3000 mm x 1800 mm Conc. Box. Culverts	38.9	1:100 Year	1:100 Year
64	Hurst Drive	3000 mm x 2100 mm Conc. Box Culvert	38.3	1:100 Year	1:100 Year
65	The Boulevard	10.67 m Open Bottom Span Structure	37.3	1:100 Year	1:100 Year
66	Brennan Avenue	Twin 9.14 m Open Bottom Span Structures	37.4	1:100 Year	1:100 Year
138	Rail Crossing	3000 mm Dia. Conc. Pipe	37.6	1:100 Year	1:100 Year
147	Rail Crossing	Twin 1800 mm Dia. Conc. Pipes	29.2	1:100 Year	1:100 Year

Table 10: Whiskey Creek Preliminary Preferred Solution Road/Rail Crossing Summary

Crossing ID	Location	Regulatory Flow (m^3/s)	Weir Flow (m^3/s)	Depth of Weir Flow (m)	Velocity of Weir Flow (m/s)
53	Harvie Road	4.2	>0.0	>0.00	>0.00
54	Harvie Road	18.5	18.1	1.70	0.09
55	Highway 400	21.2	4.1	0.41	0.74
56	Fairview Road	22.0	5.3	0.21	0.60
57	Bayview Drive	24.4	10.1	0.57	0.88
60	Huronia Road	50.0	14.2	0.43	3.55
62	Little Avenue	63.4	17.6	0.60	1.17
63	Yonge Street	66.1	18.0	0.35	0.70
64	Hurst Drive	69.3	27.1	0.62	1.06
65	The Boulevard	69.6	13.0	0.67	2.17
66	Brennan Avenue	70.1	51.8	1.05	0.48
138	Rail Crossing	67.7	30.7	0.69	0.97
147	Railway Crossing	49.5	15.8	0.33	0.65

Table 11: Hewitts Creek Preliminary Preferred Solution Culvert Capacity Summary

Culvert ID	Location	Size	Culvert Capacity (m^3/s)	Level of Service	Design Criteria
83	Mapleview Drive East	10.67 m Open Bottom Span Structure	70.8	1:100 Year	1:100 Year

Table 12: Hewitts Creek Preliminary Preferred Solution Road/Rail Crossing Summary

Crossing ID	Location	Regulatory Flow (m^3/s)	Weir Flow (m^3/s)	Depth of Weir Flow (m)	Velocity of Weir Flow (m/s)
83	Mapleview Drive East	94.5	23.7	0.39	0.80

Table 13: Lovers Creek Preliminary Preferred Solution Culvert Capacity Summary

Culvert ID	Location	Size	Culvert Capacity (m^3/s)	Level of Service	Design Criteria
89	Lockhart Road	10.67 m Open Bottom Span Structure	13.5	1:100 Year	1:100 Year
91	Lockhart Road	Twin 10.67 m Open Bottom Span Structures	96.7	1:100 Year	1:100 Year
92	Huronia Road	3600 mm x 1500 mm Conc. Box. Culvert	13.3	1:100 Year	1:100 Year
94	Welham Road	2400 mm x 1500 mm Conc. Box Culvert	7.8	1:50 Year	1:50 Year
95	Mapleview Drive	3000 mm x 2100 mm Conc. Box Culvert	7.8	1:50 Year	1:100 Year
97	Huronia Road	3000 mm x 1200 mm Conc. Box. Culvert	8.0	1:100 Year	1:100 Year
98	Welham Road	Twin 3000 mm x 1200 mm Conc. Box Culverts	30.9	1:50 Year	1:50 Year
99	Ellis Drive	3000 mm x 1200 mm Conc. Box Culvert	8.3	1:50 Year	1:50 Year
105	Tollendal Mill Road	10356 mm x 3892 mm Low Profile Bridge Plate Culvert	119.0	1:100 Year	1:100 Year
123	Rail Crossing	1500 mm Dia. Conc. Pipe	10.2	1:100 Year	1:50 Year
126	Rail Crossing	Twin 2100 mm Dia. Con. Culverts	>26.0	Regional	1:50 Year

Table 14: Lovers Creek Preliminary Preferred Solution Road/Rail Crossing Summary

Crossing ID	Location	Regulatory Flow (m^3/s)	Weir Flow (m^3/s)	Depth of Weir Flow (m)	Velocity of Weir Flow (m/s)
89	Lockhart Road	26.3	2.0	0.29	0.27
91	Lockhart Road	270.9	155.4	1.03	2.23
92	Huronia Road	25.2	9.4	0.25	0.63
94	Welham Road	18.4	17.5	1.68	0.13
95	Mapleview Drive	18.5	17.8	3.01	0.05
97	Huronia Road	26.9	19.5	0.15	0.56
98	Welham Road	31.2	0.4	0.08	0.33
99	Ellis Drive	9.5	0.1	0.06	0.25
105	Tollendal Mill Road	343.3	196.6	1.97	1.83
123	Rail Crossing	19.6	7.1	0.31	0.63
126	Rail Crossing	26.0	0.0	0.00	0.00

Table 15: Bear Creek Preliminary Preferred Solution Culvert Capacity Summary

Culvert ID	Location	Size	Capacity (m^3/s)	Level of Service	Design Criteria
78	Ardagh Road	900 mm Dia. Conc. Pipe	>2.3	1:100 Year	1:100 Year
80	County Road	Triple 525 mm Dia. HDPE Pipes	<1.1	<1:2 Year	1:50 Year
134	Rail Crossing	Triple 525 mm Dia. HDPE Pipes	<0.1	<1:2 Year	1:50 Year

Table 16: Bear Creek Preliminary Preferred Solution Road/Rail Crossing Summary

Culvert ID	Location	Regulatory Flow (m^3/s)	Weir Flow (m^3/s)	Depth of Weir Flow (m)	Velocity of Weir Flow (m/s)
78	Ardagh Road	2.3	0.0	0.00	0.00
80	County Road	27.5	26.2	0.27	0.55
134	Rail Crossing	31.2	31.2	0.55	0.44

Table 17: Georgian Creek Preliminary Preferred Solution Culvert Capacity Summary

Culvert ID	Location	Size	Capacity (m^3/s)	Level of Service	Design Criteria
82	Penetanguishene Road	2400 mm x 1200 mm Conc. Box Culvert	5.1	1:100 Year	1:100 Year

Table 18: Georgian Creek Preliminary Preferred Solution Road/Rail Crossing Summary

Culvert ID	Location	Regulatory Flow (m^3/s)	Weir Flow (m^3/s)	Depth of Weir Flow (m)	Velocity of Weir Flow (m/s)
82	Penetanguishene Road	11.9	2.4	0.28	0.66

Appendix U: Final Preferred Alternative Solution Culvert Summaries

Table 1: Kidd's Creek Final Preferred Solution Culvert Capacity Summary

Culvert ID	Location	Size	Capacity (m^3/s)	Level of Service	Design Criteria
13	Cundles Road West	3455 mm x 2195 mm Conc. Elliptical Culvert	23.2	1:100 Year	1:100 Year
16	Thomson Street	1800 mm × 900 mm Conc. Box Culvert	3.9	1:100 Year	1:100 Year
18	Wellington Street	855 mm x 1345 mm CSPA	>2.5	Regional	1:100 Year
145	Dunlop Street West	6000 mm x 1500 mm Conc. Box Culvert	14.8	1:100 Year	1:100 Year
146	Bradford Street	6000 mm x 1500 mm Conc. Box Culvert	14.8	1:100 Year	1:100 Year

Table 2: Kidd's Creek Final Preferred Solution Road/Rail Crossing Summary

Crossing ID	Location	Regulatory Flow (m^3/s)	Weir Flow (m^3/s)	Depth of Weir Flow (m)	Velocity of Weir Flow (m/s)
13	Cundles Road West	31.1	1.5	0.17	0.55
16	Thomson Street	43.6	39.4	0.86	1.23
18	Wellington Street	2.5	0.0	0.00	0.00
145	Dunlop Street West	53.5	21.5	0.56	0.86
146	Bradford Street	53.5	31.5	0.37	1.30

Table 3: Bunkers Creek Final Preferred Solution Culvert Capacity Summary

Culvert ID	Location	Size	Capacity (m^3/s)	Level of Service	Design Criteria
22	Innisfil Street	10.06 m Open Bottom Span Structure	28.7	1:100 Year	1:100 Year
23	Commercial Plaza Entrance Road	Culvert crossing to be removed			
24	Bradford Street	Twin 7.62 m Open Bottom Span Structures	41.7	Regional	1:100 Year

Table 4: Bunkers Creek Final Preferred Solution Road/Rail Crossing Summary

Crossing ID	Location	Regulatory Flow (m^3/s)	Weir Flow (m^3/s)	Depth of Weir Flow (m)	Velocity of Weir Flow (m/s)
22	Innisfil Street	39.9	3.1	0.15	0.41
23	Commercial Plaza Entrance Road	Culvert crossing to be removed			
24	Bradford Street	41.7	0.0	0.00	0.00

Table 5: Dyments Creek Final Preferred Solution Culvert Capacity Summary

Culvert ID	Location	Size	Capacity (m^3/s)	Level of Service	Design Criteria
28	Dunlop Street West	3043 mm × 914 mm Conc. Box Culvert	8.4	1:100 Year	1:100 Year
29	Ferndale Drive North	10.67 m Open Bottom Span Structure	12.3	1:100 Year	1:100 Year
30	Sarjeant Drive	Twin 3000 mm × 1500 mm Conc. Box Culvert	18.0	1:100 Year	1:100 Year
31	Dunlop Street / Highway 400 On-Ramp	9000 mm x 1500 mm Conc. Box Culvert (per MTO)	29.6	1:100 Year	1:100 Year
33	Highway 400	9000 mm x 2000 mm Conc. Box Culvert (per MTO)	54.0	Regional	1:100 Year
32	Hart Drive	9000 mm × 2000 mm Conc. Box Culvert (per MTO)	54.0	Regional	1:100 Year
34	George Street	Twin 3600 mm × 1800 mm Conc. Box Culvert	32.2	1:100 Year	1:100 Year
35	Victoria Street	Culvert crossing to be removed			
36	John Street	Twin 3000 mm × 2100 mm Conc. Box Culvert	28.9	1:100 Year	1:100 Year
37	Innisfil Street	6.71 m Open Bottom Span Structure	26.0	1:50 Year	1:100 Year
38	Sandford Street	4200 mm x 2100 mm Conc. Box Culvert	26.3	1:50 Year	1:100 Year
39	Bradford Street	10.67 m Open Bottom Span Structure	30.1	1:100 Year	Regional

Table 6: Dyments Creek Final Preferred Solution Road/Rail Crossing Summary

Crossing ID	Location	Regulatory Flow (m^3/s)	Weir Flow (m^3/s)	Depth of Weir Flow (m)	Velocity of Weir Flow (m/s)
28	Dunlop Street West	50.1	42.1	0.34	0.66
29	Ferndale Drive North	30.5	24.2	0.60	0.28
30	Sarjeant Drive	45.1	31.6	0.44	0.77
31	Dunlop Street / Highway 400 On-Ramp	49.5	18.7	0.41	0.72
33	Highway 400	54.0	0.0	0.00	0.00
32	Hart Drive	54.0	0.0	0.00	0.00
34	George Street	59.5	33.1	0.58	0.94
35	Victoria Street	Culvert crossing to be removed			
36	John Street	63.0	32.3	0.69	1.03
37	Innisfil Street	63.6	35.4	0.78	1.29
38	Sandford Street	64.0	52.6	0.77	1.12
39	Bradford Street	64.8	4.9	0.37	2.40

Table 7: Hotchkiss Creek Final Preferred Solution Culvert Capacity Summary

Culvert ID	Location	Size	Capacity (m^3/s)	Level of Service	Design Criteria
41	Mayfair Drive	750 mm Dia. Conc. Pipe	>1.6	1:100 Year	1:50 Year
42	Ardagh Road	900 mm Dia. Conc. Pipe	>2.5	1:100 Year	1:100 Year
44	Essa Road	3048 mm × 914 mm Conc. Box Culvert	>8.3	Regional	1:100 Year
48	Tiffin Street	4267 mm × 1829 mm Conc. Box Culvert	17.0	1:50 Year	1:100 Year
49	Anne Street South	Extend Existing 4270 mm x 2440 mm Conc. Box Culvert	34.6	1:100 Year	1:100 Year
50	Innisfil Street	3962 mm x 2134 mm Conc. Box Culvert	37.3	1:100 Year	1:100 Year
135	Rail Crossing	4878 mm x 914 mm Conc. Box Culvert	19.8	1:100 Year	1:100 Year

Table 8: Hotchkiss Creek Final Preferred Solution Road/Rail Crossing Summary

Crossing ID	Location	Regulatory Flow (m^3/s)	Weir Flow (m^3/s)	Depth of Weir Flow (m)	Velocity of Weir Flow (m/s)
41	Mayfair Drive	1.55	0.0	0.00	0.00
42	Ardagh Road	2.52	0.0	0.00	0.00
44	Essa Road	8.3	0.0	0.00	0.00
48	Tiffin Street	36.0	20.3	0.56	0.90
49	Anne Street South	46.4	10.5	0.40	0.75
50	Innisfil Street	54.4	9.7	0.48	0.93
135	Rail Crossing	34.3	12.5	0.57	0.72

Table 9: Whiskey Creek Final Preferred Solution Culvert Capacity Summary

Culvert ID	Location	Size	Capacity (m^3/s)	Level of Service	Design Criteria
53	Harvie Road	2100 mm x 900 mm Conc. Box Culvert	3.9	1:100 Year	1:100 Year
54	Harvie Road	1800 mm Dia. Conc. Pipe	6.4	1:100 Year	1:100 Year
55	Highway 400	2250 mm Dia. Conc. Pipe	21.2	Regional	1:100 Year
56	Fairview Road	2700 mm × 1200 mm Conc. Box Culvert	8.4	1:100 Year	1:100 Year
57	Bayview Drive	Twin 2400 mm x 900 Conc. Box Culverts	8.2	1:50 Year	1:100 Year
60	Huronia Road	10.67 m Open Bottom Span Structure	26.1	1:50 Year	1:100 Year
62	Little Avenue	Twin 7.36 Open Bottom Span Structures	27.1	1:25 Year	1:100 Year
63	Yonge Street	Twin 3000 mm x 1800 mm Conc. Box. Culverts	38.9	1:100 Year	1:100 Year
64	Hurst Drive	3000 mm x 2100 mm Conc. Box Culvert	38.3	1:100 Year	1:100 Year
65	The Boulevard	10.67 m Open Bottom Span Structure	37.4	1:100 Year	1:100 Year
66	Brennan Avenue	Twin 9.14 m Open Bottom Span Structures	37.4	1:100 Year	1:100 Year
138	Rail Crossing	3000 mm Dia. Conc. Pipe	37.6	1:100 Year	1:100 Year
147	Rail Crossing	Twin 1800 mm Dia. Conc. Pipes	29.2	1:100 Year	1:100 Year

Table 10: Whiskey Creek Final Preferred Solution Road/Rail Crossing Summary

Crossing ID	Location	Regulatory Flow (m^3/s)	Weir Flow (m^3/s)	Depth of Weir Flow (m)	Velocity of Weir Flow (m/s)
53	Harvie Road	4.2	>0.0	>0.00	>0.00
54	Harvie Road	18.5	18.1	1.70	0.09
55	Highway 400	21.2	0.0	0.00	0.00
56	Fairview Road	22.0	5.3	0.21	0.60
57	Bayview Drive	24.4	10.1	0.57	0.88
60	Huronia Road	50.0	14.2	0.43	3.55
62	Little Avenue	63.4	17.6	0.60	1.17
63	Yonge Street	66.1	18.0	0.35	0.70
64	Hurst Drive	69.3	27.1	0.62	1.06
65	The Boulevard	69.6	13.0	0.67	2.17
66	Brennan Avenue	70.1	51.8	1.05	0.48
138	Rail Crossing	67.7	30.7	0.69	0.97
147	Railway Crossing	49.5	15.8	0.33	0.65

Table 11: Hewitts Creek Final Preferred Solution Culvert Capacity Summary

Culvert ID	Location	Size	Capacity (m^3/s)	Level of Service	Design Criteria
83	Mapleview Drive East	10.67 m Open Bottom Span Structure	70.8	1:100 Year	1:100 Year

Table 12: Hewitts Creek Final Preferred Solution Road/Rail Crossing Summary

Crossing ID	Location	Regulatory Flow (m^3/s)	Weir Flow (m^3/s)	Depth of Weir Flow (m)	Velocity of Weir Flow (m/s)
83	Mapleview Drive East	94.48	23.71	0.39	0.80

Table 13: Lovers Creek Final Preferred Solution Culvert Capacity Summary

Culvert ID	Location	Size	Culvert Capacity (m^3/s)	Level of Service	Design Criteria
89	Lockhart Road	10.67 m Open Bottom Span Structure	13.5	1:100 Year	1:100 Year
91	Lockhart Road	Twin 10.67 m Open Bottom Span Structures	96.7	1:100 Year	1:100 Year
92	Huronia Road	3600 mm x 1500 mm Conc. Box. Culvert	13.3	1:100 Year	1:100 Year
97	Huronia Road	3000 mm x 1200 mm Conc. Box. Culvert	8.0	1:100 Year	1:100 Year
98	Welham Road	Twin 3000 mm x 1200 mm Conc. Box Culverts	30.9	1:50 Year	1:50 Year
99	Ellis Drive	3000 mm x 1200 mm Conc. Box Culvert	8.3	1:50 Year	1:50 Year
105	Tollendal Mill Road	10356 mm x 3892 mm Low Profile Bridge Plate Culvert	119.0	1:100 Year	1:100 Year
123	Rail Crossing	3000 mm Dia. Conc. Pipe	>19.6	Regional	1:50 Year
126	Rail Crossing	Twin 2100 mm Dia. Con. Culverts	>26.0	Regional	1:50 Year

Table 14: Lovers Creek Final Preferred Solution Road/Rail Crossing Summary

Crossing ID	Location	Regulatory Flow (m^3/s)	Weir Flow (m^3/s)	Depth of Weir Flow (m)	Velocity of Weir Flow (m/s)
89	Lockhart Road	26.3	2.0	0.29	0.27
91	Lockhart Road	270.9	155.4	1.03	2.23
92	Huronia Road	25.2	9.4	0.25	0.63
97	Huronia Road	26.9	19.5	0.15	0.56
98	Welham Road	31.2	0.4	0.08	0.33
99	Ellis Drive	9.5	0.1	0.06	0.25
105	Tollendal Mill Road	343.3	196.6	1.97	1.83
123	Rail Crossing	19.6	0.0	0.00	0.00
126	Rail Crossing	26.0	0.0	0.00	0.00

Table 15: Bear Creek Final Preferred Solution Culvert Capacity Summary

Culvert ID	Location	Size	Capacity (m^3/s)	Level of Service	Design Criteria
78	Ardagh Road	900 mm Dia. Conc. Pipe	>2.3	1:100 Year	1:100 Year

Table 16: Bear Creek Final Preferred Solution Road/Rail Crossing Summary

Culvert ID	Location	Regulatory Flow (m^3/s)	Weir Flow (m^3/s)	Depth of Weir Flow (m)	Velocity of Weir Flow (m/s)
78	Ardagh Road	2.3	0.0	0.00	0.00

Table 17: Georgian Creek Final Preferred Solution Culvert Capacity Summary

Culvert ID	Location	Size	Capacity (m^3/s)	Level of Service	Design Criteria
82	Penetanguishene Road	2400 mm x 1200 mm Conc. Box Culvert	5.1	1:100 Year	1:100 Year

Table 18: Georgian Creek Final Preferred Solution Road/Rail Crossing Summary

Culvert ID	Location	Regulatory Flow (m^3/s)	Weir Flow (m^3/s)	Depth of Weir Flow (m)	Velocity of Weir Flow (m/s)
82	Penetanguishene Road	11.9	2.4	0.28	0.66

Appendix V:
Digital Models